University of Southern Queensland
Faculty of Engineering and Surveying

Water and Wastewater Strategic Township Plan Warragul, Victoria

A dissertation submitted by

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Towards the

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ABSTRACT

In the past, water authorities have been undertaking capital works expenditure on a forward planning window of 18 months. Now under a more regulated State Government regime, water authorities have to prepare more detailed plans showing future capital expenditure over a five year period. These plans are then used to set price tariffs for the business to cover those costs over that period.

With this in mind, the main objective of this dissertation was to prepare water and wastewater strategic plans for Warragul, Victoria. These plans would then be adopted by the organisation. Any recommendations from these strategic plans are then forwarded onto Gippsland Water's asset improvement department to undergo more detailed planning and costing. These plans and costs are then submitted to the regulatory for approval in Gippsland Water's submission of the water plan. Water Plan No.2 is due for submission by March 2007.

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CERTIFICATION

I certify that the ideas, designs and experimental work, results, analyses and conclusions set out in this dissertation are entirely my own effort, except where otherwise indicated and acknowledged.

I further certify that the work is original and has not been previously submitted for assessment in any other course of institution, except where specifically stated.

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Darren James Wallace

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NOMENCLATURE

ABS	Australian Bureau of Statistics
ADWF	Average Dry Weather Flow
ARI	Average Return Interval
ARnR	Australian Rainfall and Runoff
BWE	Bulk Water Entitlement
BZ1	Business Zone
CAPEX	Capital Expenditure
CI	Cast Iron
CMPS&F	Camp Scott and Furphy
DAF	Dissolved Air Flotation
DN	Nominal Diameter
DWF	Dry Weather Flow
ESC	Essential Services Commission
EPA	Environmental Protection Agency
FRAB	Flow Rate Attenuation Basin
GMT	General Management Team
GW	Gippsland Water
Ha	Hectare
HL	High Level
IND1	Industrial Zone
LDRZ	Low Density Residential Zone
kl	Kilolitre
L/S	Litres per Second
M	Metre
MSCL	Mild Steel Concrete Lined
ML	Megalitres
MOU	Memorandum of Understanding
MWH	Montgomery Watson Houser
O&M	Operations and Maintenance Manual
PDWF	Peak Dry Weather Flow
PS	Pump Station
ROS	Regional Outfall Sewer
PWWF	Peak Wet Weather Flow
RZ1	Residential Zone
Seq	Sequence
SoO	Statement of Obligations
SPS	Sewerage Pump Station
TBL	Triple Bottom Line
Ten't	Tenement
WHO	World Health Organisation
WSA	Water Services Association
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

Chapter 1. Introduction

Gippsland Water services the area stretching from Drouin in the west to Sale in the east and Briagolong in the north and Mirboo North in the south. Over 60,000 water and 48,000 wastewater assessments are administered. Water and wastewater services are provided to 41 towns incorporated within 21 water and 16 wastewater systems as shown in Appendix B

Gippsland Water has a customer base that sets it apart from most water authorities. Demand for product is dominated by a handful of major industries, some of which are of state significance. Three of these are major power stations, a paper manufacturer and an oil and gas platform and they require wastewater disposal services to operate. The closure of any of the major customers could impact significantly on the revenue of Gippsland Water.

The nature of rural water authorities such as Gippsland Water is that development is concentrated into small towns widely dispersed. Accordingly the water and sewerage systems tend to be discrete systems serving each locality.

This dissertation describes a study of future service requirements of the Warragul water and wastewater systems to provide medium to long term security of supply for Warragul and district.

A number of investigations have been carried out and proposals to supply the area developed for Gippsland Water (GW) and other authorities. The most relevant investigation is described in a report prepared by Camp Scott & Furphy (CMPS&F) entitled, "*Warragul Northern Basin Review*", February 1995. A previous report by Kinhill Stearns entitled "*Water Supply Master Plan for Warragul and Drouin*" was prepared for Tarago Water Board about 1987 also provides some relevant information. Information contained in these reports and other relevant information obtained from GW operations staff has been utilised during the course of the study described in this report

Chapter 2. Literature Review

2.1 Background

The Essential Services Commission (ESC) as the economic regulator of the water businesses in Victoria is looking for more participation of the customers and stakeholders in the decisions and future planning of the Authorities. This process of engagement is fundamental in determining programs of work and in setting the prices for charging rates ensuring both are appropriate to the needs and expectations of the community. This requirement is further reinforced in the new *Statement of Obligations* (SoO) of Gippsland Water to the Minister of Water, Victoria, dated 26th July 2004.

Gippsland Water is reviewing its traditional approach to the provision of services. The way that some things have been done in the past may no longer be appropriate of sufficient in the new operating environment – including:

a) How long term planning for the future is carried out;

b) How the community, stakeholders and customers are consulted and their views taken into account;

c) How services are provided and managed;

d) How decisions are made (and the necessity to be more aware of the likely future economic, environmental, social and cultural consequences of every decision) and;

e) The requirement to work in a more inclusive, integrated, and coordinated way (both within the Authority organisation and with others) towards the achievement of common (and it is expected over time widely promoted and supported), desired community outcomes.

Under the guiding principles of the Water Industry Regulatory Order the Essential Services Commission has the authority to approve Gippsland Water's future submissions for proposed prices to apply from 1 July 2005.

Future Water Plan submissions to the Essential Services Commission rely on comprehensive assessments of current and future expenditure of Gippsland Water to meet its statutory and customer service requirements and standards. The expenditure will be infrastructure related such as operations and maintenance, augmentation, renewals and new works. However in addition the expenditure will incorporate business costs in delivering all the services for which the Authority is responsible.

A key aspect of the regulatory framework is the requirement for water businesses to establish a Water Plan. A water plan is required to be delivered to the ESC by a regulated entity (such as Gippsland Water) under a Statement of Obligations.

Gippsland Water must include in the Water Plan: (Clause 7.3 Statement of Obligations)

a) Outcomes to be delivered in the Regulatory Period with respect to Standards and Conditions of Service and Supply, meeting future demands on the Authority's services and complying with any obligations specified in this Statement, a Regulatory Obligation and other obligations imposed by or under legislation; and

b) How the Authority proposes to deliver those outcomes; and

c) The proposed Prices to be charged for each of the Authorities Prescribed Services

The Water Industry Regulatory Order sets out the process and regulatory principles that will guide the ESC in deciding whether to approve the prices proposed within the Water Plan.

The Minister of Water has issued a Statement of Obligations to impose on Gippsland Water in relation to the performance of its functions and exercise of powers. The statement of obligations commenced on 26th July 2004 and will remain in place or operate until it is revoked.

The guiding principles for Gippsland Water in performing its functions and providing its services under the statement of obligations are:

a) Manage water resources in a sustainable manner; and

b) Effectively integrate economic, environmental and social objectives into its business operations; and

c) Minimise the impact of its activities on the environment; and

d) Manage risk to protect public safety, quality and security of supply; and

e) Operate as efficiently as possible consistent with sound commercial practice; and

f) Manage its business operations to maintain the long term financial viability of the authority; and

g) Undertake continuous review, innovation and improvement; and

h) Collaborate with other public authorities and government agencies to take account of regional needs.

2.2 Water

Gippsland Water's water supply service functions are detailed under Part 8 of the *Water Act 1989*. These functions are:

a) To provide, manage, operate and protect water supply systems, including the collection, storage, treatment, transfer and distribution of water;

b) To identify community needs relating to water supply and to plan for the future needs of the community relating to water supply;

c) To develop and implement programs for the conservation and efficient use of water;

d) To investigate, promote and conduct research into any matter related to its functions, powers and duties in relation to water supply;

e) To educate the public about any aspect of water supply.

Further to the above functions Gippsland Water's *Annual Report 03/04* (page 9) states the following in regard to its strategic plan.

The achievement and maintenance of a high level of community confidence in the safety, reliability and quality of the regions water supply system is a critical objective for the Authority.

2.3 Wastewater

Gippsland Water's wastewater service functions are detailed under Part 9 of the *Water Act 1989*. These functions are:

a) To provide, manage and operate systems for the conveyance, treatment and disposal of sewage and, if the Authority so decides, of trade waste;

b) To identify community needs relating to sewerage services and to plan for the future needs of the community relating to sewerage services;

c) To develop and implement programs for the recycling and reuse of treated wastewater;

d) To investigate, promote and conduct research into any matter which relates to its functions, powers and duties in relation to sewerage services;

e) To educate the public about any aspect of sewerage.

Further to the above functions Gippsland Water's 2003/2004 *Annual Report 03/04* (page 9) states the following in regard to its strategic plan.

All domestic, commercial and industrial customers produce wastewater that must be collected, transferred, treated and utilised to the benefit of the environment. The protection of public health and the environment demands that all wastewater infrastructures be operated and maintained skillfully to an acceptable standard.

Chapter 3. Description of Study Area

3.1 Background

Warragul is connected to the Pederson weir water supply system, located 100km east of Melbourne along the road and rail transport corridor. Warragul has recently been bypassed by the Princes Freeway construction, but is still linked to the metropolitan railway services that make it more attractive as a base to commute to and from the eastern suburbs of Melbourne *GHD Management Engineering Environment 2005, p.4*

Warragul is located on gentle rolling hills and valleys, with land subject to inundation running east-west through the centre of town. Main roads follow ridgelines that run north-south. The town is surrounded by a series of hills and valleys that reflect the pattern of minor watercourses in the rural hinterland. The urban landscape is predominantly low density dwellings, with self contained areas of open space and recreation in strategic locations.

Warragul is the largest population centre within the Shire of Baw Baw and serves as the regional centre for commerce, retail, industrial, educational and recreation facilities. The business and employment centre of Warragul contains many of Gippsland regional services for banking and government agencies, and services.
The Tarago River is the common raw water source for the area. Warragul, Drouin, Darnum, Buln Buln, Rokeby and Nilma are currently supplied from Pedersen Weir. The harvested water is transferred to the Warragul WTP by a 24 km 450 mm diameter, MSCL gravity pipeline. A pump station supplies Neerim South from either the Pedersen Weir or the Tarago Reservoir.

During times of drought additional water can be drawn from Tarago Reservoir by arrangement with the owner of the reservoir, Melbourne Water. Some additional water is supplied to Drouin during high demand, from the Labertouche Weir and Treatment Plant. The reliability of this source during periods of extended dry weather is limited. There are plans to decommission this source at a later date.

Warragul has a current population of 11500 people and is located just 20kms east of the Melbourne Metropolitan Region boundary within the Shire of Baw Baw *Shire Council Planning Scheme Website*. Warragul has experienced significant population growth of 4.1% over the past 5 years and is expected to continue to grow due to its proximity to Melbourne. Increasing population has placed pressure on existing water and wastewater infrastructure in Warragul.

There is pressure on Gippsland Water as the regional water authority, to develop short and long term planning strategies for water and wastewater service to cope with this expansion. As a consequence, a water and wastewater Township plan using the current planning scheme needs to be developed for accommodate future growth in Warragul for the next 20 years (2026). The township plan will need to identify township growth, identify the different options and optimum solutions for each of the development areas and ultimately list the capital works programme, with timings.

3.2 Population and Growth Rates

Population and demand predictions are drawn from Gippsland Water's customer billing records showing the number of connected properties within Warragul. This information has been sourced from data in Gippsland Water *Annual Reports* between 2000/01 to 2004/05. Billing records have been preferred over published population figures due to the fact that the Australian Bureau of Statistics (ABS) population zones do not align with reticulation zones.

Table 3-1 Gippsland Water Property Connections

Period	Residential	Non-Residential
2000/01	3964	648
2001/02	4065	663
2002/03	4227	671
2003/04	4439	663
2004/05	4646	686
2 Yr Ave Growth	2.3%	1.7%
5 Yr Ave Growth	4.1%	1.4%

Meaningful forecasting of future population is complicated by recent progress in expansion in Melbourne's east, and future developments to road infrastructure such as the Hallam and Pakenham bypasses will further improve access to Melbourne. There is a lot of potential for Warragul to expand, but population expansion is impossible to forecast with certainty. For this reason, future demands used in this study where based on the above figures and presented to Gippsland Water General Management Team (GMT) for approval.

Table 3-2 Warragul Growth Rates

Period	Growth
2006/07 – 2012/13	3.0%
2013/14 – 2025/26	2.0%

The above figures were approved at May 2006 GMT meeting.

Table 3-3 Projected Connection Numbers

Year No	Period	Residential Connections	Non Residential Connections
	2000/01	3964	648
	2001/02	4065	663
	2002/03	4227	671
	2003/04	4439	663
	2004/05	4646	686
	2005/06	4785	707
1	2006/07	4929	728
5	2010/11	5548	819
10	2015/16	6246	922
15	2020/21	6896	1018
20	2025/26	7613	1124
20 Year Lot Demand		**2828**	**417**

3.3 Future Land Requirements

Future land requirements are based on residential 1 (RZ1), low density residential (LDRZ), industrial (IN1) and commercial (BZ1) are within the Baw Baw Shire planning scheme development overlay shown as Appendix C. These areas only, are considered for water and wastewater services in future planning considerations in Gippsland Water.

Results from Table 3 show, an additional 2828 residential lots and 417 non residential lots will need to be developed in Warragul over the study period to satisfy demand. Based on industry figures of 10 lots per hectare for residential and 15 lots per hectare non residential *GHD Management Engineering Environment 2005, p.13* the following land will be developed,

Table 3-4 Land Requirements

Lot Type	Residential 10 per/ha	Industrial & Commercial 15 per/ha
Required Lots	2828	417
Infill Area (ha)	202.2ha	34.6ha
Infill Lots	2022	519
Difference	-806	+102

Appendix D - Undeveloped Planning Areas shows the currently undeveloped land.

Given current growth existing residential infill will be exhausted prior to 2010. Results from Table 4 shows a deficiency of 806 residential lots over the study period, which equates to 80.6ha that will need to be rezoned.

GHD Management Engineering Environment 2005 p.29 highlights stage 2 of residential land release for Warragul will yield an additional 3094 lots and will satisfy this reports study period. See Appendix D.

3.4 Level of Service and Standards

Gippsland Water currently reports against a number of regulatory standards, internal business performance targets and various industry benchmarking measures.

Service delivery standards are set down in Gippsland Water's *Customer Charter*, which is a public document.

Under the requirements of the new *Statement of Obligations* (SoO), which became effective at 26 July 2004, a new customer charter has been developed to operate.

The Essential Services Commission will have the responsibility to approve the new customer charter specific for the authority. Through the use of a customer service code the ESC will impose certain obligations on businesses in relation to general terms and conditions of service.

The service delivery standards set down in the customer charter only apply to those customers that don't have an individually negotiated agreement. Hence they apply to the following customer segments:

- Residential
- Small commercial and industrial
- Institutional

The Customer Charter clearly outlines the commitments, responsibilities and standards of service that Gippsland Water will provide to its customers. It sets out Gippsland Water's obligations to its customers and is consistent with the Essential Services Commission's Customer Service Code for Victorian metropolitan and rural urban water authorities.

Chapter 4. Current System Demands and Standards

4.1 Water

The source supply is Pedersen Weir on the Tarago River, upstream of the Tarago Reservoir. The weir's capacity is about 11 ML. Water flows via a 450mmMSCL pipe which has a hydraulic capacity of 13.7ML/day, by gravity to the Warragul Water Treatment Plant. *Wallace.D Water System Profiles 2000*

The Warragul Water Treatment Plant is a 17 ML/day Dissolved Air Flotation (DAF) Water Treatment Plant. It has been designed to produce treated water for the townships of Warragul, Drouin, Darnum, Buln Buln, Rokeby and Nilma and rural users along the supply pipelines, of a quality that consistently complies with the Australian Drinking Guidelines 1996, for drinking water quality. *Aqua clear Technology P/L 2000*

Treated water is stored in The North Basin which has an effective storage capacity of 39 ML and stands adjacent to the Treatment Plant.

A 450 mm diameter MSCL pipeline carries treated water from the North Basin to the South Basin. There are two booster pumps along the pipe which assist in times of high demand. Warragul is supplied directly off the pipeline but water can be supplied from either North or South Basins, depending on demand. A booster pump and a header tank feed off the South Basin to supply Warragul South consumers.

The South Basin is located off Warragul-Korumburra Road, approximately 3.2 km south of the Warragul Township. The South Basin is supplied with treated water from the North Basin. The Basin holds 50 ML of water. The water is chlorinated prior to going to the customer to destroy any bacteriological re-contamination which may have occurred while being held in the open storage basins. *Wallace.D, Water System Profiles 2000*

Using existing information generated from treatment records, Scada and hydraulic modeling software the current average day and peak day demands for Warragul are

1. Average Day Demand = 5.2ML/day
2. Peak Day Demand = 9.0ML/day

See Appendix E – Warragul Water Supply Schematic

4.2 Wastewater

The Warragul sewerage system was constructed in the 1930s and has been augmented over the decades to cope with urban growth and development. A major upgrade of the plant was undertaken in 1965 in which a trickling filter, three sludge digesters and four lagoons were constructed. The early 1990s saw the construction of an extra facultative lagoon and an increase in capacity of the other four. The most recent upgrade, achieving full biological nutrient removal, was completed in 1997. *OTV-Kruger 1999*

The sewerage reticulation system consists of 7 minor and 1 major pump station. The major pump station, No.2 pump station, pumps directly into the waste water treatment plant.

The Warragul WWTP is designed to meet the load conditions specified in Table 5 below.

Table 4-1 Plant Flows

ADWF	4.2ML/day	175m3/hr
PWWF	12.6ML/day	525m3/hr
Max Flow	30.0ML/day	1250m3/hr

After treatment, effluent from Warragul WWTP is discharged to Hazel Creek, which is part of the Latrobe Basin.

Using existing information generated from treatment records, Scada and wastewater modeling software document the current average day and peak day flows for the wastewater collection system are;

1. Average Dry Weather Flow (ADWF) = 3.9ML/day (MWH June 2005)
2. Peak Wet Weather Flow (PWWF) = 18.1ML/day (MWH June 2005)

See Appendix F – Warragul Wastewater Collection

Chapter 5. Future Growth Analysis and Option

Infill area identified in Appendix C is the preferred priority areas for development and should occur prior to the development of expansion areas *GHD Management Engineering Environment 2005.*

All infill areas will be fully developed in this study with the shortfall evenly distributed among the identified expansion areas in Appendix D.

The performance of each Gippsland Water asset is reviewed from time to time to assess its capacity to enable Gippsland Water to meet its customer obligations. Performance requirements for the assets to ensure standards are met are set out in Appendix G and Appendix H to ensure security of supply.

The performance requirements apply on the day of review and throughout the planning period, of 20 years. If an asset requires upgrading, the upgraded capacity will be based on the performance required during the appropriate planning period

Chapter 6. Water Strategy

6.1 Water Consumption

The annual consumptions for each category for the last four years are shown in Table 6. The detail break-up of consumption in 01/02 is not available.

Table 6-1 Recent Annual Consumption by Category

Year	Res ML	Major Ind ML	Other Ind. Com ML	Total Ind ML	Other ML	Total ML
01/02	1330			1047		2587
02/03	866	360	230	590	580	2626
03/04	1130	436	827	899	204	3496
04/05	1086	326	360	686	249	2707

There are several features associated with the above information:

- In 03/04 Gippsland Water undertook to meter all currently unmetered properties. This is reflected with the drop in the "other" consumption figures.
- Industry usage has a major impact on overall consumption. This can vary by 100% in any one year.

6.2 Future Demand Forecast

The above variation in consumption, particularly industrial, makes it difficult to predict future demands in the study area. Four years of data has been examined, 01/02 to 04/05. An upper and lower limit of consumption is established based on this data. A four-year average has also been established. Table 7 shows the variation in extrapolations over the study period.

Table 6-2 Future Demand Forecast

	2005	2015	2025	2035
Annual Demand Lower Limit (ML)	2587	3409	4156	5066
Upper Limit (ML)	3496	4698	6314	8485
4 Year Average (ML)	2854	3835	5155	6927
Peak Weekly Demand (ML/d)	10.2	13.7	18.4	24.7
Peak Daily Demand (ML/d)	12.2	16.4	22.0	29.6

The timing of the options examined in this study will be based on the 4-year demand average.

6.3 Water Demand Forecast during Drought

In the *Camp Scott & Furphy 1995* report reference is made to the shortfall in supply during a drought period. Reference is also made to a report to Gippsland Water "Bulk Entitlement Conversion to Two Water Supply Systems" by Hydro Technology - Jan 1995.

The data used in the above report is included to show the basis for further extrapolation.

6.3.1. Monthly Demand Pattern

The monthly demand pattern (04/05) is summarised in Table 8

Table 6-3 Monthly Demand Pattern

Month	Average Year	Dry Years
Jan	147	306
Feb	131	297
Mar	132	267
Apr	131	211
May	136	225
June	152	166
July	164	158
Aug	170	204
Sept	207	192
Oct	183	246
Nov	176	258
Dec	161	313

This table indicates that the historic trend for water use in a dry year is an increase by a factor of approximately 1.2 over an average year use.

6.3.2. Raw Water Capacity.

The existing pipeline between Pedersen weir and Warragul WTP has a capacity of approximately 13.7 ML/day.

An allowance of 0.7 ML/day is allowed for consumers upstream of the treatment plant and an estimated 1.0 ML/day is allowed for sludge and filter backwash losses at the plant.

The maximum water available to consumers is estimated at 12.0 ML/day which is reduced as the availability of source water reduces.

6.3.3. Raw Water Source

Currently there is sufficient stream flow in the Tarago River to cater for the draw off via Pedersen weir for normal system demands.

In extreme dry periods there is insufficient flow available to cater for the full carrying capacity of the Pedersen Weir - Warragul WTP pipeline. Stream flow records Table 9 for a dry summer period (1983) indicate available raw water quantities.

Table 6-4 Tarago River Stream flow 1983 Summer Period

	MONTHLY SUPPLY, ML	**Daily Supply, ML/day**
October	600	19.4
November	420	14.0
December	540	17.4
January	400	12.9
February	340	12.1
March	400	12.9
April	390	13.0
May	560	18.1

Allowing for losses through upstream consumers and treatment plant usage, water available to consumers in a dry summer period is shown in Table 10

Table 6-5 Quantity of Water Available in a Dry Summer

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Available Supply ML/day	12.0	12.0	12.0	11.2	10.4	11.2	11.3	12.0

Assuming that all storage's can be maintained at full supply level at the start of the summer period, the supply/demand and shortfalls for an average year is shown in Table 11 and a dry year is shown in Table 12

This information is extrapolated, based on population increase, to estimate the expected shortfall of supply during such periods in future years. It is assumed that June to September that 12 ML/d is available from Pedersen Weir.

Table 6-6 Yearly Supply/Demand for an Average Year

		2005		2015		2025		2035	
Month	Supply	Demand*	Excess Deficit from Supply	Demand	Excess Deficit from Supply	Demand	Excess Deficit from Supply	Demand	Excess Deficit from Supply
	(ML)	(ML)	(ML)	(ML)	(ML)	(ML)	(ML)	(ML)	(ML)
May	*372*	*147*	225	197	175	265	107	356	16
June	*372*	*131*	241	176	196	236	136	317	55
July	*372*	*132*	240	177	195	238	134	320	52
August	*372*	*131*	241	176	196	236	136	317	55
September	*372*	*136*	236	183	189	245	127	330	42
October	*372*	*152*	220	204	168	274	98	369	3
November	*360*	*164*	196	220	140	296	64	398	-38
December	*372*	*170*	202	228	144	307	65	413	-41
January	*372*	*207*	165	278	94	373	-1	502	-130
February	*336*	*183*	153	246	90	330	6	444	-108
March	*372*	*176*	196	236	136	317	55	427	-55
April	*360*	*161*	199	216	144	290	70	390	-30
Excess/Deficit			**2298**		**1867**		**997**		**(-179)**

Table 6-7 Yearly Supply/Demand for a Drought Year

Month		2005		2015		2025		2035	
	Supply	**Demand**	**Excess**	**Demand**	**Excess**	**Demand**	**Excess**	**Demand**	**Excess**
			Deficit from Supply		Deficit from Supply		Deficit from Supply		Deficit from Supply
	(ML)	(ML)	(ML)	(ML)	(ML)	(ML)	(ML)	(ML)	(ML)
May	*372*	*225*	147	302	70	406	-34	546	-174
June	*372*	*166*	206	223	149	300	72	403	-31
July	*372*	*158*	214	212	160	285	87	384	-12
August	*372*	*204*	168	274	98	368	4	495	-123
September	*372*	*192*	180	258	114	347	25	466	-94
October	*372*	*246*	126	331	41	444	-72	597	-225
November	*360*	*258*	102	347	13	466	-106	626	-266
December	*372*	*313*	59	421	-49	565	-193	760	-388
January	*347*	*306*	66	411	-39	553	-181	743	-371
February	*336*	*297*	39	399	-63	536	-200	721	-385
March	*372*	*267*	105	359	13	482	-110	648	-276
April	*360*	*211*	149	284	76	381	-21	512	-152
Excess/Deficit			**1561**		**583**		**-731**		**-2497**

From the above summaries the following deductions are made:

- by 2025 the existing raw water supply and treated water storage's will not be adequate for normal demand.
- by 2015 there will be insufficient water available from Pedersen Weir to meet the demands during a drought period.

Potential solutions for these shortfalls could be:

- Provide additional storage capacity in demand area.
- Development of a supplementary raw water source with Pedersen Weir.
- Development and use of an alternate raw water source other than Pedersen Weir.
- Introduce water restrictions during the summer period in the demand area.
- Introduce water restrictions all year in the demand area.

6.4 Environmental Flow Requirements Downstream of Pedersen Weir

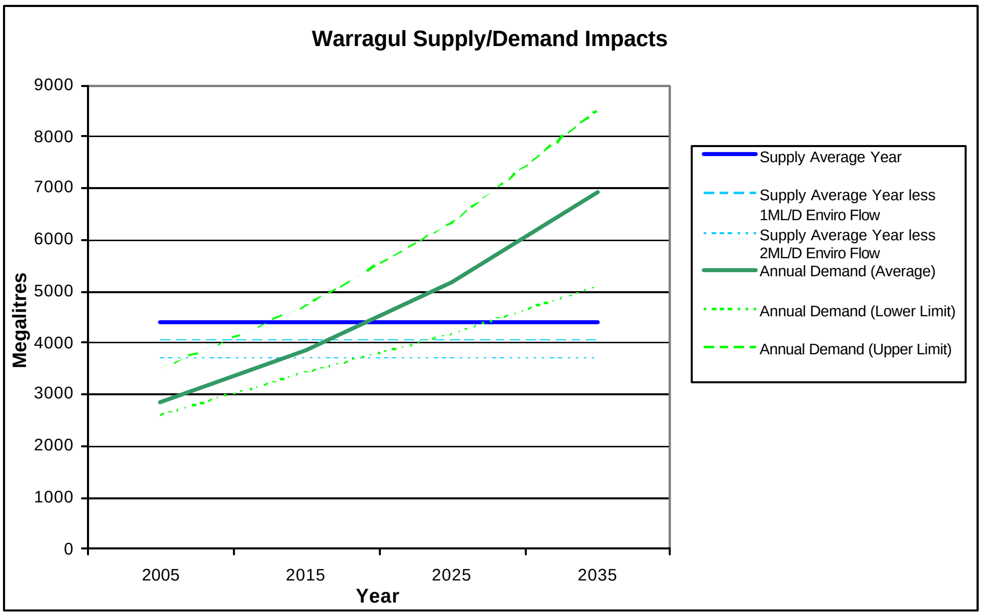
The quantity of raw water available could be further compromised if there is a requirement of a minimum environmental flow downstream of Pedersen Weir.

At this stage the level of this requirement is unknown. However, regardless of the quantity of this flow any reduction in available raw water source will have an effect on when an additional/alternate raw water source will be required. See Figure 1 Warragul Supply/Demand Impacts below for extrapolated impacts on supply to Warragul if environmental requirements are placed downstream of Pederson Weir.

As shown in the graph, if an environmental flow requirement is 1 ML/day there will be insufficient water available from Pedersen Weir by approximately 2015.

During the time of writing, Gippsland is experiencing a drought year with restrictions already in place. An environmental flow requirement of 1ML/day would see insufficient water available by 2008. Where a 2ML/day increase would directly affect supply now.

Figure 6-1– Warragul Supply/Demand Impacts



6.5 Structural Condition of Major Assets

6.5.1. Pedersen Weir

Pedersen Weir is a reinforced concrete arch structure approximately 4.6m high and 29m long and was constructed in June 1963. The weir impounds approximately 11ML and except close to the weir structure, the water is relatively shallow. The structure is in good condition. The weir has been constructed in such a way that would allow it to be raised by approximately 1.8m. Because of the narrow steep nature of the valley this would increase the storage marginally.

The weir does suffer from silting problems that reduces its storage capacity. The rough ground upstream of the weir makes it difficult to clear the silt by mechanical means. Access to the site is difficult because of the nature of the terrain. De-silting is usually conducted using the two manually operated scour valves in the base of the dam. Use of these scours is somewhat limited because of environmental restrictions on their use.

There is no accurate measurement of flows passing the weir into the river. The scour valves are not metered and the weir has no depth gauge. The weir is remote from a power supply and if metering was to be considered an alternative power source, e.g. solar, would need to be considered. Connection of gathered information to the telemetry system would also be required and may be possible with a relayed radio link.

During wet weather, it is common that the water turbidity increases significantly. There is no measurement of this factor at the weir. It is only the knowledge of the operators that this issue is able to be controlled. Unexpected increase in the turbidity of the water could have an effect on the performance of the Warragul WTP.

6.5.2. Pedersen – Warragul WTP Supply Pipeline

The 24 km 450 mm diameter MSCL pipeline is in good condition. A major factor for its good performance is that it has extensive cathodic protection system in place. The pipeline construction was commenced in the late 1950's and completed in 1963. Approximately 2 km of the pipeline is under the Tarago Reservoir.

There have been two occurrences, 1978 and 1988, of the pipeline failing beneath the Tarago Reservoir. The second incident was attributing to inadequate repair of the first failure. There have been no incidents since 1988.

6.5.3. Warragul WTP and Storage Basins

The existing Warragul WTP and storage's are in very good condition. The WTP underwent a major upgrade in 2000. The existing plant was upgraded to a Dissolved Air Flotation (DAF) at a cost of $1.5 million. The north and south water storages are both concrete lined basins with a plastic liner and floating cover. This maintains the water quality to World Health Organisation (WHO) standards.

6.6 Basis of Cost Estimates

Cost estimates prepared during this study have been calculated for the purpose of comparison between schemes. Capital costs estimates of mechanical equipment and pipes are based on budget prices obtained from suppliers. Cost estimates for construction works are based on information obtained from past projects of a similar nature and experience with like projects. Cost estimates for administration, operations and maintenance are based on information provided by GW on existing assets. Other sources of cost information have been the CMPS&F and the Kinhill reports. Costs in these reports have been indexed to reflect current costs.

For comparison of costs and the timing of major infrastructure requirements the following factors area considered:

- A 1 ML/d environmental flow is required downstream of Pedersen Weir.
- to meet the needs of water requirements in a dry season, additional infrastructure should be operational by 2015
- supplemented water supply to meet average demand will be required from 2020
- payment to Melbourne Water for extra water to commence from 2020

- duplication/augmentation of required parts of the Pedersen - Warragul pipeline is required by 2030

Table 6-8 Capital Cost Estimate Unit Rates

Item	Description	Unit	Unit Rate $
1	Pump Station 13.7 ML/d 50m lift (Rokeby)	Each	550,000
2	Pump Station 13.7 ML/d 70m lift incl. delivery pipework, Service basin. (Tarago)	Each	1,000,000
3	Pump Station 6 ML/d 70m high lift incl. delivery pipework, service basin (Tarago)	Each	650,000
4	Pump Station 6 ML/d 50m lift (Rokeby)	Each	350,000
5	Electrical supply	km	25,000
6	300 ML Service Basin	Each	850,000
7	150 Cl 16 uPVC pipeline incl. construction	km	32,000
8	375 MSCL pipeline incl. construction	km	170,000

Table 6-9 Annual Operating Costs Estimate Unit Rates

Item	Description	Unit	Unit Rate $
1	O & M 50m lift 13.7 ML/d pump station	p.a.	25,000
2	Power Supply 50m lift 13.7 ML/d pump station	p.a.	13,000
3	O & M 70m lift 13.7 ML/d pump station	p.a.	35,000
4	Power Supply high 70m 13.7 ML/d pump station	p.a.	17,000
5	O & M 50m lift 6 ML/d pump station	p.a.	18,000
6	Power Supply 50m lift 6 ML/d pump station	p.a.	7,000
7	O & M 70m lift 6 ML/d pump station	p.a.	20,000
8	Power Supply 70m lift 6 ML/d pump station	p.a.	9,000
9	O & M low lift booster pump station	p.a.	15,000
10	Power Supply low lift booster pump station	p.a.	9,000

6.7 Options

6.7.1. Option 1 - No Further Development of the System

This option is based on the assumption that no additional water supply source is developed. Main elements of the proposal are:

⇒ Continue to use Pedersen Weir as the main water supply source.

⇒ Neerim Sth. and district supplemented with Tarago Reservoir water.

⇒ Tarago Reservoir to supply water on an as needs basis to the rest of the area during drought periods.

⇒ No further development of water storage basins (raw or treated) in the demand areas.

⇒ No further development of supply system in the demand areas.

Costs

While there are no capital costs or appreciable increase in annual costs there will be costs to the organisation. These are assessed as:

1. Loss of revenue due to inability to supply water on demand to residential properties.

The figures used in the economical analysis are based on the deficiency in supply for a normal year. Costs are based on a current charge of $ 0.50/kl. This impact comes in to effect in 2025.

The impact on industrial supply has not been assessed. However, it is possible that litigation may occur depending on how the supply agreements are structured.

2. Impact of poor publicity on GW because of deterioration of service.

Deterioration of service is expected to have a direct impact on customers in about 2025. It would be expected that there would be no more than the normal complaints for the first few years. However as the deterioration of service becomes more common there will be an increase in customer complaints which would involve articles in local papers and eventually broader news agencies. This would also attract the attention of local politicians and local members of State parliament. In the economical analysis it is assumed that for the first few years there will only be one incident per year increasing to four per year in 2036.

Melbourne Water has recently introduced an estimated cost, as a result of poor publicity, on the organisation. This is assessed as $ 250,000 per incident.

The impact on GW would not be as significant as this amount. Based on population alone, GW has a customer base of 133,000 compared to 3 million in Melbourne or about 5%. Using this as a base the cost to GW is assessed at $12,500 per incident.

6.7.2. Option 2 - Increase Pedersen Weir's Hydraulic Output

Supply Neerim Sth and District with Tarago Reservoir Water

This option is based on increasing the output of Pedersen Weir with in installation of a booster pump station at the weir or further down the delivery main. Additional storage in the demand area could be used to manage the additional quantity of raw water. This however would have a limited life as the demand will outstrip supply by 2025. An alternate option is to increase the size of the weir to capture extra water. This has limited use for the same reason. Main elements of the proposal are:

⇒ Construction of booster pump station at Pedersen Weir or possibly Rokeby.

⇒ Provision of a power supply to the pump station at Pedersen Weir.

⇒ Neerim Sth and district supplied only from Tarago Reservoir.

⇒ Acceptance of a reduced river flow downstream of Pedersen Weir

<u>Costs:</u>

Capital:

<u>2020</u>

Pump Station at Pedersen $350,000

Power supply to PS approx. 10 km $250,000

TOTAL $600,000

<u>2030</u>

Additional supply main approx 24 km $ 4,080,000

Annual:

Power supply p.a. $9,000

Maintenance p.a. $20,000

6.7.3. Option 3 - Pedersen Weir supply with Tarago Reservoir Water

Supply Neerim Sth and District with Tarago Reservoir Water

This option is based on drawing additional water from Tarago Reservoir to meet the demands of the system. The extra water can either be drawn either directly from Tarago or from the Tarago-Westernport pipeline at Rokeby. Main elements of the proposal are:

⇒ Construction of a 6 ML/d pumps station at Tarago Reservoir discharging into Pedersen Weir - Warragul WTP pipeline.

⇒ Alternatively construct a 6 ML/d pump station at Rokeby.

⇒ Acceptance by the owner of Tarago Res. (Melbourne Water) on the scheme.

⇒ Neerim Sth and district supplied only from Tarago Reservoir.

6.7.3.1. 6.7.3.1 Option 3A Pump Station at Tarago

Costs:

Capital:

2020

Construction 6 ML/d pump station 70m lift $650,000

2030

Additional supply main approx 10 km $1,700,000

Annual:

Power supply p.a. $9,000

Maintenance p.a. $20,000

Extra water requirements Varies

6.7.3.2. 6.7.3.2 Option 3B Pump Station at Rokeby

Capital:

<u>2020</u>

Construction 6 ML/d pump station 50m lift $350,000

<u>2030</u>

Additional supply main approx 5 km $850,000

Annual:

Power supply p.a. $7,000

Maintenance p.a. $18,000

Extra water requirements Varies

6.7.4. Option 4 - Transfer Bulk Water Entitlement to Tarago Reservoir

Supply Neerim Sth and district with Tarago Reservoir Water

This option is based on using Tarago Reservoir as the main source of raw water for the system. It involves the transfer of all GW bulk water entitlements from Pedersen Weir to Tarago. These entitlements plus any extra demands are drawn out of Tarago via pump station. Main elements of the proposal are:

⇒ Retrieving bulk water entitlement from Tarago Reservoir in addition to any extra requirement purchased from Melbourne Water.

⇒ Acceptance of this proposal by Melbourne Water.

⇒ Construction of a pump station at Tarago Reservoir discharging into Pedersen Weir - Warragul WTP pipeline

⇒ Decommissioning/removal of Pedersen Weir

⇒ Decommissioning of Pedersen Weir - Warragul WTP pipeline upstream of Tarago Reservoir.

⇒ **Note**: additional option is to extract the water for Warragul from the Tarago - Westernport pipeline at Rokeby enabling an extra length of the Pedersen-Warragul pipeline to be decommissioned. Cost benefit of this option is to be further examined.

6.7.4.1. 6.7.4.1 Option 4A Pump Station at Tarago

<u>Costs:</u>

Capital:

<u>2020</u>

Construction 13.7 ML/d pump station 70m lift $1,000,000

<u>2030</u>

Additional supply main approx 10 km $ 1,700,000

Annual:

Power supply p.a. $17,000

Maintenance p.a. $35,000

Extra water requirements Varies

6.7.4.2. 6.7.4.2 Option 4B Pump Station at Rokeby

Capital:

<u>2020</u>

Construction 13.7 ML/d pump station 50m lift $550,000

<u>2030</u>

Additional supply main approx 5 km $850,000

Annual:

Power supply p.a. $13,000

Maintenance p.a. $25,000

Extra water requirements Varies

6.7.5. Option 5 - Connection to the Moe - Yarragon Supply Main

Supply Neerim Sth and District with Tarago Reservoir Water

This option is based on connection to the Moe supply system to supplement the existing supply system. It will require a new pipeline from Yarragon to Warragul Nth storage basin. It is also likely that a booster pump station may be required. The main elements of this proposal are:

⇒ Continue to use Pedersen Weir as the main water supply source

⇒ Neerim Sth. and district supplemented with Tarago Reservoir water.

⇒ Construction of a 150 pipeline from Yarragon to Warragul Nth storage basin

⇒ Construction of a booster pump station

⇒ Adequate capacity in Moe - Yarragon supply main to supplement Warragul area during high demand. (This will require further investigation).

<u>Costs:</u>

Capital:

<u>2020</u>

Construction of 15 km of 150 uPVC pipeline, $480,000

Construction of booster station $250,000

Total $730,000

<u>2030</u>

Additional supply main approx 24 km $4,080,000

Annual:

Power supply p.a. $9,000

Maintenance p.a. $15,000

6.8 Discussion of Options

Options 1, 2, 3 (A &B) and 5 continue to depend on Pedersen Weir as the main source of supply for the Warragul area. Several factors will effect consideration of these options.

- Requirement of an undetermined environmental flow downstream of Pedersen Weir will dramatically effect the timing of the need for an additional raw water source to be brought on line. Each 1 ML/d requirement will bring the need approximately 10 years closer. By 2025 the available supply at Pedersen will be exceeded by demand.
- The existing Pedersen - Warragul gravity main has a maximum deliverable useable capacity of 12 ML/d (allowing for system losses). By approximately 2025 the demand will also exceed the ability of the pipeline to get water to Warragul. A additional supply main will be required for the main source of supply. Including a booster pump on the existing pipeline will enable the timing of construction of the additional supply line to be deferred. However, its need will only be deferred not eliminated. Option 3A and 3B reduce the length of the duplication required.

Option 1 and 2 will not meet the needs and expectations of GW customers beyond 2020. By 2030, the available supply from Pedersen Weir, even if supplemented with an additional pipeline, will not meet customer demands. Deterioration in service will result in customer dissatisfaction and poor publicity for GW.

Option 3 (A & B) while still dependent on Pedersen Weir as the major raw water source, has the backup of an additional source from Tarago Reservoir.

Options 4 (A & B) have the major benefit of tapping the larger raw water source of Tarago Reservoir. However, the acceptance of Melbourne Water of this option, and Option 3, is necessary for these options to be viable. Negotiates on Bulk Water Entitlement at Tarago will need to be finalised to ensure all costs on these options are captured.

It should be noted that design drawings, prepared by Garlick & Stewart, already exist that could be used for option 4A.

Option 5 is dependent on the availability of excess water from the Moe supply area to supplement the Warragul demands. This issue is yet to be examined in detail. However, the long supply line, possibly requiring a booster pump increases the capital cost of this option. Duplication of the existing supply main to Pedersen Weir will still be required.

6.8.1. Option 4 Estimated Costs

The cost estimates presented above are summarised in Table 13. The table shows the capital costs of the additional assets that are required by 2020 and the additional pipeline required by 2030. The annual costs are those associated with the operation of the new assets. The cost of additional water required to meet demands are not shown but have been factored in the economical analysis figures.

Table 6-10 Summary of Estimate of Costs

Description	Option 1	Option 2	Option 3A	Option 3B	Option 4A	Option 4B	Option 5
Capital 2020 2030 $,000		 1450 4080	 650 1700	 350 850	 1000 1700	 550 850	 730 4080
Annual (Excl Extra Water Costs from 2025) $,000		29	29	29	52	38	24
Economic Evaluation (Incl Extra Water Costs From 2030) (4%, 8%, 15%) $,000	518 140 17	1674 540 96	1071 378 79	716 247 50	1401 518 115	904 326 70	1593 528 99

The options of extraction water from the Tarago - Westernport pipeline at Rokeby (Options 3B and 4B) appears the most favourable. This is regardless of the extra cost from Melbourne Water of the supply at this point. The major savings occur from the reduction in cost of the supply duplication main.

6.9 Conclusions

Based on population predictions, the Warragul water supply area will require supplementation of its raw water source by 2020. The current source, Pedersen Weir, has insufficient source water to meet demands. During a drought event the available water from this source is further reduced.

In addition to an additional raw water source the existing Pedersen - Warragul gravity pipeline will require supplementing by 2030. Provision of a booster pump on the existing pipeline will not provide additional supplies because of the lack of source water.

The Tarago Reservoir provides a significant source of raw water that is likely to meet the system demands. Availability and costs associated with this water is dependent on negotiations of a Bulk Water Entitlement Agreement with Melbourne Water. There are also a number of water quality issues of this source that also need to be resolved.

The major physical assets are generally in good condition with significant useful life remaining.

Significant savings can be made in future capital expenditure if the length of duplicate/replacement supply main is reduced. These savings add to the strengths of the options that extract water from the Tarago - Westernport pipeline at Rokeby.

6.10 Recommendations

It is recommended that GW:

1. Resolve the issue of the environmental flow requirements downstream of Pedersen Weir.
2. Resolve the issue of the Bulk Water Entitlement Agreement at Tarago Reservoir with Melbourne Water.
3. Because of the uncertain future of supply from Pedersen Weir, prepare a long term management plan based on Option 4B, Extraction of Raw Water from the Tarago - Westernport Pipeline at Rokeby, for the development of the Warragul and district water supply area.

Chapter 7. Wastewater Strategy

7.1 Introduction

Warragul has had sewerage services since about 1938 and some of the elements of the system are approaching the end of their useful life. Currently there is a significant amount of residential development proposed all around Warragul and there are approved capital works, which will be started within the next two years. There needs to be an agreed strategy to ensure the orderly, sustainable, cost effective development of the sewerage system to enable the community to be properly serviced over the next 100 years or so.

7.2 Background and Future Development

As noted above, Warragul has had a reticulated sewerage system for nearly 60 years. This section describes the sewerage system, the population growth forecast for Warragul and the sewer system upgrades required as a result of aging assets and the forecast increased load on the systems.

7.3 Existing System

The Warragul sewerage system consists of four major catchments - the north east catchment, the central catchment, the southern catchment and the western catchment – discharging to the WWTP via an influent pump station (SPS). The WWTP is located to the east of the town in the valley of Hazel Creek a tributary of the Little Moe River which in turn is a tributary of the Moe River in the Latrobe River Catchment. The north east catchment discharges directly to the WWTP influent SPS by gravity. The Central and Southern catchments connect to a common gravity outfall sewer in Queens St which is also connected to the WWTP influent SPS. The western catchment is connected to the WWTP by a pump station and rising main which discharges to a pressure main via a weir structure near the corner of Mason and Queen Sts.

The WWTP has been progressively upgraded as the township has developed since 1938. The influent pump station was replaced about 2004; the original sedimentation tanks and trickling filters were augmented by lagoons during the 1950s and replaced with a biological nutrient removal extended aeration plant about 1998. The WWTP will be modified by the addition of more effective grit removal and screening equipment and chemical dosing for Phosphorus removal during 2006. The upgraded WWTP is expected to be able to service the community then until the population approaches 20,000 about 2022.

The major outfall sewer serving the central southern and western catchments was upgraded by the addition of a pressure sewer between Queen St and the WWTP influent SPS about 1960. The western catchment SPS has been re-equipped and had minor upgrades from time to time, but the sewer system is generally unchanged from that originally constructed. It has been extended to service additional areas as they were developed.

7.4 Forecast Development

The population of Warragul at 2001 was about 10,500 persons and about 4230 allotments according to the bureau of Statistics data. The urban population is forecast to increase at an average of three percent per annum for the foreseeable future. This strategy presented herein is based on this rate of growth continuing for the effective life of this scheme.

The Shire of Baw Baw is the planning authority for the area and it has proposed zonings around the edges of the township for urban development. These limits are well inside the natural catchment boundaries so it is possible that in the future the planning scheme boundaries could be extended. In this event, additional load would be applied to any sewer system constructed to serve the currently proposed urban zoned areas. It would be prudent for this strategy to propose means of servicing the development of the full catchment should that occur in the future.

Based on the 2001 ABS data and the forecast three percent growth rate, the forecast population for Warragul is as set out in the following table. The shire of Baw Baw requested input into the preferred sites for future development under the planning scheme and GW is currently required by the Essential Services Commission to make forecasts of the year each future development will commence. The development areas as advised in letter Cor/06/2381 Appendix I and development plan Cor/06/2407 Appendix J and their forecast development dates are included in the following table.

Table 7-1 Forecast Development, Warragul

Year	**Forecast Population**		**Development Area**
	Persons	**Lots**	
Present	10,500	4,230	Existing
2011		5,725	Infill
2013		6,265	Infill
2014		6,265	Seq2
2016	16,300	6,600	Seq3
2021	18,900	7,700	Seq3
2026	21,900	8,900	Seq3
2031	25,400	10,300	Seq3
2032		10,425	Seq4
2036	29,400	11,825	Seq4
2038		12,455	Seq5
2041	34,100	13,800	Seq5
2046	39,500	16,015	Seq5
2047		16,665	Seq6
2051	45,800	18,500	Seq6

7.5 System Upgrades

GW has a program which assesses the condition of each reticulation sewer over a five year cycle. The program reviews the condition and critically of each sewer based on a condition/risk procedure and identifies reticulation sewers which require renovation or upgrade. The renovation work is carried out progressively as the defective sewer is identified. The reticulation sewer upgrade work resulting from this condition assessment program is not included in this strategy.

There are no other known deficiencies within the Warragul sewer system other than some access chambers located between Hazel Creek and the Freeway near the Warragul Hospital and inadequacies as a result of age associated with SPS2, the pump station serving the western catchment.

This strategy is primarily concerned with the augmentation of the system required to service the growing township. As augmentation or extension of trunk sewer works is found to be required, the condition of any nearby assets will be assessed and they will be considered for replacement by the new works if appropriate.

In addition to the condition/consequence/criticality sewer assessment program outlined above, GW carries out an assessment of the hydraulic capacity of its major sewer systems having created digital models of the hydraulic capacity of its major sewer schemes. These models are based on the proprietary line sewer flows modeling software INFOWORKS. At about five year intervals GW undertakes a program involving and gathering normal flow rate data and extreme flow rate data resulting from infrequent storm activity in the sewer catchment and this flow rate data is used to calibrate its digital sewer models.

A program of gathering sewer flow rate data was undertaken during the later months of 2005 for the Warragul sewer system. Those data have been used to further calibrate the Warragul digital model and identify sewer reaches that are stressed or under capacity.

The 2005 flow rate data has identified hydraulic deficiencies in the SPS2 pump station system and in the Logan Park sewer system. These deficiencies have been recognised in the development of the sewerage strategy described herein.

7.6 Solution

For servicing each of the development areas, an investigation was undertaken to evaluate the options and recommend a holistic strategic approach. No other recent allied studies have been completed but an internal study report entitled Warragul Sewerage Report on SPS2 System Upgrade Options by *Abeysinghe.N,* has been complete for one Warragul catchment. The preliminary planning of the upgrade of the North West Sewer system is being carried out under Capital Database Project 2237.

The recommendation for each of the specific area are described below and illustrated in Appendix J.

7.6.1. Basis of Design

As noted above GW has created computer models of its significant sewer schemes based on INFOWORKS. These models are very sturdy but are not readily adaptable for the analysis of a range of disparate sewer scheme scenarios involving alternative gravity sewers and pump systems. Accordingly, the preliminary design of the various alternative options is based on a simpler digital model of the subject alternatives based on Excel as described below. Once the favoured schemes have been identified, they will be analysed using the computer model to verify the outcomes of the simpler Excel based models.

7.6.2. Design Life

Sewer reticulation, pump station structures, rising mains and the like need to be designed and sized for their ultimate design life of 60 years.
Pumps, electrical, equipments and sizes are designed for 20 year design life.

7.6.3. Design Flow Rate Relationship

Sewer design flows are based on a number of factors associated with permanent infiltration, storm infiltration, peaking factors and factors of safety allowance for imponderables. For these preliminary design purposes GW uses Excel models in which these factors are related to the design flows by the following empirical relationships:

Average Dry Weather Flow Rate (ADWF)

ADWF = F_s.(P.q + A_c.C + A. (Ip))/86400

Where the symbols have the meanings:

ADWF - Average dry weather flow rate, L/s

F_s - Small area uncertainty factor

P - Allotments, Number

q - Unit sewage flow rate, L/lot/d

A_c - Area of Non Urban Use zones, Ha

C - Unit non urban flow rate, L/Ha/day

A - Area sewered, Ha

Ip - Unit permanent infiltration, L/Ha/day

The small area uncertainty factor, F_s, ranges from a value of 2 for small areas with nominal flow rates less than 6.0L/s, to a value of 1 for larger areas with flow rates in excess of 100L/s. The actual values are listed in the Excel model.

Peak Dry Weather Flow Rate (PDWF)

$$\mathbf{PDWF = F_s.((P.q + Ac.C).r + A.Ip)/86400}$$

Where the additional symbols have the meanings:

PDWF - Peak Dry Weather flow rate, L/s

r - Ratio between average and peak sewage flow rates

And

Peak Wet Weather Flow Rate (PWWF)

$$\mathbf{PWWF = F_s.((P.q + Ac.C + A. (Ip + Is))/86400}$$

Where the additional symbols have the meanings:

PWWF - Peak wet weather flow rate, L/s

Is - Unit Storm water Infiltration, L/Ha/day

For this study the flow rates from the non urban areas have been taken to be the same as the equivalent domestic flow rates so with the exception of the Warragul Linen Laundry and the nearby Hospital the non urban contributions have not been used directly in this study. The flow rate values are calculated at each location where flow rates are required usually at the location of changes of pipe size or grade, at significant junctions or at pump stations. The required flow rate data is based on catchment data readily available from reliable sources.

7.6.4. Design Parameter Values

As noted above, GW has recently completed the calibration of the digital model of its Warragul sewerage system. Calibration involves the collection of rainfall intensity and sewer flow rate data over a six to eight week period during late spring when there is likely to be high intensity rainfall events. These data are then used to adjust the parameters within the INFOWORKS model so that the flow rates forecast by the model for any actual sewer at a particular time, closely match the actual flow rates recorded during the monitoring period.

This calibration material is available for inclusion in the Excel model used for this study. The average and peak dry weather flow rate parameters were readily available from the data but the storm related infiltration rates were more difficult to enumerate because the design event is a five year average return interval (ARI) but the only relevant storm event during the monitoring period was a one year ARI event.

The unit sewerage flow rate was found to be 530L/Lot/d. This value is low compared to historical values; thought to be as a result of the reduced number of persons/lot as family units become smaller. There is increasing government pressure to maximise the use of urban infrastructure by increasing development densities in existing urban areas. It is therefore prudent to adopt a higher value for the unit sewage flow rate parameter. A multiplier of 1.2 has been adopted for this study, making the unit sewerage flow rate 640L/Lot/d.

The permanent Infiltration factor was found to be 460L/ha/d which is low compared with other systems. It probably reflects the freely draining topography of the township so a value of 500L/ha/d has been adopted for this strategy.

The storm related infiltration data resulting from the one year ARI was adjusted to establish the five year ARI parameter. The adjustment involved identifying the frequency of the actual storm event, one year ARI. The infiltration rate was calculated by comparing storm and normal hydrographs and I_{s1} was found to be 32,000L/ha/d. Based on the intensity/duration/frequency chart published by the Bureau of Meteorology for Warragul, the ratio I_{s5}/I_{s1} is 1.75.

The current edition of the publication *Australian Rainfall and Runoff* (ARnR) provides a series of relationships to model runoff from rainfall on surface catchments. These relationships also apply to sewer system rainfall driven flow rates with analogous parameters. The simplest relationship is the Rational Formula which provides that runoff is directly proportional to storm intensity, catchment area, and catchment runoff characteristics. ARnR also provides that the catchment runoff characteristics are dependent on a range of factors including rainfall intensity, surface slope, topography, soil type, cover and other variables which are lumped into a single modifier. These modifiers are illustrated in ARnR Volume 1 Book 8 Figure 1.13-‘runoff coefficients’ and Table 1.6, ‘Frequency factor for rational method runoff coefficients’.

For the purposes of the development of the sewerage strategy for Warragul, the rational formula has been adopted to calculate flow rates as a consequence of high rainfall events with judicious application of these modifiers based on professional judgement. Study of the relevant sections of ARnR indicates that the ratio I_{s5}/I_{s1} should be adjusted by the application of the catchment runoff characteristic factors 0.95 and 0.63; making the ratio I_{s5}/I_{s1} (1.75 x .95 x 0.63 =) 1.1. The value of the infiltration rate parameter was then calculated and found to be 35,000L/ha/d. For the purposes of developing this strategy, the infiltration rate parameter value of 35,000L/ha/d has been adopted for the whole of Warragul.

In summary, design criteria used for the concept design of the notional scheme described in this strategy are shown in the following table.

Table 7-2 Wastewater Design Unit Flow Rate Parameters

Characteristic	**Units**	**Unit Rate**
Average Dry Weather Flow	L/Ten’t/Day	640
Dry Weather Infiltration	L/Ha/Day	500
Wet Weather Infiltration	L/Ha/Day	35,000

GW policy requires that there be a volume of storage available at the inlet to each pump station at least equal to two hours at the design PDWF. GW experience indicates that for many SPS, there is sufficient storage available in the sewer system and the pump station wet well. In some localities there is insufficient storage in the system and additional storage facilities are required. The preliminary designs used in this strategy are based on SPS emergency storages being sized to accommodate 50 percent of two hours of inflow at PDWF with the other 50 percent stored in the SPS wet well and the incoming sewers and access chambers.

The other flow rate parameters are characteristics of the sub-catchments being analysed and are presented in the Excel model.

7.7 Catchments

7.7.1. Warragul North East

The existing gravity sewer system almost has the capacity to serve the proposed infill areas. When these have been developed the provision of sewerage to additional areas will require a duplicate sewer to be constructed up the creek valley north of the WWTP, the North East Interceptor. The North East Interceptor System will consist of about 8,500m of 225 DN, 300 DN, 375 DN, 450 DN and 600 DN sewer, a 60L/s SPS with emergency storage and about 900m of 250 ND pressure main with suitable discharge end ventilation.

These works will be constructed in a succession of stages to serve the proposed developments as they are progressed. The works will nominally be as follows:
Construct:

- About 2011 construct 1300m of 600 DN North East Interceptor sewers North West from the WWTP to just north of Sutton St.
- About 2014 construct about 600m of 375 DN Twin Ranges Branch sewers up the unnamed street to the property boundary north of Baw Baw Drive as part of Sequence 2 development.
- About 2032 construct the Copeland's Rd SPS system to serve the Sequence 4 area about two kilometres north of the WWTP. The Copeland's Rd SPS system will consist of an SPS near the south west corner of Sequence 4 on Copeland's Rd and a rising main west along the southern boundary of the development to the Twin Ranges Branch sewer. If the Sequence 4 area is under one ownership, the Copeland's Rd SPS system will not be a shared facility. However as it is likely the development will be under a multitude of ownerships, this SPS system and the associated trunk sewers, the Copeland Rd Trunk sewer system, will be shared facilities. GW will therefore be required to contribute to the cost of the trunk sewers within this catchment. The Copeland

Rd Trunk sewer system will consist of about 3600m of 225 DN, and 300 DN sewers. The pump station system will consist of a 60 L/s SPS with 50kL emergency storage and about 900m of 225 DN pressure main with suitable ventilation.

- About 2014 the North East Interceptor sewer will be extended about 1500m as a 450 DN sewer through the existing developments, northwards to Stoddart Rd and on through the Seq2 area, to the Seq5 area.
- About 2041 construct the Stoddart/Lillico Seq5 area system to serve the Seq5 area between Stoddarts and Lillico Rds. The Stoddarts/Lillico Seq5 area system will consist of a branched system of gravity sewers. If this Seq5 area is under the one ownership, the system will not be a shared facility. However as it is likely the development will be under a multitude of ownerships, these trunk sewers will be shared facilities, mostly financed by GW. The trunk sewer system will consist of about 1600m of 225 DN, and 300 DN sewers.

Note that the infill area, with the Seq3 and Seq4 areas between Brandy Creek Rd and the northern end of Bowen St, will be able to be served by the existing systems.

7.7.2. Warragul South

The existing gravity sewer system almost has the capacity to serve the proposed infill areas with small extensions to the existing reticulation system. However care may be required to ensure the incidence of overflows to the Hazel Creek near the trotting track do not exceed the minimum five year ARI goal. When the infill areas have been developed the provision of sewerage to additional areas will require two trunk sewer systems. The lower portions of these trunk sewers will duplicate or replace existing sewers.

One trunk sewer system will be the Korumburra Rd Trunk, which is up the valley parallel to Korumburra Rd south towards Lovell Drive. This will also receive the discharge from the proposed Bonavista SPS system in the valley south of East and West Rd and east of Bona Vista Rd, which serves the Seq6 area there. The Korumburra Rd Trunk System will consist of about 3,600m of 225 DN, 300 DN, 375

DN and 450 DN sewers, a 60L/s SPS with 60kL emergency storage and about 1300m of 300 DN pressure main with suitable discharge end ventilation.

Another trunk sewer system, the Landsborough St Trunk, will start in the Hazel Creek valley west of Howitt St and cross under the existing freeway to the valley near Hayes Dve at Landsborough St. One branch, the Hayes Dve Branch, will be located in the valley near Hayes Dve and will collect the flows from the balance of the Seq4 area west of Korumburra Rd and will replace Landsborough SPS. It will consist of about 1500m of 225 DN, 300 DN, 450 DN, 525 DN and 600 DN gravity sewers.

The other main branch will be located in Landsborough St then run up the valley west of Butlers Trk then across Butlers Trk and East and West Rd to the Seq5 area south of East and West Rd. It will receive flows from the proposed Stockdale Rd SPS serving the southern most portion of Seq5 and from the proposed Lardner's Rd SPS serving the western most section of Seq5

These works will be constructed in a succession of stages, to serve the proposed developments as they are progressed. The works will nominally be as follows:

- About 2030 construct the Korumburra Rd Trunk sewer from the Hazel Creek interceptor to the southern boundary of the infill area consisting of about 900m of 450 DN sewers.
- About 2032 extend the Korumburra Rd Trunk sewer through the Seq4 area as part of the Seq4 development to the southern boundary of the Seq4 area requiring about 600m of 375 DN sewers.
- About 2047, as part of the Seq6 development construct the Bona vista SPS system and inlet sewers involving about 300m of 300 DN sewer, a 60 L/s SPS, 60 kl emergency storage and about 300m of 300 DN pressure pipeline with suitable ventilation.
- About 2036 construct the Landsborough Ck Trunk sewer consisting of about 900m of 600 diameter sewer, abandon the Landsborough Rd SPS and extend the Hayes Dve Branch up the valley west of the hospital to serve Seq4 area. The Hayes Dve branch will consist of about 600m of 225 DN and 300 DN gravity sewers.

- About 2041 commence the construction of the Landsborough Rd Branch sewer along Landsborough Rd and up the western valley as part of the Seq5 development. This will consist of about 1800m of 225 DN, 300 DN, 375 DN, 450 DN and 525 DN sewers.
- About 2043 construct the Lardner's Rd SPS system consisting of a small section of 225 sewers, a 20 L/s SPS with 20kL emergency storage and about 400m of 200 DN pressure main with suitable ventilation.
- About 2045 further extend this branch sewer south as part of the Seq5 development to serve the remnant Seq6 area. This sewer will also receive the flows from the Stockdale Rd SPS system consisting of about 200m of 225 sewer, a 20 L/s pump station with 15kL emergency storage, about 300m of 200 DN pressure main. The branch will consist of about 2000m of 225 DN, 300 DN and 375 DN gravity sewers.

It is noted that the outfall works across the Hazel Creek Valley to Queen St and the outfall works along Queen St have limited capacity. About 2008 it will be necessary to augment the capacity of these outfall works by constructing a gravity sewer from near the trotting track to the WWTP Influent SPS or constructing a pump station and rising main to the WWTP inlet works. For the purposes of this strategy, the gravity sewer system has been adoption as the notional outfall works augmentation.

7.7.3. Warragul West

The infill areas west of Glendalough Crt and east of Deakin Cres will be able to be serviced by connection to the existing local reticulation. The balance of the proposed development to the west of Warragul, Seq3, will be served by the construction of several trunk sewers up the included valleys as required by the development, and as part of the development reticulation. If this Seq3 area is under one owner, the Pharaohs Rd trunk sewer system will not be a shared facility. However as it is likely the development will be under a multitude of ownerships, this system will be 'shared facilities'. GW will therefore be required to contribute to the cost of the trunk sewers within this catchment, by the Pharaohs Rd trunk sewer located in the valley west of Pharaohs Rd commencing at a couple of low points about 600m north of Dollarburn Rd. A main tributary trunk sewer system the west branch trunk sewer will be located just north of and nearly parallel to the Old Princes Highway commencing close to Lardner's Track and discharging to the Pharaohs Rd trunk sewer. This west branch sewer will have main tributaries from its north.

The existing reticulation system will not have the capacity to serve the Seq4 area Windhaven Dve and the Windhaven Crt SPS system will be required to service this area, discharging to the Seq3 area to the south west. Similarly the existing reticulation system will not have the capacity to serve the Seq3 and Seq6 areas north of Elm Crt, and the Bowen St Nth SPS system discharging to the Pharaohs Rd trunk sewer system will be required to service these areas.
The Seq3 area North West of the SPS2 site will be able to be serviced

The West Warragul sewer system will consist of about 11,000m of 225 DN, 300 DN, 375 DN, 450 DN, 575 DN, and 600 DN sewers a 20L/s SPS and a 70 L/s SPS with emergency storages and about 800m of 200 ND and 300 ND pressure mains with appropriate ventilation.

However the existing outfall works serving the west Warragul area, the SPS2 system, do not have capacity to service any Seq3 area. Before any of the West Seq3 area can be serviced, the SPS2 outfall works will need to be significantly augmented.

The West Warragul works will be constructed in a succession of stages, to serve the proposed developments as they are progressed. The works will nominally be as follows:

- About 2013 construct some SPS2 outfall works augmentation. These augmentation works can be gravity along the Hazel Creek valley to the WWTP Influent SPS or they can be a pump station or series of pump stations with a rising main system along the Hazel Creek valley to the WWTP inlet works. Concurrent investigations, described in COR/06/6983, indicate that there are advantages in reducing the sizes of the required long pipelines by providing Flow Rate Attenuation Basins (FRABs) at key junctions so that the downstream pipelines are sized for three times ADWF rather than about six times ADWF used for normal designs.

- About 2016 construct - as part of the Seq3 development - the first part of the Pharaohs Rd trunk sewer westerly from the SPS2 site to Tarwin St, duplicating the existing reticulation sewers. Then as the development of the seq3 area proceeds extend the Pharaohs Rd trunk sewer northerly to opposite the Canawindi Dve area and extend the west branch and its tributaries up the valleys, nearly to Lardner's Trk and northerly to the northern boundary of the Western portion of the Seq3 area. The initial works will consist of about 2300m of 225 DN, 300 DN, 375 DN, 450 DN, 525 DN and 600 DN gravity sewers.
- About 2020 extend the Pharaohs Rd trunk sewer and its tributaries to appoint about 700 south of Dollarburn Dve. This work will include about 1500m of 225 DN, 300 DN and 375 DN gravity sewers and the Bowen St Nth SPS system including a 70L/s SPS with 65kL emergency storage and about 500m of 300DN pressure pipeline with appropriate ventilation.
- About 2024 extend the Bowen St Nth SPS system as part of that Seq3 development east to about Birchcroft Crt and north to the island Seq3 area boundaries. This work will involve about 340m of 225 DN and 300 DN gravity sewers.
- About 2026 extend the Pharaohs Rd Trunk Sewer and its tributaries as part of the Seq3 development to serve the northern extent of the development. This work will involve about 3400m of 225 DN, 300 DN and 375 DN gravity sewers.
- About 2032 as part of the island Seq4 development north of Windhaven Dve, construct the Windhaven Dve SPS System consisting of about 400m of 225 DN and 300DN gravity sewer, the 20L/s Windhaven Dve SPS and 15kL emergency storage and about 300m of 200 DN pressure main with appropriate ventilation.
- About 2047 as part of the Seq6 development, extend the Bowen St Nth SPS system to serve the area north to Buln Buln Rd. This work will involve about 1300m of 225 DN, 300 DN and 375 DN sewers.

7.7.4. South West Outfall

The Baw Baw Planning Scheme is proposed to provide for more than two thirds of the Warragul ultimate population to be located west and south of Hazel Creek. The Existing outfall works serving these area, the SPS2 system and the existing 'S' sewer from the hospital area near Korumburra Rd appear to have the capacity to serve the existing development connected to them but have limited capacity for connection of additional areas. The proposed areas are many multiples of the existing areas so the outfall works required to cater for the proposed developments Seq3 to Seq6 will be significant. Work to date indicates that the required works will include pipelines form about the SPS2 site to the WWTP.

These pipelines may be gravity sewers connected to the existing WWTP influent SPS or they may be a series of SPS installations linked by common pressure mains to the WWTP inlet works. Alternatively they may be a combination of the two. The selection will be made after a significant study encompassing environmental, social and economic benefits and disadvantages of the various options.

The work involves about three kilometres of pipelines so the benefits of slightly increasing the cost of the nodal works are easily offset by the value of reducing the sizes of the pipelines significantly.

GW has established that where (FRABs) can be provided with storage capacity equal to about four hours at peak dry weather flow rate, then the capacity of the linking pipe lines can be reduced by 50 percent.

In addition, observation of the growth of the Melbourne outskirts indicates that it is unlikely in the longer term for the development to stop at the boundaries as currently proposed under the Baw Baw Planning Scheme. It is more likely that in the longer term future the development will extend out to the end of the drainage catchments. While this forecast extra development is in the very long term it is well within the economic life of gravity sewers and pressure mains. It has been shown that were development is likely to occur within 60 years of the construction of main sewers it is most cost effective to construct the sewers with the capacity to serve the whole area.

Duplicating such pipelines after the area has been developed for 50 years or so involves significant social cost form the disturbance and disruption of such well established areas.

Providing the main sewer systems with half the ultimate capacity and if required in the future providing a limited number of (FRAB) to provide the additional capacity when it is required is a sound economic compromise.

Accordingly the works to serve the western and southern development proposed for Warragul are likely to be served by gravity sewers or pump station systems installed at the outset with FRABs provided at key locations as required serving any additional developments as and when they occur.

It is noted that the south west outfall – the Hazel Creek Interceptor System – will enable the three existing pump stations, Hamilton Dve SPS, Munro St SPS and Spring St SPS to be replaced by short gravity sewers lining them to the Hazel Creek interceptor. This work will involve:

- Outfall sewers consisting of about 2400m of 225 DN gravity sewers.

7.8 Warragul WWTP Buffer

Under our licensing agreement with the EPA, a buffer is required around the Warragul WWTP. The buffer for a 20,000 person capacity plant has been approved by EPA; however the Shire has rezoned residential development within that buffer. As Warragul grows to the size proposed by the Baw Baw Planning proposals and by the GW full development of the whole catchment considerations the existing plant will have to be augmented or all or part of it will have to be relocated.

One clear proposition is to establish a second plant the Little Moe river valley just north of the Princes Highway west of Darnum. This plant could be established to take the overflow from the existing WWTP where the three times ADWF exceeds 150 L/s, the capacity of the existing plant. The initial connection works would be a gravity sewer down the Hazel Creek Valley or a pump station and rising main system. In either case the connecting works would be sized to serve the ultimate development of the area and use may be made of the FRAB concept outlined above. The initial load on the WWTP may be small so it would be desirable to take some of the load off the existing pant and maybe turn either plant of for low flow periods to conserve energy.

The existing Warragul WWTP could remain in action in perpetuity or when the new plant is fully established and the existing plant is no longer economically viable the old plant could be abandoned and the new plant take on the full treatment function. The new plant would not be located close to Warragul so would have disadvantages for urban reuse possibilities but would simplify the provision of sewerage services to Darnum and Nilma.

7.9 Benefits

The benefits of this strategy include:

- Provision of adequate outfall works to service programmed developments within existing serviced catchments, to industry standards at the time of development, minimising temporary or short working life works, and
- Provision for the future development of other catchments within the Warragul precinct boundaries
- Reduced frequency of spills to the Latrobe River catchment beyond the target five year ARI.

7.10 Costs

As this is a high level strategy and there are many uncertainties, the capital costs are indicative only. No attempt has been made to optimise the works to match the development or to refine any of the notional systems proposed. As the developments occur, the proposals will be studied in more detail and the works most favourable to GW taking into account Environmental, social and financial benefits and costs will be identified.

The capital cost for the overall strategy is about $32M. Some of the work will be undertaken by the relevant developer at its cost, some will be undertaken by the developer and portion of the cost reimbursed by GW as portion of its CAPEX expenditure. A large amount of the cost to GW will be financed by developer contributions. To properly budget for the GW CAPEX the capital cost of each item of the notional schemes outlined above have been calculated. No attempt has been made to apportion the cost of the main works between the developers and GW. It is sufficiently meaningful for forward planning purposes to attribute the whole of the cost of the notional works to GW.

7.10.1. Basis of Capital Cost Estimates

The design work carried out to date is generalised based on notional schemes which are likely to be suitable for the purpose. No attempt has been made to optimise the schemes and the actual works chosen may have complexly different form The Capital cost estimates presented herein have been developed for forward budgeting purposes. They are based on whole unit costs and are sufficiently meaningful for the purpose. Actual costs will be found to be quite different but future cost estimates will be increasingly more meaningful as the design detail of the relevant works becomes more representative of the actual works. The capital cost estimates herein have been developed for other parallel studies and have been adjusted to reflect changes in costs since the other prices were established so that all costs as are presented in 2006 dollars.

Unit pressure pipeline costs were found to be represented by the following relationship.

Cu = 0.8 x D x F

Where:
D is the nominal diameter in mm
Cu is the Unit cost, $/m, and
F is the degree of difficulty factor..

Similarly the cost of gravity sewers was found to be represented by the following relationship:

Cu =1.2 x D x F

Where the symbols have the same meanings

The cost of basic sewerage pump stations is based on the relationship between design duty pump capacity and capital cost as follows:

Ci = 2.5 x O + 250

Where: Ci is the total SPS cost, k$, and

O is the design SPS output in L/s

GW requires that each pump station system has the capacity to store at least two hours of inflow at the design peak dry weather flow rate (PDWF). In small pump stations this can often be achieved in the wet well which has a minimum size or in the unused capacity of the incoming sewers. For pump stations of the sizes required for this scheme these volumes are not available and special provision of emergency storage is required. The cost of recent special emergency storages constructed in the area have been evaluated and found to be represented by the following relationship:

Ci = 1.1 x V + 350 Where: V is the required basin volume in m^3.

The based on the above relationships the unit costs used to calculate the estimated capital cost of the various options investigated in this study shown in Tables 1 and 2.

The unit costs are for pipelines with a unit degree of construction difficulty. For actual pipelines a degree of construction difficulty ranging from unity to 2.4 would be applied to the unit capital costs on a case by case basis. For this study, based only on notional schemes a degree of difficulty factor of 1.6 has been applied globally to the calculated net estimates. In addition a factor of 1.45 has been applied to the net estimates to provide a contingency amount of 25 percent and an engineering and management amount of 20 percent.

7.11 Timing

The attached schedule of cost estimates also has the indicative timings for when the assets need to be constructed. Some of these assets are on the current five year capital plan and the remainder will be constructed in the future, depending on growth.

7.12 Summary

The existing sewerage system serving Warragul was established about 60 years ago and has served Warragul well over that period with minor upgrades. As the Melbourne Metropolitan area advances eastward, Warragul is destined for significant growth over the next 40 or 50 years. The Planning Authority is making provision of the orderly progression of this development and has prioritised areas for development. Some of these areas are easier to provide with sewerage services than others and GW has provided the planning authority with a preferred timetable for the development of the various areas.

The existing sewerage system does not have the capacity to service these proposed areas and it will need to be augmented. Augmentation involves the construction of main sewerage facilities up the valley north of the existing WWTP west along the Hazel Creek valley to Latrobe Rd, south down the main valleys towards Bona Vista and Stockdale's Rd and north and west up the valleys parallel to Pharaohs Rd and Drouin Warragul Rd (Old Princes Highway). The cost of these works and their main tributaries and associated SPSs is estimated to be about $65M in 2006 dollars. This money is expected to be expended spasmodically over the period to 2055.

Other parallel studies indicate that the sewerage works down the valleys are likely to be gravity sewers. It has also established that there is considerable risk associated with sizing these sewers for their technical life, about 100 years, since the forecast load over that time may not ever arise because the development is interrupted by unforeseeable events on a local or global scale, or they may be undersized for similar reasons.

GW has established that where emergency storage - with capacity of about four hours of PDWF - is provided, the downstream works can be half of the design PWWF rate.

Since the design PWWF rate will occur only a few hours on a few occasions during the life of the works, provision of such storage is frequently justified where the downstream works are extended, like at Warragul.

For Warragul they have been found to be cost effective for several sites, Hazel Ck at Latrobe Rd, Hazel Ck at Howitt St and probably the north east interceptor near Sutton St. It these location it is likely that the actual downstream works will be sized for half the ultimate catchment development with provision for (FRAB) to receive and store the wet weather associated excess flows until the wet weather flow rates have passed when the stored wastewater will be pumped back into the downstream works.

7.13 Recommendation

It is recommended that:

1. The strategy described above and summarised on the attached plans be adopted by Gippsland Water as a guide for the future development of the Warragul Sewerage System,

2. The strategy to be revised every two years.

REFERENCE

Camp Scott & Furphy (CMPS&F), "*Warragul Northern Basin Review*", February 1995.

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MWH June 2005, *Warragul Sewerage Catchment Hydraulic Modelling (Volume 1, Final)*

Gippsland Water June 06, *Activity Management Plan, Wastewater Volume 1*, Appendix 'A' Overview

Baumann D.D, Boland J.J, Hanemann W.M *Urban Water Demand Management and Planning* 1997

APPENDIX

Appendix A Project Specification

University of Southern Queensland

FACULTY OF ENGINEERING AND SURVEYING

ENG 4111/4112 Research Project
PROJECT SPECIFICATION

FOR: Darren Wallace

TOPIC: WATER AND WASTEWATER STRATEGIC TOWNSHIP PLAN FOR WARRAGUL VICTORIA

SUPERVISORS: Associate Professor Frank Young, USQ.

Paul Young, Gippsland Water.

ENROLMENT: ENG 4111 – S1, EXT, 2006

ENG 4112 – S2, EXT, 2006

PROJECT AIM: To develop a Water and Wastewater Township Plan for the current planning scheme for Warragul and future Baw Baw Shire growth strategy. The township plans will need to identify township growth, identify the different options and optimum solution for each of the development areas and ultimately list the capital works programme with timings.

SPONSORSHIP: Gippsland Water

PROGRAMME:

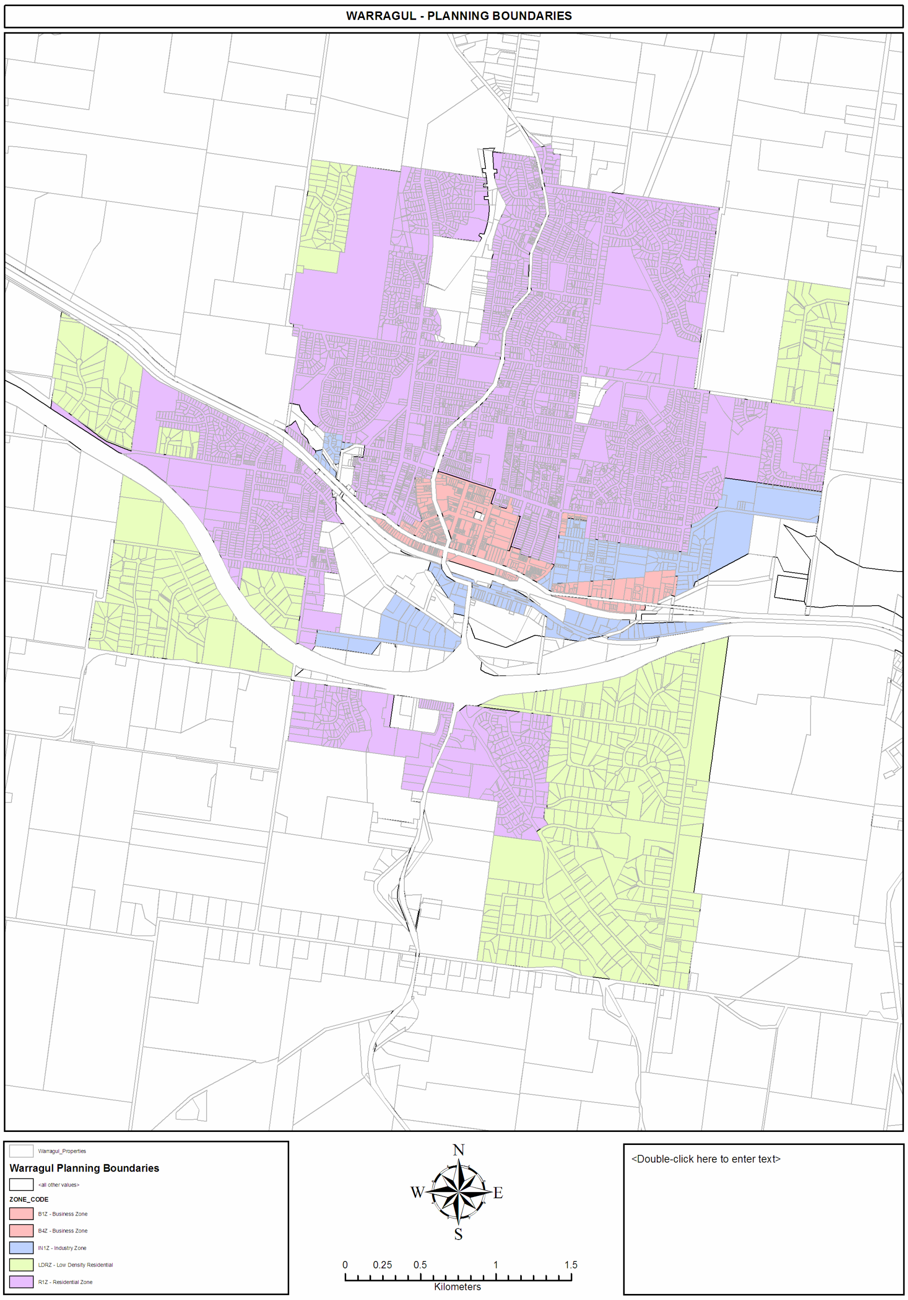
1. To confirm historical and future levels of service from agreed growth rates and there priority.
2. To identify future land requirements.
3. To identify key stakeholders and their requirements.
4. To understand the existing water and wastewater infrastructure limitations.
5. To identify potential options and undertake options analysis using planning tools and present via workshop(s).
6. To develop a short and medium term (20 years) capital works strategy (infrastructure investment and non-asset solutions) in relation to major scheme components (e.g. headwork's, trunk mains, treatment plants).
7. Document the solutions with timings and capital works programme in the Gippsland Water Activity Management Plans.

Agreed:

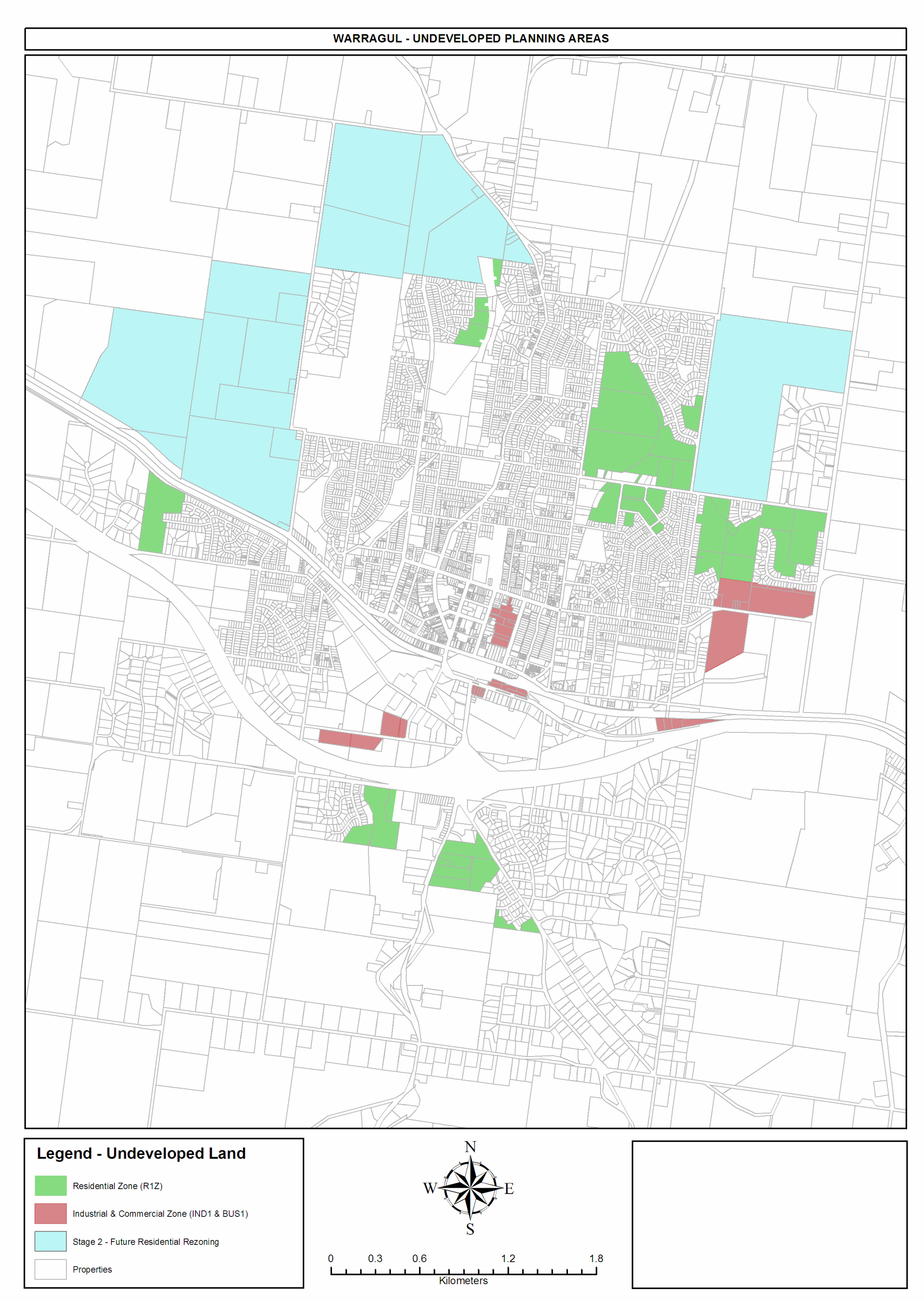
Student Darren Wallace	Supervisor (USQ) Frank Young	Team Leader Paul Young

Appendix B Gippsland Water Area

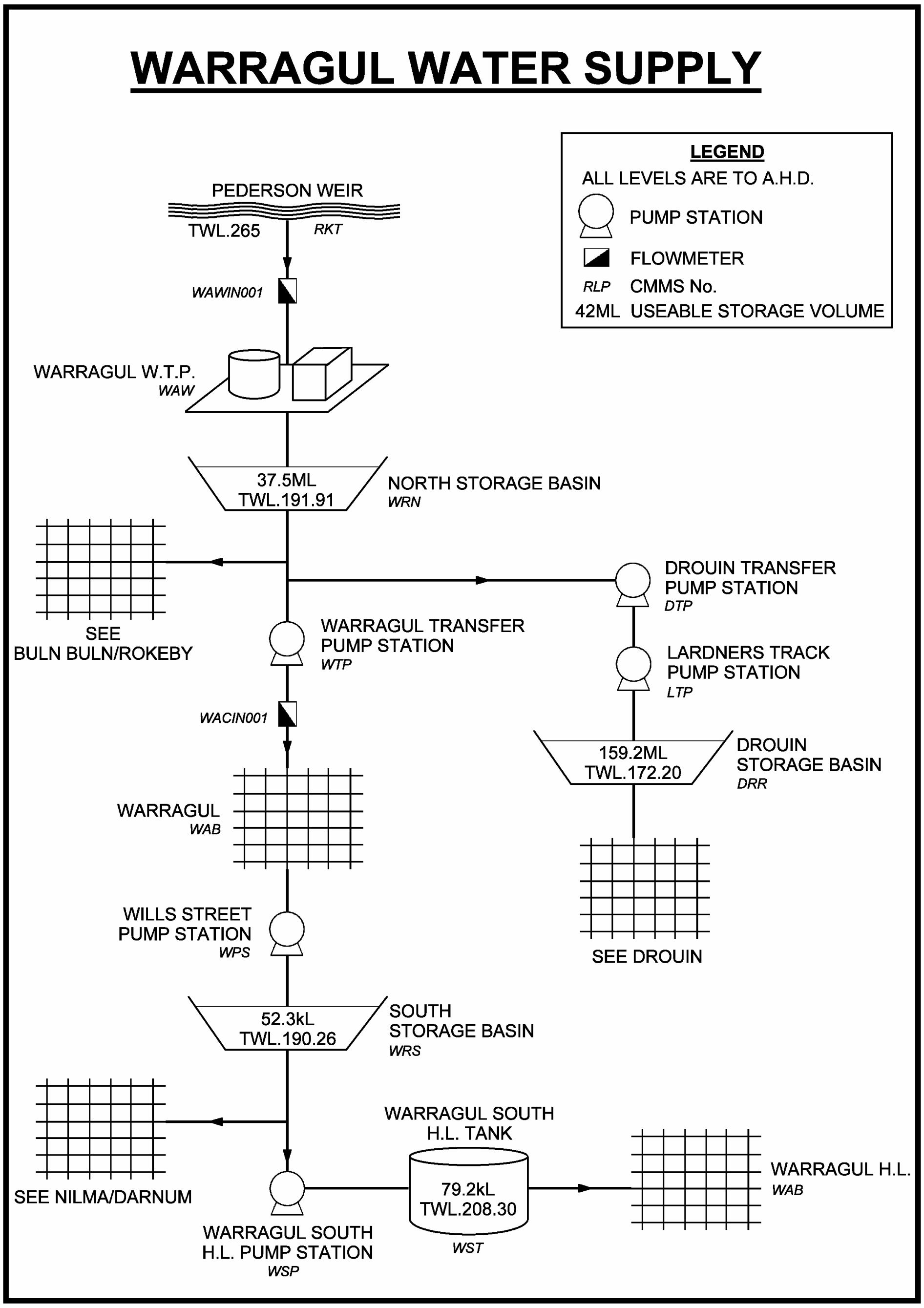
Appendix C Warragul Planning Boundaries



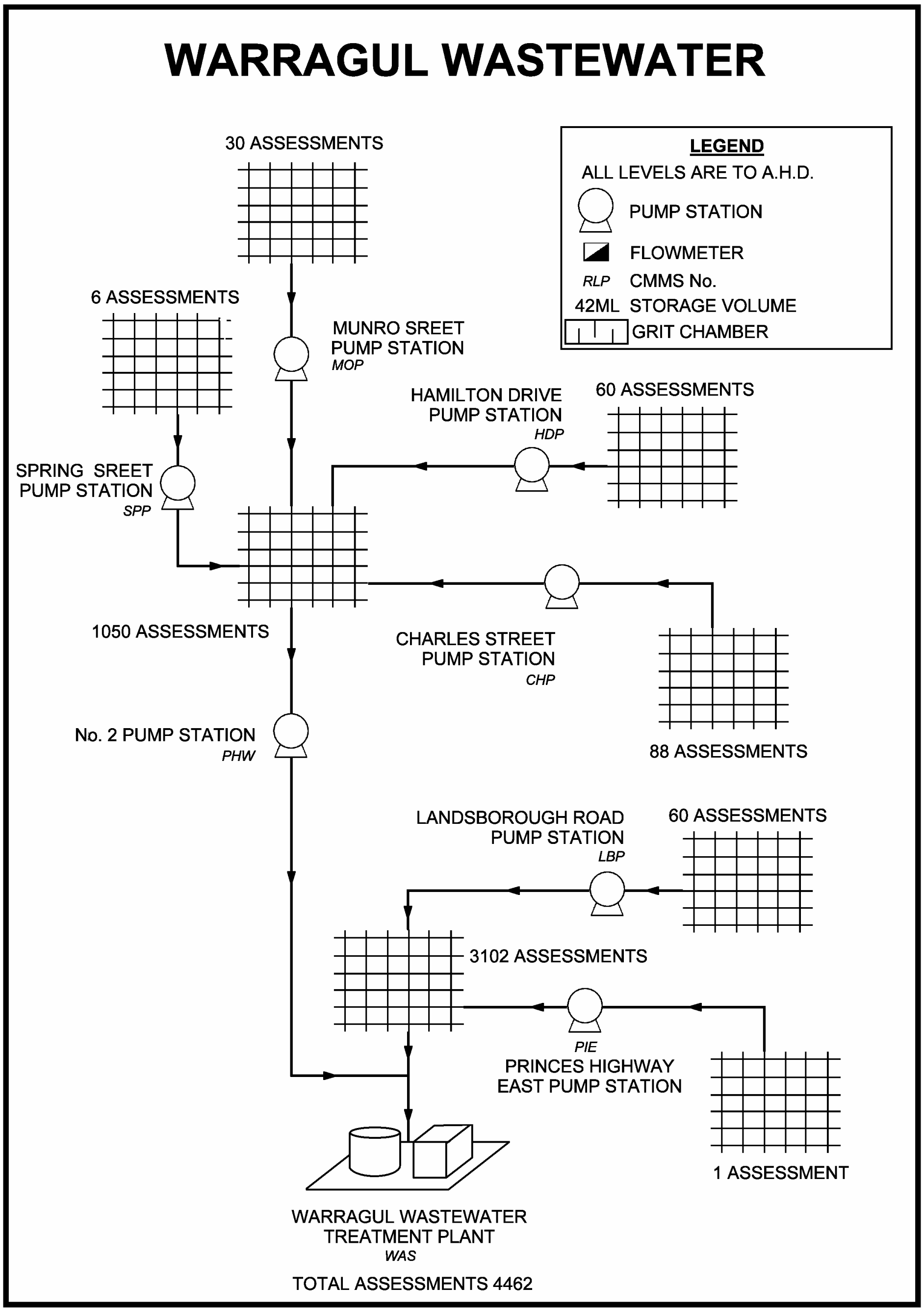
Appendix D Undeveloped Planning Areas



Appendix E Warragul Water Supply



Appendix F Warragul Wastewater Collection



Appendix G Water System Design Performance Criteria

Water Systems Design Performance Criteria

CONFIGURATION PERFORMANCE CRITERIA

This criterion is utilised to identify assets that require augmenting to meet levels of service.

PREAMBLE

The performance of each GW asset is reviewed from time to time to assess its capacity to enable GW to meet its customer obligations. Performance requirements from the assets to ensure standards are met are set out in this document (eg security of supply).

The performance requirements apply on the day of review and throughout the planning period, normally 20 years.

If an asset requires upgrading, the upgraded capacity will be based on the performance required during the appropriate planning period. Growth is different in each system and projected figures are to be used when addressing performance requirements (refer Planning & Dev Group for information).

System components will be reviewed on an individual basis. Regard for the probability of the simultaneous occurrence of adverse circumstances (ie if a back up system fails an additional back up system will not be required).

WATER SUPPLY SYSTEMS

Commencing with the customer, the water supply system consists of:

(1) Service installation;
(2) Reticulation pipelines;
(3) Treated water high level tanks and associated pump systems;
(4) Treated water storages;
(5) Treatment systems;
(6) Transfer pipelines including associated pump systems
(7) Headwork systems.

Performance criteria are presented in the following paragraphs for each of these types of assets.

Customers are defined as those connected to a water supply main fronting their property. GW undertakes to supply customers in accordance with the following criteria (Water by Agreement).

GW does not undertake to supply those on private extensions in accordance with these criteria.

1 Service Installations.

Service installations consist of a meter installation, service pipe and tapping. Service installations, both potable water and fire service, comply with the Australian Plumbing Code

2 Reticulation pipelines.

Reticulation systems consist of the network of pipelines downstream of a HL tank or treated water storage to which the service installation is connected.

Category	**Fireflow Requirement**	**Number & Duration**
All reticulation pipes	Maximum velocity of 2m/s	Peak hour demand
Residential – Pipes >100mm	15L/S for 2 hours	1 @ 2 hours
Commercial – Pipes > 150mm	30L/S for 4 hours For schemes serving a population of less than 1000 a fireflow of 15L/S for 2 hours should be satisfactory except where a special hazard or risk development exists	1 @ 4 hours
High Risk (i.e. a development where there is a probability of a fire occurring or there is a high cost of resultant damage, personal injury or property)	To be determined	Adopt a special hazard or risk fire
Residual pressure is to be 12m minimum at hydrant at all times		

Minimum Pressure & Maximum Pressure –refer to Policy in Trim COR/02/8879

3 Treated water high level tanks and associated pump systems

Treated Water High Level Tanks & Associated Pump Stations

Criterion Measured	Value/Standard	Where/how measured
Pumping to high level tank (Tank >20% of peak day demand)	Pumping rate = 1.2xPeak day demand(duty & standby pumps)	Verified by Gippsland Water hydraulic modeling simulation.
Pumping to high level tank. (Tank <20% of peak day demand)	Pumping rate = Peak hour demand (duty & standby pumps)	Minimum pressure 14m head. Verified by Gippsland Water hydraulic modeling simulation.
Pressure booster systems	Pumping rate = Peak hour demand (duty & standby pumps)	Minimum pressure 14m head. Verified by Gippsland Water hydraulic modeling simulation.
Active storage volume (security of supply)	Minimum 20% of the larger of 1 peak day demand or 2 average day demand	Verified by Gippsland Water hydraulic modeling simulation.

Back up pumping must be available when loss of mains electricity occurs. Whether a High Level Tank exists or not, there must be diesel driven pump/s or back up generator driven pump/s capable of delivering at least a peak hour demand volume with automatic pumping occurring on loss of incoming power & enough accumulator storage to provide a minimum of 14m in the reticulation until backup comes on line.

4 Treated water storages

Criterion Measured	Value/Standard	Where/how measured
Active storage	Minimum Volume. Larger of 1 peak day demand or 2 average days demand.	Verified by Gippsland Water hydraulic modeling simulation

5 Treated systems

Hydraulic and treatment capacity of water treatment plants is to satisfy current and predicted demand projections based on population projections over the planning horizon of 20 years.

Criterion Measured	Value / Standard	Where / how measured
Hydraulic and Treatment Capacity	Downstream storage volume is > 4.0 x peak day demand	Treatment capacity = 0.7 x Peak day demand over 24 hours
	Downstream storage volume is > 1.5 x peak day demand	Treatment capacity = 1.0 x Peak day demand over 24 hours
	Downstream storage volume is < 1.5 x peak day demand	Treatment capacity = 1.1 x Peak day demand over 24 hours

6 Transfer pipelines including pump stations

Transfer pipelines and pump stations are to satisfy current and predicted demand projections based on population projections over the planning horizon of 20 years.

Criterion Measured	Value / Standard	Where / how measured
Hydraulic capacity (flow)	Downstream storage volume is > 4.0 x peak day demand	Pipeline capacity = 0.7 x Peak day demand over 24 hours
	Downstream storage volume is > 1.5 x peak day demand	Pipeline capacity = 1.0 x Peak day demand over 24 hours
	Downstream storage volume is < 1.5 x peak day demand	Pipeline capacity = 1.1 x Peak day demand over 24 hours

7 Headworks

Volume of Bulk Water Entitlement (BWE) on each system is to meet current and predicted demand based on estimated on population projections over the planning horizon of 20 years. Where the BWE does not satisfy predicted demand, Gippsland Water's Strategic Planning department is to be notified to begin negotiations with the Department of Sustainability and Environment.

Appendix H Wastewater System Design Performance Criteria

Wastewater Supply System Design Performance Criteria

CONFIGURATION PERFORMANCE CRITERIA

This criterion is utilised to identify assets that require augmenting to meet levels of service.

PREAMBLE

The performance of each GW asset is reviewed from time to time to assess its capacity to enable GW to meet its customer obligations. Performance requirements from the assets to ensure standards are met are set out in this document (e.g. security of supply).

The performance requirements apply on the day of review and throughout the planning period, normally 20 years.

If an asset requires upgrading, the upgraded capacity will be based on the performance required during the appropriate planning period. Growth is different in each system and projected figures are to be used when addressing performance requirements (refer Planning & Dev Group for information).

System components will be reviewed on an individual basis. Regard for the probability of the simultaneous occurrence of adverse circumstances (i.e. if a back up system fails an additional back up system will not be required).

WASTEWATER COLLECTION SYSTEMS

Commencing with the customer, the wastewater collection system consists of:

(1) Gravity pipelines and manholes;
(2) Pump stations with wet wells and rising mains;
(3) Collector mains;
(4) Transfer pipelines including associated pump systems and wet weather storages;
(5) Treatment systems.

Performance criteria are presented in the following paragraphs for each of these types of assets.

All wastewater assets are sized to meet current demands in regard to flow and spills to the environment. (Memorandum of Understanding (MOU) 1998)

Wastewater assets are to have no more than (3) unplanned interruptions of a customer's wastewater service each year. (Customer Charter) and no nuisance odour complaints.

Customers are defined as those connected to a wastewater collections system main fronting their property.

1. Gravity pipelines and manholes

Category	Flow Requirements	Where/how measured
All gravity pipes	To contain 6 x Average Dry Weather Flow (ADWF)	Verified by Gippsland Water hydraulic modeling simulation.
All gravity pipes	Maximum velocity = 3.0m/s	Verified by Gippsland Water hydraulic modeling simulation.
All gravity pipes	Minimum grade = 1:200	Verified by Gippsland Water hydraulic modeling simulation.

2. Pump stations with wet wells and rising mains

One standby pump (i.e. 3 pumps allows for 1 standby if 2 required to run)

Category	Flow Requirements	Where/how measured
Pump wet well	Storage time > 2 hours at (PDWF)	Verified by Gippsland Water hydraulic modeling simulation.
Pump wet well	Detention time < 2 hours	Verified by Gippsland Water hydraulic modeling simulation.
Pump capacity	6 x (ADWF)	Verified by Gippsland Water hydraulic modeling simulation.
Rising main	Transfer without spill. ARI 1 in 5 year storm 2 hour duration.	Verified by Gippsland Water hydraulic modeling simulation.
Rising main – discharge	Velocity between 1 – 3 m/s	Verified by Gippsland Water hydraulic modeling simulation.

3. Collector mains

Category	Flow Requirements	Where/how measured
All collector pipes	To contain 6 x Average Dry Weather Flow (ADWF)	Verified by Gippsland Water hydraulic modeling simulation.
All collector pipes	Maximum velocity = 3.0m/s	Verified by Gippsland Water hydraulic modeling simulation.
All collector pipes	Minimum grade = 1:200	Verified by Gippsland Water hydraulic modeling simulation.

4. Transfer pipelines including associated pump systems and wet weather storages;

Transfer pipelines and pump stations are to satisfy current and predicted demand projections based on population projections over the planning horizon of 20 years.

Category	Flow Requirements	Where/how measured
Pump capacity	6 x (ADWF)	Verified by Gippsland Water hydraulic modeling simulation.
Rising main	Transfer without spill. ARI 1 in 5 year storm 2 hour duration.	Verified by Gippsland Water hydraulic modeling simulation.
Rising main – discharge	Velocity between 1 – 3 m/s	Verified by Gippsland Water hydraulic modeling simulation.
Storage – capacity	Storage time > 2 hours at (PDWF)	Verified by Gippsland Water hydraulic modeling simulation

Wet Weather Storages (i.e. ROS storages) - Sized to meet current demand in regard to flow & spill to environment prevention (MOU 1998)

- No nuisance odour complaints

5. Treatment systems

Hydraulic and treatment capacity of wastewater treatment plants is to satisfy current and predicted demand projections based on population projections over the planning horizon of 20 years.

Category	Flow Requirements	Where/how measured
Wastewater treatment plant	To treat the greater of peak wet weather flow (PWWF) or 6 x ADWF.	Verified by Gippsland Water hydraulic modeling simulation.

Appendix I Projected Infrastructure Provision for Warragul

25 January 2006

COR/06/2381
545/04/04/01

Syd Deam
Manager Strategic Planning and Development
Baw Baw Shire Council
P.O. Box 304
WARRAGUL VIC 3820

Dear Syd

RE: Projected Infrastructure Provision for Warragul

Gippsland Water has reviewed its development sequencing preferences for Warragul with regard to water and wastewater services and would like to make the following comments.

Wastewater

Currently there are two major sewer projects in the planning process. The scope of these projects have not been finalised, however they will more than likely be trunk mains running beside Hazel Creek from Latrobe St to the Wastewater Treatment Plant (WWTP) and along the northern valley from Stoddards Rd to the WWTP.

Gippsland Water's preference to growth sequence is as follows and is shown on the attached plan.

- Priority 1.Infill – preferably north of the WWTP first
- Priority 2.Land north of Sutton Street and East of Stoddard's Road.

  200 lots immediately north of Stoddard's Road.
- Priority 3.Land west of Tarwin St, starting from the south east corner and progressing north, About 50 lots north of St Paul's College
- Priority 4.Land on the north east extent of the township along Copeland's Road.

  Land immediately south of the Hospital

  50 lots west of Tyssen St
- Priority 5.Remainder of land south of the Hospital that can gravitate back to Warragul.

  The remainder of the land that gravitates north of Stoddards Road.

- Priority 6.Remainder of land north of St Paul's College. This land will need to be pumped to the West Tarwin St development.

Remainder of land south of the hospital that requires a pump station and the other adjoining catchment's infrastructure to be constructed

The criteria that has been used for identifying priority areas the sequencing of development is as follows:

- Priority 1.Infill areas
- Priority 2.areas that can be served by existing infrastructure with adequate capacity.
- Priority 3.areas that is near or directly upstream of existing infrastructure that currently requires upgrading to meet levels of service.
- Priority 4, 5 and 6.areas with increasing degrees of the following:
    - additional works to service development
    - further up the catchment/staging
    - extent of required downstream infrastructure

Water

Currently there is a large proposed main that will provide security of supply to the existing 450 mm main and also provide the future levels of service to the existing and new developments due to growth. The new main is currently in the future capital works programme and the details of the size and alignment will need to be investigated.

For the new smaller subdivisions the water reticulation will be extended and there may be a need to augment the existing system in localised areas to provide adequate levels of service.

Generally wastewater infrastructure is the governing factor for the sequencing of land release.

If there are any matters about this response that you or your staff would like to discuss, please contact Paul Young via either email paul.young@gippswater.com.au or phone 51 774 728.

Yours sincerely,

John Mitchell
Chief Executive Officer.

Appendix J Warragul Sequencing Plan