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<td>Steve McKenzie</td>
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Author:

John Xu/Alan Tyson
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EXECUTIVE SUMMARY

Goulburn Valley Water Background

Goulburn Valley Water (GVW) supplies water to 54 towns utilising 13 water supply systems as shown in Table 1.

Table 1: Goulburn Valley Water Supply Systems

<table>
<thead>
<tr>
<th>Towns Supplied</th>
<th>Source of Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woods Point</td>
<td>Brewery Creek and Goulburn River</td>
</tr>
<tr>
<td>Mansfield</td>
<td>Delatite River</td>
</tr>
<tr>
<td>Merrijig and Sawmill Settlement</td>
<td>Delatite River</td>
</tr>
<tr>
<td>Alexandra, Avenel, Bonnie Doon, Congupna, Corop, Colbinabbin, Dookie, Eldon, Girgarre, Goulburn Weir, Katandra West, Kirwan’s Bridge, Kyabram, Merrigum, Molesworth, Mooroopna, Murchison, Nagambie, Rushworth, Seymour, Shepparton, Stanhope, Tallarook, Tallygaroopna, Tatura, Thornton, Tongala, Toolamba</td>
<td>Goulburn River</td>
</tr>
<tr>
<td>Katunga</td>
<td>Groundwater</td>
</tr>
<tr>
<td>Pyalong</td>
<td>Mollisons Creek</td>
</tr>
<tr>
<td>Barmah, Cobram, Katamatite, Nathalia, Numurkah, Picola, Strathmerton, Wunghnu, Yarroweyah</td>
<td>Murray System</td>
</tr>
<tr>
<td>Longwood</td>
<td>Nine Mile Creek</td>
</tr>
<tr>
<td>Euroa and Violet Town</td>
<td>Seven Creeks, Mt Hut Creek</td>
</tr>
<tr>
<td>Strathbogie</td>
<td>Seven Creeks</td>
</tr>
<tr>
<td>Marysville and Buxton</td>
<td>Steavenson River</td>
</tr>
<tr>
<td>Broadford, Clonbinane, Heathcote Junction, Kilmore, Wandong, Waterford Park</td>
<td>Sunday Creek and Goulburn River</td>
</tr>
<tr>
<td>Yea</td>
<td>Yea River</td>
</tr>
</tbody>
</table>

Purpose of the Urban Water Strategy

The State Government’s *Water for Victoria* outlines the water management opportunities and challenges facing Victoria over the coming decades. This includes recognition that water availability and use plays a key role in the future resilience and liveability of our cities and towns.

Victoria’s planning framework requires that Urban Water Strategies (UWS) be developed by those water corporations providing urban services with a primary aim to identify the best mix of measures to maintain a balance between the demand for water and the available supply now and into the future. The balance between supply and demand is to be achieved taking into consideration:
• A long-term outlook of 50 years;
• The total water cycle, consistent with the principles of integrated water management;
• Social, environmental and economic costs and benefits; and
• Risks and uncertainty, such as population growth.

GVW previously completed a UWS in 2012 (previously named as Water Supply Demand Strategy) titled 'GVW 2060 A Sustainable Urban Water Future'.

The UWS is to be prepared by 31 March 2017, and within each five yearly period thereafter, in accordance with Clause 6-1 and 6-2 of the Statement of Obligations (DELWP, 2016).

This document represents the five-yearly update of the UWS for GVW.

**Strategy Development Process**

The scope for the development of the UWS was based on the Guidelines for the Development of Urban Water Strategies and the Melbourne Water System Strategy (DELWP, 2016) produced by the Department of Environment, Land Water and Planning.

The strategy development process has involved the following actions:

• Community Engagement;
• Establishing levels of service;
• Forecasting water demand;
• Forecasting climate-dependent supply;
• Assessing system performance;
• Managing risk and uncertainty;
• Identifying and evaluating options;
• Implementing the strategy;
• Developing Drought Preparedness Plans;
• Developing Annual Water Outlooks;
• Developing an Alternative Water Atlas;

**Community Engagement**

A Customer & Community Engagement Plan was developed for Urban Water Strategy. A copy of the plan is located in Appendix 1.

The key focus areas that help inform the UWS include Service Levels, Water Efficiency, Water Resources and Community Water.
It should be noted that Indigenous values form an important part of GVW’s community and stakeholder engagement activities. Traditional Owners have been engaged and participated in a number of engagement activities during the development of the Urban Water Strategy and Price Submission 4. This is further detailed in Section 4.

**Levels of Service**

GVW’s current level of service objectives for maintaining an adequate supply to customers are specified as follows:

- Moderate water restrictions (Stages 1 and 2) are not desired more frequently on average than 1 year in 10; and

- More severe water restrictions (Stages 3 and 4) are not desired more frequently on average than 1 year in 20.

The level of service objectives are applied equally across all GVW supply systems.

The following outcomes were adopted based on discussions in relation to levels of service:

- The existing level of service targets will be retained for the development of the UWS;

- Stage 4 water restrictions will be assessed as the minimum service standard;

- The impact of providing unrestricted supply to critical public assets will be assessed.

**Demand Forecast**

A baseline demand forecast was developed for the UWS to cover the period from 2016 – 2065.

Water demand was categorised into the following components:

- Residential customer demand;

- Commercial and minor industrial customer demand;

- Major customer demand;

- Distribution system non-revenue water; and

- Headworks non-revenue water.

A building block approach was adopted to aggregate forecasts for each demand category in predicting future total demand for each system.

The baseline demand forecast is summarised in Table 2 by the different components of demand.
Table 2: Baseline Demand Forecast

<table>
<thead>
<tr>
<th>Demand Component</th>
<th>2016 Demand (ML)</th>
<th>2065 Demand (ML)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Demand</td>
<td>13,328</td>
<td>26,109</td>
</tr>
<tr>
<td>Commercial Demand</td>
<td>4,305</td>
<td>6,007</td>
</tr>
<tr>
<td>Major Customer Demand</td>
<td>6,323</td>
<td>6,323</td>
</tr>
<tr>
<td>Distribution System Non-Revenue Water</td>
<td>2,694</td>
<td>4,327</td>
</tr>
<tr>
<td>Headworks Non-Revenue Water</td>
<td>3,205</td>
<td>3,642</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>29,855</strong></td>
<td><strong>46,408</strong></td>
</tr>
</tbody>
</table>

Demand and Supply Scenarios

A range of demand and supply scenarios were developed. The scenarios were used to produce demand and supply envelopes for each system. Examples of the scenarios considered for development of the demand and supply envelopes are shown in Figure 1 and 2.

Figure 1: Estimated Supply-Demand Balance for Goulburn System (Source: GHD, 2016b)

Demand and Supply Forecast Summary

A summary of the demand and supply (yield) forecasts based on water resource modelling for a range of scenarios is shown in Table 3.

A number of systems will require action to be undertaken in future to improve the supply-demand balance.
Table 3: Demand and Supply Forecast Summary (Source: GHD, 2016b)

<table>
<thead>
<tr>
<th>System</th>
<th>UWS Demand Forecast</th>
<th>UWS Yield Estimates</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2021</td>
</tr>
<tr>
<td>Goulburn-Regulated</td>
<td>21,367</td>
<td>22,070</td>
</tr>
<tr>
<td>Murray Regulated</td>
<td>4,948</td>
<td>5,010</td>
</tr>
<tr>
<td>Sunday Creek (Broadford/Kilmore) System</td>
<td>1,571</td>
<td>1,757</td>
</tr>
<tr>
<td>Nine Mile Creek (Longwood) System</td>
<td>55</td>
<td>57</td>
</tr>
<tr>
<td>Mollison Creek (Pyalong) System</td>
<td>46</td>
<td>46</td>
</tr>
<tr>
<td>Brewery Creek (woods Pt) System</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Yea Reiver (Yea) System</td>
<td>225</td>
<td>236</td>
</tr>
<tr>
<td>Steavenson River (Marysville/Buxton) System</td>
<td>234</td>
<td>263</td>
</tr>
<tr>
<td>Seven Creeks (Strathbogie) System</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Seven Creeks (Euora) System</td>
<td>709</td>
<td>734</td>
</tr>
<tr>
<td>Delatite River (Mansfield) System</td>
<td>550</td>
<td>590</td>
</tr>
<tr>
<td>Delatite River (Merrijig) System</td>
<td>70</td>
<td>74</td>
</tr>
<tr>
<td>Katunga</td>
<td>51</td>
<td>51</td>
</tr>
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</table>
Recommendations

Recommendations have been developed to undertake actions to improve the supply-demand balance based on three separate timeframes (short term, medium term, long term).

The short term period covers the remainder of the Water Plan 3 period and the Pricing Submission 4 period.

The medium and long term recommendations have the flexibility to be brought forward or deferred depending on the demand and supply scenarios which eventuate in future.

The following recommendations are made as a result of the GVW Water Supply Demand Strategy 2016–2065:

**Short Term (2016-2023)**

- Non-revenue water losses should be verified for a number of systems and programs implemented to reduce losses if economically justified (benefits outweigh costs);
- Assess opportunities from the Alternative Water Atlas;
- Implement demand management initiatives if they are economically justified (benefits outweigh costs);
- Continue existing streamflow monitoring programs to reduce uncertainty in water resource modelling;
- Recognise the need to transfer entitlement from the Goulburn system to mitigate shortfalls in other towns in future planning;
- Assess opportunities for water recycling projects from future growth
- Adopt water cartage as an infrequent (expected 1 in 20 years for short durations) measure to supplement supply for the Upper Delatite Diver system if streamflows fall below diversion limits;
- Recognise the reduction in entitlement when substituting water to mitigate shortfalls in other towns (regulated Murray and Sunday Creek System) for the Regulated Goulburn System;
- Monitoring of groundwater levels and salinity to identify potential reduction to annual entitlement for the Katunga System;
- Temporary transfer of groundwater entitlement from Strathmerton to Katunga to protect against low allocation years;
- Adopt water cartage as a measure to supplement supply for the Mollisons Creek (Pyalong) system in dry years;
- Transfers from Goulburn system in low allocation years or if demand exceeds the BE allocation for the Regulated Murray system;

- Recycle Water Treatment Plant sludge supernatant water at Euroa;

- Construct a new 300ML off stream storage, interconnecting pipework and a permanent pump station on Seven Creeks for the Seven Creeks (Euroa and Violet Town) system;

- Reconstruct Abbinga Reservoir at Euroa and increase capacity to 700ML;

- Replace 3 km of Gooram pipeline (3 km x DN300) for the Seven Creeks (Euroa and Violet Town) system;

- Adopt water cartage as a measure to supplement supply for the Seven Creeks (Strathbogie) system in dry years;

- Construct pre-treatment works at the Broadford Water Treatment Plant to provide capacity for increased usage of Goulburn River water;

- Review the feasibility of an integrated water management option for Kilmore as part of the next update of the UWS;

- Undertake additional community consultation on adopting unrestricted supply to critical public assets as alternative servicing standards. This is being undertaken as part of Pricing Submission 4 consultation.

- Enact the relevant actions of the Water Conservation Strategy, including those noted for each supply system in Section 5 of this report;

- Continue to engage with Councils, DELWP and other stakeholders regarding the development of regional IWM opportunities.

- Continue to engage with Councils to establish Priority Open Spaces and opportunities for enhanced water management during periods of restricted potable supply. This is to be completed in 2017/2018 and opportunities progressively explored.

**Medium Term (2023-2040)**

- Design and construct new booster pump station on transfer pipeline for the Delatite River (Mansfield) System.

- Bulk Entitlement (Mansfield) amendment to increase daily extraction limit to 7.5ML/d for the Delatite River (Mansfield) System.

- Design and construct additional 200ML storage for the Delatite River (Mansfield) System.

- Construction of an interconnection pipeline, pump station and Kilmore Tank between Broadford and Kilmore.
Long Term (2040-2065)

- Consider purchasing additional entitlement from the Goulburn system to maintain a desirable buffer to protect against risk and uncertainty;
- Construction of a pipeline from Tooborac to Pyalong to supplement supply for the Mollisons Creek (Pyalong) system;
- Construction of an additional 20ML off stream storage for the Mollisons Creek (Pyalong) system;
- Consider purchasing additional entitlement from the Murray system to reduce the reliance on annual transfers from Goulburn system bulk entitlements;
- Broadford WTP Augmentation.
1. INTRODUCTION

The State Government’s Water for Victoria outlines the water management opportunities and challenges facing Victoria over the coming decades. This includes recognition that water availability and use plays a key role in the future resilience and liveability of our cities and towns.

Victoria’s planning framework requires that Urban Water Strategies (UWS) be developed by those water corporations providing urban services with a primary aim to identify the best mix of measures to maintain a balance between the demand for water and the available supply now and into the future. The balance between supply and demand is to be achieved taking into consideration:

- A long-term outlook of 50 years;
- The total water cycle, consistent with the principles of integrated water management;
- Social, environmental and economic costs and benefits; and
- Risks and uncertainty, such as population growth.

Goulburn Valley Water (GVW) previously completed a UWS (previously named as WSDS) in 2012 titled ‘GVW 2060 A Sustainable Urban Water Future’. The UWS is to be prepared by 31 March 2017, and within each five yearly period thereafter, in accordance with Clause 6-1 and 6-2 of the Statement of Obligations (DELWP, 2016). This document represents the five-yearly update of the UWS for GVW.

2. FRAMEWORK FOR THE STRATEGY DEVELOPMENT

2.1 Policy Framework for Urban Water Strategies

The policy framework for Urban Water Strategies is outlined in the Guidelines for the Development of Urban Water Strategies and the Melbourne Water System Strategy (DELWP, 2016). Key points from the guidelines are as follows:

- Urban Water Strategies, which aim to ensure Water Corporation water service provision over a fifty years outlook, and regional Sustainable Water Strategies, which identify threats and opportunities for water supply over a similar time scale.
- Drought Preparedness Plans, which aim to define a timely and effective preparations and response to anticipated water shortages that may arise in the short-term, and Emergency Management Plans, which respond to unprecedented severe water shortage circumstances due to emergencies such as bushfires, blue-green algae outbreaks or other water quality incidents.
2.2 Integrated Water Management

The Corporation fully embraces the concepts of Integrated Water Management (IWM), as discussed in the Government’s *Water for Victoria*, understanding that it promotes collaborative planning of water, land and related services in order to maximise community benefit.

As IWM planning needs to be enacted considering local values and priorities, the Corporation has taken a lead role in working with Government and regional stakeholders to implement the creation of a Regional IWM Forum. This is the first step to enable our regional stakeholders to understand their accountabilities and discuss potential opportunities in the IWM space.

While the Regional Forum is a relatively recent initiative, for some time now the Corporation has instigated or supported many key IWM activities, such as:

- Wastewater Environmental Offset Concept – The Corporation is currently working with the Environment Protection Authority and other stakeholders to facilitate the benefits of recycled water at a catchment level. As noted in section 4.10, in a first for the State, the concept has recently been adopted for our Kilmore WMF and will now be pursued for our Mansfield WMF.

- Eastbank Lake Precinct Enhancement Project – Regional stakeholders have recognised an opportunity to transform a disconnected river arm of the Goulburn at a gateway to Shepparton into an attractive waterway and park precinct that will include stormwater reuse and interpretive aboriginal cultural linkages. See Appendix 8 for more information.

- Recycled Water Use – With reference to Section 4.10, the Corporation actively seeks out opportunities to maximise the community benefit from our recycled water.

- Mansfield Shire Domestic Wastewater Management Plan Pilot Project – The Corporation was a key partner in this pilot project that has enhanced development assessment principles in open potable water supply catchment areas.

- Small Town Wastewater Investigations – With many unsewered small towns in our region, we assist Councils to determine the most appropriate method of small town wastewater management. This can range from enhanced septic tank management by Council to potential IWM outcomes if centralised reticulation type schemes are found to be required.

- Major Industry Management – The Corporation takes a proactive stance with major industry and supports water usage and trade waste reduction initiatives. This includes active
participation in initiatives to reduce parameters that can impact on the water cycle, such as Sodium.

A further initiative commenced by the Corporation in mid-2016 was an engagement process with each of the seven Councils in our region to discuss their ‘Priority Open Spaces’ and to explore potential opportunities for enhanced water management of these spaces during future periods of restricted potable water supply.

There has been a mixed response from Councils and this outcome demonstrates there is an opportunity to increase participatory stakeholder understanding and incentive in this area. The Corporation will continue to work with Councils with an aim to assemble a list of ‘Priority Open Spaces’ and potential opportunities over 2017/2018.

2.3 Regulatory Requirements for Water Sources

There are a number of legislative and regulatory controls which need to be considered in developing the UWS. This section outlines these controls and how they influence the decisions that GVW may make in future in relation to maintaining a balance between the demand for water and available supply.

2.3.1 Bulk Entitlements

The bulk entitlements specify a number of conditions including maximum annual volume of extraction, and in many cases there are restrictions on the daily rate of extraction. The bulk entitlements have been granted to GVW by the Minister for Water under Division 1 of Part 4 the Water Act (1989). GVW also has a licence to extract groundwater to supply Katunga.

Existing Bulk Entitlements are listed below in Table 2-1.
Table 2-1: Bulk Entitlements held by Goulburn Valley Water

<table>
<thead>
<tr>
<th>Water Source</th>
<th>Water Supply System / Towns</th>
<th>Maximum Annual Entitlement Volume (ML/Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brewery Creek</td>
<td>Woods Point</td>
<td>30</td>
</tr>
<tr>
<td>Delatite River</td>
<td>Mansfield</td>
<td>1,300 (2,600ML in any 2 year period)</td>
</tr>
<tr>
<td>Upper Delatite River</td>
<td>Merrijig &amp; Sawmill Settlement</td>
<td>235</td>
</tr>
<tr>
<td>Goulburn River</td>
<td>Regulated Goulburn</td>
<td>33,490</td>
</tr>
<tr>
<td>Mollisons Creek</td>
<td>Pyalong</td>
<td>75</td>
</tr>
<tr>
<td>Murray System</td>
<td>Regulated Murray</td>
<td>5,593</td>
</tr>
<tr>
<td>Nine Mile Creek</td>
<td>Longwood</td>
<td>120</td>
</tr>
<tr>
<td>Seven Creeks &amp; Mt Hut Creek</td>
<td>Euroa &amp; Violet Town</td>
<td>1,990</td>
</tr>
<tr>
<td>Seven Creeks</td>
<td>Strathbogie</td>
<td>23</td>
</tr>
<tr>
<td>Steavenson River</td>
<td>Marysville &amp; Buxton</td>
<td>462</td>
</tr>
<tr>
<td>Sunday Creek</td>
<td>Broadford &amp; Kilmore</td>
<td>2,875</td>
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<tr>
<td>Yea River</td>
<td>Yea</td>
<td>438</td>
</tr>
</tbody>
</table>

A number of the Bulk Entitlements are subject to minimum passing flow rates which limit diversions by GVW. There are no additional environmental obligations identified in the current Bulk Entitlements. However, if the situation occurs, GVW would consult with GBCMA as required.

2.3.2 River Basin Caps and Sustainable Diversion Limits

The water supply systems operated by GVW are within the Murray Darling basin where there is a Cap on diversions. The Cap limits water extractions to the volume of water that would have been delivered under 1993/94 levels of development and no new allocation of entitlements is permitted within the Murray Darling Basin system. While the Cap for Victoria has provision for climate adjusted volumes, the Bulk Entitlements (River Murray – Goulburn Valley Water) held by GVW state an upper limit for annual extraction in any one year. For the purpose of the UWS it has been assumed that any additional future sources of water will need to be acquired by the purchase of entitlements.

2.3.3 Murray Darling Basin Plan

A Basin Plan has been released by the Murray Darling Basin Authority in 2012.
The Basin Plan identifies that water resource plans will be prepared to achieve sustainable diversion limits in future. The sustainable diversion limits will not apply until 2019.

The Basin Plan has established sustainable diversion limits for the Victorian Murray and Goulburn water resource plan areas which may impact on GVW. The sustainable diversion limits are identified as less than the current baseline diversion limit for both the Victorian Murray and Goulburn.

The impact on GVW from the Basin Plan is currently not clear and for the purpose of the UWS it has been assumed that GVW bulk water entitlements (River Murray – Goulburn Valley Water) are not impacted by the Basin Plan. The Basin Plan currently identifies that critical human needs water is the highest priority water user.

Given that the sustainable diversion limit targets will not apply until 2019, future updates of the UWS will consider any impacts on GVW from the Basin Plan.

2.3.4 Streamflow Management Plans

Streamflow Management Plans define the rules for sharing between different water users in unregulated rivers. Streamflow Management Plans are only developed in priority streams across Victoria where there are competing uses for water.

GVW aims to maintain the health of all streams when developing options. There are likely to be opportunities in future to reduce extractions during low flows in the summer period by increasing winter and spring diversions and utilising off stream storages. This would lead to an improvement in river health.

2.3.5 Heritage Rivers

The purpose of the Heritage Rivers Act 1992 is to provide protection of public land. This applies particularly to parts of rivers and river catchment areas in Victoria that have significant nature conservation, recreation, scenic or cultural heritage attributes. The Heritage Rivers Act 1992 specifies whether impoundments or artificial barriers can be constructed and the degree to which new water diversions are permitted.

The Goulburn River (from Lake Eildon to the River Murray), the Howqua River (from the junction of the north and south branches to Lake Eildon), and the Big River (from the junction of Spring and Oaks Creeks to the junction of Fryer Creek and Big River Arm at Lake Eildon), have been listed as Heritage River Areas.
The heritage river and natural catchment areas have been taken into account when considering future water supply options for GVW's water supply systems.

### 2.3.6 Victorian River Health Strategy

The Victorian River Health Strategy outlines the long-term direction for the management of Victoria's rivers. It provides a vision for the management of rivers in Victoria, policy direction on issues affecting river health and a blueprint for integrating efforts on rivers and ensuring that the most effective river health benefits are achieved for the effort and resources invested.

The intent of a Regional River Health Strategy is to:

- Establish objectives for river systems and river reaches, and to set priorities to achieve these;
- Engage communities in both the development and implementation of the strategy;
- Articulate the priorities for all relevant river health activities across an entire Catchment Management Authority region;
- Build an evidence-based and robust case for government investment in river health.

High priority rivers have been identified through Regional River Health Strategies. The Murray River (including the Goulburn River as a Murray tributary) has been identified as one of a number of high priority rivers for improving flows.

On high priority rivers, Catchment Management Authorities will integrate river restoration with the management of the Environmental Water Reserve (EWR) to:

- Reinstate and/or protect critical river and riparian habitat;
- Ensure effective delivery of the EWR, such as refurbishment of weirs or infrastructure that inhibits the release of the EWR or improving floodplain connections;
- Demonstrate the benefits of protecting and restoring the health of rivers to catchment communities through information, education and involvement;
- Monitor and assess the health of the rivers and to determine future actions.

### 2.3.7 Groundwater Supplies

GVW currently holds two groundwater licences for supply to Katunga and Strathmerton. The Strathmerton licence is currently not used for supply to Strathmerton. The Katunga and Strathmerton bores are
located in a Groundwater Supply Protection Area that is subject to a Groundwater Management Plan.

2.3.8 Recycled Water


Further discussion regarding recycled water and associated Integrated Water Management (IMW), refer to Section 2.2.

2.4 Other Legislative and Regulatory Requirements

2.4.1 Permanent Water Conservation Rules

A Permanent Water Conservation By-law was introduced in January 2004 and was aimed at encouraging customers to conserve water particularly in outside use. The By-Law limited times of watering and prohibited some inefficient watering practices.

In March 2011, the Victorian Government announced that a comprehensive review of Drought Response Plans (including water restrictions) and Permanent Water Saving Plans (including permanent water saving rules) would be conducted across Victoria.

2.4.2 Water Efficiency Labelling and Standards

The Water Efficiency Labelling and Standards Scheme (WELS) requires certain water-using products to be labelled for water efficiency.

The scheme was established on 1 July 2006 as a co-operative Commonwealth/state and territory regulatory system to help reduce domestic water consumption. Under the scheme, product suppliers are required to provide water efficiency information, and star-ratings, to consumers - clothes washers, dishwashers, showers, taps, toilets, urinals and flow controllers. Industry must register these products with the WELS Regulator.

The scheme is funded from industry registration fees and contributions from federal, state and territory governments. The WELS scheme has its own Act, The Water Efficiency Labelling and Standards Act 2005, and is underpinned by Australian Standard AS/NZS 6400.

The WELS scheme will contribute to reduced in-house demand in the GVW region through the increased use of water efficient products.
2.4.3 Statement of Obligations

Section 7.2 of the Statement of Obligations (DELWP, 2015) outlines the following requirements for GVW in relation to river health:

- The Corporation must, where waterways and wetlands are used for the supply of water, develop and implement plans and programs consistent with any guidelines issued by the Secretary to:
  
  (a) seek to enhance ecological benefits where service standards to customers are not compromised;
  
  (b) work cooperatively with the Victorian Environmental Water Holder and relevant agencies;
  
  (c) have regard to any guidelines issued by the Secretary for that purpose;
  
  (d) make available to the public information on its activities to enhance ecological benefits; and
  
  (e) work with the Department to implement relevant Murray-Darling Basin Plan obligations.

2.5 Drought Experience

Drought conditions were experienced for extended periods from 1997 to 2009 across the GVW region.

A number of GVW towns experienced high level water restrictions (Stage 4) for extended periods. Drought response plans were updated a number of times during this period and actions from the plans were successfully implemented to manage water supplies through the drought.

The Regulated Goulburn system Bulk Entitlement (Goulburn River and Eildon – Goulburn Valley Water) proved to be reliable during the drought period and provides a highly secure supply to a large number of GVW towns.

The completion of the WSDS in 2012 highlighted the impact of the extended period of drought on level of service targets and system yield forecasts. A number of systems which reliably achieved level of service targets under historical conditions were not as secure under the drought conditions which eventuated.

Key learnings from the previous drought for GVW have been:

- The benefits of maintaining updated drought preparedness and response plans.
The impact on level of service targets and system yield from climate which varies substantially from historical conditions.

The reliability of the Regulated Goulburn system bulk entitlements and the opportunities that they provide to secure supplies for additional towns through interconnections and transfers.

2.6 Objectives of the UWS

Key objectives of Urban Water Strategies from the Guidelines (DELWP, 2016) are to ensure that water corporations undertake long term planning that:

- ensures safe, secure, reliable and affordable water and sewerage services that meet society's long term needs;
- encourages the sustainable use of water resources – including rainwater, stormwater and recycled water and rainfall-independent supplies in ways that are efficient and fit-for-purpose, whilst ensuring that public and environmental health are protected;
- enhances the liveability, productivity, prosperity and environment of our cities and towns;
- ensures that the water needs of environmental assets are transparently considered; and
- provides for a transparent and rigorous decision-making process, with clear roles and responsibilities and accountabilities, which can adapt to the changing environment.

The key principles for the development of the UWS for GVW are:

- Water supply systems should be designed to provide an agreed minimum level of service;
- Planning should be based on the best available information on current and future water resources;
- Planning should be scenario based, incorporating uncertainty in supply and demand.
- All water supply and demand options should be assessed on a robust and transparent basis, examining the social, environmental and economic costs and benefits;
- Pricing and markets should be used to help balance the supply and demand for water, where it is efficient and feasible to do so;
- Plans and strategies should be able to be adapted as necessary to reflect additional information and knowledge;
The value of individual options to the overall supply-demand balance portfolio should recognise supply characteristics as well as changing circumstances.

2.7 GVW 2060 Outcomes

The Seven Creeks system (Euroa/Violet Town), the Sunday Creek system (Broadford and Kilmore) and the Nine Mile Creek system (Longwood) were identified as having immediate shortfalls in the supply-demand balance in GVW 2060.

Since the completion of GVW 2060 the following actions have been implemented to address the identified shortfalls:

- The Nine Mile Creek Reservoir has been restored to the design capacity of 27ML;
- Purchase land for a future tank site at Kilmore;
- A new 300ML off stream storage and a permanent pump station on Seven Creeks for the Seven Creeks (Euroa and Violet Town) system (currently in design stage and the construction to be completed by 18/19);
3. GOULBURN VALLEY WATER SYSTEMS

The area serviced by Goulburn Valley Water is shown in Figure 3.1.

*Figure 3.1: Goulburn Valley Water Region*
Goulburn Valley Water supplies water to 54 towns utilising 13 water supply systems as shown in Table 3-1.

Table 3-1: Goulburn Valley Water supply systems

<table>
<thead>
<tr>
<th>Towns Supplied</th>
<th>Source of Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woods Point</td>
<td>Brewery Creek and Goulburn River</td>
</tr>
<tr>
<td>Mansfield</td>
<td>Delatite River</td>
</tr>
<tr>
<td>Merrijig and Sawmill Settlement</td>
<td>Delatite River</td>
</tr>
<tr>
<td>Alexandra, Avenel, Bonnie Doon, Congupna, Corop, Colbinabbin, Dookie, Eildon,</td>
<td>Goulburn River</td>
</tr>
<tr>
<td>Girgarre, Goulburn Weir, Katanda West, Kirwan’s Bridge, Kyabram, Merrigum,</td>
<td></td>
</tr>
<tr>
<td>Molesworth, Mooroopna, Murchison, Nagambie, Rushworth, Seymour, Shepparton,</td>
<td></td>
</tr>
<tr>
<td>Stanhope, Tallarook, Tallygarooppna, Tatura, Thornton, Tongala, Toolamba</td>
<td></td>
</tr>
<tr>
<td>Katunga</td>
<td>Groundwater</td>
</tr>
<tr>
<td>Pyalong</td>
<td>Mollisons Creek</td>
</tr>
<tr>
<td>Barmah, Cobram, Katamatite, Nathalia, Numurkah, Picola, Strathmerton, Wunghnu,</td>
<td>Murray System</td>
</tr>
<tr>
<td>Yarroweyah</td>
<td></td>
</tr>
<tr>
<td>Longwood</td>
<td>Nine Mile Creek</td>
</tr>
<tr>
<td>Euroa and Violet Town</td>
<td>Seven Creeks, Mt Hut Creek</td>
</tr>
<tr>
<td>Strathbogie</td>
<td>Seven Creeks</td>
</tr>
<tr>
<td>Marysville and Buxton</td>
<td>Steavenson River</td>
</tr>
<tr>
<td>Broadford, Clonbinane, Heathcote Junction, Kilmore, Wandong, Waterford Park</td>
<td>Sunday Creek and Goulburn River</td>
</tr>
<tr>
<td>Yea</td>
<td>Yea River</td>
</tr>
</tbody>
</table>

Water usage over the past nine years and the current baseline demand forecast is shown in Table 3-2.

The current baseline demand forecast represents expected water demand in each water supply system under existing conditions and has been derived as a median of relevant past demands. Further detail in relation to the preparation of the baseline demand forecast is provided in Section 4.4.
### Table 3-2: Raw Water Demand 2006 - 2015

<table>
<thead>
<tr>
<th>Water Source</th>
<th>Water Supply System / Towns</th>
<th>Raw Water Demand (ML)</th>
<th>06/07</th>
<th>07/08</th>
<th>08/09</th>
<th>09/10</th>
<th>10/11</th>
<th>11/12</th>
<th>12/13</th>
<th>13/14</th>
<th>14/15</th>
<th>Current Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brewery Creek</td>
<td>Woods Point</td>
<td></td>
<td>25</td>
<td>25</td>
<td>34</td>
<td>17</td>
<td>13</td>
<td>10</td>
<td>9</td>
<td>9</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Delatite River</td>
<td>Mansfield</td>
<td></td>
<td>512</td>
<td>591</td>
<td>839</td>
<td>584</td>
<td>456</td>
<td>295</td>
<td>576</td>
<td>943</td>
<td>463</td>
<td>550</td>
</tr>
<tr>
<td>Upper Delatite River</td>
<td>Merrijig &amp; Sawmill Settlement</td>
<td></td>
<td>75</td>
<td>60</td>
<td>71</td>
<td>62</td>
<td>63</td>
<td>52</td>
<td>91</td>
<td>64</td>
<td>73</td>
<td>70</td>
</tr>
<tr>
<td>Goulburn River</td>
<td>Regulated Goulburn</td>
<td></td>
<td>21,381</td>
<td>18,942</td>
<td>20,032</td>
<td>19,583</td>
<td>16,579</td>
<td>19,028</td>
<td>20,601</td>
<td>19,757</td>
<td>21,133</td>
<td>21,367</td>
</tr>
<tr>
<td>Katunga Groundwater</td>
<td>Katunga</td>
<td></td>
<td>47</td>
<td>57</td>
<td>53</td>
<td>46</td>
<td>39</td>
<td>58</td>
<td>52</td>
<td>44</td>
<td>43</td>
<td>51</td>
</tr>
<tr>
<td>Mollisons Creek</td>
<td>Pyalong</td>
<td></td>
<td>67</td>
<td>51</td>
<td>39</td>
<td>40</td>
<td>55</td>
<td>31</td>
<td>36</td>
<td>31</td>
<td>35</td>
<td>46</td>
</tr>
<tr>
<td>Murray System</td>
<td>Regulated Murray</td>
<td></td>
<td>4,554</td>
<td>3,798</td>
<td>4,324</td>
<td>4,681</td>
<td>4,016</td>
<td>4,288</td>
<td>4,893</td>
<td>4,551</td>
<td>4,536</td>
<td>4,948</td>
</tr>
<tr>
<td>Nine Mile Creek</td>
<td>Longwood</td>
<td></td>
<td>57</td>
<td>52</td>
<td>50</td>
<td>49</td>
<td>41</td>
<td>44</td>
<td>75</td>
<td>63</td>
<td>51</td>
<td>55</td>
</tr>
<tr>
<td>Seven Creeks &amp; Mt Hut Creek</td>
<td>Euroa &amp; Violet Town</td>
<td></td>
<td>618</td>
<td>662</td>
<td>801</td>
<td>681</td>
<td>525</td>
<td>574</td>
<td>748</td>
<td>687</td>
<td>730</td>
<td>709</td>
</tr>
<tr>
<td>Seven Creeks</td>
<td>Strathbogie</td>
<td></td>
<td>NA</td>
<td>14</td>
<td>17</td>
<td>16</td>
<td>16</td>
<td>9</td>
<td>12</td>
<td>13</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Sunday Creek</td>
<td>Broadford &amp; Kilmore</td>
<td></td>
<td>1,236</td>
<td>440</td>
<td>620</td>
<td>2,339</td>
<td>680</td>
<td>1,254</td>
<td>1,565</td>
<td>1,588</td>
<td>1,588</td>
<td>1,571</td>
</tr>
<tr>
<td>Yea River</td>
<td>Yea</td>
<td></td>
<td>226</td>
<td>227</td>
<td>259</td>
<td>233</td>
<td>175</td>
<td>177</td>
<td>227</td>
<td>235</td>
<td>214</td>
<td>225</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>29,062</td>
<td>25,249</td>
<td>27,410</td>
<td>28,515</td>
<td>22,815</td>
<td>25,975</td>
<td>29,043</td>
<td>28,172</td>
<td>29,057</td>
<td>29,855</td>
</tr>
</tbody>
</table>
The following should be noted for Table 3-2:

- Historical raw water demands for the Regulated Murray and Sunday Creek systems do not include transfers from the Regulated Goulburn system;
- Transfers from the Regulated Goulburn system to other systems are included in the historical demand for the Regulated Goulburn system.

A comparison between Bulk Entitlements and the current baseline demand forecast is shown in Table 3-3.

**Table 3-3: Bulk Entitlement Comparison to Baseline Demand Forecast**

<table>
<thead>
<tr>
<th>Water Source</th>
<th>Water Supply System / Towns</th>
<th>Maximum Annual Entitlement Volume (ML/Year)</th>
<th>Current Baseline Demand (ML/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brewery Creek</td>
<td>Woods Point</td>
<td>30</td>
<td>13</td>
</tr>
<tr>
<td>Delatite River</td>
<td>Mansfield</td>
<td>1,300 (2,600ML in any two year period)</td>
<td>550</td>
</tr>
<tr>
<td>Upper Delatite River</td>
<td>Merrijig &amp; Sawmill Settlement</td>
<td>235</td>
<td>70</td>
</tr>
<tr>
<td>Goulburn River</td>
<td>Regulated Goulburn</td>
<td>33,490</td>
<td>21,367</td>
</tr>
<tr>
<td>Katunga Groundwater</td>
<td>Katunga</td>
<td>77 (maximum permissible allocation of 70% from 110ML licence)</td>
<td>51</td>
</tr>
<tr>
<td>Mollisons Creek</td>
<td>Pyalong</td>
<td>75</td>
<td>46</td>
</tr>
<tr>
<td>Murray System</td>
<td>Regulated Murray</td>
<td>5,593</td>
<td>4,948</td>
</tr>
<tr>
<td>Nine Mile Creek</td>
<td>Longwood</td>
<td>120</td>
<td>55</td>
</tr>
<tr>
<td>Seven Creeks &amp; Mt Hut Creek</td>
<td>Euroa &amp; Violet Town</td>
<td>1,990</td>
<td>709</td>
</tr>
<tr>
<td>Seven Creeks</td>
<td>Strathbogie</td>
<td>23</td>
<td>16</td>
</tr>
<tr>
<td>Steavenson River</td>
<td>Marysville &amp; Buxton</td>
<td>462</td>
<td>234</td>
</tr>
<tr>
<td>Sunday Creek</td>
<td>Broadford &amp; Kilmore</td>
<td>2,875</td>
<td>1,571</td>
</tr>
<tr>
<td>Yea River</td>
<td>Yea</td>
<td>438</td>
<td>225</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>46,702</td>
<td>29,855</td>
</tr>
</tbody>
</table>

Further details for each water supply source are provided in Section 5 of this strategy.
4. STRATEGY DEVELOPMENT PROCESS

4.1 General

The scope for the development of the UWS was based on the Guidelines for the Development of Urban Water Strategies and the Melbourne Water System Strategy (DELWP, 2016) produced by the Department of Environment, Land, Water and Planning.

The following section outlines the process that was followed to develop the UWS.

4.2 Community Engagement

4.2.1 Community Engagement

A Customer & Community Engagement Plan was developed for the Urban Water Strategy. A copy of the plan is in Appendix 1.

GVW will incorporate the following key focus areas to guide engagement activities for both the UWS and Pricing Submission 4:

- Service Levels
- Guaranteed Service Levels
- Water Efficiency
- Water Resources
- Carbon Neutrality
- Digital Strategy
- Community Water
- Hardship
- Non-potable supplies
- Hydration Stations

The key focus areas that help inform the UWS include Service Levels, Water Efficiency, Water Resources and Community Water.

4.2.2 Traditional Owner Engagement

Indigenous values form an important part of GVW’s community and stakeholder engagement activities. During the initial stage of engagement for the Urban Water Strategy and Pricing Submission 4, Traditional Owners participated in a Water Café at Rumbalara Co-operative and an online survey.
The survey covered topics such as water resources, water efficiency and liveability and received a 2% response rate from Aboriginal/Torres Strait Islanders which reflects the proportion of Aboriginal/Torres Strait Islanders in GVW’s service area.

GVW has engaged with Traditional Owners and explored ways of linking Indigenous values and cultural water as part of various environmental, educational and employment projects. These include an Environmental Offsets Project in Kilmore, Greater Shepparton City Council Eastbank River Project in Shepparton, a regional employment agreement (Algabonyah Agreement) and a National Water Week school art project focussing on cultural water.

GVW will continue to engage with Traditional Owners in our region, (Yorta Yorta Nation, Taungurung Clans Aboriginal Corporation and Rumbalara Co-operative) and our activities will include participatory decision making, in particular for projects that focus on integrated water management.

4.3 Levels of Service

GVW’s current level of service objectives for maintaining an adequate supply to customers are specified as follows:

- Moderate water restrictions (Stages 1 and 2) are not desired more frequently on average than 1 year in 10; and
- More severe water restrictions (Stages 3 and 4) are not desired more frequently on average than 1 year in 20.

The level of service objectives are applied equally across all GVW supply systems.

The current level of service objectives were discussed with the Corporate Community Reference Committee (CCRC). Alternative approaches to expressing levels of service such as a minimum volume or percentage of water available were presented to the CCRC.

Key points from discussions with the committee were as follows:

- Expressing levels of service in terms of frequency of water restrictions is the clearest method for communicating service levels to customers;
- Retaining the current level of service objectives was supported;
- Adopting Stage 4 water restrictions as the minimum service level was supported;
- Assessing the impact of adopting Stage 3 restrictions as the minimum service standard;
• Assessing the impact of providing unrestricted supply to critical public assets.

The following outcomes were adopted based on discussions in relation to levels of service:

• The existing level of service targets have been retained for the development of the UWS;
• Stage 4 water restrictions were assessed as the minimum service standard;
• The impact of providing unrestricted supply to critical public assets was also assessed.

4.4 Demand Forecasts

A baseline demand forecast was developed for the UWS to cover the period from 2016 – 2065.

Water demand was categorised into the following components:

• Residential customer demand;
• Commercial and minor industrial customer demand;
• Major customer demand;
• Distribution system non revenue water; and
• Headworks non-revenue water.

A building block approach was adopted to aggregate forecasts for each demand category in predicting future total demand for each system

4.4.1 Residential Demand Model

Two multi-variate regression models have been developed to forecast residential demand. The models have been developed based on the aggregated demand for all water supply systems managed by GVW and include climatic variables and restrictions on use variables.

Separate models are used for the northern and southern areas of GVW’s region to improve forecast accuracy and recognise differing demand patterns and water usage.

Water consumption can be categorised as discretionary and non-discretionary. Non-discretionary water consumption essentially consists of in-house use. Discretionary consumption is all other water usage, dominated by outside house use and is the major
contributor to variability of demand. The major demand modifiers are temperature, rainfall, usage restrictions and water efficiency initiatives.

Projections for population growth and subsequent changes in water connection numbers were derived from Victoria in Future data available from the Department of Environment, Land, Water and Planning website.

### 4.4.2 Commercial Demand Forecast

Commercial and minor industrial water demand per assessment is relatively static. This lack of variability does not warrant the development of separate complex forecasting models.

For each town an average demand per customer has been adopted for forecasting taking into account the predicted increase in customers. Growth rates for new commercial customers have been developed based on consideration of residential growth rates and historic growth in customer numbers.

### 4.4.3 Major Customer Demand Forecast

Major customers were contacted by GVW and provided with the opportunity to submit future projections for water usage.

Major customer demand is sensitive to factors such as climatic variations, changes in technology and economic conditions. It is often difficult for major customers to provide future projections for water usage due to these factors.

Where a major customer has provided future projections for water usage, this information has been used to inform the demand forecast.

Where a major customer has not provided future projections for water usage, GVW has reviewed historical water usage data for the customer and adopted an average level of demand based on this review.

For the majority of major customers, future projections have not been provided beyond the next five years. Major customer demand is assumed to remain constant beyond the next five years.

### 4.4.4 Distribution System Non-Revenue Water Forecast

Distribution system non-revenue water comprises water main cleaning, fire fighting, unmetered consumption and leakage.

The adopted volume of distribution system non-revenue water for each town has been selected based on a review of historical volumes of non-revenue water.
4.4.5 **Headworks Non-Revenue Water Forecast**

Headworks non-revenue water comprises water treatment plant production water usage, evaporation from off-stream storages where applicable, unmetered water usage and leakage on bulk water supply mains.

The adopted volume of headworks non-revenue water for each town has been selected based on a review of historical volumes of non-revenue water.

4.4.6 **Baseline Demand Forecast Summary**

The baseline demand forecast for each category of demand for 2016 and 2065 is summarised in Table 4-1.

**Table 4-1: Baseline Demand Forecast**

<table>
<thead>
<tr>
<th>Demand Component</th>
<th>2016 Demand (ML)</th>
<th>2065 Demand (ML)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Demand</td>
<td>13,328</td>
<td>26,109</td>
</tr>
<tr>
<td>Commercial Demand</td>
<td>4,305</td>
<td>6,007</td>
</tr>
<tr>
<td>Major Customer Demand</td>
<td>6,323</td>
<td>6,323</td>
</tr>
<tr>
<td>Distribution System Non-Revenue Water</td>
<td>2,694</td>
<td>4,327</td>
</tr>
<tr>
<td>Headworks Non-Revenue Water</td>
<td>2,908</td>
<td>4,403</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>29,558</strong></td>
<td><strong>47,170</strong></td>
</tr>
</tbody>
</table>

4.4.7 **Demand Scenarios**

Consultant GHD was engaged by GVW to develop demand and supply scenarios which are documented in a report titled ‘Urban Water Strategy 2016-2065 Water Resources Modelling Part B – Baseline Yield and Reliability Scenario Modelling’ (GHD, 2016).

The baseline demand forecast is intended to represent the most likely of plausible demand scenarios. Sensitivity analysis was undertaken to assess the impact of changes to components of the demand forecast. Demand components which were varied in the sensitivity analysis included population forecasts, new residential connection consumption rates and non-revenue water.

A demand forecast envelope was produced as a result of the sensitivity analysis. An example demand forecast envelope for the Goulburn system is shown in Figure 4.1 (Green lines).
4.5 Supply Forecasts

Consultant GHD was engaged by GVW to update yield and reliability estimates for water supply systems.

There are ten water supply systems operated by GVW which source water from unregulated river systems. The ten systems are represented by nine REALM models (Delatite River and Upper Delatite River are a single model). REALM is a computer based water supply system simulation package.

Yield forecasts for the Regulated Goulburn and Regulated Murray systems have been based on the bulk entitlements and the yield forecast for Katunga has been based on the groundwater extraction licence.


4.5.1 Supply Scenarios

A number of scenarios were assessed to develop a supply (yield) forecast envelope for each water supply system. The scenarios which were considered included:

- Current baseline streamflow conditions;
- Step climate change;
- Climate change impacted streamflow at 2040 and 2065. Separate scenarios were developed for Dry, Median and Wet.
- Climate change impacted streamflow occurring earlier or later than currently estimated;
- Modelling error and uncertainty. Models used to derive yield estimates have been assessed as having high, moderate or low
level accuracy with error bands of +/- 5%, +/- 10% and +/- 15% being adopted to reflect accuracy.

Figure 4.2 illustrates the method used to define the supply forecast envelope, detailing the baseline, high supply and low supply forecasts. The median climate change scenario has been adopted as the primary baseline forecast. Given the uncertainty associated with the timing and magnitude of climate change impacts, the adopted baseline represents a “middle of the road” scenario. Sensitivity analysis has shown that high supply forecast is generally defined by the degree of model uncertainty (at 2016) and the yield under the wet climate change scenario (at 2065). The low supply forecast is generally defined by the degree of model uncertainty (at 2016) and the dry climate change scenario at 2065.

Figure 4.2: Supply Forecast Envelope Example (Source: GHD, 2016)

4.5.2 Climate Change Scenarios

The Guidelines for Assessing the Impact of Climate Change on Water Supplies in Victoria (DELWP 2016) provide guidance on assessing the impacts of potential impacts of climate change on rainfall, evaporation and runoff. The impacts for the Goulburn-Broken and Upper Murray River Basins are summarised in Table 4.2 for the Wet, Median and Dry climate change scenarios.

It is noted that the guidelines express climate change in 2040 and 2065 as ‘Low’, ‘Medium’ and ‘High’ scenarios. For this project, the ‘Low’ climate change has been defined as ‘Wet’, the ‘Medium’ climate change as ‘Median’ and the High climate change as ‘Dry’. The impacts for the Goulburn-Broken and Upper Murray River Basins
are described in Table 4-2 for Wet, Median and Dry condition scenarios.

The Current Climate Baseline scenario represents the climatic conditions between 1975 and 2015, and replaces the previous ‘historical’ scenario used for the baseline. Model inputs were adjusted using an annual factoring method which sets the long term average to be equal to the average experienced over the 1975 to 2015 period. The climate change factor summarised in Table 4-2 were then applied to this dataset.

Similarly, the 1997 Step Climate Change scenario (similar to the previous ‘return to dry’ scenario) represents the climatic conditions between 1997 and 2015. Like the Current Climate Baseline scenario, model inputs were adjusted using an annual factoring method which sets the long term average to be equal to the average experienced over the 1997 to 2015 period.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>2040</th>
<th>2065</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Goulburn – Broken Basin</td>
<td>Upper Murray Basin</td>
</tr>
<tr>
<td>Runoff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet</td>
<td>+9.90%</td>
<td>+17.20%</td>
</tr>
<tr>
<td>Median</td>
<td>-9.50%</td>
<td>-8.40%</td>
</tr>
<tr>
<td>Dry</td>
<td>-29.10%</td>
<td>-23.30%</td>
</tr>
<tr>
<td>Rainfall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet</td>
<td>+3.90%</td>
<td>+7.50%</td>
</tr>
<tr>
<td>Median</td>
<td>-2.50%</td>
<td>-0.70%</td>
</tr>
<tr>
<td>Dry</td>
<td>-13.60%</td>
<td>-8.50%</td>
</tr>
<tr>
<td>Evaporation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wet</td>
<td>+4.90%</td>
<td>+4.60%</td>
</tr>
<tr>
<td>Median</td>
<td>+4.90%</td>
<td>+4.60%</td>
</tr>
<tr>
<td>Dry</td>
<td>+4.90%</td>
<td>+4.60%</td>
</tr>
</tbody>
</table>

The presentation of climate change scenarios in Section 5 of this document represents the wet, median and dry scenarios from the UWS Guidelines as high yield, median climate change (median cc) and low yield respectively.

For a number of water supply systems, the Bulk Entitlement is the limiting factor for system yield rather than the climate change scenarios. Further details are provided in Section 5 for individual water supply systems where this applies.
4.6 Demand and Supply Forecast Summary

A summary of the demand and supply (yield) forecasts based on water resource modelling for a range of scenarios is shown in Table 4-3.
Table 4-3: Demand and Supply Forecast Summary (Source: GHD, 2016)

<table>
<thead>
<tr>
<th>System</th>
<th>UWS Demand Forecast</th>
<th>UWS Yield Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2021</td>
</tr>
<tr>
<td>Goulburn-Regulated</td>
<td>21,367</td>
<td>22,070</td>
</tr>
<tr>
<td>Murray Regulated</td>
<td>4,948</td>
<td>5,010</td>
</tr>
<tr>
<td>Sunday Creek (Broadford/Kilmore) System</td>
<td>1,571</td>
<td>1,757</td>
</tr>
<tr>
<td>Nine Mile Creek (Longwood) System</td>
<td>55</td>
<td>57</td>
</tr>
<tr>
<td>Mollison Creek (Pyalong) System</td>
<td>46</td>
<td>46</td>
</tr>
<tr>
<td>Brewery Creek (woods Pt) System</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Yea River (Yea) System</td>
<td>225</td>
<td>236</td>
</tr>
<tr>
<td>Steavenson River (Marysville/Buxton) System</td>
<td>234</td>
<td>263</td>
</tr>
<tr>
<td>Seven Creeks (Strathbogie) System</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Seven Creeks (Euora) System</td>
<td>709</td>
<td>734</td>
</tr>
<tr>
<td>Delatite River (Mansfield) System</td>
<td>550</td>
<td>590</td>
</tr>
<tr>
<td>Delatite River (Merrijig) System</td>
<td>70</td>
<td>74</td>
</tr>
<tr>
<td>Katunga</td>
<td>51</td>
<td>51</td>
</tr>
</tbody>
</table>
4.7 Alternative Water Atlas

An Alternative Water Atlas has been developed to identify potential sources of alternative water that may form part of the future supply-demand balance.

The objectives of the Alternative Water Atlas from the Urban Water Strategy Guidelines (DELWP, 2016) are to:

- Identify the volumes of stormwater, recycled water and other alternative water sources available within the works of the Corporation (including wetlands and retardation basins) and/or local council;
- Help to inform future opportunities for the use of treated stormwater, recycled water and other alternative water sources in the control of either a water corporation or local council;
- Be presented in any way that is considered appropriate for the relevant water system, from a sophisticated computer model to a simple graphical representation.

The Alternative Water Atlas is located in Appendix 2.

Towns included in the Alternative Water Atlas in the draft UWS fall into the following categories:

- Towns with a predicted shortfall in the supply-demand balance in the short to medium term (Broadford, Euroa, Kilmore, Mansfield, Pyalong and Violet Town);
- GVW’s largest towns (Shepparton and Mooroopna);
- Towns with major redevelopment (Marysville).

The Atlas information is being used in discussions with Councils to explore possible IWM opportunities and also to establish ‘Priority Open Space’ management options during times of future restricted potable water supply. This is further discussed in Section 2.2.

4.8 Options Assessment

The future supply-demand balance for each water supply system has been considered under a range of supply and demand scenarios.

Options to address shortfalls either in the current or future supply-demand balance are outlined in Section 5 of this document.

4.9 Greenhouse Gas Emission Reduction Initiatives
In accordance with the State Water Plan, GVW are committed to material greenhouse gas emission reduction through the Climate Change Mitigation Strategy which will deliver the outcomes promised in GVW's TAKE2 emissions reduction pledge, being a progressive and substantial reduction in total carbon emissions over the 2011-2016 baseline by the year 2025.

A range of measures, including aggressive renewables and efficiency programs, enhanced business capability and self-generated carbon sequestration will be delivered, with outcomes being steered by empowered customers.

The climate change impacts from new assets or operational modifications that result from this UWS will be included in this forward look on carbon emission reduction.

4.10 Sewerage Initiatives

The Corporation provides reticulated wastewater services to 26 towns with the wastewater collected treated via 23 lagoon based Wastewater Management Facilities (WMF).

These systems service a total of around 50,000 properties in our region, including many large industrial customers such as SPC, Campbell Soups and Tatura Milk Industries.

Our large industrial profile means that a significant amount of wastewater is transported in our sewerage networks and treated at our WMF’s.

The Corporation takes a proactive stance to wastewater systems planning and by way of example undertakes annual network and WMF capacity reviews which are complemented by more thorough Master Plan investigations as required. The Corporation also investigates network performance via a Sewerage Management Plan.

Due to the general rural location of our WMF assets, there is opportunity to beneficially reuse the recycled water from our WMFs in various ways. Of the 10GL of recycled water that is generated annually, around 5GL is reused on GVW owned land, around 3GL is reused on nearby farm land or town golf courses and around 2GL is tertiary treated and returned to waterways.

A snapshot of some notable elements of the above recycled water profile follows:
Table 4-4 Recycled Water Snapshot

<table>
<thead>
<tr>
<th>Town</th>
<th>Recycled Water Destination</th>
<th>Typical Annual Volume (ML)</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mansfield</td>
<td>Golf Course</td>
<td>80</td>
<td>Enhanced Public Recreation</td>
</tr>
<tr>
<td>Seymour</td>
<td>Golf Course</td>
<td>70</td>
<td>Enhanced Public Recreation</td>
</tr>
<tr>
<td>Euroa</td>
<td>Golf Course</td>
<td>70</td>
<td>Enhanced Public Recreation</td>
</tr>
<tr>
<td>Yea</td>
<td>Golf Course and Race Track</td>
<td>60</td>
<td>Enhanced Public Recreation</td>
</tr>
<tr>
<td>Marysville</td>
<td>Golf Course</td>
<td>60</td>
<td>Enhanced Public Recreation</td>
</tr>
<tr>
<td>Seymour</td>
<td>WMF Wood Lot (104 Hectares)</td>
<td>400</td>
<td>Supporting Local Business</td>
</tr>
<tr>
<td>Broadford</td>
<td>WMF Wood Lot (65 Hectares)</td>
<td>90</td>
<td>Supporting Local Business</td>
</tr>
<tr>
<td>Shepparton</td>
<td>WMF Pasture</td>
<td>2800</td>
<td>Corporation Business Venture (Livestock &amp; Pasture)</td>
</tr>
<tr>
<td>Mooroopna</td>
<td>Third Party Farm</td>
<td>900</td>
<td>Supporting Local Business</td>
</tr>
<tr>
<td>Alexandra and Eildon</td>
<td>Goulburn River</td>
<td>180</td>
<td>Tertiary Treated Inflow Contributes to Bulk Water Extraction Availability</td>
</tr>
</tbody>
</table>

In summary, the Corporation is noted as having one of the highest recycled water rates in the State with up to around 95% being beneficially reused in dry seasons.

Our asset planning processes mean that we proactively forecast and program our sewerage network and WMF asset needs. Based on current and predicted domestic and industrial flows, the updates to our current networks and WMFs are generally limited to asset renewal or ‘business as usual’ type augmentation works.

For our WMF’s, this may typically involve an aeration capacity upgrade, the creation of additional lagoon storage or the sourcing of additional irrigation type enterprises. These forecast network and WMF augmentations are included in our 20 Year Infrastructure program that will be considered for Pricing Submission 4.

In an exciting recent development, the EPA has approved the State’s first ‘WMF Environmental Offsets’ project at our Kilmore WMF. A summary of this concept is attached in Appendix 6. The Corporation now intends to pursue the concept for application at our Mansfield WMF.
The Corporation is always seeking beneficial reuse opportunities that will benefit the community and has recently approached the Councils in our region to start the discussion about possible Integrated Water Management initiatives, including water management of priority ‘community green assets’ during times of future potable water restrictions. This is further discussed in Section 2.2.

4.11 Water Efficiency & ‘Target Your Water Use’

Water efficiency has the potential to be a cost efficient and flexible method for managing demand to balance with available supply. Used optimally, demand management can defer investment in supply infrastructure to ensure the required level of service is met at the lowest possible cost to the community. This is particularly relevant for systems that have low supply reliability.

Through the development of the Urban Water Strategy, GVW is required to identify the optimum mix of supply options and demand management measures to maintain a balance between the demand for water and the available supply in our cities and towns now and into the future.

Goulburn Valley Water has developed a Water Conservation Strategy (see Appendix 5) that focusses on ‘sensible water use’ and the ‘efficient delivery and use of water’. Consistent with the State Government’s ‘Target Your Water Use Program’, the strategy does not contain specific water consumption targets, but offers a practical suite of key actions as follows:

1. Align the customer services interface and corporate communication and education material, enabling customers to act on water efficiency
2. Use water efficiency where effective to help meet GVW’s required level of service in the most cost efficient manner possible
3. Collaborate with councils, customers and stakeholders to facilitate action on water efficiency where appropriate
4. Identify opportunities that could result from relevant Integrated Water Management initiatives
5. Continue to focus on reducing non-revenue water loss from our water systems
6. Be part of the Regional Water Efficiency Program (Target Your Water Use) including:
   • The Water Minister announced on 1 December 2016, the reinvigoration of water efficiency programs across the State under the dual brands of Target 155 (for metropolitan Melbourne) and Target Your Water Use (for regional Victoria);
   • In the lead up to this announcement - two groups were formed (regional and metro) to plan the industry’s approach to water efficiency. GVW was involved in this.
   • Two plans were prepared - one for the metro (Target 155) and one for the regional (Target Your Water Use) approach to water efficiency. These plans contain elements that are common to businesses across the metro and regional areas -
while individual businesses also continue to progress initiatives that are unique to their regions.

- The program’s focus is on taking a longer-term view of water usage habits and providing customers better access to the information they need to make informed decisions about the amount of water they use.

- The program recognises that each water business faces a unique set of circumstances and a one size fits all approach does not work in all cases and that a diverse range of water sources and efficiency measures are needed to help ensure there will be enough water to meet all our needs now and into the future. GVW’s approach is articulated in the key actions noted.
5. ACTION PLANS

5.1 General

The assessment of options and development of an action plan to address any current or future shortfalls in the supply-demand balance for each water supply system was undertaken by Consultant GHD. The outcomes are documented in a report titled ‘2017 Urban Water Strategy – Supply and Demand Options Assessment’ (GHD, 2016).

A summary of the supply-demand balance, options considered and an action plan for each water supply system is included in this section of the Urban Water Strategy.

5.2 Brewery Creek System – Woods Point

5.2.1 Overview of Supply-Demand Balance

The town of Woods Point is supplied from Brewery Creek, with a supplementary supply from the Goulburn River immediately downstream of the confluence with Brewery Creek. Streamflow is not gauged upstream of the diversion points, making it difficult to quantify the supply reliability. The supply system has limited offstream storage, which means that streamflow needs to be sustained at a minimum threshold for diversions to occur. The reliability of the system is therefore related to the frequency and duration that flows fall below this threshold.

The current Bulk Entitlement (Woods Point) for Woods Point is 30ML per year.

The supply-demand balance for the Brewery Creek system is shown in Figure 5.1.

Figure 5.1: Supply-Demand Balance for the Brewery Creek System
Note: The line shown in Figure 5.1 titled ‘Baseline – Median CC’ represents yield under a medium climate change scenario. This term is used in all supply-demand balance figures in this section.

For Woods Point there is no difference between a low yield, median climate change or high yield scenario, as the Bulk Entitlement (Woods Point) is the limiting factor in all scenarios.

5.2.2 Demand and Supply Options

Preferred opportunities for reducing demand for the Woods Point system have been identified in accordance with GVW’s Water Conservation Strategy (GHD, 2016d) as follows:

- Promotion of water efficiency (incl. water efficient fittings and appliances) and Government rebates, and
- Minimise distribution system losses (average distribution losses are currently estimated at 32% of raw water demand, but have been around 11 to 22% over the five year period 2010/11 to 2014/15).

Hydrological analysis has shown that under a range of reductions in streamflow, the current average annual demand of 13 ML could be accessed at the required reliability. This demonstrates that the system exhibits a high degree of resilience to changes in streamflow.

5.2.3 Action Plan for the Brewery Creek System

Table 5-1 provides a summary of recommended actions for the Brewery Creek system.

Table 5-1: Summary of Actions for the Brewery Creek System

<table>
<thead>
<tr>
<th>Actions</th>
<th>Timeframe</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Term (2016-2025)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring of demand for departures from the baseline forecast</td>
<td>2017 +</td>
<td>N/A</td>
</tr>
<tr>
<td>Verify distribution system non-revenue losses and if real and economically justified implement program to reduce losses</td>
<td>2017 +</td>
<td>Not costed</td>
</tr>
<tr>
<td>Assess preferred opportunities for demand management</td>
<td>2017 +</td>
<td>N/A</td>
</tr>
<tr>
<td>Medium Term (2025-2040)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>As for short term</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Long Term (2040-2065)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>As for short term</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>
5.3 Delatite River System – Mansfield

5.3.1 Overview of Supply-Demand Balance

Raw water supply to the Mansfield system comprises a gravity transfer from the Delatite River to the 530 ML Ritchie Storages, followed by gravity and pumped transfer to the 45 ML No. 3 Reservoir. The capacity of off-stream storage was increased from 255 ML to 575 ML in 2008, providing increased security of supply during extended dry periods, and reducing the reliance on water restrictions for supply shortfalls.

The Bulk Entitlement (Mansfield) is 2,600ML over a two year period. The allowable diversion is zero when streamflow is below 18ML/day and has a stepped scale up to 4.4ML/day of diversion for River flows greater than 32.2ML/day.

A schematic of the Mansfield supply system is shown in Figure 5.2.

Figure 5.2: Schematic of Mansfield Supply System (Source: SKM, 2009a)

The current baseline demand for Mansfield is 575ML per year. The supply-demand balance for the Delatite River system is shown in Figure 5.3.
Figure 5.3: Supply-Demand Balance for the Delatite River System

5.3.2 Community Consultation

A shortfall in the supply-demand balance is predicted for Mansfield within the medium to long term.

A customer and community engagement has been undertaken based on the plan included in Appendix 1.

5.3.3 Demand and Supply Options

A shortfall in the supply demand balance is currently predicted in the medium to long term. Based on baseline demand and a medium climate change supply scenario, actions would need to be undertaken by 2039. Actions may need to be brought forward if higher demand or increased climate change scenarios occur.

It should be noted that there are no major customers, which limits opportunities for any significant stormwater harvesting or recycling schemes. GVW currently supplies recycled water to the Mansfield Golf Course.

A feasibility study for a third pipe recycled water scheme for new development was previously completed for Mansfield. The outcome of the study was that the scale of new development in Mansfield is not large enough for a third pipe scheme to be economically viable.

Supply side options can be implemented as follows:

- Design and construct new booster pump station on transfer pipeline (2039);
- Amend Bulk Entitlement (Mansfield) to increase daily extraction to 7.5ML/d (2039);
- Design and construct the first 200ML storage (2039);
The supply side options are shown in Table 5-2. Note that options which include additional storage will have new 400ML storages constructed in two separate stages.

<table>
<thead>
<tr>
<th>Description</th>
<th>Option F</th>
<th>Option G</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>New booster pump and additional storage</td>
<td>Raw water from Lake Eildon</td>
</tr>
<tr>
<td>Capacity (ML/d)</td>
<td>7.5</td>
<td>7.5</td>
</tr>
<tr>
<td>Capital Cost</td>
<td>$9.5M</td>
<td>$8.6M</td>
</tr>
<tr>
<td>Net Present Cost</td>
<td>$1.2M</td>
<td>$2.0M</td>
</tr>
<tr>
<td>Advantages</td>
<td>Retain existing pipe easements and operating rules</td>
<td>No storage required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Additional security as not reliant on stream flow</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>Pumping costs</td>
<td>Various approvals required for new extraction point</td>
</tr>
<tr>
<td></td>
<td>Amendment of BE</td>
<td>Pumping costs</td>
</tr>
<tr>
<td>TBL Rank</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Conclusion</td>
<td>Preferred Option</td>
<td>Not preferred as all costs upfront</td>
</tr>
</tbody>
</table>

The long term options considered will require a change to the Bulk Entitlement (Mansfield) diversion rate from 4.4ML/day to 7.5ML/day.

Diversions could however move to a winter fill arrangement where diversions would only be undertaken during months with highest flows in the Delatite River.

5.3.4 **Action Plan for the Delatite River System**

Table 5-3 provides a summary of recommended actions for the Delatite River system. The impact of implementing the action plan on the supply-demand balance is shown in Figure 5.4.
Table 5-3: Summary of Actions for the Delatite River (Mansfield) System

<table>
<thead>
<tr>
<th>Actions</th>
<th>Timeframe</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short Term (2016-2025)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring of streamflow and demand for departures from the baseline forecasts</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>Verify distribution system non-revenue losses and if real and economically justified implement program to reduce losses</td>
<td>2017+</td>
<td>Not costed</td>
</tr>
<tr>
<td>Assess preferred opportunities for demand management</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>Assess opportunities for stormwater harvesting in new developments</td>
<td>2017+</td>
<td>Not costed</td>
</tr>
<tr>
<td>Assess opportunities for water recycling projects from future growth</td>
<td>2017+</td>
<td>Not costed</td>
</tr>
<tr>
<td><strong>Medium Term (2025-2040)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As for short term</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Design and construct new booster pump station on transfer pipeline</td>
<td>2039</td>
<td>$0.4M</td>
</tr>
<tr>
<td>Bulk Entitlement (Mansfield) amendment to increase daily extraction limit to 7.5ML/d</td>
<td>2039</td>
<td>N/A</td>
</tr>
<tr>
<td>Design and construct second 200ML storage</td>
<td>2039</td>
<td>$2.8M</td>
</tr>
<tr>
<td><strong>Long Term (2040-2065)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As for short term</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Figure 5.4: Future Supply-Demand Balance for the Delatite River System
5.4 Upper Delatite River System – Merrijig and Sawmill Settlement

5.4.1 Overview of Supply-Demand Balance

The Upper Delatite River system supplies the townships of Merrijig and Sawmill Settlement. Water is diverted from the Delatite River by pumping. The bulk entitlement (Upper Delatite) is 235ML with allowable diversion commencing at a minimum river flow of 5ML/day, scaling up to a maximum of 2.8ML/day when the river flow is greater than 7.8ML/day.

The baseline demand is estimated to be 70ML per year.

The yield of the system is defined as the bulk entitlement diversion limit of 235ML. For the Upper Delatite River system there is no difference between a low yield, median climate change or high yield scenario, as the Bulk Entitlement (Upper Delatite) is the limiting factor in all scenarios.

The supply system has limited off stream storage and streamflow needs to be sustained above the minimum threshold for diversions. Analysis has shown that streamflows are predicted to fall below the diversion threshold in the order of once every twenty years for a duration of several weeks.

The most practical and economical method of addressing this potential risk of shortfall is through water cartage. This is possible due to the relatively small demand within the system and predicted low frequency of the need for water cartage.

The supply-demand balance for the Upper Delatite River system is shown in Figure 5.5, which shows that supply exceeds demand for the forecast period. Note that supply scenarios are represented by a single line (baseline – median cc), as the Bulk Entitlement (Upper Delatite) is the limiting factor for system yield.

Figure 5.5: Supply-Demand Balance for the Upper Delatite River System
5.4.2 Demand and Supply Options

There is currently no predicted shortfall in the supply-demand balance under any future scenarios.

Preferred opportunities for reducing demand for the Merrijig/Sawmill Settlement system have been identified in accordance with GVW’s Water Conservation Strategy (GHD, 2016d) as follows:

- Promotion of water efficiency (including water efficient fittings and appliances) and Government rebates, and
- Minimise distribution system losses (average distribution losses are currently estimated at 24% of raw water demand, but have been as low as 7% in 2014/15).

Given that there is currently no shortfall in supply at Upper Delatite, non revenue water reduction should only be undertaken if it is economically justified.

In the event that streamflows were to reduce below minimum diversion levels, water cartage could be used as a short term measure in extreme low flow years (estimated one year in twenty from water resource modelling) due to the low supply volumes required.

5.4.3 Action Plan for the Upper Delatite River System

Table 5-4 provides a summary of recommended actions for the Upper Delatite River system.

<table>
<thead>
<tr>
<th>Table 5-4: Summary of Actions for the Upper Delatite River System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actions</strong></td>
</tr>
<tr>
<td><strong>Short Term (2016-2025)</strong></td>
</tr>
<tr>
<td>Monitoring of streamflow and demand for departures from the baseline forecasts</td>
</tr>
<tr>
<td>Assess preferred opportunities for demand management</td>
</tr>
<tr>
<td>Water cartage during low flow periods.</td>
</tr>
<tr>
<td><strong>Medium Term (2025-2040)</strong></td>
</tr>
<tr>
<td>As for short term.</td>
</tr>
<tr>
<td><strong>Long Term (2040-2065)</strong></td>
</tr>
<tr>
<td>As for short term.</td>
</tr>
</tbody>
</table>
5.5 Regulated Goulburn System

5.5.1 Overview of Supply-Demand Balance

The Regulated Goulburn system is used to supply 18 towns. GVW holds two entitlements Bulk Entitlement (Goulburn River and Eildon - Goulburn Valley Water) Order 2012 and Bulk Entitlement (Goulburn Goulburn Channel System - Goulburn Valley Water) Order 2012. The entitlements give GVW a combined entitlement volume of 33,490ML. The supplies are secured by the arrangements outlined. The supply arrangements to each of the towns supplied from the Goulburn system are outlined below.

- Alexandra/Eildon/Thornton – Water is pumped from the Goulburn River to a water treatment plant and supplied to Alexandra, Eildon and Thornton. The Alexandra Bulk Entitlement is 916ML with a maximum diversion rate of 7.4ML/day. A separate 471ML Bulk Entitlement is also available at Eildon. This is amalgamated in Bulk Entitlement (Goulburn River & Eildon – Goulburn Valley Water) in 2012.

- Bonnie Doon – Water is pumped from Lake Eildon to a 55ML earthen storage. The Bulk Entitlement is 112ML, with a maximum diversion rate of 2.0ML/day. This is amalgamated in Bulk Entitlement (Goulburn River & Eildon – Goulburn Valley Water) in 2012.

- Colbinabbin – Water is pumped from the Waranga Western Main Channel into an earthen storage. The Bulk Entitlement is 89ML, with a maximum diversion rate of 1.0ML/day. This is amalgamated in Bulk Entitlement (Goulburn Channel System – Goulburn Valley Water) in 2012.

- Corop – Water is pumped from the Waranga Western Main Channel into an earthen storage. The Bulk Entitlement is 44ML, with a maximum diversion rate of 1.0ML/day. This is amalgamated in Bulk Entitlement (Goulburn Channel System – Goulburn Valley Water) in 2012.

- Dookie – Water is pumped from the east Goulburn main Channel into an earthen storage. The Bulk Entitlement is 160ML with a maximum diversion rate of 2.0ML/day. This is amalgamated in Bulk Entitlement (Goulburn Channel System – Goulburn Valley Water) in 2012.

- Girgarre – Water is diverted from Goulburn-Murray Water’s 12/9 channel. The Bulk Entitlement is 100ML with a maximum diversion rate of 2.0ML/day. This is amalgamated in Bulk Entitlement (Goulburn Channel System – Goulburn Valley Water) in 2012.
- Katandra West – Water is diverted from Goulburn-Murray Water’s 2/24 channel. The Bulk Entitlement is 64ML with a maximum diversion rate of 6.0ML/day. This is amalgamated in Bulk Entitlement (Goulburn Channel System – Goulburn Valley Water) in 2012.

- Kyabram – Water is diverted from a Goulburn-Murray Water channel. The Bulk Entitlement is 2,000ML with a maximum diversion rate of 10.0ML/day. This is amalgamated in Bulk Entitlement (Goulburn Channel System – Goulburn Valley Water) in 2012.

- Molesworth – A Bulk Entitlement has recently been developed which grants a 15ML Bulk Entitlement per year at a diversion rate not exceeding 0.25ML/day. This is amalgamated in Bulk Entitlement (Goulburn River & Eildon – Goulburn Valley Water) in 2012.

- Murchison – Water is pumped from the Goulburn River. The Bulk Entitlement is 350ML with a maximum diversion rate of 4.0ML/day. This is amalgamated in Bulk Entitlement (Goulburn River & Eildon – Goulburn Valley Water) in 2012.

- Nagambie - Water is pumped from Lake Nagambie. The Bulk Entitlement is 825ML with a maximum diversion rate of 9.0ML/day. This is amalgamated in Bulk Entitlement (Goulburn River & Eildon – Goulburn Valley Water) in 2012.

- Rushworth - Water is pumped from the outlet channel of Waranga Basin. The Bulk Entitlement is 530ML with a maximum diversion rate of 4.0ML/day. This is amalgamated in Bulk Entitlement (Goulburn Channel System – Goulburn Valley Water) in 2012.

- Shepparton/Mooroopna/Congupna/Tallygaroopna/Toolamba – Water is pumped from the Goulburn River at Shepparton. The combined Bulk Entitlement is 17,970ML. This is amalgamated in Bulk Entitlement (Goulburn River & Eildon – Goulburn Valley Water) in 2012.

- Stanhope – Water is diverted from Goulburn-Murray Water’s 1/12/9 channel. The Bulk Entitlement is 200ML with a maximum diversion rate of 6.0ML/day. This is amalgamated in Bulk Entitlement (Goulburn Channel System – Goulburn Valley Water) in 2012.

- Tatura – Water is diverted from Goulburn-Murray Water’s 3/5/6 channel. The Bulk Entitlement is 2,600ML with a maximum diversion rate of 33.0ML/day via three outlets. This
is amalgamated in Bulk Entitlement (Goulburn Channel System – Goulburn Valley Water) in 2012.

- Tongala – Water is diverted from Goulburn-Murray Water’s 28/9 and 16/28/9 channels. The Bulk Entitlement is 1,404ML with a maximum diversion rate of 6.0ML/day. This is amalgamated in Bulk Entitlement (Goulburn Channel System – Goulburn Valley Water) in 2012.

- Seymour/Avenel/Tallarook – Water is pumped from the Goulburn River at Seymour. The Bulk Entitlement is 5,340ML, with a maximum diversion rate of 30ML/day. This is amalgamated in Bulk Entitlement (Goulburn River & Eildon – Goulburn Valley Water) in 2012.

The current baseline demand for the Regulated Goulburn system is 21,367ML per year.

Analysis of consumption data for new residential connections since 2008 indicates that demand is expected to increase by 0.7% per annum on average over the planning period. Growth rates for residential connections have been derived with consideration to Victoria In Future (VIF2016) forecasts, with adjustments to reflect more recent growth rates in supply connections to individual towns. Residential demand represents about 49% of total demand. A key area of uncertainty within the demand forecasts relates to the estimation of consumption rates in new residential connections. Updated analysis has shown that consumption rates in new connections since 2013/14 are approximately 10 to 15% lower than rates for existing dwellings. It is assumed that this reduction is attributable to the type of dwelling being constructed, with these dwellings typically comprising more efficient water appliances within the house combined with a reduction in external water use due to reduced garden/lawn areas.

Industrial use represents about 35% of the total demand across the Goulburn System. This is largely located in the townships of Shepparton, Mooroopna, Tatura, and Tongala. There is large uncertainty associated with forecasting industrial usage as decisions by individual users can have a large impact on the demand volume. Current forecasts assume no growth in industrial usage.

The annual Regulated Goulburn system allocation is a direct ratio of current inflows relative to the 99th percentile historic inflows. By definition the bulk entitlement volume has an annual reliability of 99% as the reference 99th percentile inflow is adjusted periodically in line with the long term trend in climate and inflows.

The 99% reliability is assumed to be retained under climate change scenarios. A 100% allocation in at least 99% of years achieves the
required level of service target for moderate level restrictions no more frequently on average than 1 year in 10.

The yield from bulk entitlements held in the Regulated Goulburn system is therefore defined by the bulk entitlement which can be supplied at 99% reliability under all supply scenarios. A low yield scenario has been established based on transfer of Regulated Goulburn system water to the Regulated Murray system and the Sunday Creek system in dry years. The supply-demand balance for the Goulburn system is shown in Figure 5.6.

**Figure 5.6: Supply-Demand Balance for the Regulated Goulburn System**

5.5.2 Demand and Supply Options

A shortfall in the supply-demand balance is predicted in the long term under a low yield scenario which includes transfers to the Regulated Murray and Sunday Creek systems.

Carryover rules have been implemented in the Regulated Goulburn System which enables GVW to retain unused entitlement in any given year for potential use in subsequent years (subject to carryover rules). Carryover will provide a means to mitigate the risks associated with the gradual reduction of the buffer between demand and available supply.

In the long term, purchase of additional bulk entitlement may also need to be considered.

A number of demand management opportunities will be considered in the short term and implemented if they are economically justified. The likely opportunities include:

- Promotion of water efficiency (including water efficient fittings and appliances) and Government rebates;
- Free water audits for high demand users and major industrial customers;
• Minimisation of non-revenue distribution system losses (e.g. repair leaks).

The Alternative Water Atlas for the Shepparton, Mooroopna, Tatura and Kyabram systems will also be used to assess opportunities for the supply of alternative water (sources), and potential demands for alternative water (beneficial end users).

5.5.3 Supply Side Considerations

It is anticipated that up to 700 ML per year will be required to be transferred from the Goulburn system by 2040 to maintain system reliability in the GVW Murray system towns. Furthermore, annual requirements could vary by as much as 2,000 to 3,000 ML per year, depending on allocations in the Murray System.

In addition, the Broadford/Kilmore system requires about 1,000 ML per year on average from the Goulburn System at 2016, increasing to 2,000 ML per year on average by 2040.

Carryover rules have been implemented in the Goulburn Regulated System in recent years which enables GVW to retain unused entitlement in any given year for potential use in subsequent years. Whilst total water use in any year is still constrained to the bulk entitlement volume, carryover will provide a means to mitigate the risks associated with the gradual erosion of the buffer between the demand and entitlement volume, as demand increases and more water is used for substitution purposes in other towns.
5.5.4 **Action Plan for the Regulated Goulburn System**

The action plan for the Regulated Goulburn system is outlined in Table 5-5.

**Table 5-5: Summary of Actions for the Regulated Goulburn System**

<table>
<thead>
<tr>
<th>Actions</th>
<th>Timeframe</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short Term (2016-2025)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recognise the reduction in entitlement when substituting water to</td>
<td>2017</td>
<td>N/A</td>
</tr>
<tr>
<td>mitigate shortfalls in other towns (Regulated Murray and Sunday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creek System).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitor the implementation of carryover rules, and adjust GVW</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>internal allocation process as the understanding of risks improves.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assess preferred opportunities for demand management and opportunities</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>from the Alternative Water Atlas.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitor consumption rates in new residential connections.</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Medium Term (2025-2040)</strong></td>
<td>2025+</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Long Term (2040-2065)</strong></td>
<td>2040+</td>
<td>N/A</td>
</tr>
<tr>
<td>Consider purchasing additional entitlement from the Regulated Goulburn</td>
<td>2040-2065</td>
<td>Not</td>
</tr>
<tr>
<td>System to maintain a desirable buffer to protect against future risk</td>
<td></td>
<td>Costed</td>
</tr>
<tr>
<td>and uncertainty.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.6 Katunga Groundwater System – Katunga

5.6.1 Overview of Supply-Demand Balance

The Katunga water supply is sourced from the Katunga Deep Lead by two groundwater bores. The annual licensed volume is 110ML and the supply is located within the Katunga Groundwater Supply Protection Area.

The Katunga WSPA management plan is currently being reviewed and there will be some changes to use and allocation. Planned changes will see restrictions when the 5 year average groundwater recovery level to 25 metres below ground level or lower. Carryover rules may be introduced and 100% allocation be brought back after the 70% restriction for the last 5 years. History indicates that approximately 60% of the total water allocation is being used annually by licence holders. Past studies have indicated that the water supply is sustainable for the next 1000 years. It will just depend on how deep you have to go to access the water. In addition the current 20% loss on permanent water trading is expected to be removed, allowing 100% of water to be traded both permanently and temporarily.

The current baseline demand for Katunga is 51ML.

The supply-demand balance for the Katunga system is shown in Figure 5.7.

![Figure 5.7: Supply-Demand Balance for the Katunga System](image)

5.6.2 Demand and Supply Options

The baseline demand for Katunga (51ML) is currently similar to the low yield scenario (55ML).

Preferred opportunities for reducing demand for the Katunga system have been identified in accordance with GVW’s Water Conservation Strategy (GHD, 2016d) as follows:

- Promotion of water efficiency (incl. water efficient fittings and appliances) and Government rebates, and
Minimise non-revenue water distribution system losses (average distribution losses are currently estimated at 28% of raw water demand, but have been around 10 to 15% over the three year period 2012/13 to 2014/15).

Trading is permitted in the Katunga WSPA and GVW hold a 730 ML entitlement for the township of Strathmerton. The Katunga WSPA management plan however imposes a 20% entitlement reduction for permanent licence transfers. The point of extraction can also be moved and is subject to the same determination requirements as those of a licence transfer.

There is an underlying concern, although considered unlikely, that over-extraction of the aquifer may lead to water quality changes. The Katunga WSPA management plan incorporates a salinity monitoring program to assess for potential changes in water quality. It is anticipated that such monitoring would identify emerging salinity issues before significant water treatment would be required.

A key risk is that with climate change or increased frequency of dry years, the 5-year average recovery level is not met, possibly leading to further reduction or restrictions on annual entitlement.

### 5.6.3 Action Plan for the Katunga System

The action plan for the Katunga system is outlined in Table 5-6.

<table>
<thead>
<tr>
<th>Actions</th>
<th>Timeframe</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring of groundwater levels and salinity to identify potential reduction to annual entitlement</td>
<td>Ongoing</td>
<td>N/A</td>
</tr>
<tr>
<td>Verify distribution system non-revenue losses and if real and economically justified implement program to reduce losses</td>
<td>2017+</td>
<td>Not costed</td>
</tr>
<tr>
<td>Assess preferred opportunities for demand management</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>Temporary transfer of entitlement from Strathmerton to protect against low allocation years.</td>
<td>2017+</td>
<td>Not costed</td>
</tr>
<tr>
<td>Raw Water Bore No.1 Replacement</td>
<td>2017+</td>
<td>$0.4M</td>
</tr>
</tbody>
</table>

#### Short Term (2016-2025)

As for short term | N/A | N/A |

#### Medium Term (2025-2040)

As for short term | N/A | N/A |

#### Long Term (2040-2065)

As for short term | N/A | N/A |
5.7 Mollisons Creek System – Pyalong

5.7.1 Overview of Supply-Demand Balance

The Mollisons Creek system supplies water to Pyalong. Water is pumped from a weir pool on Mollisons Creek into a 40ML raw water storage basin. The Bulk Entitlement (Pyalong) is 75ML, with a maximum diversion rate of 0.72ML/day.

The available yield is less than the baseline demand under all supply scenarios considered.

The supply-demand balance for the Mollisons Creek system is shown in Figure 5.8.

Figure 5.8: Supply-Demand Balance for the Mollisons Creek System

The quality of streamflow is extremely variable with a large increase in salinity occurring immediately after rainfall periods as salt which has accumulated within pools is transported down the Creek. During drought conditions, Mollison Creek becomes more saline and often exceeds the current ADWG TDS limit of 500 mg/L. Operational practices aim to draw upon the better quality water, however this is not always possible. The practice may also mean that the expected reliability may not be realised.

For the 2018-2023 Pricing Submission period, GVW is planning to monitor salinity levels in Mollisons Creek and determine if future works to improve water quality are required.

Options to improve the supply-demand balance for Pyalong should consider their potential to improve water quality (reduce salinity) supplied to Pyalong customers.

As part of this options assessment, the water cartage rules configured in the Pyalong system model were revised to better match what happens in practice. Based on discussions with GVW, the cartage rules were revised as follows:
Daily cartage volume of 0.1 ML (or daily demand if this is less), with treated water carted directly to the reticulation system.

Water carting commences when storage drops below 7 ML and ceases when the storage level rises above 10 ML.

Based on the revised water cartage rules, the current climate baseline scenario was re-run, with the results showing a significant reduction in the volume and frequency of water carting. Figure 5.9 shows the storage trace for the Pyalong storage and system demand and supply sources, based on the revised operating rules and an average annual demand of 48 ML (the previously estimated yield level of demand). This shows that water is carted in only 10% of years, while for the four years that water was carted, the annual carted volume ranged between 2 ML and 3 ML.

The reduced cartage volume from the revised operating rules also resulted in greater and more frequent drawdown of the storage, which in turn resulted in more frequent restrictions due to the storage level dropping below the Stage 1 restriction curve. This resulted in reducing the annual reliability for the 48 ML demand from 90% to 65%, noting that there were no supply shortfalls.

Based on GVW’s acceptance that water cartage is now a standard (non-emergency) supply source for the Pyalong system, it was decided to adjust the restriction rule curves for the system to remove the storage buffer currently allowed for in the Stage 4 restriction curve. Each of the four restriction rule curves were lowered by a constant 6.575 ML, corresponding to the existing Stage 4 level in June. Based on the revised restriction rules, the current climate baseline scenario was re-run, resulting in the annual reliability for the 48 ML demand increasing from 65% to 80%. The adjusted Stage 1 and Stage 4 restriction curves and modelling results are shown in Figure 5.10, which is otherwise very similar to the existing restriction rule results shown in Figure 5.9.
5.7.2 Community Consultation

A shortfall in the supply-demand balance is predicted for Pyalong within the medium to long term.

A customer and community engagement has been undertaken based on the plan included in Appendix 1.
5.7.3 Demand and Supply Options

A shortfall in the supply demand balance is currently predicted in the short term.

The demand side options shown in Table 5-8 have been considered for Pyalong. It should be noted that there are no major customers, which limits opportunities for any significant stormwater harvesting or recycling schemes. There is currently no reticulated wastewater in Pyalong and therefore no opportunity for wastewater recycling.

Demand reduction options specific to the Pyalong system have been identified based on the overall GVW Water Conservation Strategy (GHD, 2016d), as follows:

- Promotion of water efficiency (incl. water efficient fittings and appliances) and Government rebates, and
- Minimise distribution system losses (average annual distribution losses are currently estimated at 13% of raw water demand).

GVW has previously assessed a range of supply augmentation options for the Pyalong system, addressing the supply security and/or water quality issues. The supply augmentation option assessments for the Pyalong system are detailed in GHD (2012 and 2010). The conclusions of the assessment (GHD, 2012) were that if water quality were taken into account, the preferred option was a pipeline from Tooborac, while if water quality was ignored, the preferred option was to do nothing. Overall, it was concluded that in the short to medium term, the most cost effective option is to continue carting water to the raw water storage, and continue to monitor demand for deviations from the forecast. If demand monitoring reveals that the actual demand is higher than the forecast over a sustained period, consideration should be given to construct the Tooborac pipeline for both supply security and water quality improvement.

For the short to medium term, GVW has adopted the recommended approach of continuing to cart water to the raw water storage, and monitoring demand for deviations from the forecast. Typical water carting costs are of the order of $400 per 20kL load, or $20k/ML.

5.7.4 Action Plan for the Mollisons Creek System

The below table provides a summary of priority actions for the Pyalong system required over the short to longer term. The recommended short to medium term action for Pyalong is to continue water carting and monitoring demand and supply, with the long term strategy of constructing a pipeline from Tooborac if monitoring reveals deviations from the demand or supply forecasts. The Tooborac supply would only be required to supplement the
Mollison Creek supply during periods of sustained low flow or when water quality is poor.

**Table 5-7: Summary of Actions for the Pyalong System**

<table>
<thead>
<tr>
<th>Actions</th>
<th>Timeframe</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short Term (2016-2025)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt revised restriction rule curves to reflect current operating</td>
<td>2017</td>
<td>N/A</td>
</tr>
<tr>
<td>rules for the system in regard to water cartage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring of streamflow and demand for departures from the baseline</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>forecasts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assess preferred opportunities for demand management</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>Water cartage during low flow periods</td>
<td>2017+</td>
<td>$20K/ML</td>
</tr>
<tr>
<td><strong>Medium Term (2025-2040)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As for short term</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Long Term (2040-2065)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tooborac pipeline and booster pump station</td>
<td>2040+</td>
<td>$2.1M</td>
</tr>
</tbody>
</table>
5.8 Regulated Murray System

5.8.1 Overview of Supply-Demand Balance

The Regulated Murray System supplies eight towns with a combined Bulk Entitlement (River Murray – Goulburn Valley Water) of 5,593ML. The supply arrangement for each of these towns is described below:

- **Barmah** – Water is pumped from the River Murray. The nominal Bulk Entitlement is 82ML with a maximum diversion rate of 1.2ML/day.

- **Cobram/Strathmerton/Yarroweyah** – Water is pumped from the River Murray at Cobram. The nominal Bulk Entitlement is 3,525ML, with a maximum diversion rate of 18ML/day.

- **Katamatite** – Water is diverted from Goulburn-Murray Water’s 7/3 channel. The nominal Bulk Entitlement is 84ML, with a maximum diversion rate of 1.0ML/day.

- **Nathalia** – Water is pumped from the Broken Creek. The nominal Bulk Entitlement is 652ML, with a maximum diversion rate of 5.1ML/day.

- **Numurkah/Wunghnu** – Water is pumped from the Broken Creek at Numurkah. The nominal Bulk Entitlement is 1,206ML, with a maximum diversion rate of 8.5ML/day. Future negotiation to amend the Bulk Entitlement (River Murray – Goulburn Valley Water) is to be undertaken to include the new offtake at Numurkah.

- **Picola** – Water is diverted from Goulburn-Murray Water’s 9/9/9 channel. The nominal Bulk Entitlement is 44ML, with a maximum diversion rate of 2.0ML/day.

The volume of water available annually under this bulk entitlement is allocated to GVW by the Northern Victorian Resource Manager in accordance with seasonal determination rules, and made available via allocation against high-reliability water shares. Although demand in the Regulated Murray system is approaching full utilisation of the Bulk Entitlement volume, no trading Regulated Goulburn system Bulk Entitlement (Goulburn River and Eildon – Goulburn Valley Water) is expected to be required based on the outcome of the UWS.

Demand is expected to increase by 0.3% per annum on average over the planning period. Growth rates for residential connections have been derived with consideration to Victoria In Future (VIF2016) forecasts, with adjustments to reflect more recent growth rates in supply connections to individual towns. Residential demand
currently represents about 31% of the total demand from the system.

Industrial use represents 52% of the total demand in the Murray system. Similar to the Goulburn System, industrial water use is assumed to remain unchanged over the planning period.

The supply-demand balance for the Murray system is shown in Figure 5.10. The system yield shown for the median climate change scenario is the yield at which the level of service target can be met.

**Figure 5.11: Supply-Demand Balance for the Regulated Murray System**

5.8.2 Demand and Supply Options

Industrial demand currently represents 52% of demand in the Regulated Murray system and is a potential area of uncertainty in demand forecasting.

Opportunities for reducing demand have been identified in accordance with GVW's Water Conservation Strategy (GHD, 2016d) with an assessment of their suitability for the Murray Regulated system:

- Promotion of water efficiency (incl. water efficient fittings and appliances) and Government rebates
- Free water audits for high demand users and major industrial customers, and
- Minimisation of non-revenue distribution system losses (eg. repair leaks).

The Alternative Water Atlas will also be used to assess opportunities for substitution of demand, particularly at public facilities.

5.8.3 Action Plan for the Regulated Murray System

The action plan for the Regulated Murray system is outlined in Table 5-8.
Table 5-8: Summary of Actions for the Regulated Murray System

<table>
<thead>
<tr>
<th>Actions</th>
<th>Timeframe</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short Term (2016-2025)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitor changes in industrial use as it represents a large proportion</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>of total demand, with zero growth assumed in forecasts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assess preferred opportunities for demand management and opportunities</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>from the Alternative Water Atlas.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfers from Goulburn system in low allocation years or if demand</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>exceeds the BE allocation</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Medium Term (2025-2040)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As for short term</td>
<td>2025+</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Long Term (2030-2065)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As for short term</td>
<td>2040+</td>
<td>N/A</td>
</tr>
<tr>
<td>Consider the purchase of additional entitlement from the Regulated</td>
<td>2040+</td>
<td>Not Costed</td>
</tr>
<tr>
<td>Murray System to reduce the reliance on annual transfers from Regulated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goulburn System bulk entitlements.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.9 Nine Mile Creek System – Longwood

5.9.1 Overview of Supply-Demand Balance

The Nine Mile Creek system supplies Longwood. Water is diverted from a 27ML on stream storage (Nine Mile Creek Reservoir). The Bulk Entitlement (Longwood) is 120ML, with a maximum daily diversion rate of 1.0ML/day.

Prior to January 2014, the reservoir was operated at a maximum supply level of 22 ML for dam safety reasons. Remediation works were completed throughout 2014 which now enables the reservoir to be operated at the full 27 ML capacity.

A stream flow monitor has been installed and is recording data at Nine Mile Creek that will reduce the uncertainty in water resource modelling for Longwood.

The current baseline demand for Longwood is 55ML per year.

The supply-demand balance for the Nine Mile Creek system is shown in Figure 5.12.

Figure 5.12: Supply-Demand Balance for the Nine Mile Creek System

5.9.2 Demand and Supply Options

Demand is expected to increase by 0.5% per annum on average over the planning period. Growth rates for residential connections have been derived with consideration to Victoria In Future (VIF2016) forecasts, with adjustments to reflect more recent growth rates in supply connections to individual towns. Residential demand currently represents about 55% of the total demand from the system.

The major area of uncertainty within the demand forecasts relates to maintaining the lower levels of non-revenue water, currently around 19% of raw water demand.
There are no major customers in Longwood, which limits opportunities for any significant stormwater harvesting or recycling schemes. There is currently no reticulated wastewater in Longwood and therefore no opportunity for wastewater recycling.

Non revenue water in the distribution system currently accounts for 14ML of demand in the baseline forecast. Leak detection programs have been undertaken in recent years which have reduced non revenue water from significantly higher levels. Leak detections programs should be continued in future if economically justified.

Preferred opportunities for reducing demand for the Longwood system have been identified in accordance with GVW’s Water Conservation Strategy (GHD, 2016d) as follows:

- Promotion of water efficiency (incl. water efficient fittings and appliances) and Government rebates
- Minimise non-revenue distribution system losses (average annual non-revenue distribution losses are currently around 19% of raw water demand).

Remediation works on the Nine Mile Creek Reservoir were completed throughout 2014, which now enables the reservoir to be operated at the full 27 ML capacity. With the system yield now secure, there are no supply augmentations proposed in the short to medium term. This position should be continually reviewed in light of potential climate change impacts or other impacts from development within the catchments upstream of the diversion point.

5.9.3 Action Plan for the Nine Mile Creek System

The action plan for the Nine Mile Creek system is outlined in Table 5-9.

<table>
<thead>
<tr>
<th>Table 5-9: Summary of Actions for the Nine Mile Creek System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actions</strong></td>
</tr>
<tr>
<td><strong>Short Term (2016 - 2025)</strong></td>
</tr>
<tr>
<td>Continued gauging of storage inflows to reduce uncertainty in current yield estimates.</td>
</tr>
<tr>
<td><strong>Medium Term (2025-2040)</strong></td>
</tr>
<tr>
<td>As for short term</td>
</tr>
<tr>
<td><strong>Long Term (2040-2065)</strong></td>
</tr>
<tr>
<td>As for short term</td>
</tr>
</tbody>
</table>
5.10 Seven Creeks and Mt Hut Creek System – Euroa and Violet Town

5.10.1 Overview of Supply-Demand Balance

A group of storages on the Seven Creeks and Mt Hut Creek, including Mountain Hut Creek Reservoir, Waterhouse Reservoir, Polly McQuinns Reservoir and Abbinga Reservoir harvest water which is then supplied to Euroa by gravity or through pumping. Treated water is transferred to Violet Town from Euroa. A schematic of the Euroa and Violet Town system is illustrated in Figure 5.12.

Figure 5.12: Schematic of the Euroa and Violet Town Water Supply System

The Bulk Entitlement (Euroa System) for Euroa and Violet Town is 1,990ML, with a maximum extraction rate of 12ML/day. The current baseline demand is 709ML per year.

The overall supply-demand balance for the Euroa system is shown in the following figure. The current annual demand exceeds supply, and augmentation options should be assessed.
5.10.2 Community Consultation

A shortfall in the supply-demand balance is predicted for the Euroa system within the medium to long term.

A customer and community engagement has been undertaken based on the plan included in Appendix 1.

5.10.3 Demand and Supply Options

Demand reduction options specific to the Euroa system have been identified based on the overall GVW Water Conservation Strategy (GHD, 2016d).

An assessment of potential savings in the Euroa system was made in GHD (2012). As part of this assessment, a review of high demand users in Euroa and Violet Town was undertaken. The review found that of the top 10 users all are non-residential with only one user, a poultry farm, using more than 1% of the total raw water demand. A number of demand reduction options were assessed, ranging from capital assistance for major users to free water audits.

The demand reduction assessment found that only one of the water efficiency measures (recycle WTP sludge supernatant) would make a discernible impact on the supply-demand balance for the Euroa system, while some options required significant financial contributions from GVW. Based on the results of this assessment, the following demand-side options are recommended for the Euroa system:

- Recycling of sludge supernatant at the Euroa Water Treatment Plant
promotion of water efficiency (incl. water efficient fittings and appliances) and Government rebates, and

- Free water audits for high demand users.

5.10.4 Alternative Water Options

Alternative water maps for Euroa and Violet Town are included in Appendix A, which identify and map opportunities for the supply of alternative water (sources), and potential demands for alternative water (beneficial end users). The following are key points from the assessment of alternative water options for Euroa and Violet Town:

- Stormwater harvesting has some potential to provide an alternative water source for new residential development in Euroa and Violet Town, which could be used as a substitute for potable demand:
  - For example, it is estimated that new residential development in Euroa will provide potential for stormwater harvesting of around 35 ML/yr by 2065

- Recycled wastewater also has significant potential to provide an alternative water source for new residential development in Euroa and Violet Town:
  - In a dry year (e.g. 2009/10), all available wastewater (i.e. after evaporation) from Euroa and Violet Town is currently recycled, with no discharge to rivers
  - With future growth however, it is expected that large volumes of wastewater will become available (even in dry years), which could be used for new recycling projects
  - For example, it is estimated that over 370 ML/yr of wastewater will be available for new recycling projects in Euroa by 2065
  - In Violet Town, it is expected that around 70 ML/yr of wastewater will be available for new recycling projects by 2065

- The Euroa WTP currently recycles backwash water

- A number of recreational facilities in Euroa and Violet Town already utilise alternative water sources:
  - The Euroa golf course sources recycled water from the Euroa WMF
  - The Violet Town golf course has its own water supply
  - While not strictly alternative water, sporting grounds in Euroa source irrigation water from a local groundwater supply.

Based on the 2012 GVW WSDS and a review completed as part of the 2016 GVW UWS, The preferred supply side option is to expand storage capacity at the existing Abbinga Reservoir site to 1,000ML. This would be achieved in two stages.
The first stage would involve the construction of a new 300ML storage. The second stage would involve reconstruction of the existing Abbinga Reservoir to a capacity of 700ML.

5.10.4 Action Plan for the Seven Creeks and Mt Hut Creek System

The action plan for the Seven Creeks and Mt Hut Creek system is shown in Table 5-10.

Table 5-10: Summary of Actions for the Seven Creeks and Mt Hut Creek System

<table>
<thead>
<tr>
<th>Actions</th>
<th>Timeframe</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short Term (2016-2025)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring of streamflow and demand for departures from the baseline forecasts</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>Assess preferred opportunities for demand management</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>Recycle WTP sludge supernatant</td>
<td>2017</td>
<td>$0.3 M</td>
</tr>
<tr>
<td>Construct new 300 ML storage and interconnecting pipework</td>
<td>2018</td>
<td>$5.8 M</td>
</tr>
<tr>
<td>Construct new offtake pump station and inlet pipeline on Seven Creeks (10 ML/d)</td>
<td>2018</td>
<td>$0.8 M</td>
</tr>
<tr>
<td>Replace Abbinga pump station</td>
<td>2018</td>
<td>$0.4 M</td>
</tr>
<tr>
<td>Increase Abbinga Reservoir Capacity to 700ML</td>
<td>2022</td>
<td>$4.6 M</td>
</tr>
<tr>
<td>Replace 3 km of Gooram pipeline (3 km x DN300)</td>
<td>2022</td>
<td>$2.7 M</td>
</tr>
<tr>
<td><strong>Medium Term (2025-2040)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As for short term</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Long Term (2040-2065)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As for short term</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
The impact of implementing the action plan on the supply-demand balance is shown in Figure 5.14.

**Figure 5.14: Future Supply-Demand Balance for the Seven Creeks and Mt Hut Creek System**
5.11 Seven Creeks System – Strathbogie

5.11.1 Overview of Supply-Demand Balance

The Seven Creeks (Strathbogie) system supplies the township of Strathbogie. Water is diverted from Seven Creeks by pumping.

A Bulk Entitlement (Strathbogie) for the Strathbogie system was granted to GVW in 2012. The Bulk Entitlement (Strathbogie) has a 23 ML annual entitlement limit and a daily diversion limit of 0.4 ML, with no specified passing flow requirements. While there are no passing flow requirements, the BE does contain a low flow threshold at which GVW must contact the Goulburn Broken CMA.

The baseline demand is estimated to be 16ML per year.

Historically, streamflow has been sufficient to maintain supply to the town, including the more recent drought period. Streamflow is not gauged upstream of the diversion point and therefore it is difficult to quantify the reliability of the flow in this stream. The supply system has limited offstream storage, which means that streamflow needs to be sustained at a minimum threshold for diversions to occur. The reliability of the system is therefore related to the frequency and duration that flows fall below this threshold.

The supply-demand balance for the Seven Creeks (Strathbogie) system is shown in Figure 5.15.

Figure 5.15: Supply-Demand Balance for the Seven Creeks (Strathbogie) System

5.11.2 Demand and Supply Options

Preferred opportunities for reducing demand for the Strathbogie system have been identified in accordance with GVW’s Water Conservation Strategy (GHD, 2016d) as follows:
• Promotion of water efficiency (incl. water efficient fittings and appliances) and Government rebates; and
• Minimise non-revenue water distribution system losses

Analysis has shown that the frequency of potential shortfalls are of the order of 1 in 20 years, with a duration of several weeks. This has led to the conclusion that the most practical and economical method of addressing the risk of shortfall is via water cartage, due primarily to the relatively small demand within the system.

5.11.3 Action Plan for the Strathbogie System

Table 5-11 displays an action plan for the Strathbogie system.

Table 5-11 Summary of Actions for the Strathbogie System

<table>
<thead>
<tr>
<th>Actions</th>
<th>Timeframe</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short Term (2016-2025)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring streamflow (quantity and quality) and demand for departures form the baseline forecasts.</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>Verify distribution system non-revenue losses and if real and economically justified implement program to reduce losses</td>
<td>2017+</td>
<td>Not costed</td>
</tr>
<tr>
<td>Assess preferred opportunities for demand management</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>Water carting in dry years if required</td>
<td>2017+</td>
<td>Not costed</td>
</tr>
<tr>
<td><strong>Medium Term (2025-2040)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As for short term</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Long Term (2040-2065)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As for short term</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
5.12 Steavenson River System – Marysville and Buxton

5.12.1 Overview of Supply-Demand Balance

The Steavenson River system supplies Marysville and Buxton from a diversion point on the Steavenson River. Water diversions are transferred by a gravity pipeline to the 100ML Aub Cuzens Reservoir. The Bulk Entitlement (Marysville) is 462ML per year with a maximum diversion rate of 2.0ML/day when river flows exceed 4.0ML/day.

Bushfires in 2009 resulted in severe impacts to the Steavenson River catchment. Analysis of the impacts of the bushfires on stream hydrology (SKM, 2009) estimated a potential reduction in runoff of between 30 to 40% by 2030. Gauging of the streamflow at GVW’s offtake on the Steavenson River is now available, providing the ability to monitor changes in streamflow. Annual climate variability and climate change are other factors which need to be considered in the context of changes to stream hydrology. This is considered in the water resource modelling for Steavenson River system.

Water resource modelling shows that at present, the yield of the system is not constrained by streamflow, but rather the bulk entitlement extraction limit. Therefore, the system yield is relatively insensitive to bushfire and climate change impacts.

Total demand for the system has reduced significantly since 2009, however demand is expected to increase steadily over the next 10 years as re-building works continue (noting that the rate of growth and the magnitude of demand are difficult to estimate). Future growth in demand will need to be monitored, as a rapid return to pre 2009 demand levels would substantially reduce system reliability and erode the ability of the system to absorb the potential reductions in streamflow from climate change and bushfires.

The supply-demand balance for the Steavenson River system is shown in Figure 5.16. It has been shown that supply exceeds demand for the forecast period. The yield of the system for all climate scenarios is defined as the bulk entitlement diversion limit of 462 ML.
5.12.2 Demand and Supply Options

There are no major customers in Marysville, which limits opportunities for any significant stormwater harvesting or recycling schemes. There may however be opportunities if any large scale developments are undertaken to rebuild properties. The Alternative Water Atlas should reflect any opportunities for alternative water supplies as part of the redevelopment of Marysville.

Preferred opportunities for reducing demand for the Marysville/Buxton system have been identified in accordance with GVW's Water Conservation Strategy (GHD, 2016d) as follows:

- Promotion of water efficiency (incl. water efficient fittings and appliances) and Government rebates
- Minimise non-revenue distribution system losses (average annual non-revenue distribution losses are currently around 57% of raw water demand).

Recycled water from the Marysville Wastewater Management Facility is currently supplied to the Marysville Golf Club.

Non revenue water in the distribution system currently accounts for 78ML of demand in the baseline forecast. Leak detection programs should be undertaken in future if economically justified.

Water resources modelling has shown that under a scenario involving a 40% reduction in streamflow, the Bulk Entitlement (Marysville) volume of 462 ML could be accessed at the required reliability. This demonstrates that the system exhibits a high degree of resilience to changes in streamflow.

Modelling also shows that the supply of annual demands greater than about 400 ML potentially results in the need for more severe
water restrictions during periods of water shortage; however, this is not expected to occur within the planning period.

### 5.12.3 Action Plan for the Steavenson River System

Table 5-12 displays an action plan for the Steavenson River system.

<table>
<thead>
<tr>
<th>Table 5-12 Summary of Actions for the Steavenson River System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actions</strong></td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td><strong>Short Term (2016-2025)</strong></td>
</tr>
<tr>
<td>Continued gauging of streamflow and assessment to monitor the progressive impacts from bushfires.</td>
</tr>
<tr>
<td>Assess preferred opportunities for demand management</td>
</tr>
<tr>
<td><strong>Medium Term (2025-2040)</strong></td>
</tr>
<tr>
<td>As for short term</td>
</tr>
<tr>
<td>Respond to impacts of bushfires and growth</td>
</tr>
<tr>
<td><strong>Long Term (2040-2065)</strong></td>
</tr>
<tr>
<td>As for short term</td>
</tr>
<tr>
<td>Respond to impacts of bushfires and growth</td>
</tr>
</tbody>
</table>
5.13 Sunday Creek System – Broadford and Kilmore

5.13.1 Overview of Supply-Demand Balance

The towns of Broadford, Heathcote Junction, Kilmore, Wandong and Waterford Park are supplied from the Sunday Creek system. Water is harvested and stored in the on stream Sunday Creek Reservoir which has a capacity of 1,700ML. Water may also be harvested from diversion weirs on Hazels and Harpers Creeks to Hollowback Reservoir. The bulk entitlement (Broadford, Kilmore and Wallan) is 2,875ML in any one year with a ten year average to not exceed 22,380ML. A flow of 4.3ML/day can be taken from the diversion weirs and 16.3ML/day from the storage.

The Broadford Water Treatment Plant (WTP) supplies Broadford, and Waterford Park. The Broadford WTP receives water from either Sunday Creek Reservoir by gravity or a pumped supply from the Goulburn River.

The Kilmore WTP supplies Kilmore, Heathcote Junction and Wandong. The Kilmore WTP receives water from Sunday Creek Reservoir and Hazel and Harpers Creeks via Hollowback Reservoir. A drought relief pump station can currently transfer 3ML/day of Goulburn River water from Broadford to Kilmore via Sunday Creek and Hollowback Reservoirs.

A schematic of the Sunday Creek supply system is shown in Figure 5.17.
Demand in the Broadford-Kilmore system is expected to increase by 2.5% for the next 50 years. Growth rates for residential connections have been derived with consideration to Victoria In Future (VIF2016) forecasts, with adjustments to reflect more recent growth rates in supply connections to individual towns. Residential demand equates to about 68% of the total demand from the system, with less than 100 ML/a of industrial demand.

The overall supply-demand balance for the Broadford-Kilmore system is shown in Figure 5.18, showing that demand exceeds supply in around 2020. It is noted that the yield of the system is based on the current operating rules, which have been optimised for current levels of demand. Under these rules, water is transferred from the Goulburn River to Sunday Creek Reservoir when reservoir levels fall below an assumed operating trigger over the summer period (October to April). When the reservoir levels fall even lower, transfers from the Goulburn River to Sunday Creek Reservoir can be made at any time.

GVW intends to meet any future shortfall from the local system with water diverted from the Goulburn River under the existing Bulk Entitlement (Goulburn River and Eildon – Goulburn Valley Water). Therefore, from a resource perspective, the Broadford/Kilmore...
system is secure for the next 50 years. The major risk that existing for the system relates to the ability to operate and deliver the available water to achieve GVW level of service objectives.

The current baseline demand for the Sunday Creek system is 1,571ML per year. A high growth rate, particularly at Kilmore, is currently being experienced and is expected to continue in future due to the proximity of towns in this system to Melbourne.

The current yield for this system is based on Broadford being supplied from the Goulburn River when Sunday Creek Reservoir falls below 80% of capacity. Future shortfalls in the supply-demand balance can be addressed through diversion of additional water from the Goulburn River.

The supply-demand balance for the Sunday Creek system is shown in Figure 5.18.

![Supply-Demand Balance for the Sunday Creek System](image)

**Figure 5.18: Supply-Demand Balance for the Sunday Creek System**

### 5.13.2 Community Consultation

A shortfall in the supply-demand balance is predicted for the Broadford and Kilmore system within the medium to long term.

A customer and community engagement has been undertaken based on the plan included in Appendix 1.

### 5.13.3 Demand and Supply Options

A shortfall in the supply demand balance is currently predicted in the medium term.

Demand reduction options specific to the Broadford-Kilmore system have been identified based on the overall GVW Water Conservation Strategy (GHD 2016d).
An assessment of potential savings in the Broadford-Kilmore system was made in GHD (2012). As part of this assessment, a review of high demand users in Broadford and Kilmore was undertaken. The review found that the majority of high demand users are non-residential and only one user, Nestle, used over 1% of the total Broadford-Kilmore raw water demand during the 3 year assessment period. A number of demand reduction options were assessed, ranging from capital assistance for major users to free water audits.

The demand reduction assessment found that none of the water efficiency measures would make a discernible impact on the supply-demand balance for the Broadford-Kilmore system, while some options required significant financial contributions from GVW. Notwithstanding the results of this assessment, the following demand-side options are recommended for the Broadford-Kilmore system:

- Promotion of water efficiency (incl. water efficient fittings and appliances) and Government rebates
- Free water audits for high demand users and major industrial customers, and
- Minimise distribution system losses (average annual distribution losses are currently estimated at between 11% and 13% of raw water demand).

The demand side options which will have the most impact on deferring future supply side works are promotion of water efficient appliances and leak reduction in the distribution system. There may be opportunities from the Alternative Water Atlas that should be considered in the short term.

Demand side options on their own cannot address the medium to long term shortfall in the supply-demand balance.

Development of new operating rules for this system were considered as part of the supply side options. A new set of operating rules which maximise the use of Goulburn system water in dry years with existing infrastructure can defer the need for any augmentation until approximately 2027.

Short term works (pre treatment) will be required at the Broadford Water Treatment Plant to enable increased usage of Goulburn system water. The timing for these works will depend on actual peak day water demands. There is currently a large degree of uncertainty in peak day demand forecasts due to previous periods of water restrictions, changes to behaviour and recent above average rainfall years.

The long term supply side option to address future shortfalls is to construct infrastructure which can enable additional transfer of
water from the Goulburn system. The long term supply side augmentation will involve:

- Construction of a tank, pump station and interconnecting pipeline between Broadford and Kilmore. Purchase of land for the future tank at Kilmore should be undertaken in the short term to secure an appropriate site;

- Further augmentation of the capacity of the Broadford Water Treatment Plant to supply treated water to Kilmore.

5.13.4 Integrated Water Management Option

Alternative water maps for Kilmore and Broadford are included in Appendix A, which identify and map opportunities for the supply of alternative water (sources), and potential demands for alternative water (beneficial end users).

As the fastest growing urban centres within the GVW region, Kilmore and Broadford have significant potential for the development of alternative water supply, both as a substitute for existing potable water supply and as a new fit-for-purpose supply source. The following are key points from the assessment of alternative water options for Broadford and Kilmore:

- Stormwater harvesting has some potential to provide an alternative water source for new residential development in Kilmore and Broadford:
  - For example, it is estimated that new residential development in Kilmore will provide potential for stormwater harvesting of over 1,000 ML/yr by 2065
  - In Broadford, it is estimated that new residential development will provide potential for stormwater harvesting of around 200 ML/yr by 2065

- Recycled wastewater also has some potential to provide an alternative water source for new residential development in Kilmore and Broadford:
  - In a dry year (e.g. 2009/10), all available wastewater (i.e. after evaporation) from Broadford and Kilmore is currently recycled to farm land
  - With future growth, it is expected that additional wastewater will become available (even in dry years). However, a recent EPA approved Integrated Water Management project in Kilmore based on the ‘environmental offsets’ concept is expected to utilise additional recycled water from Kilmore growth and place it back into waterways for an enhanced Triple Bottom Line outcome.
  - In Broadford, it is expected that over 800 ML/yr of wastewater will be available for new recycling projects by 2065
• A number of recreational facilities in Broadford and Kilmore already utilise alternative water sources. For example:
  - The Broadford golf course uses stormwater and the Kilmore golf course uses water from council dams
  - The Kilmore Racecourse sources water from onsite dams.

A localised concept level Integrated Water Management option study has been previously undertaken (refer Appendix 7) and IWM solutions are currently not preferred for future servicing on the following basis:

• Higher cost than supply side augmentation only;
• It is based on the assumption that 75% of new properties can connect. This will be dependent on the location of new properties relative to the source of recycled water;
• The integrated water management options are not of sufficient magnitude to avoid the need for future supply side augmentation.

The feasibility of the integrated water management option should be reviewed any future updates considered in the context of the UWS.

5.13.5 Action Plan for the Sunday Creek System

The action plan for the Sunday Creek system is shown in Table 5-13.

Table 5-13: Summary of Actions for the Sunday Creek System

<table>
<thead>
<tr>
<th>Actions</th>
<th>Timeframe</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short Term (2016 - 2025)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring of streamflow and demand for departures from the baseline forecasts</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>Assess preferred opportunities for demand management</td>
<td>2017+</td>
<td>N/A</td>
</tr>
<tr>
<td>Assess opportunities for stormwater harvesting in new developments</td>
<td>2017+</td>
<td>Not costed</td>
</tr>
<tr>
<td>Assess opportunities for water recycling projects from future growth</td>
<td>2017+</td>
<td>Not costed</td>
</tr>
<tr>
<td>Broadford WTP Pre-Treatment</td>
<td>2017+</td>
<td>$7.8M</td>
</tr>
<tr>
<td><strong>Medium Term (2025-2040)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broadford-Kilmore Interconnection pipeline, pump station and Kilmore Tank</td>
<td>2028-2034</td>
<td>$16M</td>
</tr>
<tr>
<td><strong>Long Term (2030-2060)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As for short term</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Broadford WTP Augmentation</td>
<td>2040</td>
<td>$14M</td>
</tr>
</tbody>
</table>

The impact of implementing the action plan on the supply-demand balance is shown in Figure 5.19.

Figure 5.19: Future Supply-Demand Balance for the Sunday Creek System
5.14 Yea River System - Yea

5.14.1 Overview of Supply-Demand Balance

Water for the township of Yea is diverted via a pump from the Yea River. Bushfires in 2009 resulted in parts of the supply catchment upstream of the GVW’s offtake on the Yea River being burnt. Analysis of the impacts of the bushfires on stream hydrology (SKM, 2009) estimated a potential 5% reduction in runoff by 2030.

Streamflow analysis shows that historically, flows have been sustained well above the minimum flow thresholds that would constrain GVW’s ability to divert. To impact on security of supply, reductions in streamflow resulting from climate change would need to be well above the dry climate change reduction of around 40% by 2065.

Demand is expected to increase by 0.8% per annum on average over the planning period. Growth rates for residential connections have been derived with consideration to Victoria In Future (VIF2016) forecasts, with adjustments to reflect more recent growth rates in supply connections to individual towns. Residential demand currently represents about 61% of the total demand from the system.

The overall supply-demand balance for the Yea System is illustrated in Figure 5.20, which shows that supply exceeds demand for the forecast period. The yield of the system for all climate scenarios is defined as the bulk entitlement diversion limit of 438 ML.

**Figure 5.20: Supply-Demand Balance for the Yea System**
5.14.2 Demand and Supply Options

Preferred opportunities for reducing demand for the Yea system have been identified in accordance with GVW’s Water Conservation Strategy (GHD, 2016d) as follows:

- Promotion of water efficiency (incl. water efficient fittings and appliances) and Government rebates, and
- Minimise non-revenue distribution system losses (distribution losses are currently estimated at 16% of raw water demand).

Water resources modelling has shown that under a scenario involving a 40% reduction in streamflow, the Bulk Entitlement (Yea) volume of 438 ML could be accessed at the required reliability.

This demonstrates that the system exhibits a high degree of resilience to changes in streamflow.

5.14.3 Action Plan for the Yea System

The action plan for the Yea River system is shown in Table 5-14.

| Table 5-14: Summary of Actions for the Yea River System |
|-----------------|-----------------|-----------------|
| Actions | Timeframe | Estimated Cost |
| **Short Term (2016-2025)** | | |
| Monitoring of streamflow and demand for departures from the baseline forecasts. | 2017+ | N/A |
| Assess preferred opportunities for demand management | 2017+ | N/A |
| Maintenance to prevent the accumulation of silt at the pump intake | Ongoing | N/A |
| **Medium Term (2025-2040)** | | |
| As for short term | N/A | N/A |
| **Long Term (2040-2065)** | | |
| As for short term | N/A | N/A |
6. UNRESTRICTED SUPPLY TO CRITICAL PUBLIC ASSETS

A scenario involving the adoption of unrestricted supply to critical public assets was modelled for each water supply system. This scenario was created based on feedback received from the UWS Steering Committee.

The outcomes of this scenario were as follows:

- Unrestricted supply to critical public assets can currently be achieved for the Brewery Creek, Goulburn, Katunga, Longwood, Seven Creeks (Strathbogie), Steavenson River and Yea River systems without any impact on levels of service in the short to medium term;

- Unrestricted supply to the River Murray and Sunday Creek systems can currently be achieved provided that transfers are made in dry years from the Goulburn system;

- Unrestricted supply to critical public assets currently for the Delatite River (Mansfield) and Seven Creeks (Euroa and Violet Town) systems will potentially prolong periods of restrictions without supply side augmentations being brought forward;

- There is minimal supply to public assets in the Upper Delatite River and Mollisons Creek systems and unrestricted supply to critical public assets is unlikely to impact on service levels.

The adoption of unrestricted supply to critical public assets would potentially prolong periods of restrictions for two systems.

Further community consultation is being undertaken on this alternative service level as part of Pricing Submission 4 consultation. This initiative ties in with the establishment of Council informed ‘Priority Open Spaces’ as discussed in section 2.2.

7. ANNUAL WATER OUTLOOK

An Annual Water Outlook for each water supply system has been prepared to inform the future review and updating of the action plans developed in the UWS. The Annual Water outlook for each water supply system is located in Appendix 3.

The Annual Water Outlook and action plans will be reviewed and updated on a regular basis and will be submitted on 1 December each year as part of the Corporate Plan half-yearly performance report during the five-year implementation period of the UWS.

In addition to the development of the water security outlook for each water supply system, Drought Preparedness Plans (DPP’s) for each water supply system have been updated.
8. RECOMMENDATIONS

Recommendations have been developed to undertake actions to improve the supply-demand balance based on three separate timeframes (short term, medium term, long term).

The short term period covers the remainder of the Water Plan 3 period and the Pricing Submission 4 period. The medium and long term recommendations have the flexibility to be brought forward or deferred depending on the demand and supply scenarios which eventuate in future.

The following recommendations are made as a result of the GVW Water Supply Demand Strategy 2016 – 2065:

Short Term (2016-2023)

- Non-revenue water losses should be verified for a number of systems and programs implemented to reduce losses if economically justified (benefits outweigh costs);
- Assess opportunities from the Alternative Water Atlas;
- Implement demand management initiatives if they are economically justified (benefits outweigh costs);
- Continue existing streamflow monitoring programs to reduce uncertainty in water resource modelling;
- Recognise the need to transfer entitlement from the Goulburn system to mitigate shortfalls in other towns in future planning;
- Assess opportunities for water recycling projects from future growth
- Adopt water cartage as an infrequent (expected 1 in 20 years for short durations) measure to supplement supply for the Upper Delatite Diver system if streamflows fall below diversion limits;
- Recognise the reduction in entitlement when substituting water to mitigate shortfalls in other towns (regulated Murray and Sunday Creek System) for the Regulated Goulburn System;
- Monitor the implementation of carryover rules, and adjust GVW internal allocation process as the understanding of risks improves for the Regulated Goulburn System;
- Monitoring of groundwater levels and salinity to identify potential reduction to annual entitlement for the Katunga System;
- Temporary transfer of groundwater entitlement from Strathmerton to Katunga to protect against low allocation years;
- Adopt water cartage as a measure to supplement supply for the Mollisons Creek (Pyalong) system in dry years;

- Transfers from Goulburn system in low allocation years or if demand exceeds the BE allocation for the Regulated Murray system;

- Recycle Water Treatment Plant sludge supernatant water at Euroa;

- Construct a new 300ML off stream storage, interconnecting pipework and a permanent pump station on Seven Creeks for the Seven Creeks (Euroa and Violet Town) system;

- Reconstruct Abbinga Reservoir at Euroa and increase capacity to 700ML;

- Replace 3 km of Gooram pipeline (3 km x DN300) for the Seven Creeks (Euroa and Violet Town) system;

- Adopt water cartage as a measure to supplement supply for the Seven Creeks (Strathbogie) system in dry years;

- Construct pre-treatment works at the Broadford Water Treatment Plant to provide capacity for increased usage of Goulburn River water;

- Review the feasibility of an integrated water management option for Kilmore as part of the next update of the UWS;

- Undertake additional community consultation on adopting unrestricted supply to critical public assets as alternative service standards. This is being undertaken as part of the Pricing Submission 4 consultation.

- Enact the relevant actions of the Water Conservation Strategy, including those noted for each supply system in Section 5 of this report;

- Continue to engage with Councils, DELWP and other stakeholders regarding the development of regional IWM opportunities.

- Continue to engage with Councils to establish Priority Open Spaces and opportunities for enhanced water management during periods of restricted potable supply. This is to be completed in 2017/2018 and opportunities progressively explored.

**Medium Term (2023-2040)**

- Design and construct new booster pump station on transfer pipeline for the Delatite River (Mansfield) System.

- Bulk Entitlement (Mansfield) amendment to increase daily extraction limit to 7.5ML/d for the Delatite River (Mansfield) System.

- Design and construct second 200ML storage for the Delatite River (Mansfield) System.
• Construction of an interconnection pipeline, pump station and Kilmore Tank between Broadford and Kilmore.

**Long Term (2040-2065)**

• Consider purchasing additional entitlement from the Goulburn system to maintain a desirable buffer to protect against risk and uncertainty;

• Construction of a pipeline from Tooborac to Pyalong to supplement supply for the Mollisons Creek (Pyalong) system;

• Construction of an additional 20ML off stream storage for the Mollisons Creek (Pyalong) system;

• Consider purchasing additional entitlement from the Murray system to reduce the reliance on annual transfers from Goulburn system bulk entitlements;

• Broadford WTP Augmentation.
9. REFERENCES


APPENDIX 1 –

CUSTOMER & COMMUNITY ENGAGEMENT PLAN
APPENDIX 3 –
ANNUAL WATER OUTLOOKS
APPENDIX 4 –

DROUGHT PREPAREDNESS PLAN
APPENDIX 5 –

WATER CONSERVATION STRATEGY
APPENDIX 6 –

WMF ENVIRONMENTAL OFFSETS
APPENDIX 7 –
IWCM OPTION FOR KILMORE
APPENDIX 8 –

EASTBANK LAKE PRECINCT ENHANCEMENT PROJECT