Hay Shire Council

Integrated Water Cycle Management Strategy Supplementary Paper

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Executive Summary

Hay Shire Council initiated a review and update of its 2017 Integrated Water Cycle Management (IWCM) Strategy due to its changing needs and emerging risks. The updated IWCM strategy will guide Council to program for infrastructure and services in a manner that is sustainable, cost-effective and compliant to the relevant legislation and standards.

Growth and future development

Council is expecting significant growth in population and business opportunities in the future and has approved a plan for rezoning areas around Hay for new residential, industrial, recreational and infrastructure uses, and for an extension of the service area. Council's growth strategy includes the full development of all the RU5 zones in the first five years, and a further development of all the other zones in the 30-year horizon. Based on this strategy, an additional 463 lots are expected within the next five years and a further 200 lots, at 40 lots per year, in the following next 25 years.

Water Demands

The high growth forecast will result in significant increases in both raw and potable customer water requirements. Analysis of the water production data and customer usage date identified about 30% of avoidable water losses identified in raw and potable water supply systems.

The water demands have a baseline forecast with current water losses, and a target forecast with water losses reduced to a level considered good by international standards. These results are shown in Table S-1.

Table S-1: Current and future customer water demands

	User Classes	Average Year Demand (ML/year)			Unrestricted Future Demand (ML/year)		
		Current	Ultimate - baseline	Ultimate - target	Current	Ultimate - baseline	Ultimate - target
Raw Water	Demands	616	880	880	871	1,246	1,246
	Water Losses	289	367	156	398	505	220
	Production	**905**	**1,248**	**1,036**	**1,269**	**1,751**	**1,466**
Potable Water	Demands	230	460	460	248	516	516
	Water Losses	129	230	65	124	222	66
	Production	**359**	**690**	**525**	**372**	**739**	**582**

Water security

The total water extraction requirements for the 30-year development will not exceed Council's license entitlement. However, if there were a repeat of the millennium drought, the 30-year ultimate unrestricted demand would exceed the reduced allocation during this drought and water restrictions would be required. The imposition of restrictions could be avoided by reducing the water losses and improving the raw water and potable water system performance. This is shown in Figure S-1.

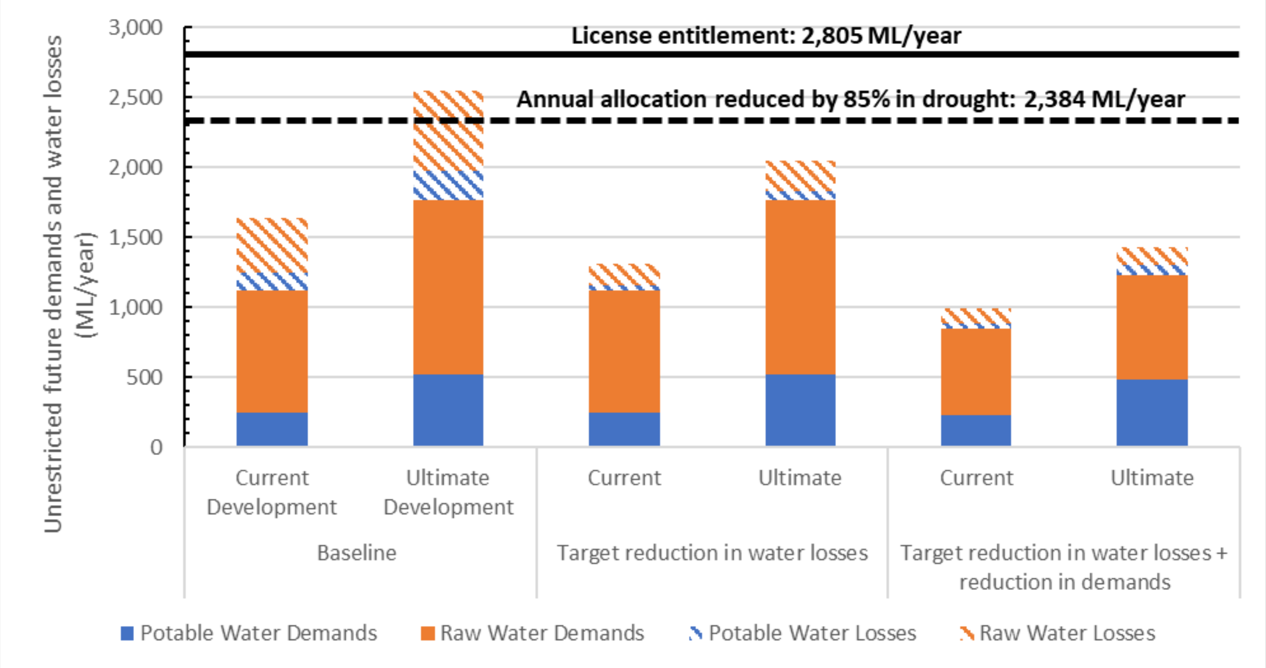

Figure S-1: Unrestricted future extraction (sum of demands and losses) compared to WAL entitlement, with demand reduction opportunities

A water loss management plan needs to be developed which would include a targeted mains replacement based on performance data, information from strategically located zone (smart) meters and active leakage control. An amount of $1.7M has been allocated for water mains replacement in the asset management plan over the next 11 years.

If the mains replacement and meter audit program does not achieve the desired reduction in ‘unaccounted for water’, Council can consider effluent reuse for irrigation of public open spaces to achieve further demand reduction.

Water quality

The water treatment plant (WTP) is in a reasonably good condition and produces water that meets the requirements of the Australian Drinking Water Guidelines. There is a medium risk of chlorine resistant pathogens being present in the water supply. A number of upgrades requirements have been identified for the WTP. In order to inform the asset management plan, these upgrades have been prioritised under the following categories:

1. plant performance and compliance with DWMS
2. work health and safety
3. monitoring and control
4. operational convenience
5. renewals as required

Supply reliability

Raw water system

For the Raw WSS, the current peak day minimum pressures do not meet Council’s minimum pressure LOS target of 15m on the outskirts of the Hay township. The lowest minimum pressure was around 6m. To meet the service level for the existing customers and service the future development zones, would require an upgrade which includes about 27.3 km of new pipelines (replacements and new routes), and a booster pumping station at South Hay. This system has been included in the asset management plan.

Potable water system

The potable water supply scheme can meet the levels of service when supplying the peak day demand. To service the future developments would require an upgrade of the clear water pumps and a booster pumping station to boost supply to South Hay. This system has been included in the asset management plan.

Potable water – continuity of supply

The Hay water supply scheme is vulnerable to any contamination, such as blue green algae, to the Murrumbidgee river as it does not have an alternate source of supply as a backup during emergencies. Two areas in the Lower Murrumbidgee Deep Aquifer, within 3 km of the WTP have been identified as potential groundwater supplies. An allowance of $300K has been included in the asst management plan for the development of the bore field.

Sewage treatment plant biosolids management

The biosolids produced at the sewage treatment plant will comply with Grade B requirements that will allow for different land application uses based on the contaminant grade. Sampling and testing should be undertaken to determine the contaminant grade before deciding on the appropriate land use application for disposal.

Unserviced areas on the town periphery

Two unsewered areas on the fringes of Hay were assessed in terms of risks posed to public health and the environment by on-site sewage management systems (OSSMS.)

The areas are located north of Hay with rural properties along the Cobb highway, and east of Hay with around ten houses on the side of the Murrumbidgee River. Both areas were assessed as having low risk to public health and the environment.

Long-term Financial Plans

Council's Total Asset Management Plan for water supply and sewerage for the previously adopted IWCM Strategy has been updated to include the identified growth and Improved Level of Service (ILOS) capital works to address the changing needs and emerging risks. Financial models for water and sewer funds have been reviewed and updated to forecast the lowest stable sustainable price path for water supply and sewerage services on which to base Council's tariff structure from 2022-23 onward. Note, all the forecast values are in 2021-22 dollars.

Water Fund Financial Plan

The water fund financial model forecasts for the updated IWCM scenario demonstrate that the current (2021/22) combined non-potable and potable water supply TRB of $850 p.a. needs to be increased at the rate of $30 per year for the next five years to $1,000 p.a. in 2026/27 and can be maintained at that level for the remaining forecast period.

There is no current outstanding borrowing for water fund as of 30 June 2021. At the forecast level of TRB, no new loan will be required during the forecast period as all the planned capital works can be fully funded internally. The levels of TRB and cash and investments during the forecast period are shown in Figure S-2. The adopted price path is sufficient to maintain liquidity with a minimum of $1.0 Million of cash and investments in the water fund over the forecast period. For a detailed discussion on the updated water fund financial model forecasts, refer to Section 14.1

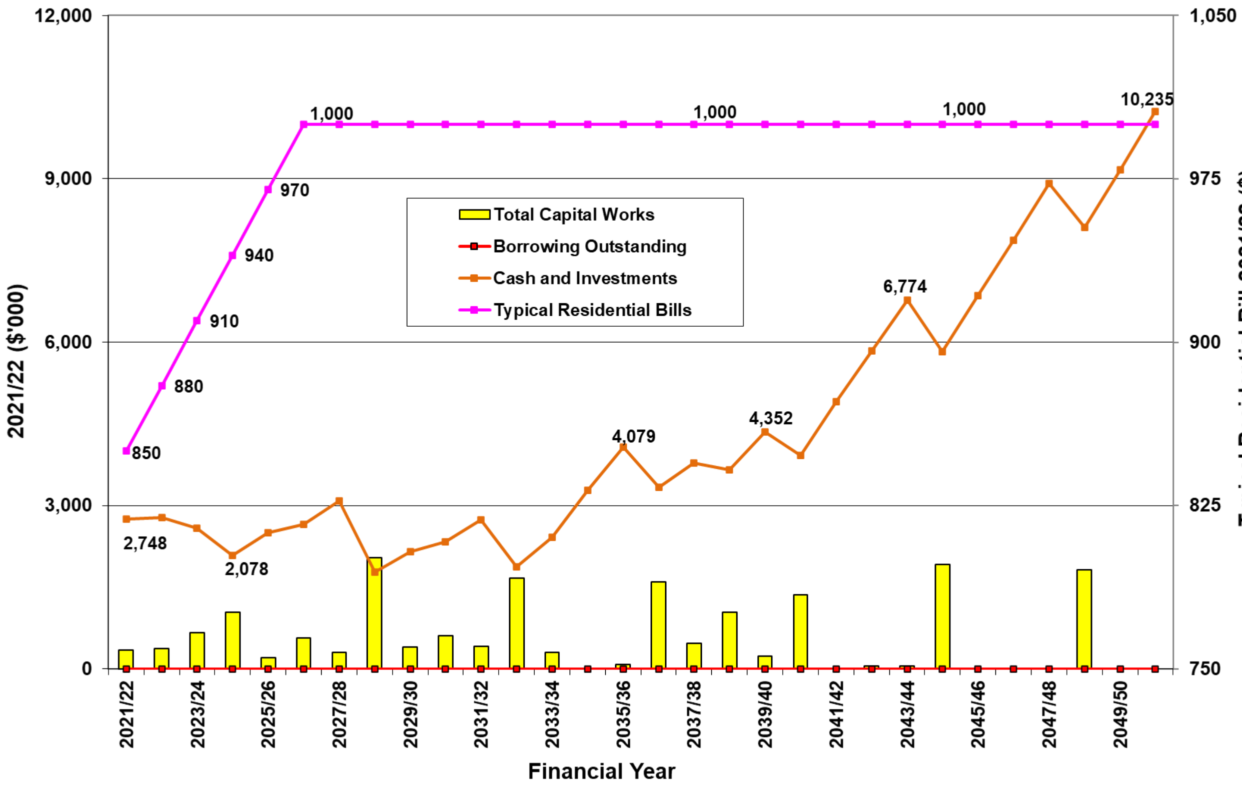

Figure S-2: Water Fund Financial Model Forecasts for the updated IWCM Strategy

<u>Sewer Fund Financial Plan</u>

The sewer fund financial model forecasts for the updated IWCM strategy show that the 2021-22 sewerage TRB of $772 p.a. can be maintained for all the remainder of the 30-year forecast period with ongoing annual adjustment for CPI/ inflation. The model considered that 90% Government grant or subsidy will be available for the new effluent reuse scheme planned for 2026/27.

At the forecast level of sewerage TRB and due consideration of expected level of government grant/ subsidy, no new loan will be required during the forecast period as all the planned capital works can be fully funded internally. The levels of TRB and cash and investments during the forecast period are shown in Figure S-3. The adopted price path is sufficient to maintain liquidity with a minimum of $1.0 Million of operating cash in the sewer fund over the forecast period. For a detailed discussion on the updated sewer fund financial model forecasts, refer to Section 14.2.

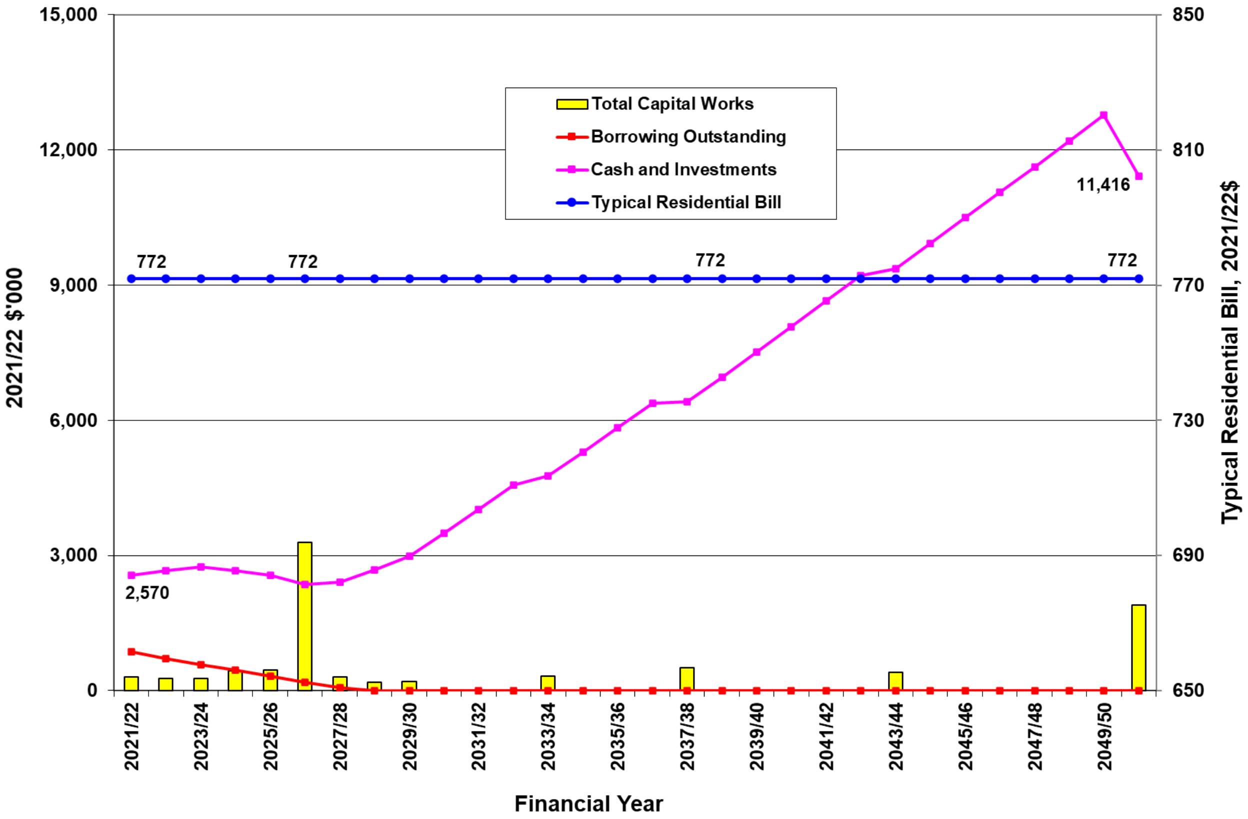

Figure S-3: Sewer Fund Financial Model Forecasts for the updated IWCM Strategy

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Glossary and Abbreviations

Term	Definition
ABS	Australian Bureau of Statistics
ADWF	Average Dry Weather Flow
ADPW	Average Day Peak Week
CCP	Critical Control Point
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCERP	Drought Contingency Emergency Response Plan
DWMS	Drinking Water Management System
EC	Evaporative Cooler
EP	Equivalent Persons
ERP	Estimated Residential Population
EPL	Environmental Protection Licence
GCM	Global Climate Models
GDE	Groundwater Dependent Ecosystems
GIS	Geographic Information System
IDEA	Intermittent Decanted Extended Aeration
ILI	Infrastructure Leakage Index
IWCM	Integrated Water Management
IWA	International Water Association
LGA	Local Government Area
LOS	Level of Service
LRV	Log Reduction Value
OEH	Office of Environment and Heritage
OSSMS	On-site Sewage Management Systems
PAC	Powdered Activated Carbon
PD	Peak Day
POS	Public Open Spaces
PS	Pump Station
PWA	Public Works Advisory
SA1	Statistical Area Level 1
SBP	Strategic Business Plan
SCADA	Supervisory Control and Data Acquisition
SPS	Sewage Pump Station
STP	Sewage Treatment Plant
TAMP	Total Asset Management Plan
Unrestricted future demand	The 99th%ile (1-in-100 year) water demand
Unrestricted future production	The 99th%ile (1-in-100 year) water production
UV	Ultraviolet
WAL	Water Access Licence
WELS	Water Efficiency Labelling and Standards
WH&S	Work Health and Safety
WSS	Water Supply Scheme
WSP	Water Sharing Plan
WTP	Water Treatment Plant

1. Introduction

1.1 Purpose

Hay Shire Council prepared and adopted its Integrated Water Cycle Management (IWCM) Strategy in 2017. Due to its changing needs and emerging risks, Council is looking at reviewing and updating the IWCM strategy.

Council received financial assistance from the state government under stream 2 of the Safe and Secure Water Program to update the IWCM Strategy. The updated IWCM strategy will guide the Council to program for infrastructure and services in a manner that is sustainable, cost-effective and compliant to the relevant legislation and standards.

Hay Shire Council engaged Public Works Advisory (PWA) to prepare a supplementary paper that addresses Council's changing needs and emerging risks.

1.2 Process

The objectives of the engagement are to:

1. Assess and optimise the performance of the water treatment plant and supply system
2. Evaluate options for reduction and management of peak potable and raw water demands including non-revenue-water and alternative water sources such as groundwater
3. Evaluate biosolids and effluent reuse options for the Hay sewage treatment plant
4. Assess the performance and options for unserviced areas in the periphery of the Hay township
5. Prepare a drought contingency and emergency response plan
6. Update the Total Asset management Plan (TAMP) and financial plan (FP) based on the findings/outcomes of the above tasks

2. Hay Raw Water and Potable Water Supply Schemes

The Hay Local Government Area is situated within the Murrumbidgee Catchment, an area of approximately 84,000 km^2 which is bordered by the Great Dividing Range to the east, the Lachlan Catchment to the north and the Murray Catchment to the south. The Murrumbidgee River is a major tributary of the Murray-Darling River system.

Hay Shire Council operates a potable water system and raw water system which are both reticulated to the townships of Hay and Hay South. Both systems source water from the Murrumbidgee River at different intake points. Water supply and sewerage services for the rest of the LGA depend on rainwater tanks and/or privately owned bores for water supply and on-site sewage systems.

The urban centre, river intakes, reservoir and treatment plants are shown in Figure 2-1.

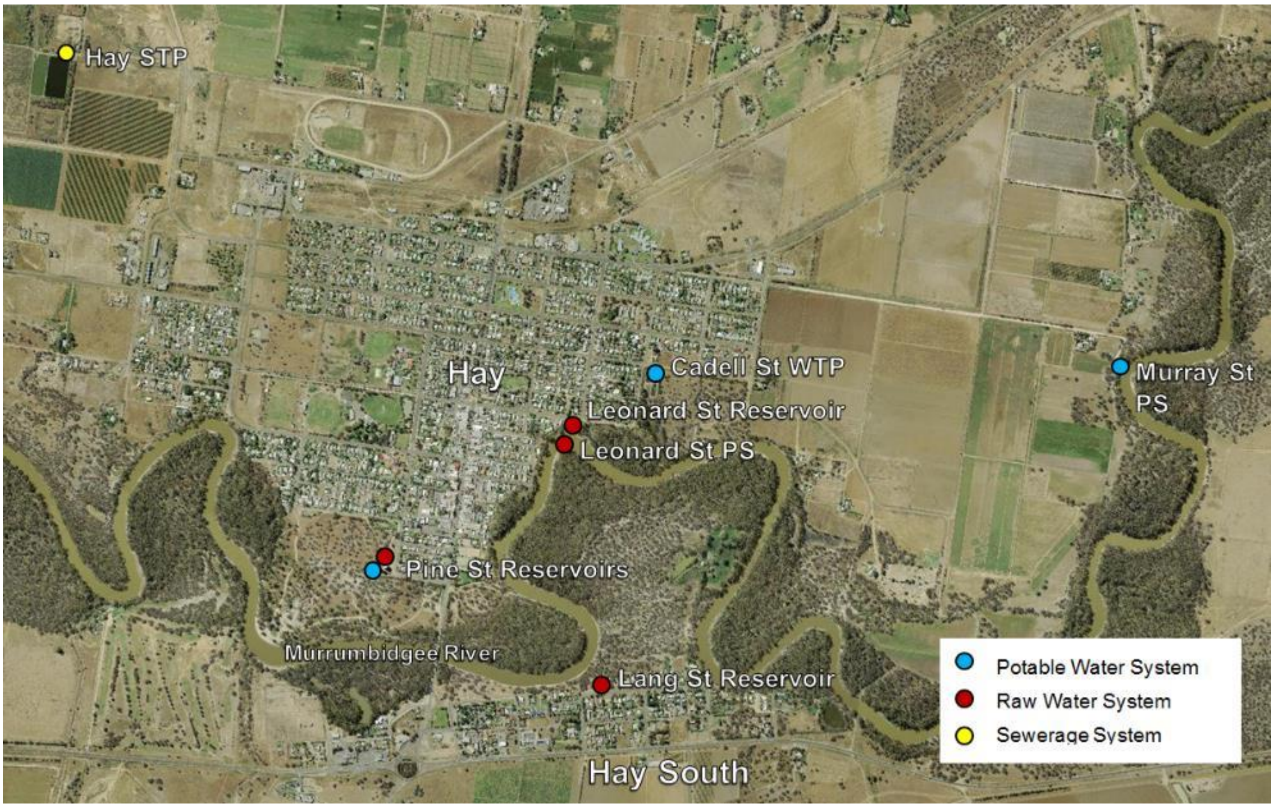

Figure 2-1: Hay Township

The water supply scheme layouts are shown is shown in Figure 2-2.

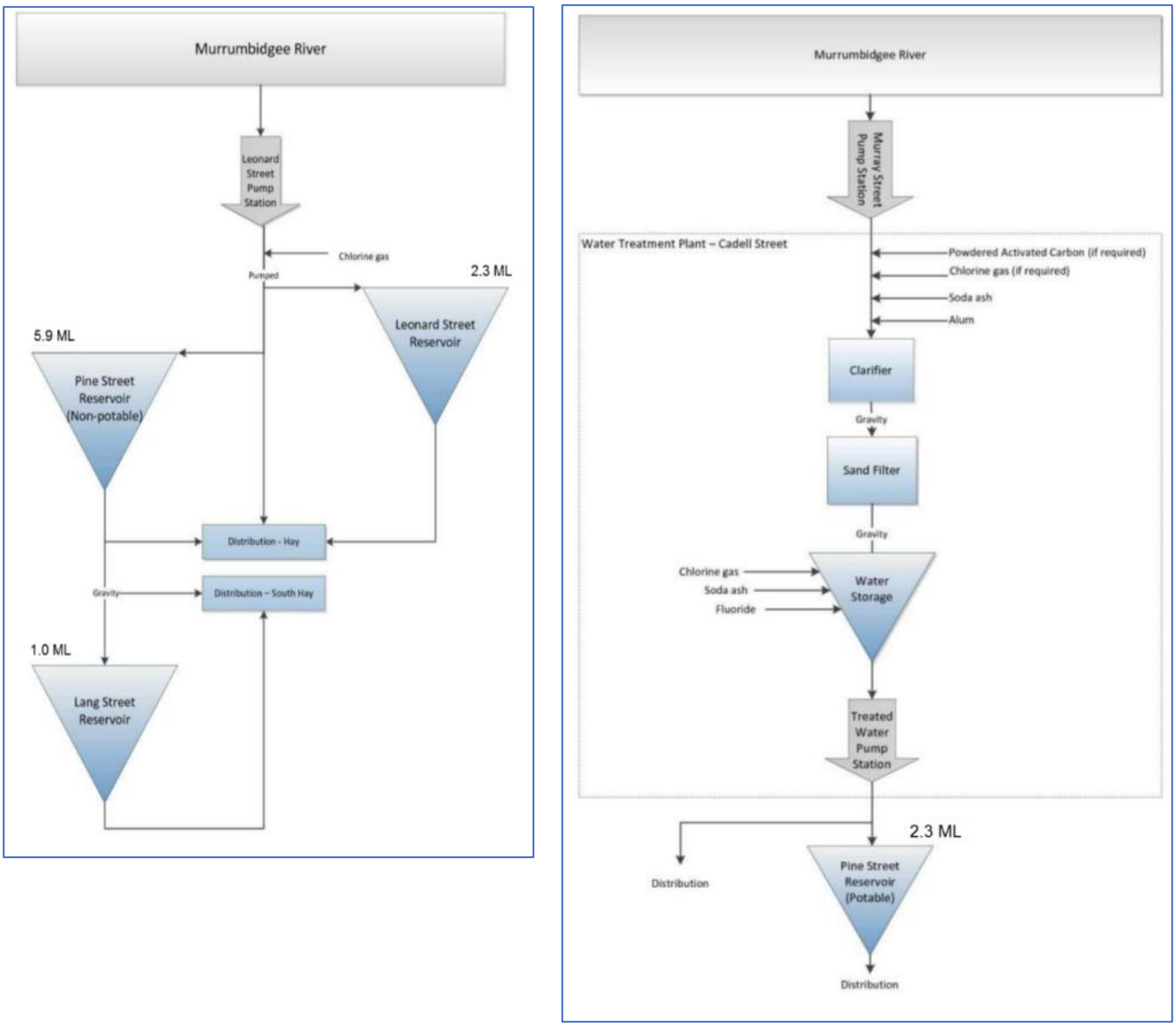

Figure 2-2: Hay Raw Water (left) and Potable Water (right) distribution systems

2.1 Water source

Both the potable water system and raw water system source water from the Murrumbidgee River.

The Murray Street Pump Station to the east of town has a duty of 26 L/s, and pumps water from the river to the Hay Water Treatment Plant (WTP) for treatment. The Leonard Street Pump Station has a duty of 228 L/s and pumps into the raw water system.

Council holds one Water Access License (WAL6457) to extract from the Murrumbidgee, issued under the *Water Management Act 2000*. The following apply to the WAL:

WAL license number	WAL 6457
Water Source	Murrumbidgee Regulated River Water Source
Category [Subcategory]	Local Water Utility
Entitlement	**2,805 ML/year**
Water Sharing Plan (WSP)	Murrumbidgee Regulated River Water Source 2016

The rules in the WAL require that a water order must be placed and confirmed with Water NSW before water is taken under the license, and water must be used for town water supply purposes.

The Murray Street Pump Station and Leonard Street Pump Station are both authorised to take water under works approval number 40WA400013.

2.2 Water Supply

2.2.1 Hay Potable WSS - Water Treatment

Water from the Murrumbidgee River is pumped by the Murray Street PS to the Hay WTP, located at Cadell Street, for treatment. The WTP is shown in Figure 2-3.

Figure 2-3: Hay Water Treatment Plant

The Hay WTP was built in 1988 and has a capacity of 2.2 ML/day. The treatment is a conventional filtration process, consisting of alum coagulation, clarification, and media filtration. Pre-dose chemicals can be added if required – PAC (for removal of taste and odour caused by algae in the river), chlorination (for oxidation of metals such as iron, rarely used) and soda ash (for pH correction, rarely used.) Potable water is dosed with fluoride and chlorine (gas) prior to distribution.

Sludge from the clarifier is discharged to one of the two sludge lagoons that is in duty. The sludge is concentrated in the lagoon as water evaporates and supernatant is discharged to the Murrumbidgee River. Very little supernatant is discharged. HSC holds an Environment Protection Licence (EPL) No. 3237 for its Hay WTP premises to discharge up to 200 kL per day of sludge lagoon supernatant with a Total Suspended Solids concentration of up 100mg/L. There have not been any breaches of the licence since 2002.

Water supplied to the raw water scheme is treated with chlorine gas prior to distribution.

2.2.2 Hay Raw WSS - Water Treatment

Raw water from the Murrumbidgee River pumped from the Leonard St river intake is disinfected at a chlorination facility at Leonard St prior to distribution in the raw water supply system.

2.2.3 Historical Production

Daily production data, recorded at the Leonard St PS for the raw water scheme, and at the WTP outlet for the potable water scheme, were available from July 2015 to October 2020. Water restrictions were not implemented during this period. The historical production data is presented in Figure 2-4 and Figure 2-5.

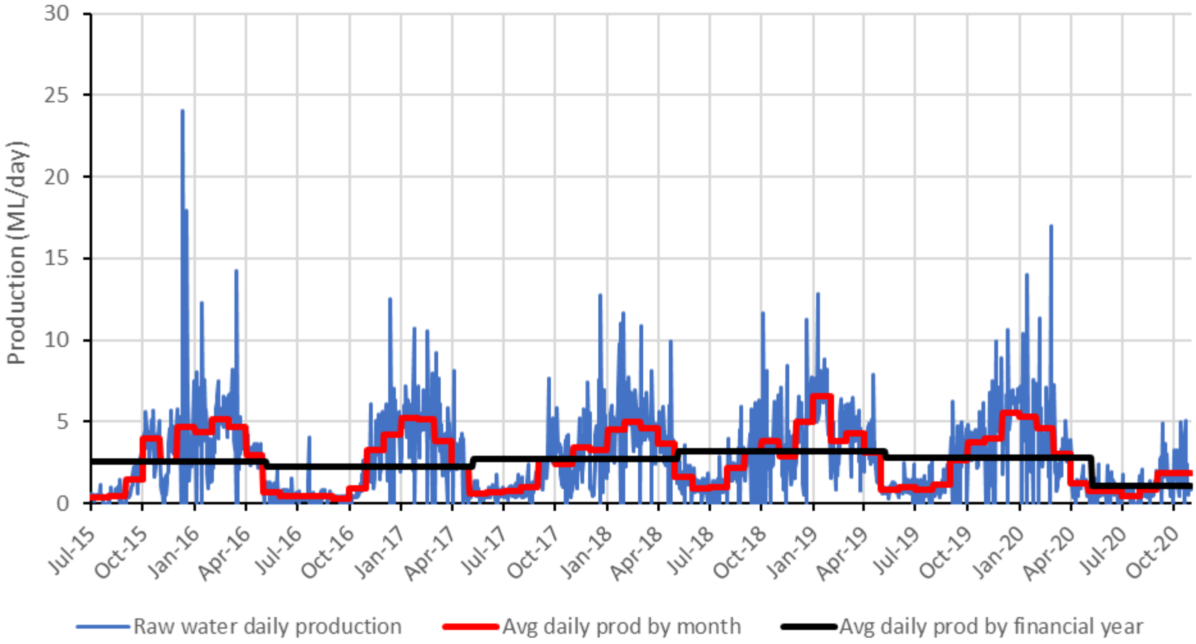

Figure 2-4: Historical Production data - Hay Raw Water Scheme

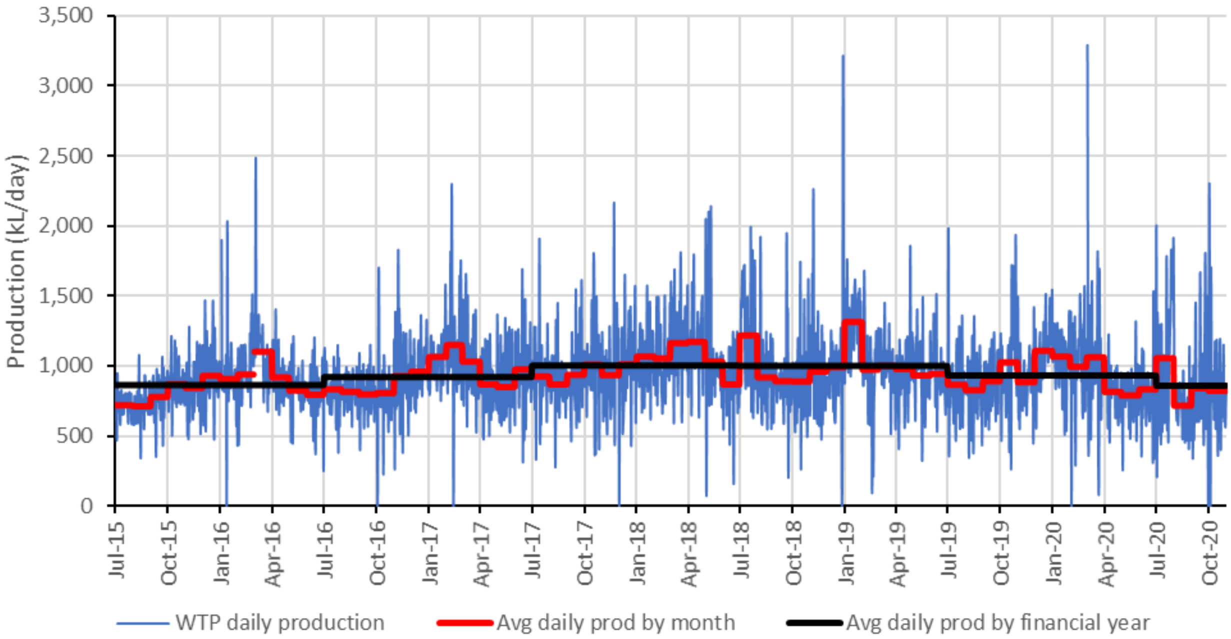

Figure 2-5: Historical Production data - Hay WTP (potable water scheme)

The graph for the raw water scheme shows a clear annual variation pattern as it is primarily used for irrigation and is therefore higher in the warmer months. The pattern for the potable water scheme is much more consistent throughout the year, however, is slightly higher in summer due to use in evaporative coolers.

The annual production totals from 2015 to 2020 is presented in Table 2-1.

Table 2-1: Historical annual production (ML/year)

Financial Year	2015/16	2016/17	2017/18	2018/19	2019/20
Hay Raw Water	935	817	994	1162	1027
Hay WTP	316	337	367	366	341

2.3 Distribution

2.3.1 Hay Potable WSS - Distribution System

Treated water from the Hay WTP is stored in a Clear Water Tank on site and then pumped to the 2.3 ML Pine Street potable water reservoir for distribution.

The location of the potable water infrastructure is given in Figure 2-6.

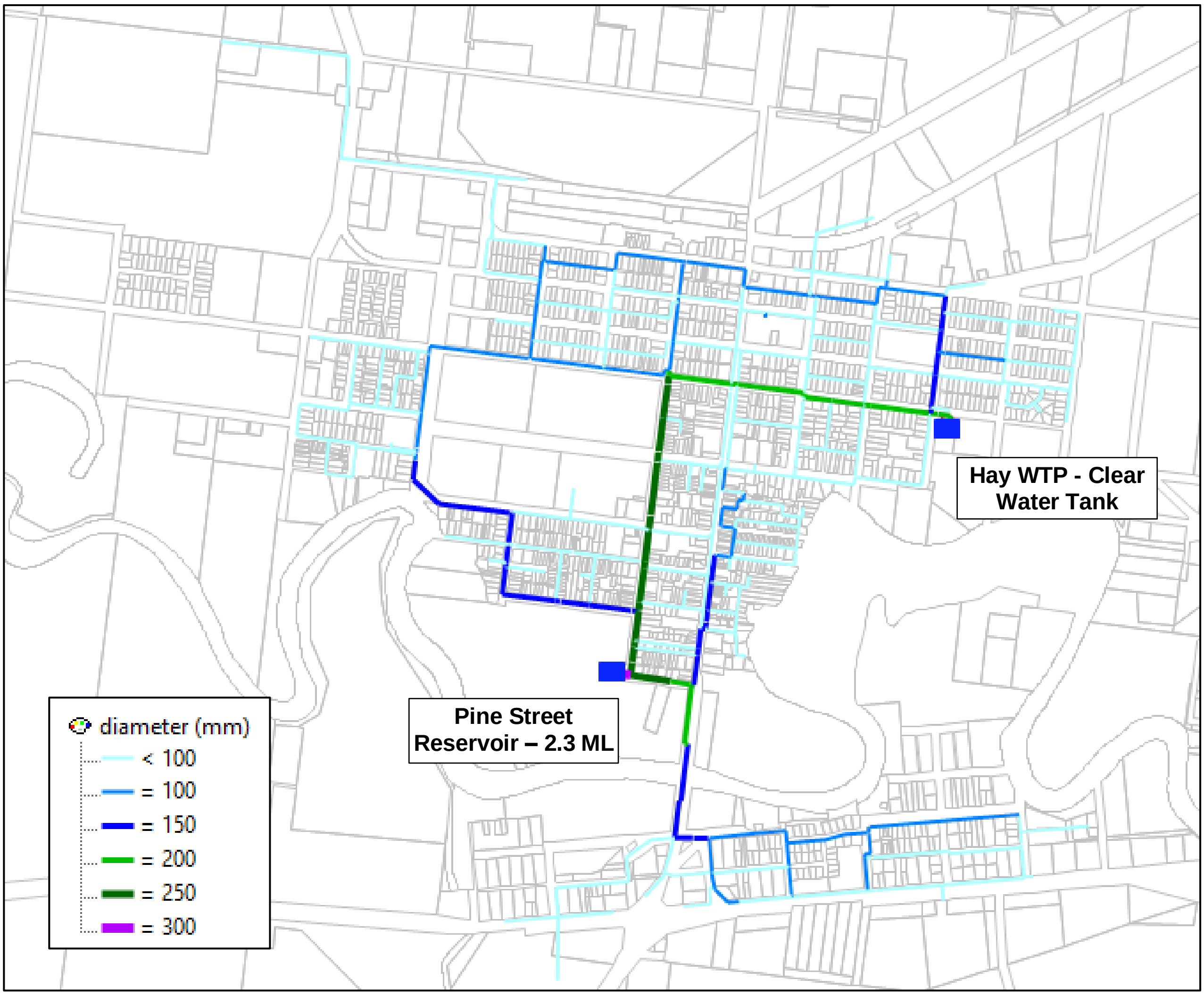

Figure 2-6: Hay potable water reticulation system layout plan

2.3.2 Hay Raw WSS - Distribution System

Water for the raw water scheme is pumped directly into the reticulation. There are two floating reservoirs in Hay which provide supply reliability and pressure – the 2.3 ML Leonard Street reservoir and the 5.9 ML Pine Street raw water reservoir. There is also a 1.0 ML Lang Street reservoir in the south of Hay.

The location of the raw water infrastructure is given in Figure 2-7.

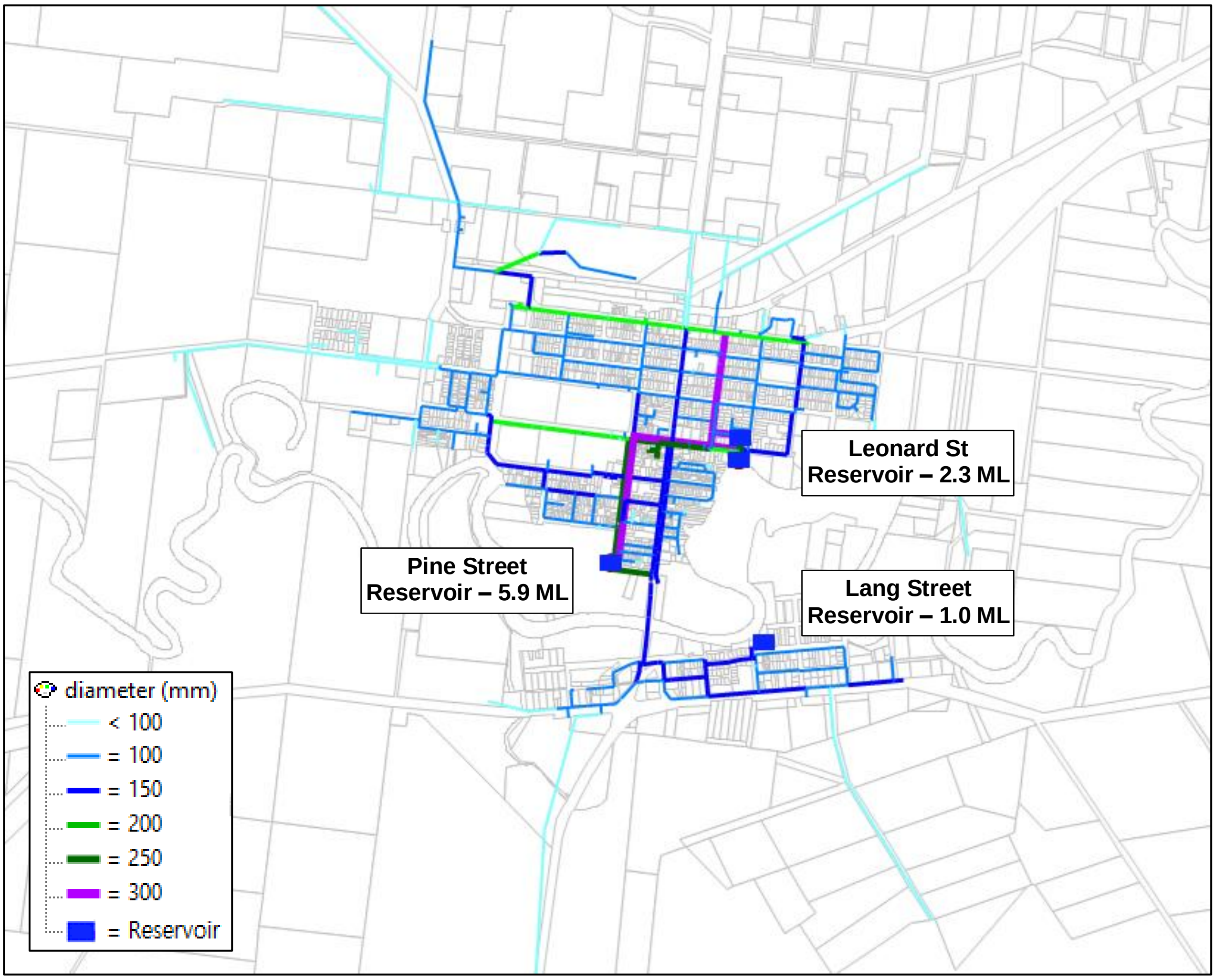

Figure 2-7: Hay raw water reticulation system layout plan

2.3.3 Metered Customer Demand

Council supplied customer billing data from 2014/15 to 2019/20, with meters being read three times a year. Data was given by the total usage of user classes during each billing period. User classes were separated into residential, commercial, municipal, rural, parks and gardens, blanks, and other industrial. Usage for separate meters or assessments was not available.

The historical number of meters for Hay Raw WSS and Hay Potable WSS are given in Table 2-2 and Table 2-3 respectively.

Table 2-2: Historical number of meters - Hay Raw WSS

Financial Year	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Residential	1,103	1,107	1,109	1,109	1,108	1,109
Commercial	126	129	131	130	131	131

Financial Year	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Municipal	50	49	50	50	50	50
Rural	45	45	45	44	44	44
Parks and Gardens	72	71	71	71	71	70
Other Industrial	2	2	2	2	2	2
Unknown	0	3	3	8	12	14
Total	**1,398**	**1,406**	**1,411**	**1,414**	**1,418**	**1,420**

Table 2-3: Historical number of meters - Hay Potable WSS

Financial Year	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Residential	1,075	1,081	1,086	1,088	1,091	1,090
Commercial	107	110	111	111	110	110
Municipal	29	29	29	29	29	29
Rural	2	2	2	2	3	3
Parks and Gardens	1	1	1	1	1	1
Other Industrial	0	0	0	0	0	0
Unknown	0	3	3	6	10	12
Total	**1,214**	**1,226**	**1,232**	**1,237**	**1,244**	**1,245**

The historical metered customer demand for Hay Raw WSS and Hay Potable WSS are given in Table 2-4 and Table 2-5 respectively.

Table 2-4: Historical customer demand (ML/year) - Hay Raw WSS

Year	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Residential	470	445	352	429	443	399
Commercial	59	44	37	42	44	35
Municipal	132	115	100	118	149	111
Rural	27	29	26	34	29	30
Parks and Gardens	125	66	49	67	97	71
Other Industrial	12	5	1	2	2	2
Unknown	0	0	0	0	1	1
Total	**825**	**704**	**566**	**692**	**764**	**650**

Table 2-5: Historical customer demand (ML/year) - Hay Potable WSS

Financial Year	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Residential	167	159	154	157	151	142
Commercial	28	27	28	29	30	26
Municipal	24	17	25	30	35	32
Rural	0	0	0	0	0	0
Parks and Gardens	0	0	0	0	0	0

Financial Year	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Other Industrial	4	0	0	0	0	0
Unknown	0	0	0	0	0	1
Total	**225**	**203**	**207**	**216**	**217**	**201**

2.4 Water Balance

The historical water production data and customer usage data was used to calculate a water balance over the system. The water losses represent the difference between the volume of water delivered into a network and the metered customer usage. The water balance used is recommended by the International Water Association (IWA).

The system losses can be estimated through finding the differences of water produced and water consumed. Assumptions were made to further categorise water losses into apparent losses (such as unauthorised consumption – theft/illegal use and customer meter under-registration) and real losses (such as leakages).

Unbilled authorised consumption was estimated as 0.5% of water supplied. Apparent losses are estimated as customer meter under-registration (2% of metered consumption) plus theft (0.1% of water supplied). These assumptions are from the Australian Government National Performance Framework [1].Unavoidable real loses are calculated using the average pressure, length of main and number connections using equations from the IWA paper titled 'A Review of Performance Indicators for Real Losses from Water Supply Systems' [2]. As these losses are calculated using assumptions, actual volumes may differ, however they are a useful indicator of where losses are occurring.

2.4.1 Hay Raw WSS – Water Balance

The water balance for Hay Raw WSS is shown in Table 2-6, and shown graphically in Figure 2-8.

Table 2-6: Hay Raw WSS historical average water losses yearly estimation

Category	Subcategory	User classes and losses	ML/year
Authorised consumption (ML/year)	Billed metered consumption by registered (retail) customers	Residential	413
		Commercial	40
		Industrial	2
		Rural	30
		Municipal - excluding parks	119
		Municipal - public parks	70
	Unbilled authorised consumption (e.g. system flushing)		5
Water losses	Apparent losses (e.g. theft, customer meter under-registration)		14
	Current Annual Real Losses	Avoidable real losses	284
		Unavoidable real losses from mains	9
		Unavoidable real losses from service connections	8
Total (raw water production)			**995**

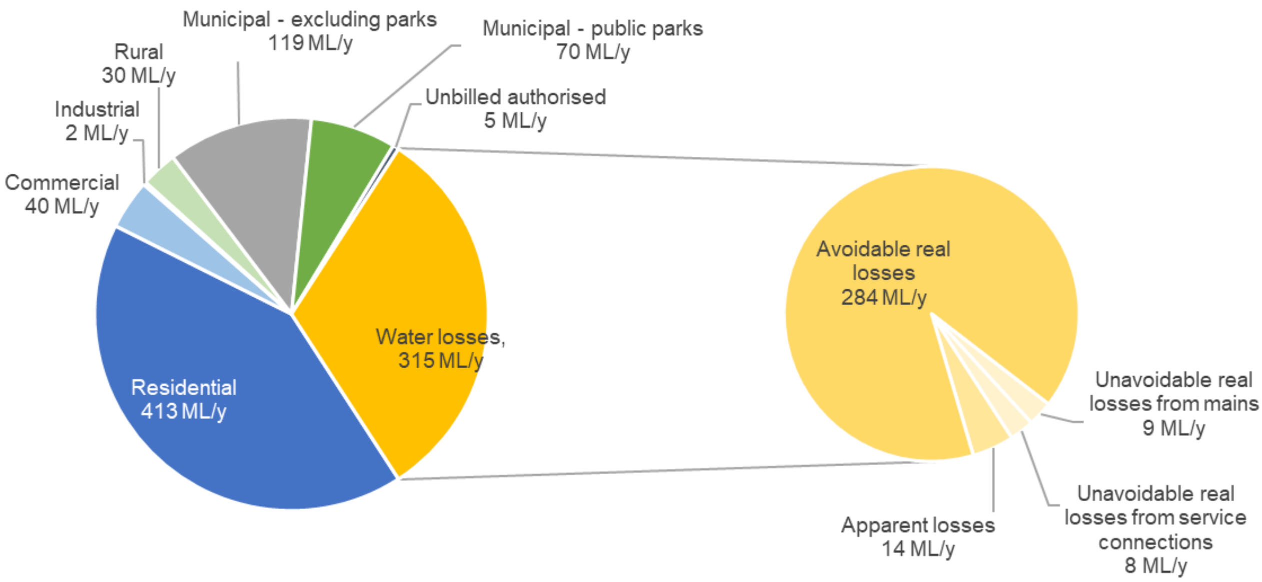

Figure 2-8: Hay Raw WSS water balance

The infrastructure leakage index (ILI) is an indicator of how effectively real losses in the distribution system are being managed at the current operating pressures. It is the preferred indicator for state and national comparisons (metric benchmarking), and has been adopted by the International Water Association as the preferred indicator for international comparisons (National Water Commission, 2014)

Based on the above water balance, Hay Raw WSS has an average infrastructure leakage index (ILI: current annual real losses / unavoidable real losses) of around 17.7. An ILI greater than 12 falls into the worst Leakage Performance Category [3], which indicates that there is significant potential for Council to reduce leakage in Hay Raw WSS.

On average, around 30% of the water produced in Hay Raw WSS is not accounted for in the billing data. The average unit water loss is estimated to be around 610 L/meter/day.

2.4.2 Hay Potable WSS – Water Balance

Council advised that there has been significant unmetered authorised use by Council for maintenance reasons such as reservoir and mains flushing, which generally occurs in the winter months. There are no records for the volume used.

PWA identified there were several months between the 2017/18 and 2018/19 financial years with unseasonably high spikes in WTP production, which was attributed to this use for maintenance purposes. PWA have estimated the council maintenance water use to be around 30 ML/year, explained further in Section 6.2.2.

The water balance for Hay Raw WSS is shown in Table 2-7, and shown graphically in Figure 2-9.

Table 2-7: Hay Potable WSS historical average yearly water losses estimation

Category	Subcategory	User classes and losses	ML/year
Authorised consumption (ML/year)	Billed metered consumption by registered (retail) customers	Residential	153
		Commercial	28
		Industrial	0
		Rural	0.3
		Municipal - excluding parks	28

Category	Subcategory	User classes and losses	ML/year
		Municipal - public parks	0.1
	Unbilled authorised consumption (e.g. system flushing) [1]		12
Water losses	Apparent losses (e.g. theft, customer meter under-registration)		5
	Current Annual Real Losses	Avoidable real losses	99
		Unavoidable real losses from mains	7
		Unavoidable real losses from service connections	10
Total (average year production)			**341**

1 – Out of the five years of historical data, it was estimated that around 30 ML/year was used as unbilled authorised consumption for Council maintenance in the 2017/18 and 2018/19 financial years. This equates to 60 ML over the five years of historical data, or approximately 12 ML/year.

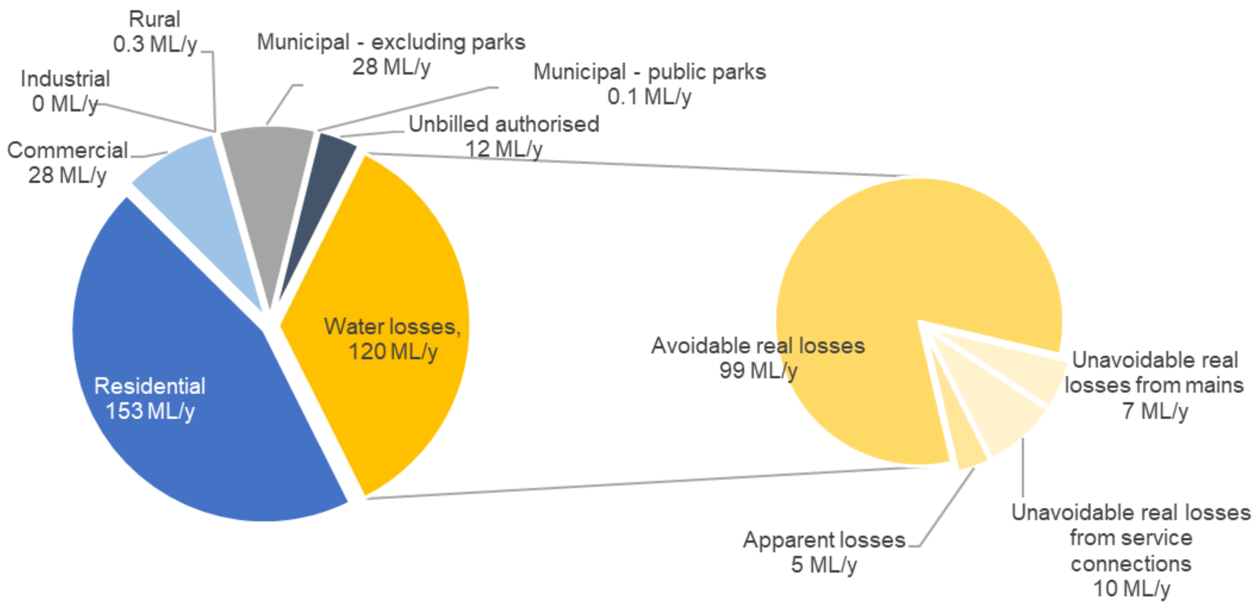

Figure 2-9: Hay Potable WSS Water Balance

Hay Potable WSS has an ILI of 6.9 in an average year.

On average, around 35% of the water produced in Hay Potable WSS is estimated to be lost. The average unit water loss is estimated to be 265 L/meter/day.

3. Water Treatment Plant Performance

PWA undertook an assessment of the Hay WTP to identify any current issues and to suggest possible plant improvements to optimise the treatment performance. The report is attached in Appendix A.

The outcome of the assessment showed that the WTP is in a reasonably good condition and well maintained compared to its age and is operated in a satisfactory manner. This is despite the clarifier not functioning as originally designed due to faulty equipment, and most plant functions being manually operated. The water quality is measured and recorded once a day from grab samples. Only an online chlorine analyser and a pH meter are provided to continuously measure the water quality of the treated water. This is of concern, as when a treatment failure occurs which negatively affects the treated water quality, this may not be known until much after the event – if at all – since there is no continuous monitoring or alarms for other vital water quality parameters.

The level of automation at the WTP needs to be seriously considered in order for the operators to effectively monitor and manage the Critical Control Points detailed in the Council's Drinking Water Management System.

Filter backwash is manual, requiring two operators to do a proper backwash. None of the chemical dosing is flow-paced, except fluoride.

The chemical dosing systems are considered adequate, however, some upgrades are mandatory, for instance providing bunding for the chemical storage tanks to comply with current environmental requirements.

There is potential to extend the life of the WTP and improve operation as well as the consistency of the final product quality. A full list of recommended upgrades is detailed in this report.

The recommendations discussed below target the work required to achieve the following:

- improve the overall plant performance to treat the raw water
- improve the reliability of the treatment process
- achieve the treated water quality levels expected
- operate the plant more efficiently
- improve WH&S and minimise the risk of environmental issues
- reduce the operational and maintenance cost
- avoid potential major failures of some of the process units that show wear and tear
- extend the remaining lifetime of the WTP.

3.1 Recommended upgrades

The recommended mandatory upgrades include:

a) Rectify the conductivity type level switch in the vacuum chamber of the clarifier.
b) Replace the galvanised mild steel enclosure for the vacuum blower with one made of aluminium, complete with handles.
c) Repair the filters inlet valve (this item not included in the cost estimates).
d) Reinstate the clarifier desludging valves.
e) Install a Y-strainer in the alum metering pumps suction line.
f) Address the issues in the alum dosing system including reinstatement of the duty/standby arrangement, providing a bund to comply with AS3780 and other minor upgrades.
g) Replace any faulty stilling plates in the clarifier.
h) Set the correct filter drain down level and provide additional level monitoring.
i) Install online water quality analysers and connect to the plant SCADA with alarms sent to operators.
j) Provide a bund for the alum storage tank and alum unloading bund.

k) Provide a bund for the soda ash solution tank area or alternatively, bund the whole machinery room where the soda ash system is located.
l) Install a dust extraction system for the soda ash bag loaders as well as lids for the batching tanks. Alternatively, consider vacuum loading system.
m) Provide a bund around the clear water tank entry hatch.
n) Flow-pace alum and chlorine dosing operation
o) Provide a safety shower/eyewash for the alum dosing system.
p) Upgrade SCADA to provide trending of individual filtered water turbidity, and generate alarms for critical water quality.
q) Provide a RF concrete PAC contact tank on the WTP site.
r) Top up the filter media.
s) Provide a new room (6mx4m) constructed immediately outside the lab room on the paved area and relocate the control monitors.
t) Prepare drawings and process description of all upgrades to be included in the O&M manuals.

The following upgrades may be required after the proposed additional investigations:

a) Upgrade the clearwater tank if required following the audit by NSW Health.
b) Replace filter media, rectify any erosion in walls, provide level switches if required after filter investigation OR install a UV dosing system.
c) Allow for underdrain repairs if required during filter media replacement.
d) Replace alum tank and address AS3780 requirements if required after investigation.

3.2 Cost estimate for upgrades

Table 7-1 provides the high-level estimated total project cost for the upgrade.

This estimate is based on PWA's recent experience on similar projects and a more accurate estimate needs to be prepared during the detailed design stage.

Table 3-1: Cost estimate of the Hay WTP upgrade works

Item #	Description	Cost ($) Ex GST
	Mandatory Upgrades	
1	Rectify the conductivity type level switch in the clarifier.	20,000
2	Replace the galvanised mild steel enclosure for the vacuum blower with one made of aluminium, complete with handles.	16,000
3	Reinstate the clarifier desludging valves	35,000
4	Replace clarifier stilling plates	46,000
5	Replace filter outlet valves	42,000
6	Install online analysers and connect to the plant SCADA.	92,000
7	Upgrade SCADA for water quality trending and alarms	40,000
8	Rectify alum dosing system including duty/standby pumps, dosing pipes, strainers etc	48,000
9	Flow pace critical dosing operations such as alum and chlorine	36,000
10	Provide a bund for the alum storage tank and upgrade the tank inlet.	48,000
11	Provide a chemical unloading bund for alum	30,000

Item #	Description	Cost ($) Ex GST
12	Provide a bund for the soda ash solution tanks or bund the whole machinery room where the soda ash system is located.	18,000
13	Install a dust extraction system for the soda ash bag loaders as well as lids to the batching tanks.	24,000
14	Provide a bund around the clear water tank entry hatch.	5,000
15	Provide a PAC contact tank including necessary raw water supply pipe modifications	81,000
16	Top up filter media	6,000
17	Provide a safety shower/eyewash for the alum dosing system	6,000
18	Provide a new room for office and control room including power supply/AC etc	80,000
19	Prepare drawings and process description of all upgrades to include in the O&M manuals	40,000
20	Investigate the filter	32,000
21	Investigate alum tank structural condition	10,000
	Subtotal of mandatory upgrades without contingency	755,000
	Sub Total of mandatory upgrade with 35% contingency	1,019,250
22	Planning, Design documentation, procurement and project management (25%)	235,000
	Total cost of mandatory upgrades	**1,254,250**
	Provisional Items	
23	Upgrade the clearwater tank if required following the audit by NSW Health	40,000
24	Replace filter media, rectify any erosion in walls, provide level switches if required after filter investigation	105,000
25	Allow for underdrain repairs if required during filter media replacement	100,000
26	Replace alum tank and address AS3780 requirements if required after investigation	40,000
	Subtotal of provisional items	285,000
	Subtotal of provisional items with 35% contingency	384,750
27	Investigations, design documentation, procurement and project management of provisional items (25% of capital cost)	98,000
	Total cost of provisional items	**482,750**
	Total project cost – mandatory upgrades and provisional items	**1,737,000**

3.3 Application of Health-Based Treatment Targets

The introduction of a microbial Health-Based Target (HBT) in the Australian Drinking Water Guidelines is being considered to determine the tolerable low level of microbial risk for drinking water. The HBT will provide the basis for determining the treatment requirements and will help define the performance standards that apply to treatment processes.

The application of HBTs requires that the source risk to a drinking water supply be assessed and quantified, and depending on the risk, a log-reduction in pathogens by treatment is required. If a system were not to meet the recommended Log Reduction Values (LRVs) then a potential issue would arise.

PWA has developed an HBT Assessment tool which categorised raw water source catchments into vulnerability categories (see assessment in Appendix B). The tool was used to assess the inherent microbial risk from the Murrumbidgee River catchment and the performance of the treatment barriers and the residual microbial risk after treatment.

3.3.1 HBT assessment of threats – Murrumbidgee River Catchment

Hay WTP sources water from the Murrumbidgee River. Water is pumped by the Murray Street Pump Station from the intake on the Murrumbidgee River, located about 2 km east of the town centre.

A catchment vulnerability assessment is undertaken for the Hay source water catchment. Threats are assessed within the inner catchment and outer catchment:

- Inner catchment – 1 km radius from the intake point on the Murrumbidgee River
- Outer catchment – 5 km radius from the intake point on the Murrumbidgee River

The likelihood of the threat occurring in the outer catchment is considered to be lower than the inner catchment, therefore risk ratings within the outer catchment are reduced.

The aerial view of the Hay source water catchment is shown in Figure 3.1. A Digital Elevation Model (DEM) made using ELVIS (Elevation Information System) data was used to identify the elevations and slope of the land in the source water catchment. The land around Hay is generally very flat, however there is a slight slope downwards in the west direction. The catchment was bound by the Sturt Highway to the south of the river, the Mid Western Highway to the north, and Bourke Street to the west. Land on the other sides of these roads is not in the source water catchment as the land does not drain towards the intake point on the Murrumbidgee River.

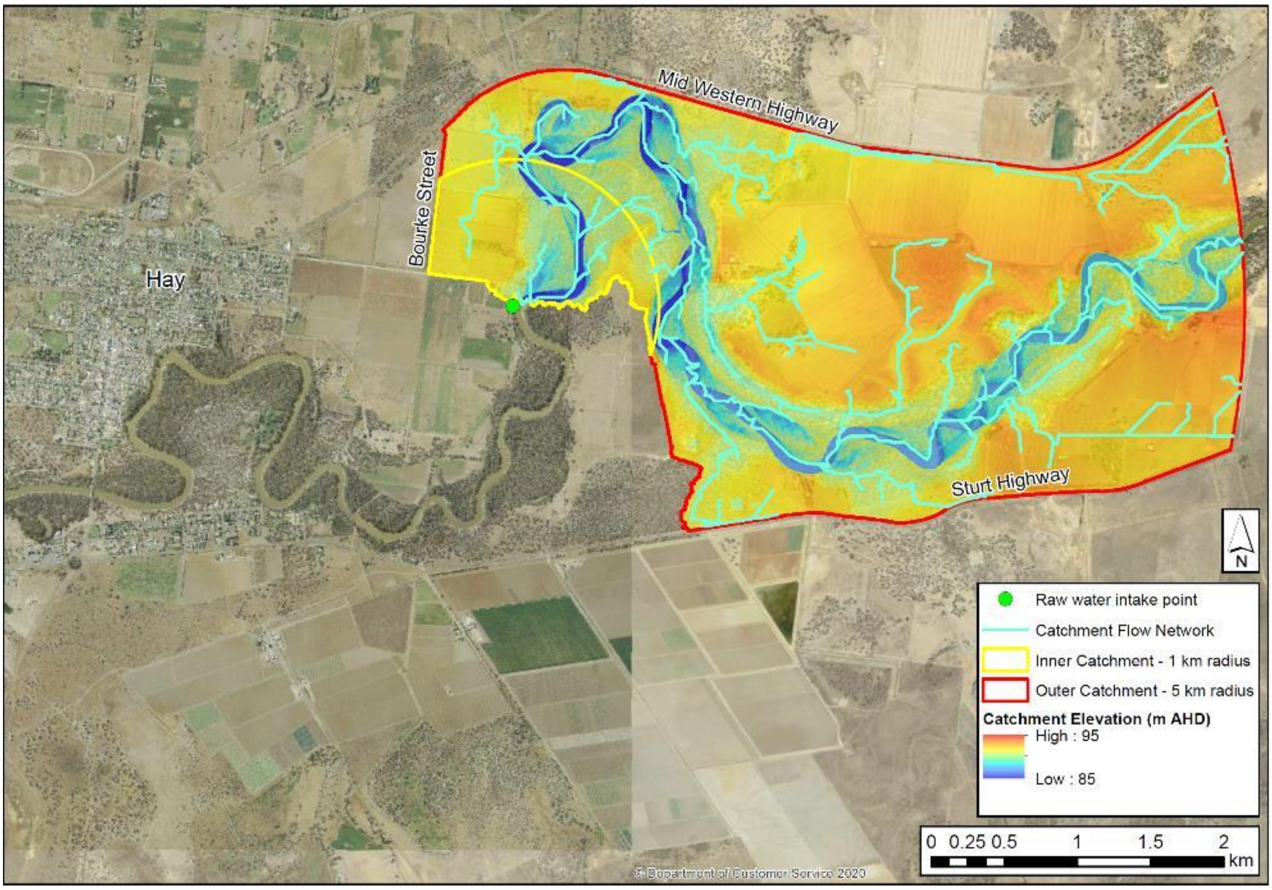

Figure 3.1: Hay source water catchment

The only significant threat of contamination identified in the source water catchment is livestock.

Around 75% of the source water catchment is grazing land, from which animal faeces may flow into the river during rain events. Local soils contain a high clay content, so faecal contaminants may remain on the land longer than for well drained soil. However the catchment is also very flat, and Hay often has long periods without rainfall, so the likelihood of animal faeces being washed into the river during rain events is lower.

There are several properties with on-site sewage management systems (OSSMS), such as septic tanks, within the source water catchment, however the number of OSSMS is low enough to only pose a low risk of pathogens.

Based on the catchment vulnerability assessment, the Hay source water catchment has an **inherent risk of 'Medium'** for chlorine sensitive and chlorine resistant pathogens.

3.3.2 HBT assessment of treatment barriers

The treatment barrier assessment considers the treatment processes, along with historical records of treated water quality. The LRV applied depends on the type and effectiveness of the treatment system.

Refer to Section 2.2.1 for the treatment process of Hay WTP and the WTP performance optimisation report in Appendix A for historical treated water quality records.

For chlorine resistant pathogens

There is no disinfection process such as UV or ozone at the Hay WTP which provides a barrier to chlorine resistant pathogens. The only barrier is the conventional filtration process.

Current treatment process

Combined filtered water turbidity is monitored once per day, and individual filtered water turbidity is not monitored. The filters have always achieved a filtered water turbidity of less than 0.3 NTU, however during periods of poor raw water quality, the filtered water has exceeded 0.20 for several consecutive days. See the treated water quality assessment in the WTP performance optimisation report in Appendix A.

The current treatment process achieves the following performance requirement for reducing the risk of chlorine resistant pathogens:

1. Combined filtered water turbidity below 1.00 NTU (maximum)
2. Combined filtered water turbidity below 0.30 NTU (95th percentile)
3. Filtration is preceded by clarification that treats all flow and has a coagulant continuously added while in operation

Based on the performance of the barrier, no further reduction in the inherent risk is achieved and the residual risk of chlorine resistant pathogens is also **Medium**

Future treatment process

To reduce the residual risk of chlorine resistant pathogens to **Low**, in addition to the above performance criteria, the following must also be achieved:

1. The combined filtered water from each filter must be monitored for turbidity either online or at least twice per shift, **AND**
2. **at least one** of the following
    a. Combined filtered water turbidity is measured online and the combined filtered water turbidity achieved is below 0.15 NTU (95^{th} percentile)
    b. Individual filtered water turbidity measured online with a reading at least every 15 minutes, and the individual filtered water turbidity achieved is below 0.30 NTU (maximum) and below 0.15 NTU (95^{th} percentile)
    c. UV disinfection achieving 0.5 log inactivation
    d. Ozone disinfection achieving 0.5 log inactivation

OR

1. No additional turbidity monitoring, **AND**
2. UV disinfection achieving 4.0 log inactivation

The simplest way to reduce the residual risk of chlorine resistant pathogens to low is by increasing the frequency of filtered water turbidity monitoring and improving the performance of the filters to achieve a 95th percentile filtered water turbidity below 0.15 NTU.

The proposed WTP upgrades in Section 3.1 include online turbidity analysers and works to the clarifier which will improve the filtered water turbidity. To achieve the combined filtered water turbidity below 0.15 NTU (95th percentile), additional works will be required. If the proposed filter inspection does not recommend media replacement, the allocated provisions for media replacement should be used to install a UV dosing system to meet LRV requirements for chlorine resistant pathogens.

For chlorine sensitive pathogens

To reduce the residual risk of chlorine sensitive pathogens to **Low**, the following must be achieved:

- Water turbidity < 1 NTU
- Chlorine contact > 15 mg.min/L

A water turbidity below 1 NTU is always achieved by the WTP. See the treated water quality assessment in the WTP performance optimisation report in Appendix A.

The clear water tank has a capacity of 150 kL and is unbaffled. This tank supplies water to the backwash pump as well as to the clear water pumps. Operators advised PWA that there is no known issue with the clearwater tank, and the right chlorine residual level is maintained throughout the reticulation including the chlorine contact time, to the first customer.

The residual risk of chlorine sensitive pathogens: **Low**

Distribution system integrity (LWU Circular 18)

The distribution system is assessed with respect to meeting LWU Circular 18 recommendations to ensure drinking water supplies. This circular was prepared in 2014 to address local water utilities of a new protocol to ensure safety of drinking water supplies across regional NSW. LWUs were required to review and update their standard operating procedures to ensure three key barriers were achieved.

The Hay Potable WSS is assessed as achieving all three barriers:

Barrier 1: Effective disinfection

Council monitors daily the factors which affect effective disinfection; treated water turbidity, pH, and free chlorine. The chlorine contact is achieved by the current treatment process.

Barrier 2: Distribution system integrity

The potable reservoirs are regularly (usually weekly) inspected. The inspection includes a walk around, a roof inspection for integrity and leaks, walkway inspection and ventilation.

Barrier 3: Maintain a free chlorine residual in the distribution system

Circular 18 recommends a minimum chlorine residual of 0.2mg/L in the distribution system.

A minimum chlorine residual of 0.2mg/L in the reticulation has consistently been achieved for Hay Potable WSS. In 2020 the minimum free chlorine recorded in the reticulation was 1.1 mg/L. See the reticulated water quality data in the WTP performance optimisation report in Appendix A.

3.3.3 NSW Health preliminary risk assessment for Cryptosporidium

NSW Health gave the Hay Potable WSS a preliminary cryptosporidium risk rating of **Medium**. Refer to letter sent to Council on 25 November 2019. NSW Health considered that cryptosporidium may be present from the stock and onsite systems in the catchment.

NSW Health also advised of the following potential action and/or improvement – "*Optimising the operation and monitoring (ideally continuously) of individual filters to consistently reduce turbidity to <0.2 NTU.)*

This advice is supported by PWA's findings.

4. Hay Sewerage Scheme

4.1 Sewage collection and transfer

The Hay sewerage scheme is a conventional gravity reticulation system, consisting of approximately 30 km of mostly vitreous clay sewer gravity mains, and 4 km of rising mains, some sections of which dates back to 1905, and eight sewage pump stations (SPSs). SPS 1 pumps all sewage to the inlet works of the Hay sewage treatment plant (STP) via a sewage rising main. The hierarchy of the SPS are shown in Figure 4-1.

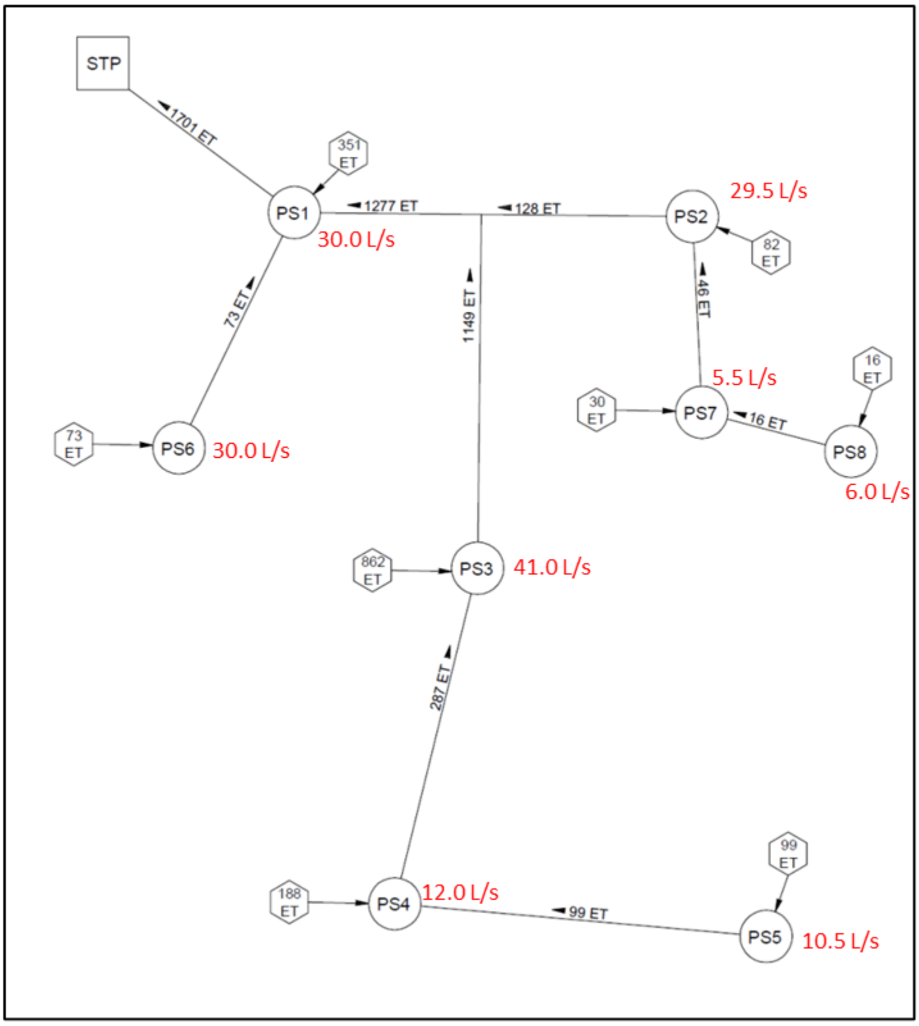

Figure 4-1: Hay Sewage Pump Station Hierarchy

Much of Hay's sewerage system is reaching the end of its useful life so Council has commenced an annual program of sewer refurbishment (re-building and relining).

4.2 Sewage treatment

The Hay STP located off Rye Lane was newly built in 2016. It replaced an old trickling filter type treatment plant that was designed in the 1940s and had serious structural as well as performance issues. The newly constructed plant consists of an Intermittent Decanted Extended Aeration (IDEA) tank with a design capacity of 3,500 EP based on a hydraulic allowance of 240 L/EP/d.

The STP comprises of the following main facilities:

- Inlet works comprising an inlet receival structure, spiral sieve mechanically raked screen with bypass channel fitted with manually cleaned bar screen, flow measurement unit and flow distribution structure. It can accommodate maximum inflows of up to 78 L/s
- An Intermittently Decanted Extended Aeration (IDEA) tank for biological oxidation, nitrification, and denitrification of the wastewater with associated aeration, effluent decanting and waste activated sludge (WAS) pumping equipment
- An effluent catch/ balance pond to attenuate secondary treated decanted effluent from the IDEA pond prior to the effluent pit.
- Sludge lagoons for stabilisation treatment, thickening and storage of waste sludge
- Raw water system for flushing points on-site
- Sludge dewatering unit and drying beds for dewatering stabilised sludge
- Wastewater pump station for collection and drainage of wastewater
- Site works including amenities building, site drainage and lighting, etc.

A schematic diagram of the process and layout for the STP is shown in Figure 4-2.

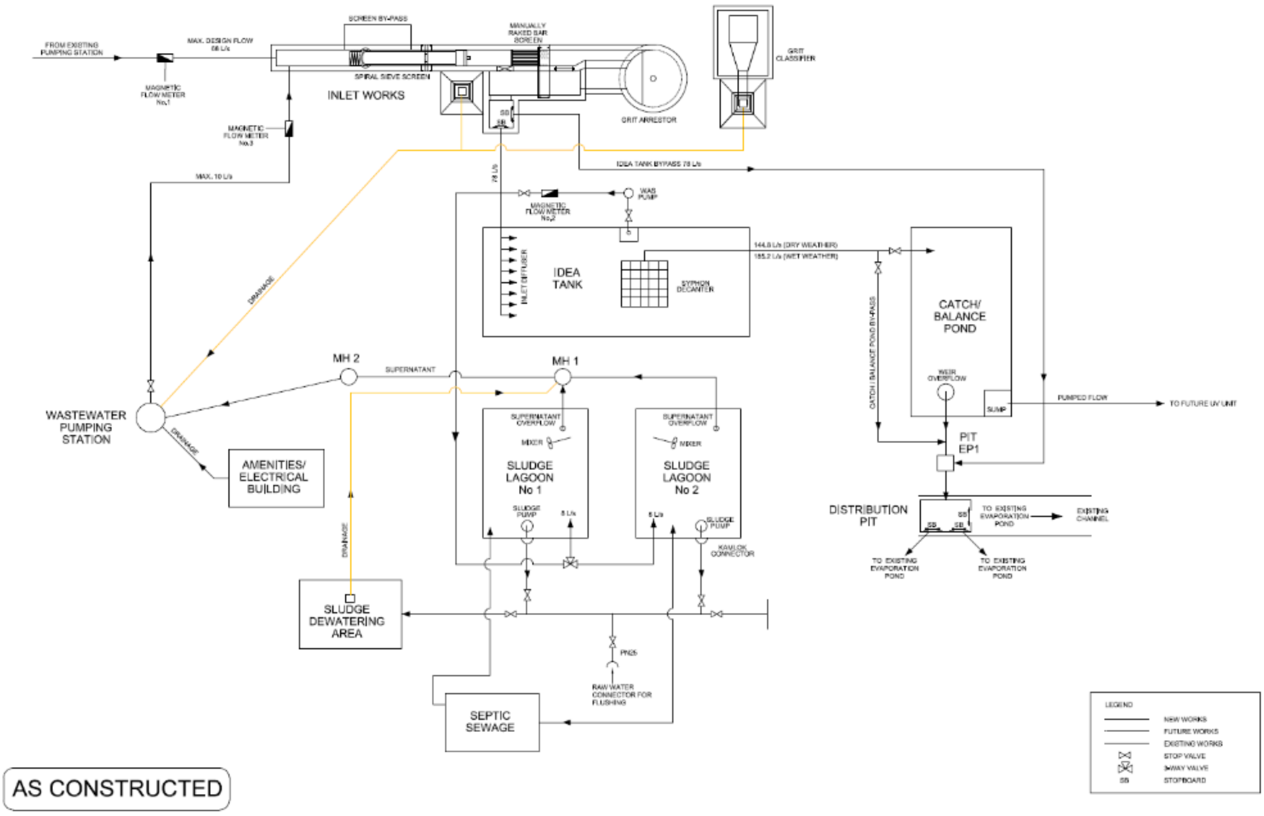

Figure 4-2: Hay STP process flow diagram

4.3 Effluent management

The Hay STP operates under the Environmental Protection Licence (EPL) number 3520. Under this licence there are no load or concentration limits required as effluent is discharged to evaporation ponds on site and not to any receiving waters, however monitoring for groundwater contamination is required.

The new STP was built with provision for an effluent reuse scheme to be implemented in the future, however currently no effluent reuse is carried out. Implementation of an effluent reuse scheme is identified as an opportunity to reduce town water demand on raw water; this is discussed in Section 7.4.

4.4 Biosolids management

The Hay STP incorporates sludge lagoons for sludge thickening and stabilisation, and a sludge dewatering hardstand. The functions of these facilities are as follow:

Sludge Lagoons

- Stabilisation of waste sludge through anaerobic biological processes that reduce volatile solid content. Stabilisation of the sludge will comply with Grade B requirement under OEH's "Environmental Guidelines – Use and Disposal of Biosolids Products"
- Thickening of waste sludge by the drawing excess supernatant off from the surface of the sludge lagoons
- Storage of waste sludge to facilitate the planning and management of sludge dewatering operations
- Transferring the supernatant liquor from the surface of the sludge lagoons to the wastewater pump station by gravity

Sludge Drying Beds

- Dewatering of stabilised sludge transferred from the sludge lagoons
- Transferring the drainage liquid to the supernatant pump station via a gravity pipeline

Grade B stabilisation allows for biosolids to be reused for 'Restricted Use 2' or 'Restricted Use 3', depending on the Contamination Grade of the biosolids at Hay STP. The allowable land application use, taken from the Biosolids Guidelines for Restricted Use 2 and 3 are shown in Table 4-1.

Table 4-1: Allowable land application use

Stabilisation Grade	Contaminant Grade	Biosolids Classification	Allowable land application use
B	C	Restricted Use 2	Agriculture Forestry Soil and site rehabilitation Landfill disposal Surface land disposal [1]
B	D	Restricted Use 3	Forestry Soil and site rehabilitation Landfill disposal Surface land disposal [1]

[1] To be applied within the boundaries of sewage treatment plant site

Note that biosolids products which are not contaminant or stabilisation graded are automatically classified as 'Not suitable for use'. Therefore, sampling and testing is first required to determine the contaminant grade. The biosolid can be sampled in batches or continuously, and the contaminants that are tested include heavy metals and toxic substances. Contaminant Grades are given based on the concentration of the contaminants, found in the Guideline.

5. Population and Growth

5.1 Historical population

Estimated from ABS Data

The Australian Bureau of Statistics (ABS) calculates an Estimated Residential Population (ERP) each year for each LGA in Australia. It uses census data as the basis (which is based on place of usual residence), then adjusts for many factors such as interstate and overseas migration, births, and deaths. The ERP for Hay Shire Council LGA over the last ten years is given in Table 5-1.

Table 5-1: Historical estimated residential population (ERP) for Hay Shire Council

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Hay Shire Council LGA	3,153	3,085	3,028	3,013	3,002	2,989	2,975	2,981	2,975	2,949
Average annual growth		-2.2%	-1.8%	-0.5%	-0.4%	-0.4%	-0.5%	0.2%	-0.2%	-0.9%

The ERP shows that population within HSC LGA has been decreasing slightly. The population may be decreasing over the whole LGA; however, it could still be increasing in the urban centre of Hay as people move in from rural areas.

The number of occupied and unoccupied dwellings in the town of Hay was obtained using 2016 Census data. The results are shown in Table 5-2.

Table 5-2: Standard private dwellings and population from 2016 Census General Community Profile

	Dwellings			Persons	Household size	% private dwellings occupied
	Occupied	Unoccupied	Total			
Separate house	795	180	975	1,792	2.3	82%
Semi-detached row or terrace house townhouse etc	24	11	35	41	1.7	69%
Flat or apartment	47	20	67	93	2.0	70%
Total for standard private dwellings	**866**	**211**	**1,077**	**1,926**	**2.2**	**80%**

* standard private dwellings exclude population in other dwellings such as caravans, cabins, houseboats, or dwellings attached to shops

The SA1 zones used are shown in Figure 5-1.

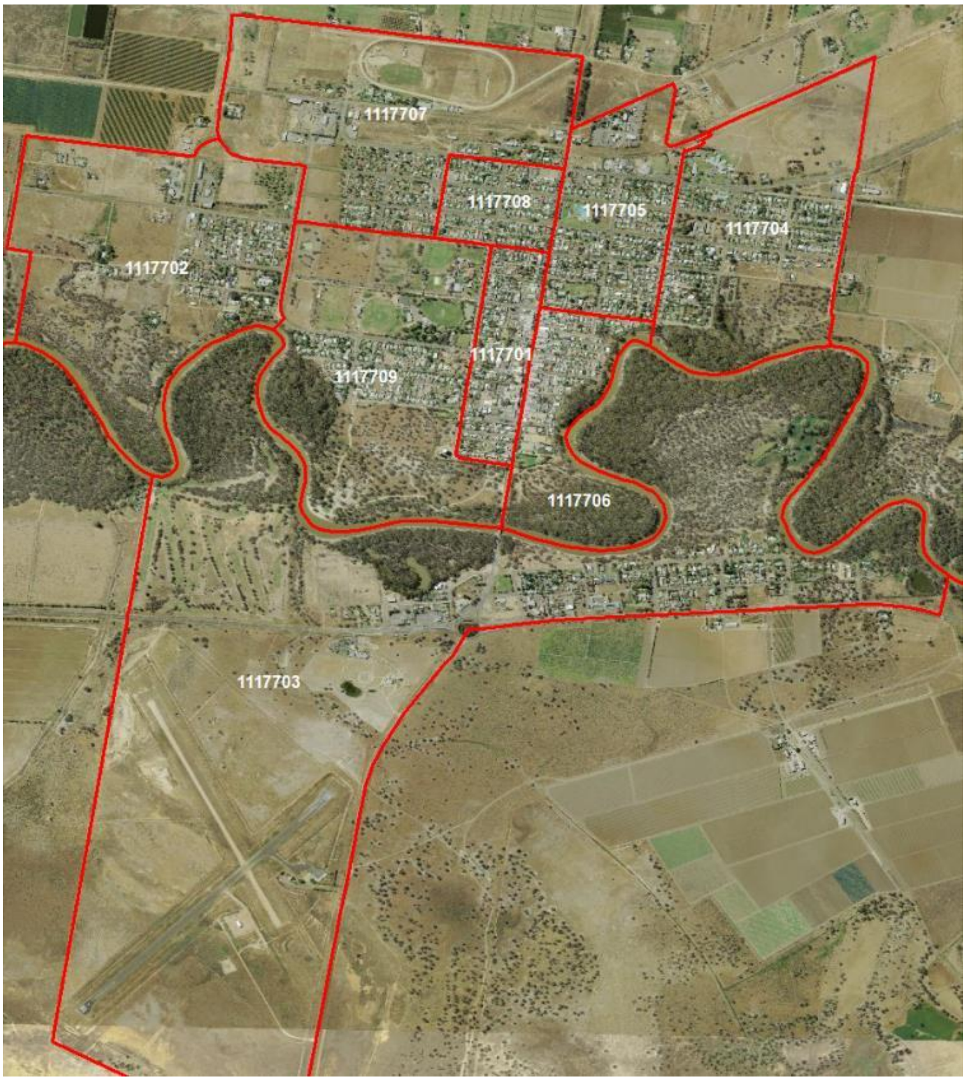

Figure 5-1: Map of SA1 statistical areas covering the town of Hay

Estimated from Water Billing Data

The water billing data was used to estimate the number of dwellings and population for Hay water supply service area. The historical number of meters with the user classes "residential" in Council's water billing data is given in Table 5-3.

Table 5-3: Historical residential assessments in Hay Raw WSS and Potable WSS

Financial Year	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Raw WSS	1,103	1,107	1,109	1,109	1,108	1,109
Potable WSS	1,075	1,081	1,086	1,088	1,091	1,090

The 1,081 residential assessments for 2015/16 in the potable water billing data correlates well with the 1,077 total private dwellings recorded in the 2016 Census data. There are slightly more assessments on the Raw WSS as the distribution extends slightly outside the main part of town.

Using the values from Table 5-2 of 80% of private dwellings occupied and 2.2 people per household, in 2019/20 there are an estimated 1,951 people supplied by the Raw WSS, and 1,918 people supplied by the Potable WSS.

5.2 Future Development

Hay Shire Council proposed a re-zoning in Hay and an extension of the service areas. Figure 5-2 below shows the proposed re-zoning areas as cross-hatched.

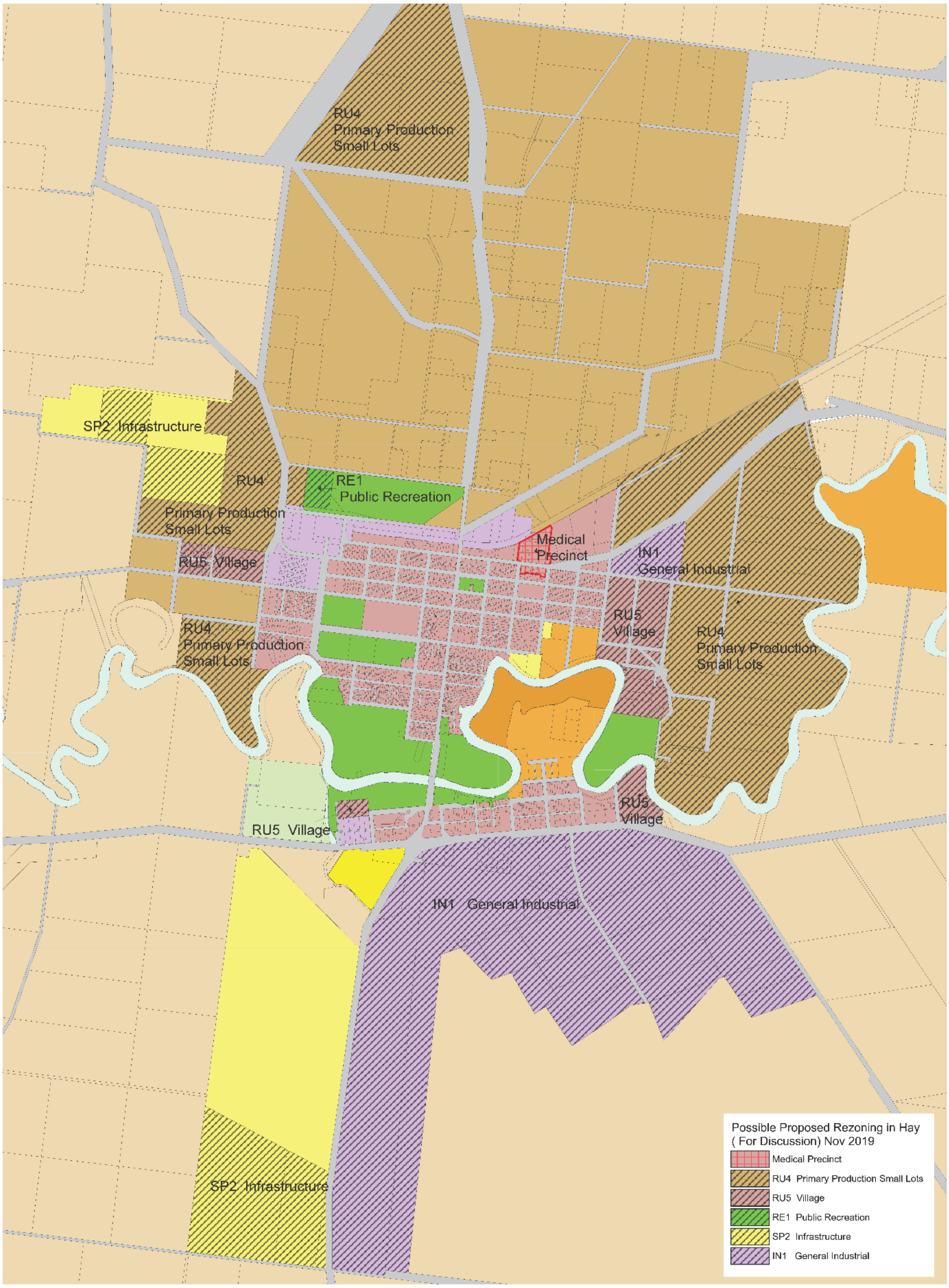

Figure 5-2: Proposed rezoning and extension of service area

The ultimate number of new lots in the residential zoned areas was estimated by dividing the land area by a lot size of 0.1 Ha for RU5 areas (Village) and 2.0 Ha for RU5 areas (Primary Production Small Lots), also leaving 30% of the area for roads.

A summary of the ultimate estimated number of residential lots is detailed below in Table 5-4.

Table 5-4: Hay water growth zones and capacities

Zone Type	Ha	Minimum Lot size (Ha)	Estimated residential lots
RE1 Public Recreation	6	N/A	N/A
IN1 General Industrial	521	N/A	N/A
SP2 Infrastructure	134	N/A	N/A
RU4 Primary Production Small Lots	572	2.0	200
RU5 Village	66	0.1	463

It is estimated that at the ultimate development there will be an additional 200 lots and 463 lots in new areas zoned as RU4 Primary Production Small Lots and RU5 Village respectively.

5.2.1 Growth Staging

The future development staging nominated by Council for the growth zones are:

1. All RU5 zones fully developed in the first five years
2. Then all other zones fully developed by 30-year horizon

Table 5-5 below shows the staging of residential dwelling growth in the residential growth zones of Hay from 2021 to 2051.

Table 5-5: Residential growth strategy for Hay – new dwellings

Zone Type	2021	2026	2031	2036	2041	2046	2051
RU5 Village	0	463	463	463	463	463	463
RU4 Primary Production Small Lots	0	0	40	80	120	160	200
Total	0	463	503	543	583	623	663

The non-residential future zones (RE1 Public Recreation, IN1 General Industrial, and SP2 Infrastructure) have been assumed to grow at a constant rate from 2026 to full capacity by 2051.

6. Water Demand Analysis

The water demand analysis undertaken calculated the unit demands, estimated the non-revenue water, and forecast the following demands:

- **Average (rainfall) year demands –** for revenue planning
- **Dry year demands –** to assess drought security for DCERP
- **Peak day demands –** to assess system reliability and for input to hydraulic model

The analysis uses the water production data (that is the water delivered into the system), and the customer billing data (metered consumption by users in the system).

The results of the water will be used to review the demands estimated in the 2017 IWCM strategy, which used three years of WTP production and customer billing data from 2012/2013 to 2014/2015.

6.1 Peak usage analysis

Weather patterns in summer that result in prolonged periods of high demand can stress systems more than a large but isolated peak day demand. Historical daily production data is analysed to understand water usage patterns during these periods of peak usage.

The first aim of the analysis is to obtain a ratio of the peak day to the average day in the peak week, which is used to estimate peak day demands from the production model hindcast. The second aim is to obtain a demand "persistence pattern" during the peak period, which can be used to estimate whether the existing reservoirs and WTP capacity can supply demand during the peak period. The persistence pattern is also used in simulating a peak demand period in the hydraulic model simulation.

Production data from 2018/19 to 2019/20 was used for peak day analysis as this period better represents current water usage patterns and was the only period of data available.

6.1.1 Hay Raw WSS – Peak usage

During the period of available data, the highest recorded raw water production was **8.8 ML/day** which occurred on the 21 of January 2019. The maximum temperature surrounding this date ranged from 35-48°C. The water production pattern is shown in Figure 6-1.

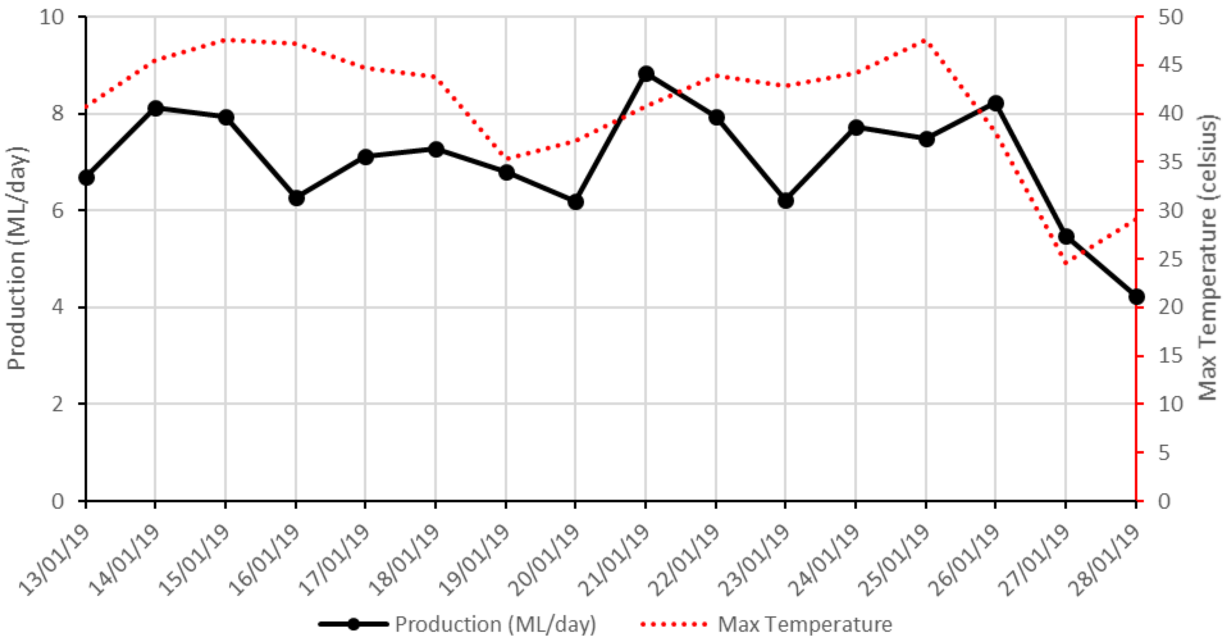

Figure 6-1: Production and max temperature around the peak day production

The daily production during the peak week, and the peak fortnight is shown in Figure 6-2. The peak fortnight includes the peak week, shown in a darker shade.

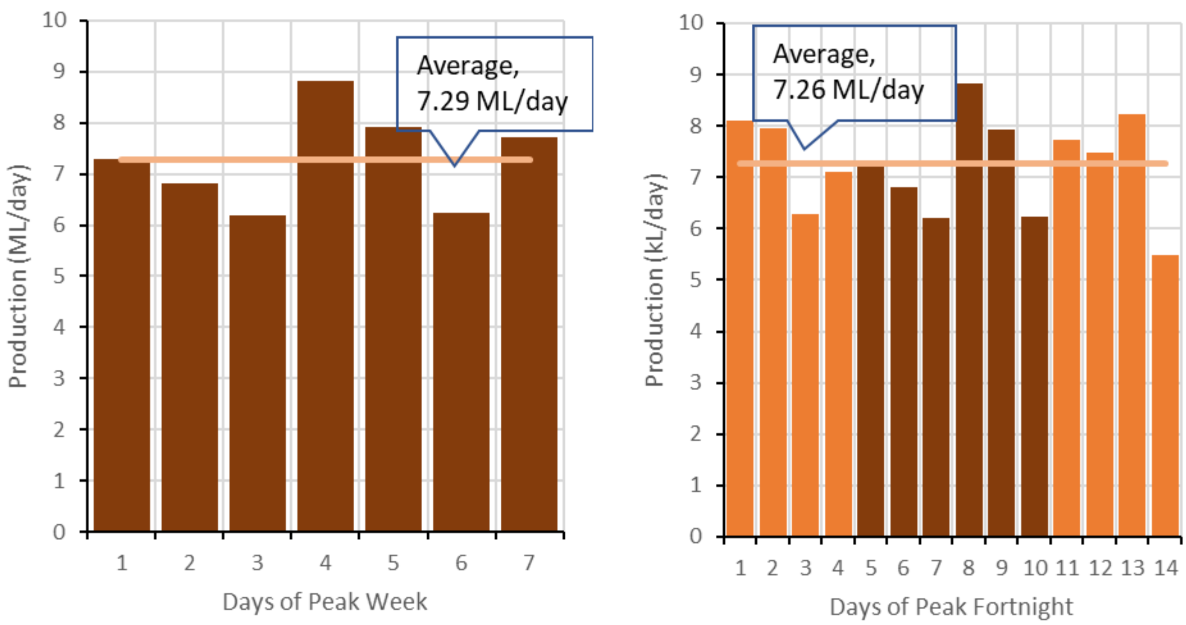

Figure 6-2: Peak fortnight and peak week production

The average daily production over the peak week and peak fortnight was 7.29 ML/day and 7.26 ML/day respectively. The ratio of Peak Day (PD) production to Average Day Peak Week (ADPW) production is 1.17.

6.1.2 Hay Potable WSS – Peak usage

During the period of available data, the highest recorded WTP production was 2.0 M/day which occurred on 30 June 2020. This was considered to be an outlier due to its previous and following day demands being significantly lower and the maximum temperature of the day week not being significant at 20°C.

The next highest appropriate WTP production recorded was **1.6 ML/day** which occurred on 18 January 2019. The maximum temperature surrounding this date ranged from 32-48°C. The water production pattern is shown in Figure 6-3.

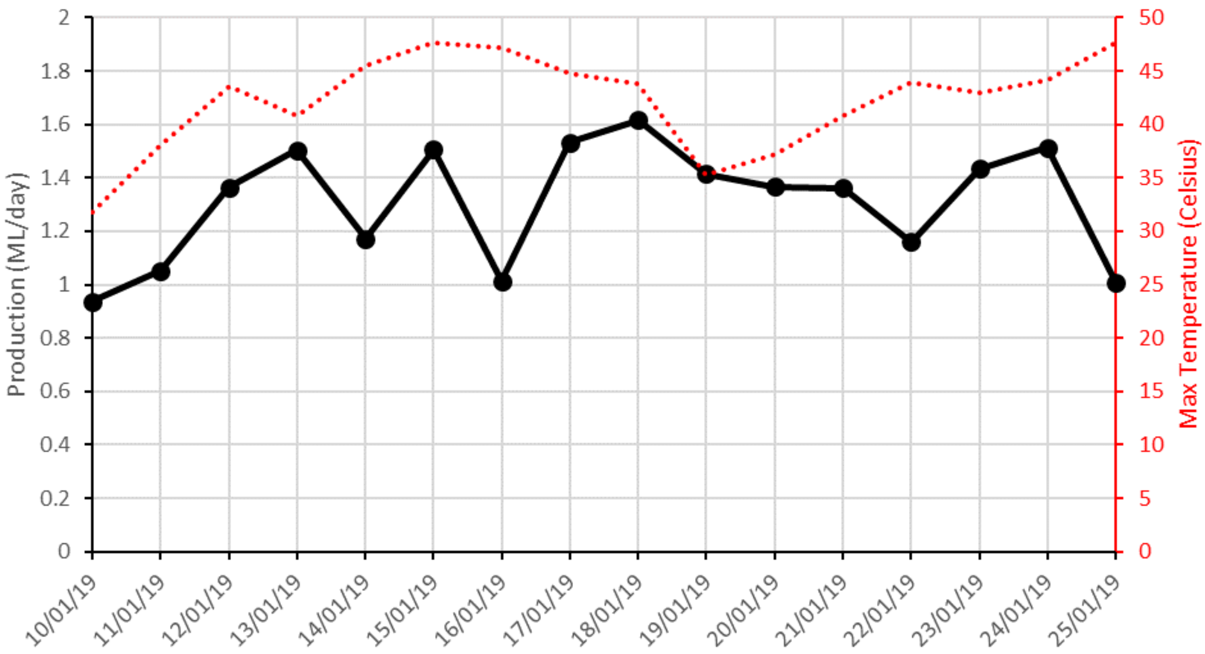

Figure 6-3: Production and max temperature around the peak day production

The daily production during the peak week, and peak fortnight is shown in Figure 6-4. The peak fortnight includes the peak week, shown in a darker shade.

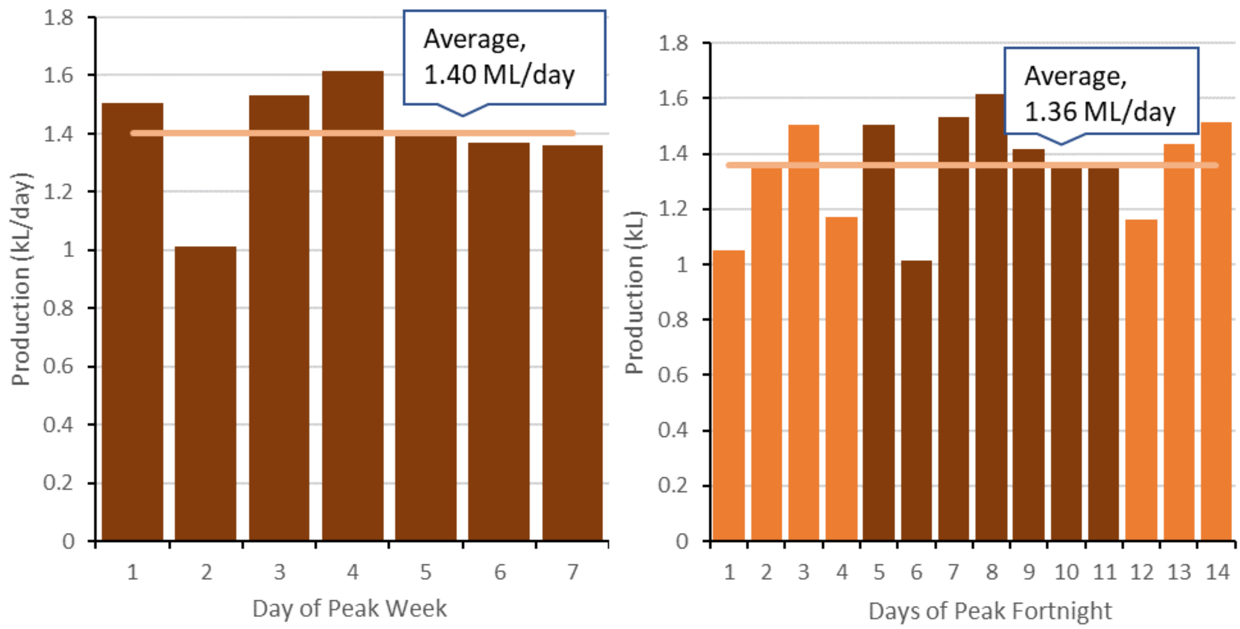

Figure 6-4: Peak fortnight and peak week production

During the same period, the week and fortnight with the highest recorded production were both in January 2019, during a fortnight when the maximum temperature ranged from 32 to 48°C. The average daily production over the peak week and peak fortnight was 1.40 ML/day and 1.36 ML/day respectively.The ratio of Peak Day (PD) production to Average Day Peak Week (ADPW) production is 1.14.

6.2 Annual water usage patterns and trends

Modelling of water production data and the customer usage data is undertaken to understand the impact of various factors/trends (demographic, climatic, economic etc.) on the variability of town water demand.

The factors that were considered were:

- Historical water requirement for grass irrigation (lawns and public open spaces) obtained from PWA's simulated water use model. The model uses location-specific historical rainfall and evaporation data, soil type and grass type
- Historical water requirement for use of evaporative coolers. The model uses location-specific historical maximum temperature data, and a 25°C trigger temperature
- Change in number of connections (reflecting population growth)
- Water restrictions

The aim is to develop a model which, when input with historical factors/trends, will output a production that correlates well with the actual historic production or customer usage.

The model is then hind-cast over a 50-year period of available climatic data of temperature and rainfall to estimate the annual demands if the current conditions of lot size, household size, number of connections, pricing and usage patterns were to prevail. The **average year demand** and **unrestricted future demand** over the 50-year period are then determined and these demands are used as the starting point for the forecasts.

There were no restrictions over the period of available data, and it was determined that the small increase in assessments in Hay did not significantly impact on the water usage.

6.2.1 Hay Raw WSS – Climate correction

Raw Water Production

The water production model for the raw water scheme was developed using WTP production records from 2015/16 to 2019/20. The modelling showed that the outdoor lawn irrigation was the most significant contributor to the raw water production, accounting for 100% of water produced.

The production model was then hindcast over a 50-year period of available climatic data of temperature and rainfall to estimate the annual demands if the current conditions of lot size, household size, number of connections, pricing and usage patterns were to prevail. The hindcast is shown in Figure 6-5.

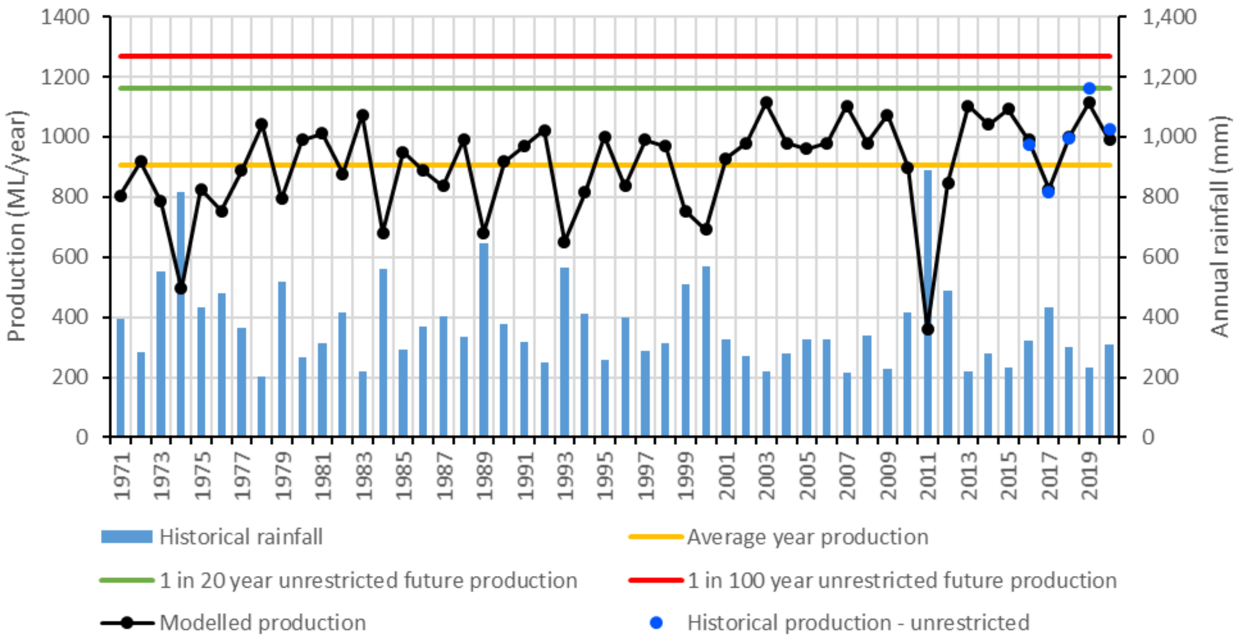

Figure 6-5: Production model hindcast – Hay Raw WSS

The hindcast was also used to estimate the historical ADPW production, which was then multiplied by the PD to ADPW ratio of 1.17 (from Section 6.1) to obtain an estimate for PD production. The 99th%ile (1 in 100 year) was taken as the **unrestricted future production**.

The model results, along with the actual average and maximum yearly production from the historical data are compared in Table 6-1.

Table 6-1: Modelled unrestricted production compared to actual values – Hay Raw WSS

Current Demands - from model			From Historical Data (since 2015/16)		
Average Year (ML/year)	**Unrestricted future production (ML/year)**	**Peak Day (ML/day)**	**Average Year (ML/year)**	**Max Year (ML/year) - 2019**	**Peak Day (ML/day) - 2019**
905	1,269	8.7	995	1,162	8.8

The model estimates values similar to the historical data. The modelled average year is slightly lower than the value from historical data because the five years over which the historical data was available were warmer than average for the last 50-years.

Customer Usage

For Hay Raw WSS, the residential, commercial, municipal, rural, parks and gardens, and total customer usage were all climate dependent and showed strong correlation between modelled irrigation demand and historical raw water usage.

For the analysis the maximum and 99th%ile (1-in-100 year) unrestricted dry year demand was selected as the starting points for the forecasts. The model results are given in Table 6-2.

Table 6-2: Estimated customer usage from climate correction – Hay Raw WSS

Financial year	Average Year Demand (ML/year)	Unrestricted Future Demand (ML/year)	Average Day Demand (kL/day)	Peak Day Demand (kL/day)
Residential	366	519	1,002	3,429
Commercial	39	52	106	324
Municipal – excl Parks and Gardens	112	159	306	1,100
Rural	28	39	77	258
Parks and Gardens	56	81	155	515
Other Industrial	15	20	41	125
Total	**616**	**871**	**1,686**	**5,750**

6.2.2 Hay Potable WSS – Climate correction

Potable Water Production

The water production model was developed using WTP production records from 2015/16 to 2019/20.

Climate correction of the production model was impacted by unusual, large production volumes during off-peak periods, attributed to water used by Council for maintenance purposes as explained in Section 2.4.2. These periods of production were removed for climate correction.

The modelling showed that around 90% of potable water production was climate independent, and 10% could be accounted for by evaporative cooler use which was climate dependent. The "R-squared" value (which quantifies the degree of correlation) between the modelled and actual production data 0.98 for the testing period.

The production model was then hindcast over a 50-year period of available climatic data of temperature and rainfall to estimate the annual demands if the current conditions of lot size, household size, number of connections, pricing and usage patterns were to prevail. The difference between the modelled data and the actual historical production in 2017/18 and 2018/19 was around 30/ML/year, which has been attributed to the water usage by Council for maintenance purposes. This volume has been added to the hindcast to estimate usage if Council continues to use 30 ML year for maintenance. The hindcast is shown in Figure 6-6.

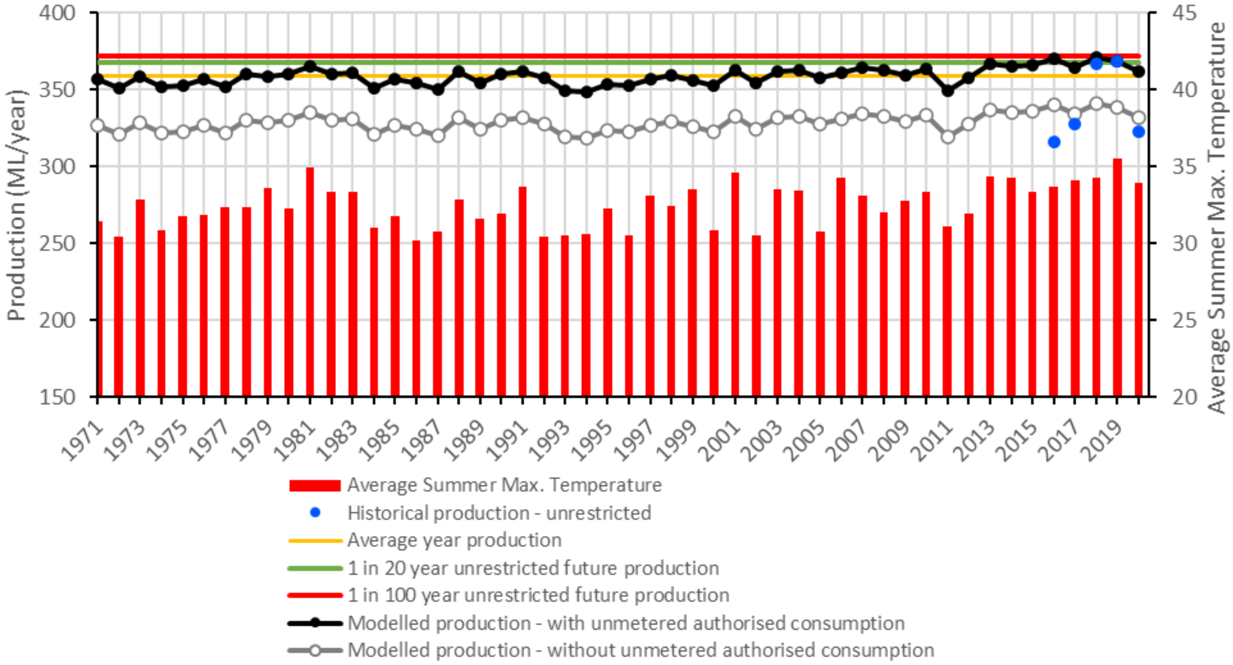

Figure 6-6: Production model hindcast - Hay WSS

The hindcast was also used to estimate the historical ADPW production, which was then multiplied by the PD to ADPW ratio of 1.14 (from Section 6.1.2) to obtain an estimate for PD production. The 99th%ile (1 in 100 year) was taken as the **unrestricted future production**.

The model results, along with the actual average and maximum yearly production from the historical data are compared in Table 6-3.

Table 6-3: Modelled unrestricted production compared to actual values – Hay Potable WSS

Current Demands - from model			From Historical Data (since 2015/16)		
Average Year (ML/year)	Unrestricted future production (ML/year)	Peak Day (ML/day)	Average Year (ML/year)	Max Year (ML/year)	Peak Day (ML/day)
359	372	1.6	341	369	1.6

The model estimates values similar to the historical data. The modelled average year is slightly higher than the value from historical data because the modelled value includes 30 ML/year for maintenance, which has not occurred in every year.

Customer Usage

For Hay Potable WSS, the residential and total customer usages were both climate dependent and showed strong correlation between modelled evaporative cooler use and historical potable water usage. The modelling showed that around 40% of the residential water use and 30% of the total customer water use could be accounted for by evaporative cooler use which was climate dependent.

For the analysis the maximum and 99th%ile (1 in 100 year) unrestricted dry year demand was selected as the starting points for the forecasts. The model results are given in Table 6-4.

Table 6-4: Estimated customer usage from climate correction – Hay Potable WSS

Financial year	Average Year Demand (ML/year)	Unrestricted Future Demand (ML/year)	Average Day Demand (kL/day)	Peak Day Demand (kL/day)
Residential	145	154	397	1,057
Commercial	26	29	72	197
Municipal – excl Parks and Gardens	28	34	77	77
Rural	0	0	1	1
Parks and Gardens	0	0	0	0
Total	**200**	**218**	**547**	**1,332**

6.2.3 Effect of Climate Change

To assess likely future water demands that results from climate change, 15 different Global Climate Models (GCMs) based on 1°C warming were used in PWA's simulated water use model, described in Section 5.2. DPIE Water provided the dataset which is from the NSW and ACT Regional Climate (NARCliM) Model.

The historical water requirement for grass irrigation and evaporative coolers were calculated using PWA's simulated water use model for each of the GCMs as well as the historical data set. The results were then inputted to the water production model developed for Hay Raw WSS and Hay Potable WSS (described in Sections 6.2.1 and 6.2.2 respectively).

The highest result from the GCM datasets was for the CSIRO dataset – the unrestricted future production calculated for the 1-degree warming scenario was 6% higher than the production estimated from historical data.

The change in production for the Hay Raw and Potable WSS are summarised in Table 6-5.

Table 6-5: Estimated increase in production as a result of climate change (1° warming)

	Current Climate		CSIRO 1-degree warming scenario	
	Average Year (ML/year)	Unrestricted future production (ML/year)	Average Year (ML/year)	Unrestricted future production (ML/year)
Hay Raw WSS	905	1,269	955 (5% increase)	1,551 (6% increase)
Hay Potable WSS	359	372	362 (1% increase)	383 (3% increase)

Results from the NARCliM project for the Murray Murrumbidgee Region predicts that for the area of Hay Shire Council, the average annual number of days above 35ºC will increase by 10-20 days in the near future (2020-2039) and 23 days in the far future (2060-2079) compared to the baseline period (1990-2009) [4]. This will put additional pressure on Hay Shire Council's assets and impact on their ability to meet the target level of service for system reliability. Prolonged dry periods may require extra storage or pumping capacity.

6.3 Residential and non-residential water use

6.3.1 Unit residential demands

Usually the number of occupied residential dwellings can be determined from the billing data as residential assessments that use over a certain amount, around 60 L/day. However, in the absence of data for individual assessments, the number of occupied dwellings was estimated using the value of 80% of private dwellings occupied (from SA1 data – see Table 5-2.)

The residential unit demand was estimated by dividing the climate corrected total residential demands by the estimated number of occupied residential dwellings. The results are given in Table 6-6.

Table 6-6: Unit demand per active residential connection

	Average Year Demand (kL/year)	Unrestricted Future Demand (kL/year)	Average Day Demand (L/day)	Peak Day Demand (L/day)
Hay Raw WSS	419	596	1,149	3,932
Hay Potable WSS	166	177	455	1,212

The estimated peak day demand values are slightly lower than the values estimated in the 2017 IWCM of 4.3 and 1.6 kL/day for raw water and potable water respectively. This may simply be caused by a change in methodology.

From DPIE Water's 2019/20 performance monitoring data, out of 13 small (≤1,500 properties) LWU's in NSW, HSC had the fifth highest annual water supplied per residential property (both potable and non-potable water combined). The value reported for Hay was 526 kL/property/year, whereas the median for small LWU's was 436 ML/year. [5]

6.3.2 Major non-residential users

The criteria used to identify major non-residential users was any customers that used more than 1% of the total customer usage for either the Hay Raw WSS or Hay Potable WSS. Seven users in the Raw WSS and six users in the Potable WSS met this criterion. Their historical usage is shown in Table 6-7.

Table 6-7: Major non-residential users

Major User	Average Yearly Usage (ML/year)	Maximum Yearly Usage (ML/year)
Raw Water Customers		
Hay Park [1]	79.1	125.3
Hay War Memorial High School	35.4	54.3
John Houston Memorial Swimming Pool	13.9	15.4
Hay Public School	11.9	13.5
Hay Showgrounds	14.3	18.0
Hay Hospital	10.2	12.2
Hay RMS Heavy Vehicle Inspection Station (HVIS)	9.4	12.1
Potable Water Customers		
John Houston Memorial Swimming Pool	17.1	22.2
Hay Hospital	2.4	3.1
Big 4 Hay Holiday Park	2.2	3.0
Hay War Memorial High School	1.6	2.6
Shell Service Station	2.1	2.9
Hay Services Club	1.9	2.4

1 – In the 2017 data file the assessment number for Hay Park is shown to include several other users, including the airport, cemetery, water treatment plant, and several other parks.

Council's Drought Management Plan states that the John Houston Memorial Swimming Pool is in excess of 50 years old and suffers significantly from leakage at a rate of about 1.5 ML/month [6]. This adds up to around 9 ML/year lost to leakage considering the pool is in operation for six months.

6.4 Projections

6.4.1 Water use of future development areas

The average year and unrestricted future demands were calculated for the future development areas described in Section 5.2, at ultimate development. The water use calculation varied slightly depending on the development zone type, explained below.

For **RE1 Public Recreation**, it was assumed that all water use will be raw water for irrigation purposes. The water demand was calculated by multiplying the area (minus 30% for roads and unirrigated area) by the per Hectare irrigation demands calculated from PWA's irrigation model.

For **IN1 General Industrial** and **SP2 Infrastructure**, it was assumed that all water use will be potable water for industrial purposes. The water demand was calculated by multiplying the areas (again minus 30%) by a unit per Ha water use for industrial areas in regional towns, based on PWA's experience.

For the residential zones, **RU4 Primary Production Small Lots** and **RU5 Village**, the number of occupied houses was first estimated by multiplying the estimated number or residential lots (see Table 5-4) by the value of 80% of private dwellings occupied. The water demand was then calculated by multiplying the number of occupied houses by the unit residential demands for raw water and potable water (see Table 6-6.)

A summary of the average year and unrestricted future demands for both raw and potable water use for the future development areas at ultimate development is given in Table 6-8.

Table 6-8: Estimated water use of new areas at ultimate development

New Area Zone Type	Ha	Estimated occupied residential lots	Raw Water use		Potable water use	
			Average year demand (ML/year)	Unrestricted future demand (ML/year)	Average year demand (ML/year)	Unrestricted future demand (ML/year)
RE1 Public Recreation	6	N/A	42	59	0	0
IN1 General Industrial	521	N/A	0	0	133	164
SP2 Infrastructure	134	N/A	0	0	9	11
RU4 Primary Production Small Lots	572	160	67	95	27	28
RU5 Village	66	370	155	221	62	65
Total			**264**	**375**	**230**	**269**

Yearly production projections using the growth staging that Council provided (see Section 5.2.1) can be found in Appendix D.1.

6.4.2 Water Demand Projections

The ultimate average year, unrestricted future year and peak day demands were estimated by adding the demands from the new development areas, above, to the climate corrected current customer demands from Section 6.2.1 and 6.2.2.

Peak day demands were also estimated by multiplying the average day demand with the average day demand to peak day demand ratio attained from the water demand analysis.

A summary of the demand projections are given in Table 6-9 and Table 6-10.

Table 6-9: Hay Raw WSS metered demand projections

User Classes	Average Year Demand (ML/year)		Unrestricted Future Demand (ML/year)		Peak Day Demand (kL/day)	
	Current	Ultimate	Current	Ultimate	Current	Ultimate
Residential	366	588	519	835	3,429	5,515
Commercial	39	39	52	52	324	324
Municipal – excl Parks and Gardens	112	112	159	159	1,100	1,100
Rural	28	28	39	39	258	258
Parks and Gardens	56	98	81	140	515	897
Other Industrial	15	15	20	20	125	125
Total Demands	**616**	**880**	**871**	**1,246**	**5,750**	**8,218**

Table 6-10: Hay Potable WSS metered demand projections

User Classes	Average Year Demand (ML/year)		Unrestricted Future Demand (ML/year)		Peak Day Demand (kL/day)	
	Current	Ultimate	Current	Ultimate	Current	Ultimate
Residential	145	233	154	248	1,057	1,700
Commercial	26	26	29	29	197	197
Municipal – excl Parks and Gardens	28	28	34	34	77	77
Rural	0	0	0	0	1	1
Parks and Gardens	0	0	0	0	0	0
Other Industrial	0	142	0	175	0	389
Council Maintenance	30	30	30	30	0	0
Total Demands	**230**	**460**	**248**	**516**	**1,332**	**2,364**

Yearly production projections using the growth staging that Council provided (see Section 5.2.1) can be found in Appendix D.2.

6.4.3 Production Projections

As described in Section 2.4, there are significant water losses in both Hay Raw and Potable WSS. Council may wish to target a certain reduction in water losses by the time the ultimate development occurs. Methods to reduce leakage are described in Section 7.1.

A well-managed system can have an ILI of 1.0, as is achieved by many Australian water utilities [7], however this does not necessarily have to be the target as the ILI is a purely technical performance indicator and does not take economic considerations into account. An ILI of 2.0 would put the utility into the second best Leakage Performance Category (LPC), based on the International LPC classification system [3].

A baseline production is projected assuming the ILI stays the same between current and ultimate demands.

A target production is also projected, with reduced water losses. The targets used to estimate the reduced water losses, and hence the reduced production requirements, are:

- For Hay Raw WSS – target water losses at 15% of production. It was found that targeting an ILI of 2.0 reduced water losses to 5% of production, which is very low. In regional NSW, water losses of 10% of production is a typical benchmark value for good performance.
- For Hay Potable WSS – target water losses so that ILI is reduced to 2.0.

The current and projected yearly production values of Hay Raw and Potable WSS, showing the baseline and target water losses are given in Table 6-11 and Table 6-12 respectively.

Table 6-11: Hay Raw WSS – yearly production projections

User Classes	Average Year Demand (ML/year)			Unrestricted Future Demand (ML/year)		
	Current	Ultimate - baseline	Ultimate - target	Current	Ultimate - baseline	Ultimate - target
Total Demands	616	880	880	871	1,246	1,246
Water Losses	289	367	156	398	505	220
Total Production	**905**	**1,248**	**1,036**	**1,269**	**1,751**	**1,466**
Water Losses % Production	32%	29%	**15%**	31%	29%	**15%**
Infrastructure Leakage Index (ILI)	16.1	16.1	6.4	22.1	22.1	8.9

Table 6-12: Hay Potable WSS – yearly production projections

User Classes	Average Year Demand (ML/year)			Unrestricted Future Demand (ML/year)		
	Current	Ultimate - baseline	Ultimate - target	Current	Ultimate - baseline	Ultimate - target
Total Demands	230	460	460	248	516	516
Water Losses	129	230	65	124	222	66
Total Production	**359**	**690**	**525**	**372**	**739**	**582**
Water Losses % Production	36%	33%	12%	33%	30%	11%
Infrastructure Leakage Index (ILI)	7.8	7.8	**2.0**	7.5	7.5	**2.0**

Ultimate peak day productions were estimated by adding the ultimate peak day demands (see Section 6.4.2) to an estimated peak day water losses. The peak day water losses were estimated by multiplying the ultimate average daily water losses by the current average day water loss to peak day water loss ratio attained from the water demand analysis.

The current and projected daily production values of Hay Raw and Potable WSS, showing the baseline and target water losses are given in Table 6-13 and Table 6-14 respectively.

Table 6-13: Hay Raw WSS – daily production projections

User Classes	Average Day Demand (kL/day)			Peak Day Demand (kL/day)		
	Current	Ultimate - baseline	Ultimate - target	Current	Ultimate - baseline	Ultimate - target
Total Demands	1,686	2,410	2,410	5,750	8,218	8,218
Water Losses	792	1,006	427	2,950	4,216	1,457
Total Production	**2,478**	**3,416**	**2,838**	**8,700**	**12,435**	**9,675**

Table 6-14: Hay Potable WSS – daily production projections

User Classes	Average Day Demand (kL/day)			Peak Day Demand (kL/day)		
	Current	Ultimate - baseline	Ultimate - target	Current	Ultimate - baseline	Ultimate - target
Total Demands	630	1,260	1,260	1,332	2,364	2,364
Water Losses	352	629	177	268	435	144
Total Production	**982**	**1,889**	**1,437**	**1,600**	**2,799**	**2,508**

Yearly production projections using the growth staging that Council provided (see Section 5.2.1) can be found in Appendix D.3.

6.4.4 Water Security Assessment

The total water extracted by Council from the Murrumbidgee River is the sum of demands and water losses for the Raw and Potable WSS.

The estimated total water extracted from the Murrumbidgee River is shown in Figure 6 7 for the current and future demands with baseline water losses, and for future target reduction in water losses. This figure shows the demands and water losses individually. The extraction is compared to the WAL entitlement (2,805 ML/year), and the allocation if it were reduced by 85% for 12 months as in the worse drought on record.

This value of 85% used for the reduction in allocation was used because during the Millennium Drought, allocations were reduced to 50% for 3 months, then 70% for a month before returning to 100% for the rest of the year [8]. The average allocation of this period was 85% of entitlement. A more detailed assessment which will look at monthly allocations during drought will be completed as part of the DCERP.

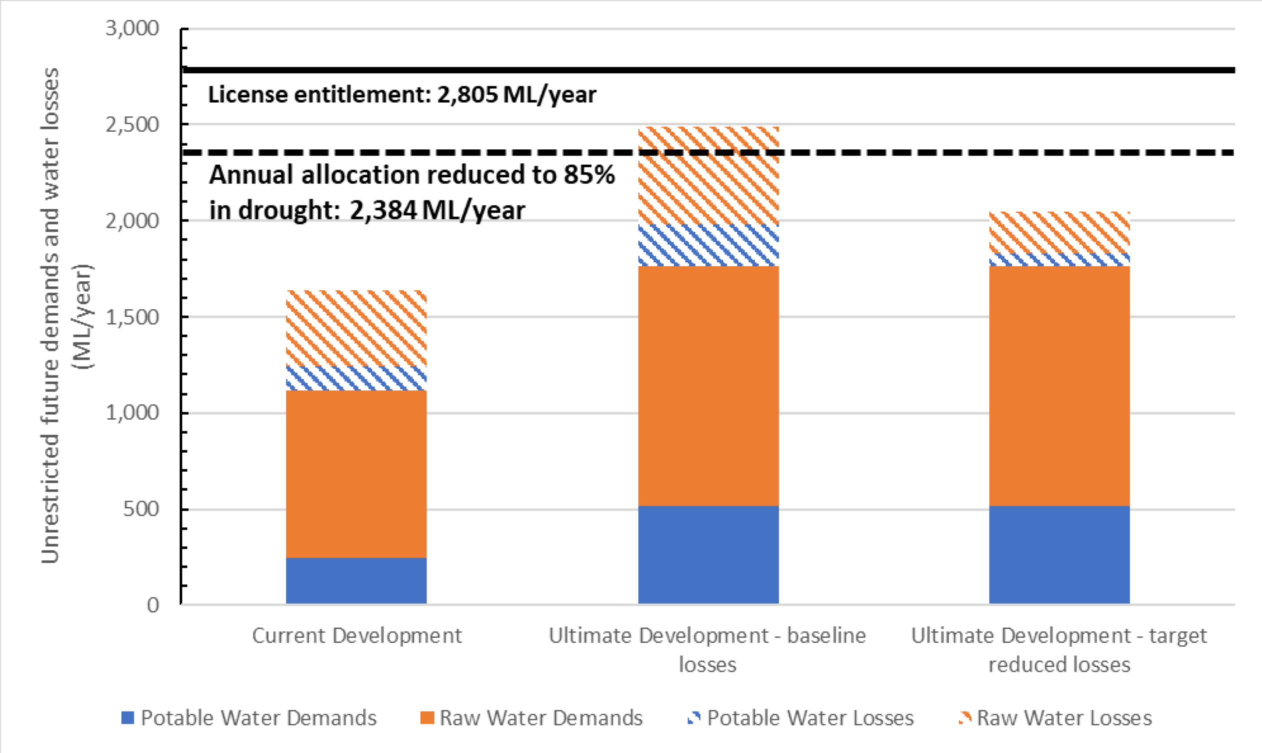

Figure 6-7: Unrestricted future extraction (sum of demands and losses) compared to WAL entitlement

The future unrestricted extraction currently, and at ultimate development, is estimated to be below the WAL entitlement. However, if the allocation were to be reduced to 85% of the entitlement, the allocation will not be enough to supply the extraction for the ultimate development with baseline losses. Unrestricted future extraction with baseline losses is expected to be exceeded in 2046.

With the target reduction in water losses, the extraction for the ultimate development is estimated to be less than the allocation even when reduced to 85% in drought. Opportunities to reduce water demands customer usage further are discussed in Section 7.

7. Opportunities to reduce water demand

This section looks at ways to reduce the current and future water demands in Hay.

LWU water demand reduction options can be categorised into four 'themes':

1. **Utility** – reducing demand on a utility level, such as reducing system water losses, reducing water use at Council properties, raising price signals
2. **Residential** – reducing both internal and external residential demand by improving efficiency of water fixtures and reducing external water use (such as garden watering)
3. **Non-residential** – perform audits on major users to improve water efficiency, also encouraging all non-residential users to be water efficient
4. **Source substitution** – using recycled water for the irrigation of public open spaces (POS)

The effectiveness of each theme in reducing water demand depends on a Council's current situation and the potential for water savings. See below for the analysis of water demand reduction for each theme.

7.1 Utility opportunities

Options for demand reduction for utility assets are:

- Leakage management – installing pressure reducing valves to reduce the stress on pipes and lower the number of leaks and breaks in pipes
- Leak detection programs – monitoring rainfall and soil moisture to predict where leaks are likely to occur and using acoustic devices to pick up the noise water makes as it leaks. This ensures a fast response time to pipe breakages
- General education program
- Smart metering, with feedback and leak alerts
- Meter audit – to ensure all premises with water connections have their meters read

To achieve utility side demand reduction, Council is advised to develop a water loss management plan which includes data collection improvements, identification of monitoring zones, flow metering, pressure management, data capture, active leak detection, repairs, operating requirements and capital budget.

Leakage reduction

From the water balances in Section 2.4, Hay Raw WSS has an ILI of 17.7 and Hay Potable WSS has an ILI of 6.9. A well-managed system can have an ILI of 1.0, as is achieved by many Australian water utilities [7], however this does not necessarily have to be the target as the ILI is a purely technical performance indicator and does not take economic considerations into account. An ILI of <1.5 would put the utility into the highest Leakage Performance Category (LPC), based on the International LPC classification system [3].

Reducing the current ILI from 17.7 to 2.0 for the Hay Raw WSS would require reducing leakage by an estimated 270 ML/year, or around a quarter of the total water produced in a year. It should be noted that ILI is usually used to indicate performance in potable water systems. Reducing the ILI from 6.9 to 2.0 for the Hay Potable WSS would require reducing leakage by an estimated 80 ML/year, or around a quarter of the total water produced in a year.

ILI can be reduced by:

- pipeline and asset management
- pressure management (which may increase or decrease the pressure)
- speed and quality of repairs
- active leakage control to locate unreported leaks

The cost of reducing leakage will heavily depend on the action required to reduce losses.

Desktop meter audit

PWA were provided Council's cadastre GIS file, which showed lot boundaries and Council's assessment number for each property. This information, along with satellite imagery and Council's water billing data, was used to perform a desktop audit to identify potential properties where a meter may not be read.

There were 45 assessments that were in the raw water billing data, that were not found in the potable water billing data. Similarly, there were 26 different assessments that were in the potable water billing data, that were not found in the raw water billing data. It is recommended an audit be conducted to determine whether any of these assessments have either a raw water or potable water connection that is not being metered.

PWA identified from satellite imagery approximately 9 lots that appeared to have a property on them but who's assessment number was not found in the potable water billing data. Similarly, 11 lots were identified for the raw water billing data. These lots appear to be mostly residential properties. Again, an audit may be undertaken to identify if these properties are using unmetered water.

The list of assessments described above is provided in Appendix C.1.

7.2 Residential opportunities

7.2.1.1 Internal residential demand

Options for reducing internal water usage for residential properties are:

- whole house retrofit (fixing leakages, replacing fixtures with 4-star rated fixtures)
- showerhead exchange program
- washing machines rebate/swap for low socio-economic residents
- evaporative cooler maintenance

The total internal water usage for residential properties, excluding evaporative cooler use, is estimated to be around 398 kL/day, which is the average water use of residential customers during the winter billing period. Using the estimated 1,918 people supplied by the Potable WSS (from Section 5.1), this is around 208 L/person/day, which is which is equivalent to around a **2-star WELS** rating appliances from *AS6400:2016 Water efficient products - Rating and labelling*.

An audit would be required to determine the true WELS fixtures used by Hay residents.

Water efficient appliances/fittings program

If all residential water fixtures in Hay Potable WSS were upgraded to 4-Star WELS water fixtures, the estimated water savings is 95 L/person/day, which totals 66.5 ML in an average year. However, a 100% participation rate is unlikely. Fitzgerald (2019) [9] conducted a survey to determine the participation rate of the Victorian Showerhead Exchange Program. In the survey, out of the 1,693 respondents, 46.8% participated in the program. In general, those who were most likely to participate in the program were males, households comprising couples with older teen children and those in the lowest income bracket (less than $50,000 per year).

Based on the survey, a participation rate of 50% was assumed for the showerhead exchange option, and 20% participation rate for washing machine rebate and whole house retrofit. The water savings are summarised in Table 7-1. The potential savings assume a current internal residential demand of 145 ML/year.

Table 7-1: Potential yearly water demand reduction and cost of option

	% participation	Potential yearly savings in average year (ML/year)	
		Current	Ultimate
Whole house retrofit	20%	13	21
Showerhead exchange program	50%	9	14
Washing machine rebate	20%	4	6

Evaporative cooler maintenance

From the climate correction of the customer potable water usage data in Section 6.2.2, it was estimated that around 40% of the residential potable water use and 30% of the total customer potable water use could be accounted for by evaporative cooler use which was climate dependent.

An audit would be required to determine if there is potential for reducing water demand by an evaporative cooler maintenance program. Such a program would involve the inspection and maintenance of the function and efficiency of residential evaporative coolers in single dwellings.

If evaporative water use could be reduced by say 25%, this would result in a savings of around 15 ML/year in potable water use.

Additionally, an audit of evaporative coolers should be considered to identify if any evaporative coolers are unnecessarily using water or using high volumes of water, for e.g. by leakage, high bleed rates, etc.

7.2.1.2 External residential demand

Options for reducing external water demand for residential properties are:

- Lawn buyback programs – rebates to replace lawn/gardens with less water intensive landscapes (e.g. using native plants or rock gardens)
- Rainwater tank rebates – an existing program
- 3rd pipe supply (using recycled water) – this is only cost effective for new developments

The water model estimates the residential external demand in a dry year to be 512 ML/year in total. The unit external demand was calculated to be 472. kL/assessment/year.

Lawn buy-back program

For residential irrigation, water savings may be achieved through a lawn buy-back program. This program provides an incentive (rebates) to convert turf to less water and fertilizer intensive landscapes. Options include planting a mix of native trees, shrubs, perennials, bunch grasses, ground covers, mulch, rocks, and stones. The Australian Arid Lands Botanic Garden have created a collection of six ‘AridSmart Display Gardens’ which feature simple landscaping and use of native species to produce a garden that can be maintained with little to no water compared to a typical garden and lawn [10].

A lawn buy-back by the Metropolitan Water District of Southern California offered a rebate of $1 USD per square foot [11], which is equivalent to around $28 AUD per square meter. However, the cost of the lawn buy-back is entirely up to Council, with a higher rebate naturally expected to lead to greater uptake.

Assuming a 75% reduction in external water demand for lawn buyback participants, an estimated 439 kL/year can be saved per participant in an unrestricted future year. Assuming only 20% of houses participate with the program, this equates to a total saving of around 78 ML/year (or around 9% of total customer usage). If this program continues to 2050 (assuming same participation rate), then the total saving achieved is estimated to be 125 ML/year. Higher participation rate could be encouraged by offering higher rebates.

Rainwater tank rebates

Rainwater tanks reduce water demand for residents, as captured rainwater can be used for garden watering and can also be connected to toilets and washing machines. Currently, council policy allows for $200 discount on connection costs if rainwater tanks are installed [12] to encourage rainwater tank uptake. This program can be expanded to incentivize installation of rainwater tanks.

It should be noted however, that rainwater tanks are less effective at reducing water use during drought, as they rely on some rainfall to be effective.

7.3 Non-residential opportunities

For major non-residentials users, water audits could be viable options to reduce water usage, however it requires ongoing liaison and funding to encourage implementation.

As mentioned in Section 6.3.2, Council has identified significant leakage at John Houston Memorial Swimming Pool. The Pool is the most significant user of potable water, using around 17 ML/year, which is around seven times more than the next highest user of potable water. It is recommended Council plan for work to reduce the leakage at the Pool, which is estimated to save around 9 ML/year [6].

There are several major non-residential users of raw water, mostly customers with irrigated grounds such as parks, the schools, and sports clubs. Council may wish to prioritise these customers when beginning a leakage reduction program. To reduce water use, source substitution with a different water source is discussed in the next Section.

7.4 Source substitution opportunities

This option considers substituting raw water currently used for irrigation with **recycled water** i.e. treated STP effluent. Effluent from Hay STP is currently disposed of by evaporation. The new STP is an activated sludge process which was built with provision for a future reuse scheme. Potential end-uses could include agricultural food and non-food crops, and public open spaces (POS). The effluent could also be considered as a top-up for the Raw WSS, reducing the extraction of raw water from the Murrumbidgee River.

This study will consider effluent reuse as source substitution as a top-up to the raw water system, or as a separate scheme to irrigate Council's public open spaces (POS) or agriculture.

7.4.1 Effluent availability - water balance

A **water balance model** was developed which simulated STP effluent availability for irrigation. The balance was performed over 44,180 days (around 120 years) of available rainfall and evaporation data for Hay. The model was run as follows:

- <u>Water in</u> was the average dry weather flow (ADWF) to the STP of 676 kL/day (measured by PWA during the 2016 72-hour inflow monitoring study), and wet weather volumes calculated using a catchment infiltration relationship derived using actual STP inflow records
- <u>Water out</u> was the irrigation demand of the Hay Raw WSS, for which the irrigation model developed in Section 6.2.1 was used, and water out to evaporation pond
- A balancing storage of 9.2 ML was used, as this is the volume of Council's raw water reservoirs, however other volumes were also tested.
- When there was no available water in the system to meet the full irrigation demand, such as in summer, it was counted as being met using raw water
- Excess water that could not be balanced in the system was counted as being sent out to the evaporation pond

The results showed that on average 87% of the STP effluent could be reused, around 220 ML/year, with the remaining 13% evaporated as there was not available storage. The average year raw water customer demand is 616 ML/year, therefore STP effluent can only be used to substitute at most around 35% of the raw water customer demand in an average year.

The results of the water balance also showed that in the year with the highest irrigation demand, 100% of STP effluent was reused, around 250 ML. This is the entire ADWF volume over the year. The unrestricted future year raw water customer demand is 871 ML/year, therefore STP effluent can only be used to substitute at most around 30% of the raw water customer demand in an unrestricted future year.

Potable water average years demands double from 230 ML/year to 460 ML/year by the time the ultimate development occurs (see Table 6-10). It is estimated that the ADWF will therefore double, and similarly the maximum volume of effluent available for reuse will also double from 250 ML/year to 500 ML/year. For the ultimate development, STP effluent may be able to supply up to 40% of the raw water customer demand in an unrestricted future year.

An average yearly effluent use pattern is shown in Figure 7-1.

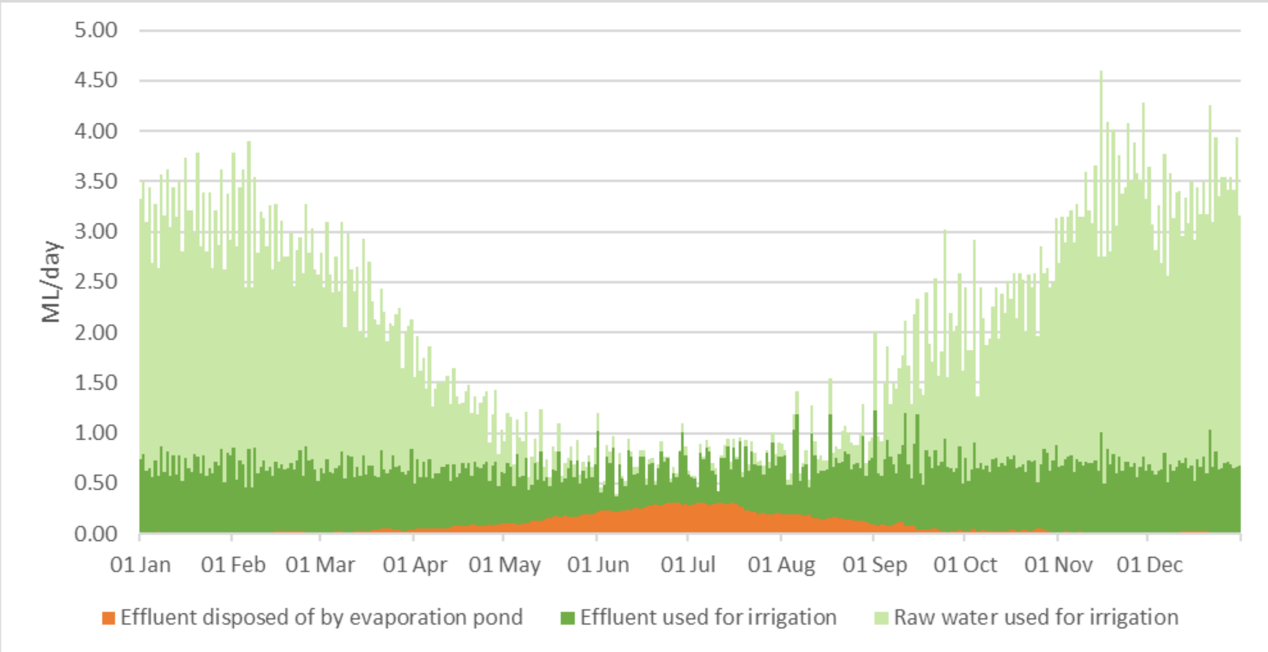

Figure 7-1: Effluent reuse water balance – average year effluent availability to supply Hay WSS irrigation demands

It can be seen that in winter effluent is sent for disposal in the evaporation ponds because irrigation demand is low, however in summer all effluent is used for irrigation. The effluent used for irrigation or disposed of by evaporation hovers around the ADWF limit of 0.68 ML/day.

7.4.2 Opportunities for irrigation of Public Open Spaces

Effluent top-up of the Hay Raw WSS will result in the public having direct, uncontrolled contact with the effluent through their raw water connections. As a result, obtaining regulatory approval will require a very high level of treatment, explained in Section 7.4.3, and monitoring to ensure the safety of users.

Council may decide to not connect the effluent to the Raw WSS, and instead develop a separate irrigation system just to irrigate certain public open spaces (POS). This will allow Council to limit contact with the public, requiring less treatment, and is a common practise in regional NSW towns.

PWA has identified the following POS in Hay that could be irrigated with effluent:

- Hay Park (cricket and rugby fields)
- Hay War Memorial High School grounds
- John Houston Memorial Swimming Pool grounds
- Hay Public School grounds
- Hay Showgrounds / Racecourse
- Hay Hospital grounds

These are shown in Figure 7-2.

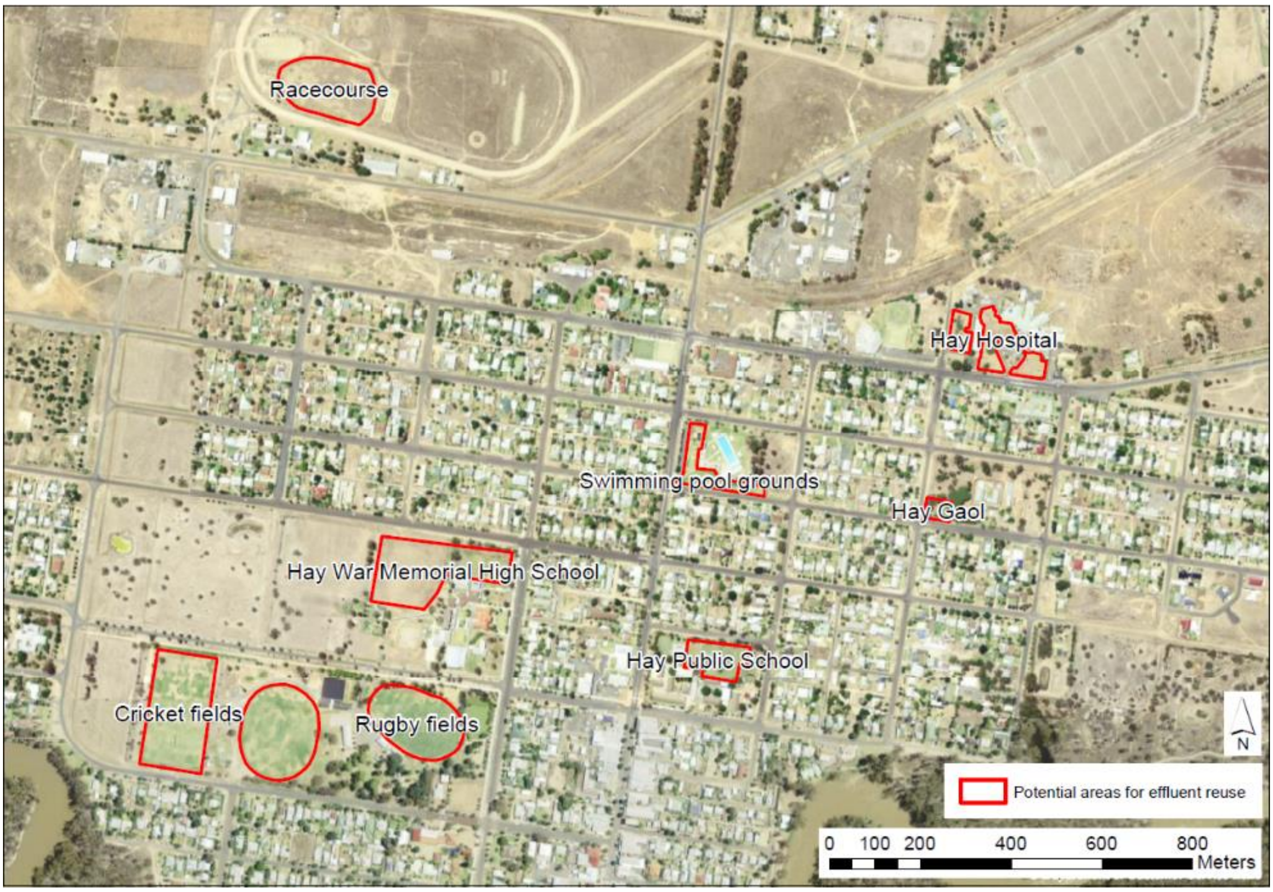

Figure 7-2: Potential areas for STP effluent reuse

These customers account for the highest consumers of raw water, as shown in Section 6.3.2. From historical data, these customers are estimated to use on average around 165 ML/year of raw water and the highest annual demand was 220 ML/year of raw water in 2015.

The irrigation demands of these select POS were also simulated with the water balance model, and it was determined that in an average year around 145 ML out of the 165 ML/year can be supplied by effluent (88%), the remainder still requiring use of raw water as there is not sufficient effluent available. This was achieved assuming a new 2.0 ML of storage is constructed. This volume was chosen as it is around one peak day demand from these POS (1.74 ML/day). Higher storage volumes saw diminishing returns, as a 10 ML storage only saw the percentage of effluent supplied increase from 88% to 95%.

The average yearly effluent use pattern for irrigating these POS is shown in Figure 7-1.

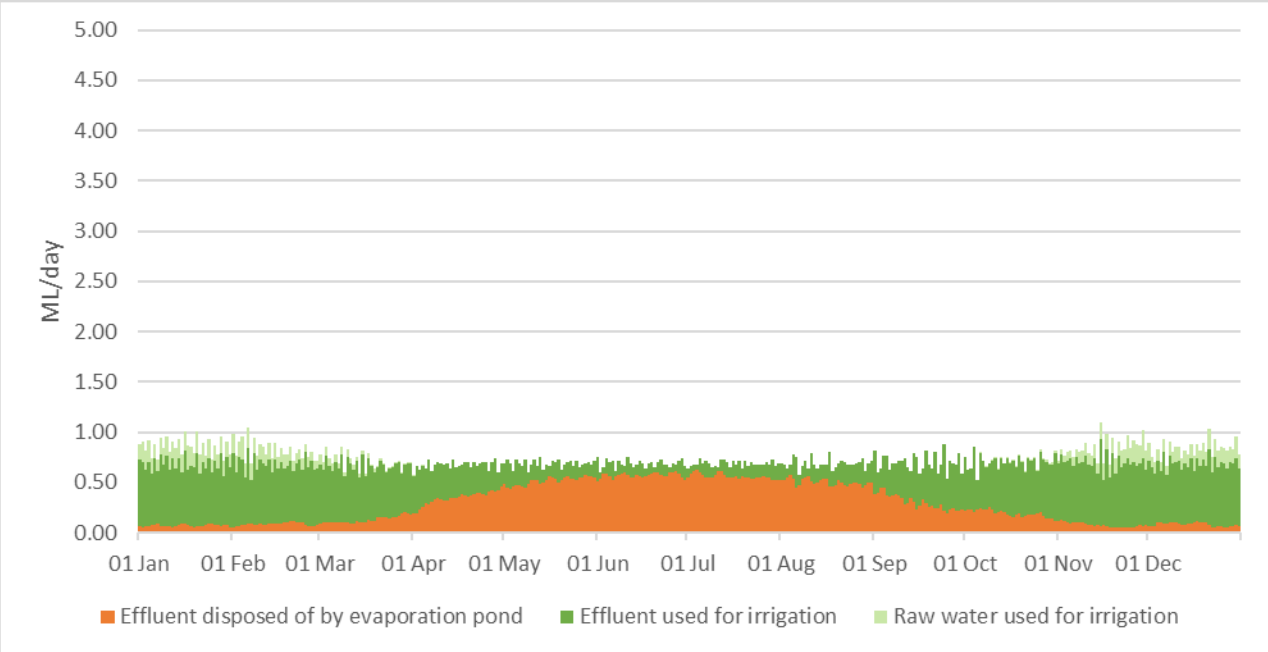

Figure 7-3: Effluent reuse water balance – average year effluent availability to supply select POS irrigation demand

7.4.3 Effluent reuse health and safety – LRV assessment

Implementation of a new reuse scheme will require approval from DPIE Water that the risk to the public has been managed. DPIE Water have released a guideline [13] which outlines how to use pathogen log reduction values (LRV) to assess the risk of exposure to the public. The LRV indicates the scale of reduction of pathogens in the wastewater, where 1-log is a ten-fold reduction, and 2-log is a hundred-fold reduction etc. The Guidelines target LRVs for the different reuse applications considered here are given in Table 7-2.

Table 7-2: LRV target for different reuse applications

Reuse application	Protozoa	Virus	Bacteria
Municipal use (such as POS) and non-food crops	3.7	5.2	4.0
Commercial food crops	4.8	6.1	5.0
Dual reticulation and municipal irrigation (such as integration into raw water scheme)	5.0	6.4	5.1

A desktop assessment for the pathogen LRVs achieved from Hay STP was undertaken. PWA nominated an LRV for each process based on the LRV range from the NSW Guidelines for Recycled Water [13]. The LRVs estimated to be achieved from the current process and compared to the target LRVs are given in Table 7-3.

Table 7-3: LRV assessment of existing treatment processes

	Protozoa		Virus		Bacteria	
Treatment process	LRV Range	Nominated LRV	LRV Range	Nominated LRV	LRV Range	Nominated LRV
Primary Treatment	0.0 – 0.5	0.0	0.0 – 0.1	0.0	0.0 – 0.5	0.0
Secondary treatment – aerated secondary process	0.5 – 2.0	1.0	0.5 – 2.0	1.5	1.0 – 3.0	2.0
Total treatment LRV		**1.0**		**1.5**		**2.0**

	Protozoa		Virus		Bacteria	
LRV Targets						
Reuse application	**Target LRV**	**LRV Achieved**	**Target LRV**	**LRV Achieved**	**Target LRV**	**LRV Achieved**
Municipal use (such as POS) and non-food crops	3.7	1.0 ✗	5.2	1.5 ✗	4.0	2.0 ✗
Commercial food crops	4.8	1.0 ✗	6.1	1.5 ✗	5.0	2.0 ✗
Dual reticulation and municipal irrigation	5.0	1.0 ✗	6.4	1.5 ✗	5.1	2.0 ✗

Based on the desktop LRV assessment, the current treatment process may not provide sufficient LRVs for any of the reuse applications.

The Hay STP design has provision for installation of a UV unit and chlorination, which could provide a high number of LRVs. Non-treatment barriers, such as preventing public access during irrigation and after for several hours, also provide LRVs. However, DPIE have advised non-treatment barriers to be limited to 2 LRVs, and in the case of dual reticulation no non-treatment barriers can be ensured.

The LRVs estimated to be achieved by implementing UV and chlorine disinfection of effluent at the STP are shown in Table 7-4.

Table 7-4: LRV assessment for current treatment process upgraded with chlorination and UV disinfection, with and without non-treatment barriers

	Protozoa		Virus		Bacteria	
Treatment process	**LRV Range**	**Nominated LRV**	**LRV Range**	**Nominated LRV**	**LRV Range**	**Nominated LRV**
Primary Treatment	0.0 – 0.5	0.0	0.0 – 0.1	0.0	0.0 – 0.5	0.0
Secondary treatment – aerated secondary process	0.5 – 2.0	1.0	0.5 – 2.0	1.5	1.0 – 3.0	2.0
UV light	3.0 – 4.0	3.0	3.0 – 4.0*	3.0	2.0 – 4.0	2.0
Chlorination	0 – 0.5	0.0	1.0 – 4.0	2.0	2.0 – 4.0	2.0
Total treatment LRV		**4.0**		**6.5**		**6.0**
Total LRV + 2 LRV for non-treatment barriers		**6.0**		**8.5**		**8.0**
LRV Targets						
Reuse application	**Target LRV**	**LRV Achieved**	**Target LRV**	**LRV Achieved**	**Target LRV**	**LRV Achieved**
Municipal use (such as POS) and non-food crops	3.7	6.0 ✓	5.2	8.5 ✓	4.0	8.0 ✓
Commercial food crops	4.8	6.0 ✓	6.1	8.5 ✓	5.0	8.0 ✓
Dual reticulation and municipal irrigation	5.0	4.0 ✗	6.4	6.5 ✓	5.1	6.0 ✓

* note the virus LRV range from UV Light for adenovirus is 1.0-4.0

The target LRVs for municipal use (such as POS), non-food and commercial crops are expected to be achieved with and without non-treatment barriers. If non-treatment barriers can be ensured (which may prove difficult at some POS), chlorination may not be required

The target LRVs for dual reticulation (such as supply to the Hay Raw WSS), may **not** be achieved, even with UV and chlorination. There is shortfall from the target of 1.0 LRVs for protozoa. Non-treatment barriers cannot be ensured for this use. The LRVs may be achieved if the treatment processes can be proven to operate at the higher end of their LRV expected range. Alternatively, LRV could be achieved by additional treatment processes such as Dual media filtration with coagulation, Membrane filtration or Ozonation.

7.5 Summary of demand side options

The annual volume of water that could be saved by the most feasible opportunities are summarized in Table 7-5. Lawn buy-backs are not included as they are not common in Australia, and reduction in demand by non-residential customer audit or evaporative cooler maintenance are not included as the volume cannot be measured without further information.

Table 7-5: Potential water savings at current and ultimate development (ML/year)

		Hay Raw WSS		Hay Potable WSS	
		Current	Ultimate	Current	Ultimate
Potential savings in water losses	Leakage reduction, reduce ILI to 2.0 (or down to 15% for raw water)	244	268	87	150
Potential savings in customer usage	Whole house retrofit with water efficient appliances and fittings	0	0	13	21
	Reduce pool leakage	0	0	9	9
	Effluent reuse supplement raw water use	250	500	0	0

The unrestricted future demand projections, with the above reductions in demand are shown in Table 7-6.

Table 7-6: Hay unrestricted future demand projections, with demand reduction opportunities

		Hay Raw WSS		Hay Potable WSS	
		Current	Ultimate	Current	Ultimate
Baseline	Total Demands	871	1,246	248	516
	Water Losses	398	488	124	214
	Total Production	**1,269**	**1,734**	**372**	**731**
Target reduction in water losses	Total Demands	871	1,246	248	516
	Water Losses	154	219	37	65
	Total Production	**1,025**	**1,465**	**285**	**581**
Target reduction in water losses + reduction in demands	Total Demands	621	746	225	486
	Water Losses*	110	131	37	65
	Total Production	**730**	**877**	**263**	**551**

* The water losses are further reduced if demands on the raw water system are reduced

The estimated total unrestricted future demands and water losses currently, and at the ultimate future development with the baseline and target water losses, is shown in Figure 7-4. The sum of these adds up to the extraction requirement from the river. This is compared to the WAL entitlement

(2,805 ML/year), and the allocation if it were reduced to 85% as in the worse drought on record (see Section 6.4.4).

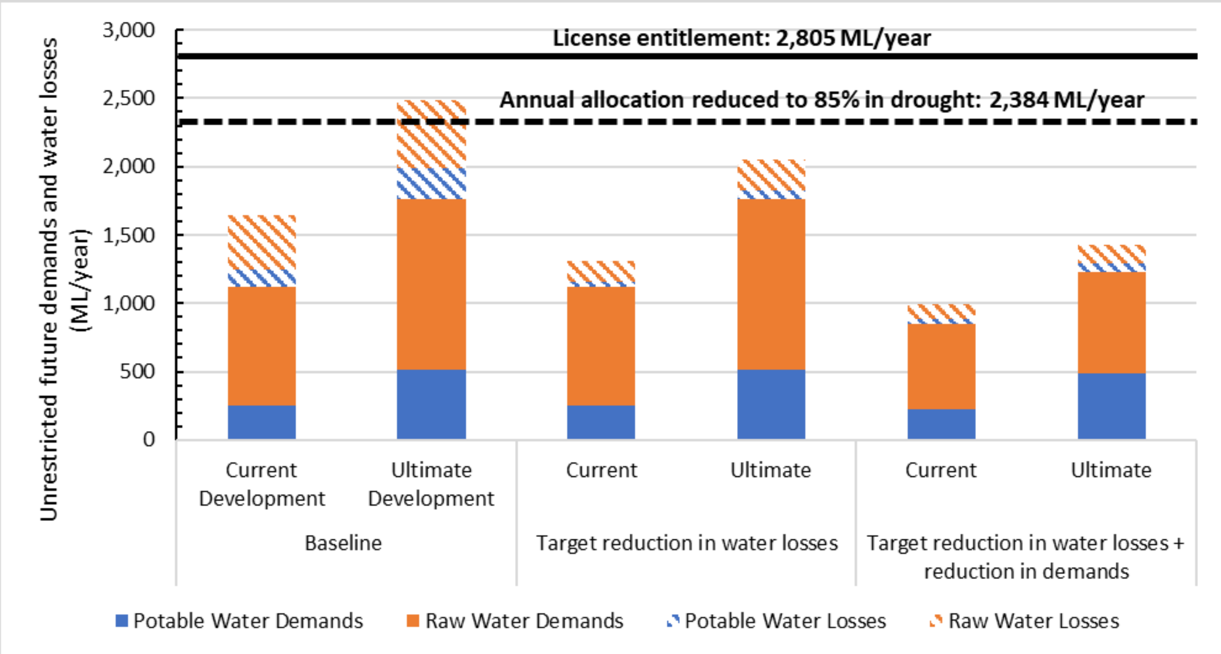

Figure 7-4: Unrestricted future extraction (sum of demands and losses) compared to WAL entitlement, with demand reduction opportunities

The above assessment shows that with the target reduction in water losses, Council is not expected to need restrictions in the drought where allocation is reduced to 85%. Water use can be reduced further by reduction in water demands, mainly by effluent reuse supplementing raw water use, however this comes with significant requirements for maintaining a high quality treated effluent.

These opportunities to reduce water demand will be considered as part of the DCERP.

7.6 Water loss management planning

Water losses in Hay Potable and Raw WSS are very high, however they do not currently pose an issue to Council's water security. As demands are expected to almost double in the next 30 years, the water losses will need to be reduced to ensure that Council's unrestricted demands can be met in times of drought. For this reason Council may wish to develop a water loss management plan which over time can be used to target areas of water losses.

The first stage in a water loss management plan should be to audit Council's current water use, to ensure that all known water use is captured in the water balance. Council should try to meter all authorized uses which are currently unmetered, such as water used for maintenance (e.g. reservoir and mains flushing), from standpipes or from certain customers who are not charged for water. A simple water balance like the one in Section 2.4 could be undertaken after each billing period, to quantify unaccounted for water.

Leakages in the water mains will require mains renewals to fix. To prioritise which mains need replacing, Council is recommended to detect, locate and pinpoint leaks and bursts. Council may have data on areas of frequent mains bursts, or other indicators of mains in poor condition, which could be used to prioritise areas for mains renewals. There are various types of leak detection equipment on the market which can also be used to detect leaks by acoustics.

Council may wish to install flow sensors in the network, which will divide the network into separate demand management zones. This information can be used to calculate a water balance over certain areas of the network, and narrow down the area where significant leakage is occurring. Council may wish to install these as the town develops outwards.

8. Effluent Reuse Scheme for Public Opens Spaces

As identified in Section 7.4.3, using effluent to irrigate Council's public open spaces (POS) will require additional disinfection of the effluent to achieve the target LRVs from the Guideline.

In the 2016 Hay STP upgrade designed by PWA, space has been allocated for future installation of chlorination and UV systems for disinfection. There is also a provision for a sump in the catch/balance pond for a future pump to transfer effluent to the disinfection processes. Figure 8-1 below shows the areas at the STP allocated for UV and chlorination.

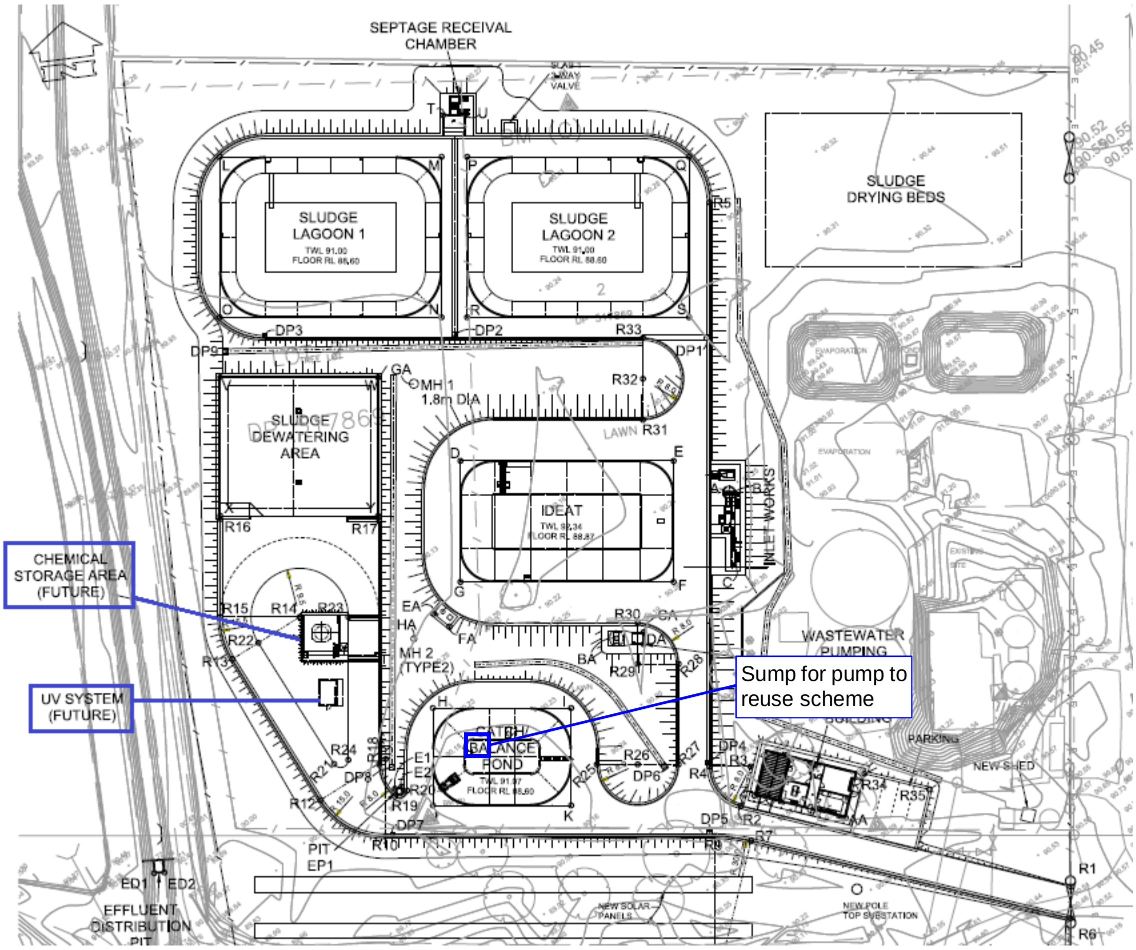

Figure 8-1: Current site layout of Hay STP with space allotted for future disinfection systems

Following disinfection, effluent will be stored in a tank onsite before being pumped through a new effluent distribution system to the POS identified in Section 7.4.2. These are:

- Hay Park (cricket and rugby fields)
- Hay War Memorial High School grounds
- John Houston Memorial Swimming Pool grounds
- Hay Public School grounds
- Hay Showgrounds / Racecourse
- Hay Hospital grounds

Figure 8-2 below shows the schematic diagram of the proposed effluent reuse system.

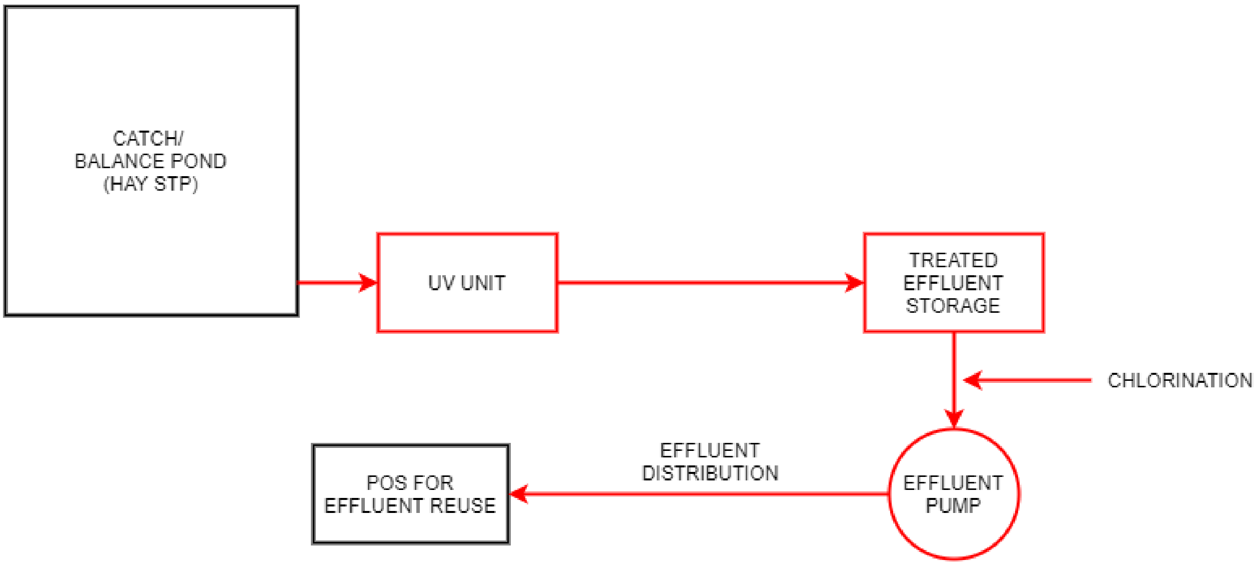

Figure 8-2: Schematic of proposed effluent reuse system

8.1 Sizing

Treatment and storage at the STP

The effluent reuse scheme is sized so that the effluent disinfection processes (UV and chlorination) have the same design capacity as the recently built Hay STP, 3,500 EP. This is equivalent to 840 kL/day at the design unit loading of 240 L/EP/day.

At the nominated ADWF of 676 kL/day (recorded during the 72-hour flow monitoring), around 88% of the average annual POS irrigation demand (165 ML/year) can be supplied with effluent. A 2.0 ML effluent storage tank is proposed to be constructed at the STP to hold one peak day demand (1.7 ML/day).

When the sewage load reaches the design capacity of the STP, 840 kL/day, it is estimated that around 98% of the average annual POS demand can be supplied with effluent. Although the sewage load to the STP is expected to almost double in the future if the ultimate growth does occur, the additional effluent will mostly have to be disposed of by evaporation as the POS irrigation demand will already be fully met with the available effluent. Council may consider expanding the reuse scheme to irrigate more open spaces.

Effluent distribution system

A possible layout of the effluent transfer system to the selected areas is shown below in Figure 8-3. The nominated diameter of the trunk mains is 180 mm and the pipe branches 80 mm. This pipe size was determined so that a velocity of 1m/s is achieved when effluent is supplied, allowing for self-cleansing of the pipelines.

The total length of mains required is 5.24 km and the selected material is uPVC.

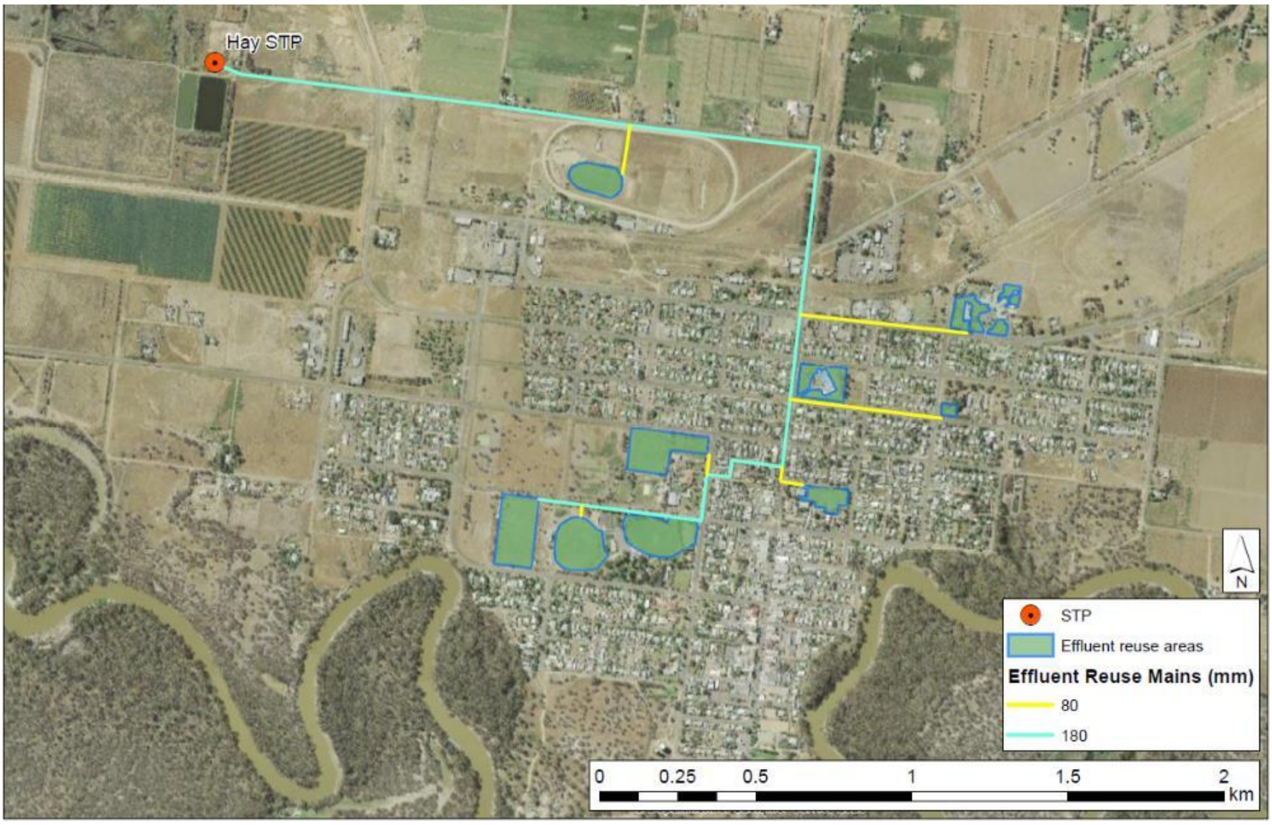

Figure 8-3: Proposed distribution for effluent reuse scheme

The head required to pump 1.7 ML/day of effluent the STP to POS was calculated to be 41m and the pump rating 14 kW.

8.2 Costing

The capital costs are indicative only and are based on the basic construction costs with the addition of 30% for project contingencies.

GST has not been included in the capital cost estimates. Unit rates are based on the DPIE Water's Water Supply and Sewerage Reference Rates Manual [14].

The scheme cost estimate is summarized in Table 8-1.

Table 8-1: Cost summary for effluent reuse

Item	Quantity	Unit	Amount ($'000)
UV Disinfection Unit	3,500	EP	230
Chlorination	0.84	ML/day	70
Effluent storage reservoir	2.0	ML	960
Effluent pump	15	kW	110
Sump pump	5	kW	70
180mm PE pipeline	3,945	m	740
80mm PE pipeline	1,397	m	160
Total			**2,310**
Total with 30% contingency			**3,000**

9. Assessment of unserviced areas on the town periphery

There are two unserviced residential areas identified on the periphery of town. The area to the north has about 30 properties along the Cobb Highway, and the area to the east has a round ten properties on the Murrumbidgee River. These areas are shown in Figure 9-1

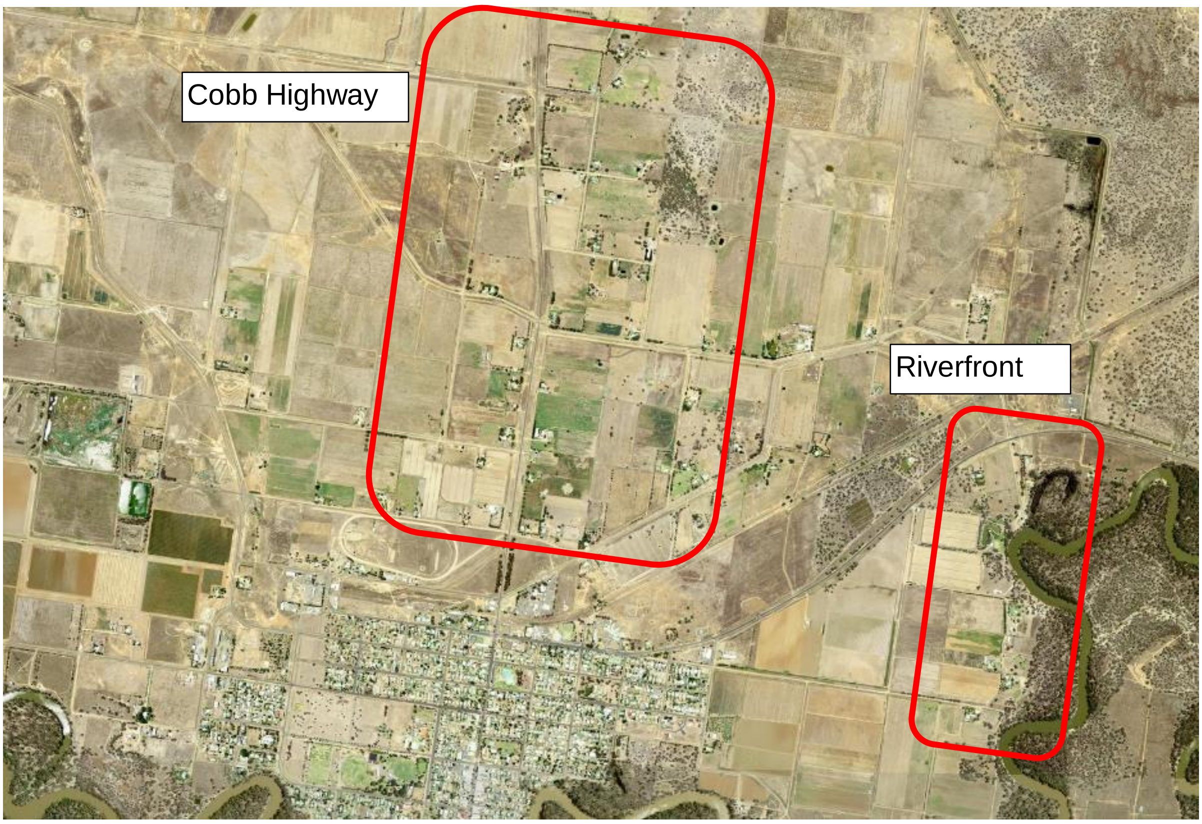

Figure 9-1: Unserviced areas in Hay

Residents in these areas are neither connected to the Hay raw or potable WSS, or the sewerage scheme. They rely on on-site sewage management systems (OSSMS) to manage sewage. A desktop OSSMS assessment was undertaken for these areas.

9.1 Cobb Highway unserviced area

The risk assessment for the Cobb Highway unserviced area is shown in Table 9-1.

Table 9-1: OSSMS risk assessment for North Hay

Criteria	Assessment
Soil drainage	Poorly drained (silty clay loam) [1]
% properties with insufficient lot size	0% (all properties greater than minimum size of 4,000 m^2 recommended for clay soils)
Potable water source	Rainwater tanks. Some bores in area, but not for drinking water
No. of properties close to waterway	0
Risk Rating	**Low Health Risk, Low Environmental Risk**

[1] HSHL Riverine Plains Survey (1004554), Profile 95, collected from a core sample on 14 April 2005 (eSPADE)

The soil in this area has poor drainage, however all properties have lot sizes greater than minimum size of 4,000 m^2 recommended for use of adsorption trenches in clay soils.

According to the WaterNSW Real Time Data website, there are around 20 bores scattered throughout this area, however all bores are monitoring bores except for one (GW007135) which is used for stock and domestic purpose. It is likely that most residents are using rainwater tanks as their source of drinking water. Based on this assessment, the risk of the OSSMS having a direct health impact is low.

The risk of environmental impact is also low as these properties are not within the recommended 100m buffer distance to a surface waterway.

9.2 Riverfront unserviced area

The risk assessment for Riverfront unserviced area is shown in Table 9-2.

Table 9-2: OSSMS risk assessment for East Hay

Criteria	Assessment
Soil drainage	Moderately well drained (sandy clay loam) [1]
% properties with insufficient lot size	0% (all properties greater than minimum size of 4,000 m^2 recommended for clay soils)
Potable water source	Rainwater tanks. No bores in area.
No. of properties close to waterway	Less than 5
Risk Score	**Low Health Risk, Low Environmental Risk**

[1] eSPADE modelled soil properties

The soil in this area has poor drainage, however all properties have lot sizes greater than minimum size of 4,000 m^2 recommended for use of adsorption trenches in clay soils.

According to the WaterNSW Real Time Data website, there are no bores in East Hay, therefore it is likely that residents are using rainwater tanks as their source of drinking water. Based on this assessment, the risk of the OSSMS having a direct health impact is low.

There is a potential risk of environmental impact as a handful of properties are within the 100m buffer distance to the Murrumbidgee River, however as there is only a handful of properties, the risk to the environment is low.

10. Alternate Water Source

Groundwater was investigated as an alternate water supply source as a drought contingency or an emergency response during extreme events such as blue green algae.

A hydrogeologist subconsultant, Golder, were engaged to undertake a desktop feasibility assessment for groundwater. Their report, which can be found in Appendix E, includes:

- Review of the Water Sharing Plan requirements for the water source to assess sustainability
- Review of log data and water level monitoring data for existing bores within the water source to understand the geology and the hydrogeology
- Review of extraction rates for surrounding groundwater users
- Identify a drilling location for a new bore with potential extraction rates

The findings are summarized below.

10.1 Potential new borefield location

Based on the findings of their assessment, Golder identified two areas within the Lower Murrumbidgee Deep Aquifer as a potential additional supply area. The two areas are shown in Figure 10-1.

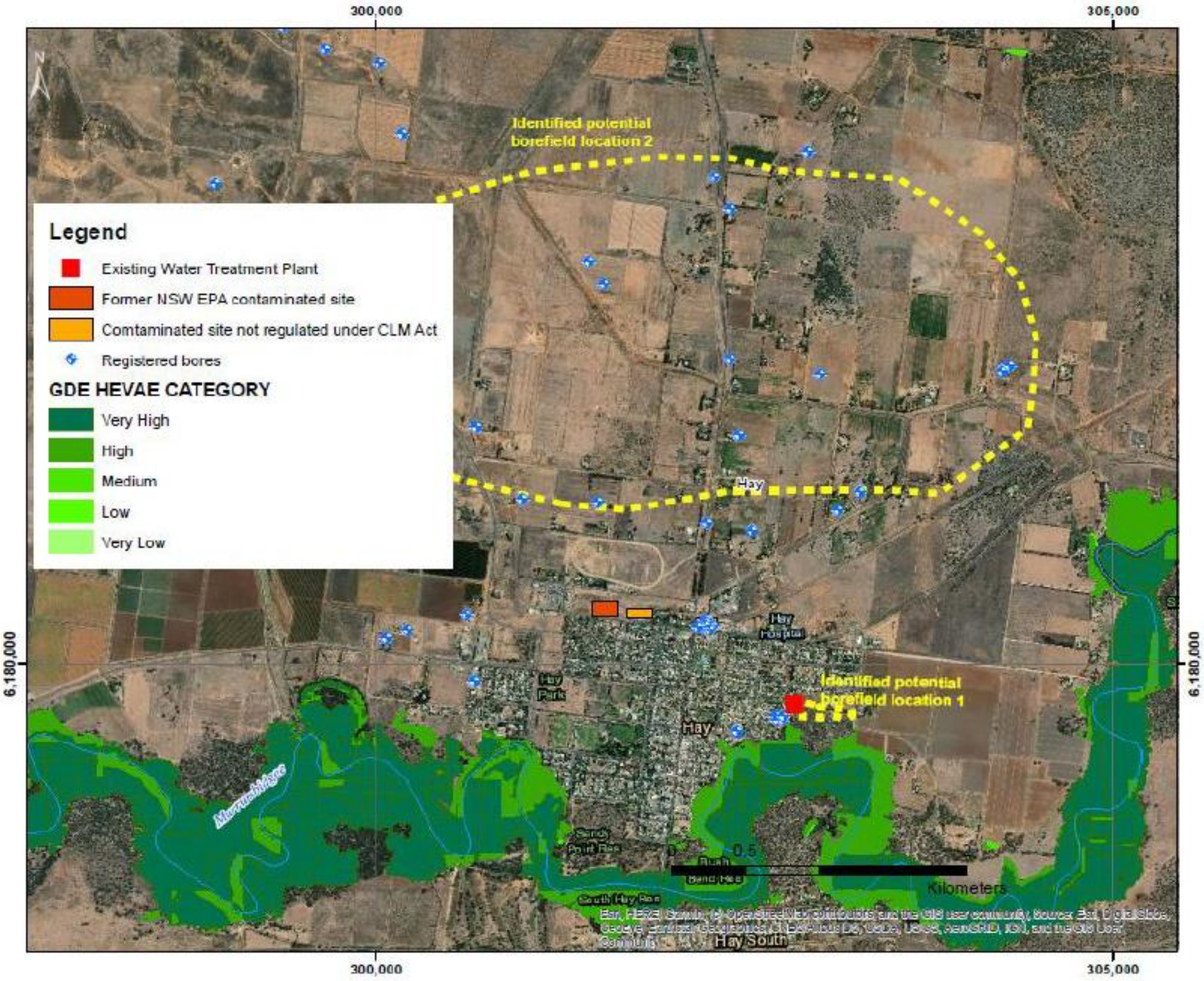

Figure 10-1: Identified Potential Borefield Investigation Areas – Borefield 1 and Borefield 2

Figure 10-2: Identified Potential Borefield Investigation Areas – Close-up of Borefield 1

A comparison of Borefield 1 and 2 is given in Table 10-1

Table 10-1: Comparison of Borefield 1 and 2

Consideration	Borefield 1	Borefield 2
Lithography	Presence of water bearing gravel layers at the following depths: • 87 to 107m bgl • 224 to 240 bgl • 328 to 331m bgl	Presence of water bearing gravel layers at the following depths: • 82 to 108m bgl
Yield of nearby bores	17 L/s	20 L/s
Drawdown before reaching 70% total available drawdown (TAD)[1]	24m	Over 40m
Salinity	1,000 mg/L TDS - acceptable for drinking water	<500 mg/L TDS - low
Proximity to WTP	0.1 km to 0.5 km	1.5 km to 3.5 km

1 – The 70% TAD requirement is the criteria for acceptable level of impact on groundwater pressure, from DPIE's Water Resource Plans Fact Sheet for assessing groundwater applications

The proposed locations for Borefield 1 and 2 were chosen to be at a distance greater than 200m from any high-priority groundwater dependent ecosystems (GDEs), which is a requirement for applying for a supply works approval under the Water Management (General) Regulation 2018. Also, as the proposed borefield will target the deep alluvial aquifer, the GDE impact due to groundwater extraction is negligible

Golder reported that the risk to other users including irrigators needs to be assessed, and negotiation with landowners for potential land acquisition is an unknown risk.

10.2 Next stages for investigation of groundwater

If Council is to pursue further investigation into the use of groundwater as an alternative supply, Golder recommends the following staged approach:

- **Phase 1: Preliminary Field Investigation**
  - **Environmental Site History** – desktop investigation to identify any potential contamination within the area
  - **Hydrogeological Investigation** – targeted water supply drilling program of the deep alluvium, installation of *monitoring wells* in shallow and deep aquifers, and airlift testing to identify high yield zones
  - **Pumping Test** – utilising data acquired from the exploration drilling, identify a suitable location to drill a large diameter pumping bore. Complete pumping test to stress the aquifer, confirm linkages to the shallow alluvium, and determine aquifer properties (hydraulic conductivity and storage parameters of the deep aquifer)
  - **Ongoing Monitoring** – groundwater level, quality, and contamination sampling from monitoring wells
- **Phase 2: Numerical Model**
  - Develop a numerical model using the site-specific parameters obtained in Phase 1 to determine the sustainable yield of the aquifer. The model will determine the impact on surrounding users and GDEs. The sustainable yield must comply with the rules of the *Water Sharing Plan for the Lower Murrumbidgee Groundwater Sources*.
- **Phase 3: Borefield Commissioning**
  - Install production bore(s) and associated surface infrastructure (pump, piping, and treatment) for sustainable groundwater supply for the town of Hay

This alternate water source will be considered as part of the DCERP.

10.3 Cost estimate for bore water supply

Assuming the yield of the bore is the same as the existing monitoring bores in the vicinity of Borefield 1 and 2, 17 and 20 L/s respectively, the bore could supply at least 1.5 ML/day if operating 24 hours per day. The Hay average day potable water production is estimated to be 1.0 ML/day (see Section 6.2.2), therefore a bores with this yield will have more than enough flow for an emergency supply.

The cost to equip the bores and construct pipeline to deliver the water to the Hay WTP is estimated. The bore pump is sized to supply 1 ML/day. The cost estimates are given in Table 10-2. Cost estimates are obtained from DPIE Water's 2014 *Reference Rates Manual* for *Valuation of water supply, sewerage, and stormwater assets*, with rates indexed to inflation to obtain 2021 costs.

Table 10-2: Cost estimate for 1 ML/day emergency bore water supply from Borefield 1 and 2

Purpose	Borefield Option 1		Borefield Option 2	
	Size	Cost	Size	Cost
Bore, pump, pipework, switchboard, and building	20kW bore pump	$270,000	25kW bore pump	$275,000
Pipeline to WTP	0.5 km DN150 uPVC	$65,000	3.5 km DN150 uPVC	$675,000
Total		**$330,000**		**$950,000**
Annual pumping cost *	Pumping 1 ML/day	$45,000	Pumping 1 ML/day	$55,000
Annual maintenance cost		$10,000		$15,000

* Pumping costs assume price of 32c per kWh.

The cost of Borefield Option 2 is more expensive than 1 as it requires a longer pipeline which must be constructed through residential areas. The pumping cost is also slightly higher given the pumping distance.

11. Hydraulic Modelling

11.1 Hay Raw WSS Hydraulic Model

A hydraulic model was developed by PWA in late 2015 using InfoWorks WS software using data provided by Council. For this analysis, the 2015 model has been migrated from InfoWorks WS to InfoWorks WS PRO. All the original pipe networks, ground elevation, pump data and operational controls will remain the same, only customer peak day demand values and demand pattern have been updated as a part of the IWCM supplementary study.

A summary of the levels of service, modelling results and outcomes are provided in the sections below. The full explanation of the model and results can be found in Appendix F.

Levels of Service

The hydraulic model will assist Council in identifying deficiencies in the Hay Raw WSS compared against the levels of service (LOS).

The following LOS have been adopted from Council's 2009 Strategic Business Plan (SBP):

- Minimum pressure 15 m
- Maximum pressure 26 m
- Supply interruption to customers 8 hours

HSC has the following fire flow requirements for the Raw WSS:

- Minimum fire flow 10 L/s
- Residual pressure 15 m head

Current system and demands

For the Raw WSS, the current peak day minimum pressures do not meet Council's minimum pressure LOS target of 15m on the outskirts of the Hay township. The lowest minimum pressure was around 6m. Council may wish to consider upgrading the pipelines that supply the low-pressure regions.

It is recommended that Council review their LOS targets to align with other water guidelines. Notably maximum pressures given for planning water supply in WSA-03 is between 50-60 m. In which case, all of the above pressure issues are within the 50 m.

Future system and demands

Two options to supply the future development areas were considered as a part of this study:

- Option 1: Extend existing network and upgrades to existing pipelines
- Option 2: Pipeline upgrades and booster PS

The upgrades and proposed development zone locations are shown in Figure 11-1 below.

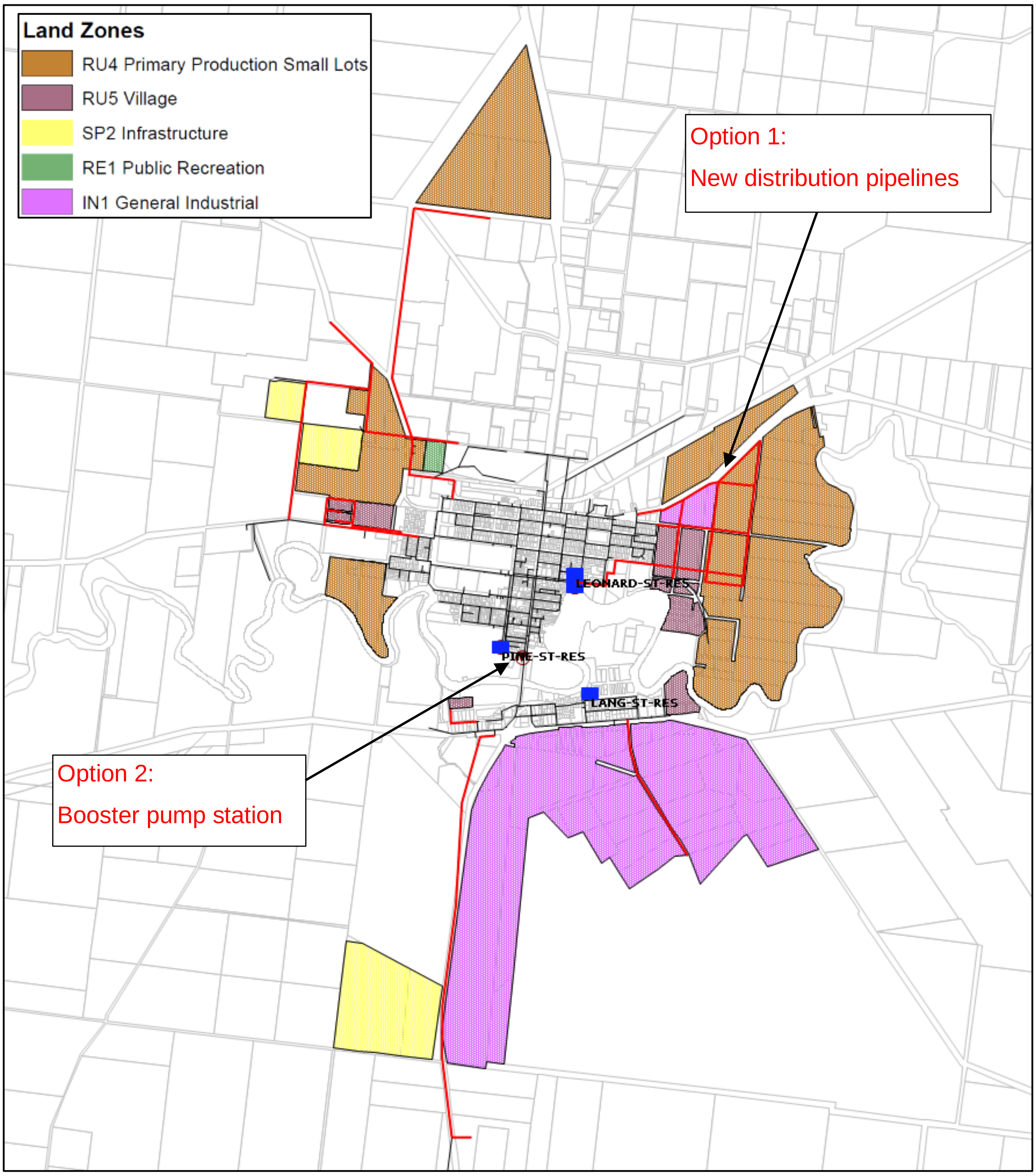

Figure 11-1: Raw WSS Model - proposed infrastructure upgrades to supply future development

Option 1 for the Raw WSS will ensure raw water access to the existing and future customers in the development zones. Pipeline selections were chosen to meet the design basis of WSA03, as such some pipelines could not be increased further to reduce head losses. Some customers on the edges of town experienced peak day minimum pressures below Council's LOS target of 15m; the lowest minimum pressure was 12.8m. The capital cost of Option 1 was estimated to be around $4.6M.

Option 2 for the Raw WSS can be seen as an upgrade to Option 1, as it services the future development zones while maintaining the minimum pressure levels as per LOS targets. Upgrades for Option 2 includes about 27.3 km of new pipelines (replacements and new routes) of varying sizes between DN100 to DN300 and a new South Hay booster pump. The capital cost of Option 2 was estimated to be around $5.8M.

For areas where unassisted pressures or flows fall below the LOS, a fixed on-site pump and/or tank should be considered.

11.2 Hay Potable WSS Hydraulic Model

A hydraulic model of Hay's Potable WSS was developed using InfoWorks WS Pro using the GIS data provided by Council and information obtained during discussions with Council staff.

A summary of the modelling results is provided in the sections below. The full explanation of the model and results can be found in Appendix G. The results and outcomes of the modellings are summarized below.

Levels of Service

The hydraulic model will assist Council in identifying deficiencies in the Hay Potable WSS compared against the levels of service (LOS).

The following LOS have been adopted from Council's 2009 Strategic Business Plan (SBP):

- Minimum pressure 25 m
- Maximum pressure 30 m
- Supply interruption to customers 8 hours

The units in the SBP were given in PSI, but after discussion with Council this was changed to meters head.

Current system and demands

The existing Potable WSS can supply current peak day demands while still providing minimum pressures above the LOS minimum pressure target. Maximum pressures can be achieved when the pumps are not operating.

Future system and demands

Three options to supply water to the future development zones were considered as a part of this study:

- Option 1: Extend existing network
- Option 2: Pipeline extension + booster PS
- Option 3: Pipeline extension + South Hay reservoir

The upgrades and proposed development zone locations are shown in Figure 11-2 below.

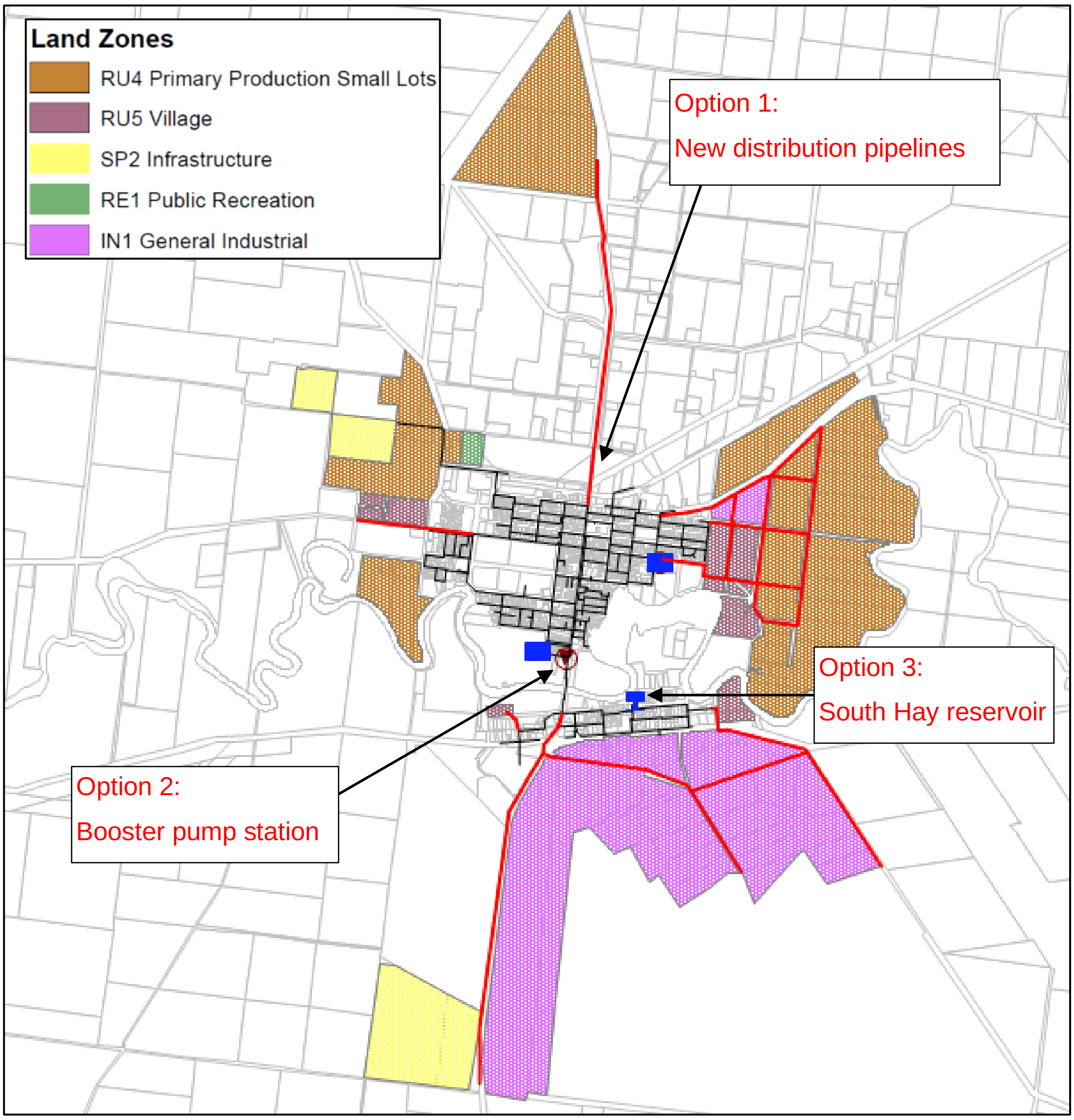

Figure 11-2: Potable WSS Model - proposed infrastructure upgrades to supply future development

Option 1 of this study will ensure potable water access to the existing and future customers in the development zones. Pipeline selections were chosen to meet the design basis of WSA03, as such some pipelines could not be increased further to reduce head losses. Some customers on the edges of town experienced peak day minimum pressures below Council's LOS target of 25m; the lowest minimum pressure was 22.3m. The capital cost of Option 1 was estimated to be around $4.5M.

Option 2 assessed the effect of a booster pump station which boosts water to the south of Hay. Pipe upgrades were the same as for Option 1. The CWPs were also upgraded to boost capacity. With the proposed infrastructure, the system will be able to provide peak day minimum pressures that meet Council's LOS target of 25m. The capital cost of Option 2 was estimated to be around $4.8M.

Option 3 assessed the effect of a new reservoir in the south of Hay. Pipe upgrades were the same as for Option 1. With the proposed infrastructure, the system still will not be able to provide peak day minimum pressures that meet Council's LOS target of 25m, the lowest minimum pressure was 18.4m. The capital cost of Option 3 was estimated to be around $5.4M.

12. Strategy Update

12.1 Growth

Council has proposed a re-zoning in Hay and an extension of the service areas. An additional 463 lots are expected within the next five years and a further 200 lots in the following 25 years.

12.2 Water security

The total water extraction requirements for the ultimate development will not exceed Council's license entitlement. However if there were a repeat of the millennium drought, the 30-year ultimate unrestricted demand would exceed the reduced allocation during this drought and water restrictions would be required. The imposition of restrictions could be avoided by reducing the water losses and improving the raw water and potable water system performance. A water loss management plan needs to be developed which would include a targeted mains replacement based on:

- Performance data
- Information from strategically located zone (smart) meters
- Active leakage control

An amount of $1.7M has been allocated for water mains replacement in the asset management plan over the next 11 years.

If the mains replacement and meter audit program does not achieve the desired reduction in 'unaccounted for water', Council can consider effluent reuse for irrigation of public open spaces to achieve further demand reduction.

12.3 Water quality

The water treatment plant (WTP) is in a reasonably good condition and produces water that meets the requirements of the Australian Drinking Water Guidelines. There is a medium risk of chlorine resistant pathogens being present in the water supply. A number of upgrades requirements have been identified for the WTP. In order to inform the asset management plan, these upgrades have been prioritised under the following categories:

6. plant performance and compliance with DWMS
7. work health and safety
8. monitoring and control
9. operational convenience
10. renewals as required

12.4 Supply reliability

12.4.1 Raw water system

For the Raw WSS, the current peak day minimum pressures do not meet Council's minimum pressure LOS target of 15m on the outskirts of the Hay township. The lowest minimum pressure was around 6m. To meet the service level for the existing customers and service the future development zones, would require an upgrade which includes about 27.3 km of new pipelines (replacements and new routes), and a booster pumping station at South Hay. This system has been included in the asset management plan.

12.4.2 Potable water system

The potable water supply scheme can meet the levels of service when supplying the peak day demand. To service the future developments would require an upgrade of the clear water pumps and a booster pumping station to boost supply to South Hay. This system has been included in the asset management plan.

12.4.3 Potable water – continuity of supply

The Hay water supply scheme is vulnerable to any contamination, such as blue green algae, to the Murrumbidgee river as it does not have an alternate source of supply as a backup during emergencies. Two areas in the Lower Murrumbidgee Deep Aquifer, within 3 km of the WTP have been identified as potential groundwater supplies. An allowance of $300K has been included in the asst management plan for the development of the bore field.

12.5 Sewage treatment plant biosolids management

The biosolids produced at the sewage treatment plant will comply with Grade B requirements that will allow for different land application uses based on the contaminant grade. Sampling and testing should be undertaken to determine the contaminant grade before deciding on the appropriate land use application for disposal.

13. Total Asset Management Plan

Total asset management plan (TAMP) provides the details of capital works and recurrent operations, maintenance, and management (OMA) expenditure forecasts for a 30-year planning horizon. TAMP is essential for managing infrastructure assets to meet the levels of service in a cost-effective manner for the current as well as the future customers.

TAMP also provides vital inputs for Council to develop their long-term funding strategies by linking to a long-term financial plan which identifies funds required to implement capital and recurrent expenditure at affordable levels of customer charges.

13.1 Capital Works

Capital works generally fall under the following three broad categories:

Growth works	Works required to increase the capacity of facilities, to service new release areas, subdivisions, etc.
Improved level of service works (ILOS), including backlog works	Works to provide better public health and environmental standards, better service, higher reliability, or an extension of services to currently unserviced existing development. Works in this category may be eligible for Government grants.
Asset renewal	Renewal and replacement of existing assets which have aged and reached the end of their effective economic service life

Council's TAM Plan includes a schedule of growth capital works to satisfy the forecast service demands for the adopted assessment growth rate of 2.60% p.a., and to improve the levels of service capital works based on the preferred options to address the identified IWCM issues. Additionally, asset renewal works have been identified and included based on:

- an analysis of asset performance in terms of water main breaks, sewer chokes, sewage overflows along with the trend in operation and maintenance expenditure, and
- an assessment of condition of all the above-ground assets and the remaining useful economic lives of asset components

Council's 30-year capital works for water supply and sewerage services are presented in Appendix H and are summarised in **Error! Reference source not found.** and **Error! Reference source not found.** for water supply and sewerage, respectively.

13.2 Recurrent Costs

Foreseeable asset life-cycle costs other than the capital costs include the management, operation, and maintenance costs.

Administration/ Management costs	Reflects true overheads associated with providing a service. Any cross subsidies with the General Fund should be eliminated or explicitly disclosed in the Annual Accounts.
Operations and Maintenance (O&M) costs	It is assumed that the current level of costs shown in the Financial Statements reflects a realistic level of expenditure for the current schemes. The O&M forecasts assume cost increases in proportion to growth. Additional O&M costs are included for specific activities that have been identified for future years. This includes new

initiatives, plus additional costs associated with new capital works identified as part of the recommended IWCM strategy.

Projected estimates of the life-cycle costs, by default, are based on historical operation and maintenance expenses increasing pro-rata the customer growth, unless Council provides revised estimates. The projections are further adjusted where new initiatives are required to address the IWCM issues and where new works required additional operating resources. Details of the projected operation, maintenance and management costs are presented as part of the financial model input data and have been estimated as below:

- Administration – as estimated by the Council
- Engineering & Supervision – as estimated by the Council
- Operating expenses – pro-rata customer growth
- Maintenance expenses – pro-rata customer growth
- Energy costs – as projected by the Council
- Chemical costs – pro-rata customer growth
- Other expenses – as estimated by the Council
- Other revenue, grants and contributions – as estimated by the Council

Summaries of 30-year OMA cost forecasts are presented in Figure 13-3 and Figure 13-4 for water supply and sewerage services, respectively.

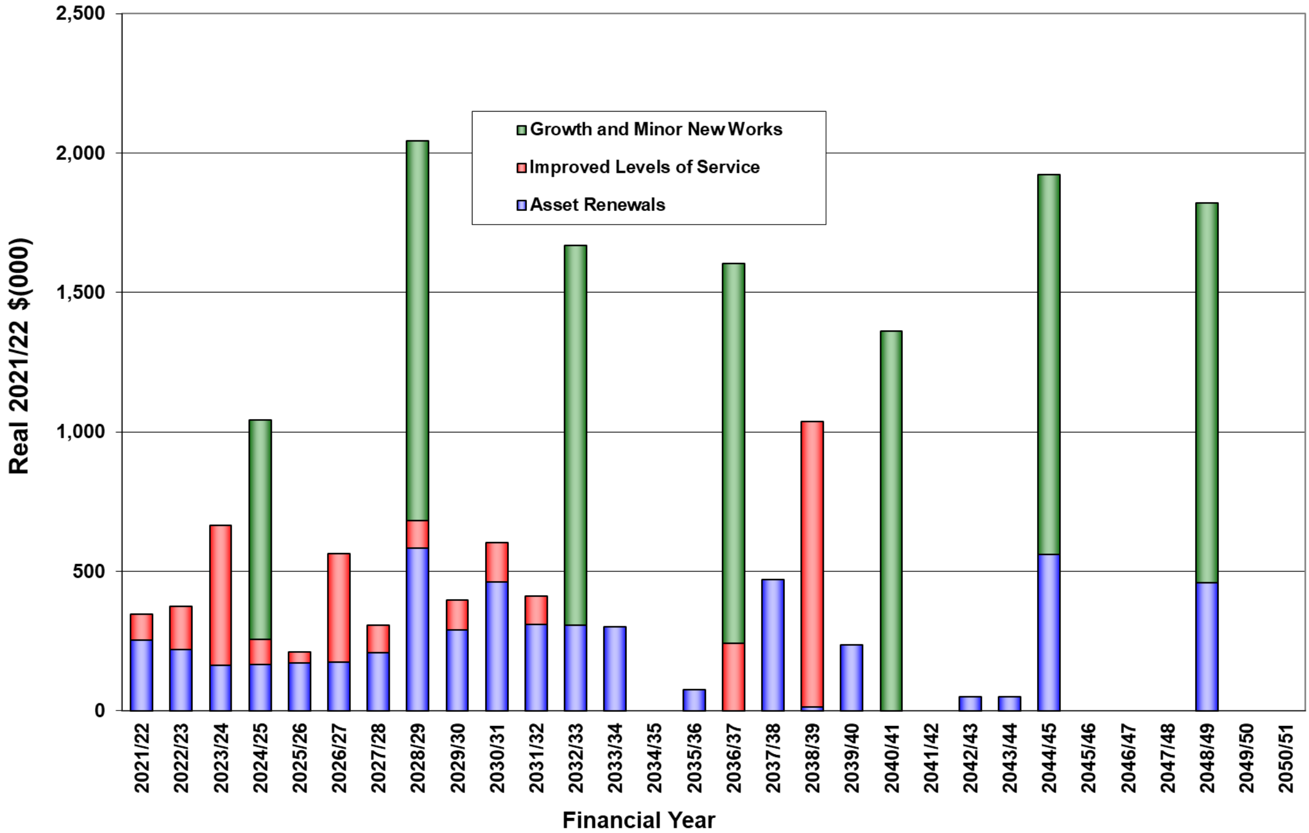

Figure 13-1: 30-year Water Supply Capital Works Summary

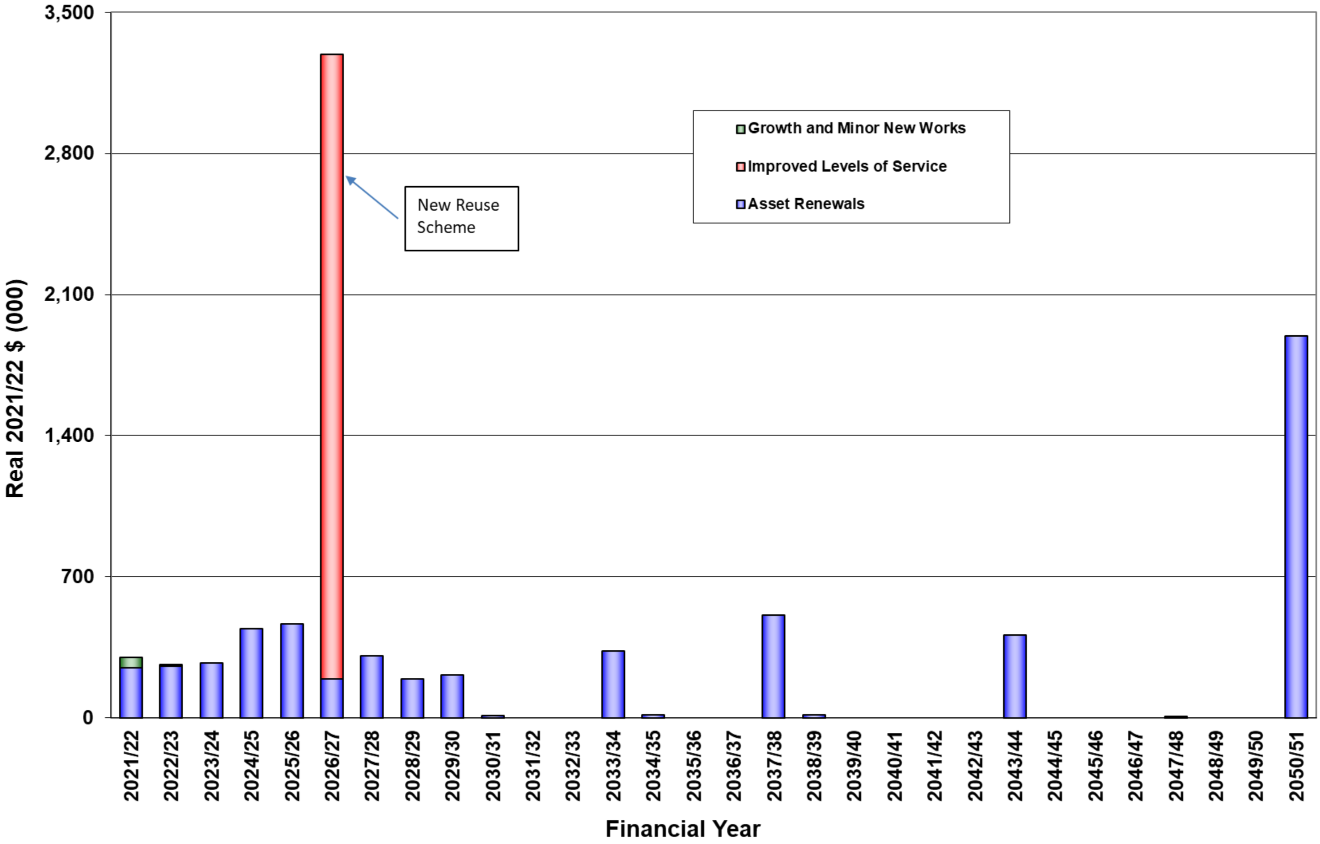

Figure 13-2: 30-year Sewerage Capital Works Summary

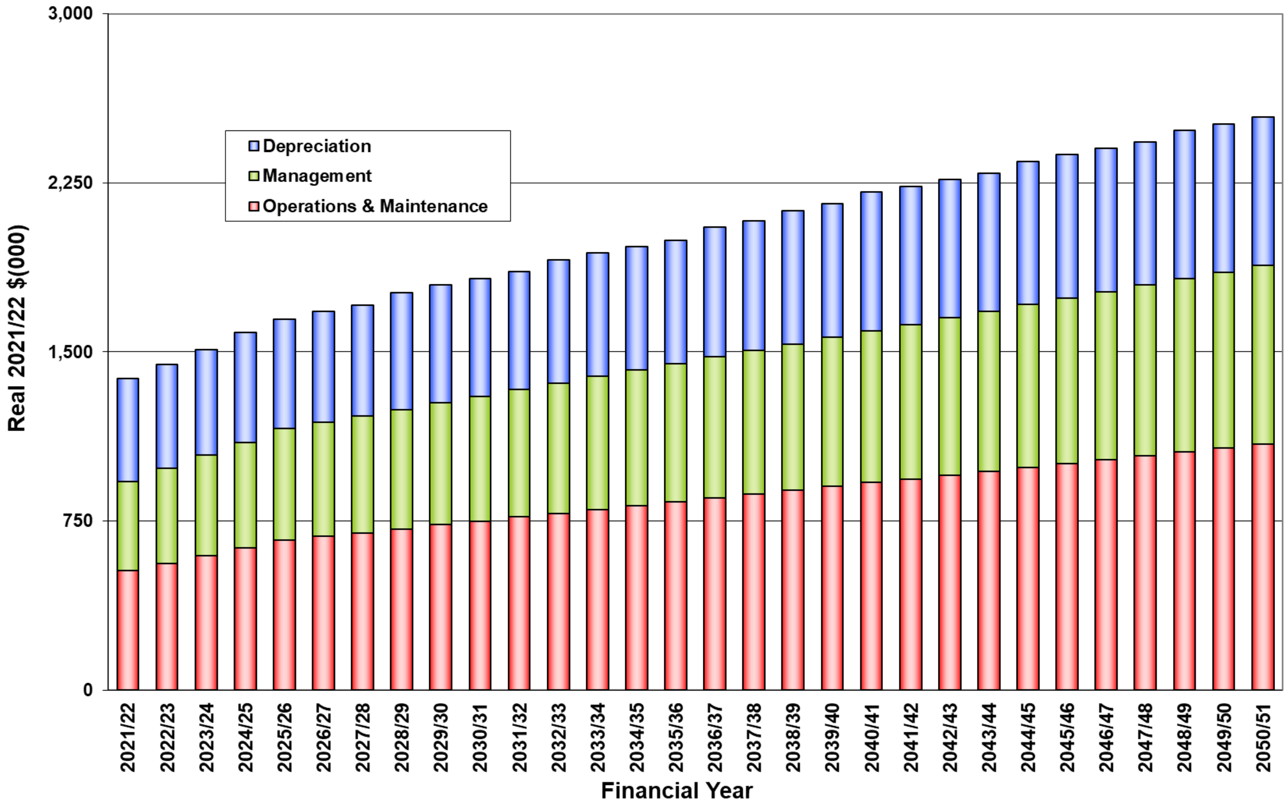

Figure 13-3: 30-year Water Supply Recurrent Cost Summary

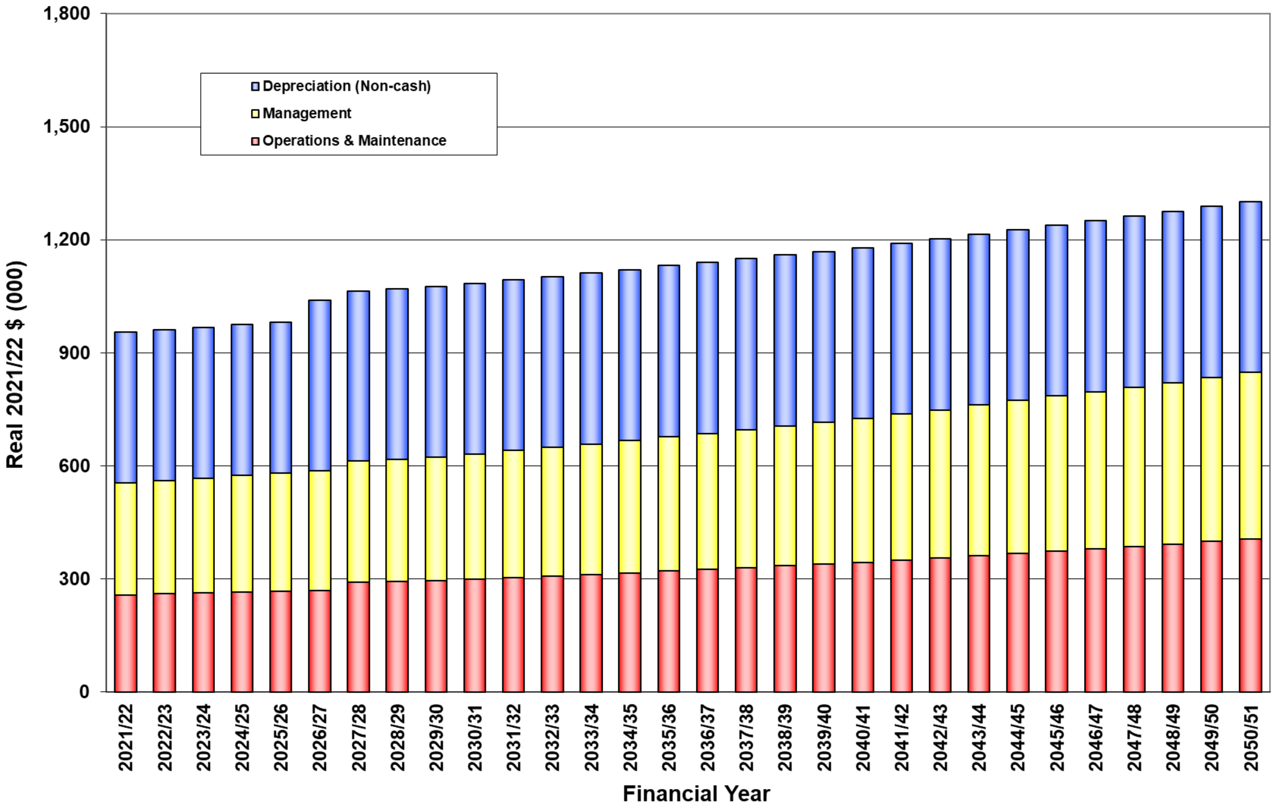

Figure 13-4: 30-year Sewerage Recurrent Cost Summary

14. Financial Plan

Financial plan covering the water supply and sewerage services have been prepared based on the forecasts by the financial models developed using the FinMod 4.0 software. FinMod enables examination of the lowest, stable level of annual residential water supply and sewerage charges by optimising the long-term funding strategy to meet the demands of the capital works program and the ongoing operating expenses while ensuring a minimum level of cash liquidity.

A number of variables and assumptions have been used as inputs in the development of the base case of the financial models. Key input data and the source are provided in Table 14.1. These parameters have been projected for the 30-year forecast period adopted for the financial models based on a representative view on a number of factors, and the Council's comments have been incorporated in the final determinations.

Table 14.1: Key Input Parameters for the Financial Models

	Input Data/ Assumptions/ Source	
	Water Supply	**Sewerage**
Historical Data	Hay Shire Council water and sewer fund income statements and financial position statements from the Financial Data Returns (FDRs) for years 2019/20 and 2020/21	
Financial Data	Average annual long-term inflation rate: 2.5% p.a. Annual Borrowing Interest Rate: 4.0% p.a. Annual Investment Interest Rate: 3.0% p.a.	
Demographic Base Data (2020/21)	No. of Resi. Assessments: 1,174 (Vacant - 22) No. of Non-Resi. Assessments: 199 (Vacant - 17) Pensioner Assessments: 226	No. of Resi. Assessments: 1,118 (Vacant - 22) No. of Non-Resi. Assessments: 184 (Vacant - 15) Pensioner Assessments: 219
Current Charges (from Revenue Policy 2021/22)	Filtered Water Supply: Access Charge (20mm): $144 p.a. Usage Charge: $1.21/Kl up to 300 Kl $1.81/Kl for >300 Kl Raw Water Supply: Access Charge: $372 p.a. Usage Charge: $0.39/Kl Typical Residential Bill for 2021/22: $850 p.a. (Raw + Filtered Water combined)	Residential Charges: $772 p.a. Non-Residential: Access Charge (20mm): $628 p.a. Usage Charge: $1.21 per Kl
	Sec.64 Developer Charges:	
	Filtered water supply: $370/ET Raw water supply: $1,561/ET	Sewerage: Nil
Opening Balances	Outstanding Loan: Nil Cash and Investments: $ 2,693 K Minimum operating cash: $1,000 K	Outstanding Loan: $975 K Cash and Investments: $ 2,470 K Minimum operating cash: $1,000 K

All costs and revenues in the input data and the model outcomes are in 2021/22 dollars unless stated otherwise, and CPI should be applied accordingly. The financial plan will be reviewed annually with respect to any material changes to the proposed capital works program and/or changes to any of the underlying assumptions.

14.1 Financial Forecasts – Water Supply

Council's water fund financial model has been developed considering all the existing and future customers will be serviced by both non-potable and potable water supply services. All the income and expenditure details used as input to the model, and hence the forecast outputs represent the costs for the combined services. No government grant/ subsidy has been considered for any of the planned capital works.

Detailed water fund model input and output data for the updated IWCM scenario are in shown in Appendix I and a summary of the financial forecasts at 5-year intervals are presented in Table 14.2 All forecast data are in 2021/22 dollars and will need to be adjusted for CPI for future years.

Table 14.2: Financial Summary – Water Fund

2021/22 $ ('000)	2021/22	2025/26	2030/31	2035/36	2040/41	2045/46	2050/51
Estimated Total Revenue	1,363	1,887	2,173	2,434	2,669	2,938	3,208
Estimated Total Expenditure	1,388	1,651	1,832	2,001	2,213	2,380	2,546
Operating Surplus / (Deficit)	-25	236	341	433	456	558	661
Acquisition of Assets	347	211	603	76	1,361	0	0
Principal Loan Payments	0	0	0	0	0	0	0
Borrowings Outstanding	0	0	0	0	0	0	0
Cash and Investments	2,748	2,504	2,338	4,079	3,927	6,850	10,235
Total Assets	20,350	20,358	21,387	22,201	23,596	23,896	23,743
Total Liabilities	0	0	0	0	0	0	0

The water fund financial model has demonstrated that the current (2021/22) combined non-potable and potable water supply TRB of $850 p.a. needs to be increased by $30 per year for the next five years to $1,000 p.a. in 2026/27 and can be maintained at that level for the remaining forecast period (Figure 14.1).

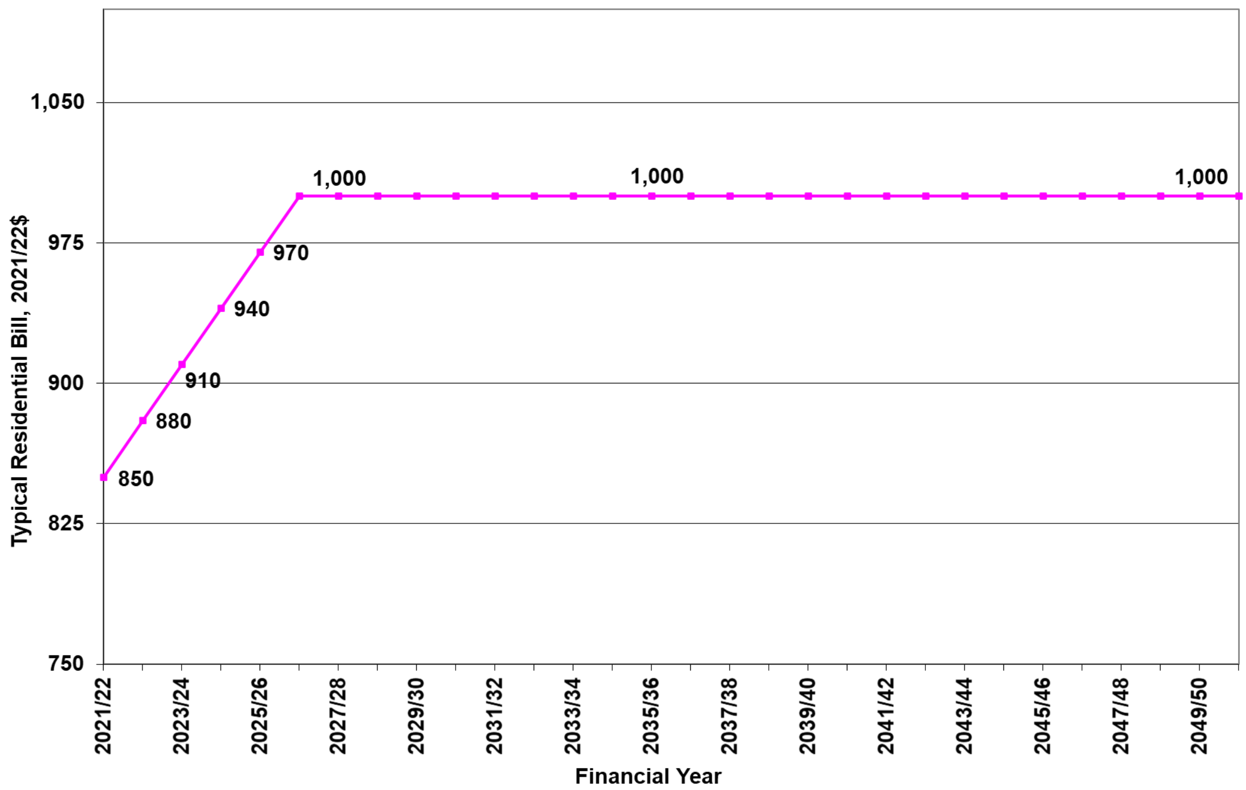

Figure 14.1: Typical Residential Bill Projections for Water Supply

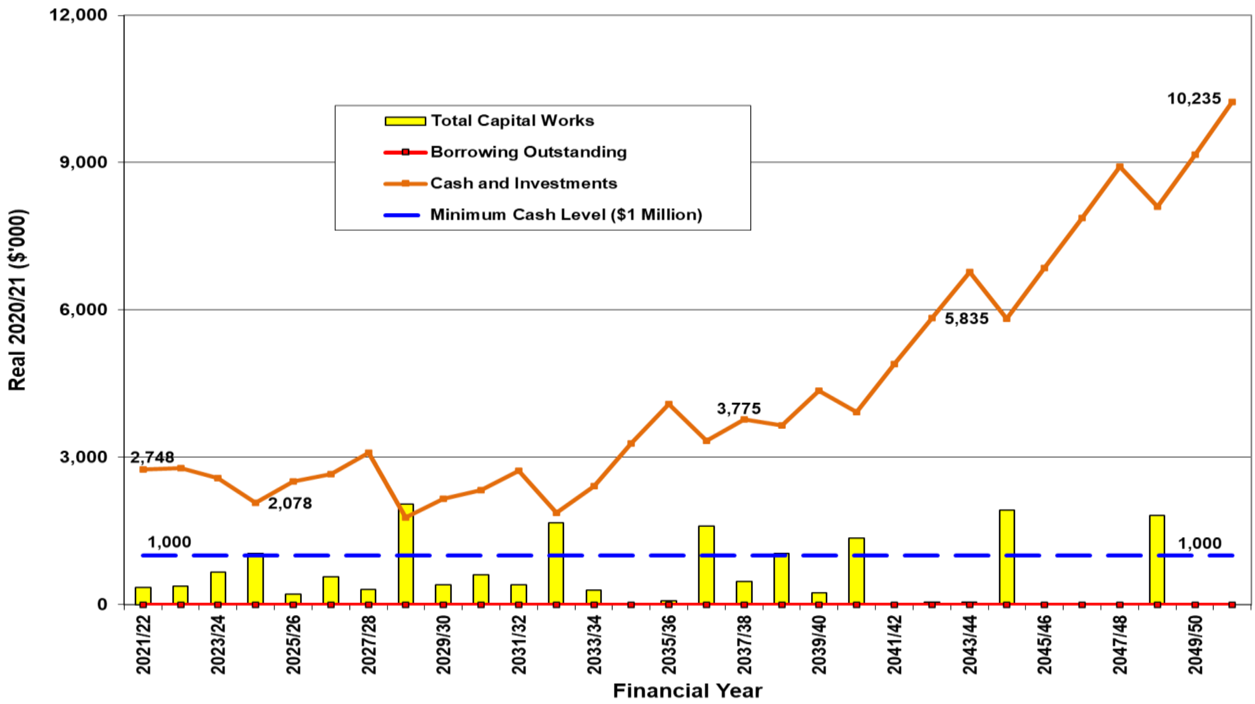

Figure 14.2: Cash & Borrowing Projections for Water Supply

The forecast level of charges are sufficient to maintain liquidity of the required minimum $1.0 Million of cash and investments in the water fund over the forecast period. The forecast also demonstrates that there will not be any need for external borrowing throughout the forecast period.

The levels of cash availability and the borrowing outstanding for water supply during the 30-year forecast period are depicted in Figure 14.2. Projected financial results over the 30-year forecast period is presented in Table 14.3.

Table 14.3: Projected Financial Position - Water Fund

2021/22 ($'000)	Revenue and Expenses			Capital Transactions		Financial Position					System Assets			
Financial Year	Total Revenue	Total Expenses	Operating Result (Before Grants)	Acquisition of Assets	Principal Loan Payments	Cash and Investments	Borrowings	Total Assets	Total Liabilities	Net Assets Committed	Current Replacement Cost	Less: Accumulated Depreciation	Written Down Current Cost	Typical Residential Bills
2021/22	1,363	1,388	-25	347	0	2,748	0	20,350	0	20,350	27,155	9,925	17,230	850
2022/23	1,490	1,449	41	376	0	2,776	0	20,248	0	20,248	27,310	10,166	17,144	880
2023/24	1,617	1,517	100	665	0	2,579	0	20,213	0	20,213	27,813	10,474	17,339	910
2024/25	1,744	1,590	154	1,044	0	2,078	0	20,270	0	20,270	28,690	10,791	17,899	940
2025/26	1,887	1,651	236	211	0	2,504	0	20,358	0	20,358	28,730	11,106	17,623	970
2026/27	1,994	1,686	308	562	0	2,659	0	20,521	0	20,521	29,117	11,423	17,694	1,000
2027/28	2,047	1,715	332	306	0	3,090	0	20,660	0	20,660	29,215	11,709	17,506	1,000
2028/29	2,081	1,768	313	2,044	0	1,778	0	21,029	0	21,029	30,678	11,645	19,033	1,000
2029/30	2,121	1,801	320	398	0	2,154	0	21,191	0	21,191	30,785	11,874	18,911	1,000
2030/31	2,173	1,832	341	603	0	2,338	0	21,387	0	21,387	30,927	11,936	18,991	1,000
2031/32	2,225	1,862	362	411	0	2,733	0	21,548	0	21,548	31,028	12,150	18,878	1,000
2032/33	2,264	1,914	350	1,669	0	1,870	0	21,971	0	21,971	32,389	12,389	19,999	1,000
2033/34	2,312	1,944	368	300	0	2,415	0	22,105	0	22,105	32,389	12,637	19,752	1,000
2034/35	2,374	1,972	402	0	0	3,280	0	22,154	0	22,154	32,389	13,184	19,205	1,000
2035/36	2,434	2,001	433	76	0	4,079	0	22,201	0	22,201	32,388	13,655	18,734	1,000
2036/37	2,473	2,058	416	1,603	0	3,340	0	22,661	0	22,661	33,991	14,228	19,763	1,000
2037/38	2,524	2,086	439	470	0	3,775	0	22,806	0	22,806	33,991	14,332	19,659	1,000
2038/39	2,570	2,132	438	1,037	0	3,649	0	23,119	0	23,119	35,013	14,908	20,106	1,000
2039/40	2,626	2,160	465	237	0	4,352	0	23,170	0	23,170	35,013	15,261	19,752	1,000
2040/41	2,669	2,213	456	1,361	0	3,927	0	23,596	0	23,596	36,374	15,874	20,500	1,000
2041/42	2,725	2,240	486	0	0	4,903	0	23,530	0	23,530	36,375	16,486	19,888	1,000
2042/43	2,786	2,269	517	50	0	5,835	0	23,461	0	23,461	36,375	17,049	19,326	1,000
2043/44	2,845	2,299	546	50	0	6,774	0	23,371	0	23,371	36,374	17,612	18,763	1,000
2044/45	2,882	2,351	531	1,921	0	5,827	0	24,035	0	24,035	37,736	17,688	20,048	1,000
2045/46	2,938	2,380	558	0	0	6,850	0	23,896	0	23,896	37,736	18,323	19,413	1,000
2046/47	2,996	2,408	588	0	0	7,878	0	23,733	0	23,733	37,736	18,960	18,776	1,000
2047/48	3,055	2,436	619	0	0	8,912	0	23,550	0	23,550	37,736	19,595	18,140	1,000
2048/49	3,092	2,488	604	1,821	0	8,107	0	24,197	0	24,197	39,097	19,794	19,303	1,000
2049/50	3,149	2,517	632	0	0	9,169	0	23,981	0	23,981	39,097	20,452	18,645	1,000
2050/51	3,208	2,546	661	0	0	10,235	0	23,743	0	23,743	39,097	21,110	17,987	1,000

14.1.1 Sensitivity Analysis – Water Supply

The water fund financial model does not involve any grant/subsidy or external borrowing. Hence, sensitivity of model forecasts for a 'no subsidy' scenario and 'higher interest rates' scenario were not warranted. The sensitivity of model forecasts were hence analysed for an 'increase in planned capital works cost estimates' and a 'lower than adopted customer growth rate' scenarios. The analysis demonstrated that the forecast TRBs are robust enough to be not affected by the considered scenarios, as the impacts can be cushioned by the accrued cash levels and through minor levels of borrowing for planned capital works servicing the new development areas. The Table below and the following Figures presents the sensitivity of model forecasts.

Table 14.4: Sensitivity Analysis of Water Fund Financial Model

Sensitivity	Values of Variables for Analysis	Effect on TRB compared to the Preferred Scenario
Higher capital work costs	20% increase in the cost of planned capital works	No impact on the TRB forecasts and are the same as for the adopted IWCM Strategy.
Lower customer growth rate	Customer growth rate at 50% of the adopted growth rate	

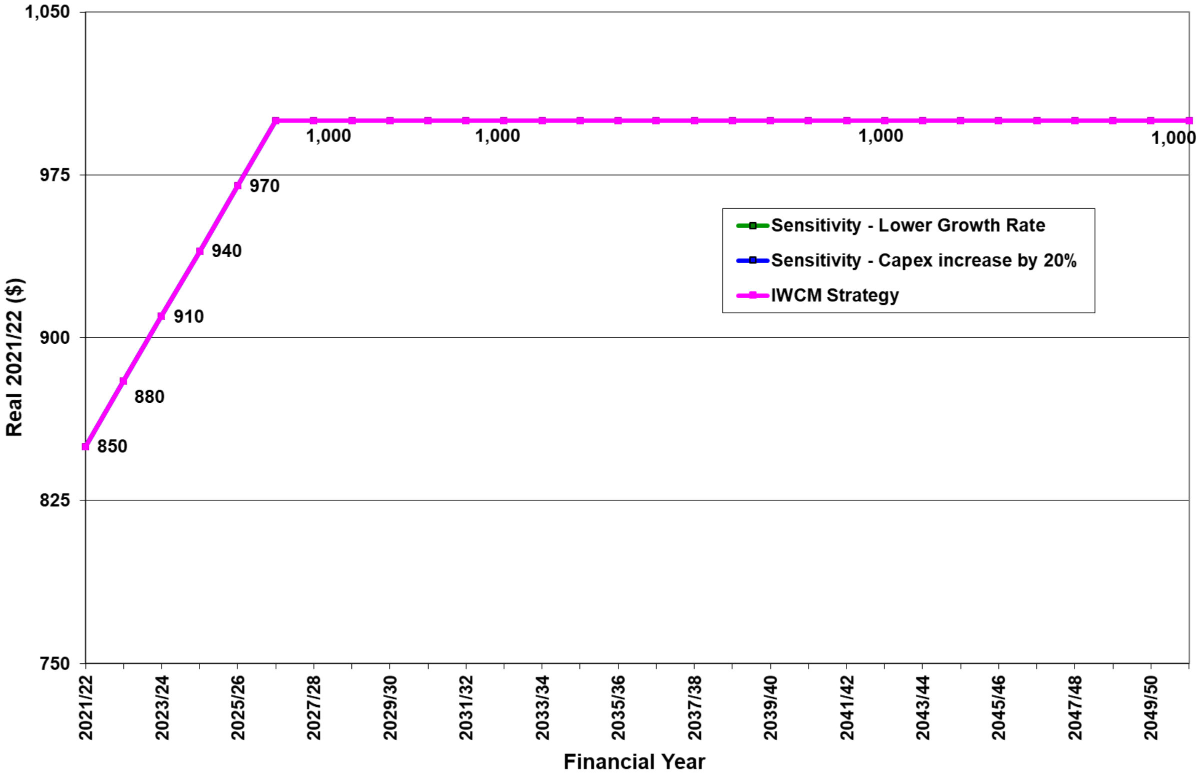

Figure 14.3: Sensitivity of Water TRBs

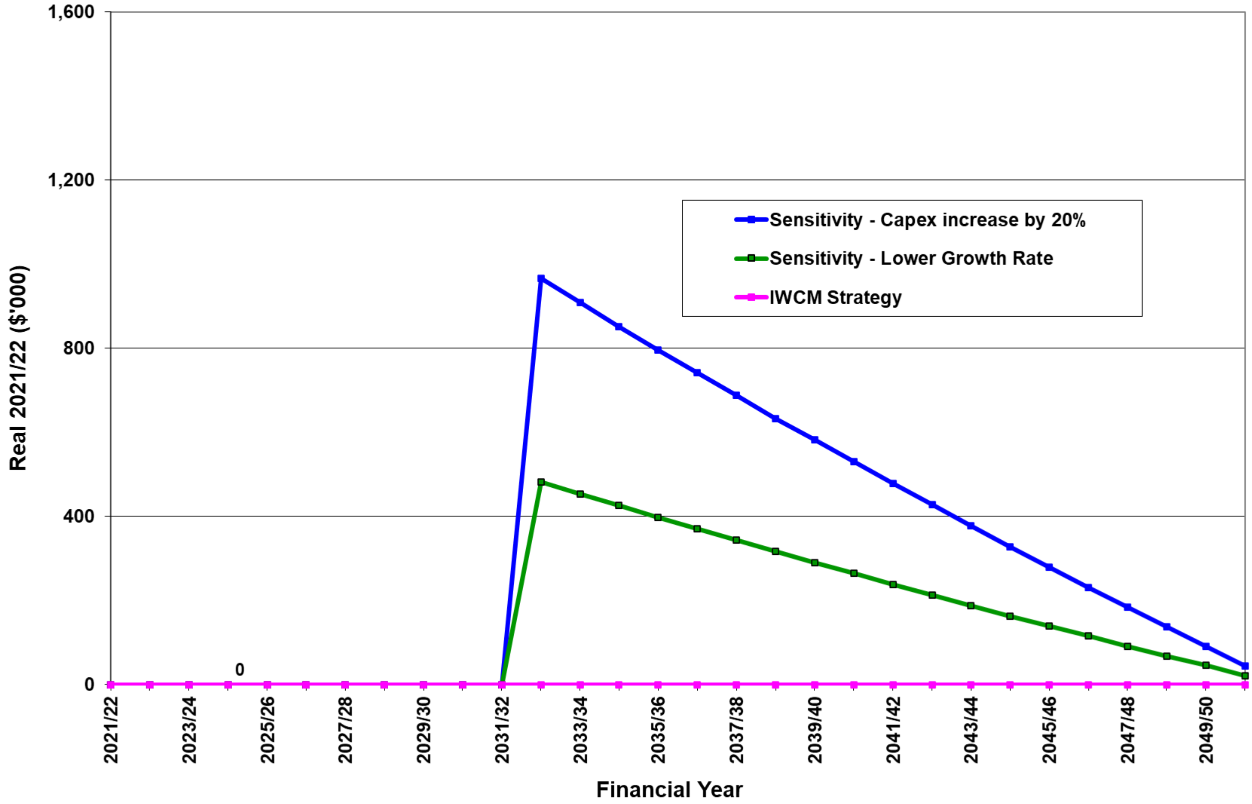

Figure 14.4: Sensitivity of Borrowing Requirements - Water

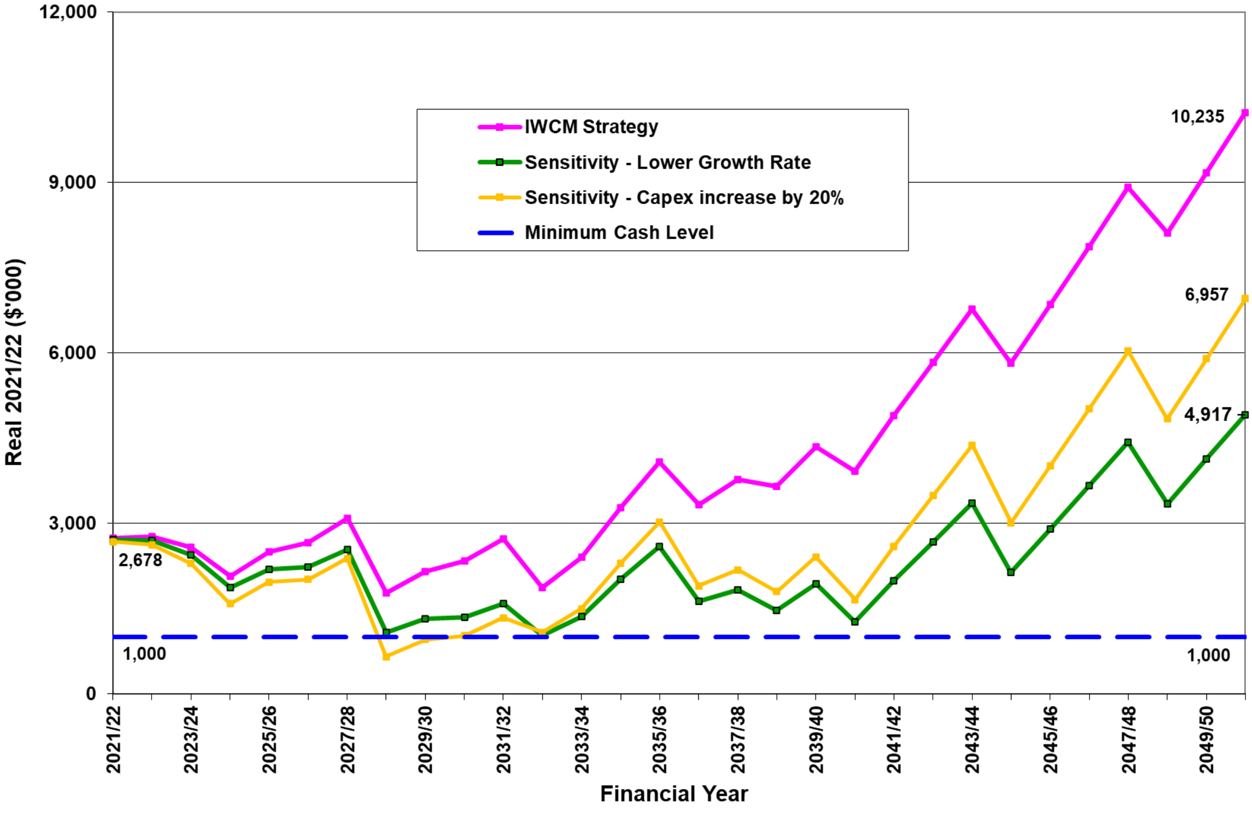

Figure 14.5: Sensitivity of Cash and Investments - Water

14.2 Financial Forecasts – Sewerage

The sewer fund financial model considered that 90% government subsidy/ grant will be available for the new effluent reuse scheme planned for 2026/27.

Detailed sewer fund model input and output data for the updated IWCM scenario are in shown in Appendix J and a summary of the financial forecasts at 5-year intervals are presented in Table 14.5. All forecast data are in 2021/22 dollars and will need to be adjusted for CPI for future years.

Table 14.5: Financial Summary – Sewer Fund

2020/21 $ ('000)	2020/21	2024/25	2029/30	2034/35	2039/40	2044/45	2049/50
Estimated Total Revenue	1,119	1,168	1,247	1,370	1,490	1,614	1,722
Estimated Total Expenditure	998	1,008	1,096	1,142	1,191	1,250	1,314
Operating Surplus / (Deficit)	121	159	151	228	299	364	408
Acquisition of Assets	300	466	12	0	0	0	1,895
Principal Loan Payments	117	120	0	0	0	0	0
Borrowings Outstanding	858	319	0	0	0	0	0
Cash and Investments	2,570	2,567	3,493	5,835	8,084	10,495	11,416
Total Assets	21,936	21,778	24,465	24,896	25,410	25,974	26,546
Total Liabilities	867	327	7	6	6	5	4

Council has adopted annual residential sewerage charges of $772 p.a. for 2021/22. The sewer fund financial model demonstrates that the current sewerage TRB of $ 772 can be maintained for all the remaining forecast period with annual adjustments for CPI/ inflation (Figure 14.6).

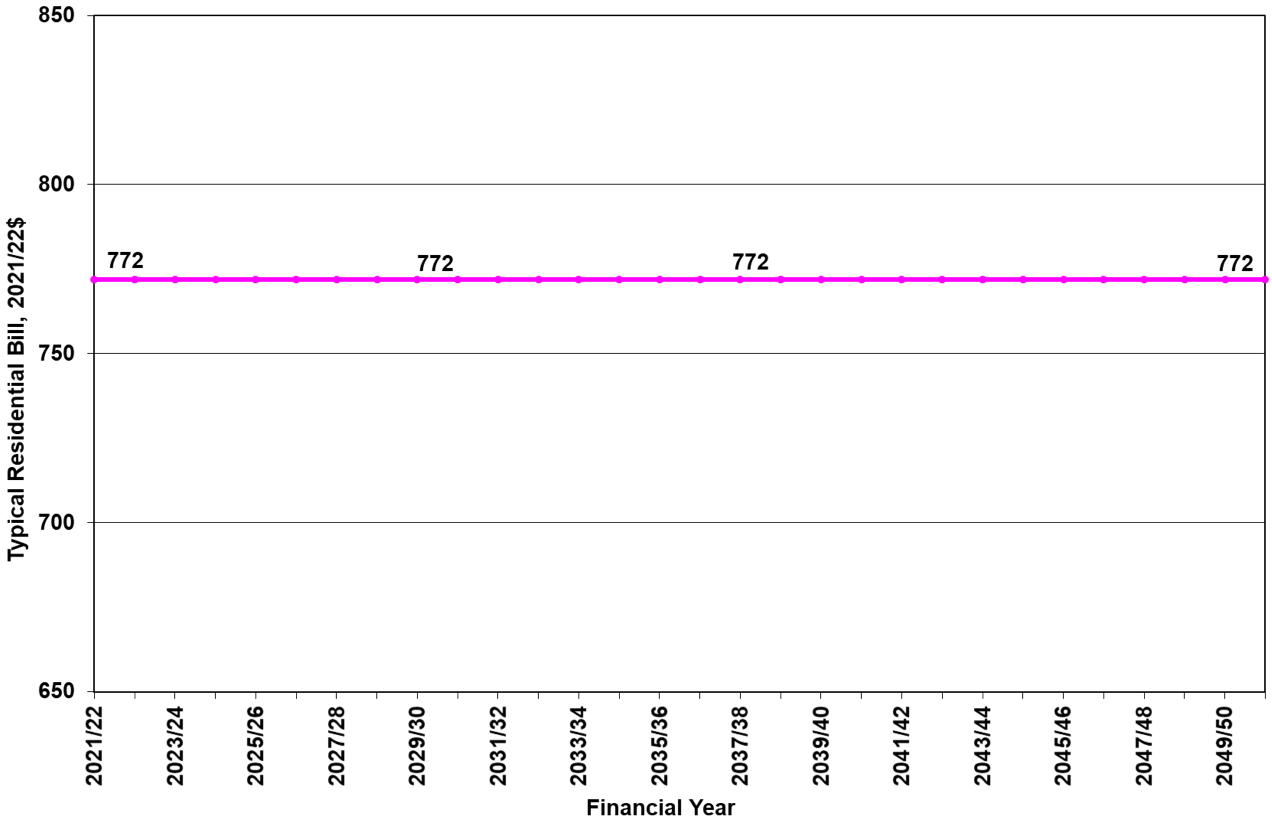

Figure 14.6: Typical Residential Bill Projections Sewerage

The forecast level of annual sewerage charge, after due consideration of the expected grant/subsidy for the new reuse scheme, is sufficient to maintain liquidity well above the adopted minimum of $1.0 Million of cash and investments over the next 30-year period. The forecast also demonstrates that there will not be any need for new external borrowing throughout the forecast period.

Projected financial results over the 30-year forecast period are presented in Table 14.6. The levels of cash and borrowing outstanding for sewerage services during the 30-year forecast period are shown in Figure 14.7.

Table 14.6: Projected Financial Position - Sewer Fund

2021/22 ($'000)	Revenue and Expenses			Capital Transactions		Financial Position					System Assets			
Financial Year	Total Revenue	Total Expenses	Operating Result (Before Grants)	Acquisition of Assets	Principal Loan Payments	Cash and Investments	Borrowings	Total Assets	Total Liabilities	Net Assets Committed	Current Replacement Cost	Less: Accumulated Depreciation	Written Down Current Cost	Typical Residential Bills
2021/22	1,119	998	121	300	117	2,570	858	21,936	867	21,069	24,497	5,261	19,236	772
2022/23	1,133	999	134	264	117	2,656	720	21,886	729	21,157	24,506	5,408	19,099	772
2023/24	1,146	1,001	145	272	118	2,741	584	21,844	593	21,251	24,506	5,537	18,970	772
2024/25	1,157	1,005	152	442	120	2,661	450	21,807	459	21,348	24,507	5,495	19,011	772
2025/26	1,168	1,008	159	466	120	2,567	319	21,778	327	21,451	24,507	5,431	19,076	772
2026/27	3,874	1,062	2,812	3,291	121	2,351	190	24,403	198	24,205	27,606	5,692	21,914	772
2027/28	1,187	1,080	106	307	122	2,417	63	24,326	71	24,255	27,606	5,837	21,770	772
2028/29	1,204	1,082	122	192	61	2,674	0	24,324	8	24,316	27,606	6,097	21,509	772
2029/30	1,225	1,089	135	211	0	2,980	0	24,391	7	24,384	27,606	6,338	21,268	772
2030/31	1,247	1,096	151	12	0	3,493	0	24,465	7	24,458	27,606	6,778	20,828	772
2031/32	1,274	1,105	169	0	0	4,024	0	24,545	7	24,538	27,606	7,232	20,374	772
2032/33	1,299	1,115	184	0	0	4,558	0	24,628	7	24,621	27,606	7,685	19,921	772
2033/34	1,320	1,124	196	330	0	4,761	0	24,710	7	24,703	27,606	7,808	19,798	772
2034/35	1,344	1,133	211	15	0	5,288	0	24,801	7	24,794	27,606	8,247	19,359	772
2035/36	1,370	1,142	228	0	0	5,835	0	24,896	6	24,890	27,606	8,700	18,906	772
2036/37	1,395	1,152	244	0	0	6,385	0	24,993	6	24,987	27,606	9,154	18,452	772
2037/38	1,414	1,162	252	509	0	6,420	0	25,086	6	25,080	27,606	9,098	18,508	772
2038/39	1,437	1,172	266	15	0	6,962	0	25,192	6	25,186	27,606	9,537	18,069	772
2039/40	1,463	1,182	281	0	0	7,521	0	25,299	6	25,293	27,606	9,991	17,615	772
2040/41	1,490	1,191	299	0	0	8,084	0	25,410	6	25,404	27,606	10,446	17,160	772
2041/42	1,517	1,203	313	0	0	8,648	0	25,522	5	25,517	27,606	10,899	16,706	772
2042/43	1,542	1,214	328	0	0	9,212	0	25,635	5	25,630	27,606	11,353	16,252	772
2043/44	1,562	1,227	335	410	0	9,360	0	25,741	5	25,736	27,606	11,397	16,208	772
2044/45	1,587	1,239	349	0	0	9,927	0	25,857	5	25,852	27,606	11,851	15,755	772
2045/46	1,614	1,250	364	0	0	10,495	0	25,974	5	25,969	27,606	12,304	15,301	772
2046/47	1,641	1,262	380	0	0	11,065	0	26,094	5	26,089	27,605	12,757	14,848	772
2047/48	1,668	1,275	393	8	0	11,627	0	26,212	5	26,207	27,605	13,202	14,403	772
2048/49	1,695	1,286	409	0	0	12,198	0	26,333	5	26,328	27,605	13,655	13,950	772
2049/50	1,723	1,300	422	0	0	12,768	0	26,453	5	26,448	27,605	14,108	13,497	772
2050/51	1,722	1,314	408	1,895	0	11,416	0	26,546	4	26,542	27,605	12,667	14,938	772

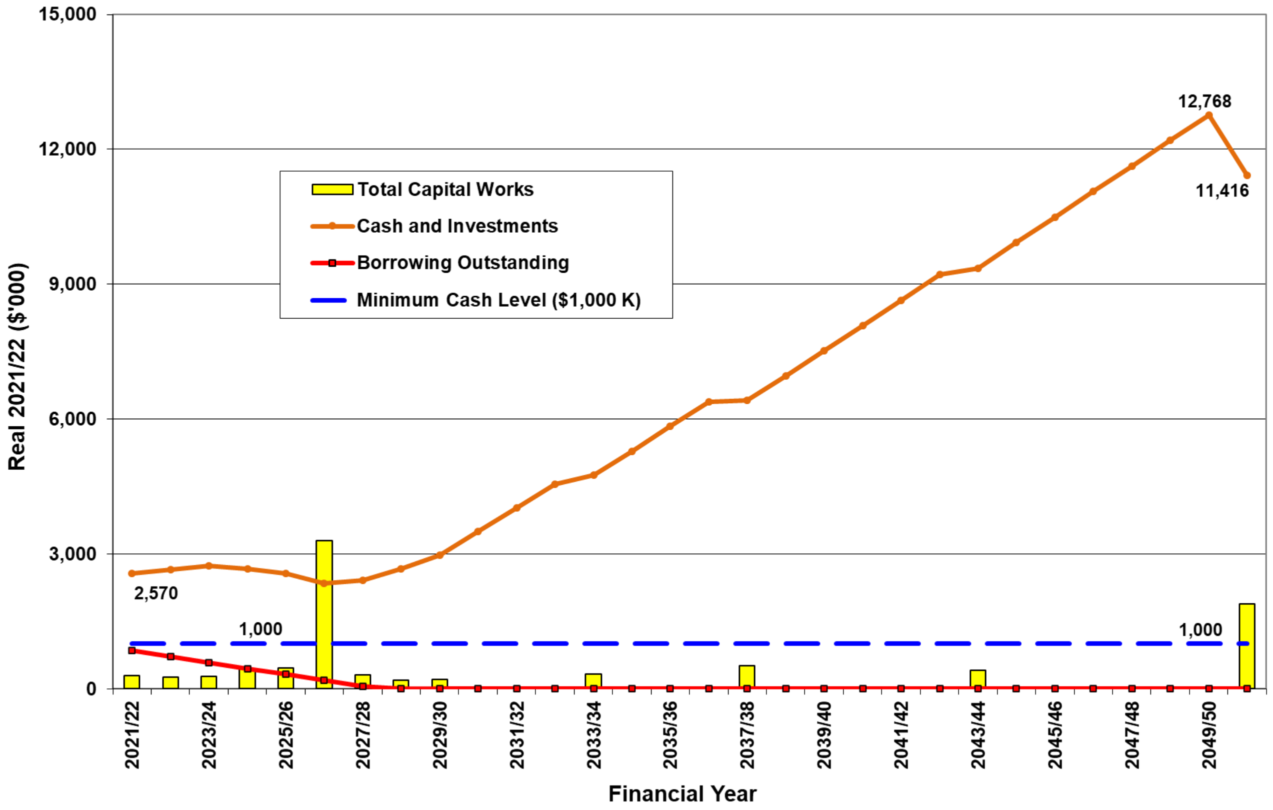

Figure 14.7: Cash & Borrowing Projections for Sewerage

14.2.1 Sensitivity Analysis – Sewerage

The sensitivity of model forecasts were analysed for an 'increase in planned capital works cost estimates' and a 'lower than adopted customer growth rate' scenarios. The analysis demonstrated that the forecast TRBs are robust enough to be not affected by the considered scenarios, as the impacts can be cushioned by the accrued cash levels and through minor levels of borrowing for planned capital works a new effluent reuse scheme. The Table below and the following Figures presents the sensitivity of model forecasts.

Table 14.7: Sensitivity Analysis of Sewer Fund Financial Model

Sensitivity	Values of Variables for Analysis	Effect on TRB compared to the Preferred Scenario
Higher capital work costs	20% increase in the cost of planned capital works	No impact on the TRB forecasts and are the same as for the adopted IWCM Strategy.
Lower customer growth rate	Customer growth rate at 50% of the adopted growth rate	

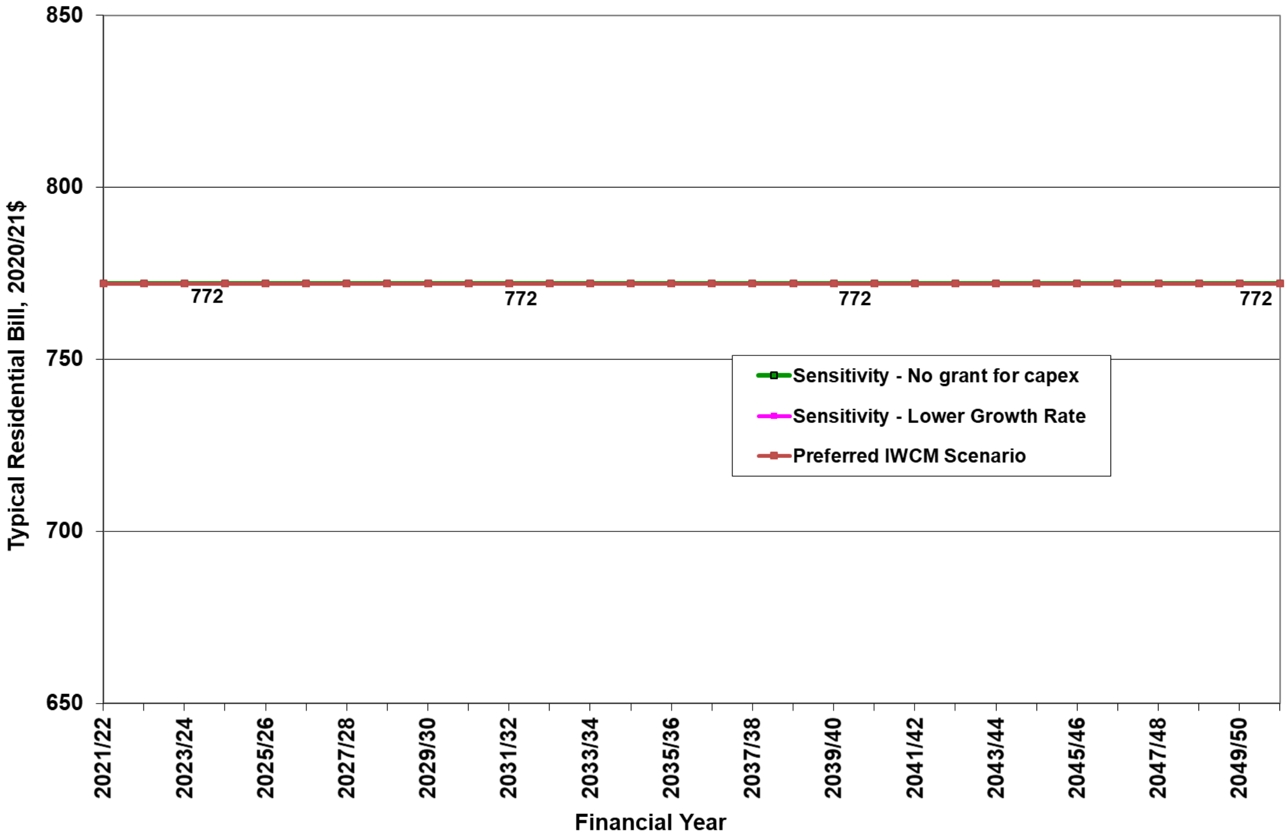

Figure 14.8: Sensitivity of Sewerage TRB

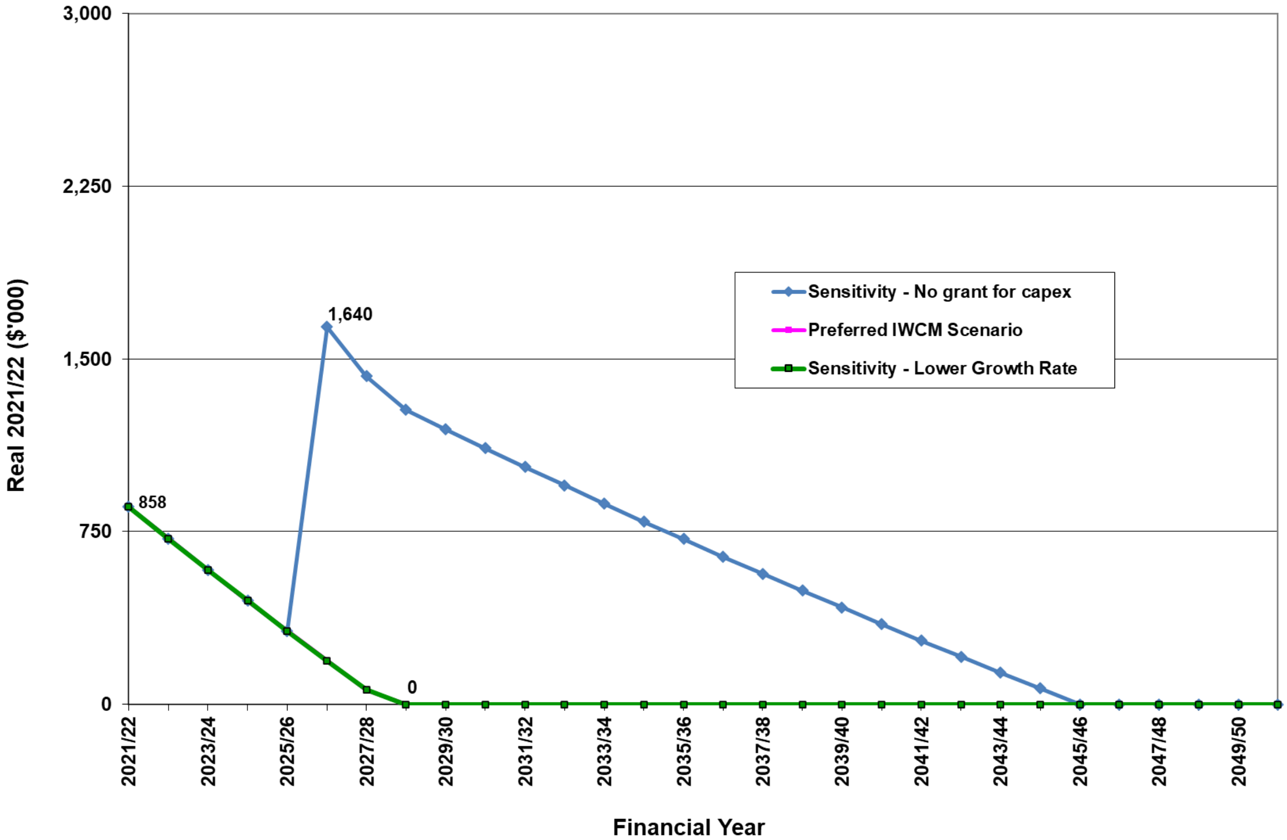

Figure 14.9: Sensitivity of Borrowing requirements - Sewerage

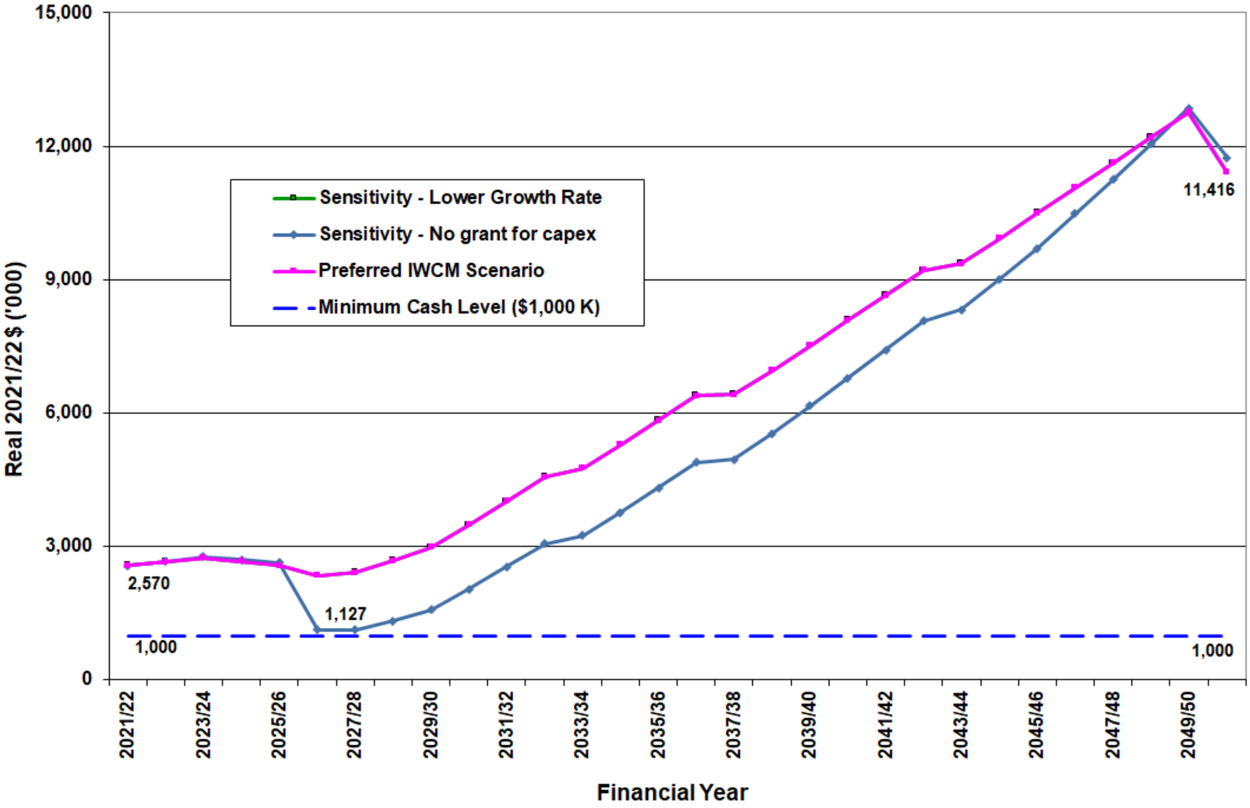

Figure 14.10: Sensitivity of Cash and Investments - Sewerage

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Appendix A Hay Water Treatment Plant – Performance Optimisation Report

Appendix B HBT Analysis – Murrumbidgee River raw water source

HBT Assessment Tool Reset Form

Question		Answer	Catchment characteristics		
Catchment Assessment					
1.1	Name of water supply	Hay Potable Water Supply	1.5	Average slope	0.2%
1.2	Name of water source	Murrumbidgee River	1.6	Average annual rainfall (mm)	374
1.3	Is this a primary or secondary source	Primary Source	1.7	Area NSW	Riverina
1.4	Is the water source groundwater or suface water	Surface Water	1.8	Soil drainage	Poorly drained
			1.9	Land use grazing (%)	75%
Surface Water Assessment					
2.1	Is extraction from a storage or dam?	No			
	Vulnerability Assessment Required?	Yes			

Vulnerability Assessment

Question	Answer - Inner Catchment	Answer - Outer Catchment	Inherent Risk Rating - Inner Catchment	Inherent Risk Rating - Outer Catchment
Definition:	1km radius upstream from surface intake (only land that slopes towards water body)	5km radius upstream from surface intake (only land that slopes towards water body)		
Urban Areas				
No of properties with OSSMS in catchment	5	16	Low	Low
Threats				
Are there STPs in catchment	No	No	Low	Low
Are there possibililties of sewer overflows in catchment	No	No	Low	Low
Are there biosolids reuse in catchment	No	No	Low	Low
Are there industrial WWTS in catchment	No	No	Low	Low
Are there landfill type facilities in catchment	No	No	Low	Low
Are there urban stormwater discharges in catchment	No	No	Low	Low
Effluent Reuse				
Any effluent reuse in catchment	No	No		
Stock animals				
Are there dairies, feedlots or other intensive farming operations in catchment	No	No	Low	Low
Are there free-roaming livestock within catchment	Yes	Yes		
Is number of calves and lambs in catchment known?	No	No	Average oocysts/Ha for Riverina will be used	Average oocysts/Ha for Riverina will be used
% of perennial waterways fenced off	<65%	<65%		
% of perennial waterways with riparian vegetation	>90%	>90%		
Weighted risk from livestock			Medium	Medium
Highest catchment rating	Medium			

Inherent Risk

Medium

Note: Extraction is from a surface water intake - requires catchment vulnerability assessment

Appendix Figure B-1: Murrumbidgee River raw water source for WTP water quality risk assessment - Inherent risk: Medium

Appendix C Extra analysis

C.1 Desktop meter audit results

Appendix Table C-1: List assessments that may have meter that is not read

In raw water billing data but not in potable water billing data	In potable water billing data but not in raw water billing data	Appear to have property, but not in raw water billing data	Appear to have property, but not in potable water billing data
1007549	1014839	1007840	1007840
1007531	1004999	1031750	1031750
1003927	1007743	1015403	1015403
1004622	1007769	1009729	1009729
1005115	1007793	1012667	1012667
1005369	1007858	1039067	1039067
1005505	1007890	1039059	1039059
1006250	1007947	1021137	1021137
1006307	1008278	1021496	1021496
1006535	1008406		1021909
1006975	1008414		1012251
1007133	1008422		
1007662	1008448		
1007727	1008456		
1007955	1010380		
1008074	1010398		
1008082	1010403		
1008105	1010411		
1008155	1010429		
1008252	1010526		
1008333	1012057		
1008341	1012617		
1008799	1021373		
1008919	1008286		
1009355	1007921		
1009559	1015322		
1011336			
1013299			
1013401			
1014261			
1014342			
1014554			
1014627			
1015437			
1015712			
1015746			
1015916			
1016271			
1016035			
1021276			
1009753			
1010869			
1036768			
1015429			
1007280			

Note: The assessments highlighted in green appear to have a property on them, but do not appear in either the potable water or the raw water billing data

C.2 Nutrient Balance for Effluent Reuse

The loading rates of phosphorus can limit the quantity of effluent to be used for irrigation in a given area. Within limits the phosphorus will be absorbed by plants or contained in the soil, but if the limits are exceeded the surplus will leach out in the environment.

The use of effluent for irrigating plants can affect the concentration of nutrient in the soil in two ways:

- the nutrient in the soil reduces over time – this can occur if the crop uses the nutrient and is removed (by harvesting) faster than the nutrient is applied
- the nutrient in the soil increases over time – this can occur if the crop uses the nutrient and is removed slower than the nutrient is applied, or if the crop is not harvested e.g. pasture is eaten by cattle but nutrients are returned to the soil by animal faeces.

To ensure a sustainable irrigation system, if the nutrient in the soil is increasing over time the application of the nutrient is stopped when the amount in the soil reaches a certain critical level.

The phosphorus (P) sorption capacity for soil types in South-west NSW, taken from the NSW Department of Environment and Conservation guidelines [15] for use of effluent for irrigation are given in Table 15-1.

Table 15-1: Phosphorus sorption capacity from

Location	Soil Parent material	Soil classification	Total P sorption capacity (kg/ha)	P sorption capacity (critical) (kg/ha)
South-west NSW	Alluvial sediments	Red-brown earth	6,070 – 6,830	2,000 – 2,300

The total phosphorus in applied effluent is calculated by multiplying the volume of effluent applied by the phosphorus concentration of the effluent.

The Phosphorus removed by crop is also obtained from the guidelines for use of effluent for irrigation. As Council uses the effluent to irrigate mostly grass grain crop type, an average value of the grass grain type was assumed, at 15 tonnes/ha/dry matter. The average phosphorus content of 0.3% was also assumed. Using this information, the Phosphorus removed by crop is 45 kg per hectare per year.

The STP Operations and Maintenance (O&M) manual states the required effluent discharge requirements, shown in Table 15-2.

Table 15-2: Effluent quality requirement for Hay STP

Parameter	90th percentile Concentration Limit (mg/L)
pH	6.5-8.5
Biochemical oxygen demand, BOD_5 (enclosed waters)	10
Total suspended solids (enclosed waters)	15
Ammonia	2
Total Nitrogen	10
Oil and grease	10

There is no requirement to record the concentration limit of phosphorus according to EPL 3520, therefore, the phosphorus concentration is assumed to be 8 mg/L for calculation. The effluent reuse modelling by PWA estimates that the phosphorus removed by crop is higher than the phosphorus applied through the reuse effluent for these towns. This indicates that the rate of phosphorus sorption exceeds the rate of phosphate applied to the soil, hence leaching of phosphorus is unlikely under these conditions.

Appendix D Projections by Year

D.1 Estimated water use of new areas at ultimate development

Appendix Table D-1: Hay Raw WSS new areas of development - Average year demand (ML/year)

New Area Zone Type	2021	2026	2031	2036	2041	2046	2051
RE1 Public Recreation	0	0	8	17	25	33	42
RU4 Primary Production Small Lots	0	0	13	27	40	54	67
RU5 Village	0	155	155	155	155	155	155
Total	0	155	177	199	221	243	264

Appendix Table D-2: Hay Potable WSS new areas of development - Average Year Demand (ML/year)

New Area	2021	2026	2031	2036	2041	2046	2051
IN1 General Industrial	0	0	27	53	80	107	133
SP2 Infrastructure	0	0	2	3	5	7	9
RU4 Primary Production Small Lots	0	0	5	11	16	21	27
RU5 Village	0	62	62	62	62	62	62
Total	0	62	95	129	163	196	230

Appendix Table D-3: Hay Raw WSS new areas of development – Unrestricted Future Demand (ML/year)

New Area Zone Type	2021	2026	2031	2036	2041	2046	2051
IN1 General Industrial	0	0	33	66	99	131	164
SP2 Infrastructure	0	0	2	4	6	8	11
RU4 Primary Production Small Lots	0	0	6	11	17	23	28
RU5 Village	0	65	65	65	65	65	65
Total	0	65	106	147	187	228	269

Appendix Table D-4: Hay Potable WSS new areas of development – Unrestricted Future Demand (ML/year)

New Area Zone Type	2021	2026	2031	2036	2041	2046	2051
RE1 Public Recreation	0	0	12	24	35	47	59
RU4 Primary Production Small Lots	0	0	19	38	57	76	95
RU5 Village	0	221	221	221	221	221	221
Total	0	221	252	282	313	344	375

D.2 Water Demand Projections by Year

Appendix Table D-5: Hay Raw WSS Water Demand Projections by User class– Average Year Demand (ML/year)

User Classes	2021	2026	2031	2036	2041	2046	2051
Residential	366	521	535	548	562	575	588
Commercial	39	39	39	39	39	39	39
Municipal	112	112	112	112	112	112	112
Rural	28	28	28	28	28	28	28
Parks and Gardens	56	56	65	73	82	90	98
Other Industrial	15	15	15	15	15	15	15
Total	616	771	793	815	837	859	880

Appendix Table D-6: Hay Raw WSS Water Demand Projections by Userclass– Unrestricted Future Demand (ML/year)

User Classes	2021	2026	2031	2036	2041	2046	2051
Residential	519	740	759	778	797	816	835
Commercial	52	52	52	52	52	52	52
Municipal	159	159	159	159	159	159	159
Rural	39	39	39	39	39	39	39
Parks and Gardens	81	81	93	105	116	128	140
Other Industrial	20	20	20	20	20	20	20
Total	871	1,092	1,123	1,153	1,184	1,215	1,246

Appendix Table D-7: Hay Raw WSS Water Demand Projections by Userclass– Peak Day Demand (ML/year)

User Classes	2021	2026	2031	2036	2041	2046	2051
Residential	3,429	4,886	5,012	5,138	5,264	5,389	5,515
Commercial	324	324	324	324	324	324	324
Municipal	1,100	1,100	1,100	1,100	1,100	1,100	1,100
Rural	258	258	258	258	258	258	258
Parks and Gardens	515	515	592	668	744	821	897
Other Industrial	125	125	125	125	125	125	125
Total	5,750	7,207	7,410	7,612	7,814	8,016	8,218

Appendix Table D-8: Hay Potable WSS Water Demand Projections by Userclass– Average Year Demand (ML/year)

User Classes	2021	2026	2031	2036	2041	2046	2051
Residential	145	206	212	217	222	228	233
Commercial	26	26	26	26	26	26	26
Municipal	28	28	28	28	28	28	28
Rural	0	0	0	0	0	0	0
Parks and Gardens	0	0	0	0	0	0	0
Other Industrial	0	0	28	57	85	114	142

User Classes	2021	2026	2031	2036	2041	2046	2051
Council Maintenance	30	30	30	30	30	30	30
Total	230	291	325	359	393	426	460

Appendix Table D-9: Hay Potable WSS Water Demand Projections by Userclass– Unrestricted Future Demand (ML/year)

User Classes	2021	2026	2031	2036	2041	2046	2051
Residential	154	220	225	231	236	242	248
Commercial	29	29	29	29	29	29	29
Municipal	34	34	34	34	34	34	34
Rural	0	0	0	0	0	0	0
Parks and Gardens	0	0	0	0	0	0	0
Other Industrial	0	0	35	70	105	140	175
Council Maintenance	30	30	30	30	30	30	30
Total	248	313	354	394	435	476	516

Appendix Table D-10: Hay Potable WSS Water Demand Projections by Userclass– Peak Day Demand (ML/year)

User Classes	2021	2026	2031	2036	2041	2046	2051
Residential	1,057	1,506	1,545	1,584	1,623	1,661	1,700
Commercial	197	197	197	197	197	197	197
Municipal	77	77	77	77	77	77	77
Rural	1	1	1	1	1	1	1
Parks and Gardens	0	0	0	0	0	0	0
Other Industrial	0	0	78	155	233	311	389
Council Maintenance	0	0	0	0	0	0	0
Total	1,332	1,782	1,898	2,015	2,131	2,248	2,364

D.3 Production Projections by Year

Appendix Table D-11: Hay Raw WSS Production Projections - Average Year Demands (ML/year)

Average Year Demands (ML/year)		2021	2026	2031	2036	2041	2046	2051
	Total Demands	616	771	793	815	837	859	880
Ultimate - baseline	Total Production	905	1,109	1,137	1,165	1,192	1,220	1,248
	Water Losses (ML/year)	289	337	343	349	355	361	367
	Water Losses % Production	32%	30%	30%	30%	30%	30%	29%
Ultimate - target	Total Production	905	908	934	959	985	1,011	1,036
	Water Losses (ML/year)	289	136	140	144	148	152	156
	Water Losses % Production	32%	15%	15%	15%	15%	15%	15%

Appendix Table D-12: Hay Raw WSS Production Projections – Unrestricted Future Demands (ML/year)

Unrestricted Future Demands (ML/year)		2021	2026	2031	2036	2041	2046	2051
	Total Demand	871	1,092	1,123	1,153	1,184	1,215	1,246
Ultimate - baseline	Total Production	1,269	1,555	1,594	1,633	1,673	1,712	1,751
	Water Losses (ML/year)	399	463	471	480	488	497	505
	Water Losses % Production	31%	30%	30%	29%	29%	29%	29%
Ultimate - target	Total Production	1,269	1,284	1,320	1,357	1,393	1,429	1,466
	Water Losses (ML/year)	399	193	198	204	209	214	220
	Water Losses % Production	31%	15%	15%	15%	15%	15%	15%

Appendix Table D-13: Hay Raw WSS Production Projections – Average Day Demands (kL/day)

Average Day Demands (kL/day)		2021	2026	2031	2036	2041	2046	2051
	Total Demand	1,686	2,112	2,172	2,231	2,291	2,351	2,410
Ultimate - baseline	Total Production	2,478	3,036	3,112	3,188	3,264	3,340	3,416
	Water Losses (ML/year)	792	923	939	956	973	989	1,006
	Water Losses % Production	32%	30%	30%	30%	30%	30%	29%
Ultimate - target	Total Production	2,478	2,486	2,556	2,627	2,697	2,767	2,838
	Water Losses (ML/year)	792	372	383	394	405	416	427
	Water Losses % Production	32%	15%	15%	15%	15%	15%	15%

Appendix Table D-14: Hay Raw WSS Production Projections – Peak Day Demands (kL/day)

Peak Day Demands (kL/day)		2021	2026	2031	2036	2041	2046	2051
	Total Demand	5,750	7,207	7,410	7,612	7,814	8,016	8,218
Ultimate - baseline	Total Production	8,700	10,905	11,211	11,517	11,823	12,129	12,435
	Water Losses (ML/year)	2,950	3,698	3,801	3,905	4,009	4,113	4,216
	Water Losses % Production	34%	34%	34%	34%	34%	34%	34%
Ultimate - target	Total Production	8,700	8,485	8,723	8,961	9,199	9,437	9,675
	Water Losses (ML/year)	2,950	1,278	1,314	1,350	1,386	1,421	1,457
	Water Losses % Production	34%	15%	15%	15%	15%	15%	15%

Appendix Table D-15: Hay Potable WSS Production Projections - Average Year Demands (ML/year)

Average Year Demands (ML/year)		2021	2026	2031	2036	2041	2046	2051
	Total Demand	230	291	325	359	393	426	460
Ultimate - baseline	Total Production	359	451	499	547	594	642	690
	Water Losses (ML/year)	129	160	174	188	202	216	230
	Water Losses % Production	36%	35%	35%	34%	34%	34%	33%
Ultimate - target	Total Production	359	337	374	412	449	487	525
	Water Losses (ML/year)	129	45	49	53	57	61	65
	Water Losses % Production	36%	13%	13%	13%	13%	12%	12%

Appendix Table D-16: Hay Potable WSS Production Projections – Unrestricted Future Demands (ML/year)

Unrestricted Future Demands (ML/year)		2021	2026	2031	2036	2041	2046	2051
	Total Demand	248	313	354	394	435	476	516
Ultimate - baseline	Total Production	372	468	522	576	630	685	739
	Water Losses (ML/year)	124	154	168	182	195	209	222
	Water Losses % Production	33%	33%	32%	32%	31%	30%	30%
Ultimate - target	Total Production	372	359	404	448	493	538	582
	Water Losses (ML/year)	124	46	50	54	58	62	66
	Water Losses % Production	33%	13%	12%	12%	12%	11%	11%

Appendix Table D-17: Hay Potable WSS Production Projections – Average Day Demands (kL/day)

Average Day Demands (kL/day)		2021	2026	2031	2036	2041	2046	2051
	Total Demand	629	798	890	982	1,075	1,167	1,259
Ultimate - baseline	Total Production	982	1,235	1,366	1,497	1,627	1,758	1,889
	Water Losses (ML/year)	352	438	476	514	552	590	629
	Water Losses % Production	36%	35%	35%	34%	34%	34%	33%
Ultimate - target	Total Production	982	922	1,025	1,128	1,231	1,333	1,436
	Water Losses (ML/year)	352	124	135	145	156	166	177
	Water Losses % Production	36%	13%	13%	13%	13%	12%	12%

Appendix Table D-18: Hay Potable WSS Production Projections – Peak Day Demands (kL/day)

Peak Day Demands (kL/day)		2021	2026	2031	2036	2041	2046	2051
	Total Demand	1,332	1,782	1,898	2,015	2,131	2,248	2,364
Ultimate - baseline	Total Production	1,600	2,109	2,247	2,385	2,523	2,661	2,799
	Water Losses (ML/year)	268	327	349	370	392	413	435
	Water Losses % Production	17%	16%	16%	16%	16%	16%	16%
Ultimate - target	Total Production	1,600	1,890	2,014	2,137	2,261	2,385	2,508
	Water Losses (ML/year)	268	108	116	123	130	137	144
	Water Losses % Production	17%	6%	6%	6%	6%	6%	6%

Appendix E Hay Alternate Water Source Report by Golder

Hydrogeological desktop study to assess the feasibility of a new bore field within the Lower Murrumbidgee Alluvial Water Source

Appendix F Hydraulic model – Hay Raw WSS

A hydraulic model was developed by PWA in late 2015 using InfoWorks WS software using data provided by Council. For this analysis, the 2015 model has been migrated from InfoWorks WS to InfoWorks WS PRO. All the original pipe networks, ground elevation, pump data and operational controls will remain the same, only customer peak day demand values and demand pattern have been updated as a part of the IWCM supplementary study.

F.1 Description of system

F.1.1 Infrastructure components

The raw water system consists of an intake pump station near Leonard Street, that draws water from the Murrumbidgee River, three reservoirs and a reticulation network. There are two pumps at the Leonard Street pump station which pumps water to the reticulation and all three reservoirs.

The main infrastructure components of the current system are as follows:

1. Pump stations
    a. Leonard Street PS (duty/ standby)
    b. Lang St (de-commissioned)
2. Reservoirs
    a. 2.3 ML reservoir on Leonard St
    b. 5.9 ML reservoir on Pine St
    c. 1.0 ML reservoir on Lang St
3. Raw water pipelines (65.6 km in total):

Pipelines

Pipeline alignments, connection, material, and nominal diameters were adopted from the 2015 Hydraulic Model. The existing pipelines in the model totalled 65.6km in length, and had the following diameters:

- DN300 2.5 km
- DN250/225 2.9 km
- DN200 2.1 km
- DN150 9.3 km
- DN100 29.7 km
- Less than DN100 19.1 km

Pipe roughness values for the pipes in the existing model were as follows:

- PVC 0.15mm
- PE 0.06mm
- DICL 0.30mm
- AC 0.30mm

Pipe roughness values for all new pipelines have been established based on Australian Standard *AS2200-2006 (Design Charts for Water Supply and Sewerage)*.

Reservoirs

All three reservoirs in the Raw WSS are connected to the reticulation. Their capacities, top water level and floor levels are given in Appendix Table F.1-1.

Appendix Table F.1-1: Hay raw water reservoirs

Name	Capacity (ML)	TWL (m)	BWL (m)
Leonard St Reservoir	2.3	113.80	90.80

Name	Capacity (ML)	TWL (m)	BWL (m)
Pine St Reservoir	5.9	115.05	90.67
Lang St Reservoir (Hay South)	1.0	115.80	90.91

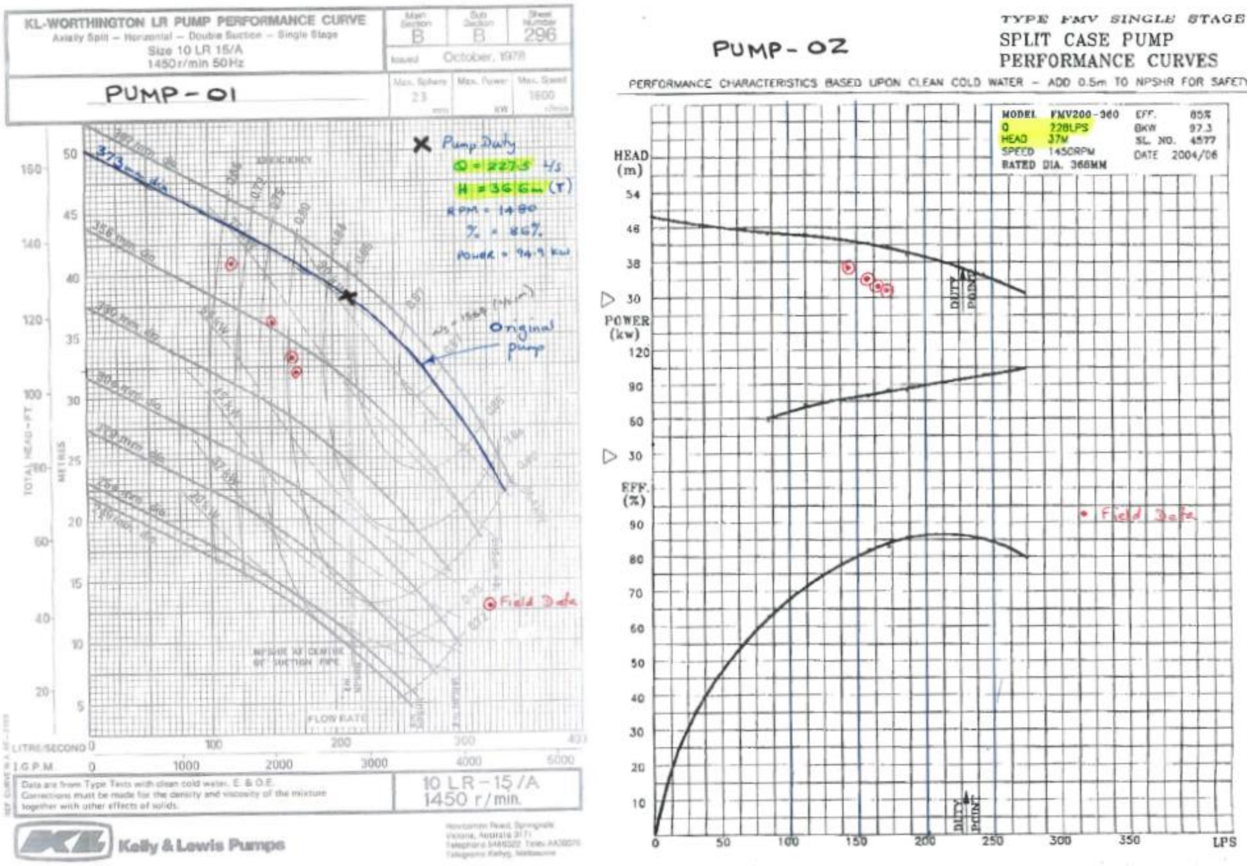
Pumps

The pumps in the Raw WSS are given in Appendix Table F.1-2.

Appendix Table F.1-2: Hay raw water pump duty points

Pump	Make & model	Pump duty	Nominal speed (rpm)
Leonard St – Pump 1	Worthington 10 LR 15/A	227.5 L/s @ 36.6 m	1,450
Leonard St – Pump 2	Indian FMV200-360	228 L/s @ 37 m	1,500
Lang St	Decommissioned		

Pump curves are provided in Appendix Figure F.1-1.



Appendix Figure F.1-1: Raw WSS Model – Pump curves for Leonard St Raw Water PS Pump 1 (left) and Pump 2 (right)

F.1.2 Operational controls

Pumps

The system has been designed for unattended operation, responding to water level signals from the reservoirs.

The Leonard St Pump start signal is provided via the telemetry. When the pressure switch at the Pine Street reservoir detects low reservoir level, a start command is generated and sent to the Leonard Street pumps to start pumping. Currently, the model specifies the Leonard Street pumps to switch on when the reservoir drops to 21.8 m (90%) and stops when the reservoir reaches 22.7 m (93%).

F.1.3 Customer points

Customer locations – current customers

Current customers were located using the cadastre file from the 2015 hydraulic model provided by Council. In Infoworks, each lot was given a customer point at its centroid and assigned to the closest pipeline.

Each customer point had an assessment number attribute, which matched the assessment numbers in the historical customer water billing data. There were nine assessments in the hydraulic model cadastre that did not have a match in the billing data. Conversely, there were 45 assessments in the billing data that were not found in the hydraulic model cadastre, likely to be assessments that did not existing when the 2015 model was built. These 45 assessments were located manually.

Customer locations – future customers

As described in Report Section 5.2, Council have identified several development areas in and surrounding Hay township where future growth is expected to occur. Each of these new areas was added to the model as a customer point in the centroid of the lot.

Customer demands

Each customer point was assigned a peak day demand and water losses, so that the total of all customers added up to the total peak day production at the WTP.

The current and future customer demands allocated to the customer points are described in Appendix F.3.1 and F.4.1 respectively.

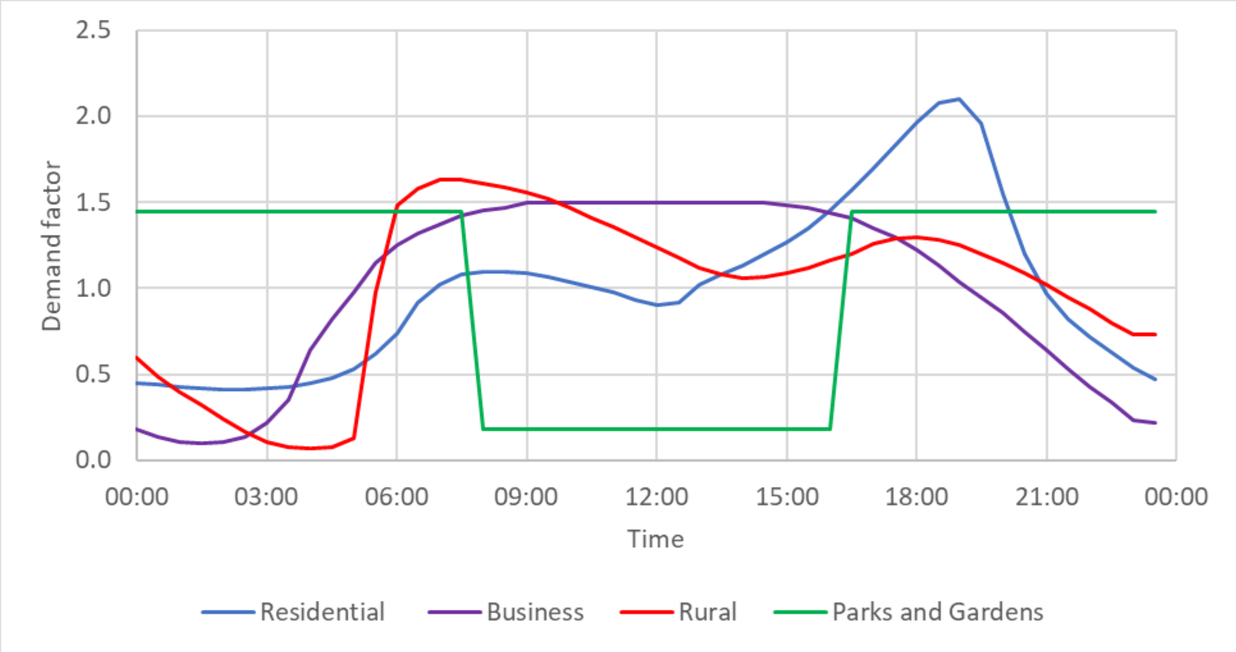
Customer demand pattern

Each customer point in the model was assigned the customer category in the water billing data for its assessment number. Demand patterns were assigned to each customer point based on their customer category.

Customers with customer categories of “commercial”, “municipal – excl parks and gardens” and “other industrial” were all given the business demand pattern.

The daily demand patterns for consumers are generally determined by analysing their individual water usage pattern, own storage, and pump capacities etc. In the absence of specific individual data, typical patterns from previous PWA projects were used.

The demand patterns are shown in Appendix Figure F.1-2.



Appendix Figure F.1-2: Customer demand patterns used in hydraulic modelling

Persistence pattern

The persistence pattern for the seven-day analysis has been established based on the results of the peak day analysis of the WTP production data in Section 6.1.2. The persistence factors used in the hydraulic model, taken from the peak week, is given in Appendix Table F.1-3

Appendix Table F.1-3: Raw WSS Model – Persistence pattern

Days before/after peak day	-3	-2	-1	Peak day	+1	+2	+3
% of Peak Day Demand	83%	77%	70%	100%	90%	71%	87%

F.2 Model calibration

The calibration for the Hay Raw WSS model could not be completed. Council's current telemetry system is not set up to monitor data at time intervals shorter than daily.

F.3 Modelling current demands

The model simulations for the Hay **current** raw water peak day production of 8.7 ML/day were performed for both the 24-hours period and 7-day persistence starting at 05:00 assuming all reservoirs are full at the start of each simulation. The results have been compared against the agreed levels of service and system deficiencies have been identified accordingly.

F.3.1 Current customer demands

A peak day demand for every individual assessment was estimated by dividing the estimated current peak day demands for each customer category (see Table 6-2) across all assessments with the same user category, proportional to their historical demand.

The peak day demands for each assessment were allocated to the customer point in InfoWorks which shared the same assessment number. Some customer points shared the same assessment number, in which case the demand was split equally across points.

The current peak day water losses (**2.95 ML**) were calculated as the difference between the peak day production (**8.70 ML** from Table 6-1) and the peak day demand (**5.75 ML** from Table 6-2). The peak day water losses were split evenly across all customer points.

A summary of the current demands and losses assigned to each customer point in the hydraulic model is shown in Appendix Table F.3-1.

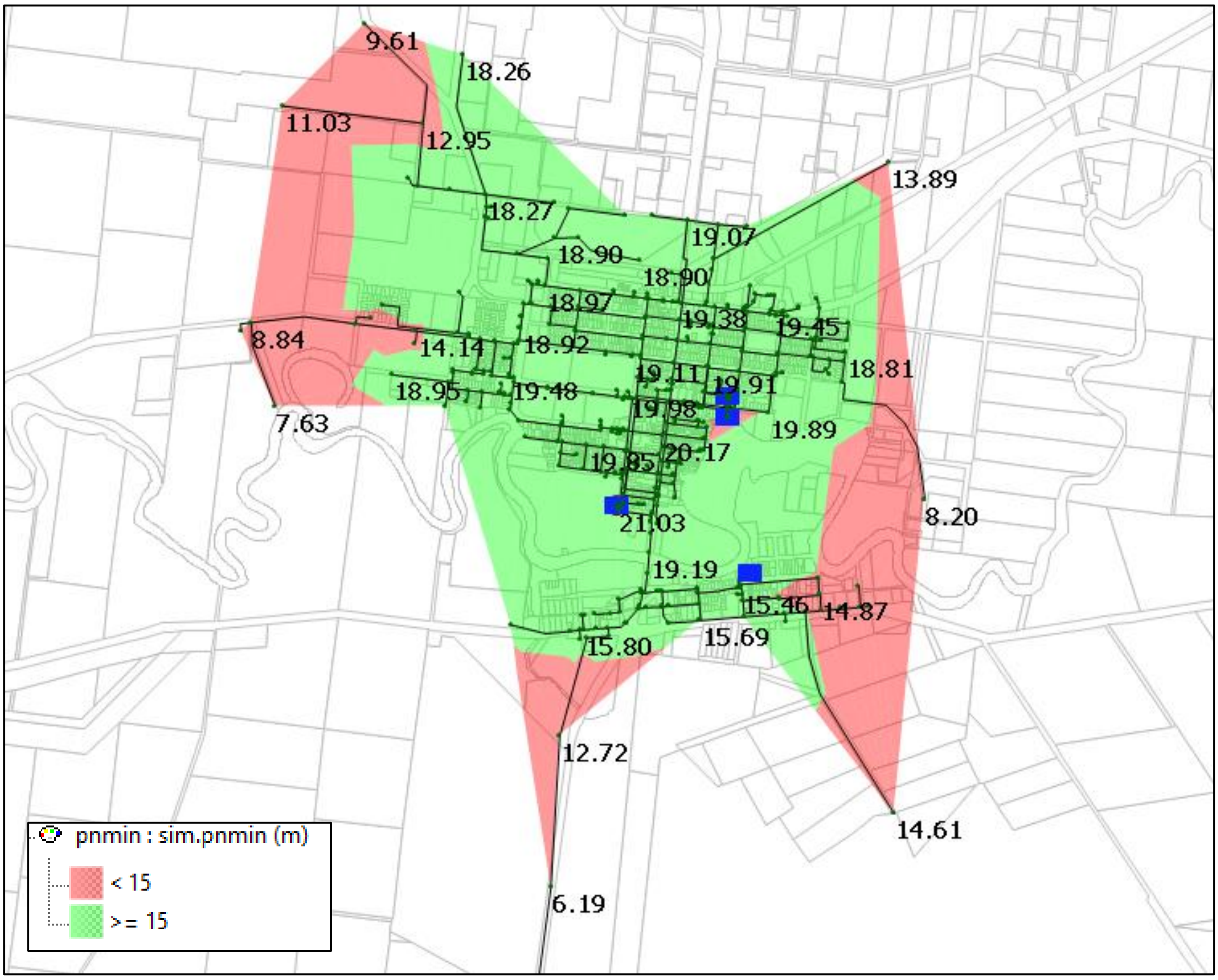
Appendix Table F.3-1: Raw WSS Model – Allocated peak day demands and water losses for each point in the hydraulic model

Customer category	Number of meters from billing data 2020	Number of customer points	Allocated peak day demands (kL/day)			
			Demands	Water Losses	Total	Average demand per point
Residential	1,109	1,114	3,429	2,514	**5,943**	5.3
Commercial	131	119	324	269	**592**	5.0
Municipal – excl Parks and Gardens	50	28	1,100	63	**1,163**	41.5
Rural	44	42	258	97	**355**	8.4
Parks and Gardens	70	32	515	2	**518**	16.2
Other Industrial	2	2	125	5	**129**	64.7
Total	**1,406**	**1,337**	**5,750**	**2,950**	**8,700**	**6.5**

F.3.2 Results of modelling current demands

Minimum pressure

The current desirable minimum pressure in the raw water reticulation as discussed with Council is 15 m. A contour plot for the minimum pressures has been provided in Appendix Figure F.3-1.



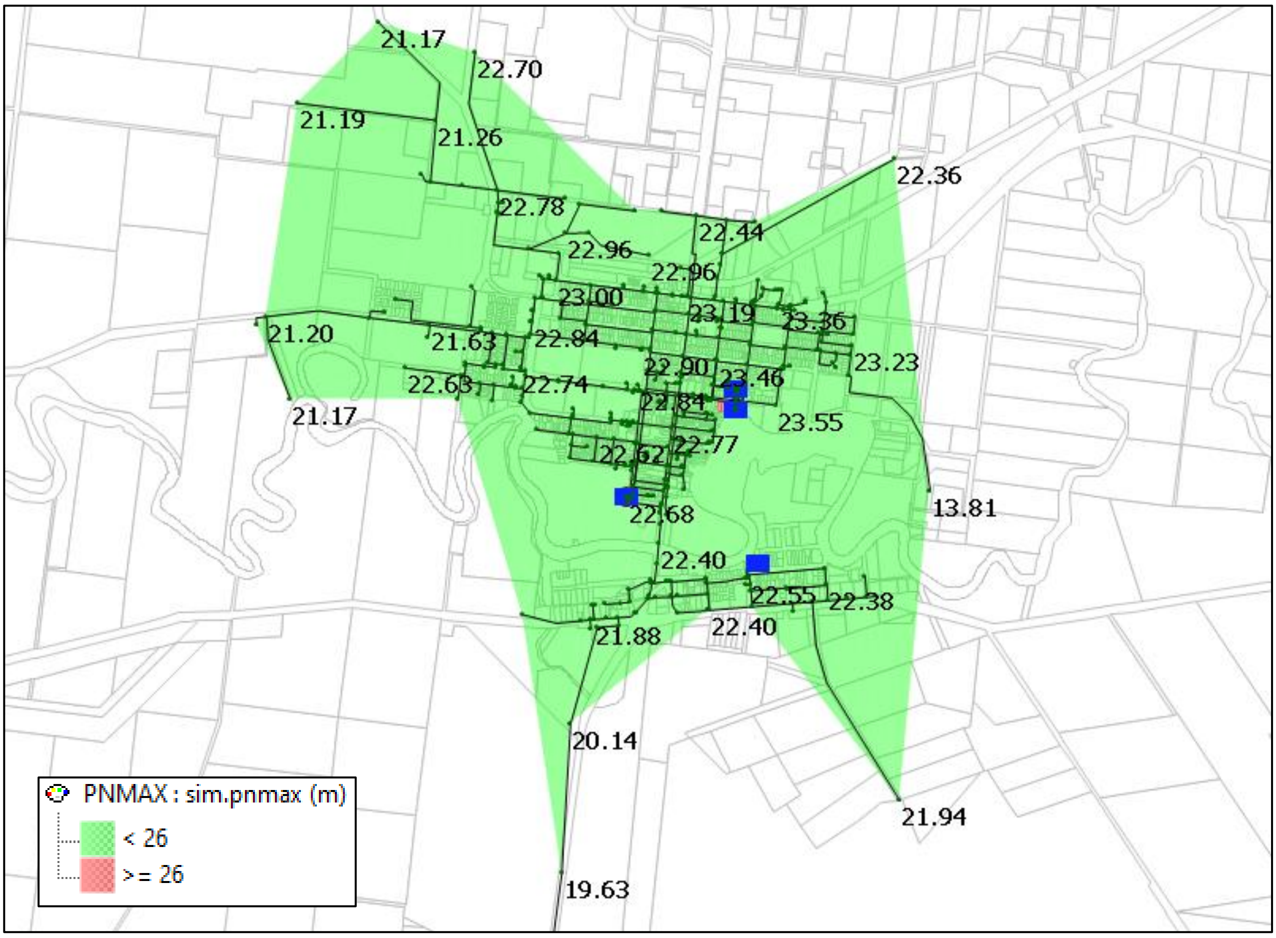
Appendix Figure F.3-1: Raw WSS model - minimum pressure at current peak day demands

Several areas on the surrounding areas of the Hay Raw WSS will have insufficient pressures. The main reason for the lower pressures occurring in the areas shown above are due to high friction losses in the pipelines. These pipelines are generally small in diameter ranging from DN25 to DN100. The lowest minimum pressure was around 6m.

These low-pressure issues have been considered in the augmentation options determined for the future augmentations.

Maximum pressure

The current maximum service pressure in the reticulation as discussed with Council is 26 m. A contour plot for maximum pressures has been provided in Appendix Figure F.3-2.



Appendix Figure F.3-2: Raw WSS model - maximum pressure at current peak day demands

No maximum pressure issues were identified in the Raw WSS.

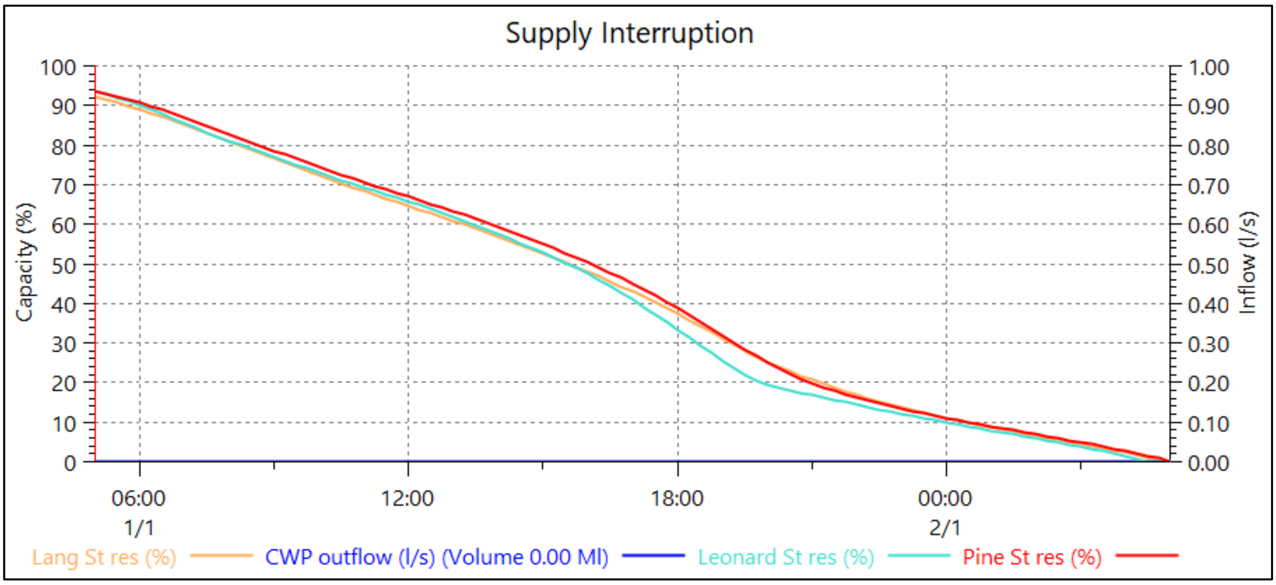
Supply reliability – interruption to customers

The supply reliability assessment provides insight on the ability of the system to maintain minimum level of service for supply in the event of an interruption and the necessary response time for Council personnel. An interruption may be due to an emergency trunk main shutdown, possible reasons of an emergency shut down include:

- mains break
- power supply failure
- mechanical failure
- flushing
- operational maintenance

For modelling purposes, raw water supply from the Leonard St PS is cut off from the start of peak day simulation (05:00).

The effect of the supply interruption scenario on the raw water reservoir levels is given in Appendix Figure F.3-3.



Appendix Figure F.3-3: Raw WSS model - Reservoir drawdown caused by supply interruption

The figure above indicates that throughout the peak day, a supply interruption all three reservoirs is expected to have sufficient capacity to meet the levels of service to supply water for 8 hours.

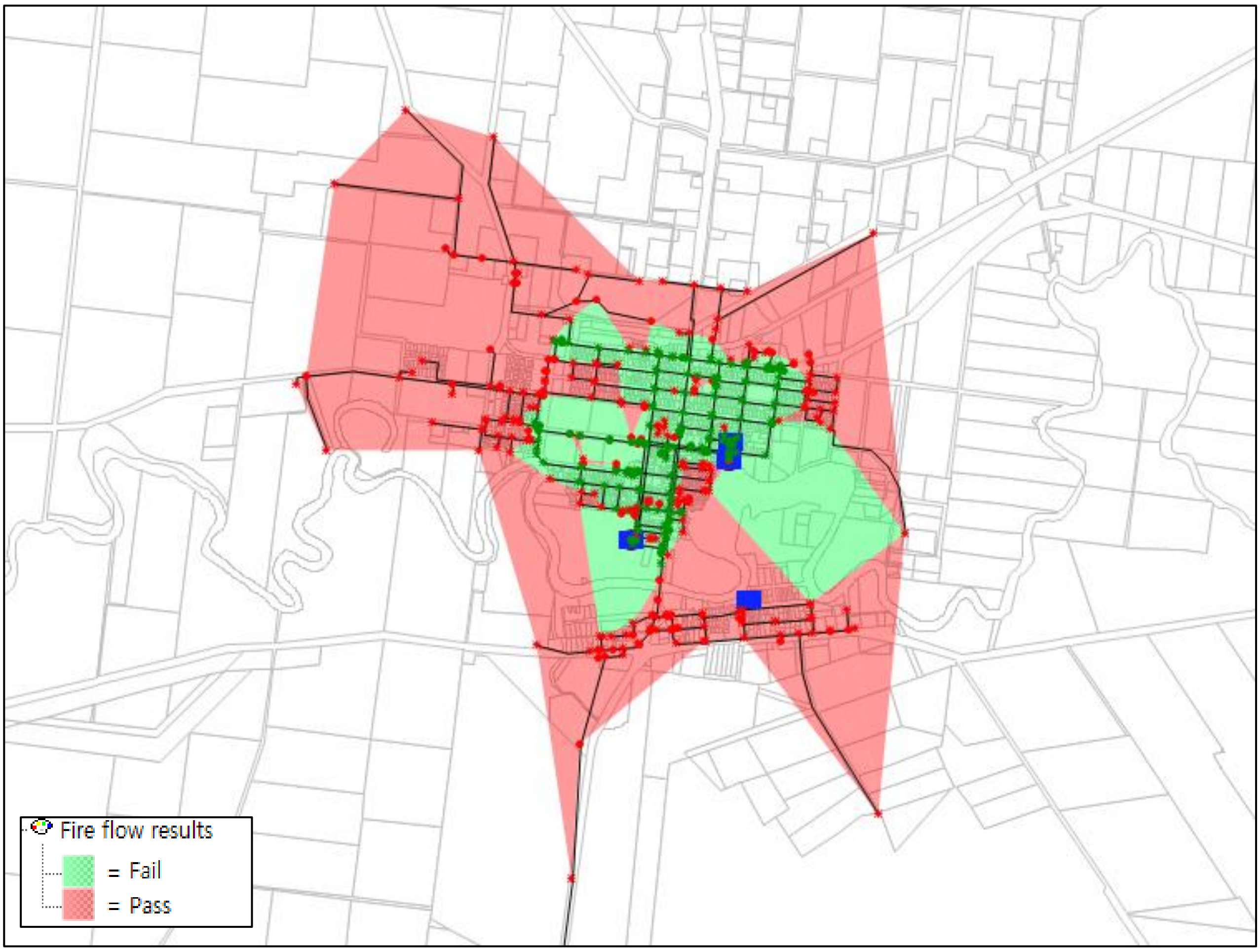
Fire flows

Fire hydrants are required to provide the LOS for fire flows; which is a minimum fire flow of 10 L/s can be supplied, with a residual pressure of 15m [16].

InfoWorks WS Pro treats every point in the system as having a hydrant attached. It then checks the ability of each point in turn to meet the defined fire flow requirements. Each point is considered independently, as if no other hydrant in the system is open. Results are calculated based on nodal pressures and hydrant characteristics specified (i.e. 65 mm hydrant, 10 L/s flow and 15 m minimum pressure) using the orifice equation.

Firefighting capabilities were assessed for current peak day demands on the existing system.

The points which can maintain a residual pressure of 15 m or more while providing a fire flow of 10 L/s at the peak time in a peak day are considered meeting fire-fighting LOS. The points meeting fire flow requirements are shown in Appendix Figure F.3-4.



Appendix Figure F.3-4: Raw WSS Model - Fire flow test results

For areas where unassisted pressures or flows fall below the LOS, a fixed on-site pump and/or tank shall be considered.

In the existing system there are a number of many small diameter pipelines (19.1km of pipelines less than DN100). These sections of pipeline will cause high pressure losses and restrict fire flows (10 L/s).

It should be noted that according to clause 3.1.5 of the WSA Code (WSA-03, 2011), water supply systems need not be designed for firefighting unless required by a Water Agency's operating licence.

F.4 Modelling future demands

The model simulations for the Hay **future** raw water peak day production of 9.7 ML/day were performed for both the 24-hours period and 7-day persistence starting at 05:00 assuming all reservoirs are full at the start of each simulation. The results have been compared against the agreed levels of service and system deficiencies have been identified accordingly.

F.4.1 Future customer demands

The future peak day demands for **existing** customer points was kept the same as the current peak day demands.

The future customer points were allocated a future peak day demand calculated for each new development zone, explained in Report Section 6.4.

The future peak day water losses (**1.45 ML** from Table 6-13) were the water losses estimated for the target water losses projections. The number of equivalent connections for each future customer point was calculated by dividing its future peak day demand by the average residential demand per connection. The peak day water losses were then split evenly across all customer points or equivalent connection for the future customers.

A summary of the current demands and losses assigned to each customer point in the hydraulic model is shown in Appendix Table F.4-1.

Appendix Table F.4-1: Raw WSS Model – Allocated peak day demands and water losses for each point in the hydraulic model (future customer points shown in italics)

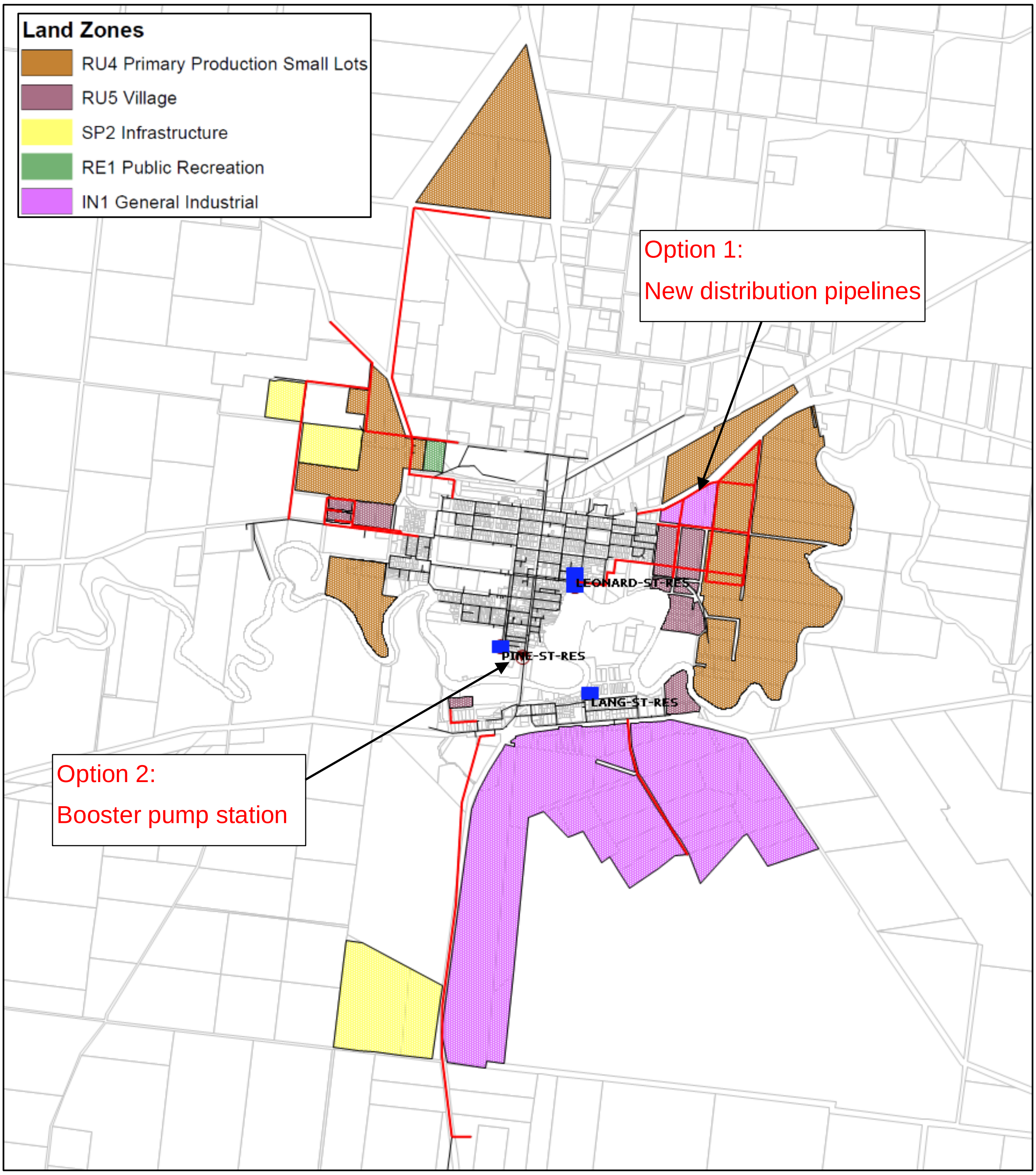
Customer category		Allocated peak day demands (kL/day)		
		Demands	Water Losses	Total
Residential	Existing customers	3,429	780	4,209
	RU4 Primary Production Small Lots - 1	136	30	167
	RU4 Primary Production Small Lots - 2	85	19	104
	RU4 Primary Production Small Lots - 3	41	9	51
	RU4 Primary Production Small Lots - 4	366	82	447
	RU5 Village - 1	322	72	394
	RU5 Village - 2	53	12	65
	RU5 Village - 3	221	49	270
	RU5 Village - 4	860	192	1,052
	All Residential	**5,514**	**1,245**	**6,759**
Commercial	**Existing customers**	**324**	**83**	**407**
Municipal – excl Parks and Gardens	**Existing customers**	**1,100**	**20**	**1,120**
Rural	**Existing customers**	**258**	**30**	**288**
Parks and Gardens	Existing customers	515	1	516
	RE1 Public Recreation - 1	381	70	451
	All Parks and Gardens	**897**	**71**	**967**
Other Industrial	**Existing customers**	**125**	**1**	**126**
Total	Total existing	5,750	915	6,665
	Total new zones	2,467	534	3,001
	All Customers	**8,217**	**1,450**	**9,666**

F.4.2 Supply to future development zones

Two options were considered as a part of this study:

- Option 1: Extend existing network and upgrades to existing pipelines
- Option 2: Pipeline upgrades and booster PS

The upgrades and proposed development zone locations are shown in Appendix Figure F.4-1.



Appendix Figure F.4-1: Raw WSS Model - proposed infrastructure upgrades to supply future development

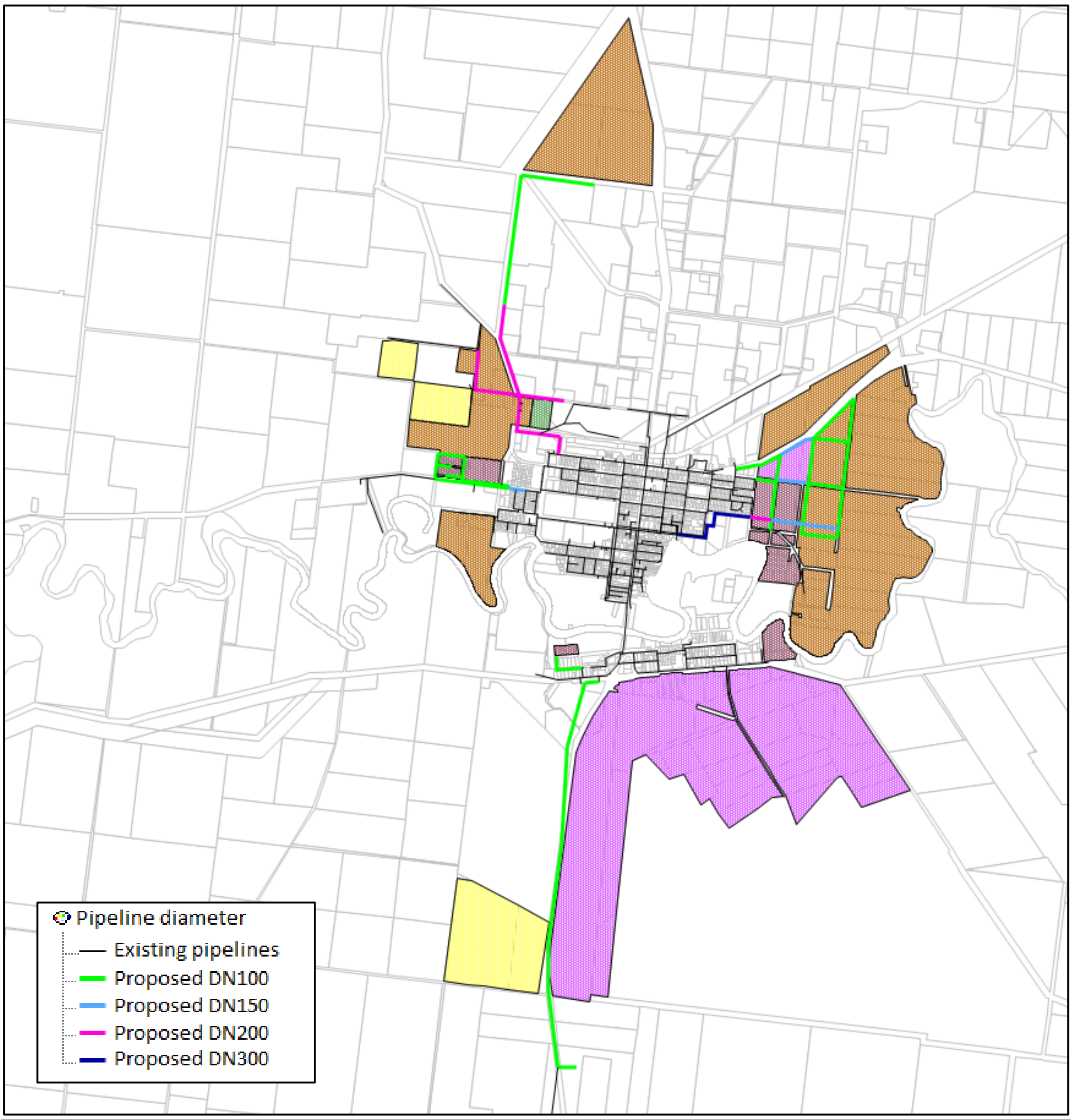
F.4.3 Raw WSS Upgrade Option 1

The proposed upgrades for Option 1 consist of pipelines that are required to service the future development zones with additional upgrades to improve flowrates and reduce head losses in the Raw WSS. These pipelines are an approximation for costs associated with servicing the respective development zones, detailed street level pipeline alignments were not considered as a part of this study.

All proposed pipelines and existing pipeline upgrades are uPVC, the size and lengths given below:

- Proposed pipelines for future development
  - DN100: 9,206 m
  - DN150: 1,442 m
  - DN200: 222 m
  - DN300: 1,002 m
- Upgraded existing pipelines
  - DN100 5,853 m
  - DN150 206 m
  - DN200 3,377 m

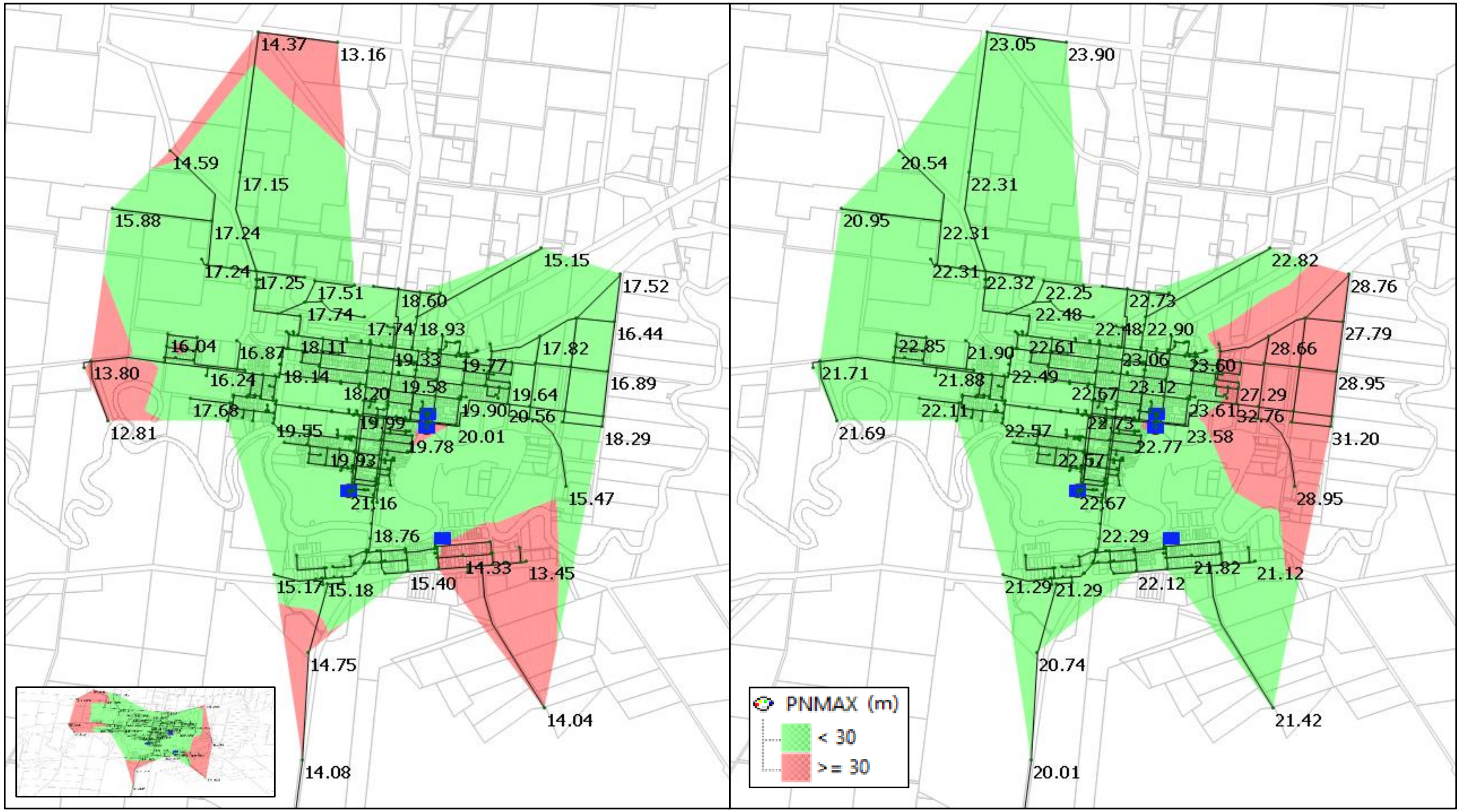
Option 1 proposed pipeline alignments is given in Appendix Figure F.4-2.



Appendix Figure F.4-2: Raw WSS – Upgrade Option 1 new pipelines

Minimum and maximum pressures

The minimum and maximum pressure contour figures are given in Appendix Figure F.4-3.



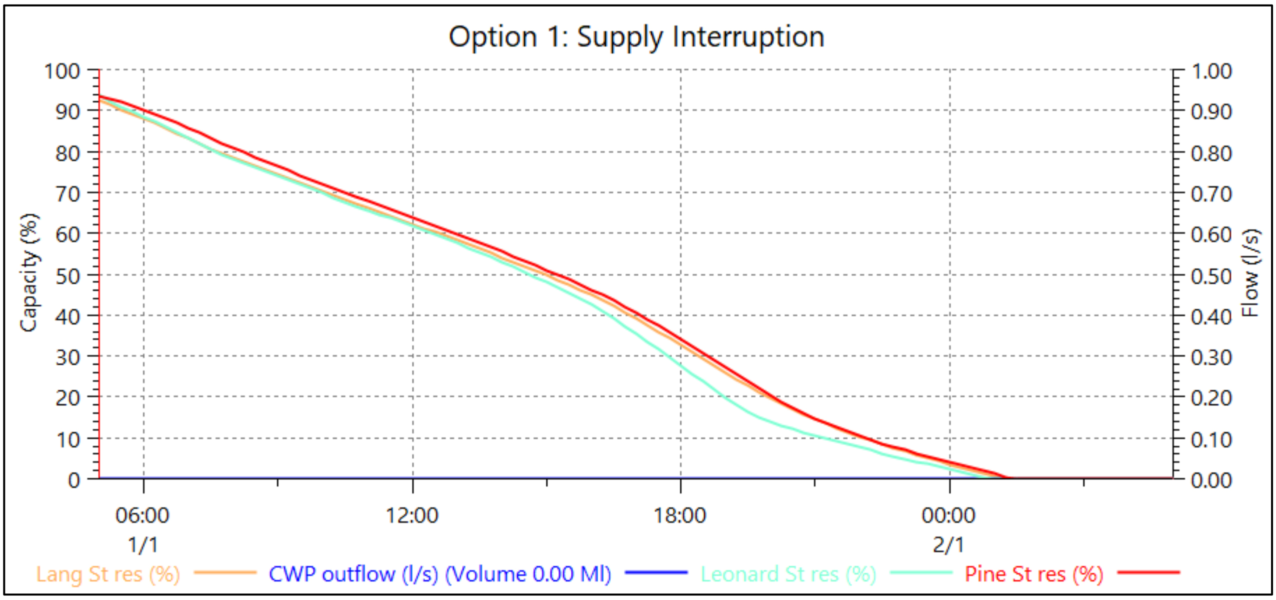
Appendix Figure F.4-3: Raw WSS Upgrade Option 1 - Pressure contours (L: minimum pressure and R: maximum pressure)

The proposed upgrades for Option 1 will provide future development zones access to raw water. The replacement of smaller diameter pipelines will increase flow rates and decrease head loss. The proposed pipelines were restricted to smaller sizes to meet optimal velocities (0.8 – 1.4 m/s, WSA03), therefore restricting availability of pressure in some areas of the town. The lowest and highest pressure identified in this study are 12.8 m and 31.2 m respectively.

Supply reliability – interruption to customers

For Option 1 supply reliability assessment, the same modelling parameters were used as the existing system reliability assessment, refer to Appendix F.3.1.

The effect of the supply interruption scenario on the raw water reservoir levels is given in Appendix Figure F.4-4..



Appendix Figure F.4-4: Raw WSS Upgrade Option 1 – Reservoir drawdown caused by supply interruption

Due to the increased demands from future development zones, the model results have found that all three raw water reservoirs will empty drawdown at equal rates and empty approximately after 20.5 hrs from the start of peak day simulation. During this supply interruption scenario, the raw water reservoirs are expected to have sufficient capacity to meet the levels of service to supply water for 8 hours during a supply interruption.

Fire flows

Fire flows for Option 1 of the raw water upgrades was not assessed due to the system being unable to deliver minimum service requirements as per the LOS.

Preliminary capital costs

The preliminary estimated capital cost for the proposed upgrades in option 1 is $4.6 million as given below.

Appendix Table F.4-2: Raw WSS Upgrade Option 1 - Preliminary capital cost

ITEM	DESCRIPTION	[UNIT]	[QTY]	[RATE]	AMT
				$ / Unit	$K
Reticulation pipelines					
	Pipeline replacement/ upgrade				
	100	m	5853	104.09	$ 609,217
	150	m	206	153.39	$ 31,630
	200	m	3377	208.17	$ 703,067
	New pipelines to service development zones				
	100	m	9206	104.09	$ 958,172
	150	m	1442	153.39	$ 221,121
	200	m	222	208.17	$ 46,224
	300	m	1002	350.60	$ 351,167
	Upgrade of existing pipelines				
	Connections to existing pipelines	Nos	8	4930.35	$ 39,443
Extras					
	misc valves (air valves, scour valves, NRV)	item	25	$ 500	$ 12,500
Prime Costs					**$2,972,541**
	General Contingency	% of Prime Cost	30%		$891,762
Direct Costs					**$3,864,303**
	Design & Preconstruction Activities	% of Direct Cost	10%		$386,430
	Construction Activities	% of Direct Cost	10%		$386,430
TOTAL CAPITAL COST					**$4,637,164**

F.4.4 Raw WSS Upgrade Option 2

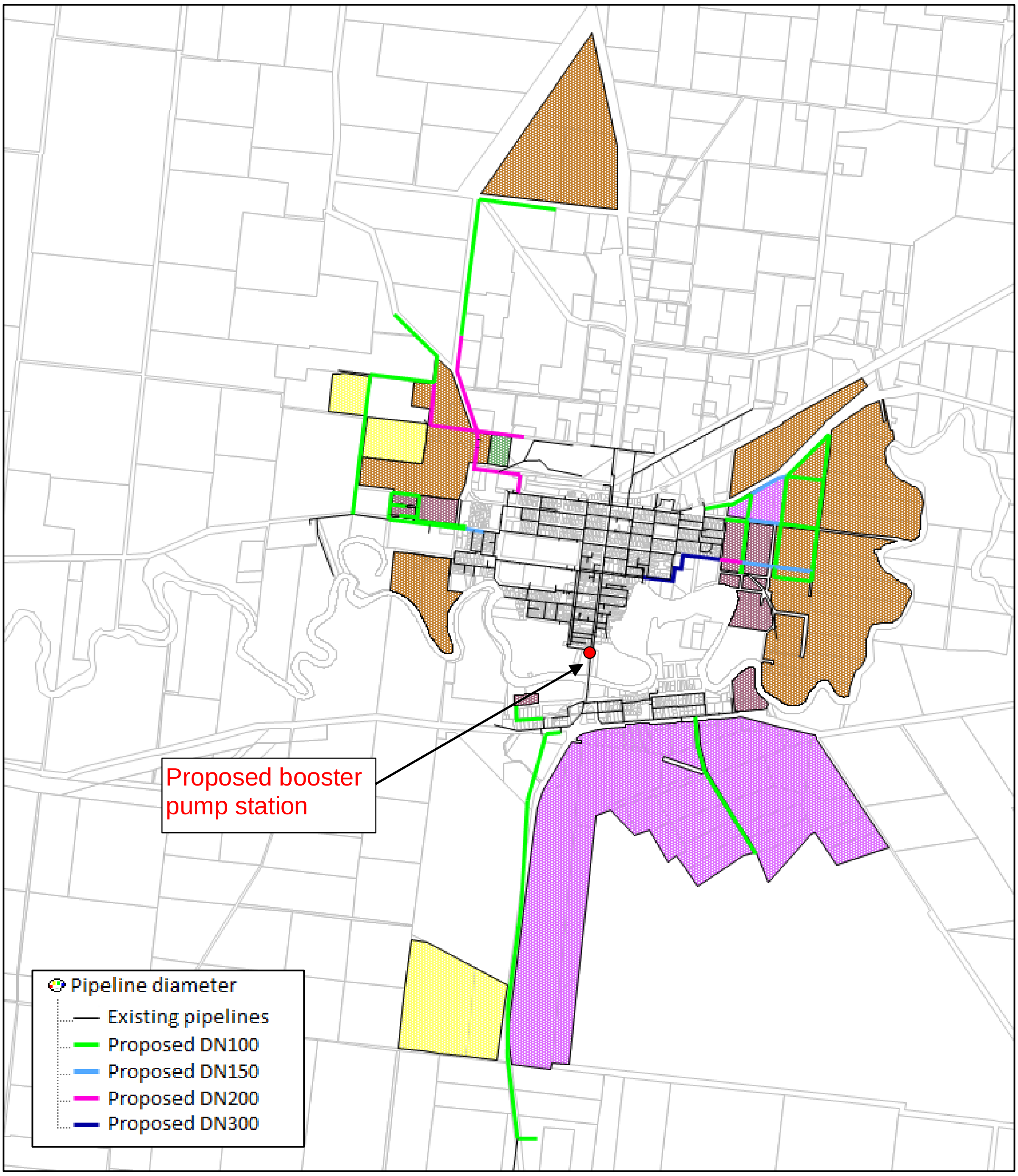
Additional to the pipeline upgrades in Option 1, this option requires a booster pump station on the outlet of Pine St reservoir to increase pressures in the South Hay area. Pipeline upgrades are similar to Option 1 with the exception of a few additional upgrades to improve connectivity of the system.

The approximate location for the proposed raw water booster pump station is shown in Appendix Figure F.4-1. These raw water pumps can be placed in the same pump station building as the booster pumps provided for Option 2 of the potable supply upgrade to reduce costs. The duty flow and head for this booster pump is 15 L/s @ 4 m head.

Additional pipelines required for Option 2 is given below:

- Proposed pipelines for future development
  - DN100: 3,018 m
- Upgraded existing pipelines
  - DN100 3,000 m

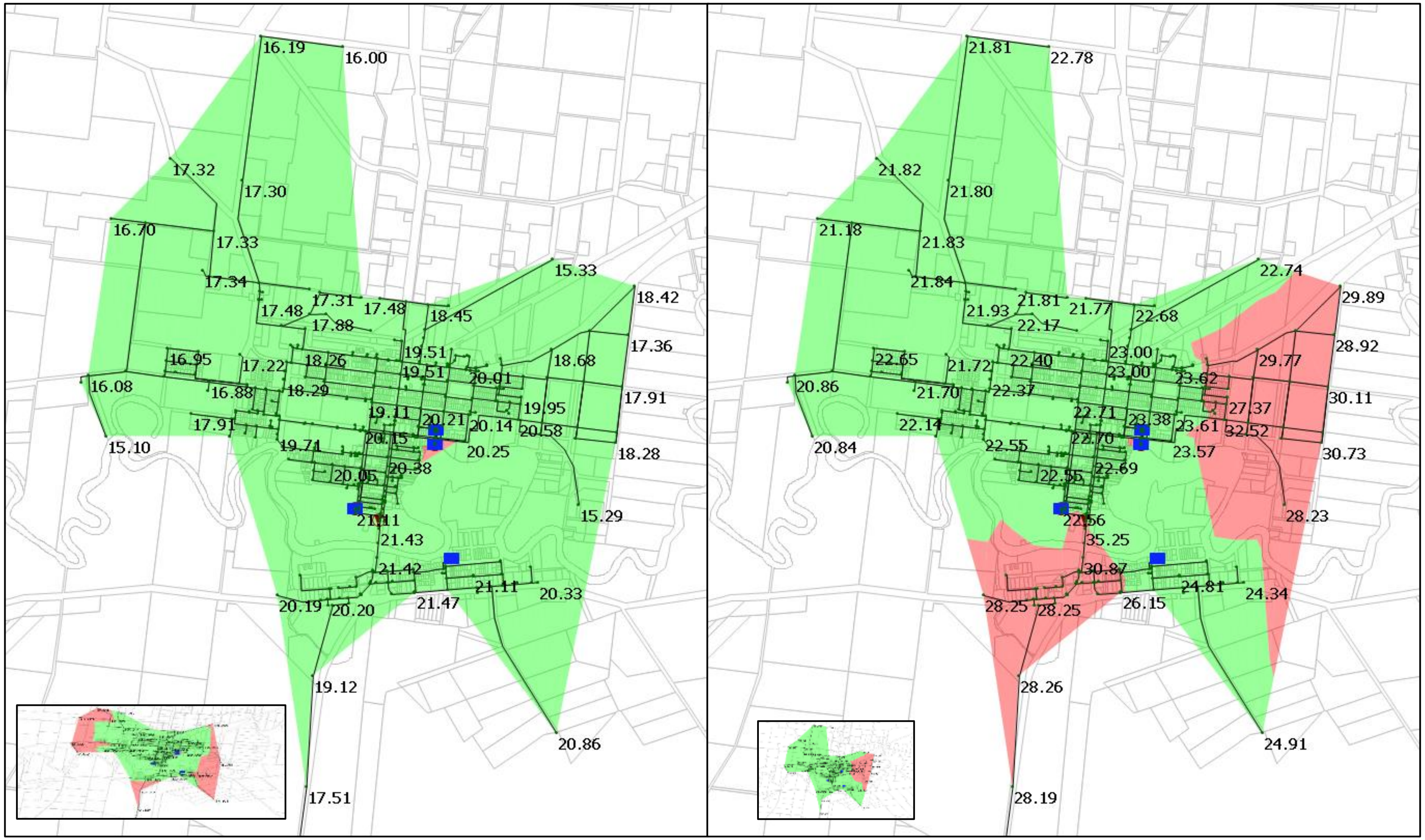
Option 2 proposed pipeline alignments is given in Appendix Figure F.4-5.



Appendix Figure F.4-5: Raw WSS – Upgrade Option 2 new pipelines

Minimum and maximum pressures

The minimum and maximum pressure contour figures are given in Appendix Figure F.4-6.



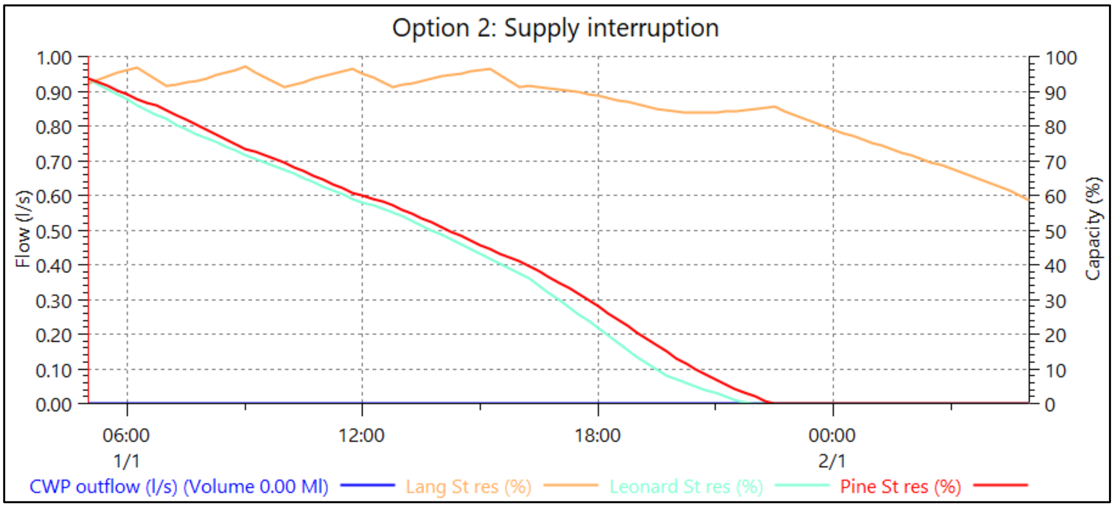
Appendix Figure F.4-6: Raw WSS Upgrade Option 2 - Pressure contours (L: minimum pressure and R: maximum pressure)

The proposed upgrades for Option 2 will provide future development zones access to raw water. With additional upgrades, the Raw WSS will be able to provide the minimum 15 m pressure as per the LOS during a peak day. The highest pressure identified in the town is 30.73 m, only slightly higher than the LOS (30m).

Supply reliability – interruption to customers

For Option 2 supply reliability assessment, the same modelling parameters were used as the existing system reliability assessment, refer to Appendix F.3.1.

The effect of the supply interruption scenario on the raw water reservoir levels is given in Appendix Figure F.4-7.



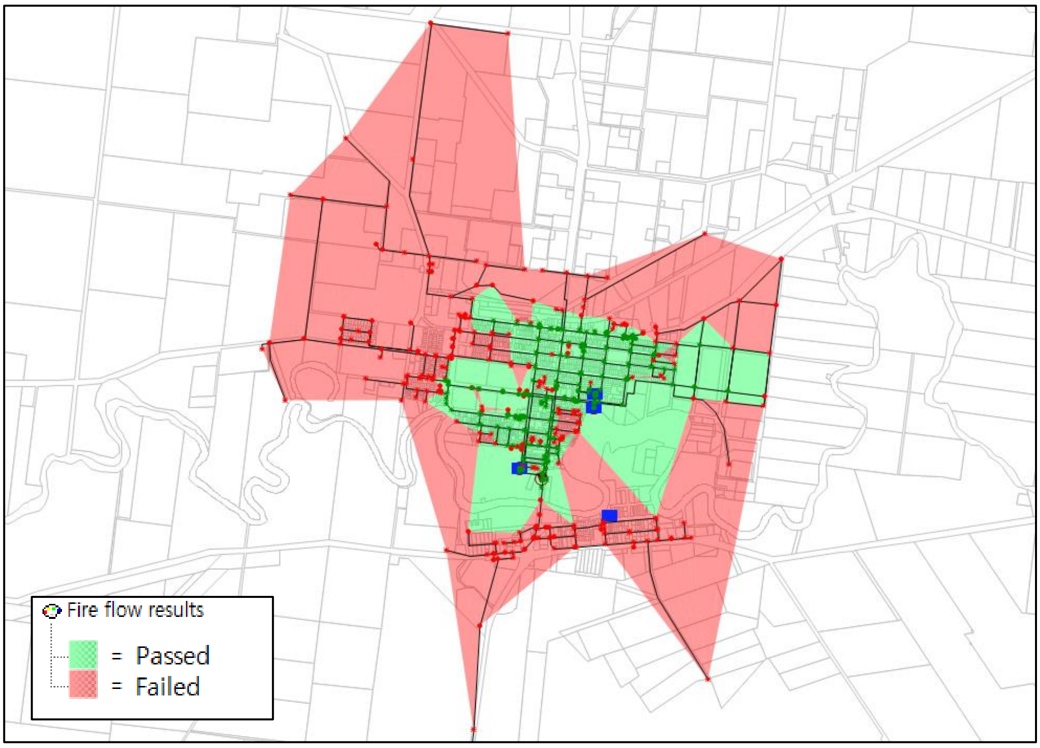
Appendix Figure F.4-7: Raw WSS Upgrade Option 2 – Reservoir drawdown caused by supply interruption

The results of the Option 2 supply reliability assessment shows that with the additional booster pump for South Hay, Lang St reservoir does not empty during the supply interruption. All other reservoirs in the Raw WSS is expected to empty around 17.5 hours from the start of simulation. The raw water reservoirs will have the capacity to maintain supply for 8 hours in the event of a supply interruption.

Fire flows

As was assessed for the current demands, the firefighting capabilities were assessed for the future peak day demands on the system with Option 2 upgrades.

The points which can maintain a residual pressure of 15 m or more while providing a fire flow of 10 L/s at the peak time in a peak day are considered meeting fire-fighting LOS. The points meeting fire flow requirements are shown in Appendix Figure F.4-8.



Appendix Figure F.4-8: Raw WSS Upgrade Option 2 - fire flow results

From the results of the fire flow analysis, it is apparent that majority of the Hay township will not receive either 10 L/s and the residual 15 m head. Nearly all of the point will supply the minimum 10 L/s for firefighting, however the residual 15 m will not be satisfied. This is largely due to the topography of Hay being very flat.

It should be noted that according to clause 3.1.5 of the WSA Code (WSA-03, 2011), water supply systems need not be designed for firefighting unless required by a Water Agency's operating licence.

Preliminary capital costs

The preliminary estimated capital cost for the proposed upgrades in option 2 is $5.7 million as given below.

Appendix Table F.4-3: Raw WSS Upgrade Option 2 - Preliminary capital cost

ITEM	DESCRIPTION	[UNIT]	[QTY]	[RATE]	AMT
				$ / Unit	$K
Reticulation pipelines					
	Pipeline replacement/ upgrade				
	100	m	8871.49	104.09	$ 923,392
	150	m	206.21	153.39	$ 31,630
	200	m	3377.36	208.17	$ 703,067
	New pipelines to service development zones				
	100	m	12206.34	104.09	$ 1,270,500
	150	m	1441.57	153.39	$ 221,121
	200	m	222.05	208.17	$ 46,224
	300	m	1001.61	350.60	$ 351,167
	Upgrade of existing pipelines				
	Connections to existing pipelines	Nos	8.00	4930.35	$ 39,443
Pumps					
	South Hay boosters pump (civil and mechanical)	item	1	$ 87,651	$ 87,651
Extras					
	misc valves (air valves, scour valves, NRV)	item	35	$ 500	$ 17,500
Prime Costs					**$3,691,695**
	General Contingency	% of Prime Cost	30%		$1,107,508
Direct Costs					**$4,799,203**
	Design & Preconstruction Activities	% of Direct Cost	10%		$479,920
	Construction Activities	% of Direct Cost	10%		$479,920
TOTAL CAPITAL COST					**$5,759,044**

F.5 Summary of outcomes

Current system and demands

For the Raw WSS, the peak day minimum pressures do not meet Council's minimum pressure LOS target of 15m on the outskirts of the Hay township. The lowest minimum pressure was around 6m. Council may wish to consider upgrading the pipelines that supply the low-pressure regions.

It is recommended that Council review their LOS targets to align with other water guidelines. Notably maximum pressures given for planning water supply in WSA-03 is between 50-60 m. In which case, all of the above pressure issues are within the 50 m.

Future system and demands

Option 1 for the Raw WSS will ensure raw water access to the existing and future customers in the development zones. Pipeline selections were chosen to meet the design basis of WSA03, as such some pipelines could not be increased further to reduce head losses. Some customers on the edges of town experienced peak day minimum pressures below Council's LOS target of 15m; the lowest minimum pressure was 12.8m. The capital cost of Option 1 was estimated to be around $4.6M.

Option 2 for the Raw WSS can be seen as an upgrade to Option 1, as it services the future development zones while maintaining the minimum pressure levels as per LOS targets. Upgrades for Option 2 includes about 27.3 km of new pipelines (replacements and new routes) of varying sizes between DN100 to DN300 and a new South Hay booster pump. The capital cost of Option 2 was estimated to be around $5.8M.

Appendix G Hydraulic model – Hay Potable WSS

A hydraulic model of Hay's Potable WSS was developed using InfoWorks WS Pro using the GIS data provided by Council and information obtained during discussions with Council staff.

G.1 Description of system

G.1.1 Infrastructure components

The system consists of an intake on the Murrumbidgee River at the Murray St pump station, approximately 2.7 km east of Hay town centre. The raw water is treated at the Hay water treatment plant (WTP) at Cadell St. Treated water from the WTP is pumped via the reticulation network to a 2.3 ML service reservoir located on Pine Street.

The main infrastructure components of the current system are as follows:

1. Pump stations
    a. Clear water pumps located at the WTP located on Cadell Street.
2. Reservoirs
    a. 2.3 ML reservoir on Pine St
3. Potable water pipelines (36.4 km in total)

Pipelines

Pipeline alignments, connection, material, and nominal diameters were adopted from GIS data provided by Council. The pipelines in the GIS data totalled 36.4km in length, and had the following diameters:

- DN300 0.06 km
- DN250 1.15 km
- DN200 1.32 km
- DN150 2.50 km
- DN100 6.07 km
- Less than DN100 25.17 km

Pipe roughness values for all new pipelines have been established based on Australian Standard *AS2200-2006 (Design Charts for Water Supply and Sewerage)*.

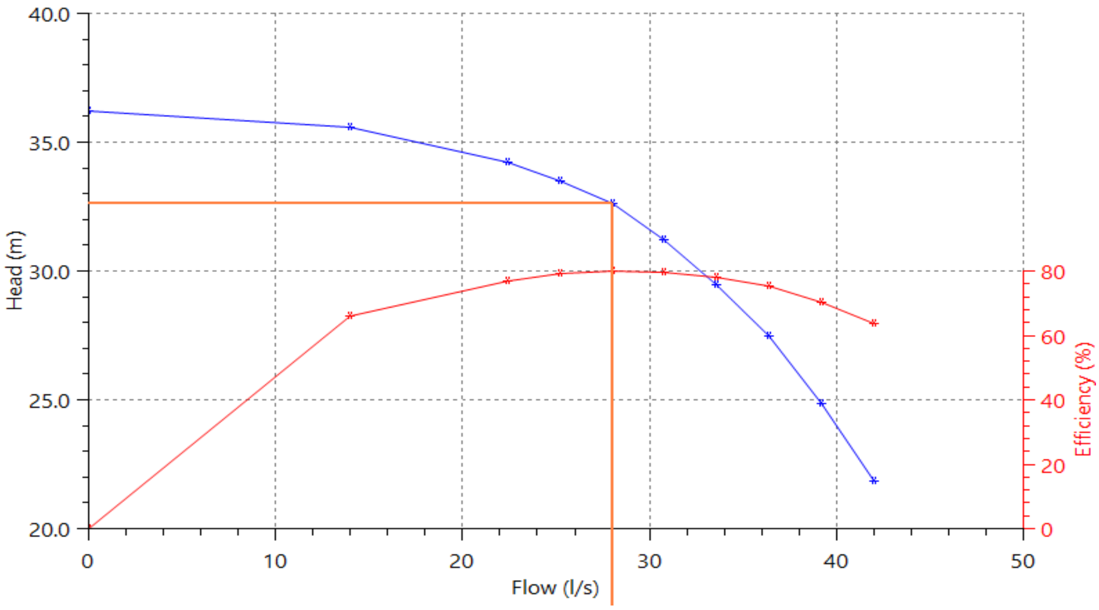
Reservoirs

There is one service reservoir in the Potable WSS connected to the reticulation located on Pine Street. The details of this reservoir are given below:

- Capacity: 2.3 ML
- TWL: 119.00 m
- BWL: 90.80 m
- Height: 28.20 m

Pumps

The Potable WSS has one set of clear water pumps (CWP) that transports treated water to the reticulation. The pump has a duty of 28 L/s @ 35 m head, as provided by Council. No pump curves were provided by Council, a pump curve was generated using a InfoWorks WS Pro inbuilt tool, the assumed pump curve is given in Appendix Figure G.1-1.



Appendix Figure G.1-1: Potable WSS Model – Pump curves for Clear Water Pump

G.1.2 Operational controls

Pumps

The system has been designed for unattended operation, responding to water level signals from the reservoirs.

The CWP start signal is provided via the telemetry. When the pressure switch at the Pine Street reservoir detects low reservoir level, a start command is generated and sent to the CWP to start pumping. Currently, the model specifies the CWP to switch on when the reservoir drops to 26.2 m (93%) and stops when the reservoir reaches 27.4 m (97%).

G.1.3 Consumers and demands

Customer locations

Customers were located using a GIS cadastre file provided by Council, in which there were 1,594 lots. In Infoworks, each lot was given a customer point at its centroid and assigned to the closest pipeline.

Each lot in the GIS data had an assessment number attribute, which matched the assessment numbers in the historical customer water billing data.

Customer demands

Each customer point was assigned a peak day demand and water losses, so that the total of all customers added up to the total peak day production at the WTP.

The current and future customer demands allocated to the customer points are described in Appendix G.4.1 and G.5.1 respectively.

Customer demand pattern

The same demand curves were used as in the Hay Raw WSS Hydraulic Model.

Persistence pattern

The persistence pattern for the seven-day analysis has been established based on the results of the peak day analysis of the WTP production data in Section 6.2.2. The persistence factors used in the hydraulic model, taken from the peak week, is given in Appendix Table G.1-1

Appendix Table G.1-1: Potable WSS Model – Persistence pattern

Days before/after peak day	-3	-2	-1	Peak day	+1	+2	+3
% of Peak Day Demand	93%	63%	95%	100%	88%	85%	84%

G.2 Target service levels

The hydraulic model will assist Council in identifying deficiencies in the Hay Potable WSS compared against the levels of service (LOS).

The following LOS have been adopted from Council's 2009 Strategic Business Plan (SBP):

- Minimum pressure 25 m
- Maximum pressure 30 m
- Supply interruption to customers 8 hours

The units in the SBP were given in PSI, but after discussion with Council this was changed to meters head.

G.3 Model calibration

The calibration for the Hay Potable WSS model could not be completed. Council's current telemetry system is not set up to monitor data at time intervals shorter than daily.

G.4 Modelling current demands

The model simulations for the Hay **current** potable water peak day production of 1.6 ML/day were performed for both the 24-hours period and 7-day persistence starting at 05:00 assuming all reservoirs are full at the start of each simulation. The results have been compared against the agreed levels of service and system deficiencies have been identified accordingly.

G.4.1 Current customer demands

A peak day demand for every individual assessment was estimated by dividing the estimated current peak day demands for each customer category (see Table 6-4) across all assessments with the same user category, proportional to their historical demand.

The peak day demands for each assessment were allocated to the customer point in Infoworks which shared the same assessment number. Some customer points shared the same assessment number, in which case the demand was split equally across points.

The current peak day water losses (**0.27 ML**), were calculated as the difference between the peak day production (**1.60 ML** from Table 6-3) and the peak day demand (**1.33 ML** from Table 6-4). The peak day water losses were split evenly across all customer points.

A summary of the current demands and losses assigned to each customer point in the hydraulic model is shown in Appendix Table G.4-1.

Appendix Table G.4-1: Potable WSS Model – Allocated peak day demands and water losses for each point in the hydraulic model

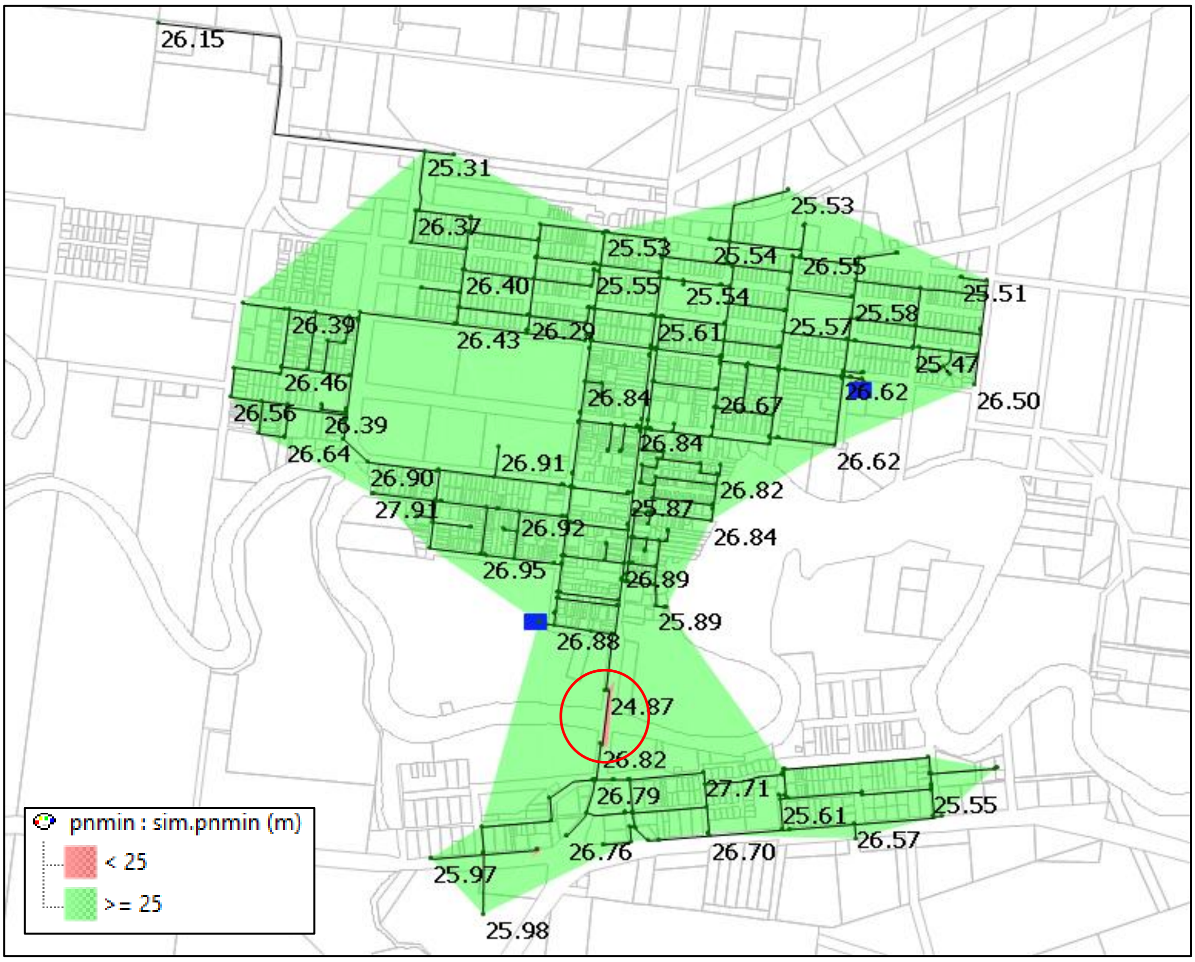
Customer category	Number of meters from billing data 2020	Number of customer points	Allocated peak day demands (kL/day)			
			Demands	Water Losses	Total	Average demand per point
Residential	1,090	1,075	1,057	238	**1,295**	1.2
Commercial	110	104	197	23	**220**	2.1

Customer category	Number of meters from billing data 2020	Number of customer points	Allocated peak day demands (kL/day)			
			Demands	Water Losses	Total	Average demand per point
Municipal – excl Parks and Gardens	29	24	77	5	**83**	3.4
Rural	3	3	1	1	**1**	0.5
Parks and Gardens	1	1	0	0	**1**	0.6
Other Industrial	0	0	0	0	**0**	0.0
Total	**1,233**	**1,207**	**1,332**	**268**	**1,600**	1.3

G.4.2 Results of modelling current demands

Minimum pressure

The current desirable minimum service pressure in the potable reticulation as discussed with Council is 25 m. A contour plot for minimum pressures has been provided in Appendix Figure G.4-1. There is one minor area showing minimum pressures below 25 m, circled in red.

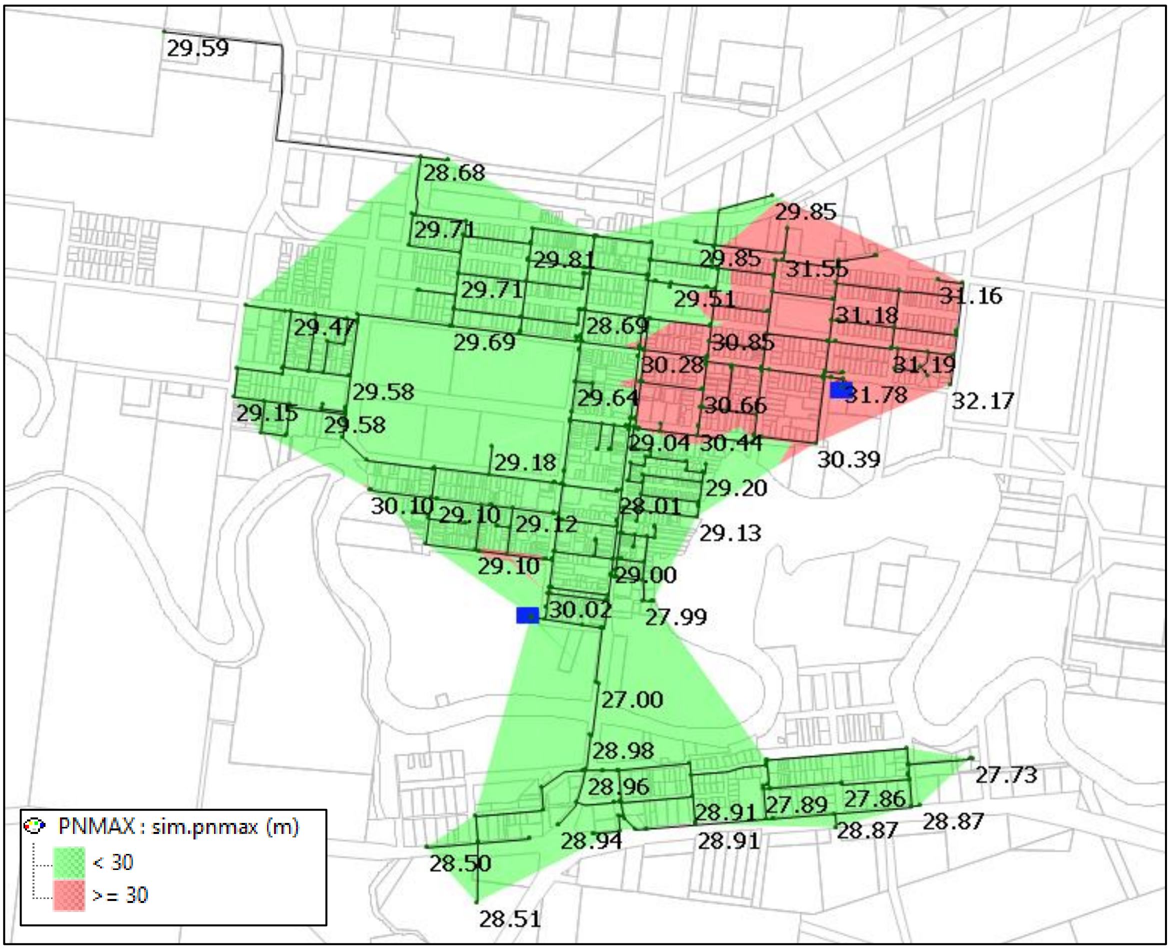


Appendix Figure G.4-1: Potable WSS model - minimum pressure at current peak day demands

For the circled area where minimum pressure is below 25m, it is likely that this is due to the section of pipeline running along the bridge over the Murrumbidgee River. However, the low pressures (24.8m) here is not a significant issue as it services no potable water users.

Maximum pressure

The current maximum service pressure in the reticulation as discussed with Council is 30m. A contour plot for maximum pressures has been provided in Appendix Figure G.4-2.

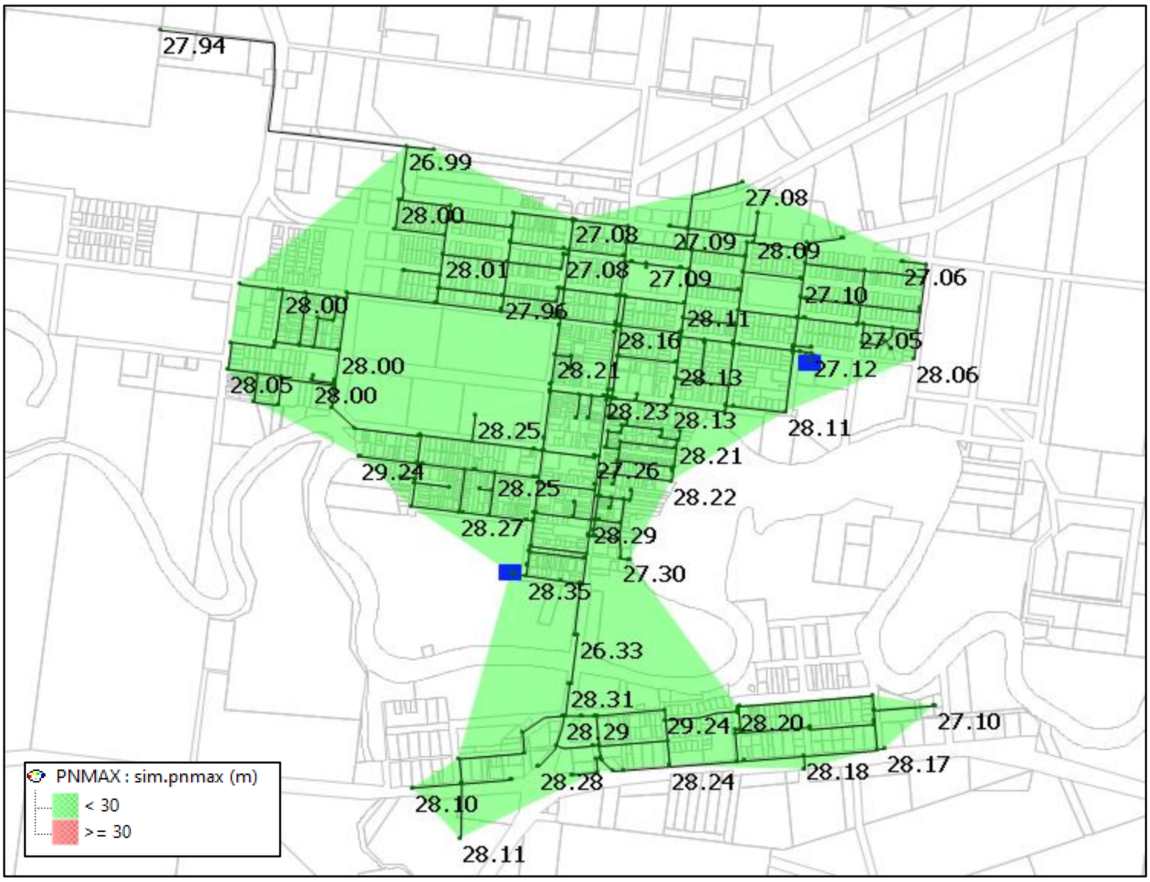


Appendix Figure G.4-2: Potable WSS model - maximum pressure at current peak day demands (clear water pump on)

The model results have shown that a portion of the network close to the Hay WTP will experience above 30m pressures during a peak day, with the largest pressure in these areas being 32.4m. These high pressures are caused by the potable water pumping to fill the Pine Street reservoir.

From PWA previous experience, 30 m maximum pressure in the reticulation network is not high compared to other standards. The allowable maximum pressure as suggested by the WSAA [17], is 60 m for water customers. The Hay Potable WSS is comfortably within the maximum pressures as defined by the WSAA guidelines.

Additional model result was provided in Appendix Figure G.4-3 displaying maximum pressures in the system when the Potable WSS is not pressurised.



Appendix Figure G.4-3: Potable WSS model - maximum pressure at current peak day demands (clear water pump off)

During this period the town water supply is gravitated from Pine St reservoir and all pressures are within the maximum of 30m.

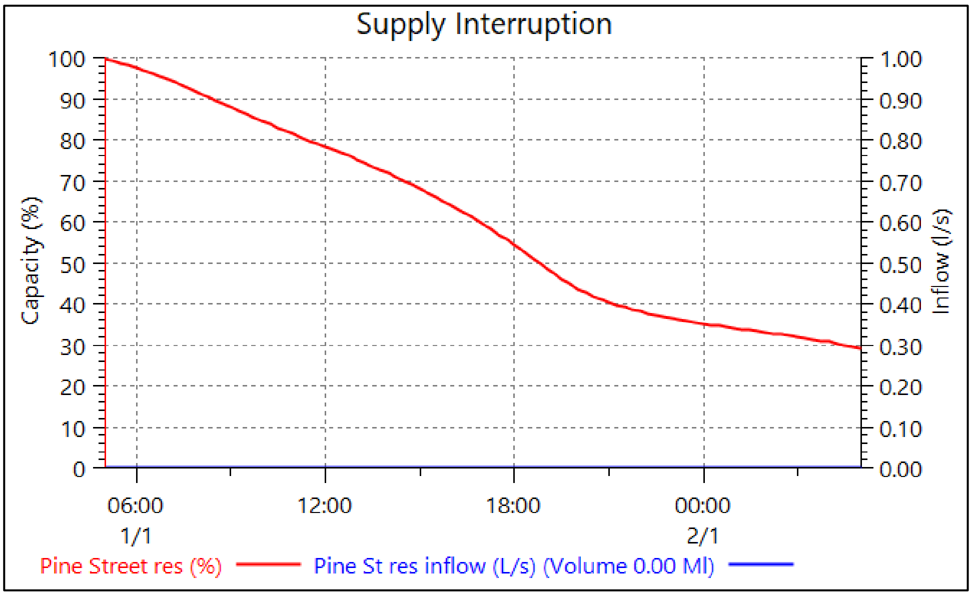
Supply reliability – interruption to customers

The supply reliability assessment provides insight on the ability of the system to maintain minimum level of service for supply in the event of an interruption and the necessary response time for Council personnel. An interruption may be due to an emergency trunk main shutdown, possible reasons of an emergency shut down include:

- mains break
- power supply failure
- mechanical failure
- flushing
- operational maintenance

For modelling purposes, Pine St reservoir will have water supply cut off at the WTP from the start of peak day simulation (05:00).

The effect of the supply interruption scenario on the Pine St reservoir level is given in Appendix Figure G.4-4.



Appendix Figure G.4-4: Potable WSS model - Reservoir drawdown caused by supply interruption

The results of the supply reliability assessment shows Pine St reservoir will have sufficient capacity to provide flow for the 8 hours of supply interruption and for the duration of the peak day simulation.

G.5 Modelling future demands

The model simulations for the Hay **future** potable water peak day production of 2.5 ML/day were performed for both the 24-hours period and 7-day persistence starting at 05:00 assuming all reservoirs are full at the start of each simulation. The results have been compared against the agreed levels of service and system deficiencies have been identified accordingly.

G.5.1 Future customer demands

The future peak day demands for **existing** customer points was kept the same as the current peak day demands.

The future customer points were allocated a future peak day demand calculated for each new development zone, explained in Report Section 6.4.

The **future** peak day water losses (**0.14 ML** from Table 6-14) were the water losses estimated for the target water losses projections. The number of equivalent connections for each future customer point was calculated by dividing its future peak day demand by the average residential demand per connection. The peak day water losses were then split evenly across all customer points or equivalent connection for the future customers.

A summary of the current demands and losses assigned to each customer point in the hydraulic model is shown in Appendix Table G.5-1.

Appendix Table G.5-1: Potable WSS Model – Allocated peak day demands and water losses for each point in the hydraulic model (future customer points shown in italics)

Customer category		Allocated peak day demands (kL/day)		
		Demands	Water Losses	Total
Residential	Existing customers	1,057	56	1,113
	RU4 Primary Production Small Lots - 1	42	2	44

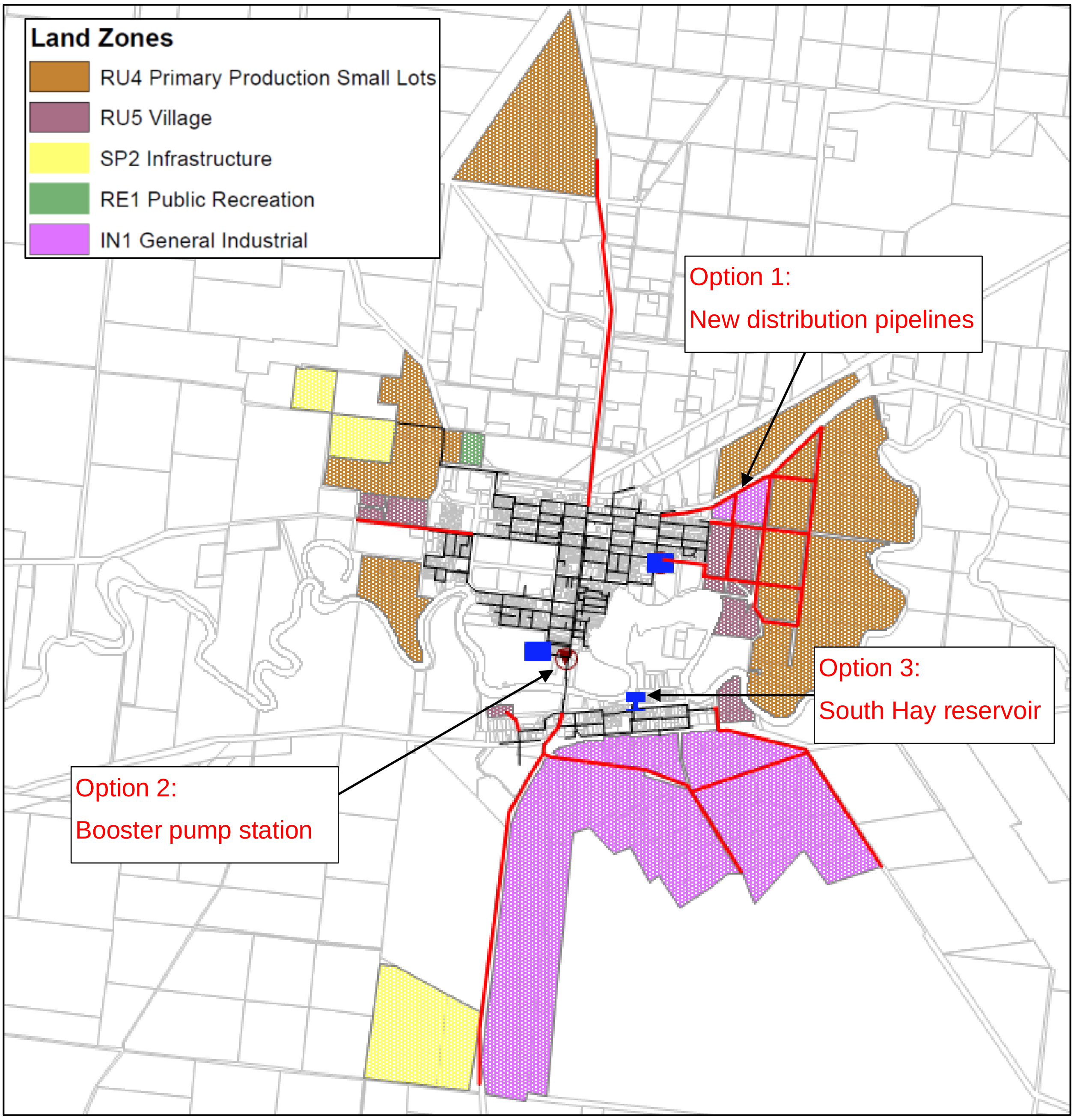
Customer category		Allocated peak day demands (kL/day)		
		Demands	Water Losses	Total
	RU4 Primary Production Small Lots - 2	26	1	28
	RU4 Primary Production Small Lots - 3	13	1	13
	RU4 Primary Production Small Lots - 4	113	6	119
	RU5 Village - 1	99	5	105
	RU5 Village - 2	16	1	17
	RU5 Village - 3	68	4	72
	RU5 Village - 4	265	14	279
	All Residential	**1,700**	**90**	**1,790**
Commercial	**Existing customers**	**197**	**5**	**202**
Municipal – excl Parks and Gardens	**Existing customers**	**77**	**1**	**78**
Rural	**Existing customers**	**1**	**0**	**1**
Parks and Gardens	**Existing customers**	**0**	**0**	**0**
Other Industrial	**Existing customers**	**0**	**0**	**0**
	IN1 General Industrial - 1	354	40	394
	IN1 General Industrial - 2	11	1	13
	SP2 Infrastructure - 1	7	1	8
	SP2 Infrastructure - 2	17	2	18
	All Industrial	**389**	**44**	**433**
Total	Total existing	1,332	63	1,395
	Total new zones	1,031	79	1,110
	All Customers	**2,364**	**142**	**2,505**

G.5.2 Supply to future development zones

Three options to supply water to the future development zones were considered as a part of this study:

- Option 1: Extend existing network
- Option 2: Pipeline extension + booster PS
- Option 3: Pipeline extension + South Hay reservoir

The upgrades and proposed development zone locations are shown in Appendix Figure G.5-1.



Appendix Figure G.5-1: Potable WSS Model - proposed infrastructure upgrades to supply future development

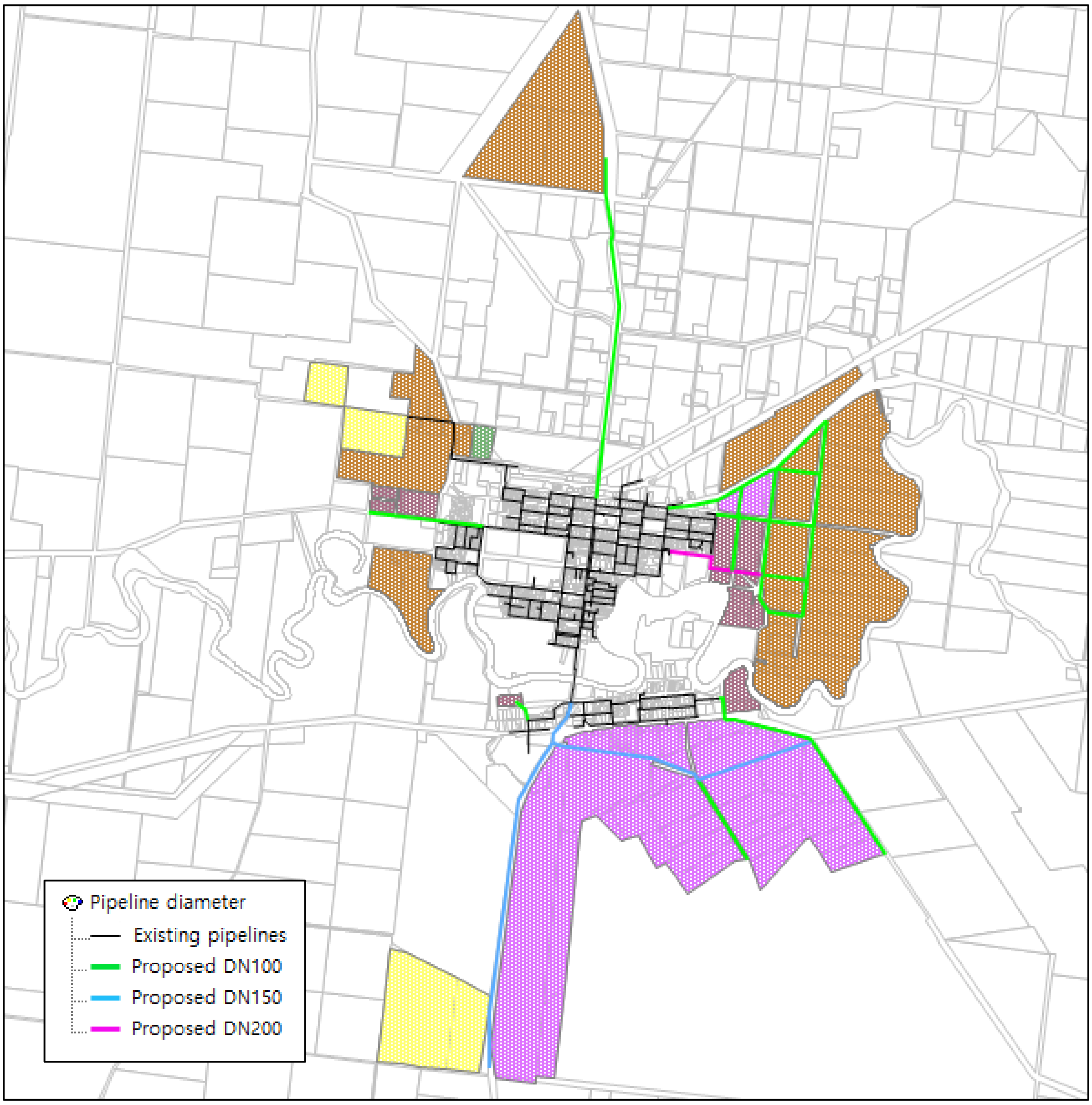
G.5.3 Potable WSS Upgrade Option 1

The proposed upgrades for Option 1 consist of pipelines that are required to service the future development zones. These pipelines are an approximation for servicing the respective development zones, detailed street level pipeline alignments were not considered as a part of this study.

All proposed pipelines are uPVC, the sizes and lengths are:

- DN100: 16,020 m
- DN150: 6,300 m
- DN200: 1,020 m

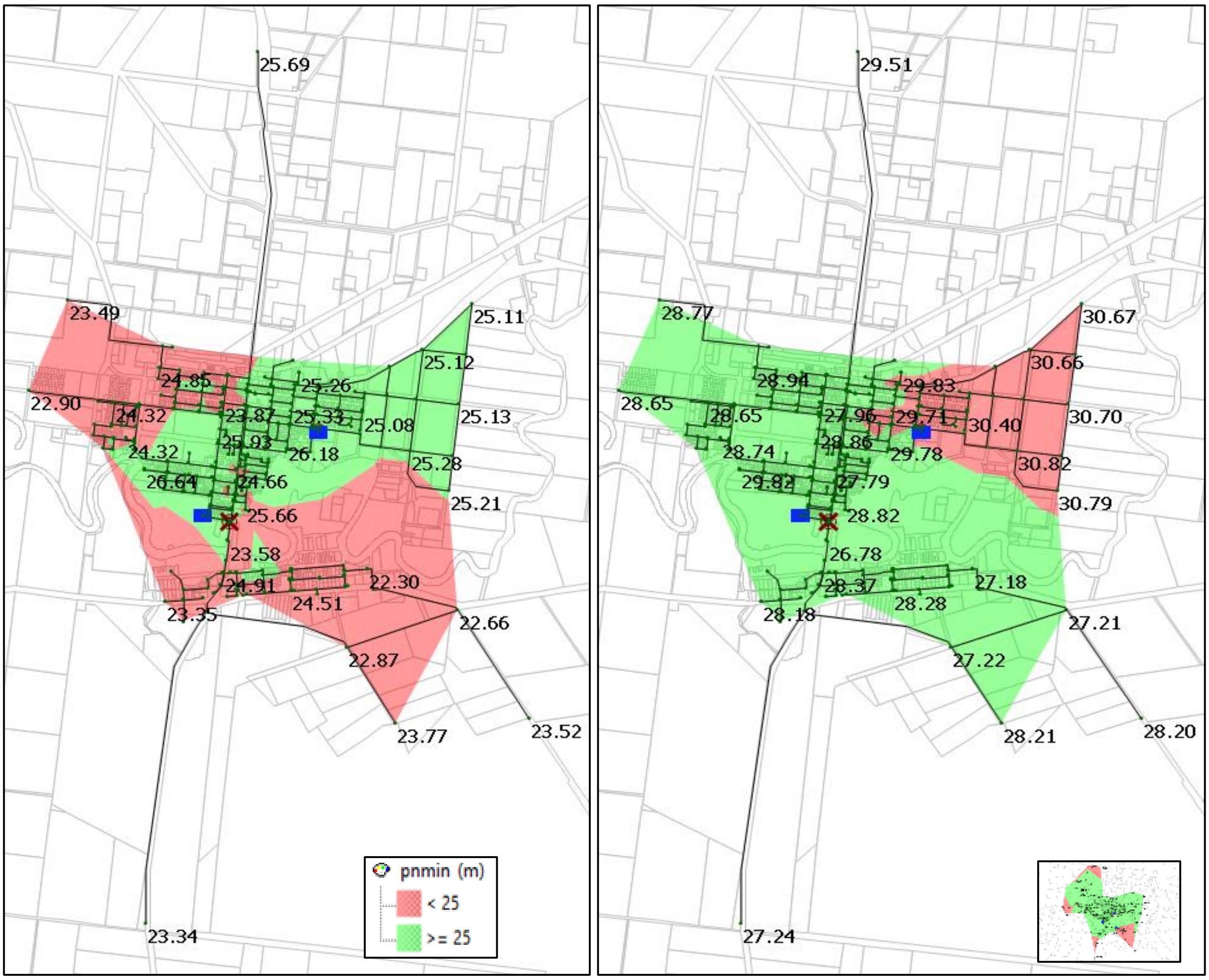
Option 1 proposed pipeline alignments is given in Appendix Figure G.5-2.



Appendix Figure G.5-2: Potable WSS – Upgrade Option 1 new pipelines

Minimum and maximum pressures

The minimum and maximum pressure contour figures are given in Appendix Figure G.5-3.



Appendix Figure G.5-3: Potable WSS Upgrade Option 1 - Pressure contours (L: minimum pressure and R: maximum pressure)

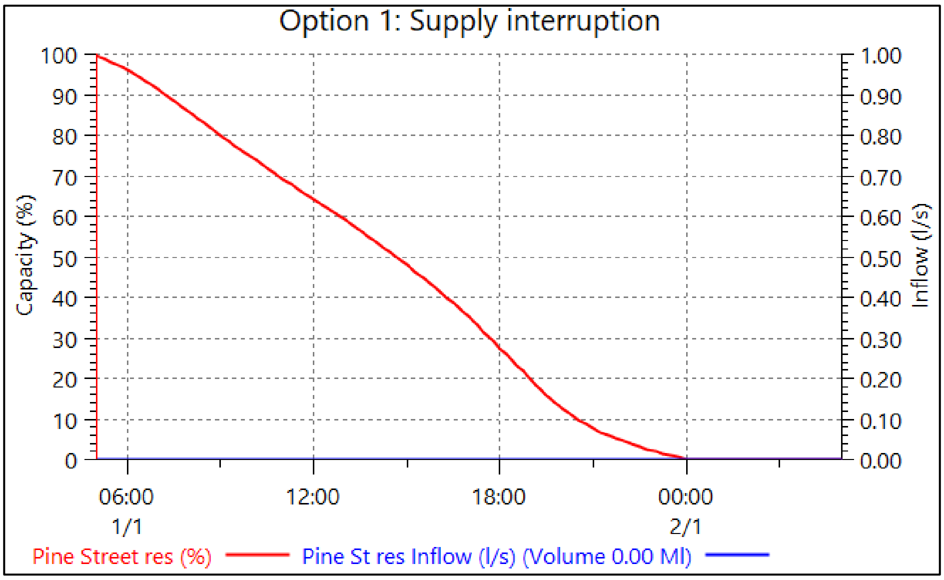
Option 1 will allow future zones to access potable water, however the majority of the town will be below the minimum pressure requirements. The lowest pressure identified in the system is 22.30 m, all pipelines were planned with WSA03 in consideration. Due to the flat ground elevation of Hay, the gravity system will fall short of the LOS.

The highest pressure identified by the model is 30.82 m, slightly higher than the LOS (30 m).

Supply reliability – interruption to customers

For Option 1 supply reliability assessment, the same modelling parameters were used as the existing system reliability assessment, refer to Appendix G.4.1.

The effects of the supply interruption scenario on Pine St reservoir is given in Appendix Figure G.5-4.



Appendix Figure G.5-4: Potable WSS Upgrade Option 1 – Reservoir drawdown caused by supply interruption

As a result of the increased demands from the future development zones, Pine St reservoir will drawdown noticeably faster compared to the existing system (ref Appendix Figure G.4-4). In this Option, Pine St reservoir will take 19 hrs to empty. During this supply interruption scenario Pine St reservoir is expected to have sufficient capacity to meet the levels of service to supply water for 8 hours during an interruption to water supply

Preliminary capital costs

The preliminary estimated capital cost for the proposed upgrades in Option 1 is $4.5 million as given below.

Appendix Table G.5-2: Potable WSS Upgrade Option 1 - Preliminary capital cost

ITEM	DESCRIPTION	[UNIT]	[QTY]	[RATE]	AMT
				$ / Unit	$K
Reticulation pipelines					
	New pipelines to service future growth zones				
	DN100	m	16019.70	104.09	$ 1,667,414
	DN150	m	6299.54	153.39	$ 966,279
	DN200	m	1020.57	208.17	$ 212,453
	Connections to existing pipelines	Nos	8.00	4930.35	$ 39,443
Extras					
	misc valves (air valves, scour valves, NRV)	item	25	$ 500	$ 12,500
Prime Costs					**$2,898,089**
	General Contingency	% of Prime Cost	30%		$869,427
Direct Costs					**$3,767,515**
	Design & Preconstruction Activities	% of Direct Cost	10%		$376,752
	Construction Activities	% of Direct Cost	10%		$376,752
TOTAL CAPITAL COST					**$4,521,018**

G.5.4 Potable WSS Upgrade Option 2

In this Option, CWP upgrades is required and a new booster pumping system is proposed at the outlet of the Pine Street reservoir. The new booster pumps would pressurise the existing and future customers of the South Hay area when the pressures drop below the levels of service.

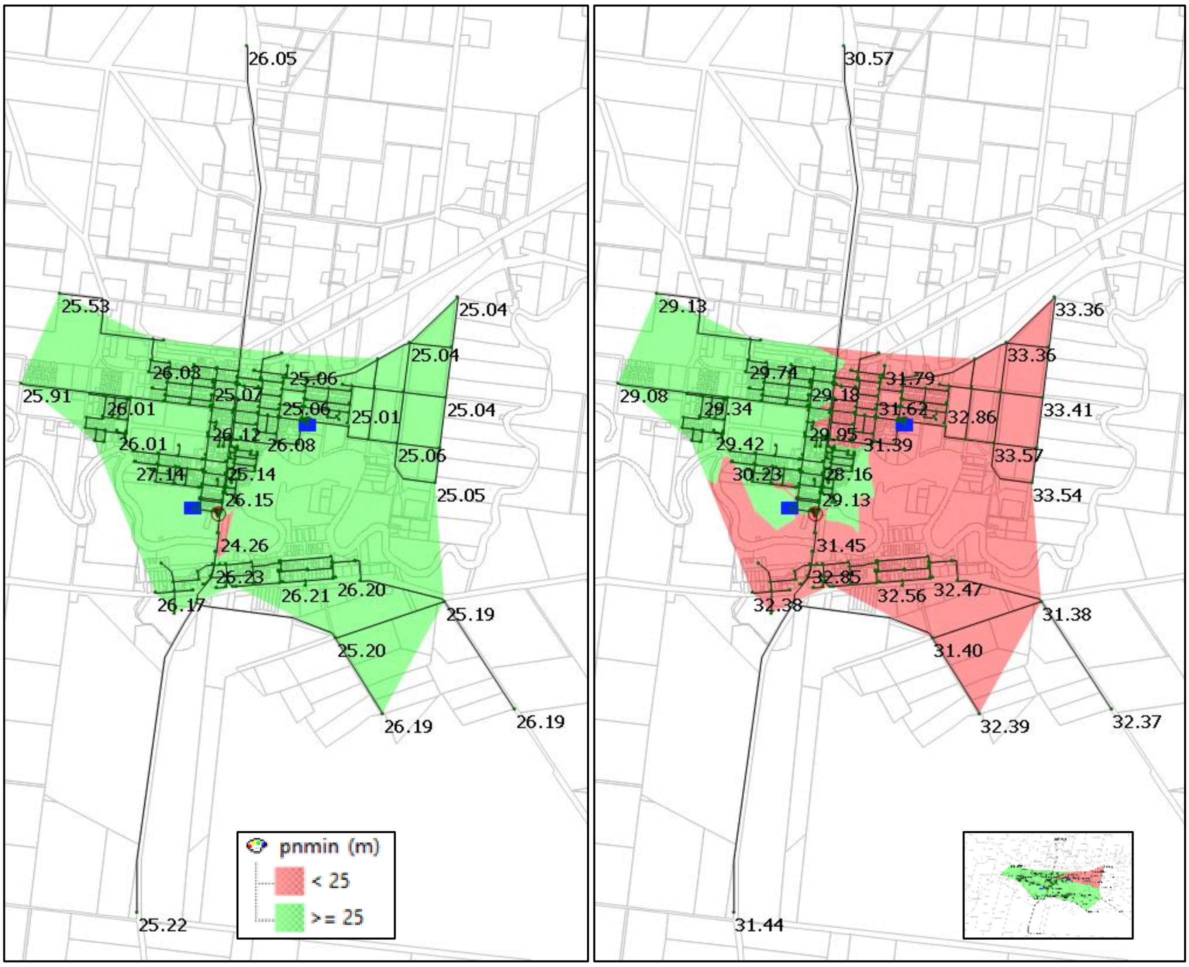
The approximate location for the proposed booster PS is provided in Appendix Figure G.5-1. Estimated required pumping upgrades are given below:

- New booster pump station for South Hay 15 L/s @ 4m head
- Upgrade of CWP to 35 L/s @ 35m head

All pipeline upgrades are the same as Option 1.

Minimum and maximum pressures

The minimum and maximum pressure contour figures for Option 2 are given in Appendix Figure G.5-5.



Appendix Figure G.5-5: Potable WSS Upgrade Option 2 - Pressure contours (L: minimum pressure and R: maximum pressure)

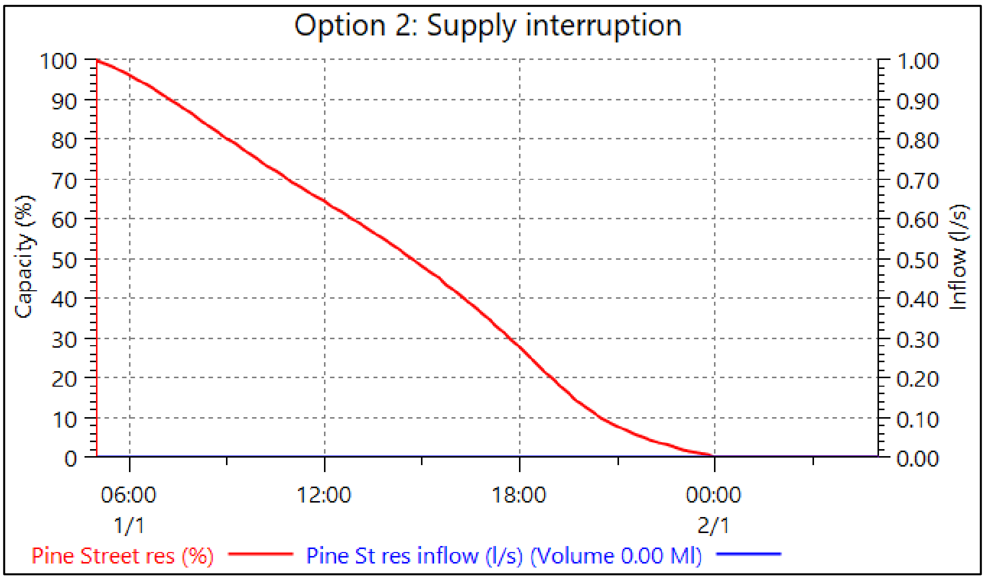
Option 2 will allow future development zones access to potable water and the included booster pumps will pressurise the system to the levels of service requirements. With the addition of a booster pump station on pipelines suggested in Option 1, the system will be able to provide the minimum 15 m pressure as per the LOS.

As a consequence of improving the minimum pressures in the system, the maximum pressures in the system will slightly exceed the LOS. With the highest pressure identified in the system to be 33.57 m.

Supply reliability – interruption to customers

For Option 2 supply reliability assessment, the same modelling parameters were used as the existing system reliability assessment, refer to Appendix G.4.1.

The effects of the supply interruption scenario on Pine St reservoir is given Appendix Figure G.5-6.



Appendix Figure G.5-6: Potable WSS Upgrade Option 2 – Reservoir drawdown caused by supply interruption

The results of the Option 2 supply reliability assessment are identical to the results of Option 1. Similarly, Pine St reservoir is expected to have sufficient capacity to meet the levels of service to supply water for 8 hours during an interruption to water supply.

Preliminary capital costs

The preliminary estimated capital cost for the proposed upgrades in Option 2 is $4.8 million as given below.

Appendix Table G.5-3: Potable WSS Upgrade Option 2 - Preliminary capital cost

ITEM	DESCRIPTION	[UNIT]	[QTY]	[RATE]	AMT
				$ / Unit	$K
Reticulation pipelines					
	Upgrade existing pipelines				
	DN100	m	16019.70	104.09	$ 1,667,414
	DN150	m	6299.54	153.39	$ 966,279
	DN200	m	1020.57	208.17	$ 212,453
	Connections to existing pipelines	Nos	8.00	4930.35	$ 39,443
Pumps					
	South Hay boosters pump (civil and mechanical)	item	1	$ 87,651	$ 87,651
	CWP Upgrade (only mechanical)	item	1	$ 88,199	$ 88,199
Extras					
	misc valves (air valves, scour valves, NRV)	item	35	$ 500	$ 17,500
Prime Costs					**$3,078,938**
	General Contingency	% of Prime Cost	30%		$923,681
Direct Costs					**$4,002,619**
	Design & Preconstruction Activities	% of Direct Cost	10%		$400,262
	Construction Activities	% of Direct Cost	10%		$400,262
TOTAL CAPITAL COST					**$4,803,143**

G.5.5 Potable WSS Upgrade Option 3

In this Option, in addition to the pipelines for the future development areas, a new reservoir is proposed near the existing Lang St raw water reservoir site located off Lang Street, south of the Murrumbidgee river.

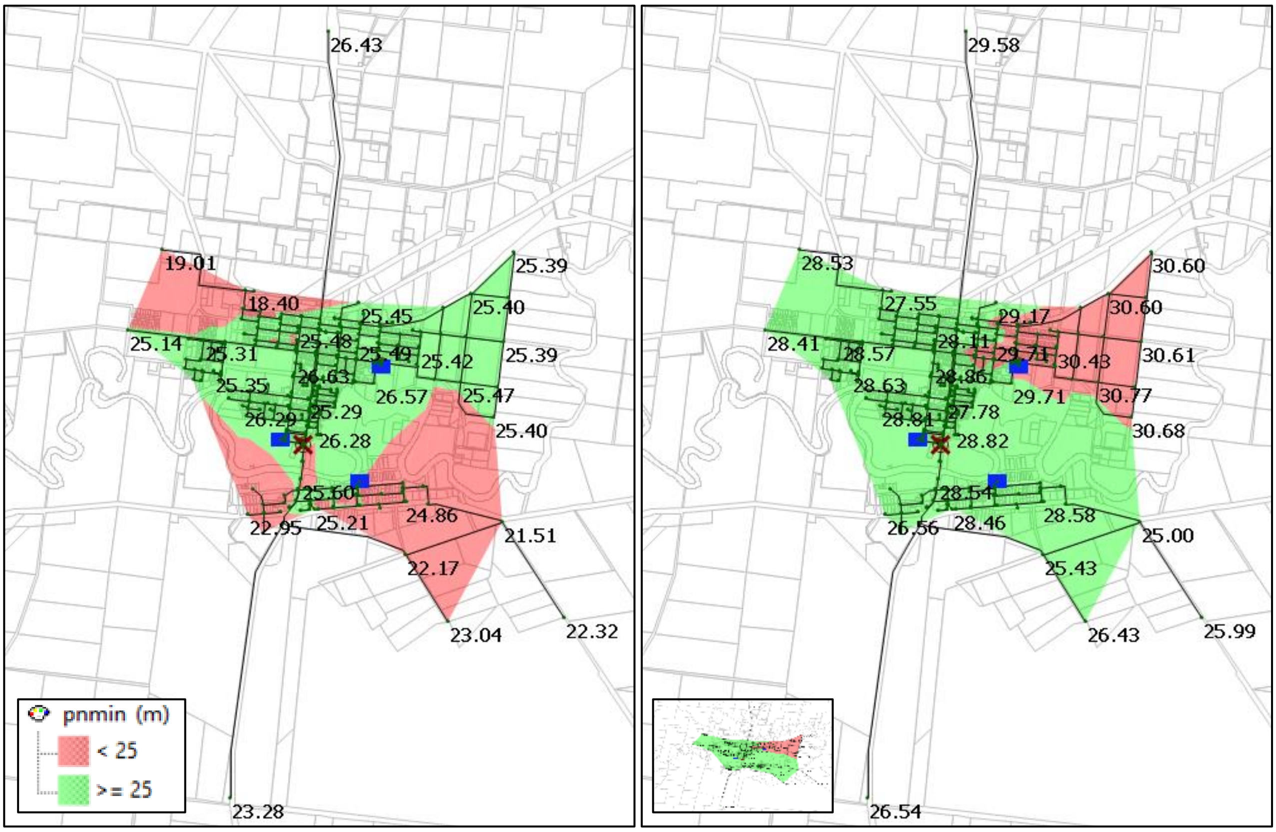
The proposed potable reservoir will be an act as a balance tank for the existing and future customers of South Hay. The new reservoir will be an elevated steel tank with the same TWL as the existing Pine St potable water reservoir. Summary of the specifications for this reservoir is given below:

- Capacity: 1,000 kL
- Material: Concrete
- Height: 29 m
- BWL: 90 m
- TWL: 119 m

All pipeline upgrades are the same as Option 1.

Minimum and maximum pressures

The minimum and maximum pressure contour figures are given in Appendix Figure G.5-7



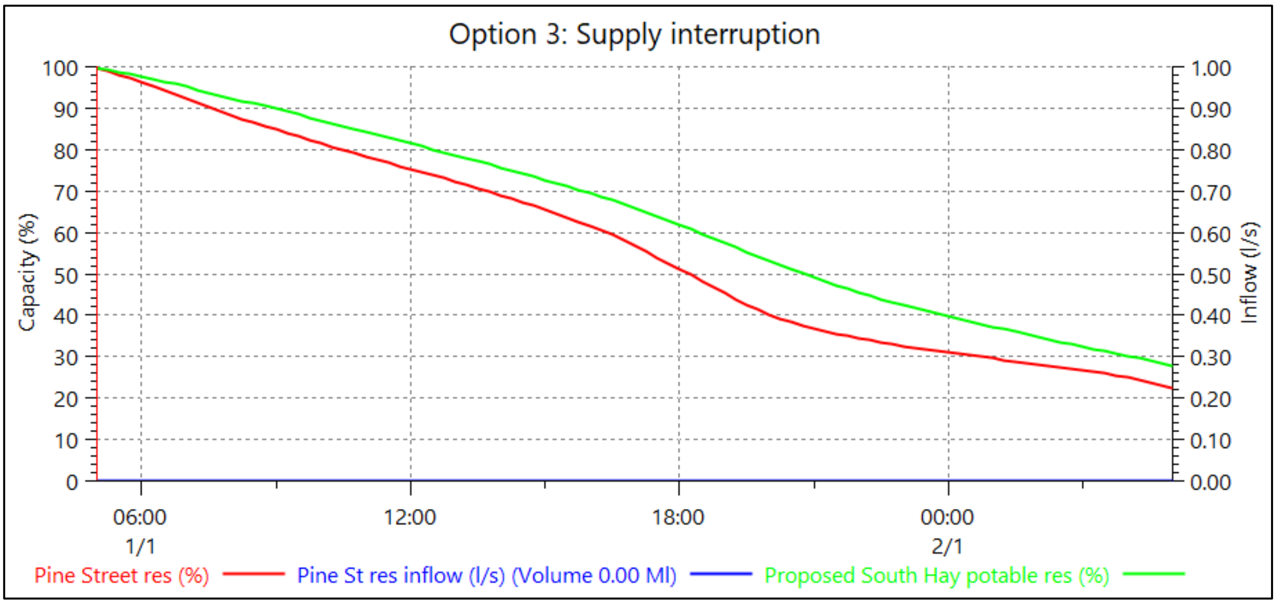
Appendix Figure G.5-7: Potable WSS Upgrade Option 3 - Pressure contours (L: minimum pressure and R: maximum pressure)

Option 3 will allow future development zones access to potable water and improved water security from the 1,000 kL reservoir in South Hay. Compared to Option 1 (both are essentially gravity supply systems) the minimum pressures at South Hay is slightly improved. However, these pressures still fall under the LOS requirements. The lowest pressure identified in the system is 18.4m.

Supply reliability – interruption to customers

For Option 3 supply reliability assessment, the same modelling parameters were used as the existing system reliability assessment, refer to Appendix G.4.1.

The effects of the supply interruption on Pine St reservoir and the proposed South Hay potable reservoir are given in Appendix Figure G.5-8.



Appendix Figure G.5-8: Potable WSS Upgrade Option 3 – Reservoir drawdown caused by supply interruption

With the additional 1,000 kL capacity at South Hay, this provides more reliability for the existing Pine St reservoir. Both of the reservoirs in the system does not deplete for the duration of the peak day simulation. Regarding the LOS, the Hay potable water supply scheme will maintain continuous supply for more than 8 hours in the event of a supply interruption.

Preliminary capital costs

The preliminary estimated capital cost for the proposed upgrades in Option 3 is $5.2 million as given below.

Appendix Table G.5-4: Potable WSS Upgrade Option 3 - Preliminary capital cost

ITEM	DESCRIPTION	[UNIT]	[QTY]	[RATE]	AMT
				$ / Unit	$K
Reticulation pipelines					
	Upgrade existing pipelines				
	DN100	m	16019.70	104.09	$ 1,667,414
	DN150	m	6299.54	153.39	$ 966,279
	DN200	m	1020.57	208.17	$ 212,453
	Connections to existing pipelines	Nos	8.00	4930.35	$ 39,443
Reservoir					
	1 ML concrete reservoir (inc excavation, roofing, restoration, pipework and valves)	item	1	$ 591,642	$ 591,642
Extras					
	misc valves (air valves, scour valves, NRV)	item	27	$ 500	$ 13,500
Prime Costs					**$3,490,731**
	General Contingency	% of Prime Cost	30%		$1,047,219
Direct Costs					**$4,537,950**
	Design & Preconstruction Activities	% of Direct Cost	10%		$453,795
	Construction Activities	% of Direct Cost	10%		$453,795
TOTAL CAPITAL COST					**$5,445,540**

G.6 Summary of outcomes

Current system and demands

The existing Potable WSS provides pressures above the minimum service levels. Maximum pressures can be achieved when the pumps are not operating.

It is recommended that Council review their LOS targets to align with other water guidelines. Notably maximum pressures given for planning water supply in WSA-03 is between 50-60 m. In which case, all of the above pressure issues are within the 50 m.

Future system and demands

Option 1 of this study will ensure potable water access to the existing and future customers in the development zones. Pipeline selections were chosen to meet the design basis of WSA03, as such some pipelines could not be increased further to reduce head losses. Some customers on the edges of town experienced peak day minimum pressures below Council's LOS target of 25m; the lowest minimum pressure was 22.3m. The capital cost of Option 1 was estimated to be around $4.5M.

Option 2 assessed the effect of a booster pump station which boosts water to the south of Hay. Pipe upgrades were the same as for Option 1. The CWPs were also upgraded to boost capacity. With the proposed infrastructure, the system will be able to provide peak day minimum pressures that meet Council's LOS target of 25m. The capital cost of Option 2 was estimated to be around $4.8M.

Option 3 assessed the effect of a new reservoir in the south of Hay. Pipe upgrades were the same as for Option 1. With the proposed infrastructure, the system still will not be able to provide peak day minimum pressures that meet Council's LOS target of 25m, the lowest minimum pressure was 18.4m. The capital cost of Option 3 was estimated to be around $5.4M.

Appendix H 30-year Capital Works Programs

Appendix Table H-1: 30-year Capital Works Program for Water Supply

CAPITAL WORKS IN 2021/22 $('000)					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	SUBSIDY	ILOS	GROWTH	RENEW	Total	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46	2046/47	2047/48	2048/49	2049/50	2050/51
Reservoirs - Cleaning		100%			80	20	20	20	20	0	0	0	0	0	0	0																			
Upgrade confind space accesses - multiple sites (5) -		100%			50	50	0	0	0	0	0	0	0	0	0	0																			
Various locations - Install fire hydrants to improve coverage		100%			275	25	25	25	25	25	25	25	25	25	25	25																			
On-going valve replacemt -				100%	180	20	20	20	20	20	20	20	20	0	0	20																			
Various streets - Replace old water mains: Keeble Street (Edward to George) - 100 dia raw wate				100%	1,705	137	140	143	147	151	155	158	162	166	171	175																			
FILTERED WATER SUPPLY:																																			
Filtered Water River Intake Murray St																																			
Murray St intake platform - Replace walkway				100%	25	25	0	0	0	0	0	0	0	0	0	0																			
Renewals				100%	150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150	0	0	0	0	0	0
FW Intake Pump Station Murray St																																			
Renewals				100%	360	0	0	0	0	0	0	15	0	0	0	0	0	95	0	0	0	50	0	0	0	0	0	0	0	0	0	0	200	0	0
Water Treatment Plant 2.2ML/d Cadell St																																			
WTP Upgrades - Performance		100%			362	0	85	117	0	0	161	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WTP Upgrades - Monitoring and Control		100%			187	0	0	0	0	0	187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WTP Upgrades - Operational convenience		100%			380	0	0	0	29	0	0	58	61	67	102	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WTP Upgrades - Regulatory		100%			1,301	0	10	26	0	0	0	0	0	0	0	0	0	0	0	0	242	0	1022	0	0	0	0	0	0	0	0	0	0	0	0
WTP Upgrades - Renewals				100%	273	0	10	0	0	0	0	0	0	0	0	0	263	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WTP Upgrades - Renewals (Provisional items relating to filter)				100%	503	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76	0	190	0	237	0	0	0	0	0	0	0	0	0	0	0
Renewals				100%	720	0	0	0	0	0	0	0	0	0	290	0	0	0	0	0	0	150	5	0	0	0	50	0	225	0	0	0	0	0	0
New Water bore - For alternative town water supply source						0	0	0	0	0	0	0	0	0	0	0																			
Alternative water supply - bore and pipeline to WTP		100%			300	0	0	300																											
2.3 ML Filtered Water Resevoir Pine St																																			
Reservoir-Filtered water, Pine St - Roof replacement				100%	115	0	0	0	0	0	0	0	0	0	0	115																			
Renewals				100%	35	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0
Distribution																																			
New pipelines to service development zones			100%		3,860	$0	$0	$0		$0	$0	$0	$643	$0	$0	$0	$643	$0	$0	$0	$643	$0	$0	$0	$643	$0	$0	$0	$643	$0	$0	$0	$643	$0	$0
South Hay boosters pump (civil and mechanical)			100%		137	$0	$0	$0	$137	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Clear water pump (CWP) upgrade			100%		138	$0	$0	$0	$138	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
RAW WATER SUPPLY:																																			
Raw Water River Intake Leonard St																																			
Leonard St intake - Rehabilitate platform				100%	50	0	50	0	0	0	0	0	0	0	0	0																			
- Dredge out the intake area				100%	60	60	0	0	0	0	0	0	0	0	0	0																			
Renewals				100%	185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	185	0	0	0	0	0	0
RW Intake Pump Station Leonard St																																			
Leonard St Pump Station - Improvement to hardstand area for loading ar		100%			-	0	0	0	0	0	0	0	0	0	0	0																			
Renewals				100%	560	0	0	0	0	0	0	15	0	0	0	0	0	205	0	0	0	80	0	0	0	0	0	0	0	0	0	0	260	0	0
1 ML Raw Water Resevoir Lang St																																			
Reservoir- Lang St - Inspection				100%	10	10	0	0	0	0	0	0	0	0	0	0																			
Reservoir- Lang St - Repainting				100%	400	0	0	0	0	0	0	0	400	0	0	0																			
Renewals				100%	25	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0
2.3 ML Raw Water Resevoir Leonard St																																			
Reservoir-Raw water, Leonard St - Roof Installation				100%	110	0	0	0	0	0	0	0	0	110	0	0																			
Renewals				100%	25	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
5.9 ML Raw Water Resevoir Pine St																																			
Renewals				100%	35	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0
Raw Water Main																																			
Renewals				100%	-	0	0	0	0	0	0	0	0	0	0	0	0												0	0					0
Pipeline replacement/ upgrade			100%		2,628		$0	$0	$375	$0	$0	$0	$375	$0	$0	$0	$375	$0	$0	$0	$375	$0	$0	$0	$375	$0	$0	$0	$375	$0	$0	$0	$375	$0	$0
New pipelines to service development zones			100%		2,054		$0	$0		$0	$0	$0	$342	$0	$0	$0	$342	$0	$0	$0	$342	$0	$0	$0	$342	$0	$0	$0	$342	$0	$0	$0	$342	$0	$0
South Hay boosters pump (civil and mechanical)			100%		137	$0	$0	$0	$137	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
GRAND TOTAL					**17,564**	**347**	**375**	**667**	**1043**	**211**	**562**	**307**	**2045**	**399**	**603**	**411**	**1669**	**300**	**0**	**76**	**1603**	**470**	**1037**	**237**	**1361**	**0**	**50**	**50**	**1921**	**0**	**0**	**0**	**1821**	**0**	**0**
Expected Subsidy / Contribution on Projects					**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**																							

Appendix Table H-2: 30-year Capital Works Program for Sewerage

CAPITAL WORKS IN 2021/22$('000)					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
	SUBSIDY	ILOS	GROWTH	RENEW	Total	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46	2046/47	2047/48	2048/49	2049/50	2050/51
Sewerage																																			
Various Pumps Stations																																			
Various sewage pump stations - Service All Pumps/Detail Report				100%	50	50	0	0	0	0	0	0	0	0	0																				
Various sewage pump stations - Provision to upgade metal & pipework				100%	108	0	12	12	12	12	12	12	12	12	12																				
Sewerage Pump Station PS 1 Council Depot																																			
Depot pump stn - Rehabilitate the internal well to strengthen the wall (including investigation)				100%	250	0	0	0	250	0	0	0	0	0	0																				
Renewals				100%	380	0	0	0	0	0	0	30	0	0	0	0	0	110	0	0	0	50	0	0	0	0	0	190	0	0	0	0	0	0	0
Sewerage Pump Station PS 2 Hospital (aka POW Camps)																																			
Hospital pump stn - Replace the Rising main No 2				100%	40	0	0	40	0	0	0	0	0	0	0																				
Hospital pump stn - Repace both pumps				100%	20	0	0	20	0	0	0	0	0	0	0																				
Hospital pump stn - Upgrade electricals				100%	20	0	0	20	0	0	0	0	0	0	0																				
Renewals				100%	130	0	0	0	0	0	0	15	0	0	0	0	0	40	0	0	0	15	0	0	0	0	0	60	0	0	0	0	0	0	0
Sewerage Pump Station PS 3 Queen St																																			
Queen St pump station - Replace both pumps and undertake accessory works				100%	-	0	0	0	0	0	0	0	0	0	0																				
Queen St pump station - Rehabilitate the internal well to strengthen the wall (including investigation)				100%	-	0	0	0	0	0	0	0	0	0	0																				
Renewals				100%	280	0	0	0	0	0	0	15	0	0	0	0	0	90	0	0	0	35	0	0	0	0	0	140	0	0	0	0	0	0	0
Sewerage Pump Station PS 4 Lang St																																			
Sewage pump St Corner- Lang St - Upgrade electricals				100%	-	0	0	0	0	0	0	0	0	0	0																				
Renewals				100%	125	0	0	0	0	0	0	15	0	0	0	0	0	60	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0
Sewerage Pump Station PS 5 Russell St																																			
Russell St pump station - Upgrade electricals				100%	18	0	18	0	0	0	0	0	0	0	0																				
Renewals				100%	45	0	0	0	0	0	0	15	0	0	0	0	0	15	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0
Sewerage Pump Station PS 6 Pal Richards Park (aka Kebel St)																																			
Pal Richards pump station - Upgrade electricals				100%	20	0	20	0	0	0	0	0	0	0	0																				
Renewals				100%	45	0	0	0	0	0	0	15	0	0	0	0	0	15	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0
Sewerage Pump Station PS 7 Stephen St (aka Meakes St)																																			
Stephen St pump station - Replace both pumps and upgrade electricals				100%	250	0	25	0	0	225	0	0	0	0	0																				
Renewals				100%	23	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0
Sewerage Pump Station PS 8 Bourke St (aka Rodeo Club)																																			
Rodeo pump Station - Replace both pumps				100%	10	0	0	0	0	0	0	10	0	0	0																				
Renewals				100%	35	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	5	0	0	0	0	15	0	0	0	0	0	0	0
Sewerage Pump Station PS 9 Sandy Point Ablution Block																																			
Sandy point pump station - Replace both pumps				100%	20	20	0	0	0	0	0	0	0	0	0																				
Renewals				100%	19	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	10	0	0	0	0	5	0	0	0	0	0	0	0
Sewage Treatment Plant 3000 EP																																			
Sewage Treatment Plant - Install a system to re-use water		100%			100	0	0	0	0	0	100	0	0	0	0																				
New reuse scheme	90%	100%				0	0	0	0	0	3000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Renewals - Catch/Balance Pond				100%	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
Renewals - Compressed Air				100%	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
Renewals - IDEA Tank				100%	335	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	335
Renewals - Inlet Works				100%	420	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	420
Renewals - Site Services				100%	1,075	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1075
Renewals - Sludge Lagoon 1				100%	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25
Renewals - WasteWater PS				100%	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15
Sewer Mains																																			
Various sewer mains & manholes - Renewal & upgrade, reline, camera inspections				100%	1,620	180	180	180	180	180	180	180	180	180	0																				
Renewals - Rising Main 1				100%	329	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	329	0	0	0	0	0	0	0	0	0	0	0	0	0
Renewals - Rising Main 2				100%	49	0	0	0	0	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New subdivisions																																			
East Hay new subdivision- pump station - Replace both pumps			100%		10	0	10	0	0	0	0	0	0	0	0																				
Bishops Lodge Subdivision - Sewermain extension			100%		50	50	0	0	0	0	0	0	0	0	0																				
GRAND TOTAL					**8,940**	**300**	**265**	**272**	**442**	**466**	**3,292**	**307**	**192**	**211**	**12**	**-**	**-**	**330**	**15**	**-**	**-**	**509**	**15**	**-**	**-**	**-**	**-**	**410**	**-**	**-**	**-**	**8**	**-**	**-**	**1,895**
Expected Subsidy / Contribution on Projects					0	0	0	0	0	0	2700	0																							

Appendix I Financial Model Input and Output Data – Water Supply

Hay SC IWCM Supplementary - Water Fund Model : IWCM Base Case

FINMOD
DEPARTMENT OF COMMERCE

Historical Operating Statement

	2019/20*	2020/21*
EXPENSES		
Management Expenses	*348*	*555*
Administration	324	332
Engineering and Supervision	24	223
Operation and Maintenance Expenses	*538*	*483*
Operation Expenses	95	137
Maintenance Expenses	285	218
Energy Costs	92	82
Chemical Costs	41	20
Purchase of Water	25	26
Depreciation	*442*	*446*
System Assets	442	446
Plant & Equipment		
Interest Expenses		
Other Expenses	13	5
TOTAL EXPENSES	**1341**	**1489**
REVENUES		
Rates & Service Availability Charges	*685*	*687*
Residential	599	601
Non-Residential	86	86
User Charges	*505*	*508*
Sales of Water : Residential	430	407
Sales of Water : Non-Residential	75	101
Extra Charges	10	5
Interest Income	11	3
Other Revenues		1
Grants	*12*	*105*
Grants for Acquisition of Assets		
Pensioner Rebate Subsidy	12	11
Other Grants		94
Contributions	*0*	*0*
Developer Charges		
Developer Provided Assets		
Other Contributions		
TOTAL REVENUES	**1223**	**1309**
OPERATING RESULT	**-118**	**-180**
OPERATING RESULT (less Grants for Acq of Assets)	**-118**	**-180**

Hay SC IWCM Supplementary - Water Fund Model : IWCM Base Case

Historical Statement of Financial Position

FINMOD
DEPARTMENT OF COMMERCE

	2019/20*	2020/21*
Cash and Investments	2697	2693
Receivables	207	336
Inventories	4	4
Property, Plant & Equipment	*11094*	*16919*
System Assets (1)	11094	16919
Plant & Equipment		
Other Assets		
TOTAL ASSETS	**14002**	**19952**
LIABILITIES		
Bank Overdraft		
Creditors		
Borrowings		
Provisions		
TOTAL LIABILITIES	**0**	**0**
NET ASSETS COMMITTED	**14002**	**19952**
EOUITY		
Accumulated Operating Result	7364	7183
Asset Revaluation Reserve	6638	12769
TOTAL EQUITY	**14002**	**19952**

(1) Notes to System Assets

	2019/20*	2020/21*
Current Replacement Cost	25698	26400
Less: Accumulated Depreciation	14604	9481
Written Down Current Cost	11094	16919

Hay SC IWCM Supplementary - Water Fund Model : IWCM Base Case

FINMOD
DEPARTMENT OF COMMERCE

Base Forecast Data

	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
Financial Data																									
Inflation Rate - General (%)	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Inflation Rate - Capital Works (%)	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Borrowing Interest Rate for New Loans (%)	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Investment Interest Rate (%)	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Number of Assessments																									
Growth Rate (%)																									
Residential Assessments	7.92	7.34	6.84	6.40	6.02	0.49	0.49	0.48	0.48	0.48	0.48	0.47	0.47	0.47	0.47	0.47	0.46	0.46	0.46	0.46	0.45	0.45	0.45	0.45	0.45
Non-Residential Assessments	0.50	0.50	0.50	0.50	0.49	18.63	15.70	13.57	11.95	10.67	9.64	8.80	8.09	7.48	6.96	6.51	6.11	5.76	5.44	5.16	4.91	4.68	4.47	4.28	4.10
Total Assessments	6.85	6.41	6.02	5.68	5.37	2.50	2.44	2.38	2.32	2.27	2.22	2.17	2.12	2.08	2.04	2.00	1.96	1.92	1.88	1.85	1.82	1.78	1.75	1.72	1.69
Number of New Assessments																									
Residential	93	93	93	93	93	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Non-Residential	1	1	1	1	1	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38
Total New Assessments	94	94	94	94	94	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46
Projected Number of Assessments																									
Residential	1267	1360	1453	1546	1639	1647	1655	1663	1671	1679	1687	1695	1703	1711	1719	1727	1735	1743	1751	1759	1767	1775	1783	1791	1799
Non-Residential	200	201	202	203	204	242	280	318	356	394	432	470	508	546	584	622	660	698	736	774	812	850	888	926	964
Total Projected Assessments	1467	1561	1655	1749	1843	1889	1935	1981	2027	2073	2119	2165	2211	2257	2303	2349	2395	2441	2487	2533	2579	2625	2671	2717	2763
Backlog Assessments																									
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Backlog Assessments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Developer Charges / Vacant Assessments (Values in 2021/22 $)																									
Developer Charges $/Assessment																									
Residential	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931
Non-Residential	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931	1931
Number of Vacant Residential Assessments	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Average Charge of Vacant Assessments	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
% of Occupied Assessments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Depreciation of Existing Plant and Equipment (Values in 2021/22 $'000)																									
Current Replacement Cost of System Assets	27060																								
Override																									
Written Down Current Cost of System Assets	17342																								
Override																									
Annual Depreciation of Existing System Assets	457																								
Override																									
Written Down Value of Plant and Equipment	0																								
Override																									
Annual Depreciation of Existing Plant and Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Hay SC IWCM Supplementary - Water Fund Model : IWCM Base Case

Base Forecast Data

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	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
Existing Loan Payments (Values in Inflated $'000)																									
Existing Loan Payments : Principal (Total:0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Loan Payments : Interest (Total:0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capital Works Program (Values in 2021/22 $'000)																									
Subsidised Scheme (Total:3082)	95	155	503	89	40	387	98	101	107	142	101	0	0	0	0	242	0	1022	0	0	0	0	0	0	0
Other New System Assets (Total:8953)	0	0	0	787	0	0	0	1361	0	0	0	1361	0	0	0	1361	0	0	0	1361	0	0	0	1361	0
Renewals (Total:5526)	252	220	163	167	171	175	208	582	291	461	310	308	300	0	76	0	470	15	237	0	0	50	50	560	0
Total Capital Works (Total:17561)	347	375	666	1043	211	562	306	2044	398	603	411	1669	300	0	76	1603	470	1037	237	1361	0	50	50	1921	0
Grant For Acquisition of Assets (% of Subsidised Scheme)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grant For Acquisition of Assets ($) (Total:0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Developer Provided Assets (Total:0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plant and Equipment Expenditure / Asset Disposal (Values in 2021/22 $'000)																									
Plant and Equipment Expenditure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Proceeds from Disposal of Plant and Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Written Down Value of Plant and Equipment Disposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gain/Loss on Disposal of Plant and Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Proceeds from Disposal of Assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Written Down Value of Assets Disposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gain/Loss on Disposal of System Assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Hay SC IWCM Supplementary - Water Fund Model : IWCM Base Case

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	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
OMA / Revenue Overrides (Values in 2021/22 $'000)																									
Administration	364	387	410	433	456	467	478	489	500	511	522	533	544	555	566	577	588	599	610	621	632	643	654	665	676
Override																									
Engineering and Supervision	244	260	276	292	308	316	324	332	340	348	356	364	372	380	388	396	404	412	420	428	436	444	452	460	468
Override	31	32	34	36	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58
Operating Expenses	150	160	170	180	190	195	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290
Override																									
Maintenance Expenses	239	254	269	284	299	306	313	320	327	334	341	348	355	362	369	376	383	390	397	404	411	418	425	432	439
Override																									
Energy Costs	90	96	102	108	114	117	120	123	126	129	132	135	138	141	144	147	150	153	156	159	162	165	168	171	174
Override																									
Chemical Costs	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
Override																									
Purchase of Water	28	30	32	34	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
Override																									
Other Expenses	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Override																									
Other Revenue	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Override																									
Other Grants	103	110	117	124	131	134	137	140	143	146	149	152	155	158	161	164	167	170	173	176	179	182	185	188	191
Override	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Contributions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Override																									
Developer Charges Overrides (Values in 2021/22 $'000)																									
Calculated from Scheme Data	182	182	182	182	182	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89	89
Override	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Pensioner Rebate (Values in Inflated $)																									
Pensioner Rebate per Pensioner ($)	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50
Override																									
Pensioner Rebate Subsidy (%)	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00
Override																									
Number of Pensioner Assessments	247	265	283	302	320	321	323	324	326	328	329	331	332	334	335	337	338	340	342	343	345	346	348	349	351
Override																									
Percentage of Pensioners (%)	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51	19.51
Override																									
Pensioner Rebate	22	23	25	26	28	28	28	28	29	29	29	29	29	29	29	29	30	30	30	30	30	30	30	31	31
Pensioner Rebate Subsidy	12	13	14	14	15	15	15	15	16	16	16	16	16	16	16	16	17	17	17	17	17	17	17	17	17
Revenue Split (%)																									
Residential Rates	50.53	50.99	51.40	51.76	52.09	51.03	50.02	49.05	48.13	47.25	46.41	45.62	44.85	44.11	43.40	42.73	42.08	41.46	40.85	40.28	39.72	39.18	38.67	38.16	37.69
Override																									
Non-Residential Rates	6.74	6.37	6.04	5.75	5.48	6.34	7.15	7.93	8.67	9.38	10.05	10.69	11.31	11.90	12.47	13.01	13.54	14.04	14.52	14.99	15.43	15.87	16.28	16.69	17.07
Override																									
Sales of Water: Residential	35.24	35.56	35.85	36.11	36.34	35.59	34.89	34.21	33.57	32.96	32.38	31.82	31.28	30.77	30.28	29.81	29.35	28.92	28.50	28.09	27.71	27.33	26.97	26.62	26.28
Override																									
Sales of Water: Non-Residential	6.90	6.52	6.18	5.88	5.61	6.49	7.32	8.12	8.87	9.59	10.28	10.94	11.57	12.18	12.76	13.32	13.85	14.36	14.86	15.33	15.79	16.24	16.66	17.07	17.47
Override																									
Extra Charges	0.59	0.56	0.53	0.50	0.48	0.55	0.62	0.69	0.76	0.82	0.88	0.93	0.99	1.04	1.09	1.13	1.18	1.22	1.27	1.31	1.35	1.38	1.42	1.46	1.49
Override																									
Total Non-Residential Revenue (%)	13.64	12.89	12.22	11.63	11.09	12.83	14.47	16.05	17.54	18.97	20.33	21.63	22.88	24.08	25.23	26.33	27.39	28.40	29.38	30.32	31.22	32.11	32.94	33.76	34.54
Total Residential Revenue (%)	85.77	86.55	87.25	87.87	88.43	86.62	84.91	83.26	81.70	80.21	78.79	77.44	76.13	74.88	73.68	72.54	71.43	70.38	69.35	68.37	67.43	66.51	65.64	64.78	63.97
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Hay SC IWCM Supplementary - Water Fund Model : IWCM Base Case

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	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
New Loan Payment Overrides (Values in Inflated $'000)																									
Standard Loan Payments: Principal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Standard Loan Payments: Interest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Structured Loan Payments: Principal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Structured Loan Payments: Interest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capitalised Interest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total New Loan Payments: Principal Override	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total New Loan Payments: Interest Override	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capitalised Interest Override	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Hay SC IWCM Supplementary - Water Fund Model : IWCM Base Case

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Operating Statement

	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
EXPENSES																									
Management Expenses	*395*	*420*	*444*	*469*	*494*	*506*	*517*	*530*	*542*	*554*	*566*	*578*	*590*	*602*	*614*	*626*	*638*	*650*	*662*	*674*	*686*	*698*	*710*	*722*	*734*
Administration	364	387	410	433	456	467	478	489	500	511	522	533	544	555	566	577	588	599	610	621	632	643	654	665	676
Engineering and Supervision	31	32	34	36	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58
Operation and Maintenance Expenses	*529*	*563*	*598*	*631*	*666*	*682*	*698*	*715*	*734*	*750*	*768*	*783*	*801*	*818*	*834*	*853*	*869*	*886*	*903*	*921*	*936*	*954*	*971*	*988*	*1005*
Operation Expenses	150	160	170	180	190	195	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290
Maintenance Expenses	239	254	269	284	299	306	313	320	327	334	341	348	355	362	369	376	383	390	397	404	411	418	425	432	439
Energy Costs	90	96	102	108	114	117	120	123	126	129	132	135	138	141	144	147	150	153	156	159	162	165	168	171	174
Chemical Costs	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
Purchase of Water	28	30	32	34	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
Depreciation	*459*	*461*	*470*	*485*	*486*	*492*	*494*	*518*	*520*	*523*	*524*	*547*	*547*	*547*	*547*	*574*	*574*	*591*	*591*	*613*	*613*	*613*	*613*	*636*	*636*
System Assets	459	461	470	485	486	492	494	518	520	523	524	547	547	547	547	574	574	591	591	613	613	613	613	636	636
Plant & Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest Expenses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Expenses	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
TOTAL EXPENSES	**1388**	**1449**	**1517**	**1590**	**1651**	**1686**	**1715**	**1768**	**1801**	**1832**	**1862**	**1914**	**1944**	**1972**	**2001**	**2058**	**2086**	**2132**	**2160**	**2213**	**2240**	**2269**	**2299**	**2351**	**2380**
REVENUES																									
Rates & Service Availability Charges	*700*	*774*	*850*	*930*	*1014*	*1068*	*1092*	*1116*	*1138*	*1163*	*1186*	*1210*	*1234*	*1258*	*1282*	*1304*	*1330*	*1353*	*1376*	*1400*	*1424*	*1447*	*1471*	*1495*	*1518*
Residential	618	688	760	837	918	949	955	961	964	970	975	981	986	991	996	1000	1006	1011	1015	1020	1025	1030	1035	1040	1045
Non-Residential	82	86	89	93	96	118	136	156	174	193	211	229	248	267	286	304	323	342	361	380	399	417	436	455	473
User Charges	*515*	*567*	*622*	*678*	*738*	*784*	*806*	*829*	*851*	*874*	*896*	*918*	*941*	*965*	*987*	*1009*	*1032*	*1054*	*1078*	*1100*	*1123*	*1146*	*1168*	*1191*	*1213*
Sales of Water : Residential	431	479	530	583	640	663	667	670	673	677	680	684	687	691	694	697	701	705	708	712	715	719	722	725	729
Sales of Water : Non-Residential	84	88	91	95	99	121	140	159	178	197	216	235	254	273	292	311	331	350	369	388	408	427	446	465	484
Extra Charges	7	8	8	8	8	11	12	13	16	17	19	20	22	23	25	26	28	30	31	33	35	36	38	40	41
Interest Income	68	67	64	54	53	57	63	50	42	46	51	42	42	55	69	62	62	61	68	64	73	85	98	86	95
Other Revenues	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Grants	*12*	*13*	*13*	*13*	*14*	*13*	*13*	*13*	*13*	*13*	*12*	*12*	*12*	*12*	*11*	*11*	*11*	*11*	*11*	*11*	*10*	*10*	*10*	*10*	*9*
Grants for Acquisition of Assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pensioner Rebate Subsidy	12	13	13	13	14	13	13	13	13	13	12	12	12	12	11	11	11	11	11	11	10	10	10	10	9
Other Grants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Contributions	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*	*60*
Developer Charges	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Developer Provided Assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Contributions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL REVENUES	**1363**	**1490**	**1617**	**1744**	**1887**	**1994**	**2047**	**2081**	**2121**	**2173**	**2225**	**2264**	**2312**	**2374**	**2434**	**2473**	**2524**	**2570**	**2626**	**2669**	**2725**	**2786**	**2845**	**2882**	**2938**
OPERATING RESULT	**-25**	**41**	**100**	**154**	**236**	**308**	**332**	**313**	**320**	**341**	**362**	**350**	**368**	**402**	**433**	**416**	**439**	**438**	**465**	**456**	**486**	**517**	**546**	**531**	**558**
OPERATING RESULT (less Grants for Acq of Assets)	**-25**	**41**	**100**	**154**	**236**	**308**	**332**	**313**	**320**	**341**	**362**	**350**	**368**	**402**	**433**	**416**	**439**	**438**	**465**	**456**	**486**	**517**	**546**	**531**	**558**

Hay SC IWCM Supplementary - Water Fund Model : IWCM Base Case

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Cashflow Statement

	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
Cashflow From Operating Activities																									
Receipts																									
Rates and Charges	1222	1348	1479	1616	1760	1862	1910	1958	2005	2054	2101	2148	2197	2246	2293	2339	2390	2437	2485	2533	2581	2629	2677	2725	2773
Interest Income	68	67	64	54	53	57	63	50	42	46	51	42	42	55	69	62	62	61	68	64	73	85	98	86	95
Other Revenues	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Grants	12	13	13	13	14	13	13	13	13	13	12	12	12	12	11	11	11	11	11	11	10	10	10	10	9
Contributions	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Total Receipts from Operations	**1363**	**1490**	**1617**	**1744**	**1887**	**1994**	**2047**	**2081**	**2121**	**2173**	**2225**	**2264**	**2312**	**2374**	**2434**	**2473**	**2524**	**2570**	**2626**	**2669**	**2725**	**2786**	**2845**	**2882**	**2938**
Payments																									
Management	395	420	444	469	494	506	517	530	542	554	566	578	590	602	614	626	638	650	662	674	686	698	710	722	734
Operations (plus WC Inc)	561	595	631	665	700	705	722	739	758	774	792	808	825	843	860	878	895	912	929	948	963	981	999	1016	1033
Interest Expenses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Expenses	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Total Payments from Operations	**961**	**1020**	**1080**	**1138**	**1199**	**1216**	**1244**	**1274**	**1304**	**1333**	**1362**	**1391**	**1421**	**1450**	**1479**	**1509**	**1538**	**1567**	**1596**	**1627**	**1654**	**1684**	**1714**	**1743**	**1773**
Net Cash from Operations	**402**	**470**	**537**	**605**	**688**	**778**	**803**	**808**	**817**	**840**	**862**	**873**	**891**	**923**	**955**	**964**	**986**	**1003**	**1030**	**1042**	**1072**	**1102**	**1131**	**1139**	**1165**
Cashflow from Capital Activities																									
Receipts																									
Proceeds from Disposal of Assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Payments																									
Acquisition of Assets	347	376	665	1044	211	562	306	2044	398	603	411	1669	300	0	76	1603	470	1037	237	1361	0	50	50	1921	0
Net Cash from Capital Activities	**-347**	**-376**	**-665**	**-1044**	**-211**	**-562**	**-306**	**-2044**	**-398**	**-603**	**-411**	**-1669**	**-300**	**0**	**-76**	**-1603**	**-470**	**-1037**	**-237**	**-1361**	**0**	**-50**	**-50**	**-1921**	**0**
CashFlow from Financing Activities																									
Receipts																									
New Loans Required	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Payments																									
Principal Loan Payments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Cash from Financing Activities	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL NET CASH	**55**	**95**	**-128**	**-438**	**477**	**216**	**497**	**-1237**	**419**	**237**	**452**	**-796**	**591**	**923**	**879**	**-639**	**516**	**-34**	**792**	**-319**	**1072**	**1052**	**1081**	**-782**	**1165**
Current Year Cash	55	95	-128	-438	477	216	497	-1237	419	237	452	-796	591	923	879	-639	516	-34	792	-319	1072	1052	1081	-782	1165
Cash & Investments @Year Start	2693	2681	2708	2517	2028	2443	2594	3015	1735	2101	2281	2666	1824	2356	3200	3979	3258	3682	3559	4245	3831	4783	5692	6608	5684
Cash & Investments @Year End	2748	2776	2579	2078	2504	2659	3090	1778	2154	2338	2733	1870	2415	3280	4079	3340	3774	3648	4352	3926	4902	5835	6773	5826	6850
Capital Works Funding:																									
nternal Funding for New Works ($'000)	95	155	503	877	40	387	98	1462	107	142	101	1361	0	0	0	1603	0	1022	0	1361	0	0	0	1361	0
Internal Funding for Renewals	252	220	163	167	171	175	208	582	291	461	310	308	300	0	76	0	470	15	237	0	0	50	50	560	0
New Loans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Capital Works	**347**	**376**	**665**	**1044**	**211**	**562**	**306**	**2044**	**398**	**603**	**411**	**1669**	**300**	**0**	**76**	**1603**	**470**	**1037**	**237**	**1361**	**0**	**50**	**50**	**1921**	**0**

Hay SC IWCM Supplementary - Water Fund Model : IWCM Base Case

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Statement of Financial Position

	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
Cash and Investments	2748	2708	2455	1930	2269	2350	2664	1496	1768	1872	2135	1425	1796	2379	2887	2306	2543	2398	2790	2456	2992	3474	3935	3302	3787
Receivables	368	391	415	438	462	474	485	497	509	520	532	543	555	567	578	590	602	613	624	636	647	659	671	682	694
Inventories	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2
Property, Plant & Equipment	*17230*	*17144*	*17339*	*17899*	*17623*	*17694*	*17506*	*19033*	*18911*	*18991*	*18878*	*19999*	*19752*	*19205*	*18734*	*19763*	*19659*	*20106*	*19752*	*20500*	*19888*	*19326*	*18763*	*20048*	*19413*
System Assets (1)	17230	17144	17339	17899	17623	17694	17506	19033	18911	18991	18878	19999	19752	19205	18734	19763	19659	20106	19752	20500	19888	19326	18763	20048	19413
Plant & Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL ASSETS	**20350**	**20248**	**20213**	**20270**	**20358**	**20521**	**20660**	**21029**	**21191**	**21387**	**21548**	**21971**	**22105**	**22154**	**22201**	**22661**	**22806**	**23119**	**23170**	**23596**	**23530**	**23461**	**23371**	**24035**	**23896**
LIABILITIES																									
Bank Overdraft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Creditors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borrowings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Provisions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL LIABILITIES	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
NET ASSETS COMMITTED	**20350**	**20248**	**20213**	**20270**	**20358**	**20521**	**20660**	**21029**	**21191**	**21387**	**21548**	**21971**	**22105**	**22154**	**22201**	**22661**	**22806**	**23119**	**23170**	**23596**	**23530**	**23461**	**23371**	**24035**	**23896**
EOUITY																									
Accumulated Operating Result	7158	7024	6953	6938	7005	7142	7300	7435	7574	7730	7904	8061	8233	8434	8661	8866	9088	9305	9543	9766	10014	10286	10582	10855	11148
Asset Revaluation Reserve	13192	13623	14062	14518	14999	15486	15987	16495	17061	17637	18230	18834	19490	20154	20816	21478	22194	22924	23689	24459	25279	26094	26905	27713	28598
TOTAL EQUITY	**20350**	**20315**	**20337**	**20419**	**20593**	**20830**	**21086**	**21312**	**21577**	**21853**	**22145**	**22415**	**22725**	**23054**	**23393**	**23695**	**24038**	**24370**	**24732**	**25066**	**25441**	**25822**	**26210**	**26559**	**26959**
(1) Notes to System Assets																									
Current Replacement Cost	27155	27310	27813	28690	28730	29117	29215	30678	30785	30927	31028	32389	32389	32389	32388	33991	33991	35013	35013	36374	36375	36375	36374	37736	37736
Less: Accumulated Depreciation	9925	10166	10474	10791	11106	11423	11709	11645	11874	11936	12150	12389	12637	13184	13655	14228	14332	14908	15261	15874	16486	17049	17612	17688	18323
Written Down Current Cost	17230	17144	17339	17899	17623	17694	17506	19033	18911	18991	18878	19999	19752	19205	18734	19763	19659	20106	19752	20500	19888	19326	18763	20048	19413

Hay SC IWCM Supplementary - Water Fund Model : IWCM Base Case

Performance Indicators

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	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
Typical Residential Bills	850	880	910	940	970	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Average Residential Bills (2021/22$)	828	858	888	918	950	978	980	980	980	981	981	982	982	983	983	983	984	984	984	985	985	985	986	985	986
Mgmnt Cost / Assessment (2021/22$)	269	268	268	268	268	268	267	268	268	267	267	267	267	267	267	267	266	266	266	266	266	266	266	266	266
OMA Cost per Assessment (2021/22$)	611	610	610	609	610	609	609	609	609	609	609	609	610	609	609	610	609	609	609	609	609	609	609	609	609
Operating Sales Margin (%)	-7.18	-1.85	2.33	5.93	10.02	12.96	13.56	12.96	13.38	13.89	14.34	13.86	14.38	14.96	15.41	14.66	15.29	15.03	15.54	15.05	15.57	15.98	16.32	15.93	16.29
Economic Real Rate of Return (%)	-0.54	-0.15	0.21	0.56	1.04	1.42	1.54	1.38	1.47	1.56	1.65	1.54	1.65	1.81	1.95	1.79	1.92	1.88	2.01	1.91	2.08	2.23	2.39	2.22	2.39
Debt Service Ratio	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Debt/Equity Ratio	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest Cover	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Return on capital (%)	-0.12	0.20	0.49	0.76	1.16	1.50	1.61	1.49	1.51	1.59	1.68	1.59	1.67	1.81	1.95	1.83	1.92	1.90	2.01	1.93	2.06	2.20	2.34	2.21	2.33
Cash and Investments (2021/22$'000)	2748	2776	2579	2078	2504	2659	3090	1778	2154	2338	2733	1870	2415	3280	4079	3340	3775	3649	4352	3927	4903	5835	6774	5827	6850
Debt outstanding (2021/22$'000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Debt (2021/22$'000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Hay SC IWCM Supplementary - Water Fund Model : IWCM Base Case

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Summary Report of Assumptions and Results

	2021/22	2025/26	2030/31	2035/36	2040/41	2045/46	2050/51
Inflation Rates - General (%)	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Inflation Rates - Capital Works (%)	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Borrowing Interest Rate (%)	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Term of New Loans (years)	20	20	20	20	20	20	20
Investment Interest Rate (%)	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Growth Rate - Residential (%)	7.92	6.02	0.48	0.47	0.46	0.45	0.44
Developer Charges per Assessment - Residential (2021/22 $)	1931	1931	1931	1931	1931	1931	1931
Subsidised Scheme Capital Works ($m)	0.10	0.04	0.14	0.00	0.00	0.00	0.00
Grants on Acquisition of Assets ($m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Renewals ($m)	0.25	0.17	0.46	0.08	0.00	0.00	0.00
Renewals (%)	0.93	0.60	1.49	0.23	0.00	0.00	0.00
Cash and Investments ($m)	2.75	2.27	1.87	2.89	2.46	3.79	5.00
Borrowing Outstanding ($m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mgmnt Cost / Assessment	269	268	267	267	266	266	265
Debt Equity Ratio	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OMA Cost Per Assessment	611	610	609	609	609	609	609
Economic Real Rate of Return (%)	-0.54	1.04	1.56	1.95	1.91	2.39	2.97
Return on Capital (%)	-0.12	1.16	1.59	1.95	1.93	2.33	2.78
Net Debt ($m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Debt Service Ratio	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average Residential Bills	828	950	981	983	985	986	987
Typical Residential Bills (2021/22$)	850	970	1000	1000	1000	1000	1000

Appendix J Financial Model Input and Output Data – Sewerage

Hay Sewer Fund IWCM Supplementary Model : IWCM Sewer Base Case

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DEPARTMENT OF COMMERCE

Historical Operating Statement

	2019/20*	2020/21*
EXPENSES		
Management Expenses	*290*	*286*
Administration	290	281
Engineering and Supervision		5
Operation and Maintenance Expenses	*214*	*248*
Operation Expenses	136	130
Maintenance Expenses	38	82
Energy Costs	40	36
Chemical Costs		
Depreciation	*592*	*444*
System Assets	592	444
Plant & Equipment		
Interest Expenses	38	34
Other Expenses	9	12
TOTAL EXPENSES	**1143**	**1024**
REVENUES		
Rates & Service Availability Charges	*985*	*1012*
Residential	832	856
Non-Residential	153	156
Trade Waste Charges	7	
Other Sales and Charges		
Extra Charges	22	4
Interest Income		6
Other Revenues	2	6
Grants	*482*	*186*
Grants for Acquisition of Assets	471	176
Pensioner Rebate Subsidy	11	10
Other Grants		
Contributions	*0*	*0*
Developer Charges		
Developer Provided Assets		
Other Contributions		
TOTAL REVENUES	**1498**	**1214**
OPERATING RESULT	**355**	**190**
OPERATING RESULT (less Grants for Acq of Assets)	**-116**	**14**

Hay Sewer Fund IWCM Supplementary Model : IWCM Sewer Base Case

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Historical Statement of Financial Position

	2019/20*	2020/21*
Cash and Investments	2353	2470
Receivables	102	122
Inventories	3	3
Property, Plant & Equipment	*15512*	*18865*
System Assets (1)	15512	18865
Plant & Equipment		
Other Assets		
TOTAL ASSETS	**17970**	**21460**
LIABILITIES		
Bank Overdraft		
Creditors	10	9
Borrowings	1088	975
Provisions		
TOTAL LIABILITIES	**1098**	**984**
NET ASSETS COMMITTED	**16872**	**20476**
EQUITY		
Accumulated Operating Result	14101	14291
Asset Revaluation Reserve	2771	6185
TOTAL EQUITY	**16872**	**20476**

(1) Notes to System Assets

	2019/20*	2020/21*
Current Replacement Cost	23252	23851
Less: Accumulated Depreciation	7740	4986
Written Down Current Cost	15512	18865

Hay Sewer Fund IWCM Supplementary Model : IWCM Sewer Base Case

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Base Forecast Data

	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
Financial Data																									
Inflation Rate - General (%)	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Inflation Rate - Capital Works (%)	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Borrowing Interest Rate for New Loans (%)	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Investment Interest Rate (%)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Number of Assessments																									
Growth Rate (%)																									
Residential Assessments	2.86	2.87	2.79	2.80	2.80	2.80	2.80	2.72	2.80	2.72	2.72	2.71	2.70	2.69	2.62	2.68	2.66	2.65	2.64	2.62	2.61	2.59	2.63	2.56	2.59
Non-Residential Assessments	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Assessments	2.46	2.47	2.41	2.43	2.44	2.45	2.46	2.40	2.47	2.41	2.41	2.42	2.42	2.42	2.36	2.41	2.41	2.40	2.40	2.39	2.38	2.37	2.41	2.35	2.38
Number of New Assessments																									
Residential	32	33	33	34	35	36	37	37	39	39	40	41	42	43	43	45	46	47	48	49	50	51	53	53	55
Non-Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total New Assessments	32	33	33	34	35	36	37	37	39	39	40	41	42	43	43	45	46	47	48	49	50	51	53	53	55
Projected Number of Assessments																									
Residential	1150	1183	1216	1250	1285	1321	1358	1395	1434	1473	1513	1554	1596	1639	1682	1727	1773	1820	1868	1917	1967	2018	2071	2124	2179
Non-Residential	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184	184
Total Projected Assessments	1334	1367	1400	1434	1469	1505	1542	1579	1618	1657	1697	1738	1780	1823	1866	1911	1957	2004	2052	2101	2151	2202	2255	2308	2363
Backlog Assessments																									
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Backlog Assessments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Developer Charges / Vacant Assessments (Values in 2021/22 $)																									
Developer Charges $/Assessment																									
Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-Residential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Vacant Residential Assessments	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Average Charge of Vacant Assessments	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
% of Occupied Assessments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Depreciation of Existing Plant and Equipment (Values in 2021/22 $'000)																									
Current Replacement Cost of System Assets	24447																								
Override																									
Written Down Current Cost of System Assets	19337																								
Override																									
Annual Depreciation of Existing System Assets	455																								
Override	400																								
Written Down Value of Plant and Equipment	0																								
Override																									
Annual Depreciation of Existing Plant and Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Hay Sewer Fund IWCM Supplementary Model : IWCM Sewer Base Case

Base Forecast Data

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	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
Existing Loan Payments (Values in Inflated $'000)																									
Existing Loan Payments : Principal (Total:975)	117	120	124	129	133	137	142	73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Existing Loan Payments : Interest (Total:132)	31	27	23	19	15	10	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capital Works Program (Values in 2021/22 $'000)																									
Subsidised Scheme (Total:3100)	0	0	0	0	0	3100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other New System Assets (Total:60)	50	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Renewals (Total:5781)	250	255	272	442	466	192	307	192	211	12	0	0	330	15	0	0	509	15	0	0	0	0	410	0	0
Total Capital Works (Total:8941)	300	265	272	442	466	3292	307	192	211	12	0	0	330	15	0	0	509	15	0	0	0	0	410	0	0
Grant For Acquisition of Assets (% of Subsidised Scheme)	0.00	0.00	0.00	0.00	0.00	87.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grant For Acquisition of Assets ($) (Total:2700)	0	0	0	0	0	2700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Developer Provided Assets (Total:0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plant and Equipment Expenditure / Asset Disposal (Values in 2021/22 $'000)																									
Plant and Equipment Expenditure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Proceeds from Disposal of Plant and Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Written Down Value of Plant and Equipment Disposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gain/Loss on Disposal of Plant and Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Proceeds from Disposal of Assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Written Down Value of Assets Disposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gain/Loss on Disposal of System Assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Revised/Additional Forecast Data

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	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
OMA / Revenue Overrides (Values in 2021/22 $'000)																									
Administration	295	302	309	317	325	333	341	349	358	367	376	385	394	404	414	424	434	444	455	466	477	488	500	512	524
Override																									
Engineering and Supervision	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Override																									
Operating Expenses	137	140	143	146	150	154	158	162	166	170	174	178	182	186	190	195	200	205	210	215	220	225	230	235	241
Override	137	140	143	147	150	154	176	180	184	189	193	198	203	208	212	218	223	228	234	239	245	251	257	263	269
Maintenance Expenses	86	88	90	92	94	96	98	100	102	104	107	110	113	116	119	122	125	128	131	134	137	140	143	146	149
Override																									
Energy Costs	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
Override																									
Chemical Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Override																									
Other Expenses	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Override																									
Other Revenue	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Override																									
Other Grants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Override																									
Other Contributions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Override																									
Developer Charges Overrides (Values in 2021/22 $'000)																									
Calculated from Scheme Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Override																									
Pensioner Rebate (Values in Inflated $)																									
Pensioner Rebate per Pensioner ($)	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50
Override																									
Pensioner Rebate Subsidy (%)	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00
Override																									
Number of Pensioner Assessments	214	220	226	233	239	246	253	259	267	274	281	289	297	305	313	321	330	339	347	357	366	375	385	395	405
Override																									
Percentage of Pensioners (%)	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60	18.60
Override																									
Pensioner Rebate	19	19	20	20	21	22	22	23	23	24	25	25	26	27	27	28	29	30	30	31	32	33	34	35	35
Pensioner Rebate Subsidy	10	10	11	11	12	12	12	13	13	13	14	14	14	15	15	15	16	17	17	17	18	18	19	19	19
Revenue Split (%)																									
Residential Rates	83.53	83.91	84.28	84.62	84.98	85.32	85.64	85.97	86.28	86.60	86.90	87.19	87.48	87.76	88.02	88.29	88.55	88.80	89.05	89.30	89.53	89.76	89.99	90.21	90.43
Override																									
Non-Residential Rates	14.87	14.52	14.18	13.86	13.53	13.22	12.91	12.61	12.32	12.03	11.75	11.48	11.22	10.96	10.71	10.46	10.22	9.99	9.76	9.53	9.32	9.10	8.89	8.69	8.49
Override																									
Trade Waste Charges	0.35	0.35	0.35	0.35	0.35	0.35	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
Override																									
Other Sales and charges	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Override																									
Extra Charges	1.25	1.22	1.19	1.17	1.14	1.11	1.09	1.06	1.04	1.01	0.99	0.97	0.94	0.92	0.90	0.88	0.86	0.84	0.82	0.80	0.78	0.77	0.75	0.73	0.71
Override																									
Total Non-Residential Revenue (%)	15.22	14.87	14.53	14.21	13.88	13.57	13.27	12.97	12.68	12.39	12.11	11.84	11.58	11.32	11.08	10.83	10.59	10.36	10.13	9.90	9.69	9.47	9.26	9.06	8.86
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total Residential Revenue (%)	83.53	83.91	84.28	84.62	84.98	85.32	85.64	85.97	86.28	86.60	86.90	87.19	87.48	87.76	88.02	88.29	88.55	88.80	89.05	89.30	89.53	89.76	89.99	90.21	90.43

Hay Sewer Fund IWCM Supplementary Model : IWCM Sewer Base Case

Revised/Additional Forecast Data

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	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
New Loan Payment Overrides (Values in Inflated $'000)																									
Standard Loan Payments: Principal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Standard Loan Payments: Interest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Structured Loan Payments: Principal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Structured Loan Payments: Interest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capitalised Interest	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total New Loan Payments: Principal Override	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total New Loan Payments: Interest Override	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capitalised Interest Override	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Operating Statement

	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
EXPENSES																									
Management Expenses	*300*	*307*	*314*	*321*	*331*	*339*	*346*	*354*	*363*	*372*	*380*	*390*	*399*	*409*	*419*	*429*	*439*	*450*	*460*	*471*	*482*	*493*	*505*	*517*	*529*
Administration	295	302	309	317	325	333	341	349	358	367	376	385	394	404	414	424	434	444	455	466	477	488	500	512	524
Engineering and Supervision	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Operation and Maintenance Expenses	*261*	*267*	*273*	*280*	*286*	*293*	*318*	*325*	*332*	*340*	*348*	*357*	*366*	*375*	*383*	*394*	*402*	*411*	*421*	*430*	*439*	*450*	*459*	*470*	*480*
Operation Expenses	137	140	143	147	150	154	176	180	184	189	193	198	203	208	212	218	223	228	234	239	245	251	257	263	269
Maintenance Expenses	86	88	90	92	94	96	98	100	102	104	107	110	113	116	119	122	125	128	131	134	137	140	143	146	149
Energy Costs	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
Chemical Costs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Depreciation	*401*	*401*	*401*	*401*	*401*	*445*	*445*	*445*	*445*	*444*	*445*	*444*	*444*	*443*	*443*	*443*	*443*	*444*	*444*	*444*	*444*	*444*	*444*	*444*	*445*
System Assets	401	401	401	401	401	445	445	445	445	444	445	444	444	443	443	443	443	444	444	444	444	444	444	444	445
Plant & Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest Expenses	31	26	22	18	14	9	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Expenses	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
TOTAL EXPENSES	**1006**	**1015**	**1023**	**1033**	**1045**	**1100**	**1127**	**1137**	**1152**	**1169**	**1186**	**1204**	**1222**	**1240**	**1258**	**1278**	**1297**	**1318**	**1337**	**1358**	**1379**	**1400**	**1422**	**1445**	**1467**
REVENUES																									
Rates & Service Availability Charges	*1023*	*1050*	*1074*	*1100*	*1129*	*1155*	*1184*	*1213*	*1243*	*1273*	*1304*	*1337*	*1367*	*1401*	*1435*	*1469*	*1506*	*1542*	*1579*	*1616*	*1655*	*1695*	*1735*	*1775*	*1818*
Residential	868	895	919	945	974	1001	1029	1058	1088	1118	1148	1181	1212	1246	1280	1314	1350	1386	1423	1460	1499	1539	1579	1620	1662
Non-Residential	155	155	155	155	155	155	155	155	155	155	155	155	155	155	156	155	156	156	156	156	156	156	156	156	156
Trade Waste Charges	4	4	4	4	4	4	4	4	5	5	5	5	5	5	6	6	5	6	6	6	6	7	6	7	7
Other Sales and Charges	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Extra Charges	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Interest Income	75	77	78	76	72	67	66	69	76	86	98	110	116	124	135	145	148	154	164	173	182	191	193	200	208
Other Revenues	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Grants	*10*	*10*	*10*	*10*	*11*	*2711*	*10*	*11*	*11*	*10*	*11*	*11*	*10*	*11*	*11*	*10*	*11*	*11*	*11*	*11*	*11*	*11*	*11*	*11*	*11*
Grants for Acquisition of Assets	0	0	0	0	0	2700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pensioner Rebate Subsidy	10	10	10	10	11	11	10	11	11	10	11	11	10	11	11	10	11	11	11	11	11	11	11	11	11
Other Grants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Contributions	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Developer Charges	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Developer Provided Assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Contributions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL REVENUES	**1131**	**1159**	**1185**	**1209**	**1235**	**3957**	**1283**	**1317**	**1354**	**1392**	**1437**	**1481**	**1518**	**1560**	**1605**	**1650**	**1688**	**1732**	**1779**	**1825**	**1874**	**1923**	**1965**	**2012**	**2062**
OPERATING RESULT	**125**	**144**	**162**	**176**	**190**	**2858**	**156**	**179**	**202**	**223**	**251**	**277**	**297**	**319**	**347**	**371**	**391**	**415**	**441**	**467**	**495**	**522**	**543**	**568**	**595**
OPERATING RESULT (less Grants for Acq of Assets)	**125**	**144**	**162**	**176**	**190**	**157**	**156**	**179**	**202**	**223**	**251**	**277**	**297**	**319**	**347**	**371**	**391**	**415**	**441**	**467**	**495**	**522**	**543**	**568**	**595**

Hay Sewer Fund IWCM Supplementary Model : IWCM Sewer Base Case

Cashflow Statement

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	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
Cashflow From Operating Activities																									
Receipts																									
Rates and Charges	1040	1066	1091	1117	1145	1173	1201	1231	1261	1291	1322	1354	1386	1419	1454	1488	1524	1561	1598	1635	1674	1715	1755	1795	1838
Interest Income	75	77	78	76	72	67	66	69	76	86	98	110	116	124	135	145	148	154	164	173	182	191	193	200	208
Other Revenues	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Grants	10	10	10	10	11	2711	10	11	11	10	11	11	10	11	11	10	11	11	11	11	11	11	11	11	11
Contributions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Receipts from Operations	**1131**	**1159**	**1185**	**1209**	**1235**	**3957**	**1283**	**1317**	**1354**	**1392**	**1437**	**1481**	**1518**	**1560**	**1605**	**1650**	**1688**	**1732**	**1779**	**1825**	**1874**	**1923**	**1965**	**2012**	**2062**
Payments																									
Management	300	307	314	321	331	339	346	354	363	372	380	390	399	409	419	429	439	450	460	471	482	493	505	517	529
Operations (plus WC Inc)	267	273	280	286	293	301	325	331	339	348	355	364	374	383	391	402	411	421	430	439	449	460	469	481	491
Interest Expenses	31	26	22	18	14	9	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Expenses	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Total Payments from Operations	**611**	**620**	**629**	**638**	**650**	**661**	**689**	**699**	**715**	**732**	**749**	**767**	**786**	**805**	**823**	**844**	**862**	**883**	**903**	**923**	**944**	**966**	**987**	**1010**	**1033**
Net Cash from Operations	**520**	**540**	**556**	**571**	**585**	**3296**	**594**	**617**	**639**	**661**	**687**	**713**	**732**	**754**	**782**	**806**	**826**	**849**	**876**	**902**	**929**	**956**	**978**	**1002**	**1029**
Cashflow from Capital Activities																									
Receipts																									
Proceeds from Disposal of Assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Payments																									
Acquisition of Assets	300	264	272	442	466	3291	307	192	211	12	0	0	330	15	0	0	509	15	0	0	0	0	410	0	0
Net Cash from Capital Activities	**-300**	**-264**	**-272**	**-442**	**-466**	**-3291**	**-307**	**-192**	**-211**	**-12**	**0**	**0**	**-330**	**-15**	**0**	**0**	**-509**	**-15**	**0**	**0**	**0**	**0**	**-410**	**0**	**0**
CashFlow from Financing Activities																									
Receipts																									
New Loans Required	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Payments																									
Principal Loan Payments	117	117	118	120	120	121	122	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Cash from Financing Activities	**-117**	**-117**	**-118**	**-120**	**-120**	**-121**	**-122**	**-61**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TOTAL NET CASH	**103**	**158**	**166**	**9**	**-1**	**-117**	**165**	**364**	**428**	**649**	**687**	**713**	**402**	**739**	**782**	**806**	**317**	**834**	**876**	**902**	**929**	**956**	**568**	**1002**	**1029**
Current Year Cash	103	158	166	9	-1	-118	165	364	428	649	687	713	402	739	782	806	317	834	876	902	929	956	568	1002	1029
Cash & Investments @Year Start	2470	2510	2603	2701	2644	2579	2401	2504	2798	3148	3704	4284	4875	5149	5745	6367	6998	7136	7776	8441	9115	9799	10493	10791	11505
Cash & Investments @Year End	**2573**	**2668**	**2769**	**2711**	**2644**	**2462**	**2566**	**2868**	**3226**	**3796**	**4391**	**4997**	**5278**	**5888**	**6527**	**7173**	**7315**	**7970**	**8652**	**9343**	**10044**	**10756**	**11061**	**11793**	**12534**
Capital Works Funding:																									
nternal Funding for New Works ($'000)	50	10	0	0	0	400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Internal Funding for Renewals	250	255	272	442	466	192	307	192	211	12	0	0	330	15	0	0	509	15	0	0	0	0	410	0	0
New Loans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grants	0	0	0	0	0	2700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Capital Works	**300**	**264**	**272**	**442**	**466**	**3292**	**307**	**192**	**211**	**12**	**0**	**0**	**330**	**15**	**0**	**0**	**509**	**15**	**0**	**0**	**0**	**0**	**410**	**0**	**0**

Hay Sewer Fund IWCM Supplementary Model : IWCM Sewer Base Case

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Statement of Financial Position

	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
Cash and Investments	2573	2668	2769	2711	2644	2462	2567	2869	3227	3797	4392	4998	5279	5889	6527	7174	7316	7971	8653	9344	10045	10756	11061	11794	12535
Receivables	128	131	134	137	140	144	147	151	154	158	162	165	170	173	178	182	186	191	195	200	204	210	214	219	224
Inventories	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Property, Plant & Equipment	*19236*	*19099*	*18970*	*19011*	*19076*	*21921*	*21783*	*21530*	*21295*	*20863*	*20418*	*19974*	*19860*	*19433*	*18989*	*18547*	*18613*	*18185*	*17741*	*17296*	*16852*	*16408*	*16373*	*15929*	*15485*
System Assets (1)	19236	19099	18970	19011	19076	21921	21783	21530	21295	20863	20418	19974	19860	19433	18989	18547	18613	18185	17741	17296	16852	16408	16373	15929	15485
Plant & Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL ASSETS	**21940**	**21900**	**21876**	**21862**	**21862**	**24530**	**24500**	**24551**	**24679**	**24820**	**24974**	**25139**	**25311**	**25497**	**25696**	**25904**	**26116**	**26348**	**26590**	**26841**	**27103**	**27375**	**27651**	**27944**	**28246**
LIABILITIES																									
Bank Overdraft	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Creditors	9	9	9	8	8	8	8	8	7	7	7	7	7	7	6	6	6	6	6	6	5	5	5	5	5
Borrowings	858	720	584	450	319	190	63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Provisions	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL LIABILITIES	**867**	**729**	**593**	**459**	**327**	**198**	**71**	**8**	**7**	**7**	**7**	**7**	**7**	**7**	**6**	**6**	**6**	**6**	**6**	**6**	**5**	**5**	**5**	**5**	**5**
NET ASSETS COMMITTED	**21073**	**21172**	**21283**	**21403**	**21535**	**24333**	**24430**	**24544**	**24672**	**24813**	**24967**	**25132**	**25304**	**25491**	**25690**	**25898**	**26110**	**26342**	**26585**	**26836**	**27098**	**27370**	**27646**	**27939**	**28241**
EOUITY																									
Accumulated Operating Result	14416	14209	14024	13858	13711	16234	15994	15783	15600	15443	15317	15220	15145	15095	15075	15078	15102	15148	15220	15316	15437	15583	15746	15930	16136
Asset Revaluation Reserve	6657	6963	7259	7545	7825	8099	8436	8761	9072	9370	9650	9912	10158	10395	10615	10820	11008	11194	11365	11520	11660	11787	11900	12009	12105
TOTAL EQUITY	**21073**	**21172**	**21283**	**21403**	**21535**	**24333**	**24430**	**24544**	**24672**	**24813**	**24967**	**25132**	**25304**	**25491**	**25690**	**25898**	**26110**	**26342**	**26585**	**26836**	**27098**	**27370**	**27646**	**27939**	**28241**
(1) Notes to System Assets																									
Current Replacement Cost	24497	24506	24506	24507	24507	27606	27606	27606	27606	27606	27606	27606	27606	27606	27606	27606	27606	27606	27606	27606	27606	27606	27606	27606	27606
Less: Accumulated Depreciation	5261	5408	5537	5495	5431	5685	5823	6076	6311	6743	7188	7632	7746	8173	8617	9059	8993	9422	9865	10309	10754	11198	11232	11676	12121
Written Down Current Cost	19236	19099	18970	19011	19076	21921	21783	21530	21295	20863	20418	19974	19860	19433	18989	18547	18613	18185	17741	17296	16852	16408	16373	15929	15485

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Performance Indicators

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	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46
Typical Residential Bills	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772	772
Average Residential Bills (2021/22$)	755	756	756	756	758	757	757	759	759	759	759	760	759	760	761	761	761	762	762	762	762	763	762	763	763
Mgmnt Cost / Assessment (2021/22$)	225	224	225	224	225	224	224	225	224	224	224	225	225	224	224	224	224	224	224	224	224	224	224	224	224
OMA Cost per Assessment (2021/22$)	421	420	420	419	420	420	430	430	429	430	429	430	430	430	430	430	430	430	430	428	428	428	428	428	427
Operating Sales Margin (%)	7.67	8.66	9.54	10.41	11.30	8.32	7.86	8.90	9.83	10.54	11.44	12.17	12.88	13.59	14.44	15.05	15.83	16.49	17.16	17.80	18.48	19.12	19.74	20.29	20.87
Economic Real Rate of Return (%)	0.42	0.49	0.56	0.62	0.69	0.45	0.44	0.52	0.59	0.66	0.75	0.84	0.91	1.00	1.12	1.22	1.31	1.43	1.56	1.70	1.85	2.02	2.14	2.31	2.50
Debt Service Ratio	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Debt/Equity Ratio	0.04	0.03	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest Cover	5.03	6.48	8.39	11.00	15.00	18.80	31.17	214.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Return on capital (%)	0.71	0.78	0.84	0.89	0.93	1.96	0.66	0.73	0.82	0.90	1.00	1.10	1.17	1.25	1.35	1.43	1.50	1.57	1.66	1.74	1.83	1.91	1.96	2.03	2.11
Cash and Investments (2021/22$'000)	2573	2668	2769	2711	2644	2462	2567	2869	3227	3797	4392	4998	5279	5889	6527	7174	7316	7971	8653	9344	10045	10756	11061	11794	12535
Debt outstanding (2021/22$'000)	858	720	584	450	319	190	63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Debt (2021/22$'000)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Hay Sewer Fund IWCM Supplementary Model : IWCM Sewer Base Case

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Summary Report of Assumptions and Results

	2021/22	2025/26	2030/31	2035/36	2040/41	2045/46	2050/51
Inflation Rates - General (%)	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Inflation Rates - Capital Works (%)	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Borrowing Interest Rate (%)	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Term of New Loans (years)	20	20	20	20	20	20	20
Investment Interest Rate (%)	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Growth Rate - Residential (%)	2.86	2.80	2.72	2.62	2.62	2.59	2.53
Developer Charges per Assessment - Residential (2021/22 $)	0	0	0	0	0	0	0
Subsidised Scheme Capital Works ($m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grants on Acquisition of Assets ($m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Renewals ($m)	0.25	0.47	0.01	0.00	0.00	0.00	1.90
Renewals (%)	1.02	1.90	0.04	0.00	0.00	0.00	6.86
Cash and Investments ($m)	2.57	2.64	3.80	6.53	9.34	12.53	14.45
Borrowing Outstanding ($m)	0.86	0.32	0.00	0.00	0.00	0.00	0.00
Mgmnt Cost / Assessment	225	225	224	224	224	224	223
Debt Equity Ratio	0.04	0.01	0.00	0.00	0.00	0.00	0.00
OMA Cost Per Assessment	421	420	430	430	428	427	427
Economic Real Rate of Return (%)	0.42	0.69	0.66	1.12	1.70	2.50	3.24
Return on Capital (%)	0.71	0.93	0.90	1.35	1.74	2.11	2.36
Net Debt ($m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Debt Service Ratio	0.13	0.11	0.00	0.00	0.00	0.00	0.00
Average Residential Bills	755	758	759	761	762	763	764
Typical Residential Bills	772	772	772	772	772	772	772

Public Works Advisory
12 Darcy Street, Parramatta NSW 2150
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