Business Case to Connect into the Melbourne Water Supply System

A report prepared for South Gippsland Water for community comment

April 2011

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BACKGROUND

South Gippsland Water (SGW) has commissioned Marsden Jacob Associates (MJA) to prepare a '*Business Case to Connect into the Melbourne Water Supply System*' (The 'Business Case').

This Business Case presents the justification for investment in a connection to the Melbourne System and related water supply augmentation works for the Northern and Southern parts of SGW's supply system.

SGW is at a critical stage and needs to determine how the future potable water demands of the residential and industrial users of the region will be met. In particular, the ability to supply the townships Poowong, Loch and Nyora is just sufficient to meet South Gippsland Water's current level of service objectives under medium climate change and could face a shortfall in water supply within the next five years.

PROJECT NEED

The need for connecting to the Melbourne System and interconnecting the Southern and Northern Supply Systems of SGW is driven by four main issues:

1. **Increased volatility** associated with stream flows due to the effects of climate change/variability resulting in prolonged and more severe droughts.

   Climate modelling undertaken by the Department of Sustainability and Environment shows a reduction in water availability of 17 percent, assuming a medium climate change scenario, or 41 percent, assuming continuation of recent low inflows, i.e. the impacts experienced from 1997 to 2009.

   It is important to note that these are potential changes to averages. As such, small changes in averages could 'mask' more significant changes to rainfall variability or extremes and resulting impacts on runoff and streamflow.

2. **Population growth** is placing upward pressure on water demand. Growth is occurring along the coast near Inverloch with likely city-fringe growth centred around Nyora, which is scheduled to be sewered over the next three years.

   A critical determinant for future industrial water demand will be the success of water use efficiency projects undertaken by Murray Goulburn. The dairy processing factory accounted for about 70 percent of Leongatha's water demand of 1,511 ML in 2009/10.

3. **Water quality**, especially the occurrence of trihalomethanes (THMs), requiring the upgrade of water treatment plants (WTPs).

   Intensive dairy and cattle farming in South Gippsland's open catchments has led to high levels of nutrients and natural organic matter in the raw water reservoirs. Additionally, blue green algae blooms have occurred in all raw water reservoirs of the Northern and Southern systems. These algal blooms can have a significant impact on water quality, customer health as well as plant operation. These are a significant obstacle to achieve future water quality standards both in the Northern and Southern Systems.

4. **Dam safety** deficiencies, necessitating major upgrades of existing reservoirs located in the Northern Systems.

Remedial works, a reduction of hazard category or decommissioning are necessary within the next decade to address deficiencies, such as stability of embankment. Decommissioning would provide a potential benefit of improving environmental flows, especially during summer months or providing water for agricultural needs.

EXISTING WATER SUPPLY SYSTEM

SGW currently operates ten separate supply systems to deliver water to 22 towns:

- **The Northern Systems** comprises
  - Little Bass, which supplies Poowong, Loch and Nyora;
  - Coalition Creek, servicing Korumburra; and
  - Ruby Creek, which supplies Leongatha and Koonwarra.
- The **Southern System** includes the Lance Creek System, which delivers water to the three towns Wonthaggi, Inverloch and Cape Paterson.
- The remaining systems have been grouped as **Eastern Systems.** Those are treated separately and do not form part of this Business Case.

As highlighted in the Corporation's Water Supply Demand Strategy (WSDS), all systems could face water supply shortages within the next 20 years. Table 1 provides a summary of current and future yields under the medium climate change and recent low inflows scenarios and contrasts these with current and future demand under Victoria in Future (ViF) and Local Growth scenarios[1].

Table 1: Summary of current and future yields and demand (raw water)

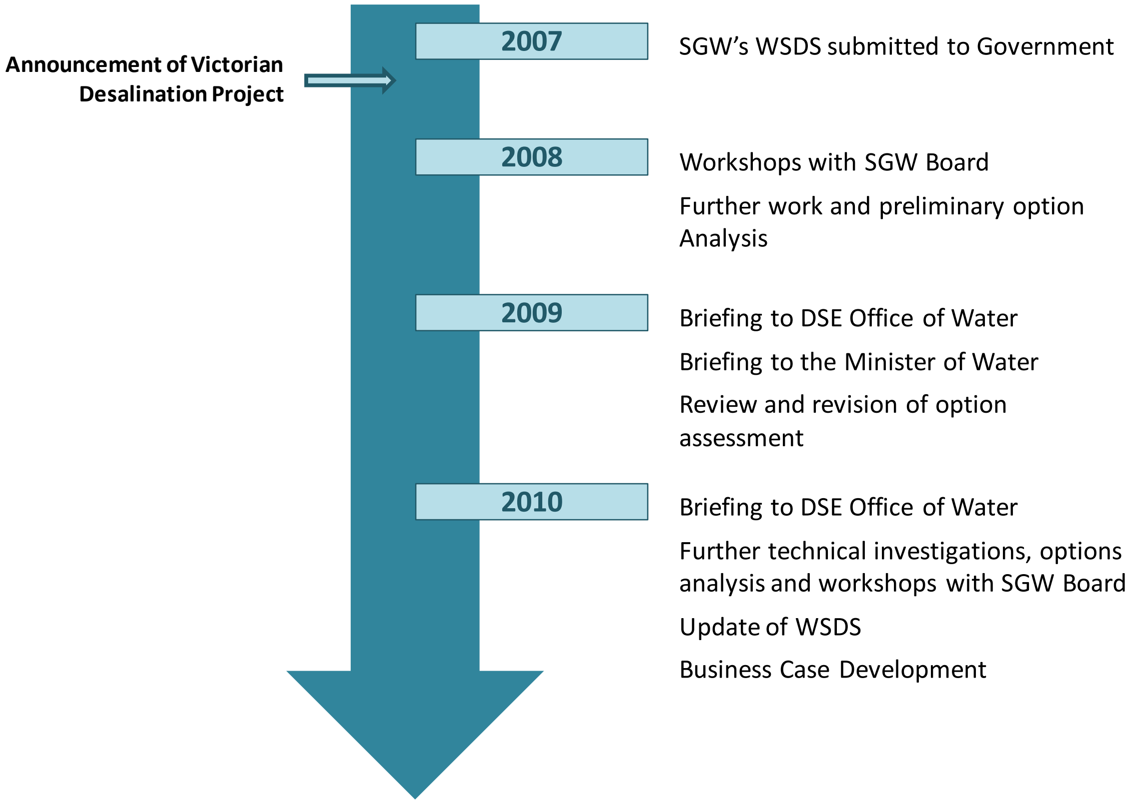
Region	Current Yield ML/a	Medium Climate Change Yield 2058 ML/a	Recent Low Inflows Yield 2058 ML/a	Current Demand ML/a	ViF Demand 2058 ML/a	Local Growth Demand 2058 ML/a
Poowong, Loch, Nyora	274	274	265	264	321	594
Korumburra	741	717	692	621	810	1,079
Leongatha and Koonwarra	1,995	1,833	1,879	1,893	1,692	3,046
Wonthaggi, Inverloch, Cape Paterson	3,426	3,164	2,957	1,734	3,457	4,763
Unserviced Towns	-	-	-	1,200	1,563	1,870

[1] These two demand scenarios have been produced for SGW's WSDS, based on two sets of population projections and future industrial water needs. ViF population forecasts are published by the State Government and based on historical residential trends. The Local Growth scenario was produced by SGW based on consultation with Local Governments and major local industries. It allows for stronger population growth within towns and assumes a greater increase in industrial water needs compared with the ViF forecast.

SUMMARY OF THE OPTIONS AND ALTERNATIVES CONSIDERED

Over the course of the past three years, SGW had undertaken a thorough process of internal workshops, consultations with State Government and use of expert advisors in order to thoroughly assess available options for supply augmentation (Figure 1).

Figure 1: Process to date



The outcomes of the revised assessment and consultations with State Government stakeholders prompted SGW to commission updates of previous studies and additional reports to inform this Business Case. With this information at hand, SGW decided to focus on two options for this Business Case:

- connection of the Northern Systems to the Melbourne System Supply; and
- continued development of existing Surface Supply systems.

The **Melbourne System Supply** option assumes that the Northern and Southern supply systems will be connected to the Melbourne System via Lance Creek. The Northern Systems will source water from the Melbourne System and/or Lance Creek Reservoir. This means all reservoirs and WTPs in the Northern Systems would be decommissioned, once each of the respective systems are connected to Lance Creek Reservoir and the Melbourne System.

Under the **Surface Supply** option existing storage capacities need to be augmented and an additional storage constructed on Ruby Creek to be able to harvest additional winter flows and increase the average annual yield. All WTPs require upgrades for water quality purposes and some for production and capacity purposes. Under ViF demand, Northern Systems are predicted to have sufficient supply capacity thereby avoiding any requirement to connect to Lance Creek and the Melbourne System. However, assuming Local Growth demand, it is ***inevitable to connect the Northern Systems to the Melbourne System supply*** – resulting in redundant surface supply assets. There are no other feasible and viable surface augmentation options available to service excess demand.

Both options will utilise the existing transfer pipeline system between the desalination plant and the Lance Creek clear water storage (CWS) to source water from the Melbourne System, when the Wonthaggi Desalination Plant is commissioned in 2012.

THE PREFERRED OPTION

A cost effectiveness assessment was used to analyse the economics of the options. To allow a ‘like-with-like’ comparison of the options, differences in supply risks and the level of service were addressed by improving supply security of the Surface Supply option. The base case scenario assumes that additional supply augmentations will be implemented to the four systems to cope with two consecutive years of low inflows, similar to the inflows experiences in 2006/07.

Table 2 shows the estimated whole of life or present value costs (PVCs) in 2010/11 dollars, assuming a 5.8 percent real discount rate, for the base case scenario for both the Melbourne System Supply and Surface Supply option under the two demand scenarios, ViF and Local Growth. Under the base case assumptions and ViF Demand, the PVCs are around $108.2 million for the Melbourne System Supply option and $118.6 million for the Surface Supply option. That is, the Melbourne System Supply option is about 9 percent less expensive than the Surface Supply option. Under Local Growth demand, PVCs increase to $152.9 million and $156.8 million for Melbourne System Supply and Surface Supply, respectively.

Table 2: Whole of life costs – Base Case

	ViF Demand		Local Growth Demand	
	Melbourne System Supply	*Surface Supply*	*Melbourne System Supply*	*Surface Supply*
	$ million	$ million	$ million	$ million
Northern Systems	71.0	85.6	99.8	115.9
Southern System	37.3	33.0	53.1	40.8
Total	**108.2**	**118.6**	**152.9**	**156.8**

Source: MJA Analysis

Note: All figures are in 2010/11 dollars

The Melbourne System Supply is the preferred option. The main arguments supporting the preferred option include:

- the Melbourne System Supply option provides a higher level of supply security. Even if augmentations to surfaces supplies were undertaken to increase the level of service there is still the risk that supply could fail during a sequence of low inflows. The Melbourne System Supply option effectively mitigates the likelihood of future supply failures due to low stream flows into the relatively small storages resulting from climate change/variability and provides greater flexibility to accommodate changes in demand;
- the Melbourne System Supply option avoids the risk of investing in redundant assets – a risk that would prevail if further investment were to be made in augmenting existing surface supply systems. Assuming Local Growth demand, investments to connect all

Northern Systems to the Melbourne System supply are required prior to 2040, regardless of previous surface water augmentations.

- it provides the necessary security to support the future economic growth in the region, including the ability of SGW to service major industrial customers, e.g. Murray Goulburn, a potential industrial shift in the area and/or significant population growth;
- it provides an opportunity for the agricultural sector to use additional flows, offering greater security and the potential for future growth for the agricultural value chain;
- it avoids the need for, and associated impacts of, applying for additional bulk entitlements and the consequential reduction in environmental flows; and
- the cost estimates for the Melbourne System Supply option are considered more reliable given the benefit of the more detailed engineering studies undertaken during 2010.

FUNDING OPTIONS

State Government subsidies are a common funding option for projects, which improve the reliability and security of water supplies in Victoria. Two funding options were assessed using SGW's financial model:

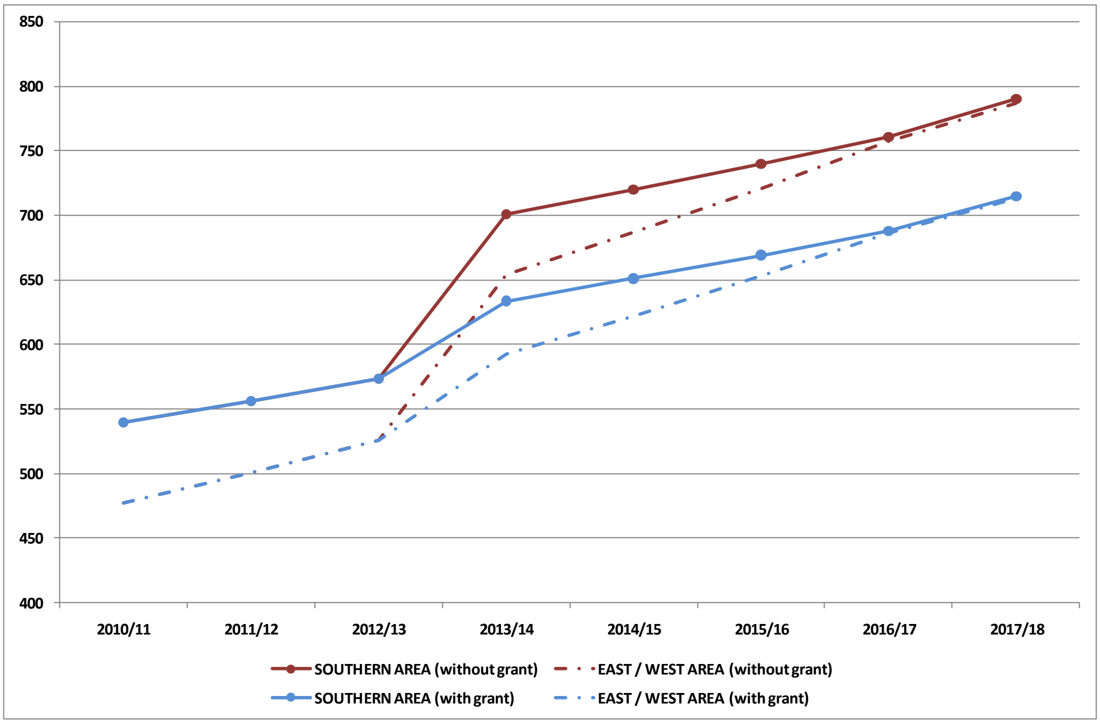
- **'with grant'** – State Government funding is granted for the first stage of the project, i.e. connecting Korumburra and Poowong, Loch, Nyora with the Lance Creek CWS and as such the Melbourne System in 2011/12; and
- **'without grant'** – all stages of the project are fully funded by SGW.

The extent of the grant would be $18.9 million (in 2010/11 dollars), i.e. the initial infrastructure capital costs to connect Korumburra and Poowong, Loch and Nyora to the Lance Creek Reservoir and the Melbourne System.

Figure 2 below shows the impacts of connecting to the Melbourne System on average customer bills for SGW's southern and east/west areas tariffs[2]. The two red lines show the change estimated in average customer water bills for both areas without State Government funding, whereas the blue lines depict the change in average customers bills with State Government funding.

2 Northern Systems are part of the east/west area.

Figure 2: Average Customer Bill for southern and east/west tariff areas – Impacts with and without State Government funding (balance sheet approach, in 2010/11 dollars)



Source: SGW financial analysis

In 2013/14, a substantial increase in real terms in tariffs (about 25 percent rise in average customer bills) would be required to recover the capital expenditure and service associated loans for connecting Korumburra and Poowong, Loch, Nyora to the Melbourne System. This increase would be lessened substantially (by $75 or 10%), if the capital costs for the first stage of the project, $18.9 million, were funded through a State Government grant.

Obtaining government funding for this first stage of the project would not only substantially lessen impacts on customers and underwrite the future development of the region, but also support the financial stability of SGW, securing its ability to provide reliable service.

RECOMMENDATION

The Melbourne System Supply is the preferred option, having lower whole-of-life costs of $108.2 million (in 2010/11 dollars), assuming ViF demand. The option provides:

- a substantially higher level of supply security compared to the Surface Supply option;
- avoids the risk of investing in redundant assets;
- provides the necessary security to support the future economic growth in the region;
- provides an opportunity for the agricultural sector to use additional flows; and
- allows for higher environmental flows.

The Melbourne System Supply option therefore provides security and a basis for the economic prosperity of the region going forward.

The analysis of two funding options shows that impacts on customers could be significantly mitigated with a grant from State Government for the first stage of the project.

Without Government funding water prices are set to rise significantly with the start of the Water Plan 2013 – 2018 to recover the investment of $18.9 million for the capital works of connecting the northern towns Korumburra, Poowong, Loch and Nyora to Lance Creek and the Melbourne System. Additionally, funding through the State Government would ensure that SGW remains financially viable.

The SGW Board therefore recommends that State Government provides funding of $18.9 million (in 2010/11 dollars) to SGW to support the future reliable water supply, and economic growth and prosperity of the region into the future.

1. Introduction

1.1. Background

South Gippsland Water (SGW) has commissioned Marsden Jacob Associates (MJA) to prepare a '*Business Case to Connect into the Melbourne Water Supply System*' (The 'Business Case').

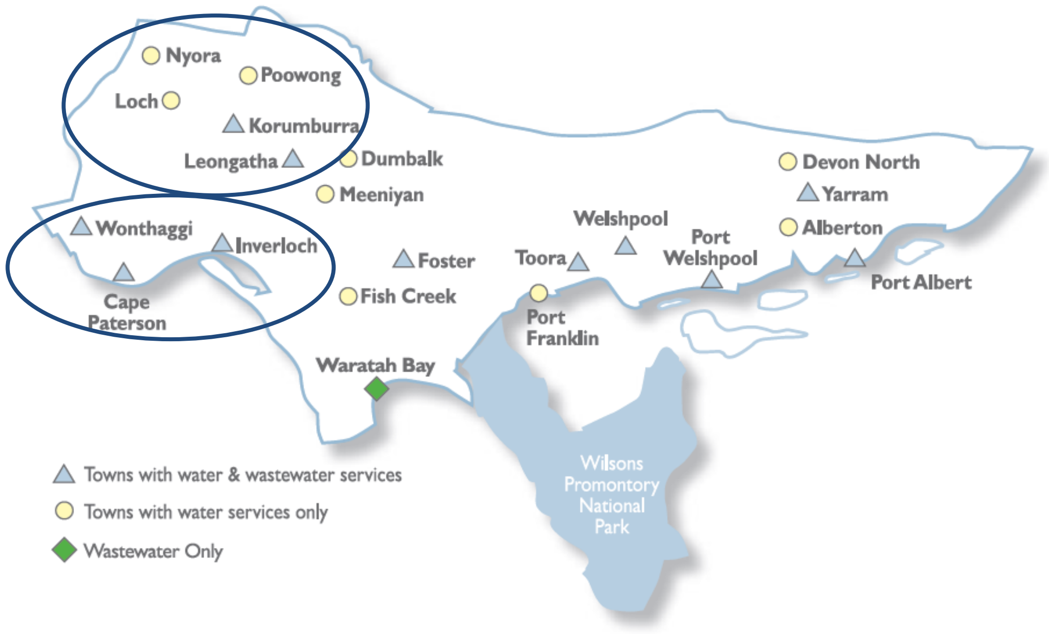
The South Gippsland region is located about 2 hours to the south-east of Melbourne. Main towns include Leongatha, Korumburra, Inverloch, Wonthaggi and Foster. The agricultural sector, in particular dairy farming, is an important driver of employment and wealth creation in the region. Murray Goulburn Co-operative and Burra Foods are the major dairy processors the region, located in Leongatha and Korumburra, respectively.

The region has experienced, and is anticipating further, extended population growth along its coastal areas and in the north-west, adjacent to the city fringes of Melbourne.

SGW is the region's water and wastewater service provider and currently operates ten separate water supply systems delivering water to 22 towns:

- The **Northern Systems** comprises:
  - Little Bass, which supplies Poowong, Loch and Nyora;
  - Coalition Creek, servicing Korumburra; and
  - Ruby Creek, which supplies Leongatha and Koonwarra.
- The **Southern System** includes the Lance Creek System, which supplies the three towns Wonthaggi, Inverloch and Cape Paterson.
- The remaining systems have been grouped as **Eastern Systems.** Those are treated separately and do not form part of this business case.

Figure 3: SGW's area of operation



1.2. Purpose

This Business Case presents the justification for investment in a connection to the Melbourne System and related water supply augmentation works for the Northern and Southern parts of SGW's supply system.

SGW is at a critical stage and needs to determine how the future potable water demands of the residential and industrial users of the region will be met. In particular, the ability to supply the townships Poowong, Loch and Nyora is just sufficient to meet South Gippsland Water's current level of service objectives under medium climate change and could face a shortfall in water supply within the next five years.

After record low inflows well below the long-term average, storage levels fell significantly and SGW was forced to implement emergency supplies, such as groundwater bores and a temporary connection to the Tarwin River during the 2006/07 drought.

Going forward, climate change/variability, prolonged droughts and subsequent impacts on run-off and stream flows, together with a growing population necessitate the augmentation and diversification of water supplies.

This Business Case aims at identifying the best value for money option, taking into account not only growth in water demand and potentially reduced water availability, but also other required upgrades and replacements of existing assets. Water quality standards, dam safety requirements and general aging of some assets will necessitate remedial works in the coming decade.

1.3. Supplementary reports

This report draws on information contained in supplementary reports to this Business Case commissioned by SGW. The relevant Supplementary Reports are listed in Table 3.

Table 3: Supplementary reports to the Business Case

Report	*Title*	*Author*	*Date*
Supplementary Report no.1	Water Supply Demand Strategy	Sinclair Knight Merz	March 2011
Supplementary Report no.2	Water Treatment Plant Upgrades Study – South Gippsland Water	Aurecon	August 2010
Supplementary Report no.3	Review of Future Management of Northern Systems Dams	URS	May 2010
Supplementary Report no.4	Connection to Melbourne System Supply via Lance Creek	GHD	July 2010
Supplementary Report no. 5	Cultural Heritage Desktop Assessment – South Gippsland Water Pipeline Alignment	Tim Stone	May 2010

1.4. Consistency with Government Policies

The former Victorian Government's long-term plan for water *"Our Water Our Future"*[3], implemented in 2004, outlines actions and measures for sustainable water management with the aim to secure water and sustain growth within the State.

In 2007, the former Government established the *Next Stage* of the plan, which aims at providing long-term solutions to secure Victoria's water supplies. It comprises several infrastructure projects, including the construction of a major desalination plant near Wonthaggi and expanding Victoria's Water System to pipe water around the State. The desalination plant is due to transfer water by the end of 2011. The Next Stage of the plan envisages that towns in the Westernport and South Gippsland region will be serviced through links to the Melbourne System.

Securing future water supplies, in particular in regional Victoria, is also consistent with the *Victorian Liberal Nationals Coalition Plan for Water,* which states that *'water is the lifeblood of regional communities'*.[4] The strategy and preferred option outlined in this Business Case support the Government's principles and fosters regional growth.

1.5. Business Case Format

Section 2 of this report outlines the project need, and explains the existing supply system and future water supply and demand balance.

Section 3 provides an overview of the process of identification and evaluation of options to date and explains the proposed augmentation options and main assumptions underlying the economic analysis in detail.

Section 4 describes the financial analysis undertaken and outlines the preferred option and its advantages, including lower supply risk, better water quality and environmental benefits.

Section 5 depicts the planning and approval process, including environmental, aboriginal and cultural heritage approvals. It also outlines the process of project delivery, procurement and stakeholder management.

Section 6 assesses possible funding options and customer impacts. It then identifies the preferred funding option.

Section 7 explains the risk assessment process undertaken in preparation of the Business Case and provides an overview of high priority risks.

Section 8 outlines the implementation schedule of the first project stages.

Section 9 provides recommendations regarding the granting of approvals and State Government funding.

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3 http://www.ourwater.vic.gov.au/

4 Liberal Victoria, 2010, *The Victorian Liberal Nationals Coalition Plan for Water,* p. 2

2. Project need

This section of the Business Case outlines the need for connecting to the Melbourne System and interconnecting the Southern and Northern supply systems of SGW. The four main drivers are:

1. Increased volatility associated with stream flows due to the effects of climate change/variability resulting in prolonged and more severe droughts;
2. population growth is placing upward pressure on water demand. Growth is occurring along the coast near Inverloch with likely city-fringe growth centred around Nyora, which is scheduled to be sewered over the next three years;
3. water quality, especially the occurrence of trihalomethanes (THMs), requiring the upgrade of water treatment plants (WTPs); and
4. dam safety deficiencies, necessitating the upgrade of existing reservoirs located in the Northern Systems.

In addition to a description of the abovementioned drivers, this section provides an overview of the existing water supply systems, current levels of demand and supply, and future demand and supply imbalances.

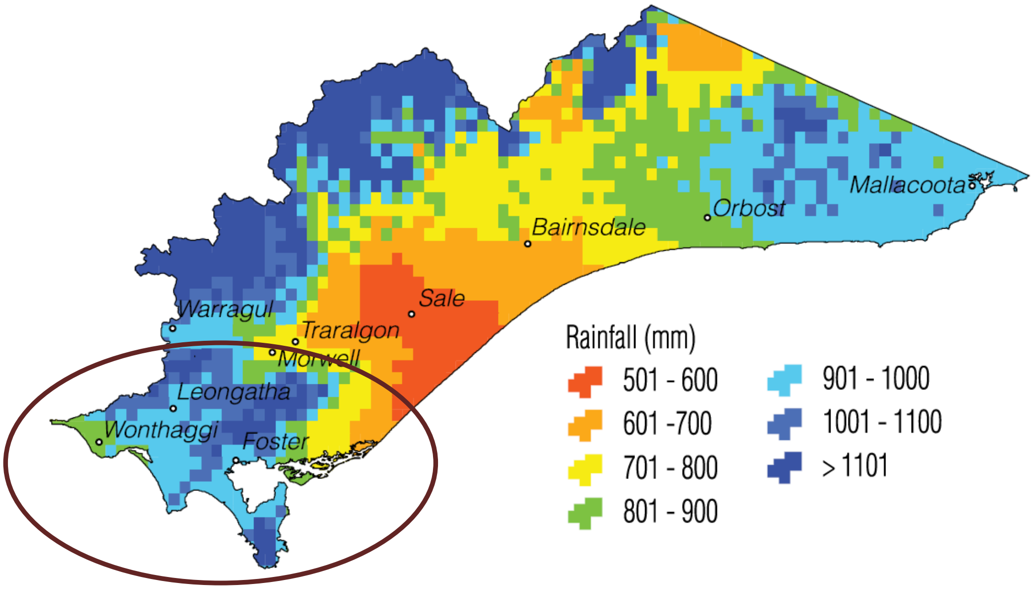
2.1. Climate Change and water availability

Climate change and greater climate variability is emerging as a vital issue for rural and regional communities across Victoria. Although climate variability has always been a fact of life for these communities, the prolonged drought in much of eastern and southern Australia through the 2000s has heightened awareness of the potential for greater variability in the future.

The climate in Victoria is expected to be hotter and drier, with more frequent and severe droughts interspersed by periods of intense rainfall and storms. In conjunction with increasing temperatures, a significant reduction in rainfall, run-off and river flows, is likely.

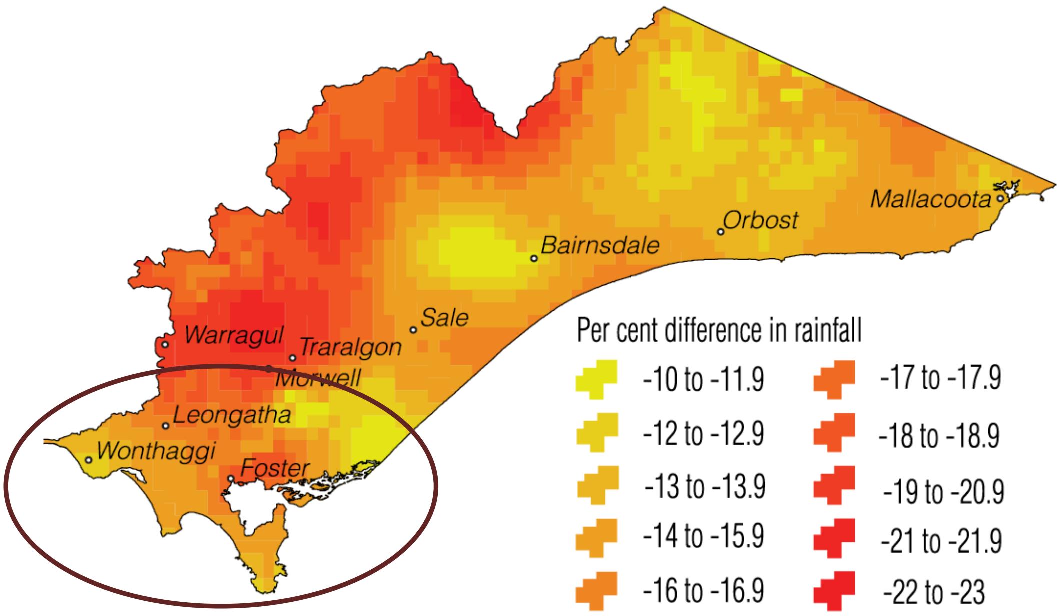
The South Gippsland region has moderate to high rainfall of 900 – 1100 mm annually (long-term average). However, the region experienced its longest drought on record from 1997 to 2009 and a decline in rainfall of between 10 and 20 percent during this period (Figure 4, Figure 5).

Figure 4: Long-term average annual distribution of rainfall across Gippsland



Source: Department of Sustainability and Environment, 2010
Note: Average annual rainfall calculated over the period from 1900-2009

Figure 5: Change in annual rainfall for Gippsland over the past 13 years, compared with the long-term record



Source: Department of Sustainability and Environment, 2010
Note: Calculated as the percentage difference between the average annual rainfall over the period 1997-2009 and the average annual rainfall over the period 1900-1996

Rainfall projections to 2070 indicate that average annual rainfall will decline by between 6 to 11 percent compared with the historic averages, especially during winter and spring.[5] Moreover, increased rainfall variability (season to season and year on year) points to an increase in drought frequency. It is also likely that rain will fall in more intense and less

5 Department of Sustainability and Environment, 2008, *Climate Change in West Gippsland*, June

frequent bursts. In summary, the future most likely will be drier, warmer, and rainfall will be less reliable and more extreme.

Major reductions in run-off and stream flows are a direct consequence of the decline in rainfall. The relationship between rainfall and surface run-off is not linear. It is expected that, in Victoria, the percentage decrease in run-off is about two to three times greater than the decrease in rainfall. [6]

This relationship between rainfall and run-off may be influenced and possibly exacerbated by a complex set of drivers and interactions. Variables such as seasonality of rainfall, temperature, soil moisture, plant evapo-transpiration rates and relative humidity play a significant role, as does catchment land use, vegetation composition and numbers of farm dams.

Climate modelling was undertaken by the Department of Sustainability and Environment to understand the impacts of climate change/variability on future water availability and reliability of supply. The modelling is based on five future climate scenarios: historic, low climate change, medium climate change, high climate change and recent low inflows.

Overall, the modelling shows a reduction in water availability, impacting on both consumptive users and the environment, under all future climate scenarios (Table 4). The reduction experienced since 1997 is more severe than the projected impacts under the high climate change scenario. It is possible, however, that the prolonged drought and low inflows of the past decade represent a permanent shift in water availability.[7]

Additionally, it is important to note that the data presented in Table 4 provides potential changes to averages. As such, small changes in averages could 'mask' more significant changes to rainfall variability or extremes and resulting impacts on runoff and streamflow.

Table 4: Potential reduction in total inflows for the South Gippsland river systems as a result of climate change (compared with the long-term average)

Climate scenario	Inflow impact in 2055
A – Low	-7%
B – Medium	-17%
C – High	-28%
D – Impact experienced since 1997	-41%

Source: CSIRO, cited in DSE, 2010, Sustainable Water Strategy

Note: Reduction of average annual inflows when comparing pre-July 1997 average inflows with post-July 1997 inflows. Reductions shown are calculated to 2008.

Scenario D for Bass, Powlett, Tarwin, Agnes and Tarra systems only. Data sourced from resource allocation modelling.

It should be noted, that Table 4 only accounts for changes due to a decline in rainfall. While climate change/variability is likely to be the main driver of reduced water availability, other factors, such as population growth and changing industrial water needs, also pose a significant risk to water availability. Those factors are discussed in more detail in section 2.2.

6 Chiew, F.H.S, 2006, *Estimation of rainfall elasticity of streamflow in Australia*, Hydrological Sciences Journal

7 Department of Sustainability and Environment, 2010, *Draft Gippsland Region Sustainable Water Strategy*

While the focus of the *Sustainable Water Strategy* is on the medium climate and the recent low inflows scenarios, the Business Case is centred on the medium climate change scenario.

SGW commissioned SKM to model the average annual yield for all four Northern and Southern Systems up to 2058 as part of its Water Supply Demand Strategy (WSDS). Again, it is important to note that the annual yields are expressed as average only, and therefore significant variations are possible in any given year. That is, the yield in a particular year could be significantly lower than suggested by the modelling. This poses a notable risk to SGW's water supply.

The yield modelling also shows that existing reservoirs are small and designed to fill every year over the winter period. This adds to the abovementioned risk, because no additional water can be stored to buffer reduced water availability during a drought year. Supply augmentation is necessary to increase and secure the reliability of SGW's water supply.

2.2. Population growth and industrial water use

The South Gippsland region is experiencing extended population growth. The two LGAs in the region, Bass Coast Shire and South Gippsland Shire, grew 2.5 and 2.0 percent in 2008/09, respectively – well above the average annual growth of 1.6 percent in regional Victoria.[8] Future growth is expected to occur particularly in the western towns, such as Nyora, and the coastal areas closer to Melbourne.

Usually, industrial water use is expected to increase with population growth. For SGW, a critical determinant for future industrial water demand will be the success of water use efficiency projects undertaken by Murray Goulburn. The dairy processing factory accounted for about 70 percent of Leongatha's water demand of 1,511 ML in 2009/10. It aims to achieve water savings of around 600 ML/a, almost a third of Leongatha's average long-term demand of 1,893 ML/a.

Demand Forecasts

Drivers of growth in water demand in the region include:

- population growth;
- industrial and commercial expansion; and
- connection of unserviced towns.

Two demand scenarios have been produced for SGW's WSDS, based on two sets of population projections and future industrial water needs. The Business Case utilises these two demand scenarios up to 2058 to determine costs and benefits of shortlisted options.

- *Victoria in Future (ViF)*: ViF population forecasts are published by the State Government and based on historical residential trends. Projections are available for Statistical Local Areas (SLAs). The population growth data for the SLAs South Gippsland Central (covering Leongatha and Koonwarra), South Gippsland West (covering Korumburra, Poowong, Loch and Nyora) and Bass Coast (covering Wonthaggi, Inverloch and Cape Paterson) was used to project future water demand for the WSDS in accordance with Department of Environment and Sustainability (DSE) guidelines.

8 Department of Planning and Community Development, 2010, Victorian Population Bulletin

- *Local Growth*: This forecast was produced by SGW based on consultation with Local Governments and major local industries. It allows for stronger population growth within towns and assumes a greater increase in industrial water needs compared with the ViF forecast.

ViF and Local Growth scenarios represent the lower and upper bound of water demand for this Business Case.

Consistent with DSE recommendations, an increase in residential, and stock and domestic demand by about 2.5 percent per year due to medium climate change was incorporated for all growth forecasts. This is based on the assumption that water demand will increase under drier and hotter climatic conditions, e.g. as a result of increased garden watering.[9]

However, this increase in demand is assumed to be offset by various demand reduction measures implemented by both SGW and the State Government. For instance, these measures include community education, more stringent building standards (Five Star Standard) and permanent outdoor water savings measures.[10]

2.3. Water quality

In Victoria, water quality is regulated under the *Safe Drinking Water Act 2003* and *Safe Drinking Water Regulations 2005*.

In 2008 and 2010, SGW commissioned Aurecon to examine its current and future water quality issues in detail. Both reports[11] found that operational risks associated with Surface Supply option in particular, require upgrades to WTPs and CWSs to meet future customer and regulatory requirements:

> *Continuation with the surface water supply option would require major upgrades to the existing water treatment facilities to cater for 50 year demand projections and to meet anticipated tightening of potable water quality standards.* [12]

Intensive dairy and cattle farming in South Gippsland's open catchments has led to high levels of nutrients and natural organic matter in the raw water reservoirs. This is a significant obstacle to achieve future water quality standards both in the Northern and Southern Systems.

Chloramination and chlorination are currently used for water treatment in all four systems. The resulting occurrence of THMs already exceeded regulatory compliance levels in the Lance Creek System for three years (2006-08). The increase in chlorination has also led to taste and odour complaints.

Additionally, local conditions mean that high manganese levels are an issue in both the Northern and Southern Systems. Whilst presenting a low health risk to consumers, it causes a significant amount of customer complaints ('dirty water'). SGW currently oxidises the manganese and then removes it via traditional clarification and filtration, which is often not

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9 WSDS, 2010

10 WSDS, 2010

11 Aurecon, 2010, *Water Treatment Plant Upgrades Study – An Update*, prepared for South Gippsland Water, August; and Connell Wagner (now Aurecon), 2008, *Future Desalinated and Surface Water Supply Risk Assessment and Water Treatment Plant Upgrades Study*, August, Melbourne

12 Connell Wagner (now Aurecon), 2008, *Future Desalinated and Surface Water Supply Risk Assessment and Water Treatment Plant Upgrades Study*, August, Melbourne, p. 2

sufficient to prevent manganese reaching customers. Reticulation pipes are cleaned periodically through air scouring and flushing.

In all raw water reservoirs of the Northern and Southern Systems blue green algae blooms have occurred. These algal blooms can have a significant impact on water quality, customer health as well as plant operation. Blooms are currently controlled with copper sulphate, an algaecide. However, this can lead to increasing copper levels in the sediment and raw water. Increasing copper levels are already occurring in Lance Creek Reservoir. Blue green algae will remain a risk in the systems until advanced treatment is provided at the WTPs.

Upgrades or replacements of SGW's treatment plants are required within the next decade, due to water quality issues, capacity and/or age. The WTPs in Leongatha and Korumburra are both 30 years old and Aurecon recommends a complete replacement by 2020. The Poowong and Wonthaggi treatment plants have the capacity to service ViF demand up to 2058, but upgrades are necessary to meet possible future water quality standards. Aurecon has adopted SGW's view that a tightening of water quality standards could come into force and that 2020 and 2025 would be appropriate timeframes for such increased standards.[13]

The sizing of treatment options is primarily based on future demand requirements. Aurecon based its analysis on ViF and Local Growth scenarios and used peaking factors provided by SGW to estimate peak daily flows and determine the sizing of the treatment plants and CWSs.

The suggested treatment train has been designed to address expected future regulatory requirement with regard to water quality and comprises:

- Dissolved Air Flotation Filtration (DAFF);
- Ozone - Biological Granulated Activated Carbon Filtration (BAC); and
- Microfiltration / Ultrafiltration (MF/UF).

Upgrades would be staged in 2020 (ozone/BAC and DAFF) and 2025 (MF/UF).

2.4. Dam Safety

In 2010, SGW commissioned URS to prepare a review[14] of future management options for the dams in the Northern Systems.

Dam safety deficiencies have been identified for all dams, including:

- stability of embankment, tower and/or upstream and downstream shoulders;
- piping risk due to no filters; and
- excessive seepage.

Remedial works, a reduction of hazard category or decommissioning are necessary within the next decade to address those deficiencies. SGW has decided to decommission dams in the Northern Systems, should they be connected to the Melbourne System via Lance Creek. This provides additional potential benefits of improving environmental flows, especially during summer months, and/or providing water for agricultural services.

[13] Aurecon, 2010, *Water Treatment Plant Upgrades Study – An Update*, prepared for South Gippsland Water, August. p. 14

[14] URS, 2010, *Review of Future Management of Korumburra System Dams and Little Bass Dam*, prepared for South Gippsland Water, May

2.5. Overview of existing water supply system

SGW currently operates ten separate supply systems to deliver water to 22 towns (Figure 6):

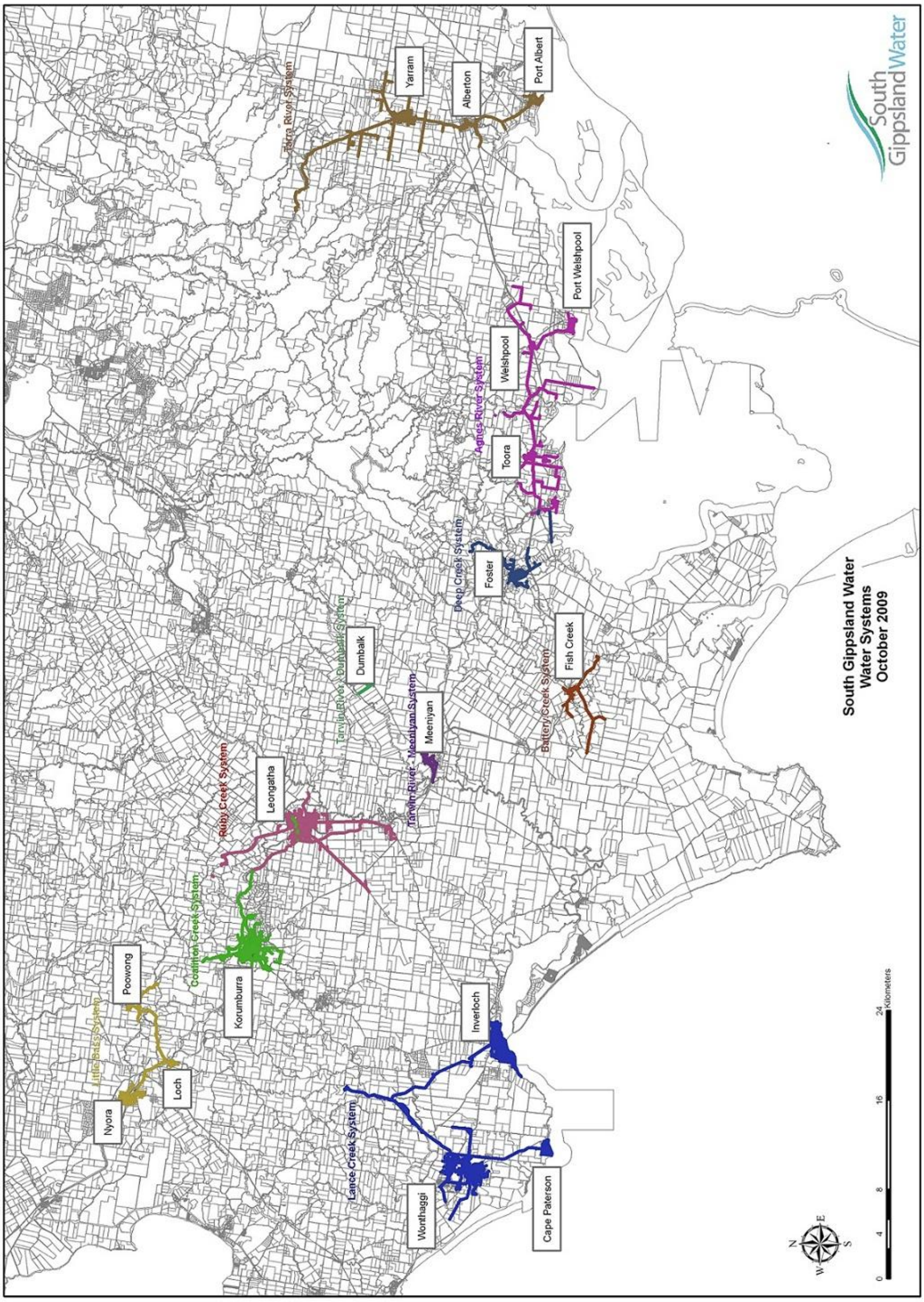
- **The Northern Systems** comprises
  - Little Bass, which supplies Poowong, Loch and Nyora;
  - Coalition Creek, servicing Korumburra; and
  - Ruby Creek, which supplies Leongatha and Koonwarra.
- The **Southern System** includes the Lance Creek System, which delivers water to the three towns Wonthaggi, Inverloch and Cape Paterson.
- The remaining systems have been grouped as **Eastern Systems.** Those are treated separately and do not form part of this Business Case.

The Business Case focuses on the *medium climate change* scenario, which assumes that runoff in the South Gippsland Basin will decrease by 15 percent by 2058 relative to 2009.[15]

The demand scenarios are based on the two growth scenarios, ViF and Local Growth, as described in section 2.2. Both scenarios assume that demand reduction measures are in place.

[15] South Gippsland Water, 2011, Water Supply Demand Strategy

Figure 6: South Gippsland Water's Water Supply Systems



2.6. Northern Systems

The following sections provide an overview of the three Northern Systems.

Storage capacity and bulk entitlements

The eight reservoirs of the Northern Systems have a combined capacity of 2,771 ML (Table 5). SGW currently holds bulk entitlements (BEs) totalling 5,696 ML[16] for the Northern Systems, representing the maximum volume that could be harvested in any given year, subject to availability, i.e. maximum diversion rate and minimum passing flows.

Additionally, SGW has now secured an amendment to its Korumburra and Leongatha BE's to allow SGW to access up to 1,800 ML/a (effective 19 October 2010) from Coalition Creek and the Tarwin River West Branch. The diversion rules comprise various seasonal access rules, diversion rates and passing flow requirements. SGW's current diversion infrastructure would not be able to harvest the full entitlement volume. However, river basin caps and sustainable diversion limits, which limit total water use in river basins, restrict SGW's access to new resources and will make it difficult to obtain new BEs.[17]

Table 5: Water Supply Northern Systems

	Bulk Entitlements	Storage Capacity	Current Yield
	ML/a	ML	ML/a
Poowong, Loch, Nyora	420	202	274
Korumburra	1,000	658	741
Leongatha	4,276	1,911	1,995
Total – Northern Systems	**5,696**	**2,771**	**3,010**

Source: WSDS and SKM

Demand

Despite residential growth, the long-term average of total raw water demand under the ViF projections is expected to increase only marginal to about 2,823 ML/a in 2058, compared with the current long-term average of 2,778 ML/a (Table 6). This is due to major water savings in the order of 600 ML proposed to be achieved by 2013 at Murray Goulburn's processing plant. Those savings offset the increase in residential and other industrial demand, assuming ViF growth.

16 WSDS, 2010

17 WSDS, 2010

Table 6: Raw Water Demand Northern Systems

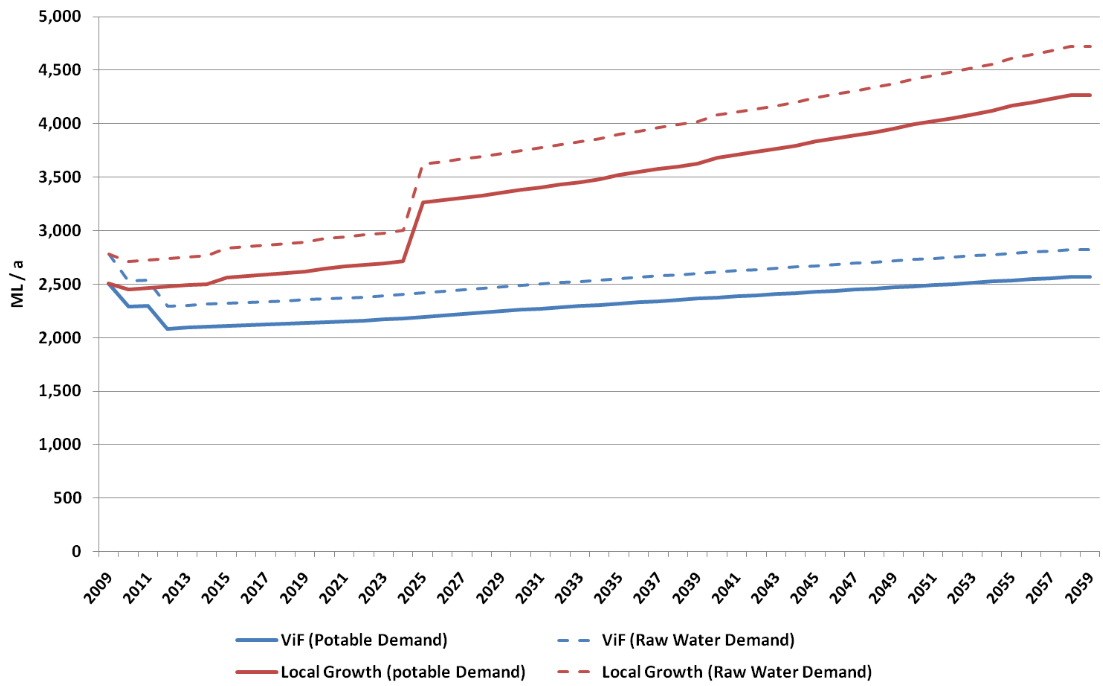
	Annual Demand current	Annual Demand 2058	
		ViF	Local Growth
	ML	ML	ML
Poowong, Loch, Nyora	264	321	594
Korumburra	621	810	1,079
Leongatha	1,893	1,692	3,046
Total – Northern Systems	**2,778**	**2,823**	**4,719**

Source: WSDS and SKM

Note: Annual Demand in 2058 assumes demand reduction measure will be in place.

It should be noted that there are uncertainties surrounding the demand forecasts, in particular the feasibility of water savings for Murray Goulburn and possibly stronger residential growth in urban centres. These are addressed with the Local Growth forecast, which provides an upper bound of 4,719 ML/a in 2058. Figure 7 shows both potable and raw water demand under ViF and Local Growth scenarios, which represent the lower and upper bounds for the Business Case analysis.

Figure 7: Water Demand Northern Systems



A comparison of current average annual demand (2,778 ML/a, Table 6) and capacity of existing storages (2,771 ML, Table 5) illustrates the small size of the storages and the reliance on annual fills. This poses a substantial risk to SGW's water supply. Significant water shortages are highly likely if further dry years and droughts do occur. This was illustrated in 2006/07 when both Leongatha and Korumburra would have had extreme water shortages without the qualification to the Bulk Entitlements.

2.6.1. Poowong, Loch and Nyora

Supply

The three towns Poowong, Loch and Nyora are supplied with water from the Little Bass River, a tributary of the Bass River. Water is stored in the Little Bass Reservoir, located south-east of Poowong, and treated at the nearby WTP (Figure 8).

Table 7 provides information on the key parameters of the Poowong, Loch and Nyora supply system.

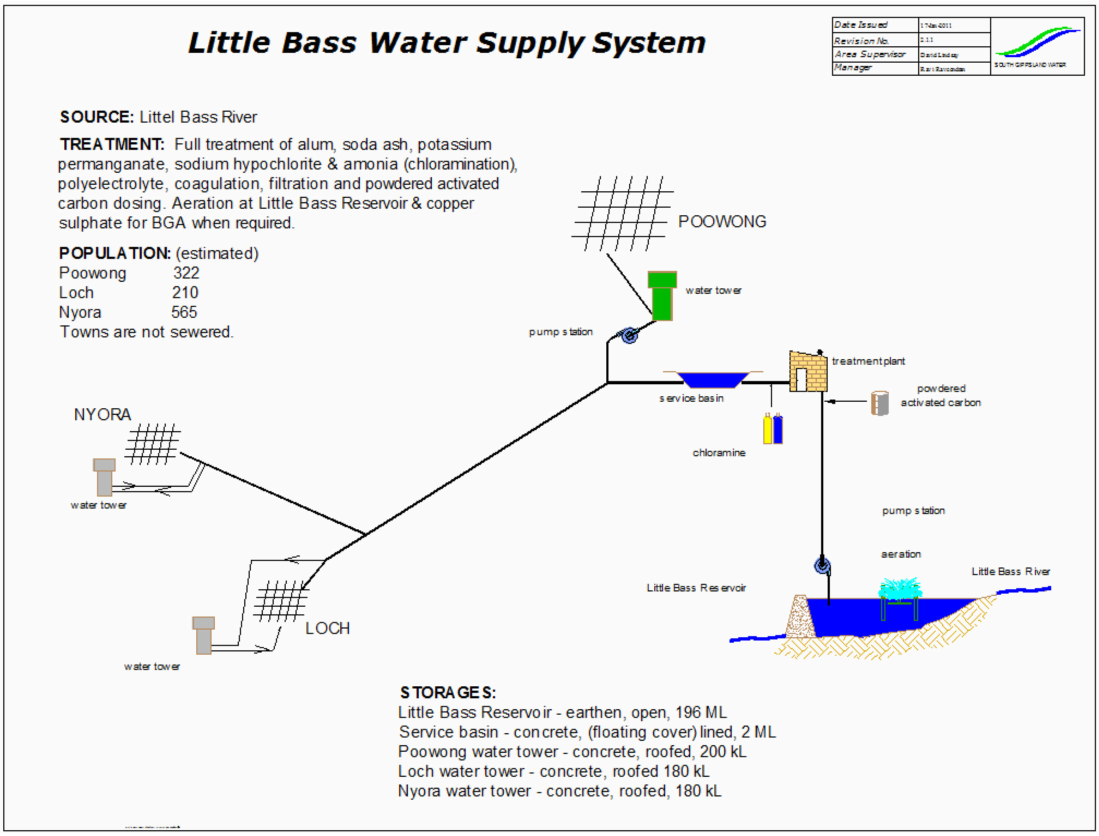
Table 7: Key Parameters – Water Supply Poowong, Loch and Nyora

Bulk Entitlements ML/a	Storage Capacity ML	WTP Capacity ML/d	Current Yield ML/a
420(1)	202	2.4	274

Source: WSDS 2010, Aurecon 2010

Note: (1) Diversion subject to minimum passing flows of 0.5 ML/d and a maximum diversion rate of 2.7 ML/d (WSDS, 2010)

Figure 8: Poowong, Loch and Nyora Supply System



Source: SGW

Demand

In 2009/10 SGW serviced about 1,048 residents in the three towns Poowong, Loch and Nyora. Customer numbers (assessments) have increased steadily in recent years to 686 in 2009/10. [18]

With increasing population and customer numbers, water demand has been growing over the last decade, except for the period from 2007 to 2009, which saw a significant drop in water demand due to restrictions and an enforced decline in industrial water usage. Table 8 provides information on long-term, three year average (2007-2010) and most recent water demand.

Table 8: Key Parameters – Water Demand Poowong, Loch and Nyora

Estimated Long Term Current Demand				2009/10	2007-2010
Annual Demand *(raw)*	**Annual Demand** *(potable)*	**Average Daily Demand** *(potable)*	**Peak Day Demand** *(potable)*	**Annual Demand** *(potable)*	**Annual Demand** *(potable)*
ML/a	ML/a	ML/d	ML/d	ML/a	ML/a
264(1)	240	0.66	1.64(2)	159	189

Source: WSDS 2010, Aurecon 2010

Note: *(1) WTP losses estimated at 9% (WSDS, 2010)*

(2) Peak day is calculated using specific peaking factors for each WTP provided by SGW. The peaking factor for the Poowong, Loch and Nyora system is 2.5.

Residential demand, including stock and domestic, accounts for around 70 percent of total water demand. [19] There is no clear seasonal pattern of demand, with variations attributable to the variable water use at the Poowong Abattoir. [20]

Future demand and supply imbalances

The ViF scenario for Poowong, Loch and Nyora assumes annual growth in residential customers of 0.6 to 1.1 percent per annum with no change in major industrial demand. This results in an average annual demand of 321 ML/a in 2058 (Table 9).

By contrast, the Local Growth scenario assumes a 1.5 to 2.5 percent growth per annum and incorporates an allowance for an increase in industrial demand to 230 ML/a (from currently 89 ML/a). In summary, average annual demand in 2058 under Local Growth is forecasted at 594 ML/a (Table 9).

The higher population growth under the Local Growth scenario is largely attributed to Nyora. The town is within commuting distance to the eastern parts of Melbourne and there is potential for strong 'city fringe' growth. Future residential development in the order of 1,000 lots may occur.[21]

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18 South Gippsland Water, 2010, Annual Report 2010, p.2

19 South Gippsland Water, 2010, Annual Report 2010, p.18

20 WSDS, 2010

21 WSDS, 2010

Table 9: PLN – Summary of current and future yields and demand (raw water)

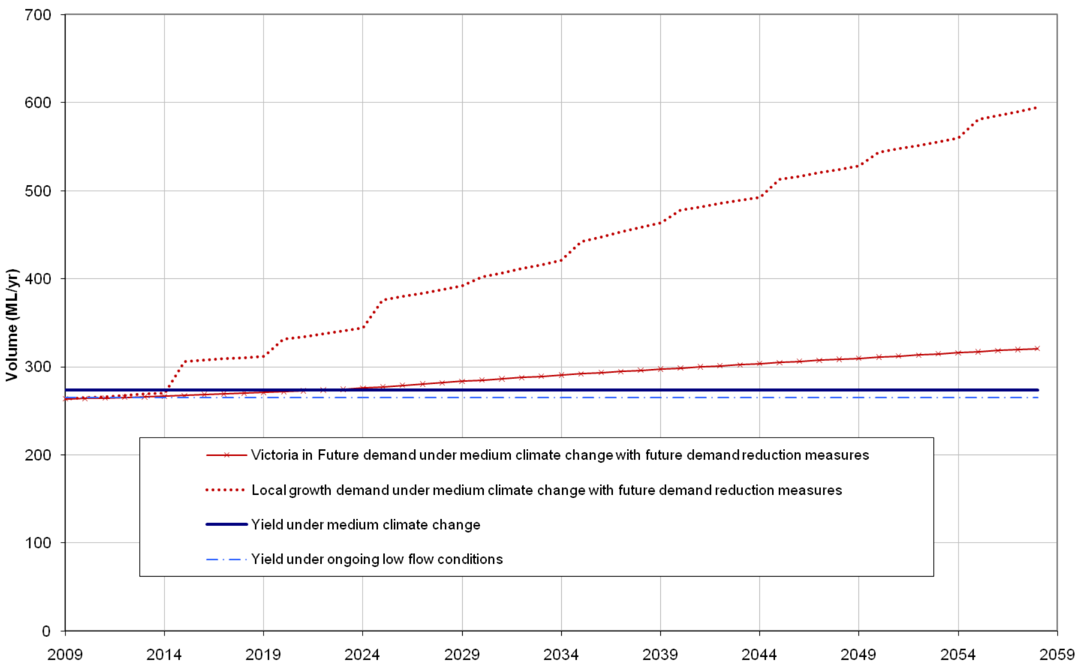
Region	Current Yield ML/a	Medium Climate Change Yield 2058 ML/a	Recent Low Inflows Yield 2058 ML/a	Current Demand ML/a	ViF Demand 2058 ML/a	Local Growth Demand 2058 ML/a
Poowong, Loch, Nyora	274	274	265	264	321	594

Source: WSDS, SKM modelling

Note: 2058 yields do not include any supply augmentations

In Poowong, Loch and Nyora demand will exceed available supply in 2022, assuming a medium climate change scenario and population growth in line with ViF projections. Water shortages could occur as soon as 2012, should the low inflow scenario takes place (Figure 9).

Figure 9: Raw Water Supply and Demand for Nyora, Poowong and Loch



The WSDS concluded that available supply is not sufficient to cater for immediate future demand in Poowong, Loch and Nyora. Potential supply enhancement options for the Little Bass System include connecting to the Melbourne System via Lance Creek and Korumburra or raising the existing reservoir by about 2 metres to harvest additional winter flows. This surface upgrade would increase the storage capacity by about 200 ML and would service Poowong, Loch and Nyora for about 40 years under the Local Growth scenario and over 50 years under the ViF scenario under the medium climate change scenario.

Supply augmentation options considered in this Business Case are discussed in more detail in section 3.2.

Water Quality and Dam Safety

The existing treatment plant in Poowong has sufficient capacity to service ViF Demand, but capacity upgrades are required, should stronger growth in demand occur. Upgrades to meet expected future water quality standards are required for both demand scenarios starting in 2020.

Dam safety upgrades (under the surface option) or dam decommissioning (under the Melbourne System Supply option) have been scheduled for 2014.

2.6.2. Korumburra

Supply

The Korumburra supply system sources water from Coalition Creek, Ness Creek and Bellview Creek. Raw water is stored in three reservoirs and treated at the Korumburra WTP (Figure 10). Table 10 depicts key parameters of the Korumburra supply system.

Table 10: Key parameters – Water Supply Korumburra System

Bulk Entitlements ML/a	Storage Capacity ML	WTP Capacity ML/d	Current Yield ML/a
1,000 (1)	658	4.0	741

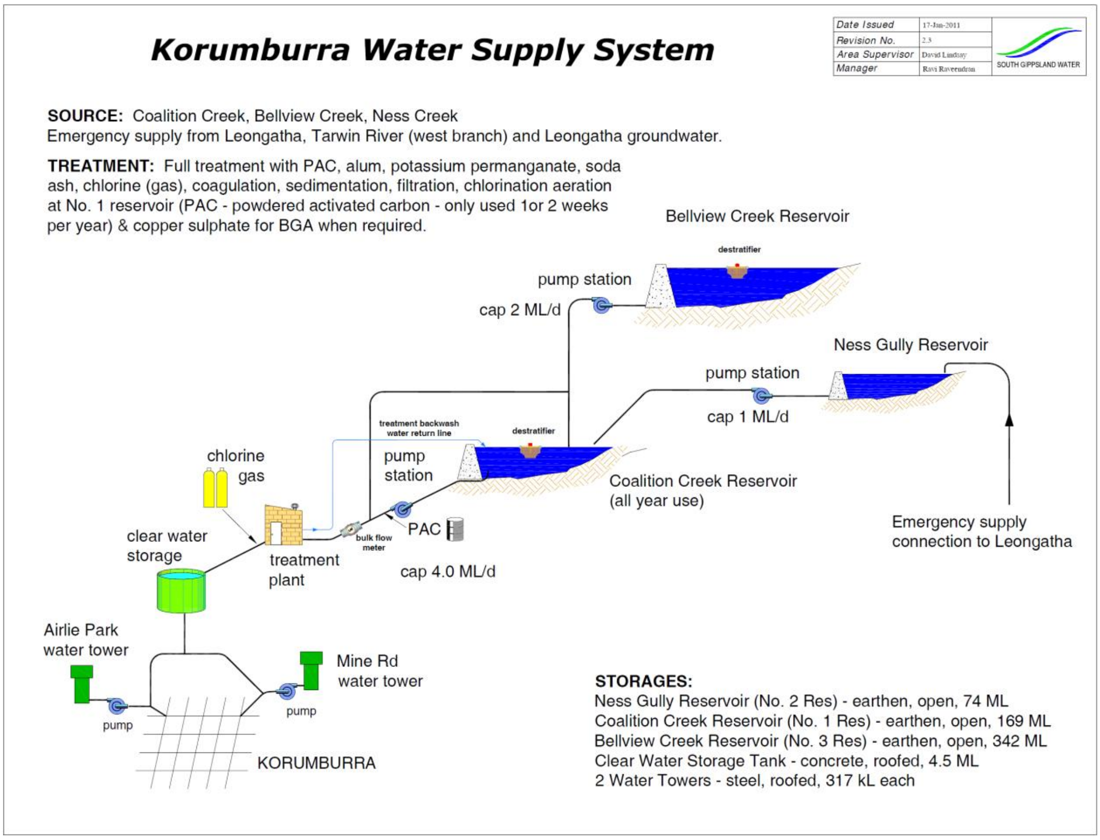
Source: WSDS 2010, Aurecon 2010

Note: (1) Diversions are subject to minimum passing flows and maximum diversion rates (WSDS, 2010)

During the 2006/07, temporary pumping occurred from the Tarwin River West Branch via Leongatha to Korumburra. This was formalised into a qualification of rights through an amendment to the Meeniyan BE in June 2008, allowing SGW to divert up to 1,800 ML/a, subject to storage trigger volumes and cease-to-pump stream flow thresholds.

SGW has now secured an amendment to its Korumburra and Leongatha BE's to allow SGW to access up to 1,800 ML/a (effective 19 October 2010) from Coalition Creek and the Tarwin River West Branch. The diversion rules comprise various seasonal access rules, diversion rates and passing flow requirements. SGW's current diversion infrastructure would not be able to harvest the full entitlement volume.

Figure 10: Korumburra Supply System



Source: SGW

Demand

In 2009/10, a population of 3,266 in Korumburra was serviced by SGW. Population remained relatively constant over the past two decades. Customer numbers (assessments), however, increased consistently since the early 1980s, now amounting to 2,031. [22] Despite increasing customer numbers, residential demand decreased significantly over the last few years, largely due to the restrictions[23]. Industrial demand has been fairly constant over the last three to four years.

[22] South Gippsland Water, 2010, Annual Report 2010, p.2

[23] Stage 4 restrictions were in place in 2006/07

Key parameters of water demand in Korumburra are listed in Table 11.

Table 11: Key Parameters – Water Demand Korumburra

Estimated Long Term Current Demand				2009/10	2007-2010
Annual Demand *(raw)*	**Annual Demand** *(potable)*	**Average Daily Demand** *(potable)*	**Peak Day Demand** *(potable)*	**Annual Demand** *(potable)*	**Annual Demand** *(potable)*
ML/a	ML/a	ML/d	ML/d	ML/a	ML/a
621(1)	602	1.65	3.3(2)	382	402

Source: WSDS 2010, Aurecon 2010

Note: *(1)* ***WTP losses estimated at 3% (WSDS, 2010)***

(2) ***Peak day is calculated using specific peaking factors for each WTP provided by SGW. The peaking factor for the Korumburra system is 2.0.***

The split of residential and industrial water demand is about 60 and 40 percent, respectively.[24] Demand varies seasonally with climate, but base demand in winter is relatively high.

Future demand and supply imbalances

ViF demand projections assume annual growth in residential customers of 0.6 to 1.1 percent per annum with no change in major industrial demand. The Local Growth scenario for Korumburra assumes a 1.5 percent growth per annum, while industrial demand is assumed to grow by 10 percent in 2015 and a further 10 percent in 2040.[25]

In 2058, ViF and Local Growth demand are expected to amount to 810 ML/a and 1,079 ML/a, respectively (Table 12).

Table 12: Korumburra – Summary of current and future yield and demand (raw water)

Region	Current Yield	Medium Climate Change Yield 2058	Recent Low Inflows Yield 2058	Current Demand	ViF Demand 2058	Local Growth Demand 2058
	ML/a	ML/a	ML/a	ML/a	ML/a	ML/a
Korumburra	741	717	692	621	810	1,079

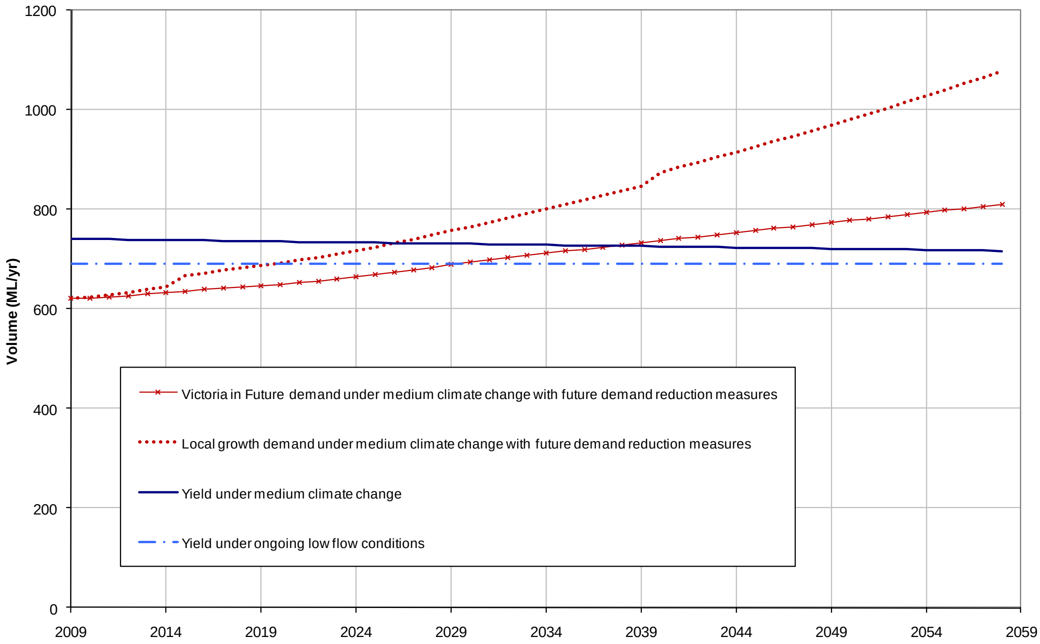
Source: WSDS, SKM modelling

In Korumburra demand will exceed available supply in 2037, assuming a medium climate change scenario and population growth in line with ViF projections. Under the Local Growth scenario, demand will surpass supply in 2026. Water shortages are forecast for 2030 and 2019 under the ViF and Local Growth demand scenarios, respectively, should low inflows occur (Figure 11).

24 South Gippsland Water, 2010, Annual Report 2010, p.18

25 These increases in industrial demand have been assumed for modeling purposes. However, volume and timing of actual increases is uncertain and may not occur.

Figure 11: Raw Water Supply and Demand for Korumburra



The current yield under both the medium climate change and ongoing low inflow scenario is not sufficient to cater for future demand. The system therefore requires supply augmentation. Supply enhancement options for the system would comprise a connection between Little Bass Reservoir and Bellview Creek to transfer water from the Poowong, Loch and Nyora system and/or the raising of dam walls of existing reservoirs, Coalition Creek and Bellview Creek. This would increase the storage capacity by about 200ML and allow harvesting of winter flows, provided sufficient rainfall and runoff. However, further augmentation would again be necessary in 15 to 20 years under the Local Growth scenario.

Alternatively, supply could be sourced from the Melbourne System via Lance Creek.

Supply augmentation options considered in this Business Case are discussed in more detail in section 3.2.

Water Quality and Dam Safety

The Korumburra treatment plant is approximately 30 years old. Aurecon proposed a complete replacement of the plant in 2020, with subsequent water quality upgrades in 2025.

Dam safety upgrades would be required between 2012 and 2018 for the three reservoirs, Coalition Creek, Ness Gully and Bellview Creek.

2.6.3. Leongatha and Koonwarra

Supply

Water for the towns Leongatha and Koonwarra is supplied from and stored in four reservoirs on Ruby Creek. Treatment occurs in the Leongatha WTP (Figure 12).

Table 13 depicts the key parameters of the Leongatha supply system.

Table 13: Key parameters – Water Supply Leongatha System

Bulk Entitlements ML/a	Storage Capacity ML	WTP Capacity ML/d	Current Yield ML/a
4,276(1)	1,911	8.7	1,995

Source: WSDS 2010, Aurecon 2010

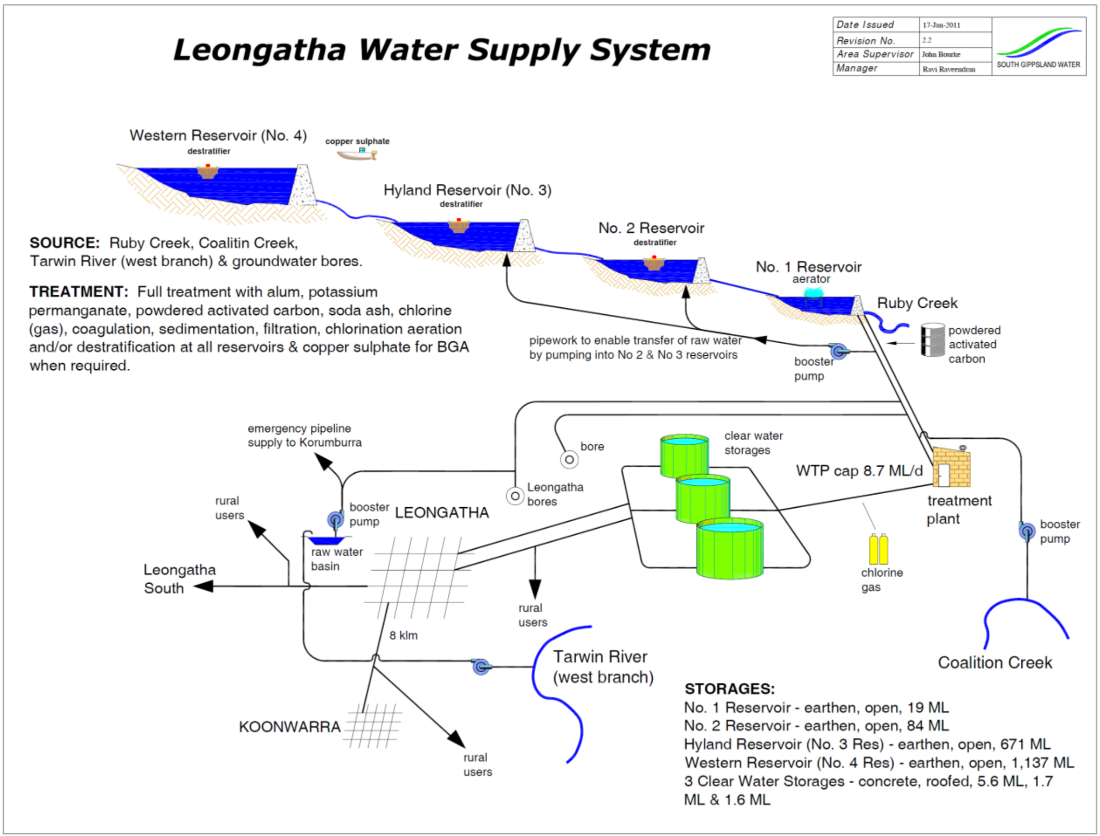
Note: (1) Diversions are subject to minimum passing flows, maximum diversion rates and storage capacity triggers (WSDS, 2010)

As outlined in section 2.6.2, water was pumped from the Tarwin River West Branch to Korumburra and Leongatha during the 2006/07 drought.

SGW has now secured an amendment to its Korumburra and Leongatha BE to allow SGW to access up to 1,800 ML/a (effective 19 October 2010) from Coalition Creek and the Tarwin River West Branch. The diversion rules comprise various seasonal access rules, diversion rates and passing flow requirements. SGW's current diversion infrastructure would not be able to harvest the full entitlement volume. An upgrade of the Tarwin River West Branch connection and an additional 1,000 ML reservoir on Ruby Creek would be required.

There are several groundwater bores in the Leongatha area. The Current Management and Infrastructure rules incorporate the licence conditions on the groundwater licence issued by Southern Rural Water in 2010, but conservatively assume that only 1.0 ML/d can be sustained from the bores rather than the 2.1 ML/d that has been licensed.

Figure 12: Leongatha Supply System



Source: SGW

Demand

Both the population and the number of customers have increased steadily over the last two decades. In 2009/10, SGW serviced a population of 4,794 in Leongatha and Koonwarra, this equates to 2,990 customers (assessments). [26]

Leongatha has regularly experienced restrictions in the last decade, including stage 4 restrictions in 2006/07. These have moderated demand in recent years.

Key parameters of water demand in Leongatha and Koonwarra are listed in Table 14.

Table 14: Key Parameters – Water Demand Leongatha and Koonwarra

Estimated Long Term Current Demand				2009/10	2007-2010
Annual Demand *(raw)*	**Annual Demand** *(potable)*	**Average Daily Demand** *(potable)*	**Peak Day Demand** *(potable)*	**Annual Demand** *(potable)*	**Annual Demand** *(potable)*
ML/a	ML/a	ML/d	ML/d	ML/a	ML/a
1,893(1)	1,668	4.57	6.85(2)	1,511	1,550

Source: WSDS 2010, Aurecon 2010

Note: ***(1) WTP losses estimated at 12% (WSDS, 2010)***

(2) Peak day is calculated using specific peaking factors for each WTP provided by SGW. The peaking factor for the Leongatha system is 1.5.

Demand from the Murray Goulburn milk processing factory has accounted for approximately 70 percent of the total Leongatha raw water demand in recent years.

Future demand and supply imbalances

The ViF forecast assumes annual growth in residential customers of 0.5 to 1.0 percent per annum for the two towns. It is assumed that Murray Goulburn's demand reduces by around 370ML/a in 2010 and a further 220ML/a by 2013, as a result of the company implementing water efficiency upgrades at its plant near Leongatha. Overall, ViF demand in 2058 has been estimated at 1,692 ML/a, some 200 ML lower than the current raw water demand (Table 15).

While reductions in consumption have been made by Murray Goulburn, the anticipated reduction of 370ML/yr in 2009/10 was not achieved. Uncertainty around the water efficiency upgrades of Murray Goulburn are reflected in the Local Growth scenario. It assumes that Murray Goulburn demand is reduced by only 67 ML/a. For the purpose of the scenario, an additional industrial demand of 500 ML per year is assumed to occur in 2025[27]. Residential growth of 1.5 percent per annum is expected under this scenario. This leads to a total raw water demand of 3,046 ML/a in 2058 (Table 15).

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26 South Gippsland Water, 2010, Annual Report 2010, p.2

27 These increases in industrial demand have been assumed for modeling purposes. However, volume and timing of actual increases is uncertain and may not occur.

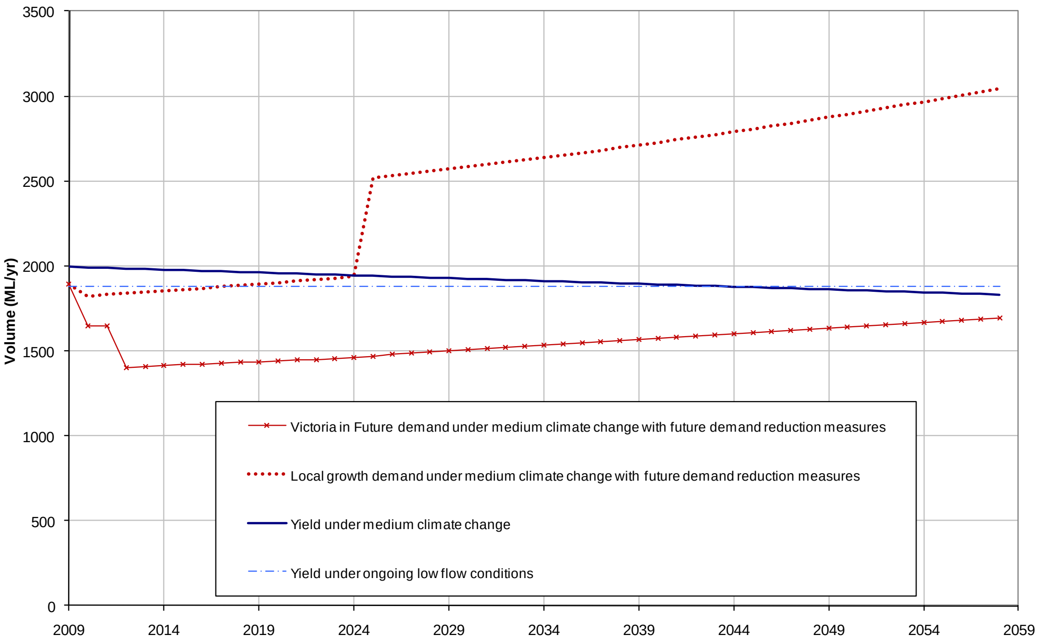
Table 15: Leongatha – Summary of current and future yield and demand (raw water)

Region	Current Yield ML/a	Medium Climate Change Yield 2058 ML/a	Recent Low Inflows Yield 2058 ML/a	Current Demand ML/a	ViF Demand 2058 ML/a	Local Growth Demand 2058 ML/a
Leongatha and Koonwarra	1,995	1,833a	1,879	1,893	1,692	3,046

Source: WSDS, SKM modelling

Figure 13 shows that supply augmentation will not be required provided Murray Goulburn successfully implements its demand reduction measures. Should Murray Goulburn not be able to implements all of its water saving measures as planned or population growth occurs as anticipated in the Local Growth scenario, supply augmentation would be required within the next 15 years, assuming the medium climate change scenario.

Figure 13: Water Supply and Demand for Leongatha and Koonwarra



Options for augmentation include upgrading the Tarwin River West Branch supply and/or constructing an additional 1,000 ML reservoir on Ruby Creek. Similar to the other Northern Systems, supply from Lance Creek and/or connection to the Melbourne System is an alternative.

As noted, supply augmentation options considered in this Business Case are discussed in more detail in section 3.2.

Water Quality and Dam Safety

The Leongatha treatment plant is approximately 30 years old. Aurecon proposed a complete replacement of the plant in 2020, with subsequent water quality upgrades in 2025.

Dam safety upgrades would be required between 2018 and 2020 for the four reservoirs on Ruby Creek.

2.6.4. Northern unserviced towns

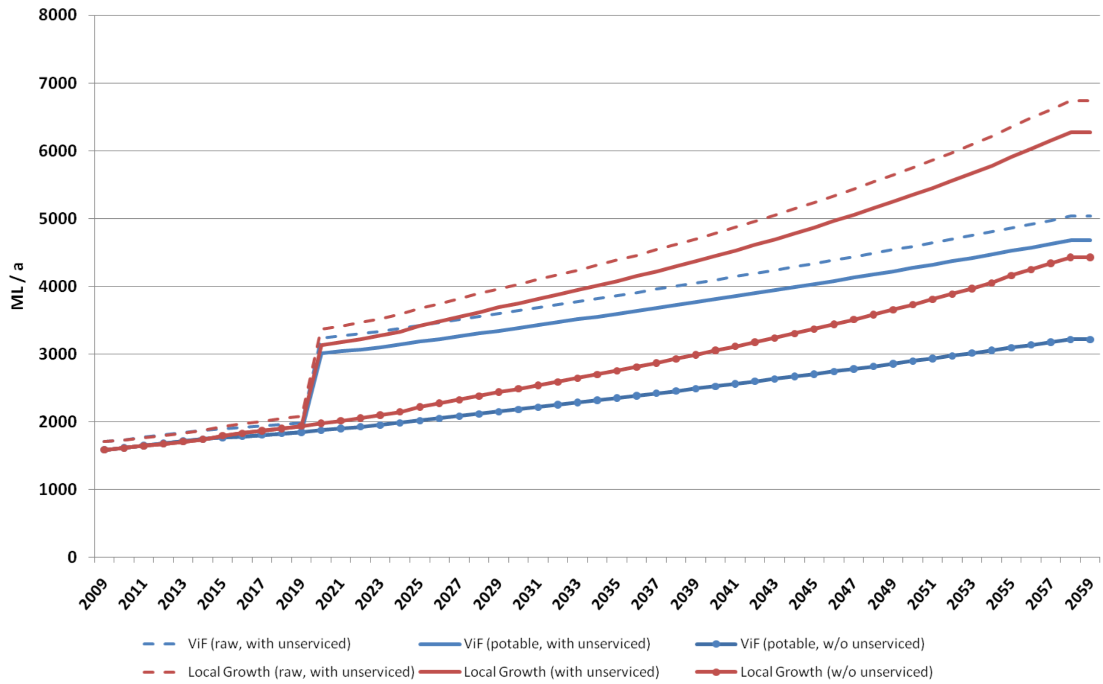
A number of small towns in the northern parts of South Gippsland region are not currently connected to water or sewerage services. These include Bena and Tarwin, which are currently considered too small to feasibly connect to the supply system.

2.7. Southern System

Lance Creek Reservoir, located north of Wonthaggi, is the main supply source for the Southern System. It currently services the major towns Wonthaggi, Inverloch and Cape Paterson.

At present the villages of Venus Bay and Tarwin Lower are not connected to the mains supply and depend on rainwater tanks. However, these townships and future residential developments could require connection to the Lance Creek supply system in the future. This would significantly increase the future water demand for the Southern System, as illustrated by Figure 14, which shows water demands under two growth scenarios (ViF and Local Growth) including and excluding the forecast demand from these unserviced towns.

Figure 14: Water Demand Southern System



2.7.1. Wonthaggi, Inverloch and Cape Paterson

Supply

Water is stored in the Lance Creek Reservoir and treated in the nearby WTP (Figure 15). Table 13 depicts key parameters of the Lance Creek supply system.

The Bulk Entitlement for Wonthaggi/Inverloch allows South Gippsland Water to divert up to a maximum of 3,800 ML/yr from Lance Creek and 1,800 ML/yr from the Powlett River.

South Gippsland Water also has a Bulk Entitlement to access up to 1,000 ML/yr from the Melbourne System to potentially supply Wonthaggi, Inverloch and Cape Paterson when the desalination plant at Wonthaggi has been commissioned. A physical connection of 10 ML/d between Wonthaggi and the Melbourne System has been constructed and can be used to access the Melbourne System via the first tranche of 1,000 ML/a of the Melbourne System BE.

Table 16: Key parameters – Water Supply Lance Creek System

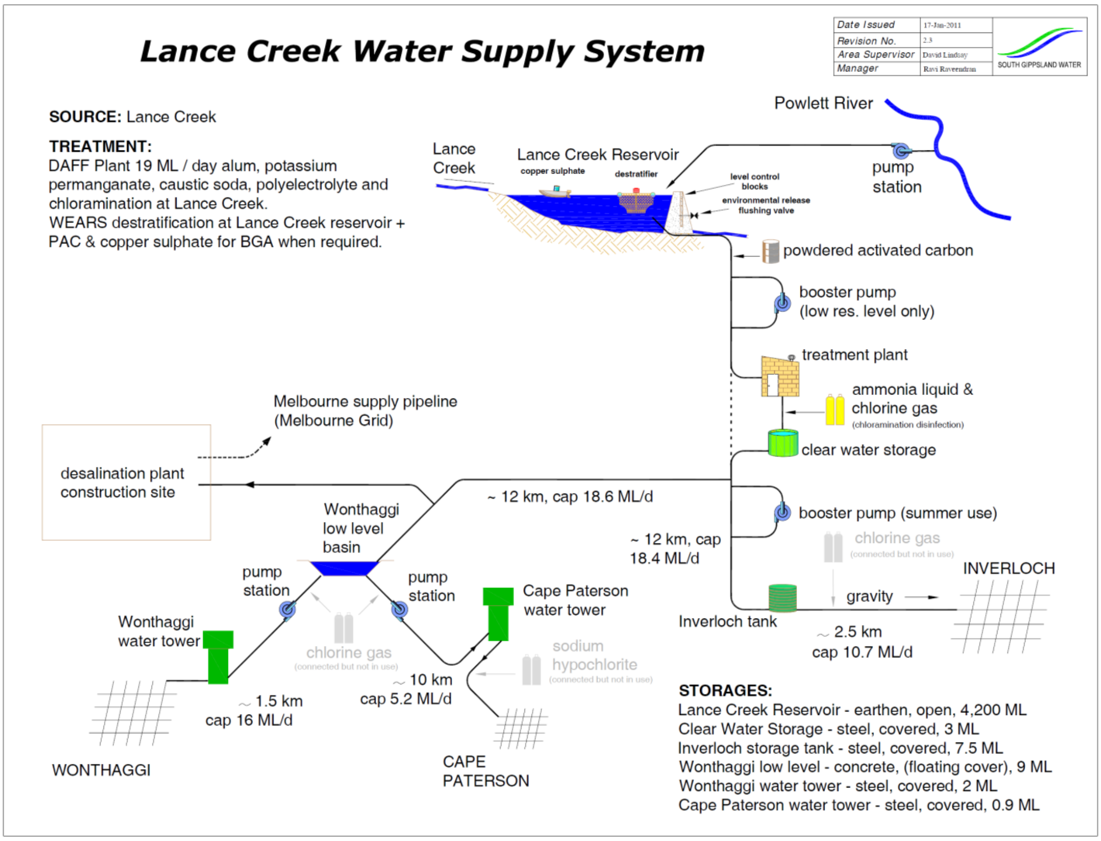
Bulk Entitlements ML/a	Storage Capacity ML	WTP Capacity ML/d	Current Yield ML/a
5,600(1) + 1,000(2)	4,200	19.0	3,426

Source: WSDS 2010, Aurecon 2010

Note: (1) Diversions are subject to maximum diversion rates (WSDS, 2010)

(2) first tranche of Melbourne System BE, capped at 5,000 ML

Figure 15: Lance Creek Water Supply System



Source: SGW

Demand

The towns Wonthaggi, Inverloch and Cape Paterson had a population of 12,165 residents serviced by SGW in 2009/10[28], with an additional 4,000 to 5,000 visitors during the summer months. SGW recorded 9,386 customers (assessments) in the three towns.

The population for all three towns has grown significantly over the last two decades, although a marginal decline was experienced from 2001 to 2006 due to a decrease in residents at Inverloch. Nevertheless, the number of customers increased steadily during this time period. It is anticipated that sea change investment around Wonthaggi and Inverloch will continue to be an important driver for growth in the region.

Key parameters of water demand of the Lance Creek System are listed in Table 17.

Table 17: Key Parameters – Water Demand Lance Creek

Estimated Long Term Current Demand				2009/10	2007-2010
Annual Demand *(raw)*	**Annual Demand** *(potable)*	**Average Daily Demand** *(potable)*	**Peak Day Demand** *(potable)*	**Annual Demand** *(potable)*	**Annual Demand** *(potable)*
ML/a	ML/a	ML/d	ML/d	ML/a	ML/d
1,706(1)	1,587	4.35	8.70(2)	1,384	1,388

Source: WSDS 2010, Aurecon 2010

Note: (1) WTP losses estimated at 7% (WSDS, 2010)

(2) Peak day is calculated using specific peaking factors for each WTP provided by SGW. The peaking factor for the Lance Creek System is 2.0.

The Lance Creek supply system did not require restrictions prior to 2006. Level 4 restrictions were implemented during 2007, although this was largely due to the provision of water to the Western Port region as a result of the severe drought conditions. Demand varies seasonally with climate and the influx of tourists during summer, with peak summer demands being about double the winter demands.[29]

Future Demand and Supply Balance

The ViF scenario includes a growth in residential customers of between 1.6 to 3.3 percent per annum. Stronger growth in the order of 3.0 to 3.3 percent is assumed to occur between 2010 and 2014, thereafter decreasing to about 2 percent per annum for the next 20 years and then declining to 1.6 percent. Industrial demand is assumed to stay constant. Based on these assumptions ViF demand totals to 3,457 ML/a by 2058.

By contrast, under the Local Growth scenario total demand at 2058 is estimated at 4,763 ML/a (Table 18). This assumes residential growth of 3.0 percent per year, decreasing to 2.5 percent per annum after 2030. Industrial demand is assumed to increase by 10 percent in 2015 and 2025, respectively. Total demand at 2058 is estimated at 4,763 ML/a.

[28] South Gippsland Water, 2010, Annual Report 2010, p.2

[29] WSDS, 2010

Table 18: Wonthaggi, Inverloch, Cape Paterson – Summary of current and future yield and demand (raw water)

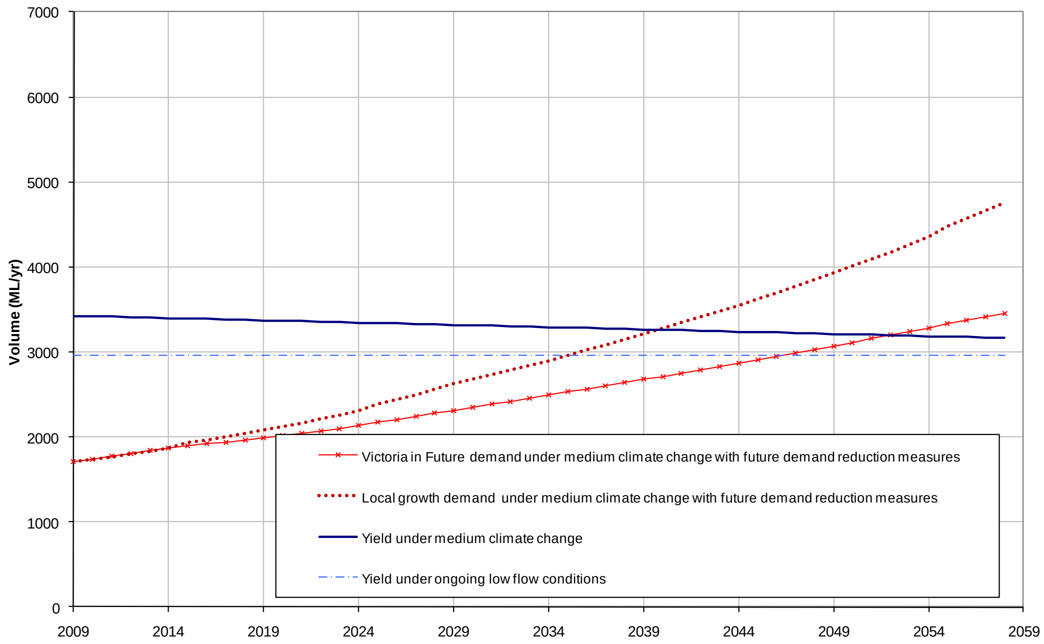
Region	Current Yield ML/a	Medium Climate Change Yield 2058 ML/a	Recent Low Inflows Yield 2058 ML/a	Current Demand ML/a	ViF Demand 2058 ML/a	Local Growth Demand 2058 ML/a
Wonthaggi, Inverloch, Cape Paterson	3,426 (1)	3,164	2,957	1,734	3,457	4,763

Source: WSDS, SKM modelling

Note: ***(1) Current Yield for Lance Creek supply only, does not include supplies from Melbourne System***

Under the medium climate change and ViF demand scenario, it is expected that a new water resource would be required by around 2050, provided unserviced towns are not connected to SGW's supply system. Under the Local Growth scenario, supply augmentation would be required in 2040. These water shortages would occur five years earlier, assuming the low inflow scenario (Figure 16).

Figure 16: Water Supply and Demand for the Lance Creek System



Although the current system is sufficient to cater for future demand in the coming decades, stronger than expected residential and industrial growth, and the possible connection of unserviced towns may necessitate augmentation. A pipeline connecting Lance Creek and the Melbourne System already exists, as SGW is supplying water to the construction site of the desalination plant.

The only other supply enhancement option would be from Foster Creek.

Supply augmentation options considered in this Business Case are discussed in more detail in section 3.2.

Water Quality and Dam Safety

The Lance Creek WTP, with the 10ML/d connection to the Melbourne System, has sufficient capacity to service future demand. Upgrades to meet expected future water quality standards are required under both scenarios in 2020 and 2025.

2.7.2. Unserviced Towns

Venus Bay and Tarwin Lower have sufficient demand for water and are in close proximity to the Lance Creek System to make their supply by SGW financially feasible. This could result in additional demand of around 1,200 ML/a for SGW, if unserviced towns were to be connected in the immediate future.

Table 19: Unserviced Towns – Summary of estimated current and future demand (raw water)

Region	Current Demand ML/a	ViF Demand 2058 ML/a	Local Growth Demand 2058 ML/a
Unserviced Towns	1,200	1,563	1,870

Source: WSDS, SKM modelling

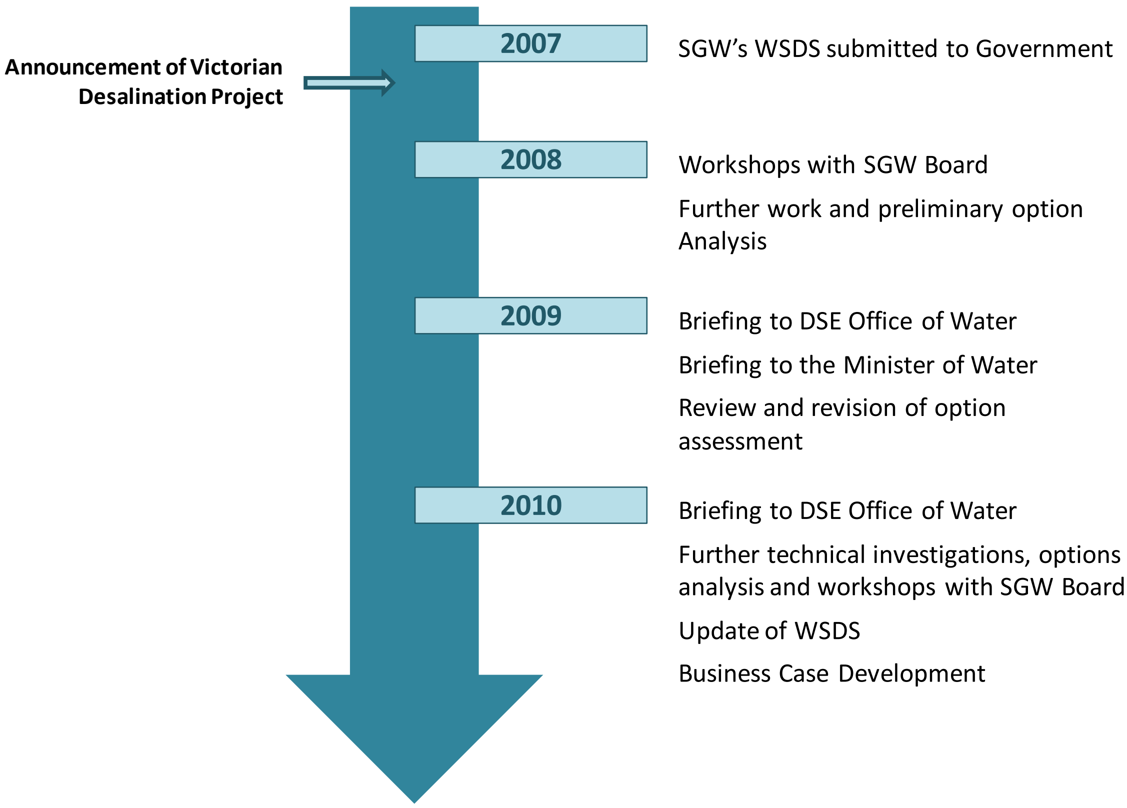
3. Options assessment

This chapter describes the comprehensive process of identification, analysis and evaluation of supply options undertaken by SGW (Figure 17). It explains the shortlisted options in detail and also briefly outlines options, which have been investigated, but subsequently dismissed or amended.

3.1. Overview of process

Over the course of the past three years, SGW had undertaken a thorough process of internal workshops, consultations with State Government and use of expert advisors in order to thoroughly assess available options for supply augmentation (Figure 17).

Figure 17: Process to date



The steps of this process are outlined in the following sections.

3.1.1. Water Supply Demand Strategy

In June 2007, SGW submitted its WSDS to the Victorian Government. The WSDS is a 50 year plan identifying actions to maintain the long-term balance between demand for water and available supply, focussing on both supply and demand side measures. It established a timetable for completion of planning and investigation of contingency supply options and also developed a consultation plan. The WSDS has subsequently been updated (March 2011) to reflect new findings and conditions.

Projections for water availability are based on medium term climate change conditions as well as a continued low flow scenario (see also section 2.1). Forecasts of population growth for Statistical Local Areas (SLAs) are based on *ViF* forecasts. This has later been expanded to include *Local Growth* forecasts (refer to section 2.2).

Shortly after the publication of SGW's WSDS, the Victorian Government announced plans for the development and construction of a desalination plant located near Wonthaggi. From early 2012, this desalination plant will provide drinking water for Melbourne and surroundings. The then Minister for Water, the Hon. John Thwaites stated that "*South Gippsland will also be connected to the desalination pipeline to secure water for towns like Wonthaggi."*[30]

SGW has since been investigating options to access the Melbourne System for water supply, in particular leveraging off the newly build Lance Creek connection to the desalination plant. Other augmentation options of existing surface and groundwater sources have also been examined.

3.1.2. Workshops with SGW Board & Executive Team

From July to November 2008, the SGW Board conducted a series of monthly workshops to identify strategic issues impacting on future water supply as well as to evaluate a range of possible options and scenarios for future water supply augmentation. The initial set of options considered by the Board included surface augmentation, Melbourne System supply and a combination of both (Table 20).

Table 20: Overview strategic options

System	*Options*
Northern Systems	Surface, Enhanced Surface & Desalination
Southern System	Surface and Desalination
Eastern System	Surface and Desalination

Strategic Issues

During the workshops, the Board identified and defined the following strategic issues, which have to be taken into account in water supply augmentation planning: The main issues included:

- **reliability of surface storages**

  SGW's surface storages are small and rely on annual fill with no significant carry over of supply. This increases SGW's vulnerability to a repeat of low inflows similar to 2006 and the risk of failure under adverse climate change outcomes.

- **limited ability to increase yield of surface storage**

  SGW faces difficulties in securing additional Bulk Entitlements (BEs). Furthermore, an increase in yield is expected to entail high costs, both financial and environmental.

- **level of service objectives**

  SGW has defined level of service objectives for maintaining adequate supply to customers. In particular, water restriction should not occur more frequently than 1 in 10 years and more severe restrictions, i.e. level 3 and 4, should not occur more frequently than 1 in 15 years.

[30] Media Release, 2007, *Desalination and Pipelines to Secure Water Supplies*, 19 June, available at: http://thesource.melbournewater.com.au/content/media_releases/media_releases/20070619.asp [accessed: 12th April 2010]

The ability to provide an assured supply (level of service) is a crucial criterion for SGW Board.

- **impact of grazing on water quality**

  Highly productive grazing and dairying activities affect SGW's water quality through increased nutrient flows, exacerbating the risk of THMs, cryptosporidium and giardia. WTP quality upgrades will be required.

- **new and excavated farm dams** in the Ruby Creek catchment have increased significantly in the last decade, increasing the competition for water within SGW's catchments.

- **significant residential growth**

  Population growth forecasts suggest potential city fringe growth around Nyora and sea change investment around Wonthaggi and Inverloch. Potential connection of unserviced towns and new developments to the reticulated supplies could place another strain on water supplies.

- **uncertainties around industrial growth**

  Murray Goulburn's water usage accounts for a significant proportion of water demand in the Northern Systems. The company is currently undertaking significant upgrades in its processing plant to improve water use efficiency and reduce water demand. At this stage, it has not been able to deliver the envisaged savings and the risk remains that Murray Goulburn will require supplementary supply.

  Further growth in water demand is anticipated due to relocation of industries with more stringent EPA policies (e.g. saline treatment and/or disposal).

3.1.3. Preliminary option analysis – 2008

In 2008, MJA undertook a high level assessment of the potential cost impacts of increasing resilience of supply from surface storages over a 50 year period. Alternative supply options, such as connecting to the Melbourne System, were also costed. Customer impacts of supply augmentations were assessed using building block regulatory models for all scenarios. Sensitivity analysis included variations in growth scenarios, such as city fringe growth in the Northern Systems, connection of unserviced towns to the Southern System and higher industrial demand of Murray Goulburn.

Northern Systems

The options examined included the costs for WTP upgrades, either as planned, i.e. in 2015, or delayed for 10 years:

- *current surface supply* system with upgrades of WTPs;
- *enhanced surface supply* system, e.g. expanding current system to a two year supply capacity, with upgrades of WTPs; and
- supply from the *Melbourne System* to all towns.[31]

The main conclusions drawn from the strategic analysis included:

[31] Pricing for this option was based on a levelised volumetric charge with three prices: \$2,500/ML, \$1,900/ML or \$1,300/ML

- the Melbourne System Supply option has lower expected capital costs than the surface option, but higher operating costs would be incurred under the Melbourne System Supply option;
- at a medium bulk water price, the Melbourne System Supply option has overall lower present value costs (PVC) compared with the current surface supply option (including upgrades of WTPs in 2015); and
- augmentation of the surface supply to provide for a two year supply capacity and improve supply security would have significantly higher whole-of-life cost than connecting to the Melbourne System.

Southern System

The base case assumed supply to unserviced coastal towns. The upgrade options for WTPs and related costs are included in economic analysis of the following options:

- *immediate* supply from Melbourne System;
- *Delayed Hybrid* with deferred connection to Melbourne System, i.e. after full utilisation of Lance Creek System; and
- *Early Hybrid* with immediate connection but reduced supply from Melbourne System (e.g. 25 percent). This option leverages the government funded pipeline to the desalination plant construction site.

The main findings from the strategic analysis were:

- the *delayed hybrid* option had the lowest PVC;
- the *early hybrid* option had slightly higher PVC, but underpins system security and enhances the ability to services growth and unserviced towns; and
- an *immediate connection* to, and exclusive use of, the Melbourne System, would result in the highest PVC costs for the Southern System.

Eastern System

For the Eastern System, both a connection to the Melbourne System and surface supply augmentation were analysed. The results of the preliminary analysis indicated that a connection to the Melbourne System would be cost-intensive, both in terms of capital and operating costs, with PVC approximately twice as high as those for augmentation of surface supply sources, leading to a significant increase in customer bills. Further analysis of the Eastern System was deferred and, as noted, does not form part of the Business Case.

Preferred Option – Packaged Solution

The option analysis for both the Northern and Southern Systems indicated that supply from the Melbourne System was the preferred option based on preliminary cost assumptions, in particular when taking into account the value of supply security under adverse climate change/variability impacts.

Therefore, SGW's preferred option has been a 'packaged solution' for both systems, with the Melbourne System Supply option for the Northern Systems and the Early Hybrid option for the Southern System, which allows an immediate partial supply from the Melbourne System.

3.1.4. DSE and Ministerial Briefings

During the course of developing and assessing future water resource options, SGW has undertaken extensive consultations with Government stakeholders, informing them of the strategic water supply options available to SGW, the magnitude of relating costs and resulting impacts on customers. SGW has provided briefings to:

- the Office of Water (30 October 2008);
- the Secretary of the Department of Environment and Sustainability (DSE) (19 January 2009); and
- the Minister for Water (27 February 2009).

At all three briefings the options and analysis results outlined above were presented and in principle support for the 'Packaged Solution' as the water supply solution for South Gippsland sought. Further, SGW intended to confirm integration with government policy on desalination and an indicative price range for Melbourne System water to incorporate in the financial modelling and evaluation of customer impacts.

3.1.5. 2009 Review

Arising out of the briefings, the Victorian Government provided $5 million funding for a two-way pipeline from the Lance Creek Reservoir to the desalination plant in order to supply the construction site with potable water during construction and commissioning.

This connection between Lance Creek and the desalination plant led to a revision of the assumption underlying the Melbourne System Supply option for the Southern System. In particular, the pipeline reduced the cost of connecting the Southern System to the Melbourne System and provided the opportunity to utilise the Lance Creek System to supply the Northern Systems. Additionally, more information regarding possible connection and volumetric charges for the Melbourne System became available from DSE.

As a result of this information, SGW commissioned further studies to refine and enhance the option analysis. These included:

- demand forecasts as well as system yields for the WSDS have been revised and updated by SKM;
- GHD was commissioned to assess the technical feasibility of connection options and routes from the Melbourne System using the Lance Creek pipeline. The associated report[32] also provides more detailed and consistent cost estimates; and
- the economics of supply options and resulting customer impacts were updated and revised by MJA. In particular, Melbourne System Supply options, utilising the newly constructed Lance Creek pipeline, have been revised. The outcomes were subsequently workshopped with the SGW Board to determine the best possible option for SGW, taking into account risks and uncertainties.

Revised Assessment

The revised assessment includes new information and leverages off the Lance Creek pipeline to the desalination site. The options examined focussed on the Northern Systems and included:

[32] GHD, 2009, *Connection to Desalination Supply – Report on Connection Options*, September, Melbourne

- **Surface supply to northern towns**

  Surface storages servicing Poowong, Loch and Nyora as well as Korumburra would be upgraded, including a future connection to the Tarwin River. Leongatha and Koonwarra supply will be secured from the Tarwin River. WTP upgrades would be staged in 2015, 2025 and 2035.

- **Melbourne System supply via Lang Lang**

  This supply would either occur as *full Melbourne System supply* to all towns and Murray Goulburn, or as a *hybrid supply* with Melbourne System supply for Poowong, Loch, Nyora and Korumburra and surface supply for Leongatha and Murray Goulburn.

- **Melbourne System supply via Lance Creek**

  As in the previous option, this consists of either a *full Melbourne System supply* for all towns and Murray Goulburn or a *hybrid supply* with surface supply for the Leongatha system and Melbourne System supply for the remaining towns.

All options assumed ViF demand, including reduced water demand from Murray Goulburn, and a connection to the Tarwin River for Leongatha and related WTP upgrades.

Preferred Option – full Melbourne System supply

The preferred solution resulting from the revised assessment was:

- an immediate connection to the Melbourne System for the Southern System via the newly constructed pipeline to supply potable water to the desalination site; and
- subsequent connection to the Melbourne System for the Northern Systems via Lance Creek.

The preferred solution was based on it having:

- the lowest PVC (whole-of-life cost) of the options assessed;
- provided a substantially improved level of supply security through effectively mitigating the effects of climate change/variability, i.e. the preferred solution avoided the risk of water shortages due to reduced stream flows as a result of climate change/variability;
- avoided the risk of investing in redundant assets – a risk that would prevail if further investment were to be made in augmenting existing surface supply systems; and
- avoided the need for, and associated impacts of, applying for additional bulk entitlements and the consequential reduction in environmental flows.

3.1.6. 2010 Briefing

A briefing to the Office of Water was held in February 2010, which provided an update on the additional work undertaken and the revised assessment of water supply options available to SGW.

The estimated costs and customer impacts were presented and in principle support was sought for the preferred water supply solution for South Gippsland.

3.2. Shortlisted Business Case options

The outcomes of the revised assessment and consultations with State Government stakeholders prompted SGW to commission updates of previous studies and additional reports to inform this Business Case (Table 25). In particular, the supplementary reports no. 2, 3 and 4 provide detailed capital and operating costs for the cost effectiveness assessment conducted as part of this Business Case.

Table 21: Supplementary reports to the Business Case

Report	*Title*	*Author*	*Date*
Supplementary Report no.1	Water Supply Demand Strategy	Sinclair Knight Merz	March 2011
Supplementary Report no.2	Water Treatment Plant Upgrades Study – South Gippsland Water	Aurecon	August 2010
Supplementary Report no.3	Review of Future Management of Northern Systems Dams	URS	May2010
Supplementary Report no.4	Connection to Melbourne System Supply via Lance Creek	GHD	July 2010
Supplementary Report no. 5	Cultural Heritage Desktop Assessment – South Gippsland Water Pipeline Alignment	Tim Stone	May 2010

With this information at hand, SGW decided to focus on two options for this Business Case:

- connection of the Northern Systems to the Melbourne System Supply; and
- continued development of existing Surface Supply systems.

The options outline supply augmentation for the Southern and Northern Systems and have common features: under both options, SGW will have a transfer pipeline system to transfer water from the Melbourne System pipeline to the Lance Creek clear water storage (CWS), when the Wonthaggi Desalination Plant is commissioned in late 2011.

The section of the pipeline between the Wonthaggi supply pipeline at the Powlett River and the desalination plant is currently used for supply of potable water to the plant during its construction. After commissioning of the desalination plant, the pipeline will be used to transfer Melbourne System water to SGW's supply systems.

This existing pipeline has a capacity to transfer 10 ML/d of water from the Melbourne System to the Lance Creek CWS. The pipeline will require a pump station to be installed near the Powlett River and a disinfection plant to be constructed before it can be used to transfer Melbourne System water to the Lance Creek CWS.

The section of the pipeline, from the Powlett River to Lance Creek, is currently used to transfer water from Powlett River to Lance Creek Reservoir during the winter months. This section of the transfer pipeline will have two future operational capacities. Its primary use is to transfer water from the Melbourne System, but it can also be used to transfer water from Powlett River to the Lance Creek Reservoir during the winter months.

3.2.1. Melbourne System Supply

The Melbourne System Supply option assumes that the Northern and Southern supply systems will be connected and the Northern Systems will source water from the Melbourne System and Lance Creek Reservoir.

This means all reservoirs and WTPs in the Northern Systems would be decommissioned, once each of the respective systems are connected to Lance Creek Reservoir and the Melbourne System. CWSs will be in operation in Poowong, Korumburra and Leongatha and have a capacity matched to peak day demands.

Under this option, connections to the Lance Creek / Melbourne System are scheduled for 2012 for Korumburra and Poowong and 2020 for Leongatha. Dams will be decommissioned about 2 to 3 years after the commissioning of the pipelines to allow for the lowering of water levels in the reservoirs to an acceptable safety level.

The transfer pipelines from the Melbourne System and the Lance Creek WTP are sized to deliver average daily demand in the event of disruption of supply from either the Lance Creek WTP or the Melbourne System. The combination of the treatment plant and the transfer system from the Melbourne System operating at average daily demand will provide sufficient capacity to provide supply for peak day demand for both demand forecast scenarios. Peak day demand for the combined system is estimated at around 1.9 times the average daily demand.

Capital Expenditure

The main capital cost components for the Melbourne System option are:

- construction cost of a pipeline and pumping station from Lance Creek outlet main to Korumburra CWS;
- construction of a pipeline between the Korumburra CWS and the CWS near Poowong;
- construction of a pipeline between the Korumburra CWS and the CWS near Leongatha;
- upgrade of the Lance Creek WTP and all CWSs; and
- additional works, such as decommissioning of all Northern Systems reservoirs.

All capital costs include contingencies and an allowance for 'Engineering, Procurement and Construction Management' (EPCM). Contingencies reflect that cost estimates for the options presented in the Business Case are based on high level conceptual design work that does not include any field inspections. For instance, construction costs for pipelines might be impacted due to ground conditions (e.g. rock or steep terrain) and/or removal of vegetation and offset plantings.

Table 22 presents the contingencies and project management allowances assumed for the analysis as a percentage of capital costs of capital works. The difference in contingencies for separate types of work reflects the detail and complexity of the planning work undertaken.

Table 22: Contingency and EPCM allowance

	Contingency	Project Management
Pipelines & Pump stations	50%	25%
WTPs	20%	20%
Storage Decommissioning[1]	40%	--

Note: (1) The 40% contingency covers both contingency and project management.

The total capital expenditure required for the Melbourne System Supply option, assuming the ViF Demand scenario, is estimated at $86.1 million, comprising $39.6 million for the Southern System and $46.5 million for the Northern Systems.

Table 23 sets out the capital expenditures, including allowances for contingencies and project management, for the Melbourne System Supply option for the Northern and Southern Systems.

Table 23: Melbourne System Supply Capex for ViF Demand

	Storage Decomm.	WTPs	Pipelines	Pump Stations	Other	Total
	$000s	$000s	$000s	$000s	$000s	$000s
Southern System	-	26,665	10,500	2,063	375	**39,603**
Northern Systems	12,978	10,758	18,731	2,953	1,125	**46,545**
Total Capex	**12,978**	**37,157**	**29,231**	**5,016**	**1,500**	**86,148**

Source: Business Case Analysis

Note: 1. All figures are in 2010/11 dollars

2. Costs include expenditures for Planning & Design, Contingencies and Renewals.

3. WTPs include the cost of Clear Water Storages.

Operating Expenditure

The main operating cost components for the Melbourne System Supply option are:

- service (fixed) and usage (variable) bulk water costs for the Melbourne System supply;
- maintenance and operating costs (for pipelines, pump stations, and storages);
- Lance Creek WTP operating costs; and
- energy costs (e.g. pumping costs).

Avoided costs, such as overhead costs, have been accounted for in the economic and financial analysis. These represent savings in operating costs due to decommissioning of dams or WTPs.

Table 24 sets out the operating expenditures for the Melbourne System Supply option under the ViF Demand scenario.

Table 24: Melbourne System Supply Opex for ViF Demand Scenario

Cost	Southern System	Northern Systems
Storage Maintenance ($/a)	238,000	-
WTP Variable ($/ML)	340	-
WTP Fixed ($/a)	279,800	-
WTP & CWS Maintenance ($/a)	206,332	107,576
Pumping ($/ML) (1)	49	137 23
Pipeline Maintenance ($/a)	56,000	100,000
Pump Maintenance ($/a)	55,000	78,800
Melb System Bulk Entitlement ($/ML) (2)	370	370
Melb System Fixed ($/ML/a) (3)	266	266
Melb System Variable ($/ML) (4)	1,100	1,100
Avoided Costs	-	(245,500)

Note: *All figures are in 2010/11 dollars*

(1) Pumping costs assume energy costs of $0.16 per kWh; Pumping costs for the section Lance Creek to Korumburra amount to $137 per ML, pumping costs for the section Korumburra to Poowong amount to $23 per ML

(2) Melbourne System Bulk Entitlement is a once only payment of $370 per ML of entitlement

(3) Melbourne System fixed operating cost is an annual cost of $266 per ML of entitlement

(4) Melbourne System variable cost is a $1,100 per ML actually delivered

3.2.2. Surface Supply

This option assumes that each of the Northern and Southern Systems utilises surface and to some extent ground water as the primary supply source.

Northern Systems

As noted earlier, reservoirs in the Northern Systems require upgrading to address dam safety deficiencies. Storage capacities need to be augmented to be able to harvest additional winter flows and increase the average annual yield. All reservoir upgrades and storage increases are scheduled between 2012 and 2020. This is triggered by the need to meet dam safety requirements.

To improve the supply security of the Leongatha system to a similar level as under the Melbourne System Supply option, an upgrade of the connection to the Tarwin River West Branch and an additional 1,000 ML reservoir on Ruby Creek need to be in place by 2020 (see also section 4.2.1). These augmentations would reduce the vulnerability of the system to sequences of low inflows, similar to the inflows experienced in 2006/07. The additional storage and upgraded Tarwin River connection also allow harvesting of additional flows from Coalition Creek and the Tarwin River West Branch under the amendment to SGW's Korumburra and Leongatha BE. Further a connection between Little Bass Reservoir and Bellview Reservoir is required to supply additional water from the Poowong, Loch and Nyora to the Korumburra system, assuming Local Growth demand.

All WTPs require upgrades for water quality purposes and some for production and capacity purposes. The Northern WTPs need to be sized to provide peak day demand of the towns serviced by the plants. Upgrades and refurbishments are planned for 2020, 2025, 2035, 2040, 2050 and 2055.

Under ViF demand, Northern Systems are predicted to have sufficient supply capacity thereby avoiding any requirement to connect to Lance Creek and the Melbourne System. However, assuming Local Growth demand, it is ***inevitable to connect the Northern Systems to the Melbourne System supply*** – resulting in redundant surface supply assets. There are no other feasible and viable surface augmentation options available to service excess demand. Additional transfer capacity to the Northern Systems of average daily demand less yield of surface and ground water will then be required.

Southern System

The Southern System is effectively a hybrid system, utilising the existing pipeline between the Lance Creek CWS and the desalination plant. Therefore, capacity upgrades of the Lance Creek Reservoir and the WTP will not need to be undertaken. The Lance Creek WTP has a current capacity of 19 ML/d, which provides sufficient supply to meet both growth scenarios.

The transfer system between the Melbourne System and the Lance Creek CWS is sized to meet the average daily demand of the Lance Creek System thereby covering an event where supply from the Lance Creek Reservoir or the Melbourne System is disrupted.

The combination of the treatment plant and the transfer system from the Melbourne System operating at average daily demand will provide sufficient capacity to supply peak day demand for both demand forecast scenarios. For this option, peak day demand for the Lance Creek is about twice the average daily demand.

Capital Expenditure

The main capital cost components for the surface supply option are:

- Dam safety upgrades for all reservoirs;
- Storage capacity increases for Coalition Creek, Bellview Creek and Little Bass Reservoirs;
- Construction of the Tarwin River connection and an additional 1,000 ML reservoir on Ruby Creek;
- upgrades of WTPs and CWSs; and
- in the case of Local Growth demand, construction of pipelines to successively connect all Northern Systems to Lance Creek and the Melbourne System.

Allowances for contingencies and project management are the same as under the Melbourne System Supply option (Table 22).

The total capital expenditure required under the Surface Supply option, assuming ViF Demand scenario, is estimated at $140.8 million, comprising $25.8 million for the Southern System and $115.0 million for the Northern Systems.

Table 25 sets out the total capital costs, including allowances for contingencies and project management, for the Surface Supply option under ViF demand for each system.

Table 25: Surface Supply Capex for ViF Demand

	Tarwin River Connection	1,000 ML Storage	Storage Upgrades	WTPs	Total
	$000s	$000s	$000s	$000s	$000s
Total Southern System	-	-	-	*25,771*	**25,771**
Poowong, Loch, Nyora		-	*5,979*	*6,169*	*12,148*
Korumburra		-	*17,286*	*24,503*	*41,789*
Leongatha	*3,720*	*19,751*	*5,432*	*32,212*	*61,115*
Total Northern Systems	3,720	19,751	28,697	62,885	**115,051**
Total Capex	**3,720**	**19,751**	**28,697**	**88,656**	**140,823**

Source: Business Case Analysis

Note: All figures are in 2010/11 dollars

Costs include expenditures for Planning & Design, Contingencies and Renewals

Operating Expenditure

The main operating cost components for the Surface Supply option are:

- WTP operating costs;
- maintenance and operating costs (for pipelines, pump stations and storages);
- bulk water costs for Melbourne System supply under the Local Growth scenario; and
- energy costs (e.g. pumping costs).

Compared to the Melbourne System Supply option, avoided costs do not occur under the Surface Supply option.

Table 26 sets out the operating expenditures for the Surface Supply option.

Table 26: Surface Supply Opex for ViF Demand

	Southern System	Korumburra	Leongatha	Poowong
Storage Maintenance ($/a)	238,000	91,000	132,500	72,000
WTP Variable ($/ML)	340	658	428	790
WTP Fixed ($/a)	268,400	91,300	106,200	68,700
WTP Maintenance ($/a)	201,726	191,800	250,054	47,004
Pumping ($/ML)	49	-	-	68.6
Pump Maintenance ($/a)	30,000	-	-	30,000
Pipeline Maintenance ($/a)	-	-	-	11,800
Melb System BE(1) ($/ML entitlement)	370	-	-	-
Melb System Fixed(2) ($/ML/a)	266	-	-	-
Melb System Variable(3) ($/ML)	1,100	-	-	-

Notes: All figures are in 2010/11 dollars

(1) Melbourne System Bulk Entitlement is a once only payment of $370 per ML of entitlement

(2) Melbourne System fixed operating cost is an annual cost of $266 per ML of entitlement

(3) Melbourne System variable cost is a $1,100 per ML actually delivered.

4. Value-for-Money

4.1. Cost effectiveness assessment

A cost effectiveness assessment identifies the option that achieves a target outcome at the least net cost. It offers a priority ranking of options on the basis of comparative 'cost per unit of effectiveness'.

A cost effectiveness analysis was selected because the primary benefits of the supply options are essentially the same, i.e. the supply of potable water to meet the growing demands within the Northern and Southern Systems. The economically preferred option, all other things being equal, is the option having the least whole of life cost (i.e. present value cost of the capital and operating expenditure).

Therefore, differences in supply risks and the level of service between the two options need to be addressed to allow a 'like-with-like' comparison of the options. The Melbourne System Supply option, with interconnections between all systems and the Melbourne Supply, provides a higher level of security compared with the Surface Supply option. To improve the level of service of the Surface Supply option, it was assumed that additional supply infrastructure and upgrades will be implemented to the four systems to cope with two consecutive years of low inflows, similar to the inflows experienced in 2006/07, with the upgrade of the Tarwin River connection and an additional 1,000 ML storage on Ruby Creek being the main augmentation.

Costs avoided through the supply of water from the Melbourne System, including water treatment costs, reservoir maintenance costs and direct administration costs, are taken into account as part of the Melbourne System Supply option.

4.1.1. Modelling Approach and Assumptions

The economic analysis sets out the flow of capital and operating costs in 2010/11 dollars over time associated with the two options and then, utilising the principles of discounting,[33] reduces these costs to a single present value for each option. The option with the lowest present value cost (PVC) would generally be considered the preferred option, other things being equal.

For the purpose of the base case analysis, a real pre-tax discount rate of 5.8 percent has been adopted as this is the Weighted Average Cost of Capital (WACC) derived by the ESC[34] for regional urban water authorities. The sensitivity of the results to changes in discount rates was undertaken using a lower estimate of 4 percent and an upper estimate of 8 percent.

A 50 year evaluation period was adopted for the economic analysis with financial years 2010/11 being treated as Year 1 and 2059/60 as Year 50.

The base case analysis is built on a set of assumptions for the yield and demand forecasts:

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[33] The standard approach to discounting reduces a time stream of costs and income to an equivalent amount of today's dollars. That single amount is known as the present value of the future stream of costs and income. Present Value is calculated using the method of compound interest. The rate at which the present value is computed is known as the discount rate.

[34] Essential Services Commission 2008, *2008 Water Price Review, Regional and Rural Businesses' Water Plans 2008-2013, Melbourne Water's Drainage and Waterways Water Plan 2008-2013 — Final Decision*, June; p.36

- average annual yield estimates for the Northern and Southern Systems are based on the medium climate change scenario;
- supply augmentations for the Surface Supply option are expedited to provide a similar level of service as the Melbourne System Supply option, if two years of ongoing low inflows (i.e. 2006/07 events) would occur;
- average annual demand estimates are based on ViF population growth forecasts and assume unserviced southern towns will not be connected to the supply system. It is further assumed that demand management measures are in place and water efficiency targets by Murray Goulburn are met;
- one-off bulk entitlement costs for access to the Melbourne System are $370 per ML. SGW water will progressively take up this bulk entitlement, which is initially capped at 5,000 ML, in two tranches of 1,000 ML and a third and final tranche of 3,000 ML;
- variable costs for supply from the Melbourne System water are $1,100 per ML consumed and fixed costs are $266 per annum per ML[35], based on entitlement size. Both variable and fixed costs are assumed to remain constant in real terms over the analysis period; and
- electricity costs for pump stations are set a $0.16 per kWh and held constant in real terms over the analysis period, although the sensitivity of the results to real increases in energy costs are examined.

It should be noted, that all dollar figures presented in this report are in 2010/11 dollars and rounded; accordingly, rounding errors may occur.

4.1.2. Modelling Results

Table 27 below shows the estimated PVCs in 2010/11 dollars for the base case scenario for both the Melbourne System Supply and Surface Supply options under the two demand scenarios, ViF and Local Growth. Under the base case assumptions and ViF demand, the PVCs are around $108.2 million for the Melbourne System Supply and $118.6 million for the Surface Supply option. That is, the Melbourne System Supply option is about 9 percent less expensive than the Surface Supply option.

Table 27: Whole of life costs – Base Case

	ViF Demand		**Local Growth Demand**	
	Melbourne System Supply	*Surface Supply*	*Melbourne System Supply*	*Surface Supply*
	$ million	$ million	$ million	$ million
Northern Systems	71.0	85.6	99.8	115.9
Southern System	37.3	33.0	53.1	40.8
Total	**108.2**	**118.6**	**152.9**	**156.8**

Source: MJA Analysis

Note: All figures are in 2010/11 dollars

Under Local Growth demand, the PVCs increase to $153.6 million and $156.9 million for Melbourne System Supply and Surface Supply option, respectively, closing the gap between

35 Note: Potential trading of entitlements and thereby offsetting part of the fixed annual cost component has not been taken into account.

whole of life costs between the two options. This outcome is largely driven by a significant increase in bulk purchases of Melbourne System supplies, which unsurprisingly has a greater impact on the PVCs of the Melbourne System Supply option. However, the Surface Supply option is nevertheless more expensive under the Local Growth demand scenario.

4.1.3. Sensitivity Analysis

A further possibility for reduced operating costs under the Melbourne System Supply option is the introduction of the trading of entitlements to offset part of the fixed annual cost component Melbourne System supplies. This possibility has not been modelled.

Table 28 below illustrates the results of the sensitivity analysis. As expected, increases in water demand, i.e. Local Growth instead of ViF demand and/or connection of unserviced towns, result in higher whole of life costs for both options. The Melbourne System Supply option has lower PVCs in 11 out of the 14 scenarios modelled.

The Melbourne System Supply option is more sensitive to changes in operating costs. Increases in demand or costs of Melbourne System supplies have a significantly higher impact on the whole of life costs of the Melbourne System Supply option than the Surface Supply option.

On the other hand, changes in capital costs have a greater impact on the PVCs of Surface Supply option, increasing the difference in whole of life costs of the two options in favour for the Melbourne System Supply option. It should also be noted that the margin of error associated with capital cost estimates is significantly larger than for operating costs, given the complexities and uncertainties inherent to infrastructure projects. This error margin is somewhat lower for the Melbourne System Supply option, given the detailed engineering studies undertaken to supplement this Business Case.

An additional scenario with regard to operating costs was assessed assuming lower variable costs for Melbourne System water supply. Due to its geographical location close to the desalination plant, SGW is not using the Melbourne System distribution infrastructure. It is therefore possible, subject to negotiations with Melbourne Water, that SGW would not be required to pay the proportion of service and usage charges allocated to transfer infrastructure.

If this is the case, the fixed and variable costs for water from the Melbourne System for SGW would be significantly lower, comprising only charges allocated to headworks. An indicative scenario assumed $191 per ML for annual service charges (a reduction of 28 percent) and $884 per ML for usage charges (a reduction of 20 percent).[36] This reduced price for Melbourne System water would results in lower PVC for both options, with substantially greater impacts on the Melbourne System Supply option under both the ViF and Local Growth demand scenario.

The whole of life costs of the Melbourne System Supply option would amount to $100.5 million and $142.3 million under ViF and Local Growth demand, respectively. That is, the PVC would decrease by $7.7 million and $10.6 million. By contrast, the PVC for the Surface Supply option, under both the ViF and Local Growth demand scenario, is less susceptible to changes in the price for Melbourne System water and would only decline slightly by $1.1 million and $2.4 million, respectively. As such, the whole-of-life costs for the Melbourne System Supply option would be more than 14 percent less expensive than the Surface Supply option, assuming ViF demand.

[36] Melbourne Water, 17.03.2010, pers. comm..

A reduction in supply security for the Surface Supply option was also assessed. This assumes that the surface systems are designed for medium climate change flows, but are not configured to cope with a sequence of extreme low inflows, resulting in lower capital costs. Therefore the risk to SGW to require severe restriction and/or not being able to deliver water to its customers increases substantially. This higher risk compares with PVC savings of $15 million. The Melbourne System Supply option would then be more expensive, although by less than 5 percent, providing a significantly higher supply security.

A further possibility for reduced operating costs under the Melbourne System Supply option is the introduction of the trading of entitlements to offset part of the fixed annual cost component Melbourne System supplies. This possibility has not been modelled.

Table 28: PV costs – Sensitivity Analysis

	Melbourne System Supply $ million	*Surface Supply* $ million	*Difference*
Base Case			
ViF Demand	108.2	118.6	-8.7 %
Demand			
Local Growth Demand	152.9	156.8	-2.5 %
ViF Demand & unserviced towns	124.9	126.9	-1.6 %
Local Growth Demand & unserviced towns	170.9	167.6	+2.0 %
CAPEX sensitivities			
Capex +10%	112.8	125.8	-10.3 %
Capex -10%	103.7	111.4	-6.9 %
OPEX sensitivities			
Melb System +1% p.a.	116.7	119.4	-2.3 %
Melb System +2% p.a.	128.0	120.4	+6.3 %
Melb System without transfer charges (ViF)	100.5	117.4	-14.4 %
Melb System without transfer charges (LG)	142.3	154.4	-7.9 %
Discount rate			
4%	144.3	151.8	-4.9 %
8%	81.4	91.9	-11.4 %
Supply Security			
Lower Supply Security (ViF)	108.2	103.3	+4.8 %
Lower Supply Security (LG)	152.9	153.8	-0.6 %

Source: MJA Analysis

Note: ***All figures are in 2010/11 dollars***

All PV cost are for the ViF demand scenario, unless otherwise stated

4.2. Preferred Option

The Melbourne System Supply is the preferred option. The main arguments supporting the preferred option include:

- the Melbourne System Supply option provides a significantly higher level of supply security. Even if augmentations to surfaces supplies were undertaken to increase the level of service there is still the risk that supply could fail during a sequence of low inflow years. The Melbourne System Supply option effectively mitigates the likelihood of future supply failures due to low stream flows into the relatively small storages resulting from climate change/variability and provides greater flexibility to accommodate changes in demand;
- the Melbourne System Supply option avoids the risk of investing in redundant assets – a risk that would prevail if further investment were to be made in augmenting existing surface supply systems. Under the Local Growth demand scenario, investments to connect all Northern Systems to the Melbourne System supply are required before 2040 regardless of previous surface supply augmentations;
- it provides the necessary security to support the future economic growth in the region, including the ability of SGW to service major industrial customers, e.g. Murray Goulburn, a potential industrial shift in the area and/or population growth;
- it provides an opportunity for the agricultural sector to use additional flows, offering greater security and the potential for future growth for the agricultural value chain;
- it avoids the need for, and associated impacts of, applying for additional bulk entitlements and the consequential reduction in environmental flows; and
- the cost estimates for the Melbourne System Supply option are considered more reliable given the benefit of the more detailed engineering studies undertaken during 2010. Uncertainties regarding the comprehensive surface supply augmentations could potentially results in higher capital costs than estimated, whereas the structural design for the Melbourne System Supply infrastructure is notably less complex.

Elements of the justification are amplified in the following sections.

4.2.1. Supply risk

Water is a fundamental input to the economic growth of any region. Reduced water reliability caused either by climate change/ variability or inadequate supply infrastructure could place significant constraints on the prosperity of the South Gippsland region.

The Melbourne System Supply option is a coherent long term strategy to address future supply demand imbalances arising from reduced water availability and increasing water demand.

Uncertainty about future stream flows

As noted in section 2.1, changes in rainfall, runoff and stream flow, and yields are expressed as average only. Therefore significant variations are possible in any given year. That is, the available yield in a particular year could be significantly lower than suggested by the modelling, exposing the annual fill of the Northern Systems storages to extreme events, e.g. prolonged dry periods.

The vulnerability of the four supply systems to extreme drought was assessed by assuming two consecutive years of low inflows, similar to the inflows experienced in 2006/07. It was concluded that, if sufficient surface supply augmentations for VIF demand only were implemented, all systems, except the Leongatha system, would able to cope with two years of drought similar to 2006/07, depending on demand. However, the Ruby Creek System supplying Leongatha would be expected to reach the minimum operating level in the second year of an extreme drought event.

Therefore, the base case scenario assumes that the Ruby Creek supply augmentations will need to be implemented in order to secure supply risk. Under both the ViF and Local Growth scenario, the Tarwin River connection and the additional 1,000 ML reservoir on Ruby Creek would need to be operational in 2020 to reduce the supply risk in a two year drought event. This would provide a similar level of security, but still inferior, as under the Melbourne System Supply option.

The risks of reduced water availability and resulting water supply shortages are effectively removed by implementation of the Melbourne System Supply option, which provides a secure water supply even in years of drought. As such, this option provides long term water supply security for the region and the reliability necessary for future economic growth. In particular, the food industry, a major water user and important contributor to economic growth in the region, will benefit from secure and reliable water supply.

Uncertainty about future demand and economic growth

From a demand side perspective, the Melbourne System Supply option provides more flexibility as stronger growth in water demand can be accommodated by bringing forward augmentation works. On the other hand, should growth in demand slow down in the future, the Melbourne System Supply option also provides the flexibility to defer investment.

The connecting pipelines are sized to service both ViF and Local Growth demand. A greater increase in water demand will be accommodated through additional pumping capacity, incorporated only as required. Therefore, the Melbourne System Supply option avoids duplication of works and a possible redundancy of assets.

By contrast, the Surface Supply option does not allow for a connection between the Southern and Northern Systems under ViF demand. Should demand increase at a higher rate, e.g. Local Growth, interconnections between the systems and supply from the Melbourne System will be necessary to service this additional demand, because there are no further feasible augmentation opportunities to increase the yield of the surface systems. Therefore, the Surface Supply option is effectively a hybrid system under the Local Growth scenario and will inevitably require a connection to Melbourne System Supply connection, resulting in redundant surface supply assets.

Backup in case of system failure

The supply system for the Melbourne System Supply option is designed to deliver average daily demand to all four supply systems in the event of disruption of supply from either the Lance Creek WTP or the Melbourne System. This provides a significantly higher supply security for the Northern Systems than under the Surface Supply option.

Under the Surface Supply option, assuming ViF demand scenario, the Northern Systems would not be connected to the Melbourne System and therefore could face significant water shortages in drought years. Under the Local Growth scenario, the system design allows for additional transfer capacity, but only to cover average daily demand less the yield of surface and groundwater of the Northern Systems.

4.2.2. Water quality

As outlined in section 2.3, SGW faces significant obstacles to achieve future water quality standards both in the Northern and Southern Systems. This is largely due to intensive dairy and cattle farming in the region and resulting high levels of nutrients and natural organic matter in the reservoirs. Apart from complying with regulatory requirements, this also is an issue for SGW in terms of customer complaints, e.g. taste and odour.

Water sourced from the Melbourne System would be at a consistent water quality and therefore risks to water quality related to intensive dairy and cattle farming or blue green algae blooms would be mitigated. All Northern reservoirs would be decommissioned by 2020 and a disruption of supply from Lance Creek Reservoir, e.g. due to algae blooms, would be covered by the capacity of the system to supply average daily demand from the Melbourne System. By contrast, under the Surface Supply option the systems are not connected and therefore exposed to supply disruptions and/or system failures due to water quality issues, such as algae blooms.

4.2.3. Benefits for the agricultural value chain

Agriculture is one of the main industries in the region, with about 15 percent of the working population of the South Gippsland Statistical Subdivision[37] being employed in the industry.[38] The South Gippsland region is well integrated within the agricultural value chain, providing inputs and using outputs of agricultural activities.

The existing small storage infrastructure made redundant by connecting to the Melbourne System allows the agricultural sector and other industries embedded in the agricultural value chain to use additional water resources. This provides greater security for the sector and supporting industries, such as major food processors. It may also provide the potential for the establishment of new food industries, such as horticulture or the extension of the growing dairy manufacturing sector.

The Melbourne System Supply option provides job security to workers and enables future economic growth in the region. Given various climate condition, the economic prosperity of the region could be hindered under the Surface Supply option.

4.2.4. Environmental benefits

Additional environmental flows, in particular summer flows, are a substantial environmental benefit of the Melbourne System Supply option, significantly contributing to the recovery of stressed rivers and ecosystems in the Northern Systems.

Several assessments of the condition of South Gippsland's rivers have been undertaken in the past few years:

- DSE's Index of Stream Conditions shows that the environmental conditions of Coalition Creek and Tarwin River (both West Branch and Main Branch) are very poor and poor, respectively; Stream Condition Bass River is listed as moderate; and
- An environmental assessment by Ecowise Environmental suggests that the water quality in the Tarwin River West Branch appears to be degraded and further reductions in water levels could potentially result in an extended decline in water quality.

[37] A statistical subdivision is a special geographic (spatial unit) area that is used for the collection and publication of Census data. The South Gippsland Statistical Subdivision comprises the Local Government Areas Bass Coast and South Gippsland.

[38] Australian Bureau of Statistics, 2006, Census of Population and Housing

The West Gippsland Catchment Management Authority has stated that a key environmental benefit to the restoration of a natural flow regime, i.e. unimpeded by in-stream dams and extraction for urban supply, would be

- to enable fish passage throughout the entire Tarwin River system, enhancing the abundance of self sustaining populations of Australian Grayling in the river; and
- to enhance the populations of native fish species in tributaries of the Tarwin, including river blackfish, smelt, lamprey, pygmy perch, galaxias species, as well as short finned eel, tupong and spiny crayfish.

Additional flows over and above those required for the environment, could be utilised for agricultural purposes, such as livestock. By contrast, similar achievements are not feasible under the Surface Supply option.

It should also be noted that river basin caps and sustainable diversion limits, which limit total water use in river basins, constrain SGW's access to new resources and make it difficult to obtain new BEs.

5. Review of planning, approval and implementation phases

5.1. Introduction

A key component of the Business Case is to provide assurance that the project planning and approvals, implementation and operations phases present no potential impediments to the development of the Melbourne System connection and supply augmentation. In this Section, we review key elements of SGW's strategy in respect of all principal elements of project development and operations, including the process of gaining all necessary development approvals, and processes used for procurement of design and construction services.

5.2. Planning process

SGW has an in-house project delivery team that manages the planning, procurement, and delivery of infrastructure projects similar to the works required for implementation of the preferred Business Case option of connection to the Melbourne System. Capital expenditure managed by the project team amounts to $15 million per annum on average. Moreover, recent infrastructure projects have been of similar size and nature to the proposed connection to the Melbourne System. Recent projects have included upgrades to WTPs, pipelines up to 450mm diameter, pump stations, reservoir embankment and spillway remedial works.

5.3. Planning approvals – compliance with legislative & regulatory requirements

This section of the Business Case outlines the compliance with the legislative and regulatory requirements, and indicates the next steps that have been identified and will be undertaken in the process of gaining the relevant approvals.

Multiple planning and environmental approvals will be required for components of the project. SGW will prepare a planning and environmental approvals strategy to identify:

- relevant approvals required for the project,
- approvals already in place or being managed by others, and
- issues associated with obtaining the approvals within required timeframes.

Budgetary provision has been made for this process and time has been allowed for it in the project plan.

The environmental and planning approvals team would utilise its extensive knowledge of approval requirements together with existing information on the project and the locality, and liaise with relevant agencies to prepare an approvals strategy for the project.

The approvals strategy would comprise the following key elements:

- description of likely planning and environmental approvals, including relevant legislation;
- methodology and procedural guide for seeking each approval;
- timelines for each approval process together with interdependencies between approvals and required sequencing;

- information requirements for each approval application and potential to assemble common information to submit with multiple approvals;
- an assessment of the risks of being delayed in obtaining one or more approvals and/or not obtaining a required approval; and
- contingency plans for resolving potential issues.

5.3.1. Planning and development approvals

Planning permits

The area is governed by the Bass Coast Planning Scheme and the South Gippsland Planning Scheme. The planning authorities are the respective Councils.

The approvals outlined in the following sections are likely to include planning permits for some components of the work.

5.3.2. Environmental approvals

SGW's environmental planners, engineers and consultants have a detailed knowledge of the approvals required for infrastructure projects and extensive experience in preparing such strategies.

To implement the supply augmentations proposed, SGW will need to comply with a number of statutes, including:

- Environment Protection and Biodiversity Conservation Act 1990 (Cth)
- Environment Protection Act 1970 (Vic)
- Environment Effects Act 1978 (Vic)
- Planning and Environment Act 1987 (Vic)
- Flora and Fauna Guarantee Act 1988 (Vic)
- Water Act 1989 (Vic)
- Wildlife Act 1975 (Vic)
- Victorian Land Act 1958 and/or Crown Land (Reserves) Act 1978.

The project could, potentially, require preparation of an Environment Effects Statement (EES) under the *Environment Effects Act 1978* (Vic), as the proposed works are capable of impacting on the environment. Similarly, the project needs to take account of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act).

SGW will address environmental approvals and planning permit issues. Necessary steps that are typically required are set out in Table 29. SGW will employ specialist consultants to undertake these steps.

Table 29: Flora & Fauna Assessment Methodology

Step	***Task***
Step 1	Desktop review and initial site investigation
Step 2	Short report – summarising ecological issues, legislative and policy risks, options assessment and next required actions
Step 3a (if required)	Targeted surveys for one or more threatened species and communities
Step 3b (if required)	Collection of field information for Net Gain Assessment
Step 3c (if required)	Aquatic Assessments and Surveys
Step 3d (if required)	Other investigations – It is common for the initial assessment to identify other necessary tasks required to fulfil legislative requirements
Step 4 (if required)	Preparation of detailed flora and fauna report(s) suitable for submission in planning applications.

Budgetary provision has been made for this process and time has been allowed for it in the project plan.

Project works site studies and investigations

In the early stages of the project, SGW will commission specialist consultants to produce a Framework Environmental Management Plan. This plan addresses the environmental issues associated with the construction works. It is generally prepared in accordance with the Environment Protection Authority Victoria (EPA) Environmental Guidelines for Major Construction Sites. The plan takes into account relevant federal, state and local environmental guidelines and policies. The framework plan is generally issued to the successful contractor to become the basis for the contractor's Environmental Management Plan.

SGW will undertake several site and location assessments prior to the construction of the proposed pipelines and pump stations proceeding on site, such as a flora and fauna assessment. This assessment will be undertaken externally by qualified environmental consultants and/or ecologists. It involves an inspection of the site to identify any flora and fauna issues. A report will then be prepared and targeted surveys carried out to determine the presence of threatened species. Mitigation measures are implemented to avoid and/or minimise the impact.

A works specific Environmental Risk Assessment is also undertaken prior to construction works commencing. This assessment is undertaken internally by a SGW Environmental officer and aims to identify, assess and manage potential environmental issues arising from the proposed works.

5.3.3. Aboriginal and cultural heritage

SGW commissioned a desktop assessment[39] to identify potential impacts on Aboriginal and historic sites located along the proposed pipeline routes from Lance Creek Reservoir to Korumburra, Poowong and Leongatha.

39 Stone, T., 2010 *South Gippsland Water Pipeline Alignment – Powlett River – Lance Creek – Korumburra – Poowong- Leongatha – Cultural Heritage Desktop Assessment*, May

Under the *Aboriginal Heritage Act 2006* and the *Heritage Act 1995*, all developers are obliged to ensure that all steps have been taken to ensure that Aboriginal and historic site are not disturbed.

Aboriginal heritage

The *Aboriginal Heritage Act 2006* and the accompanying *Aboriginal Heritage Regulations 2007* require a cultural heritage management plan (CHMP) for a proposed activity, if:

> (a) all or part of the activity area for the activity is an area of cultural heritage sensitivity; and
>
> (b) all or part of the activity is a high impact activity.

An area of cultural heritage sensitivity includes any land within 200 metres of a waterway and land within 50 metres of a registered cultural heritage place. However, if an area of cultural heritage sensitivity has been subject to significant ground disturbance, the disturbed part is no longer an area of cultural heritage sensitivity.

Construction of the pipelines could trigger a CHMP because it is a high impact activity impacting on six areas of cultural heritage sensitivity. However if the pipeline can be build on land subject to significant ground disturbance within these areas (e.g. road side verges, existing pipeline easement), a CHMP might not be required.

The desktop assessment also identified two Aboriginal sites, both stone artefact scatter, within 2 km of the proposed pipeline, based on the Victorian Aboriginal Heritage Register kept by Aboriginal Affairs Victoria. The proposed water pipeline will have no impact on those sites.

SGW will commission an aboriginal heritage assessment. This assessment is undertaken externally by a qualified Archaeologist who inspects the site and also carries out a desktop study. The project plan includes provision for a cultural heritage due diligence assessment, e.g. field inspections, and the preparation of a CHMP. Construction works may require supervision from a representative of the Aboriginal tribe.

Cultural heritage

The *Heritage Act 1995* provides for the protection of all Victorian historic sites, places and objects older than 50 years. According to section 127(1) of the Act,

> *a person must not knowingly or negligently deface or damage or otherwise interfere with an archaeological relic or carry out an act likely to endanger an archaeological relic except in accordance with a consent issued under section 129.*

The Victorian Heritage Register and Heritage Inventory do not list any historic sites that are located along the proposed route of the pipeline. However, local planning schemes of Bass Coast Shire and South Gippsland Shire have heritage overlays on seven sites, which have local historical significance, close to the pipeline route.

The project plan includes provision for field inspections and historic site surveys, if required.

5.4. Project delivery and procurement

Project implementation for the supply augmentation has been divided into two broad phases:

- development and construction phase; and
- operational phase.

In each phase, different entities have been allocated responsibilities to ensure that the project is managed by those with the most appropriate experience and expertise in that area. The roles and responsibilities are explained below.

5.4.1. Development and construction phase

The options for project delivery depend on the nature and scope of, and the timing for the project. Whilst the total project scope might be considered large by SGW standards, it will be delivered as smaller elements over a number of years. These elements or sub-projects are considered well within the capability of SGW. Potential methods of delivery include:

- Design and Tender;
- Design and Construct; or
- Alliance

It is anticipated that the project delivery for this project will comprise mainly design and tender, with some design and construct for specialised works. Because the works for this project can be spread over several years, the amount of work in any one year would be well within the capacity of SGW to deliver through standard project delivery methods. Accordingly, an alliance is considered inappropriate and is therefore not recommended.

Based on past experience, SGW proposes to design and tender for this project, in particular for components, such as pipelines, pump stations and WTPs, that required comprehensive specifications of requirements. From SGW's perspective, the design and tender approach provides a better opportunity to control the outcome of the project and to involve local contractors and suppliers in the works. However, the design and construct approach might be used for components such as water tanks.

The first project to be implemented will be the transfer pipelines from Lance Creek to Korumburra, and Korumburra to Poowong. The transfer section between the Melbourne System and Lance Creek is already in place. As noted, it is currently used to transfer potable water from the Lance Creek WTP to the Wonthaggi Desalination Plant for construction and commissioning.

SGW will separately employ engineering consultants for the design of the transfer sections, preparation of tender documents for procurement of pipeline materials, construction of the pipelines, and construction of the pump stations.

SGW will arrange procurement of pipes and fittings and tender the construction works for the pipelines and pump stations. This process has proven to provide more competitive pricing for pipe work and fittings, allows for staging of the delivery components and provides opportunity for local pipe laying contractors to competitively tender for the works.

5.4.2. Operations phase

The newly constructed supply infrastructure will be passed into SGW's regular operations of its supply system after construction and commissioning.

5.5. Stakeholder management and consultation process

A major component of the development of the WSDS and this Business Case has been, and will continue to be, stakeholder consultation. Up to this stage of the development of the WSDS and the Business Case, SGW has identified and consulted with relevant stakeholders, including government departments, local government, the community and major customers.

SGW has commissioned a communications strategy[40] to support the public release of its WSDS. The strategy aims at:

- providing residents and stakeholders with balanced and objective information to assist their understanding of the need for and appropriateness of the WSDS and the Business Case;
- gaining community and stakeholder views on the WSDS and the Business Case;
- monitoring community mood during the roll-out of the strategy; and
- identifying any issues early and preparing appropriate responses.

5.5.1. Identification of stakeholders

The communication strategy includes a consultation program and a comprehensive list of customers and stakeholders. Key stakeholders include:

- Government agencies: Department of Sustainability and Environment, Department of Health, Regional Development Victoria and Environment Protection Agency;
- Local Governments: South Gippsland Shire, Bass Coast Shire and respective Councillors;
- Water related organisations: West Gippsland Catchment Management Authority, VicWater Industry, Victorian Desalination Project Water Agency Group, Desalination Communications Team, Westernport Water and Southern Rural Water; and
- Town Development and Community Groups: Korumburra Community Development and Action Group, Leongatha Progress Associations, Nyora Development Group, Loch Development Group, Inverloch Residents and Ratepayers Association, Wonthaggi Business Association, Koonwarra Sustainable Communities Centre, Rotary and Lions;
- Major Customers: Burra Foods, Murray Goulburn, Gippsland Beef Producers, Tabro Meats, Gippsland Sprout Co, Esso, Korumburra & Leongatha Hospitals, Bass Coast Regional Health, and South Gippsland Splash Aquatic Centre;
- Environmental Groups: South Gippsland Conservation Society, Bass Coast Renewable Energy group, Bass Coast Landcare, South Gippsland Landcare and Watershed Victoria Community Group.

5.5.2. Consultative process

Stakeholder engagement for the Business Case commenced with briefings of the Department of Sustainability and Environment (DSE) in 2008, after the Victorian Government announced plans for the development and construction of a desalination plant located near Wonthaggi.

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40 Royce, 2010, South Gippsland Water Communications Strategy, August

Stakeholder and customer input will be ensured through the public launch of the WSDS, stakeholder submissions and other feedback to the WSDS and the Business Case, ongoing meetings and consultation with government agencies, major customers, community groups, and other stakeholders, and website updates and regular newsletters.

Stakeholder feedback from government agencies and Councils to date has been positive.

6. Funding options and customer impacts

This section considers two funding options for the first stage of the project, i.e. connecting the Korumburra and Poowong, Loch, Nyora systems to the Melbourne System via the Lance Creek CWS. Both the impacts on SGW's customers as well as financial impacts on the business itself resulting from the two funding options were assessed.

6.1. Funding options assessed

Precedents exist where State Government grants have been provided to facilitate investment in securing water supplies and mitigate the customer impacts of such investment (for example, grants provided to Central Highlands Water and Coliban Water for the Goldfields Superpipe). For this Business Case, two funding options were assessed using SGW's financial model:

- **'with grant'** – State Government funding is granted for the first stage of the project, i.e. connecting Korumburra and Poowong, Loch, Nyora with the Lance Creek CWS and as such the Melbourne System in 2011; and
- **'without grant'** – all stages of the project are fully funded by SGW.

The assessment of funding options utilised both a building block approach and SGW's existing financial model and assumes ViF demand.

A building block approach, consistent with the Water Plan framework, was used to determine and compare customer impacts of both the Melbourne System Supply and Surface Supply option. This assessment directly builds on the economic evaluation and draws on the same assumptions and capital and operating costs as the economic model.

SGW's existing financial model was then utilised to analyse customer and financial impacts of the Melbourne System Supply option from a whole-of-business perspective, considering potential interrelations with other parts of SGW's capital works program. That is, a balance sheet and profit and loss approach was used to estimate the impacts over the coming ten financial years, 2010/11 to 2019/20. All capital and operating costs for the Melbourne System Supply option scheduled to occur over this time period were extracted from the economic model and incorporated into the financial model. Any avoided costs, i.e. savings in operating costs due to decommissioning of dams or WTPs, have been taken into account, i.e. subtracted from operating costs.

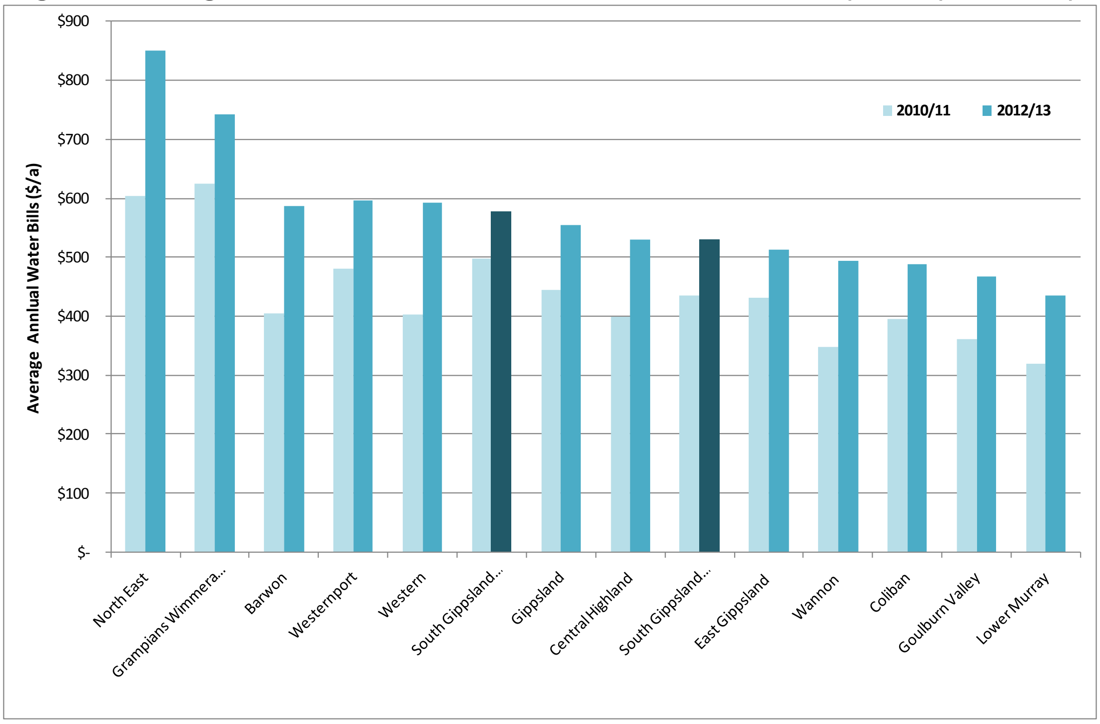
The financial model was then adjusted to assure that the business remains financially stable. That is, tariffs were manipulated to ensure that liquidity and solvency of the business is maintained over the ten years.

6.2. Customer impacts and affordability

6.2.1. Customer Impacts

SGW was able to limit increases of average customer bills over the current regulatory period. Average customer bills for residents in the southern area increased least, compared with average water bills of other Victorian water businesses (Figure 18). By the end of this regulatory period, in June 2013, SGW's average water bill for the southern area will be in sixth place relative to customer bills of other water businesses, down from second place in 2008/09. Future augmentations to enable a secure and reliable future water supply by connecting to the Melbourne System, will put upward pressure on SGW's water tariffs and average customer bills in future regulatory periods.

Figure 18: Average Annual Customer Bills of Victorian Water Businesses (in 2010/11 dollars)

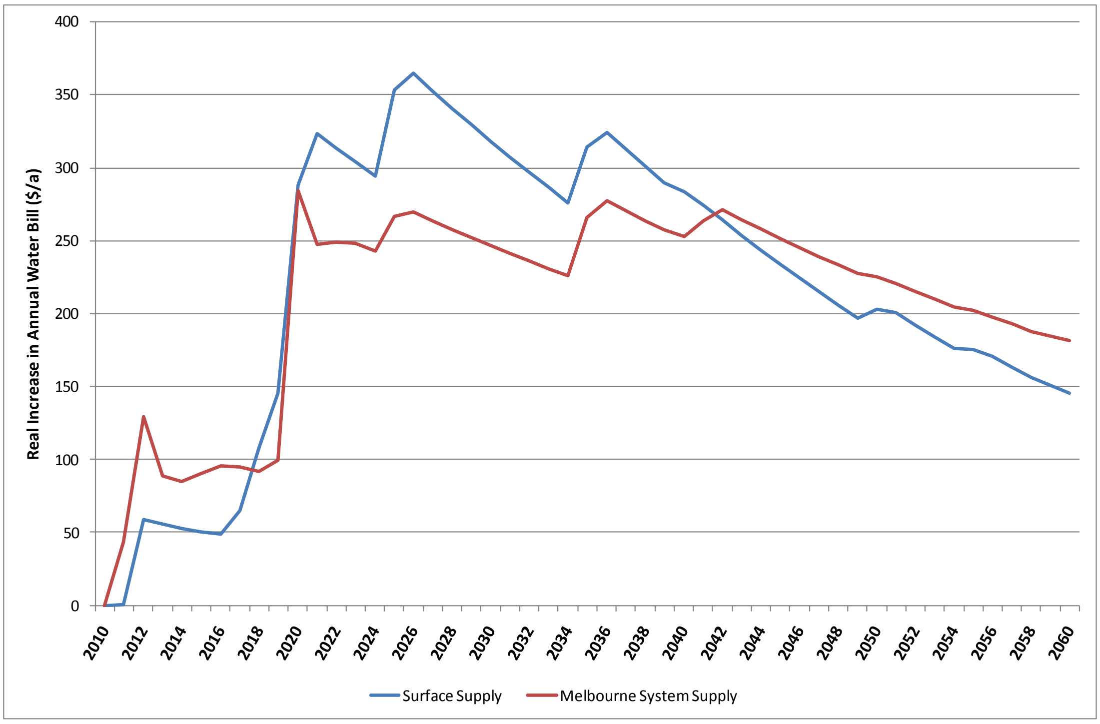


Source: ESC price determinations

The analysis of customer impact, using the building block approach, assumed uniform water service charges across the South Gippsland region consistent with SGW's pricing policy. As such, total customer numbers were used to determine the direct impact on average customer bills arising from the two supply augmentation options.

Figure 19 shows the incremental impacts of supply augmentations on average customer bills without a State Government subsidy for the Melbourne System connection and without smoothing of water tariff increases. That is, it shows the impacts on average customer bills, if tariffs were adjusted to recover operating costs, and return on and of assets occurring in each given year.

Figure 19: Customer Impacts of Melbourne System and Surface Supply (building block approach, uniform pricing, in 2010/11 dollars)



Source: MJA analysis

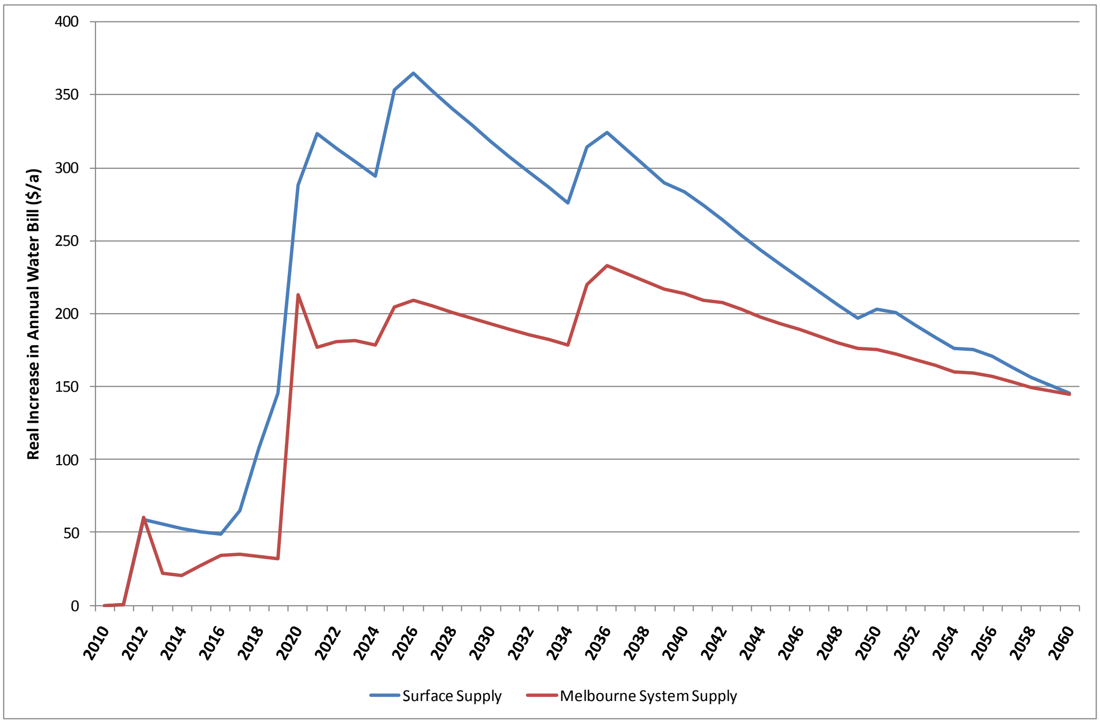
The Melbourne System Supply option results in significantly higher customer impacts over the first ten years. This is mostly due to the capital investments of $18.9 million (in 2010/11 dollars) for the connections of Korumburra and Poowong, Loch, Nyora to the Lance Creek CWS and the Melbourne System in 2011/12. The substantial increase in impacts in 2020 is due to the connection of Leongatha to the Melbourne System via Korumburra.

Under the Surface Supply option, storage upgrades and increases take place in the first ten years and major capital investments occur in 2020 and 2025, as the Tarwin River Connection is upgraded, an additional 1,000 ML storage constructed and WTPs undergo substantial upgrades.

As noted, the Melbourne System Supply option is the preferred option. It provides a substantially higher level of supply security compared to the Surface Supply option, in particular with regard to potential impacts from climate change/variability and uncertainties in future population and industrial growth.

A State Government subsidy for the first stage of the project – the connection of Korumburra and Poowong, Loch, Nyora to the Melbourne System via the Lance Creek CWS – would partially mitigate the customer impacts arising from the Melbourne System Supply option and underwrite the future development of the region. Resulting real increases in average customer bills would be lower than under the surface option (Figure 20). The maximum increase in real terms in customer bills in 2020 is lessened by approximately $70 per customer from $285 to $215.

Figure 20: Customer Impacts of Melbourne System Supply with State Government grant and Surface Supply (building block approach, uniform pricing, in 2010/11 dollars)



Source: MJA analysis

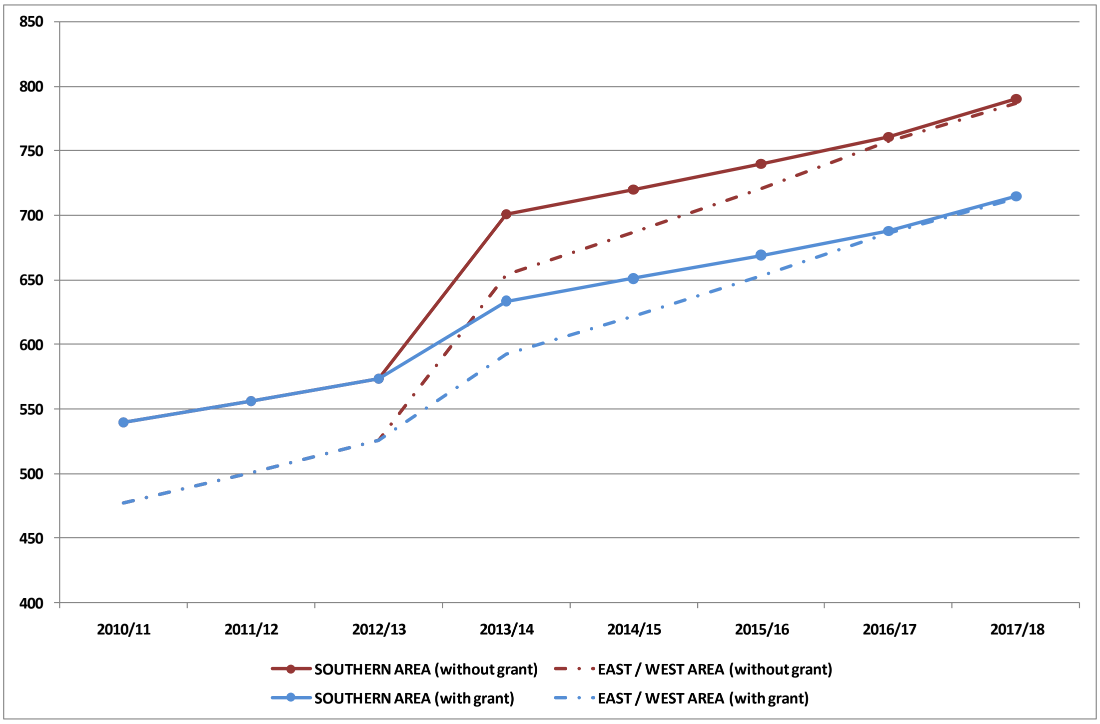
Taking a balance sheet, and profit and loss approach, SGW's existing financial model was utilised to analyse customer from a whole-of-business perspective over the next ten years. This allows for potential interrelations with other parts of SGW's planned capital works program and also takes account of existing arrangements, such as SGW's current Water Plan.

The proposed connection to the Melbourne System will not impact on the water pricing tariffs already contained within SGW's current Water Plan, covering the five year period from July 2008 to June 2013, as these have previously been assessed and approved by the Essential Services Commission (ESC).

As noted in the current Water Plan, SGW is in the process of moving towards a uniform water service charge across the region. It currently has two separate water service charges: one for the southern area, including Wonthaggi and surrounds, and one for the east-west area, which comprises the Northern Systems, i.e. Korumburra, Leongatha, Poowong, Loch and Nyora as well as the eastern towns, which do not form part of this Business Case. This move towards uniform pricing has been considered in the following assessment. Tariffs for both areas are brought in line over the ten year period.

Figure 21 below shows the impacts of connecting to the Melbourne System on average customer bills for the southern and east/west areas both with and without a State Government subsidy for the first stage of the project. The two red lines show the estimated change in average customer bills for both areas without State Government funding, whereas the blue lines depict the change in average customers bills with State Government funding.

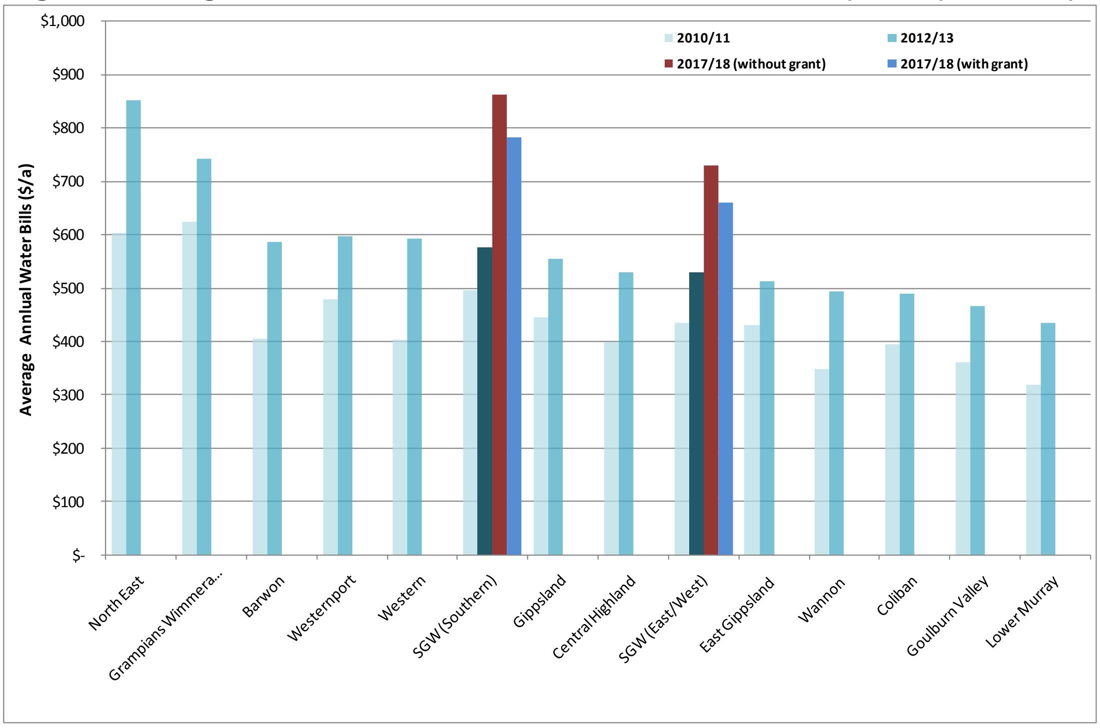
Figure 21: Average Customer Bill for southern and east/west areas – Impacts with and without State Government funding (balance sheet approach, in 2010/11 dollars)



Source: SGW financial analysis

In 2013/14, a substantial increase in tariffs (about 25 percent rise in real terms in average customer bills) would be required to recover the capital expenditure and service associated loans for connecting Korumburra and Poowong, Loch and Nyora to the Melbourne System and securing the system's supply reliability. This increase would be mitigated substantially (reduced to a rise in average customer bills of about 15 percent in real terms), if the capital costs for the first stage of the project, $18.9 million (in 2010/11 dollars), were funded through a State Government grant. By 2017/18 the difference in average customer bills would be approximately $75 per year.

Figure 22: Average Annual Customer Bills of Victorian Water Businesses (in 2010/11 dollars)



Note: ***assumes customer bills of all other water corporations stay constant in real terms***

6.2.2. Affordability

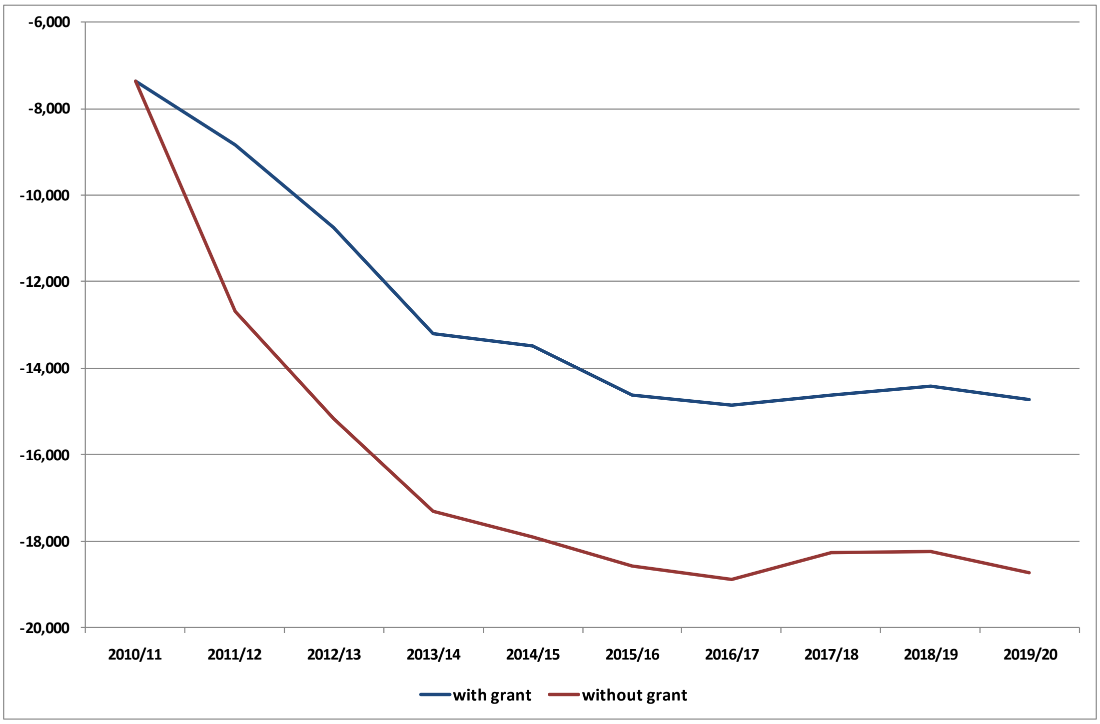
As noted earlier, using the balance sheet approach the water tariffs were manipulated from 2013/14 onwards to increase revenue from volume and service charges and maintain a financially stable position of the business, ensuring that SGW is capable to deliver its services going forward. Cash holdings were maintained at around $1 million to $1.5 million per year.

If additional capital expenditure for the first stage of the project ($18.9 million) is to be funded by SGW, an increase in loans would be required to finance the costs of construction in 2011/12.

Figure 23 to Figure 25 show the changes in three financial indicators from 2010/11 to 2019/20 for both funding options, i.e. with and without State Government grant.

As expected, *working ca*pital decreases significantly without State Government funding, as current liabilities increase to raise additional funds for the capital investment for the connection to the Melbourne System, resulting in a less secure financial position.

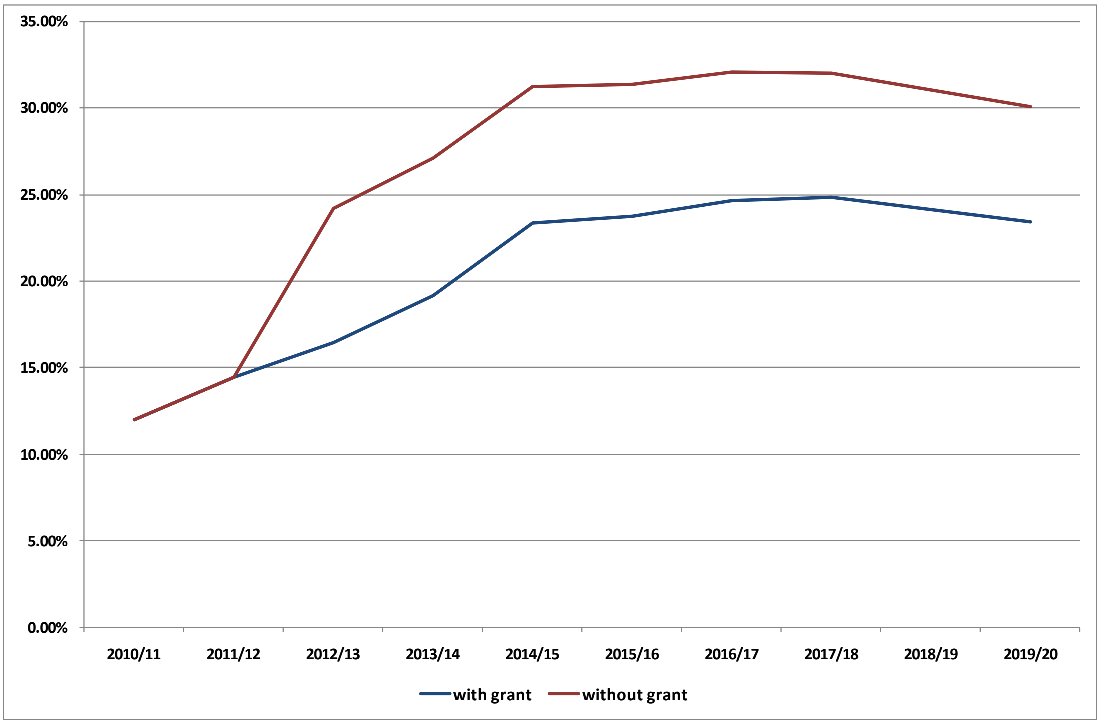
Figure 23: Net Working Capital



Source: SGW financial analysis

Similarly, the *long-term financial viability indicator*, i.e. net borrowings over total assets, increases (unfavourably) more strongly, if no government funding is secured, due to higher net borrowings.

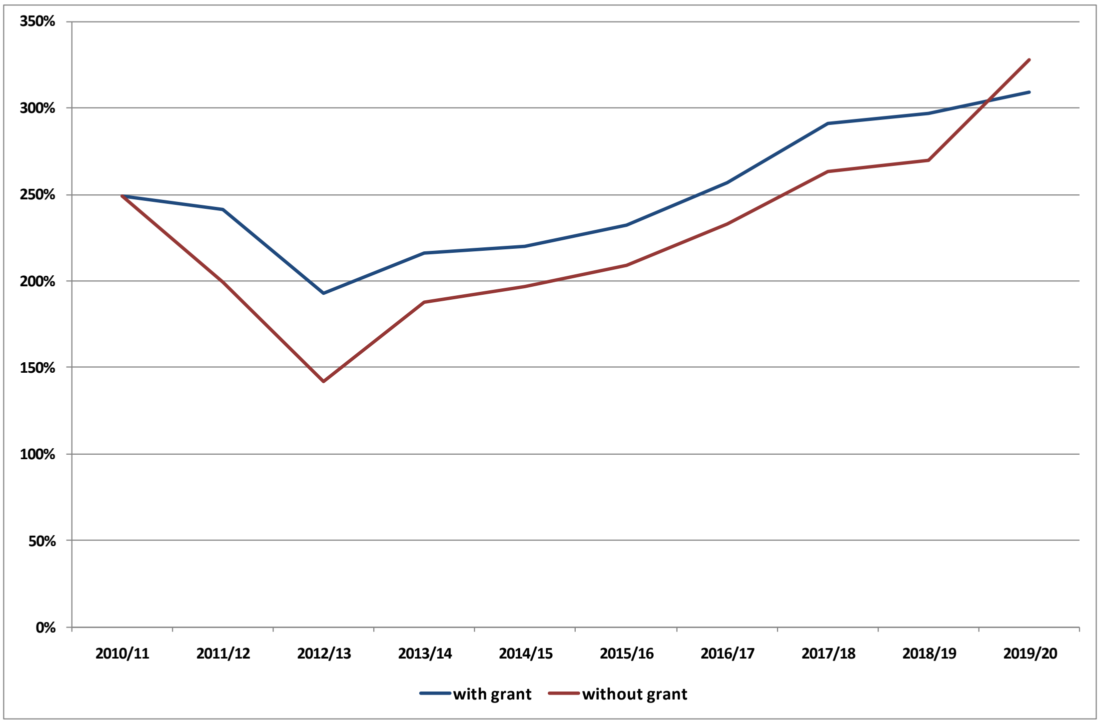
Figure 24: Long-term Financial Viability Indicator (net borrowings / total assets)



Source: SGW financial analysis

Without State Government funding, the *immediate liquidity and debt servicing indicators* decline more severely in 2011/12 and 2012/13, as revenue from volume and service charges cannot be raised to service additional debt, as tariff prices are fixed for the current water plan period.

Figure 25: Immediate Liquidity and Debt Servicing Indicator



Source: SGW financial analysis

All financial indicators depicted above show a healthier financial position going forward, if State Government funding for the first connection of northern towns, i.e. Korumburra, Poowong, Loch and Nyora to the Melbourne System is provided. It also ensures that financial indicators for SGW are in line with the ESC and Department of Treasury and Finance (DTF) benchmarks.

6.3. Preferred funding option

The preferred funding option for the connection to the Melbourne System is State Government funding of the capital costs for connecting Korumburra and Poowong, Loch, Nyora with the Lance Creek CWS to enable Melbourne System supply to these Northern towns. The capital costs of this connection amount to $18.9 million (in 2010/11 dollars) and the connections are scheduled for construction over 2011 to 2012.

Obtaining government funding for this first stage of the project would not only substantially lessen impacts on customers – average customer bills would be approximately $75 per annum (10 percent) lower in real terms, but also support the financial stability of SGW and securing its ability to provide reliable service and underwrite the future economic growth of the region.

7. Risk assessment

A comprehensive risk assessment process has been undertaken for this Business Case, as required by the Department of Treasury and Finance *Investment Lifecycle Guidelines – Business Case*.

Two risk workshops were convened by Connell Wagner (now Aurecon) for the purpose of determining appropriate risk ratings. The workshops identified and assessed risks associated with the supply of water from the Melbourne System as well as augmentation of the current surface and groundwater water systems. Attendees at the workshops held in Foster in May and June 2008 included the SGW project managers and senior management.

The results of the risk assessment were reviewed in January 2011 as new information became available.

Based on the findings of the workshops and the 2011 review, it can be concluded that there are no unmanageable risks associated with the project. All key risks can be addressed through implementation of proposed mitigation strategies.

7.1. Risk identification, analysis and evaluation

The risk assessments were based on the methodology consistent with the Australian and New Zealand Standard for Risk Management AS/NZS 4360:2004 and ISO 31000:2009.

This method entails

- identifying the risks (What could happen? How could it happen?);
- analysing the risk, including a review of controls, and assessment of the likelihood and consequences of a particular risk with a score from 1 to 5, where a likelihood of 1 is rare and 5 is almost certain, and a consequence of 1 is insignificant and 5 is catastrophic;
- evaluating the risks and ranking in them in terms of their severity using a risk evaluation table (Figure 26), based on SGW's consideration of overall business risks in its Draft SGW Risk Profile Report.

Figure 26: Risk Evaluation Table

Likelihood	Consequences				
	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Almost certain (5)	High	Extreme	Extreme	Extreme	Extreme
Likely (4)	High	High	Extreme	Extreme	Extreme
Possible (3)	Medium	Medium	High	High	Extreme
Unlikely (2)	Low	Low	Medium	High	Extreme
Rare (1)	Low	Low	Low	Medium	High

Source: Connell Wagner (now Aurecon), 2008, Future Desalinated and Surface Water Supply Risk Assessments and WTP Upgrades Study, South Gippsland Water, August

7.2. Risk mitigation strategies

Risk identification and evaluation was followed by the development of mitigation plans and assessment of post-mitigation risk. Both risks and risk management strategies have been documented in a risk report.[41]

The risks identified in the two workshops were recorded in risk registers, including a description of the risk, the evaluation of likelihood and consequence, the resulting risk rating and possible mitigation measures and the manager thereof. The risk register is a dynamic document that will continue to be updated and applied throughout project implementation.

As such, a review of the risk assessments was undertaken in January 2011. Risk ratings of some risks were adjusted, as new information became available. Risk management strategies have been updated, if required.

Risks are presented in sub-categories under each of the major categories which comprise: commercials, project planning and financial, construction, community and other stakeholders, operation and supply, drinking water quality (incl. maintenance and testing), surface water quantity, groundwater quantity, and recycled water.

Table 30 provides an overview over the high priority risks, i.e. risk rated 'Extreme', and possible risk management strategies to address these risks to the Melbourne System Supply option.

Table 30: High priority risks identified in desalination risk workshop

#	*Category*	*Risk*	*Risk Management Strategy*
1.	Drinking Water Quality	If backflow from Cardinia Reservoir is required the water quality may be different to desalinated supply Risk rating was reduced to ***High***	Monitoring of water quality Disinfection at Lance Creek WTP of reverse back flow water
2.	Drinking Water Quality	Biofilm dislodgement from reversing of flow Risk rating was reduced to ***Medium***	Low organics in desalination water
3.	Operation and Supply	Interruption of supply (for longer than 1 day) Risk rating was reduced to ***High***	Lance Creek System sized to supply average daily demand CWSs for each connected system supplied sized to provide one peak day demand
4.	Operation and Supply	Desalination plant decommissioned within 50 year horizon due to sufficient rainwater and 100% dam capacities Risk rating was reduced to ***High***	Supply from Melbourne System with surface water from Cardinia Reservoir Lance Creek System sized to supply connected systems with average daily demand

[41] Connell Wagner (now Aurecon), 2008, *Future desalinated and Surface Water Supply Risk Assessments and Water Treatment Plant Upgrades Study, South Gippsland Water*, August

#	*Category*	*Risk*	*Risk Management Strategy*
5.	Project Planning and Financial	Operational and maintenance costs of operating systems with desalinated water may exceed current operational costs	Financial analysis (this Business Case) and financial planning
6.	Project Planning and Financial	Cost of purchasing desalinated water is excessive to customer	Lobbying / application for subsidies
7.	Project Planning and Financial	ESC may not accept large cost increase to customer	Lobbying / application for subsidies
8.	Project Planning and Financial	Competition for staff and resources with desalination plant	Provide adequate training to existing staff, advertise lifestyle and career opportunities to attract additional staff
9.	Construction	Lack of available resources for construction Risk rating was reduced to ***High***	Adequate project planning, staging of construction Given current status of industry construction works, adequate resources are available
10.	Commercials	Out of spec water supplied Risk rating was reduced to ***High***	Protocols and agreements are robust, preventing supply of out of spec water
11.	Commercials	Take or pay agreement may be applied to SGW	Bulk Entitlement water volumes secured Melbourne 'pool' price for water was made available to SGW, fixed and variable supply costs are known
12.	Community	Potential for increased cost of water resulting in community opposition	Community education and consultation program, Lobbying / application for subsidies
13.	Community	Poor public perception of desalinated water in the region resulting in community opposition	Community education and consultation program, with guidance from DSE
14.	Community	Changeover to fluoridated water supply resulting in community opposition	Community education and consultation program
15.	Community	Customers wary of changes in taste/odour	Community education and consultation program

Source: Connell Wagner (now Aurecon), 2008; SGW, 2011

Table 31 provides an overview over the high priority risks, i.e. risk rated 'Extreme', and possible risk management strategies to address these risks to the Surface Supply option.

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Table 31: High priority risks identified in surface and groundwater risk workshop

#	*Category*	*Risk*	*Risk Management Strategy*
1.	Surface Water Quantity	Climate change leading to reduction/loss in supply (> 15% CSIRO yield reduction from 100 year record	Increasing dam capacity, interconnection of supply systems, supply from Tarwin and Powlett River
2.	Surface Water Quantity	Extreme weather events leading to decrease in raw water quality	Robust water treatment and reservoir management
3.	Surface Water Quantity	Regulatory changes to existing Bes (including environmental release enforcement) – *esp. Ruby Creek*	Negotiations with DSE, collaboration with CMA re environmental management of assets
4.	Surface Water Quantity	No access to new Bes after completion of Wonthaggi desalination plant – *esp. Lance Creek*	Negotiations with DSE, collaboration with CMA re environmental management of assets
5.	Surface Water Quantity	Insufficient storage for raw water to ensure future supply – *esp. Lance Creek, Little Bass and Coalition Creek*	Increasing storage capacity, investigating alternative supplies
6.	Groundwater Quantity	Lack of access to Kooweerup aquifer	Investigating alternative supplies
7.	Groundwater Quantity	Unsustainability of Leongatha groundwater source (from either extraction or lack of rainfall	Investigating alternative supplies
8.	Drinking Water Quality	Existing treatment processes unable to ensure compliance with more stringent drinking water standards for existing parameters over 50 year time period	Improvements of treatment train, upgrades of WTPs
9.	Drinking Water Quality	Existing treatment processes unable to ensure compliance with drinking water standards for quality parameters that are not currently regulated	Improvements of treatment train, upgrades of WTPs
10.	Drinking Water Quality	Blue green algae blooms – *esp. Lance Creek*	Active monitoring, advanced treatment, trigger level copper sulphate dosing
11.	Drinking Water Quality	Failing water quality audit / non-compliance to Safe Drinking Water Act – *esp. Lance Creek, Coalition Creek*	Improvements of treatment train, upgrades of WTPs

#	*Category*	*Risk*	*Risk Management Strategy*
12.	Drinking Water Quality	Level of THMs do not comply with Safe Drinking Water Regulations – *esp. Lance Creek*	Improvements of treatment train (chloraminated disinfection), upgrades of WTP; Lance Creek upgraded to chloraminated disinfection, which reduces THM risk but does not eliminated future regulation of DBPs such as Cyanogens chloride and NMDA
13.	Operation and Supply	Insufficient storage facilities for treated water to ensure future supply	Increase CWS capacity
14.	Operation and Supply	Insufficient water available to connect unserviced towns to existing system – *Lance Creek*	Investigating alternative supplies
15.	Maintenance and Testing	Increase in testing costs to SGW due to regulatory changes (water quality)	Engage with water quality testing agencies
16.	Construction	Land acquisition and planning requirements for work in private property, and access to private property, resulting in delays and cost overruns – *esp. Little Bass*	Community consultation, compulsory acquisitions
17.	Community	Negative public reaction due to imposed drinking water restrictions	Community education and communication program, ensuring compliance with level of service requirements
18.	Community	Community response to flushing and air scouring, perceived waste of water Risk rating was reduced to ***High***	Community education and consultation program
19.	Community	Environmental issues regarding removal of native vegetation resulting in community opposition – esp. Little Bass, Ruby Creek	Planning, development of strategy for dam expansion,
20.	Community	Negative community response to increased storage capacity – *Ruby Creek, Coalition Creek systems*	Community education and consultation program

Source: Connell Wagner (now Aurecon), 2008; SGW, 2011

Risks associated with the supply of water from Melbourne System are largely concerned with negative community reaction to the project, and contract and cost uncertainties with regard to the Melbourne System bulk supply. Interruption or loss of supply from the Melbourne System is also a key concern. However, in case of a disruption of the desalination plant, Melbourne System water can be supplied from the Cardinia Reservoir to the Lance Creek Reservoir. These risks have subsequently been addressed through risk management /

mitigation strategies, such as a detailed communications strategy, a 5GL bulk entitlement for Melbourne System supply and the sizing of the Lance Creek WTP.

By contrast, key issues identified in the surface and groundwater risk assessment are by large concerned with water quality issues and reliability of supply. Mitigation measures for these risks were proposed and are included in the risk register.

At this point in time there are no major unmanageable financial and economic risks remaining for either option, after mitigation strategies have been applied.

8. Project implementation

This section sets out the proposed arrangements for the successful delivery of the Melbourne System Connection and related supply augmentation works.

8.1. Implementation timetable

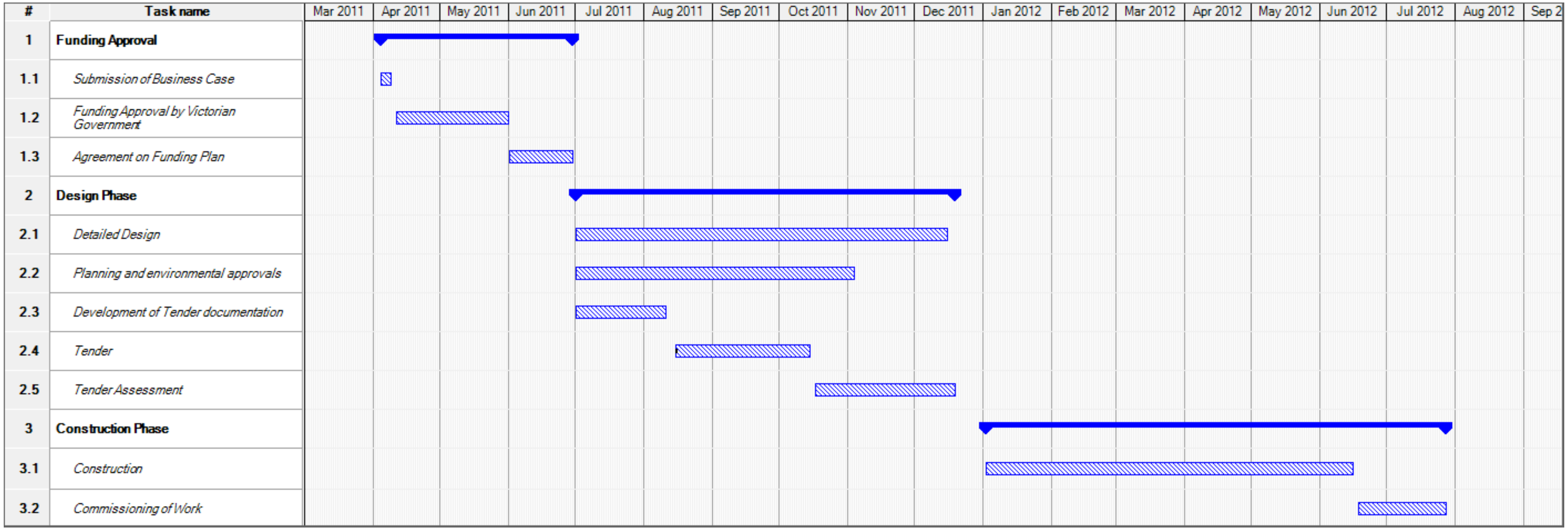
Figure 27 illustrates the main project activities and their related timing for the delivery of Stage 1 of the Melbourne System Connection to Korumburra and Poowong via Lance Creek.

8.2. Project governance

The initiation of the each stage of the project will depend on the sign off by the SGW Board. Governance arrangements for the implementation of the project build on the expertise and capabilities of SGW's in-house project delivery team, which regularly manages the implementation of projects of similar size and nature.

The coordination of the planning, environmental planning and cultural heritage arrangements and permitting will be managed by SGW's project delivery team (as discussed in section 5.3).

Figure 27: Implementation program and timetable



9. Conclusions and recommendations

The Melbourne System Supply is the preferred option, having lower whole of life costs of $108.2 million (in 2010/11 dollars), assuming ViF demand. The option provides a substantially higher level of supply security compared with the Surface Supply option, avoids the risk of investing in redundant assets, provides the necessary security for future economic growth and prosperity, allows for use of additional flows by the agricultural sector and for higher environmental flows. The Melbourne System Supply option therefore provides security and a basis for the economic prosperity of the region.

The analysis of two funding options, i.e. with State Government subsidy and without subsidy, shows that impacts on average customer bills could be significantly mitigated with a grant from State Government for the first stage of the project. That is, the connection of Korumburra and Poowong, Loch, Nyora to the Melbourne System via the Lance Creek CWS.

Without Government funding water prices are set to rise significantly with the start of the Water Plan 2013 - 2018 to recover the investment of $18.9 million for the capital works. As shown in Figure 21, this would lead to an estimated 25 percent increase in average customer bills in 2013/14, which could be significantly lessened through a State Government grant.

Additionally, funding through the State Government would ensure that SGW remains financially viable. That is, within the boundaries of financial indicators as recommended by the ESC and hence capable of delivering water supply services to the region into the future.

The SGW board therefore recommends that the State Government provides funding of $18.9 million (in 2010/11 dollars) to SGW to support the future reliable water supply, and economic growth and prosperity of the region.