REPORT:

Hamilton Integrated Water Management Plan

May 2020

Southern Grampians
SHIRE COUNCIL

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This project was undertaken in Hamilton, on Gunditjmara Country, and in Naarm (Melbourne), on the lands of the Kulin Nations.

We pay our respects to their elders, and the elders of all Aboriginal and Torres Strait Islander Peoples, past, present, and into the future.

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Abbreviations

Alluvium	Alluvium Consulting Australia Pty Ltd
BPEM	Best Practice Environmental Management
CMA	Catchment Management Authority
DELWP	Department of Environment, Land, Water and Planning

GL	Gigalitre
GHCMA	Glenelg Hopkins Catchment Management Authority
GPT	Gross pollutant trap
GSC	Great South Coast
Ha	Hectare
IWM	Integrated Water Management
LGA	Local Government Area
ML	Megalitre
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
PET	Potential Evapotranspiration
SDS	Strategic Directions Statement
SGSC	Southern Grampians Shire Council
SRW	Southern Rural Water
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total suspended solids
WSUD	Water sensitive urban design

1 Introduction

Integrated water management (IWM) has been defined as a "collaborative approach to water planning and management that brings together organisations with an interest in all aspects of the water cycle" (Department of Environment, Land, Water and Planning (DELWP), 2018). The process of developing an IWM plan includes identifying where the objectives of all water cycle stakeholders intersect to enable collaboration to identify opportunities and collectively leverage investment to optimise social, economic and environmental outcomes.

The IWM Plan for Hamilton is a strategic document that will guide Southern Grampians Shire Council (SGSC) to address water related environmental and social challenges so that Hamilton continues to be a great place to live, work and recreate.

The Hamilton IWM plan was identified as a priority project within the Great South Coast Region IWM Forum as summarised within the Great South Coast Region 'Strategic Directions Statement' (SDS). As well as setting out the water cycle context for each region, the SDS lists IWM opportunities identified through a collaborative process involving Council, Wannon Water, the Glenelg Hopkins Catchment Management Authority (GHCMA), Southern Rural Water (SRW) and DELWP.

This plan aligns with the vision, outcomes and objectives defined within the SDS to identify opportunities associated with Council's and stakeholders' direct areas of responsibility such as drainage, recycled water, stormwater quality, Council buildings and facilities, public open spaces and streetscapes. The plan focuses on the urban centre of Hamilton for the period 2020-2030. While there are references to the surrounding region and upstream catchments, the opportunities and actions focus on the urban environment.

1.1 Developing the plan

The following elements were critical to the development of this plan:

Engagement: This IWM Plan was informed through consultation with Council staff, agency stakeholders, SGSC Councillors and community members. Consultation focussed on the plan's vision, objectives and outcomes before collaboratively developing project opportunities. These opportunities will rely upon ongoing collaboration with Wannon Water, the GHCMA, SRW and DELWP. Engagement centred around two workshop sessions in November 2019 and February 2020, each with three separate sessions and audiences:

- SGSC staff, agency partners and Great South Coast Forum representatives
- SGSC councillors, and
- local community.

Clear vision, outcomes and objectives: The existence of a vision, outcomes and objectives as defined within the SDS was an advantage, providing initial momentum and clear direction for the group regarding the breadth and purpose of the plan.

System understanding: This included a collation of data and information to enable communication of critical system characteristics that led to the identification of issues and opportunities across:

- Potable and non-potable water supply networks
- Water consumption behaviour and end uses
- Stormwater quality and management and downstream impacts (including current and future land use)
- Natural and recreational values including Lake Hamilton, the Grange Burn, Grange wetlands, the 'Old Res' Community Parklands and the town's many open spaces.

1.2 Context

The Great South Coast SDS (IWM Forum, 2019)
The critical strategic document supporting this plan is the Great South Coast Region SDS. Prior to that work Chapter 5 (*Water's role in resilient and liveable cities and towns*) of *Water for Victoria* (DELWP, 2016) set out similar outcomes. The Great South Coast IWM Forum is one of nine regional Forums across Victoria. Their aim is to identify, prioritise and oversee the implementation of collaborative IWM opportunities.

The Great South Coast Region is characterised by moderate to low population growth across a number of small to medium sized towns, of which Warrnambool is the largest. The region is predominantly agricultural land with urban areas making up 0.2% by area. Climate change is identified as a key risk factor influencing temperature, rainfall and evaporation as well as sea level rise along the coast.

Wannon Water is leading IWM facilitation across the Great South Coast region to deliver upon the SDS vision:

Pareeyt Poondee-teeyt (Water is Life)

Pa poonteeyt paman (and life is sacred)

Water is life– we will work together with our communities to deliver integrated water outcomes contributing to the resilience of our environment, culture and economy.

The seven strategic outcomes within the SDS, that are discussed further below include:

1. Safe secure and affordable supplies in an uncertain future
2. Effective and affordable wastewater systems
3. Avoided or minimized existing and future flood risks
4. Healthy and valued waterways and marine environments
5. Healthy and valued landscapes
6. Community values reflected in place-based planning
7. Jobs, economic growth and innovation.

The SDS also highlights targeting low emissions solutions as an important aspect of identified opportunities.

Southern Grampians Shire Council (SGSC)
SGSC has prepared strategies and plans that provide some context for water management within the Shire and for this plan specifically. The following briefly summarises where this IWM Plan intersects with existing Council strategies.

Council Plan (2017 – 2021) sets out Council's priorities including "*Promot(ing) our Natural Environment"*, that states Council's wish to "promote a culture that supports a clean, green and sustainable environment". Objectives under this theme are to:

- promote and support improved biodiversity and the health of waterways, wetlands, soil and air
- balance environmental protection with Council's support for growth
- promote and provide sustainable waste management services
- develop and implement climate change adaptation strategies to prepare for climate change, especially extreme events.

Economic Development Strategy (2011-2021) outlines a framework for Council to support economic development in the Shire with a focus on supporting liveability and amenity within Hamilton. The document highlights the link and importance of good water management to sustainable economic development.

Hamilton Structure Plan (2011): Presents a vision for Hamilton as "*a liveable, beautiful, progressive, well planned and sustainable city".* It also highlights priorities such as service provision for the surrounding region, connection to that region and the value that Hamilton provides to agricultural and other economic activities.

Grange Burn Masterplan (2005): Outlines the waterway's condition with recommendations for the Grange Burn below the Lake Hamilton Spillway to Digby Road. Issues identified significant infestations of exotic weeds, which blocked views of the river from the path and choked the in-stream environment as well as point source pollution from stormwater outlets. Since this report, progress on these points has been made, particularly on improving habitat and amenity values.

Lake Hamilton Action Plan (2012): This study responded to recurring incidents of blue green algae and *E.coli* leading to restriction of recreational activities on the lake. The conclusions suggest a large load of nutrients entering the lake in surface runoff, with a store of nutrients in the lake sediment itself. The study presented short to medium term options that were generally seen as expensive or posing risks to the downstream environment.

It was found that long term management options would be required with key recommendations including stormwater treatment swales to treat the local urban catchment, supporting the aquatic macrophytes in the Lake, and reducing nutrient inputs from the Grange Burn with large scale catchment management and an upstream wetland. GHCMA has been implementing a catchment management program, and SGSC has constructed treatments for some of the urban catchment.

CBD revitalisation plan: A CBD revitalisation plan was identified as part of the Hamilton Structure Plan focussing on the area around Melville Oval to Gray St between Thompson St and Brown St. The master planning process was guided by input from community, businesses, and government through stakeholder workshops and written submissions. The plan will guide improvements to access and linkages, public spaces, landscaping and parking. These works will enhance the quality, connectivity and character of the CBD and with it the local economic activity and services.

Sustainable Water Use Plan (2006): The plan assessed the Shire's water use (volume) and identified ways to reduce this into the future with a 20% reduction target over a 10-year period. Objectives of the plan included alleviating stress on local water resources and becoming a community leader in sustainable water use. The plan was developed collaboratively being led by Wannon Water in partnership with nearby councils. Actions focused on auditing water use to identify efficiencies, investigating technological improvements and alternative water sources, educating council staff and the local community on the importance of saving water as well as ways to achieve this.

Sustainability Strategy (2010): The strategy presents a mission to have "Everyone working co-operatively to develop an environmentally responsible and sustainable Shire: a great place to live, work and visit". The strategy was developed around five key themes: land, water, waste, liveability, and climate. Twenty six "management objectives" were identified along with prioritised supporting actions.

Under the water theme, the objectives were conservation, quality, behavioural change and capacity building, increased re-use of stormwater, sewerage/grey water treatment, and enhancement of significant waterways and wetlands. There are linkages between the other themes and IWM in the interconnection between land and water management and the ways that IWM supports liveability and adaptation to climate change.

Climate Change Adaption plan (2017 – 2027): The plan outlines priority risks and actions over the ten year period to ensure Council is responding and adapting to the impacts of climate change. The plan acknowledges the importance of a shared responsibility and is committed to organisational partnerships in the community, across the region and with all levels of government.

Action 2 of the Climate Change Adaptation plan is to "Develop and deliver an Integrated Water Plan" and the actions within that plan have been considered here on the role of water in building climate resilience within Hamilton.

Partner organisations
SGSC has worked closely with Wannon Water, GHCMA and SRW throughout the development of this plan. Two key documents that have been referred to include:

- **Wannon Water Urban Water Strategy (2017-65)** that describes the Grampians system that supplies water to Hamilton, as well as considering future supply and demand scenarios over the next 50 years. The plan identifies a combination of medium term (0-5 years) and long term (5-50 year) measures to maintain a balance between demand and supply of urban systems currently and into the future. The strategy shows water supply in the region is generally reliable and measures to increase supply to Hamilton are not immediately required. The plan does however highlight the potential risks that climate change, through a reduction in streamflow, presents to Hamilton in the medium and long term. Through this report and past works, Wannon Water have expressed their commitment to IWM as part of a broader approach to servicing townships like Hamilton.

- **Glenelg Hopkins Regional Catchment Strategy (2013-19)** This is the primary planning framework for land, water and biodiversity management within the Glenelg Hopkins region. It sets the direction for how the region's land, water and biodiversity resources should be managed and is an important building block in improving the condition of those resources over time (GHCMA website). It takes an asset based approached that defines Thematic Asset Classes and Objectives (20-years), Management measures (6-years) and Action plan for each asset class.

  From the Hamilton perspective, GHCMA has been intrinsic in driving waterway improvements along Grange Burn through revegetation and weed removal works, supported by the Grange Burn Waterway Action Plan (WAP) in 2012.

2 Hamilton's social and biophysical context

2.1 Location

Hamilton is the largest town in Southern Grampians Shire, located in Western Victoria on the traditional lands of the Gunditjmara People. Hamilton is a regional and commercial hub at the junction of five major roads as well as being a gateway to the southern sections of the Grampians National Park or Gariwerd (Figure 1). The town is situated on the beloved and highly valued Grange Burn, a tributary of the Wannon River in the Glenelg catchment. Hamilton has a rich agricultural history with wool driving the growth and wealth of the town and region. This is highlighted by 'Sheepvention', an annual sheep and wool convention that draws about 20,000 people to Hamilton annually. Education is also a prominent activity with four secondary schools educating those from across the region.

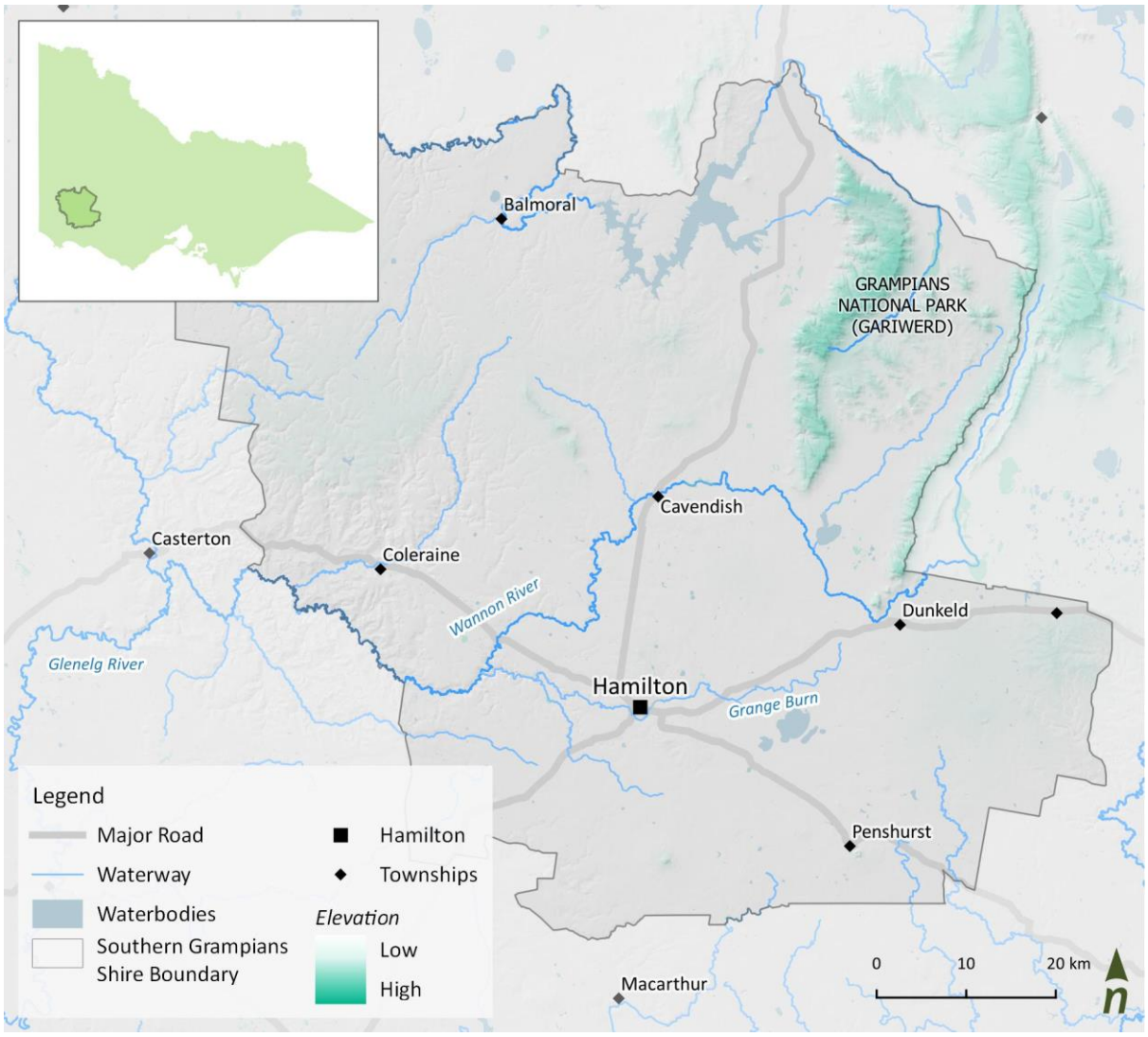


Figure 1. *Hamilton location plan*

Figure 2 highlights the study area for the IWM plan that includes the urban and peri-urban areas of Hamilton. The plan shows the course of the Grange Burn and Lake Hamilton, a significant man-made water body to the east of the town centre.

Figure 2. *The study area is focused on the Hamilton township*

2.2 Population

Hamilton has approximately 8,900 residents living within the study area (2016 Census, Hamilton UCL). This represents over half of the Shire's total population of about 16,000. Population in the Shire is predicted to decline slightly over time with Figure 3 illustrating the anticipated population trend for Hamilton and the Shire out to 2036.

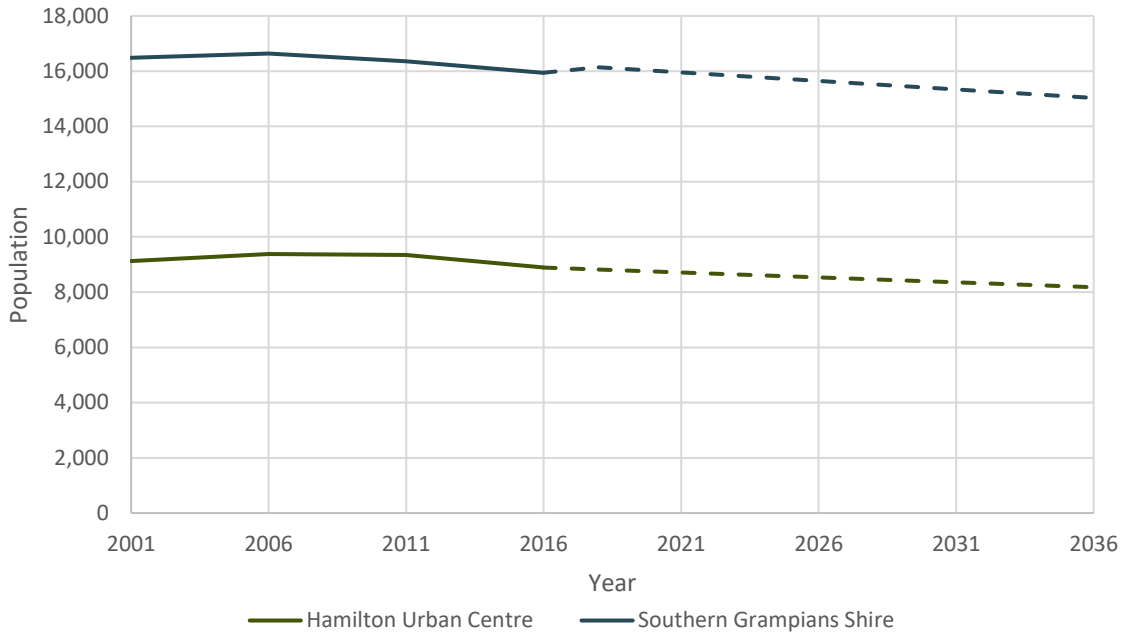


Figure 3. *Population in Hamilton township and Southern Grampians Shire (Census record + DEWLP forecast)*

2.3 Climate

Hamilton has a cool oceanic to warm temperate climate, with a wet, cool winter and a warm, dry summer. Figure 4 shows average monthly rainfall and temperature. Historically, average annual rainfall has been approximately 600mm with relatively reliable winter rains amongst annual variability of rainfall (Figure 5).

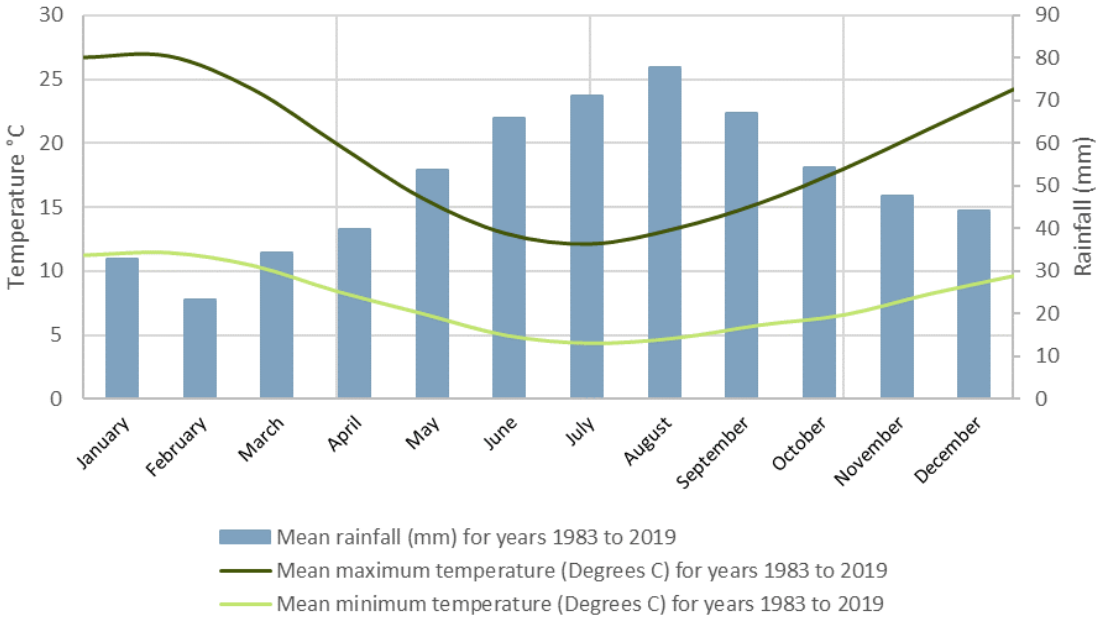


Figure 4. *Monthly average temperature and rainfall at Hamilton Airport, 1983-2019 (Bureau of Meteorology)*

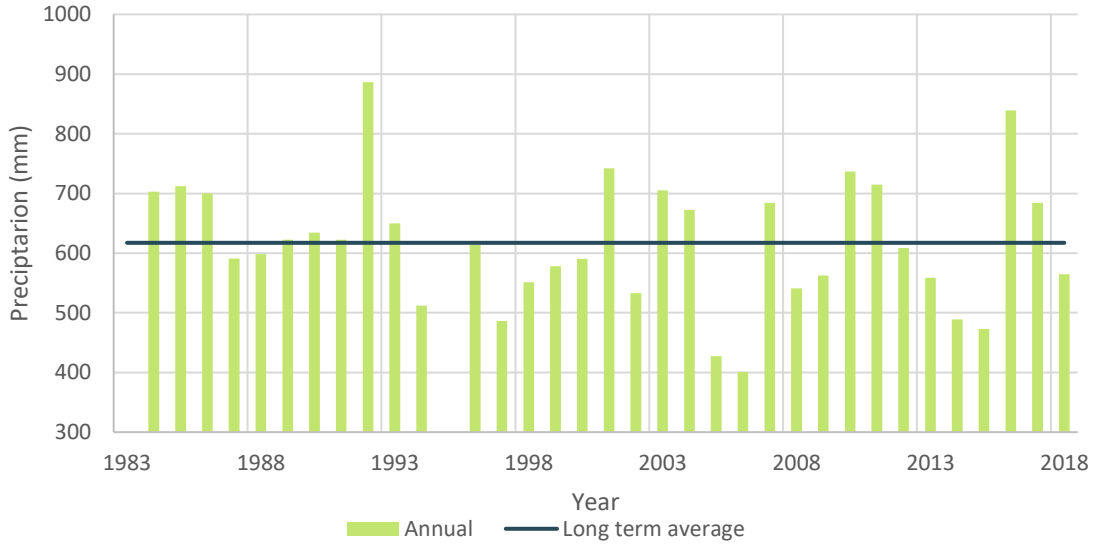


Figure 5. *Yearly rainfall and long-term average (Hamilton Airport)*

Climate change

Climate change is a significant driver behind the preparation of IWM plans across Victoria. Reduced rainfall and increased temperature and evaporation will impact the reliability of surface water supplies across the state, as well as impacting upon the condition of natural assets like waterways and wetlands. Further, the amenity of Hamilton will be impacted if open spaces and urban streetscapes cannot be maintained, with healthy vegetation and shade during hotter, drier periods.

DELWP's *Guidelines for Assessing the Impact of Climate Change on Water Supplies (2016)* sets out anticipated changes in temperature, rainfall and runoff at 2040 and 2065 for metropolitan and rural catchments. The projected impacts on the Glenelg River Basin are summarised in Table 1*. What is perhaps most notable is the significant reduction in average annual runoff that is anticipated under a high climate change scenario (~60%).

Table 1. *Estimated changes relative to current climate baseline in the Glenelg River Basin (Source: DELWP, 2016)*

	Change relative to baseline	
Criteria	**2040**	**2065**
Temperature change (˚C)		
10th percentile (low)	0.8	1.6
50th percentile (medium)	1.1	2
90th percentile (high)	1.4	2.6
Potential evapotranspiration. 1975-2014 average: 1157 mm / year		
10th percentile (low)	2.60%	5.00%
50th percentile (medium)	3.80%	6.70%
90th percentile (high)	5.70%	10.10%
Rainfall. 1975 – 2014 average: 655 mm / year)		
10th percentile (low)	1.20%	1.40%
50th percentile (medium)	-5.00%	-8.40%
90th percentile (high)	-12.70%	-21.70%
Average annual runoff (mm) 67 (1975 – 2014 average)		
10th percentile (low)	7.60%	-3.40%
50th percentile (medium)	-13.60%	-31.40%
90th percentile (high)	-37.30%	-60.80%

** Please note that the figures above are for the whole Glenelg River Basin and not specifically Hamilton.*

2.4 Land use

At Hamilton's heart is the commercial and retail centre, surrounded by residential land, open spaces and parkland. Hamilton is well served by green and blue spaces including Lake Hamilton, the Grange Burn, Pedrina Park and the nearby Community Parklands and bandicoot reserve, Hamilton Botanic Gardens and a number of smaller parks and gardens throughout the town.

The town is surrounded by agricultural land, being historically sheep and pasture and recently with increasing areas of plantation forestry and horticulture. Hamilton has a rural interface of low density and rural living and rural industrial zones including nurseries, agricultural supplies and the livestock exchange to the south west of the town centre.

The relevance for this plan will be opportunities to retrofit the urban landscape when renewals occur and also how additional stormwater coming from new developments is managed to protect the downstream environment.

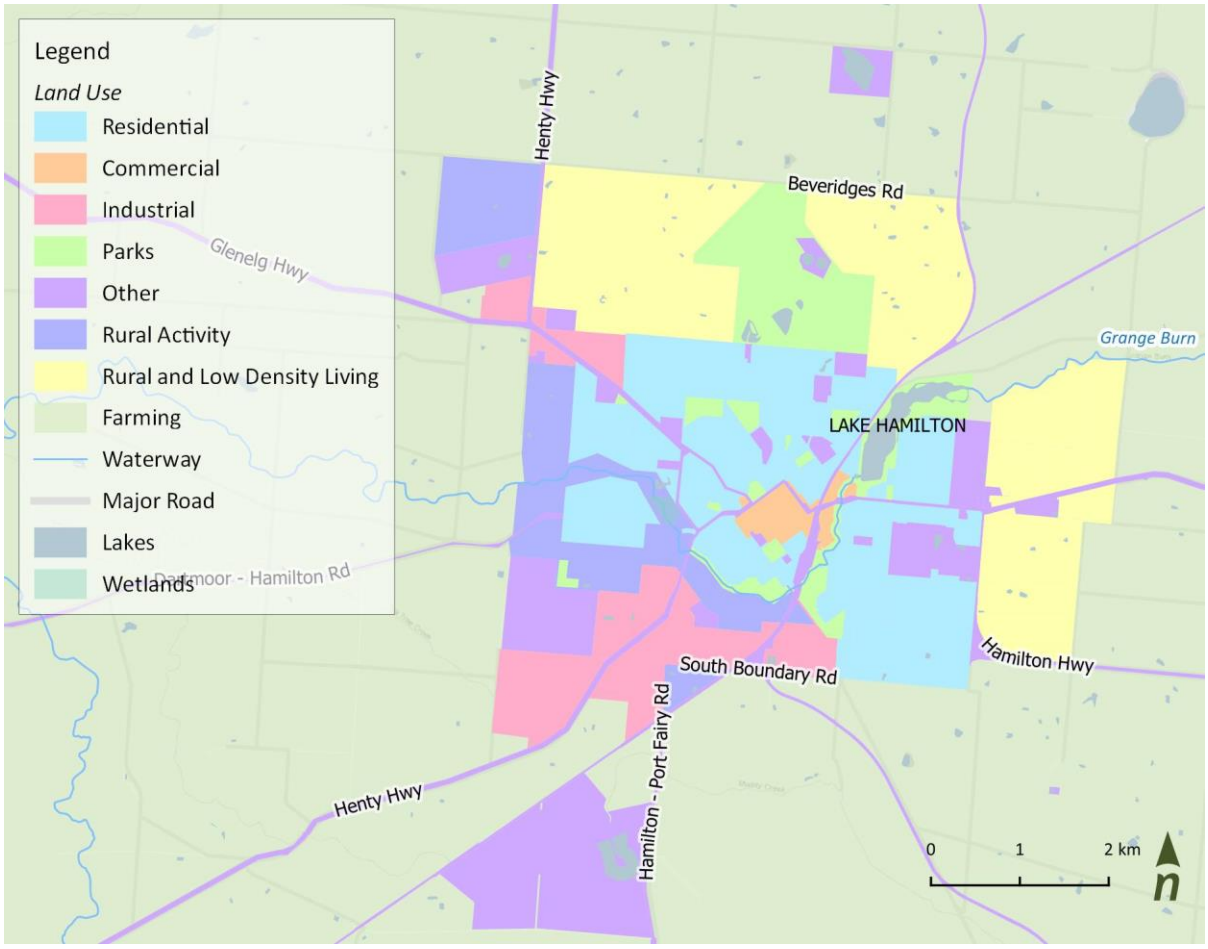


Figure 6. *Township land use*

2.5 Catchments, waterways, lakes and wetlands

The Grange Burn is Hamilton's main waterway, a tributary of the Wannon River that flows through Lake Hamilton, an artificial lake to the east of town created in 1977. It represents a critical recreational and community asset and although substantially modified since European colonisation, the Grange Burn supports a range of native flora and fauna. Substantial weed removal (particularly of woody weeds) and revegetation works have improved the quality of riparian reaches primarily through the '*Grange Burn Restoration Project*', a collaboration between SGSC, GHCMA and Wannon Water to remove pest species, create habitat corridors, improve biodiversity and river health and enhance recreational uses.

The project has also supported a traditional garden with interpretive signage that was established with Gunditj Mirring Traditional Owners Corporation and Windamara Aboriginal Corporation. The river provides valuable habitat for threatened native fish including the endangered Variegated Pygmy Perch, Little Galaxias and Glenelg Spiny Crayfish. It also supports one of the district's healthiest platypus populations and has locations for platypus viewing (The Spectator, 2017; and Glenelg Hopkins CMA, 2017).

Lake Hamilton is also an important recreational asset hosting rowing, fishing and boating as well as walking, running and cycling around its edge. Lake Hamilton experiences blue green algae blooms that impacts utility and enjoyment. Numerous reports and action plans have examined this finding contributing causes to include shallow depth, excess nutrients in urban and rural runoff, high residence time, a degraded riparian corridor upstream and stock accessing waterways (*per comms*).

The 14 Ha Grange Burn Wetland was constructed from grazing land and now treats 70% of Hamilton's stormwater before it enters the Grange Burn. This has reduced litter and dissolved pollutants as well as providing valuable habitat for birds. The Old Hamilton Reservoir, or "Old Res", is an open waterbody that, as well as providing a non-potable water source to the town, is the site of the unique Hamilton Institute of Rural Learning Bandicoot Enclosure with walking trails throughout the enclosure.

The protection of Hamilton's natural assets noted above to enhance their social, recreational and ecological values is central to this plan.

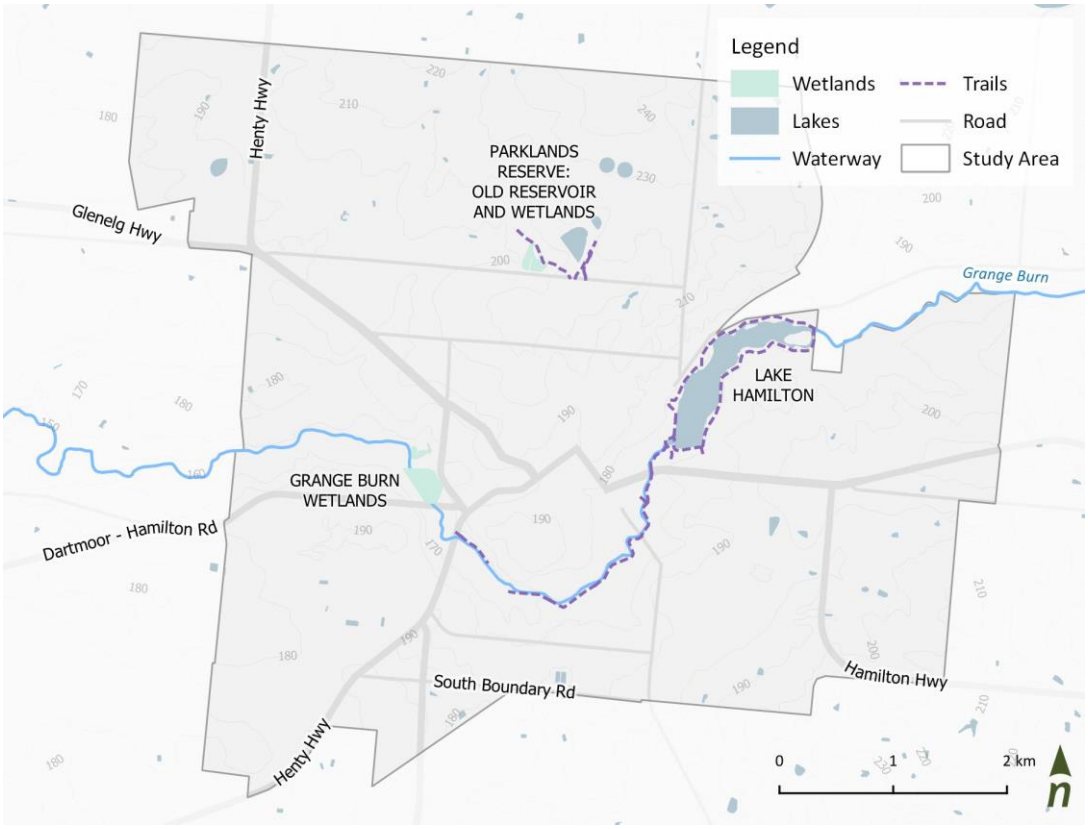


Figure 7. *Waterways, lakes and wetlands in Hamilton*

2.6 Flooding

A 2012 flood study conducted by Cardno for GHCMA determined the 1% AEP flood extents for the Grange Burn floodplain and minor tributaries (see Figure 8). Some riverine flooding from the Grange Burn and other tributaries can be observed in urban areas downstream of Lake Hamilton, while the report also notes the occurrence of some flash flooding following intense rainfall events. The report recommended updating flooding and land subject to inundation overlays, building additional levee walls and additional monitoring.

The largest recorded flood in Hamilton occurred in 1946 with eight inches (or about 200mm) falling across the weekend of the 16th and 17th of March with a reported 60-70 people left homeless (The Age, Mon 18 April, 1946). More recently, in 2016 an evacuation warning was issued for 45 homes along Grange Burn near Apex Park (abc.net.au, Accessed May 2020).

While flooding is a relevant element of the urban water cycle in Hamilton, the subject is relatively well covered by existing Council and State Emergency Services (SES) plans and processes.

Figure 8. *Map of 20% and 1% AEP flood overlays for Hamilton (Cardno, 2012)*

2.7 Natural values, health and well being

Hamilton's natural assets are highly valued and directly contribute to the health and wellbeing of locals and the reason tourists visit the town. Figure 9 from the Shire's Economic Development Strategy illustrates the conceptual link between water and physical and mental wellbeing (SGSC, 2011).

These natural assets and spaces contribute to what is broadly referred to as liveability. Visually beautiful and ecologically valuable they support physical health by delivering active recreation opportunities like rowing, 'parkrun', walking and cycling. In a 2018 survey more than 9/10 respondents said they participated in sport, recreation or physical activities at least once in the past 12 months. Most of the popular activities made use of the publicly available open space and natural assets (SGSC Recreation and Leisure Plan, 2019).

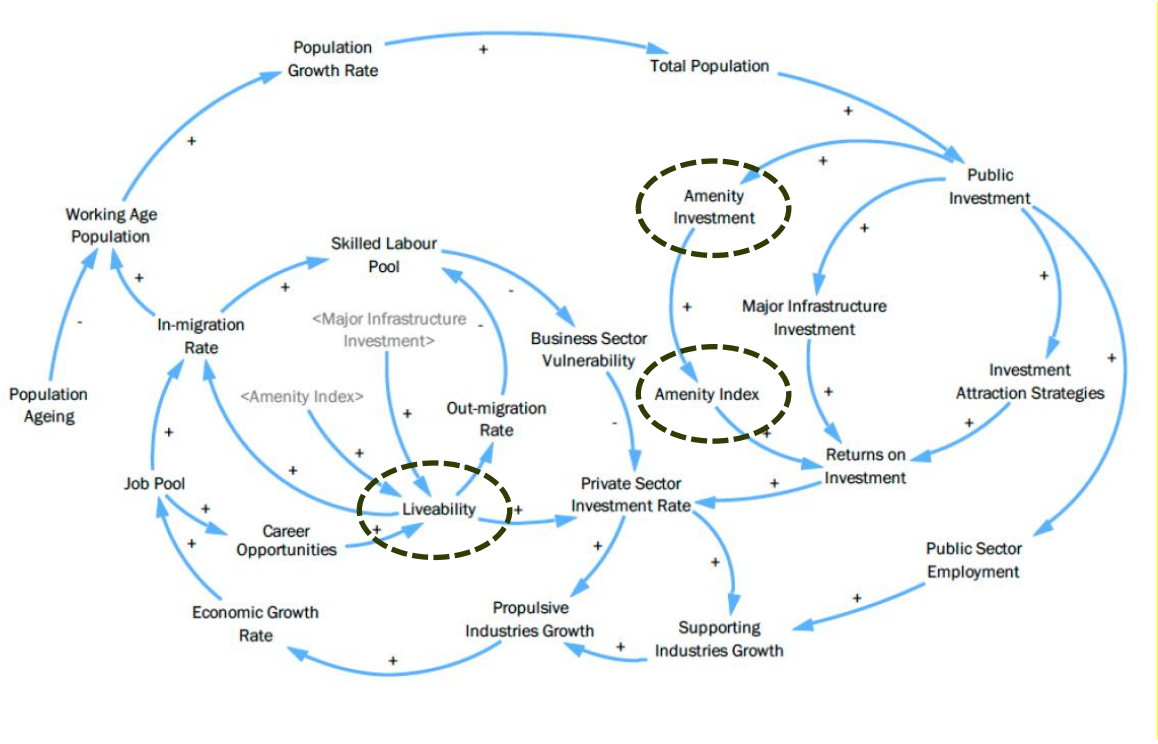


Figure 9. *Amenity and liveability are key parts of Hamilton's future (Economic Development Strategy, 2011)*

Hamilton residents are also passionate and protective of their trees. As well as greening the town, in the urban landscape trees mitigate the urban heat island effect, future-proofing cities against the impacts of climate change. Hamilton's urban forest incorporates native and introduced tree species throughout streetscapes and in community spaces like the Botanic Gardens.

The intersection with this and the IWM plan is ensuring that water delivered to the natural environment from urban catchments doesn't negatively impact that environment, and that the sources of water available are used efficiently to green the landscape and support the health of valued assets like trees.

3 Hamilton's water cycle

Hamilton's water cycle is unique. Potable water is supplied from the traditionally reliable catchments of the Southern Grampians, with non-potable sources available from a recycled water network and raw water from the 'Old Reservoir' network. Approximately 70% of the urban catchment is treated by a constructed wetland, improving water quality downstream and offering another potential non-potable source. The town has a large-scale rainwater harvesting project at the livestock exchange as well as a high take up of residential rainwater harvesting.

The following section looks at each aspect of the water cycle and examines the town's natural advantages as we seek to realise a vision of environmental, cultural and economic resilience.

3.1 Potable water supply

Hamilton's water is part of the Grampians system, with water sourced from the "western slopes of the Victoria Range in the southern part of the Grampians National Park" (Wannon Water 2017) with water diverted from eight streams and a headworks bore. The main storage at the head of the Grampians system is the 350 GL Rocklands Reservoir. Wannon Water manages its bulk entitlement arrangements for both the stream diversions and extractions from Rocklands.

Water flows from these diversions via approximately 47km of pipeline to supply the Hayes, Cruckoor and Hartwichs storages. Water reaching Hamilton is treated at the Hamilton water treatment plant (WTP) that was judged as producing the best tasting tap water in Australia (and second in the world) in 2018. The system that supplies Hamilton also supplies the townships of Tarrington and Dunkeld.

Figure 11 illustrates the relative locations of these assets in the context of the system.

Long term water supply planning

As part of its Urban Water Strategy (2017-2065), Wannon Water undertakes population and climate change scenario modelling to understand resilience within the Grampians system and the need for potential upgrades over the longer term. Wannon Water presented this information to stakeholders during the workshop series, highlighting that under a high climate change, high demand scenario, the need for system augmentation may be required as soon as 2031-2036. At this stage, the planned augmentation would include purchasing an increased entitlement from Rocklands.

So, while in the near future Hamilton's water supply is secure, over the longer term, like all towns and cities in Victoria, Hamilton and Wannon Water will need to consider supply security opportunities in the context of a changed climate.

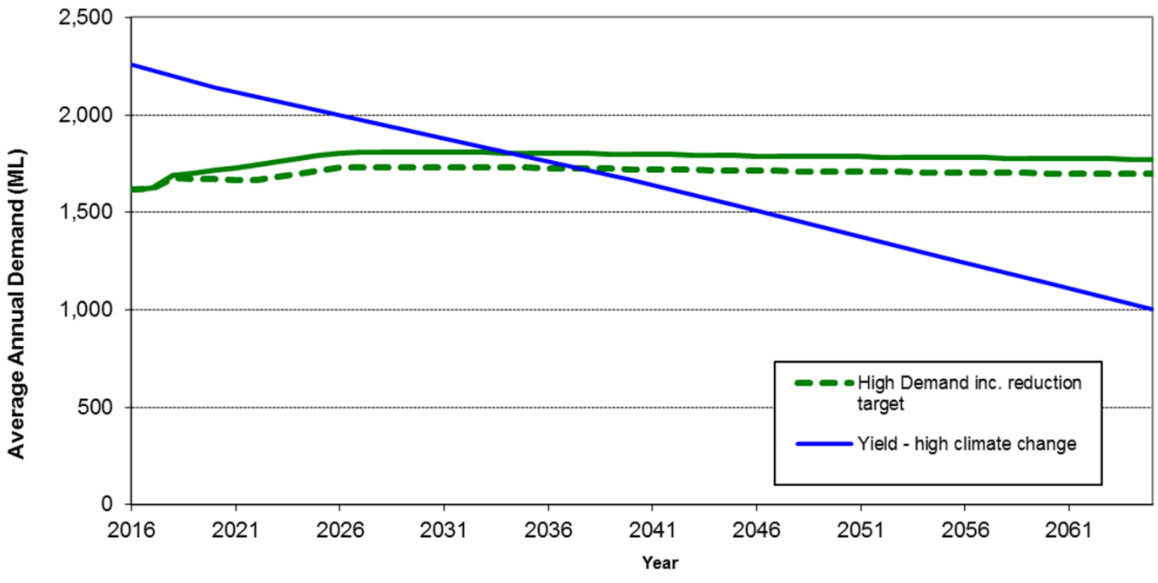


Figure 10. *Grampians system supply and demand (Courtesy Wannon Water)*

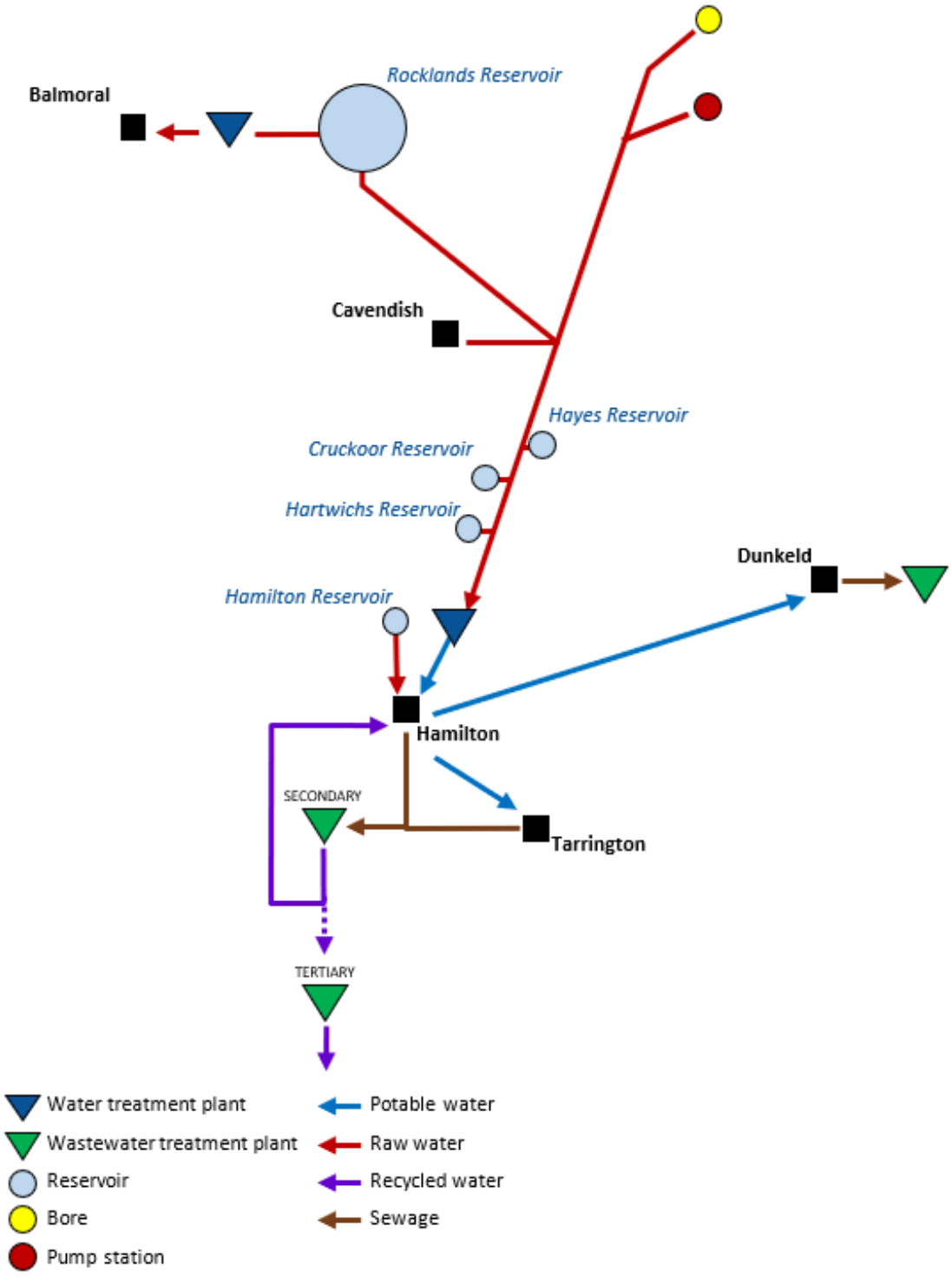


Figure 11. *The Grampians network*

3.2 Potable water consumption

Figure 12 shows the breakdown of potable water use in Hamilton. Approximately three quarters of potable water goes to residential users, equating to approximately 182 L/person/day (Wannon Water, 2015-16). Non-residential uses including Council's water use is included within this category. Wannon Water's figures also accounted for water supplied directly to public open space, which is relatively small as much of that demand is accounted for in Council's water use figures.

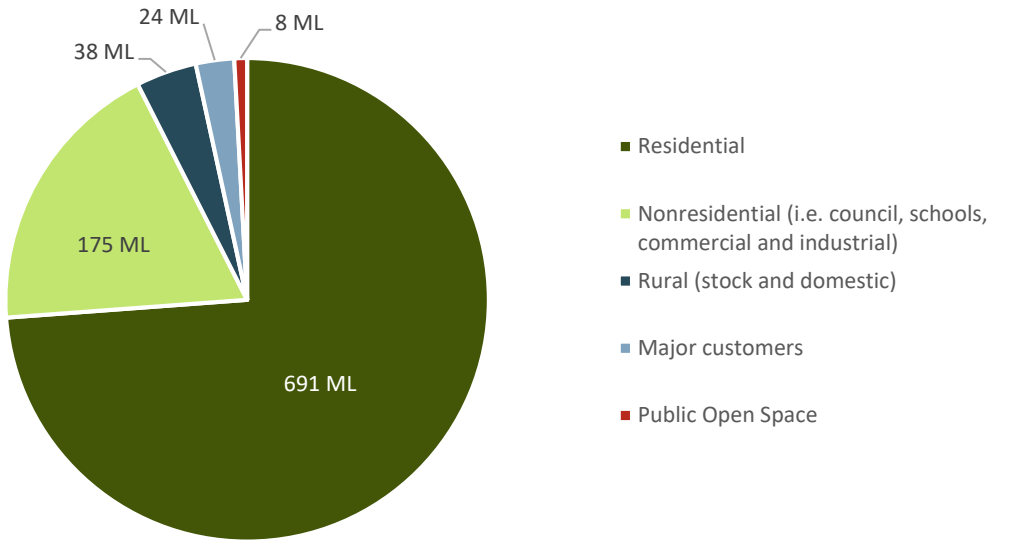


Figure 12. *Water use in Hamilton 2015-16 FY (Wannon Water - Urban Water Strategy, 2017)*

Figure 13 breaks down Southern Grampians Shire Council's (SGSC) water use in Hamilton. Of 34 ML in 2018/19, approximately 10 ML is used for the irrigation of sportsfields and open spaces. This is far less than the typical 70% or more that Council's typically use for irrigation. It is assumed that this is due to the availability of Class C recycled water and raw water from the 'Old Reservoir' network (discussed further below). Also notable is that the largest individual users are the saleyards and town swimming pools (including the Hamilton Outdoor Swimming Pool which uses 5ML and the Hamilton Indoor Leisure and Aquatic Centre (HILAC) which uses 5.8ML).

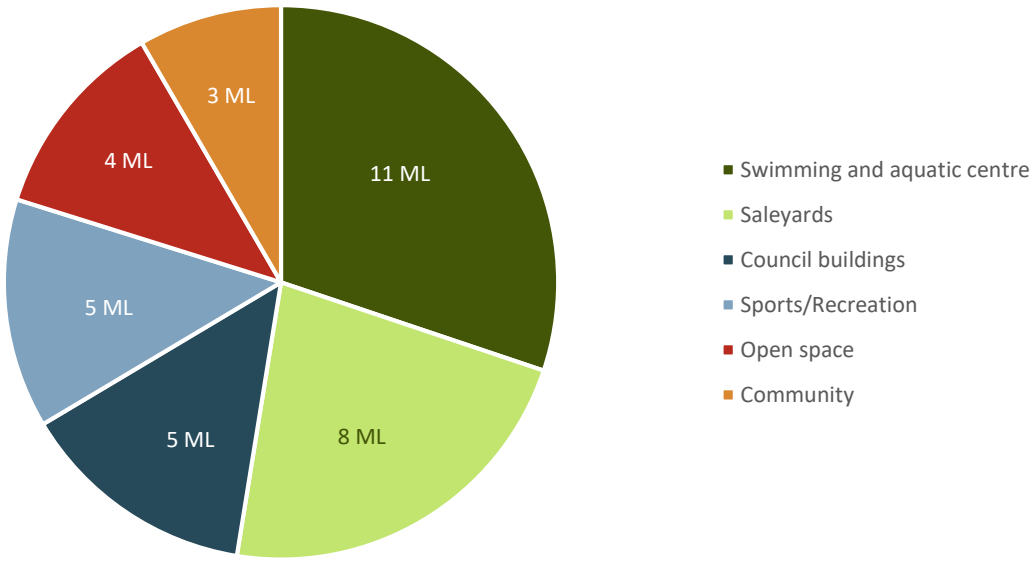


Figure 13. *SGSC Potable water use for Hamilton, 2018-19 FY (total = 34 ML)*

3.3 Wastewater

Wannon Water manages wastewater collection, conveyance and treatment services in Hamilton. Wastewater is treated at the Hamilton wastewater treatment plant (Figure 14), producing Class C recycled water that is suitable for and is used for irrigation (discussed further below). The township also has a Class A treatment plant that was constructed to service the Iluka Resources mineral sands operation. The Class A plant is not currently operational.

Wannon Water, through its Urban Water Strategy (2017) advise that there is adequate capacity in the sewerage system to accommodate anticipated growth. An exception may be the proposed new abattoir that could discharge directly to the treatment plant that may present a risk to treatment processes and salinity levels in recycled water. Further, evidence suggests that there is an inflow and infiltration issue in the town's wastewater network, with flows spiking during rainfall events.

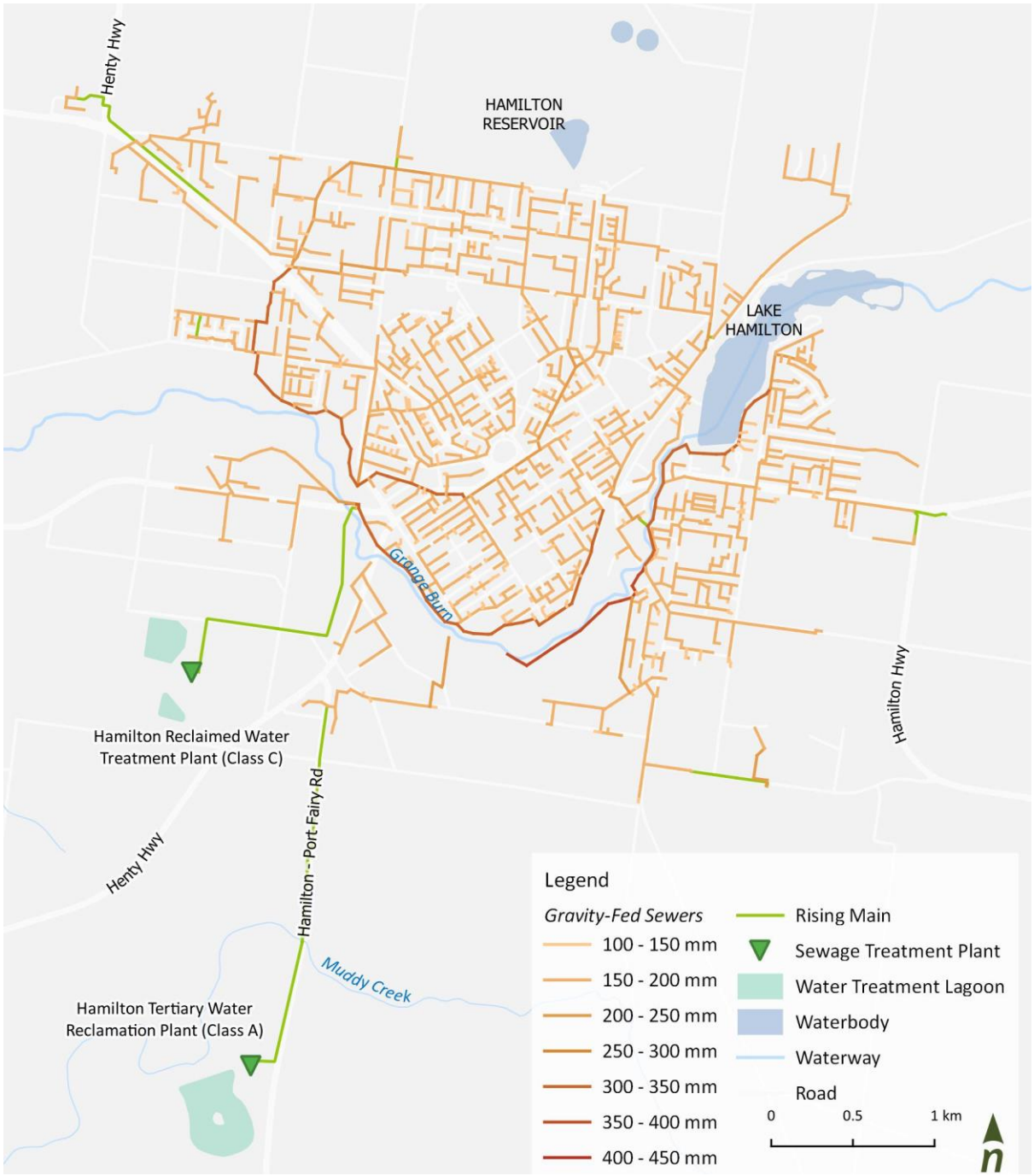


Figure 14. *Hamilton township wastewater infrastructure*

3.4 Alternative (non-potable) water sources

Raw Water – The Old Reservoir

SGSC owns and manages the "Old Res" that was constructed in 1880 with a capacity of 125 ML. Today, raw water is reticulated to the central business district (CBD) via a raw water network that includes some of the original wooden reticulation pipes. The Old Res collects water from upstream catchments with the network providing water to the adjacent Pedrina Park, Hamilton Showgrounds, Hamilton College, Melville Oval and the Hamilton Botanic Gardens (Figure 15). As noted above, the land surrounding the Old Res has been retained as a Bandicoot enclosure providing protection for an endangered species as well as a place for relaxation, fishing and walking.

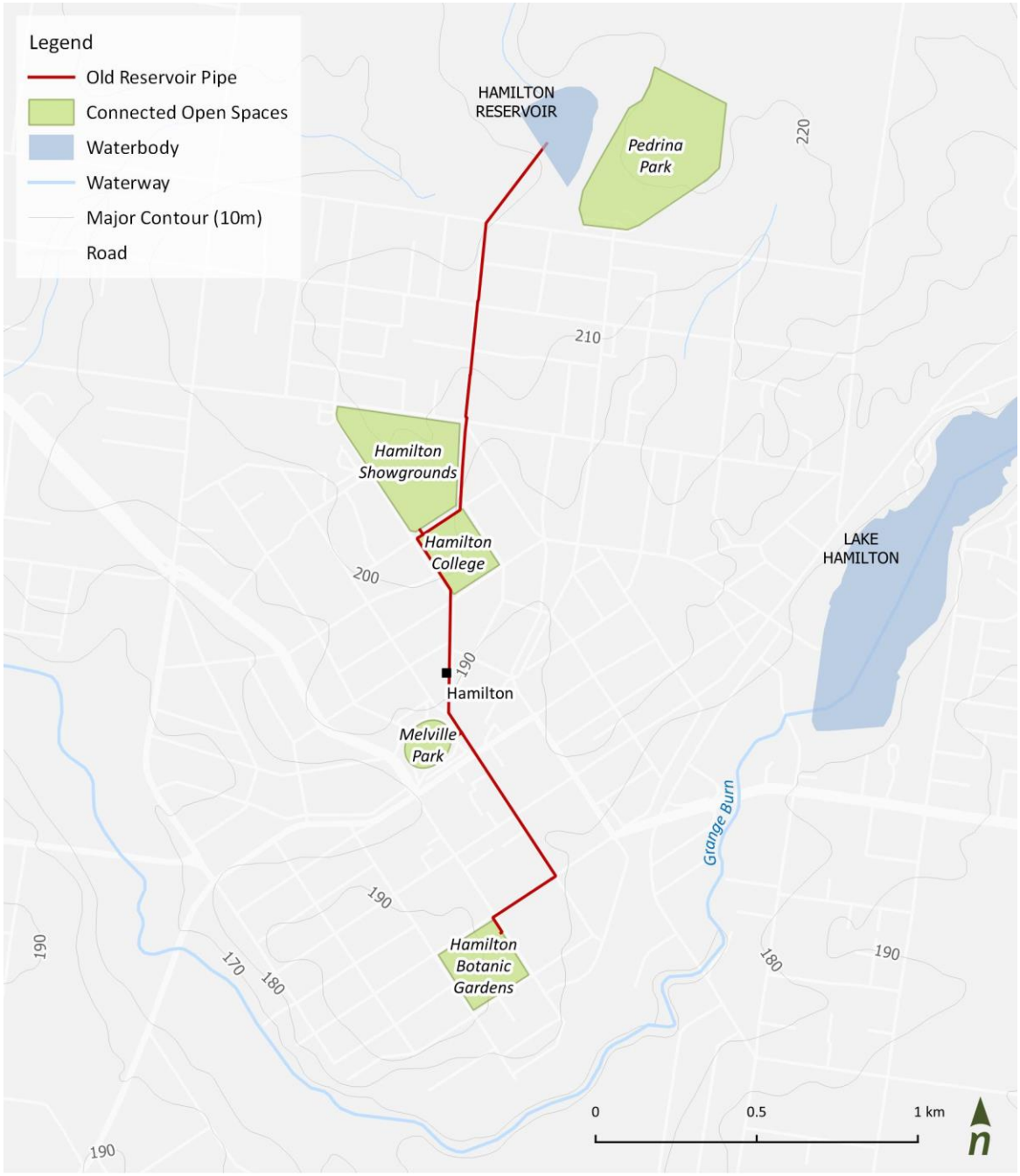
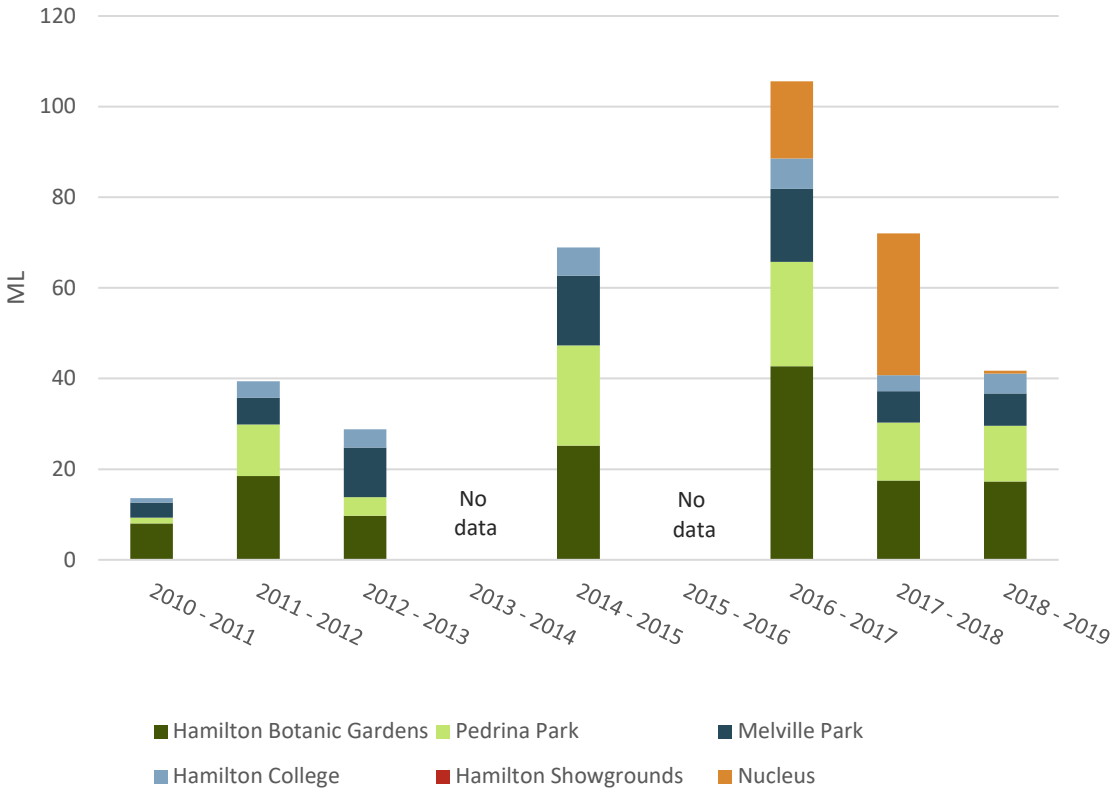


Figure 15. *Hamilton Reservoir and its associated raw water reticulation network*

Usage of raw water from the Old Res varies from year to year with climate and rainfall influencing demand for irrigation (Figure 16). Very low usage can be observed during the wet years of 2010 – 2012, with irrigation increasing in recent years.



Note: *"Nucleus" demand was associated with a leak.*

Figure 16. *Old Reservoir water consumption*

Figure 17. *Hamilton Reservoir ('Old Res')*

Recycled Water

The Hamilton STP treats approximately 635 ML/year of wastewater (Wannon Water, 2017), producing Class C quality water that is suitable for the irrigation of recreational reserves and pastures. Figure 18 shows the Class C network connecting to the Hamilton Golf Club, ovals, parks, tennis courts, pastures and businesses including Hamilton Turf. 100% of treated water is irrigated. Anecdotally, there is excess recycled water available and during consultation stakeholders discussed the potential for this water to be directed toward higher value end uses.

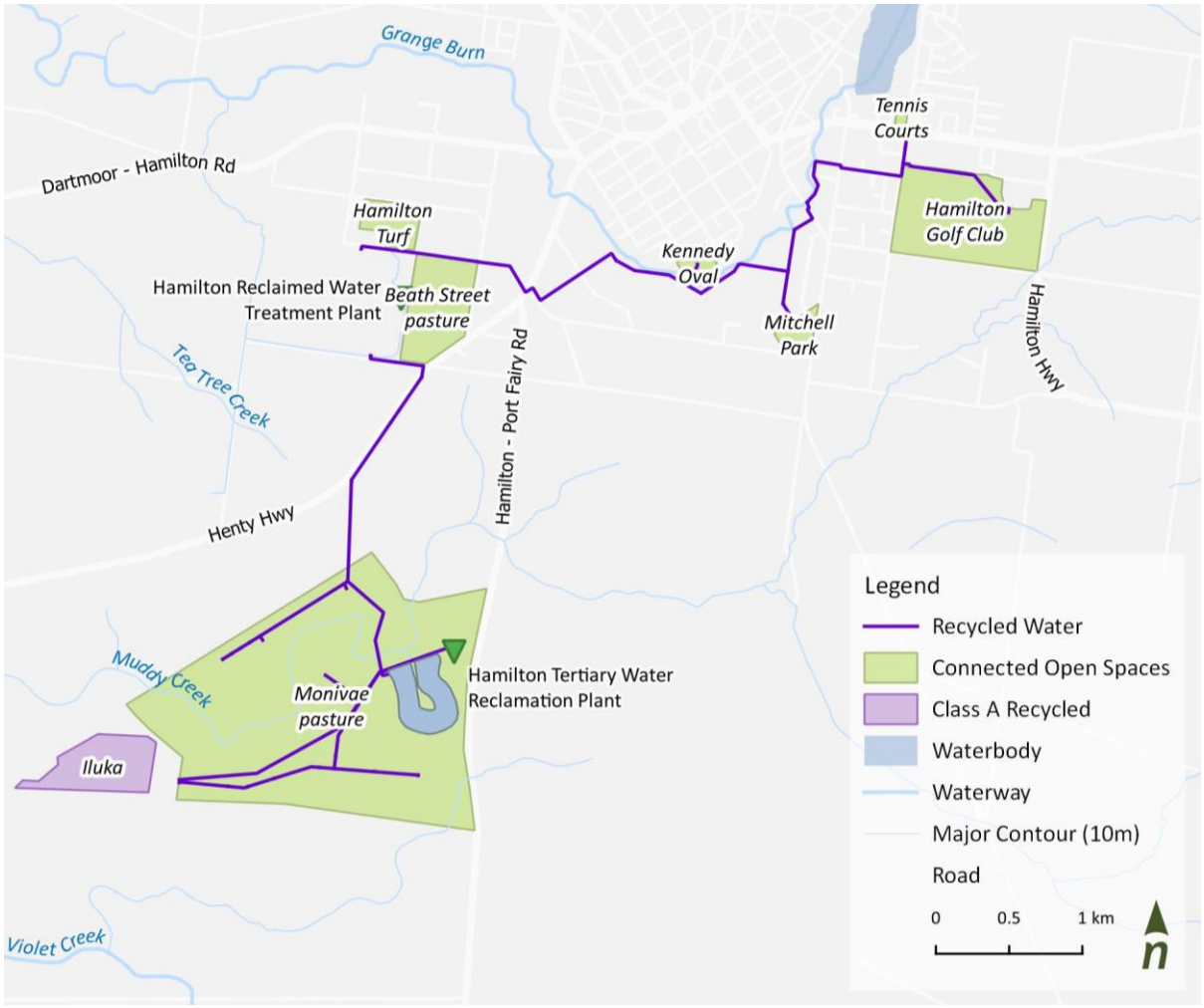


Figure 18. *Class C Recycled Water network*

Rainwater harvesting

The Wannon Water Urban Water Strategy suggests that 58% of households in the Grampians system have a rainwater tank. This number is system wide (i.e. beyond just Hamilton) and includes smaller townships and rural properties.

The most notable example of large-scale rainwater harvesting is at the Hamilton Regional Livestock Exchange. Hamilton's saleyards are one of Victoria's busiest. With a new roof installed in 2015, there was an opportunity to harvest rainwater primarily for truck wash down (noting that the relatively saline bore water originally used was causing rust). Four 230kL tanks collect water from the saleyards roofs significantly reduce demand on the town's water supply. The scheme also reduces stormwater runoff into receiving waterways.

This precedent highlights the potential for other rainwater harvesting opportunities across the town.

3.5 Stormwater and pollutants

Stormwater is generated when rainfall comes into contact with impermeable surfaces like footpaths, roads and carparks before being directed to the drainage network. Stormwater carries pollutants to receiving environments including nutrients, grease and oils, heavy metals and litter. To protect the Grange Burn and its resident ecology as well as to improve water quality within Lake Hamilton, managing stormwater quality is an important aspect of the urban water cycle.

Modelling was undertaken to estimate the stormwater flows and associated pollutant loads generated within Hamilton's urban area in an average rainfall year. The model (MUSIC) specifically focuses on total nitrogen, total phosphorus, total suspended solids and gross pollutants (litter). MUSIC requires a pluviograph input data and the Bureau of Meteorology (BoM) does not maintain this data for Hamilton itself. However, based on its proximity and similar rainfall patterns to Casterton where the BoM does maintain this dataset, Casterton was selected as the best representation of expected rainfall in Hamilton. Potential evapotranspiration (PET) data used in the modelling was taken from BoM's average areal potential evapotranspiration data. The rainfall record for 1985 to 1994 was used as this had minimal data gaps and was a close representation of the long-term averages.

Scenarios

Three water and pollutant balance scenarios were examined:

- **Current**: the stormwater and pollutant balance under current climate and existing urban development conditions.
- **Future:** based on anticipated land use changes. With no specific timeframe, this scenario assumes all proposed development areas are built out.
- **Climate change:** The impact of climate change was modelled by scaling the historical rainfall data to the median (50^{th} percentile) rainfall and PET changes for 2040 and 2065, as outlined in Section 2.3 above.

Figure 19 illustrates the changes in land use and the fraction of impervious surfaces which could be expected due to projected development as per the existing planning scheme. Modelling outputs are included in Attachment B with a summary of results in Table 2 below.

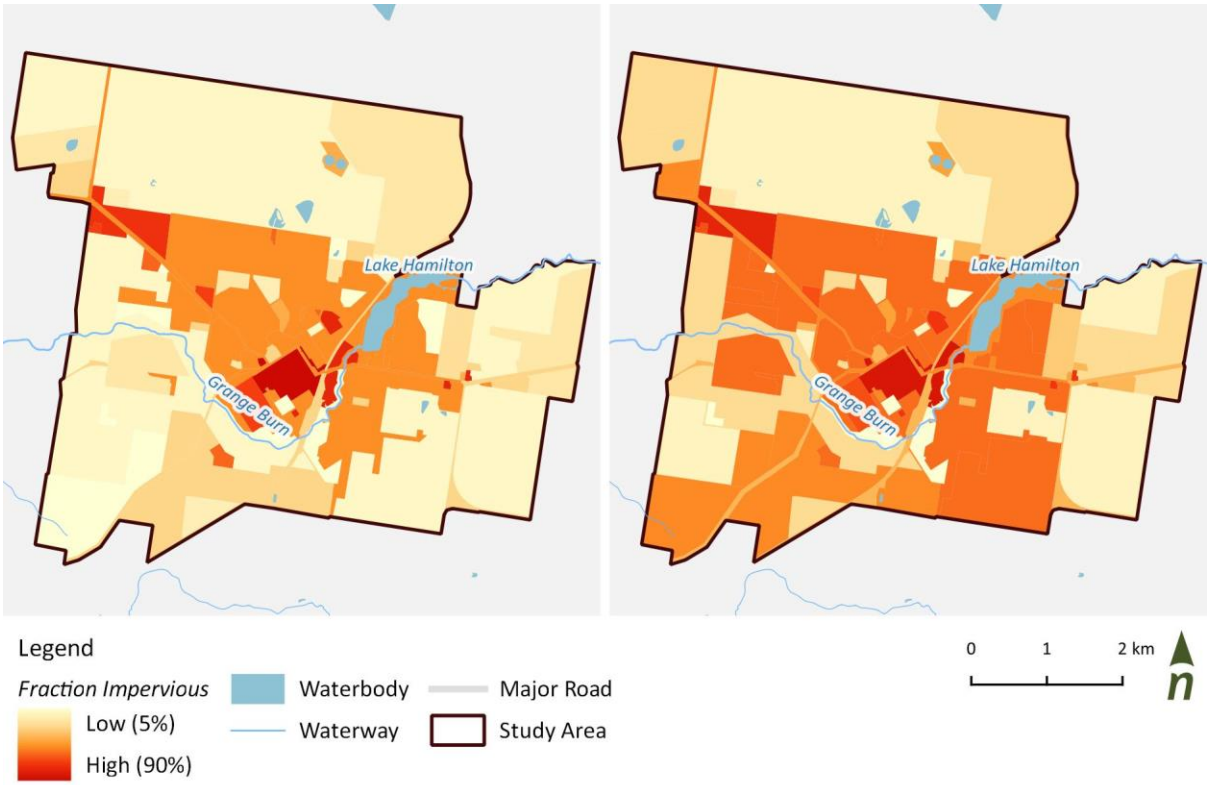


Figure 19. *Land use changes expected in Hamilton based on the planning scheme.*

Table 2. *Stormwater modelling results*

Model#	Land use	Impervious area (ha)	Climate (year)	Precipitation (mm/year)	PET (mm/year)	Stormwater (GL/year)	Nitrogen (tonne/year)
A	Existing	840	1995	595	1200	4.2	11.6
B			2040	565	1245	3.8	10.8
C			2065	545	1280	3.8	10.4
D	Developed	1160	1995	595	1200	5.6	16.4
E			2040	565	1245	5.2	14.7
F			2065	545	1280	5	14.3

Comparing the results of the models for existing and developed land use scenarios under the current climate (Model A and D) shows that Hamilton can expect a 36% increase in stormwater flows and a 41% increase in pollutant loads. These results are consistent with the projected 38% increase in impervious surfaces. In these examples the same rainfall and climatic data is assumed. Comparing model runs with steady land use (i.e. Model A, B, and C) and changing climates, shows that anticipated reductions in rainfall expected due to climate change (Table 1 above) will cause some reduction in runoff and pollutant loads. The model results are graphed in Figure 20, which shows that the reduction in run off and pollutants due to climate change does not negate the increase which would come from development.

Climate change will lead to some decreases in runoff and annual nitrogen loading (where nitrogen is used as a proxy for all pollutants). However, because climate change will lead to more intense rainfall events and result in an increase in risk of flash flooding, this reduction in average annual pollutant loading should not be considered a 'benefit' or a reason to overlook efforts to reduce the area of impervious surfaces directly connected to waterways.

The greatest volume of stormwater generated is associated with smaller and more frequent events. Hence water sensitive urban design (WSUD) assets are typically sized to manage and treat 3 – monthly events (i.e. events that are likely to occur four times a year or smaller).

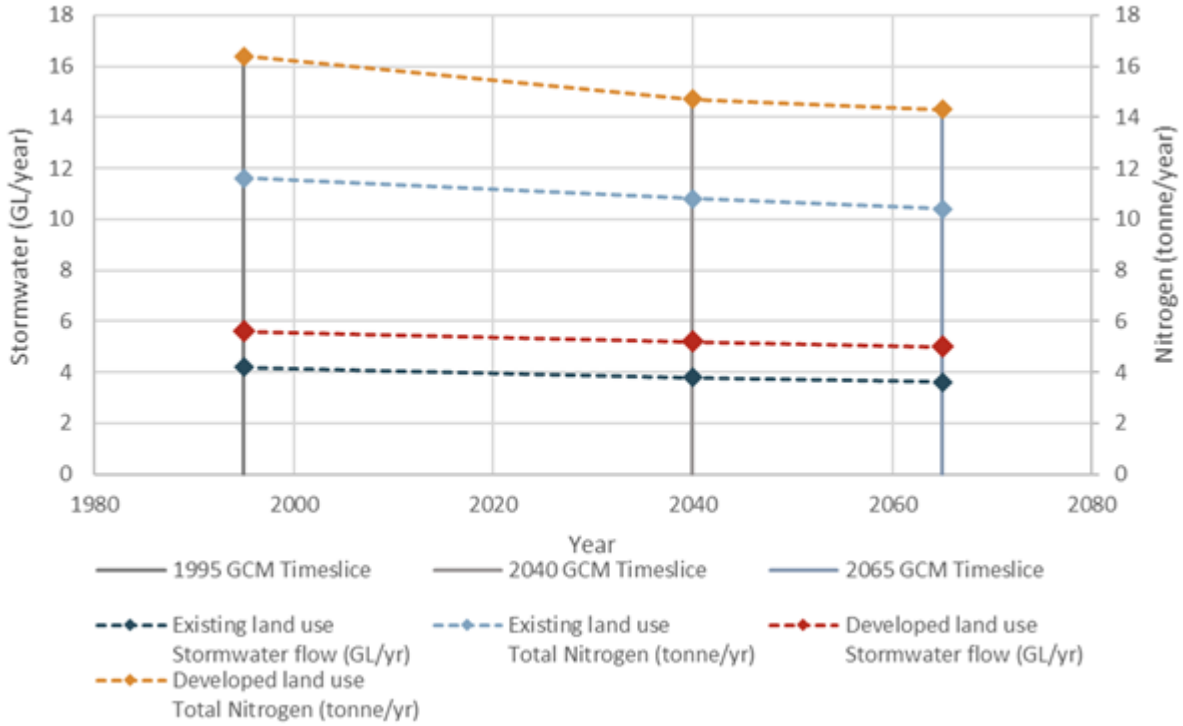


Figure 20. *Climate change and development impact on stormwater and pollutant loads*

3.6 Stormwater Treatment

Hamilton has existing stormwater treatment assets, the most significant being the aforementioned 14 Ha Grange Burn wetland that treats 70% of the town's stormwater (see 2.5 above). This wetland is shown as two assets adjacent to the Grange Burn in Figure 21 below. This is a significant water quality asset that contributes to the overall uniqueness of Hamilton's water cycle.

Figure 21 shows the catchment areas treated by existing WSUD assets including litter traps, biofilters and wetlands. Blue areas show smaller assets adjacent to Lake Hamilton including near Tyers and Gray St on the western side of the lake and along Rippon Rd (at the end of Handbury Boulevard) adjacent to the lake. Based on observation, the effectiveness of the Tyers St WSUD asset may require review (Figure 22), while there is confidence that the Rippon Rd asset is functioning well. Further, SGSC have also been trialling litter nets that at the time of visiting were operating effectively (Figure 24).

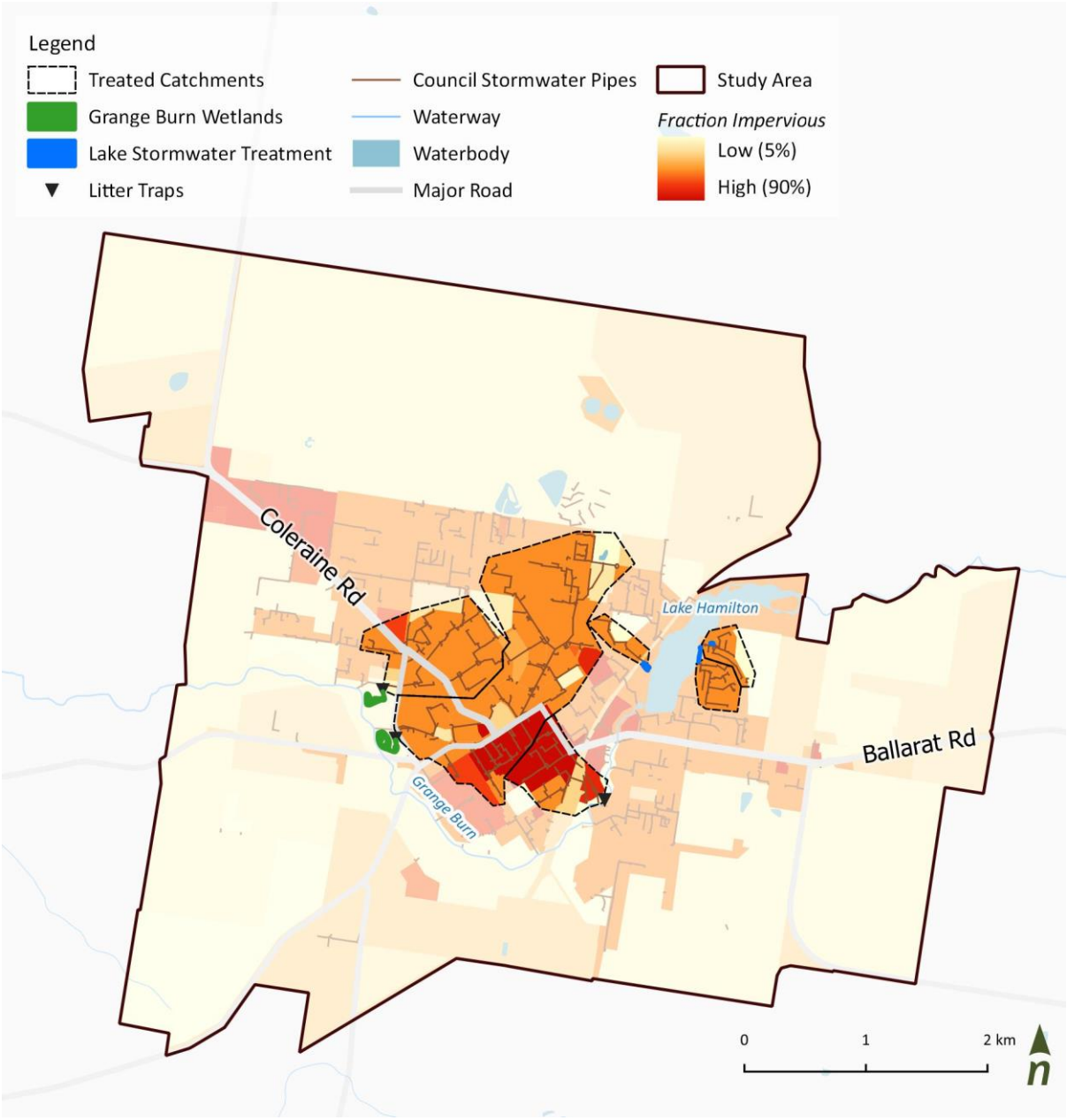


Figure 21. *Existing WSUD treatment assets and catchments in Hamilton*

Figure 22. *Stormwater treatment asset near the corner of Tyers and Gray St*

Figure 23. *The Grange Burn wetlands noting the open water and potential for greater density of emergent macrophytes*

Figure 24. *Installed litter net*

3.7 Water cycle summary

The summary above highlights some of the current water cycle issues faced by Hamilton, and also the advantages Hamilton may have in addressing them. In summary:

- Hamilton has access to a high-quality potable water supply network, that has traditionally been highly reliable.
- Wannon Water modelling suggests that under high climate change and demand scenarios, additional supply may be required by 2036. Options to achieve this include utilising existing entitlement out of Rocklands Reservoir or increasing that entitlement. This would be subject to availability, noting a risk should that supply decrease e.g. during drought.
- Population drives potable water demand, with about ¾ of total potable demand in Hamilton being residential.
- Hamilton has access to alternative, non-potable water supplies from both a Class C recycled water network and a raw water supply. Both of these networks supply irrigation water for pastures, parks, schools, sportsgrounds and high value community assets including the Hamilton Botanic Gardens.
- Likely due to the availability of non-potable sources, Council's use of potable water for open space irrigation is relatively low when compared with other local government areas.
- Wannon Water's Urban Water Strategy notes approximately 58% of households within the Grampians system have a rainwater tank
- The largest mains water consumption in the township are the pools / aquatic centres and the Hamilton Regional Livestock Exchange that is home to a significant rainwater harvesting scheme .
- Urban development in Hamilton and the associated increase in imperviousness will increase stormwater runoff and pollutant loads to receiving waterways including Grange Burn and Lake Hamilton, putting pressure on values within those systems, diminishing their condition over time.
- The impact of climate change will reduce rainfall and increase evaporation, reducing total annual runoff. However, heavy storm events will be more frequent, potentially compounding existing flash flooding issues.
- With climate change expected to increase PET by up to 5.7%, decrease rainfall by up to 12.7%, and decrease runoff by up to 37% by 2040 (90^{th} percentile), there is potential for the long-term water security of Hamilton to be impacted.
- Wannon Water has investigated contingencies in this event; however it does underscore the importance of optimising the use of Hamilton's various non-potable water supplies, across recycled water, raw water, rainwater and stormwater.

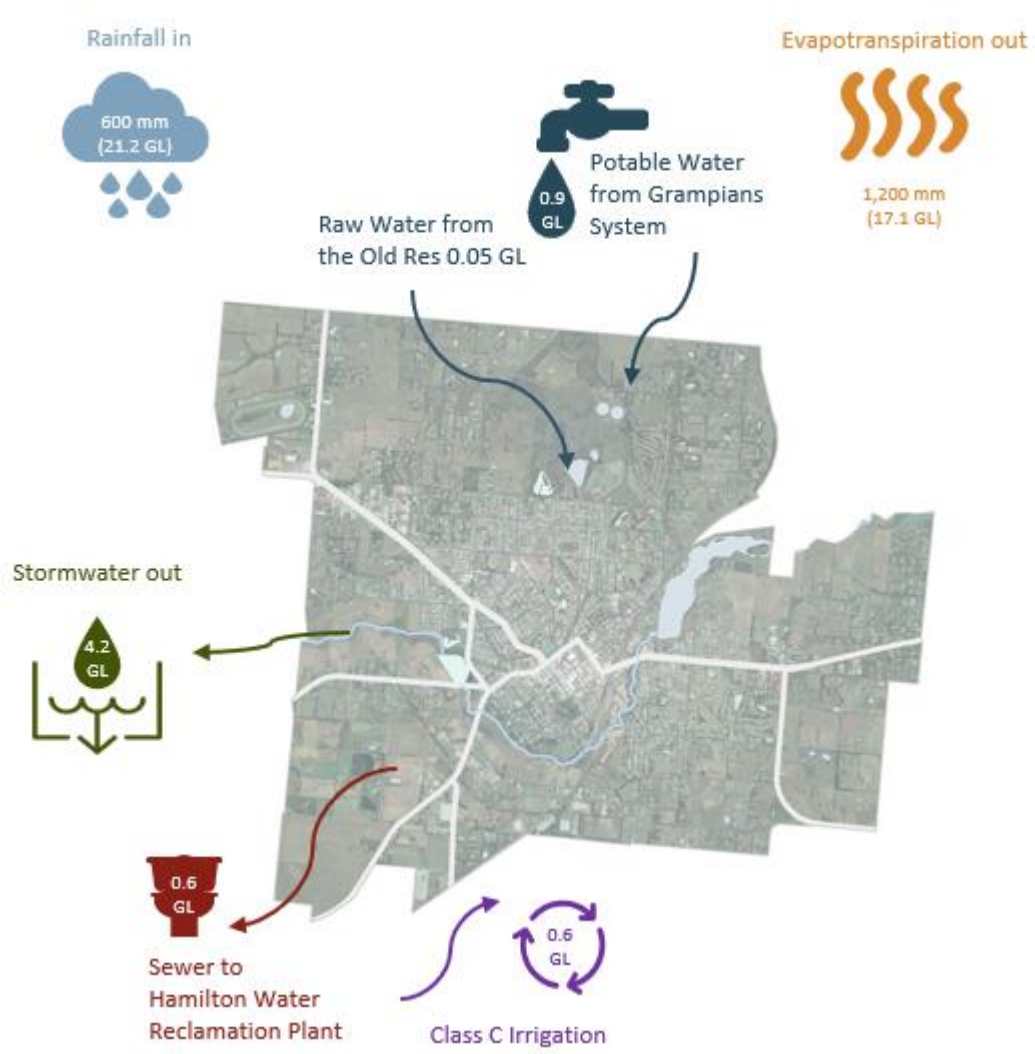


Figure 25. *Hamilton water cycle schematic*

Table 3. *Hamilton water balance table*

Inflow (GL/year)		**Outflow (GL/year)**		
Rainfall	21.2	Evapotranspiration		17.1
		Stormwater		4.2
Potable water	0.9	Consumed (including irrigation / pool etc) (0.1-0.2)	Sewer (Class C treatment plant) (0.6)	0.1
Non-potable water: Class C	0.6	Irrigation (0.6)		0
Non-potable water: Old Res	0.05	Irrigation (0.05)		0
Total	**~22.2**			**~21.4**

4 Vision, Outcomes, and Objectives

The vision, outcomes and objectives for the Hamilton IWM Plan are drawn from the Great South Coast Region SDS. As SGSC was a part of that forum, and contributed to the development of that framework, adopting these vision and outcomes is logical to ensure consistency with other organisations in the region and with other IWM Forums across the State.

4.1 Vision

The vision for the Great South Coast Region IWM Forum is:

Water is Life Pareeyt Poondee-teeyt
(Dhauwurd Wurrung language group)

We will work together with our communities to deliver integrated water outcomes contributing to the resilience of our environment, culture and economy

This vision emphasises the central role water plays in sustaining community, culture and economy as well as the emphasis on collaboration between organisations to achieve this.

4.2 Outcomes and objectives

The SDS sets out seven outcomes for IWM across the region (Figure 26). Each regional SDS has seven outcomes however the wording associated with each is tailored toward the given Forum. They are broad, covering every aspect of the water cycle across water, sewerage, stormwater, waterways and flooding while also extending to community, landscapes and economy. In doing so they open the door for IWM plans to consider the contribution that water can have on a range of values and activities across Hamilton and on realising the community's aspirations for their town.

The outcomes were used during consultation to frame the identification of issues and opportunities. A full summary of the outcomes and the objectives associated with each, as published within the SDS, is provided in Attachment A.

Figure 26. *Great South Coast Region Strategic Directions Statement outcomes*

5 Issues and opportunities

Having established the water cycle context in Hamilton, a consultation process identified issues and opportunities for this IWM plan to address.

5.1 Opportunity long list

The first workshop series was made up of three sessions:

- A Council and agency stakeholder workshops (attended by SGSC, Wannon Water, SRW and Forum representatives)
- A SGSC Councillors meeting (also attended by SGSC and Wannon Water), and
- A community session within the Hamilton library.

The first session sought to understand from those working in the field, the issues and opportunities Hamilton experiences under each of the seven outcomes. Following a brief, contextual presentation, a discussion and debate identified key takeaways, whether the data presented reflected actual experience and whether there were additional gaps to be addressed.

At workshop completion a 'long list' of issues and opportunities was reflected back to the group. In the following sessions with Councillors and community, a similar albeit less formal process was undertaken to understand what each group saw as the key water related issues under the same outcomes. A long list is included in Attachment C.

Figure 27. *Issues and opportunities - Workshop 1.*

5.2 Opportunity short list

Following the first workshop series, the long list was reviewed by the Project Control Group (PCG) with a short list of 12 opportunities agreed upon for further assessment. The titles of the 12 opportunities are listed below. A more detailed summary is provided below.

- Lake Hamilton: Blue green algae action plan
- Hamilton Showgrounds roof water harvesting for HILAC
- Expansion of the recycled water network
- Irrigation efficiency investigation
- Water for horticulture
- 'Old Res' system investigation
- Environmental and cultural wayfinding
- Grange Burn urban water quality improvement program
- Residential rainwater disconnection
- Wetland condition and stormwater harvesting study
- CBD Streetscape WSUD and greening
- Integrated water networks.

5.3 Opportunity assessment

In the second workshop series (a three-part structure similar to the first), the opportunity short list was critically reviewed against a qualitative project assessment framework, using a simple low, medium or high rating against the following criteria:

- cost (both advantages and disadvantages)
- risk
- urgency
- importance.

While this assessment method did prioritise the opportunities, the discussions around them were arguably more important as attendees critically discussed the merits of each option before agreeing a position. At the completion of that process a further vote was taken to decide which opportunities would be best suited to, and progress through to, concept design. These opportunities were then taken to Councillors and the community for review and to gauge level of support.

During the discussion in workshop 2 it was agreed that:

- *Central business district (CBD) streetscape WSUD and greening* (Opportunity 3) was suitably addressed and progressed in current masterplans (e.g. the Shire's CBD Revitalisation Plan, March 2019) and was not required to be addressed in this plan
- *Wetland condition and stormwater harvesting* (Opportunity 8) while ensuring the good condition of the wetland was well supported, the option of identifying another alternative water source was not, due to the availability of Class C recycled water and raw water.
- *Integrated water networks* (Opportunity 11) was sufficiently covered by assessments of recycled and raw water networks as part of other opportunities.

These opportunities were omitted from subsequent discussions.

It is notable that discussions with the community tended to focus upon the health, amenity and utility of natural assets like Lake Hamilton and the Grange Burn and the importance of recreational activities on and around the water.

Table 4 below summarises the outcomes of the review.

Table 4. *Opportunity assessment summary*

Opportunity	Preliminary assessment method					Concept design votes
	Benefits	Urgency	Importance	Cost (Advantages / Disadvantages	Risk	
Showgrounds roof water harvesting for HILAC	H	L	M	H	H	12
Irrigation efficiency investigation	H	L	L	H	M	6
Environmental and cultural wayfinding	M	L	L	H	H	5
Recycled water for horticulture	H	M	M	H	H	8
Lake Hamilton: Blue green algae action plan	H	M	H	H	h	13
'Old Res' system investigation	H	M	M	H	M	6
Grange Burn urban water quality improvement program	M	L	M	M	M	4
Residential rainwater disconnection	H	H	L	M	M	3

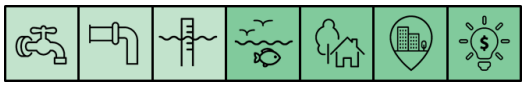
Based on the above rating, votes cast within the workshop and subsequent discussion with the PCG, the following four opportunities were agreed to progress to concept design stage:

1. Lake Hamilton Blue Green Algae Action Plan
2. Showgrounds roof water Harvesting for HILAC
3. Expanding the recycled water network for horticulture
4. Old res system investigation.

The following section provides a summary of each of these opportunities including the SDS outcomes that the opportunity addresses.

5.4 Opportunity summaries

H-1. Lake Hamilton Blue Green Algae Action Plan



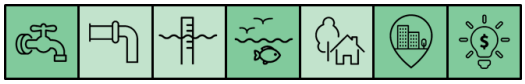
Blue green algae has been a regular occurrence in Lake Hamilton impacting upon the recreational, ecological and aesthetic values of this critical man-made asset. Numerous past reports have identified upstream rural catchments, excess nutrients, waterway erosion and sediment transport and livestock interactions with waterways as key drivers. Urban catchments also contribute nutrient loads and can be influential over summer months.

This opportunity will specifically identify and prioritise a suite of WSUD assets designed to treat urban runoff draining to Lake Hamilton from existing drainage outlets.

Works will include SGSC lead stormwater management and urban community engagement, and GHCMA catchment programs, and investigate structural works on the lake.

Partners	SGSC (lead) GHCMA
Location	Lake Hamilton urban catchment
Timeframe	Concept in 2020 Long term
Scale	Hamilton urban catchment

H-2. Roof water harvesting for HILAC



The Hamilton Indoor Leisure and Aquatic Centre (HILAC), is one of the largest potable water users in Hamilton. HILAC itself and the nearby Showgrounds buildings have large roof areas that could potentially collect and provide large volumes of rainwater for non-potable demands within HILAC. The Showgrounds has limited demand for that water, with potential space for storages (including potentially along Shakespeare St).

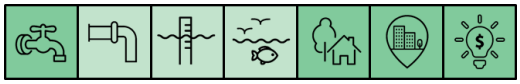
The opportunity is to investigate the feasibility of harvesting rainwater from nearby roofs to reduce potable water use within HILAC (as well as other nearby demands).

The investigation would include the identification of suitable non-potable demands, assessment of storage requirements (and locations), a transfer concept and assessment of potential volumes saved and cost of that water.

This example is seen as replicable in other towns, as well as influencing potential Council policy on broader rainwater harvesting and use.

Partners	SGSC (lead) Wannon Water
Location	Hamilton HILAC and Showgrounds
Timeframe	Concept in 2020 Short to medium term
Scale	Building / precinct

H-3. Irrigation efficiency investigation



Many reserves in Hamilton are irrigated with potable, raw or recycled water. It is the intent of this plan that all water, regardless of source, is used efficiently. While some parks and reserves have automatic sprinkler systems, manual watering is required in some locations and anecdotal evidence suggests that some irrigation infrastructure could be upgraded to improve water use efficiency.

The opportunity is to improve the efficiency of irrigation systems across open spaces in Hamilton.

Partners	SGSC (lead)
Location	Hamilton Parks and Gardens
Timeframe	Medium term
Scale	Township

This could involve:

- Prioritising open spaces and irrigation demand
- Auditing current systems to identify opportunities for irrigation system upgrades
- Explore the use of smart irrigation systems and soil moisture probes (linking to the LoRaWAN network) to improve efficiency of irrigation (currently being trialled in Pedrina Park)
- A cost benefit to understand highest priority works
- Consider drought-tolerant or warm season grasses that can lower irrigation rates

H-4. Recycled water for horticulture

'Class C' recycled water produced at the Hamilton Water Reclamation Plant (WRP) is used for a range of irrigation purposes in Hamilton with excess Class C recycled water irrigated to the 'Monivae' pasture. 100% of recycled water is applied to land via these end uses.

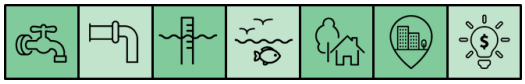
This opportunity would investigate the identification of higher value uses for this recycled water, and specifically to support horticulture through the extension of the Class C network.

The opportunity is to establish a horticultural trial with irrigation provided by Class C recycled water. The focus will be on understanding the role of the water cycle in expanding economic opportunities within Hamilton.

It will consider the cost per kL, demand, reliability, and crops which could be supported.

Partners	SGSC Wannon Water Agriculture Victoria Local growers
Location	Monivae Pasture (TBC)
Timeframe	Short to medium term
Scale	Trial

H-5. 'Old Res' system investigation



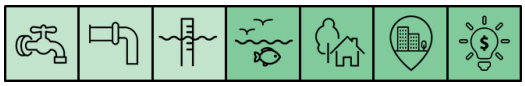
Hamilton's Old Reservoir and its associated distribution network provides untreated raw water for irrigation of parks including Pedrina Park. There is uncertainty about the condition of the network given the materials used (wood, in some cases) and the age of the assets (the Old Reservoir was constructed in 1880).

This opportunity is to improve Council's collective understanding of the Old Res network, condition and capacity with a view to understanding if the Old Res network requires upgrades to improve performance, and where those upgrades should be.

The investigation will include an asset review (based on available information) and a system water balance.

Partners	SGSC (lead) Wannon Water SRW
Location	Old Reservoir and network
Timeframe	Short to medium term
Scale	Township

H-6. Environmental and cultural wayfinding



Hamilton has a wealth of environmental and cultural assets. One way of protecting natural assets is to get locals and visitors to value them.

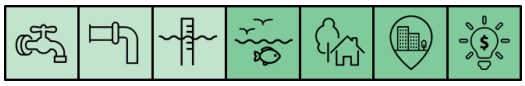
The opportunity is to create a coordinated and consistent wayfinding program that connects the people of Hamilton and visitors to and around the town's natural and cultural assets.

It is proposed that this include Lake Hamilton, Grange Burn, Hamilton botanic gardens, the Old Res bandicoot enclosure, walking and cycling tracks (including along Grange Burn), areas of valuable habitat (platypus observation area) and green corridors (as proposed within the Hamilton structure plan). The signage could also support water literacy and connection of people to the natural environment.

SGSC would work with Gunditj Mirring Traditional Owner Aboriginal Corporation to include cultural and historical landmarks and interpretation.

Partners	SGSC Gunditj Mirring Traditional Owner Aboriginal Corporation GHCMA Wannon Water Community / Tourism operators
Location	Hamilton wide
Timeframe	Short to medium term
Scale	Township

H-7. Grange Burn urban water quality improvement program



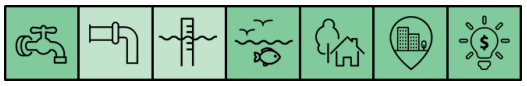
There are a number of untreated point source stormwater discharges that enter the Grange Burn downstream of the Lake Hamilton Spillway.

This opportunity is to improve stormwater quality entering the Grange Burn by improving network understanding and increasing pollution reduction through the identification of WSUD requirements.

This opportunity would investigate urban runoff, document drainage network, investigate potential treatment opportunities and propose concepts for pollution mitigation works. These works would be included in an update of the Grange Burn master plan.

Partners	GHCMA
Location	Grange Burn stormwater catchments between Lake Hamilton and the Grange Burn Wetlands.
Timeframe	Medium term
Scale	Hamilton urban sub-catchments

H-8. Residential rainwater disconnection	
Through their network modelling and analysis Wannon Water have identified sewerage catchment with high rates of inflow. This indicates illegal roof and stormwater connections to the sewerage network, creating peaks during rainfall events with stress on the network and pump stations, increasing the risk of sewage spills during wet weather. *This opportunity will seek to identify illegal connections to reduce inflows from illegally connected property drains. This could be combined with an incentive to install rainwater tanks or other onsite water saving assets.* Wannon Water and SGSC would develop a strategy to disconnect household drains from the sewerage network by prioritising catchments, exploring incentives for disconnections or increasing enforcement. Supported by community consultation and education.	**Partners** Wannon Water (lead) SGSC **Location** Hamilton **Timeframe** Long term **Scale** Hamilton sewerage network

H-9. Wetland condition	
Hamilton's 14 Ha Grange Burn Wetland was constructed in 2005 to treat approximately 70% of Hamilton's urban catchment. Observation indicates large open water sections in the wetland and raising the possibility that the wetland may not be treating stormwater as designed. *This opportunity is to investigate the performance of the Grange Burn wetland .* The investigation will include a condition audit of the existing wetlands and identification of improvement requirements (if any).	**Partners** SGSC GHCMA **Location** Grange Burn wetland **Timeframe** Short to medium term **Scale** Wetland

The following provides an action plan to execute the prioritise actions, focusing upon those opportunities nominated for concept design.

6 Action plan

The following action plan sets out the next steps to progress each of the opportunities identified above. The opportunities have been prioritised through this process, so this plan defines the project, timing, and responsibility for each.

Lake Hamilton blue green algae action plan

Action	Sub actions / Description	Notes	Timing	Priority	Responsibility
Concept development (underway)	As part of this IWM plan, prepare a concept design that: • Estimates the area and pollutant load of urban catchments contributing runoff to Lake Hamilton (*plan prepared*) • Identifies and maps drainage assets and outlets to the lake • Calculates a possible or suitable WSUD asset (e.g. biofilter / wetland) within Hamilton's urban catchments to treat runoff and to understand the level of that treatment (compared to best practice) • Identifies possible locations for those assets • Prepare a concept level shape and cost estimate for each asset • Identifies other management approaches or concepts that could contribute to reducing pollutant loads in the lake.	This concept design is to be prepared as part of the scope for the Hamilton IWM Plan See Appendix D for concept design	2020	Very high	Alluvium Consulting Australia with IWM Project Control Group
Lake Hamilton WSUD program: design and construction	• Prioritise actions including the more detailed design of WSUD assets based on the results of the above analysis (including cost of nitrogen removal and the feasibility / constructability of each asset) • Commission functional and detailed design for the priority asset/s • Construct the highest priority WSUD asset • Prepare budget application to undertake functional and detailed design for the remaining WSUD assets identified within the concept • Complete functional and detailed design for all WSUD assets	As part of the functional design incorporate informative community signage explaining the objective and role of the asset It is proposed that the design and construction of the highest priority WSUD asset be completed first, to provide the community with an example of outputs from this plan that they contributed to	Functional and detailed design: 2021 - 2025 Construction commencing 2022/23	High	Assets and engineering
	• Prepare an ongoing construction program for the remaining WSUD assets over a 5-10 year capital period • Maintain an allocation of operational funding for the maintenance of WSUD assets i.e. include these in the asset register • Combine maintenance funding with capacity building program with Civil Works and Operations staff	Estimate cost of construction within the concept has been based on Melbourne Water Schedules Capacity building to be run by designer or through an organisation like Clear Water. Apply for funding support through similar organisations	2022 - 2027	High	Civil works and operations
	• Ensure that new developments achieve best practice environmental management (BPEM) stormwater treatment requirements as a matter of policy • Investigate the potential to 'offset' small scale WSUD assets to build larger assets lower in the catchment to reduce maintenance burden and improve performance	The aim is that all new developments contribute to this objective in accordance with the Victorian Planning provisions stormwater and integrated water management requirements	From 2022	High	Assets and engineering Planning
Catchment scale collaboration	• Collaborate with the GHCMA to support the prioritisation of funding for upstream catchment and waterways improvements that will benefit Lake Hamilton water quality including: ○ Fencing to exclude stock from waterways ○ Revegetating the riparian corridor ○ Removal of exotic weeds ○ Working with landowners to optimise fertiliser application.	This IWM plan focuses on urban Hamilton It is recognised that these urban catchments are one contributor to lake health with significant sediment and nutrient loads being contributed by rural catchments upstream This action is about supporting GHCMA in their work to improve upstream conditions over time.	2020 - 2030	Medium	GHCMA (lead) Assets and engineering
Other initiatives	• Investigate other complementary actions that could be implemented should funding become available or an opportunity present itself ○ Removing sediment in the event that the lake is drained/empty ○ Excavation of the lake to increase depth in the event that the lake is drained/empty ○ Increasing macrophyte coverage to absorb nitrogen / harvest macrophytes (possibly for soil improvement projects)	Note that dredging was discussed with a prohibitive cost excluding it from this plan Nitrogen (macrophyte) harvesting may complement the horticultural trials also proposed as part of this plan	2020 - 2030	Low	SGSC (lead) with GHCMA

Showgrounds rainwater harvesting

Action	Sub actions / Description	Notes	Timing	Priority	Responsibility

Concept development (underway)	As part of this IWM plan, prepare a concept design to:
	• Identify showground and HILAC roof areas that could be the source of rainwater for nearby uses
	• Confirm non-potable demands within HILAC, focussing on pool use, irrigation etc
	• Based on a water balance (MUSIC model) optimise a rainwater storage volume assuming
	  ○ Showgrounds and HILAC roof, and
	  ○ Showgrounds roof only
	  ○ to meet assessed pool and irrigation demand
	• Identify a suitable location for storage either on showgrounds, HILAC land or as part of other nearby construction activities
	• Identify a transfer arrangement including pump and sub-road pipeline arrangement to supply HILAC
	• Identify all existing underground services
	• Calculate the potential water saving, capital and operating cost and the cost per kL of water
		This concept design is to be prepared as part of the scope for the Hamilton IWM Plan
		See Appendix E for concept design
		Note that most water is used in the pool and surrounding gardens
		Backwash water is used to flush toilets so that has been ignored here
		Key issue will be storage location taking into account Showgrounds Masterplanning
		Notionally locate storage along Shakespeare St
			2020	Very high	Alluvium Consulting Australia with IWM Project Control Group

Policy	Council should consider a policy that requires rainwater harvesting to be incorporated into Council's new builds and facilities As part of this review existing buildings should be audited to understand if there is potential for retrofitting Council buildings	The aim of this is to ensure that this project is not a stand-alone, rather that water and rainwater harvesting will be considered as part of Council projects more broadly	From 2022	Medium	Assets and engineering
Functional and detailed design	Assuming that the concept illustrates that the option, or a variation of it is feasible, progress the concept design to functional and detailed design to define: • Reconfiguration of drainage and guttering requirements at the showgrounds site with a view to collecting all rainwater in as fewer locations as possible • Confirm storage location, footprint and volume (including whether surface or sub-surface) • Civil design of rainwater transfer assets including pipe and small pump station to transfer water from showgrounds storage to HILAC • Connection of rainwater to the internal plumbing. Assumption is that rainwater will be directed to the balancing tank, for treatment and use	Non-potable end uses have been identified with Government guidelines confirming suitability of rainwater for pool use. Preference is for above ground storage to reduce cost	2021	High	Assets and engineering
Construction	• Construction of one or more storage to achieve desired total volume • Construction of transfer pump / pipe arrangement from storage to HILAC plumbing (notionally under Shakespeare St) • Plumbing to balance tank • Commissioning • Signage within HILAC highlighting the end uses that now rely on rainwater • Preparation of management plan for the ongoing management and maintenance of the harvesting system as per the recommendations within "Rainwater use in community facilities" (Dept of Health, Vic, 2013)	Time construction for complementary works e.g. • Car park refurbishment • King St roundabout works • Masterplan, or upgrade works within the showgrounds Ensure promotion of the initiative to the facility users via signage and (if possible) cumulative statistics on water saved) Undertake training and awareness for staff to ensure that maintenance is ongoing	2022	High	Civil works and operations

Expanding non-potable water networks to support horticulture

Action	Sub actions / Description	Notes	Timing	Priority	Responsibility
Concept development (underway)	As part of this IWM plan, prepare a concept design that: • Identifies available Class C recycled water resources that are available for irrigation from the Hamilton recycled water treatment plant • Identify a preferred site for a horticultural trial with suitable soil, proximate to recycled water source and with manageable lease and land transfer arrangements (i.e. land owned and managed by Council or Wannon Water preferably) • Identify suitable crops for the horticultural trial noting their volumetric demand and water quality requirements (as per EPA guidelines and with reference to the Deakin University study from 2014) • Identify infrastructure requirements to extend (if required) the recycled water network to the nominated site • Confirmation of storage requirements, if any, taking into account existing storages (e.g. as per the Old Monivae Farm site) • Assess the cost (including infrastructure requirements) and potential benefits of the trial including respective value of trial crops	This concept design is to be prepared as part of the scope for the Hamilton IWM Plan. See Appendix F for concept design Options for the trial site include Old Monivae farm and the site south of the existing landfill / transfer station Work with Economic Development staff to define trial scope, location and crops Wannon Water will be a key partner in this concept	2020	Very high	Alluvium Consulting Australia with IWM Project Control Group Wannon Water

Detailed planning	Assuming that the concept supports ongoing investigation, progression to a detailed planning phase will commence, including:
	• Negotiations between Wannon Water and Council to confirm lease and land availability arrangements for the preferred site
	• Establish an MoU with Wannon Water for collaboration in the design and construction (if required) of recycled water infrastructure
	• Engage with external commercial, agricultural producers to confirm the most beneficial trial crops and agree the number of crops being trialled (e.g. are we focussed on one crop or potentially investigating a number. This may be a function of available space)
	• Undertake soil testing to assess land capability and particularly the potential impact of recycled water salinity concentrations on soil
	• Functional and detailed design of
	  ○ the recycled water network extension requirements
	  ○ irrigation network, pumping etc
	  ○ storage construction or improvement of existing storage (if required)
		Propose that Wannon Water manage the functional and detailed design of recycled water related assets including any changes to the recycled water network and storage
		Irrigation infrastructure to be co-managed by Council and Wannon Water
		Soil and impact of recycled water salinity to be assessed prior to detailed asset planning
		Note also that the proposed abattoir could impact salinity periodically and the preference is for this trail to be protected from those changes.
		Seek external funding from bodies like Regional Development Victoria
			2022	Very High	Economic development and Tourism
					Wannon Water
					Assets and engineering

Construction	• Construction of designed assets
	  ○ the recycled water network extension
	  ○ pump station
	  ○ storage construction or improvement of existing storage (if required)
	  ○ irrigation network
	• Planting – source subject crop/s stock
	• Commissioning and opening
		This phase focuses on installing irrigation infrastructure and planting of resident crops
		Timing of this may be directed by
		• negotiation of lease agreements
		• plant requirements.
		Propose a launch of the trial that may coincide with other community or regional events
			2025	High	Economic development and Tourism
					Wannon Water
					Civil works and operations

Old Reservoir system investigation

Action	Sub actions / Description	Notes	Timing	Priority	Responsibility
Concept development (underway)	As part of this IWM plan, prepare a concept design that: • Prepare a high-level MUSIC water balance model of the system, taking into account storage volume, demands, catchment and historical rainfall, runoff and evaporation to understand the yield of the system • Rely on service proving to document the current condition of network assets • Document the condition of the network assets highlighting any asset improvement requirements to realise the optimal operation of this network • Maps the assets in the network by condition with commentary on potential remaining asset life and replacement schedule • Prioritise works based on agreed criteria like asset age, condition and criticality to overall network performance • Consider the need for additional pumping assets to serve irrigation networks at open spaces across the Old Res network. • Provide as capital cost estimate for high priority assets.	Concept work is to be prepared as part of the scope for the Hamilton IWM Plan. See Appendix G for concept design This concept work is likely to rely upon an external service provider to undertake service proving or CCTV to understand the condition and age (if possible) of existing assets	2020	High	Alluvium Consulting Australia with IWM Project Control Group
Planning and functional design	• Engage a water infrastructure / network designer to prepare functional designs for distribution assets in order of priority (scope to be determined in line with available budget) • Commence functional design of assets that are considered critical to the ongoing and efficient operation of the network. Include completion of relevant survey. • Confirm method of construction (excavation, boring, pipe cracking etc) • Confirm network connections to potential end users ensuring new designs can accommodate head / pressure of design flow (irrigation demand) • Prepare functional designs for required raw water pump stations • Provide capital and operating cost estimate	The program of works will be designed to take advantage of funding opportunities over time. The main objective is to ensure irrigation is efficiently delivered to end use locations At this stage, additional treatment is not required for the whole system but could be considered by end user.	2022	High	Assets and engineering In partnership with Wannon Water
Detailed design and construction	Upon receipt of funding complete: • the detailed design of critical / high priority assets • geotechnical analysis, environmental and cultural studies • construction documentation Collaborate with Wannon Water to engage construction contractor Maintain Wannon Water in construction supervisor / support role if possible	Detailed design and construction is intended to be undertaken on an opportunistic basis when internal or external funding becomes available Suggest collaboration with Wannon Water to specify functional and detailed design requirements and construction contract	Dependent upon funding opportunities and streams	High	Civil Works and operations Assets and engineering In partnership with Wannon Water

Irrigation efficiency investigation

Action	Sub actions / Description	Notes	Timing	Priority	Responsibility

Initial investigation	• Initiate an audit of irrigated open spaces within Hamilton to estimate
	  ○ Volume consumed (on average)
	  ○ Age and condition of irrigation infrastructure
	  ○ Operational efficiency including need for manual handling
	• Collate existing asset and operational information re: constructed irrigation plans and identify gaps
	• Engage with Council's civil works and operations team to review the available data and plans and combine this anecdotal evidence of irrigation conditions and perceived efficiency from the field
	• Undertake a qualitative ranking based on the above to prioritise renewal or upgrade of existing irrigation infrastructure.
	• Conclude with a prioritised list for further investigation
		The aim is to identify the opportunity that will improve water efficiency overall, this may be irrigation infrastructure, grass type or automated operation.
		This will also improve operator efficiency
		This investigation could be undertaken in conjunction, or with consideration of, the scope of the Old Res Network investigation, for those open spaces irrigated by the Old Res network.
			2023	Medium / High	Assets and engineering

Detailed planning	For higher priority open spaces scope required works including • Irrigation upgrades to improve irrigation coverage, reduce leaks, reduced manual handling etc • Identify opportunities for automation (to eliminate manual handling, enable remote operation and improve efficiency) • Review turf renewal program, and consider locations to sow warm season grasses to reduce long term water consumption (potentially increasing short term demand) • Prepare capital cost estimates for identified works, highlighting potential cost savings associated with reduced labour		2025	Medium / High	Civil works and operations
Design and construction	• When budget becomes available, implement improvements for highest priority site/s • Engage an irrigation designer to review existing irrigation infrastructure and undertake detailed design for improvements providing a detailed cost estimate. • Engage irrigation construction contractor		2025 onward	Medium / High	Civil works and operations

Environmental and cultural wayfinding

Action	Sub actions / Description	Notes	Timing	Priority	Responsibility

Concept development	• Engage with the CMA and Gunditj Mirring to identify cultural and environmental destinations for potential inclusion in a wayfinding plan
	• Collate information and internally (or via engaging an external consultant), draft a wayfinding strategy that includes:
	  ○ Key locations
	  ○ A hierarchy of signs – including directional signage, indication of routes and distances, and information about specific interests at those locations
	  ○ Wayfinding information in a consistent format
	  ○ Highlights local walking and cycling trails
	  ○ Identifies where signage should be located for maximum visibility and effect
	• Collate to develop a detailed signage plan
		The aim is to have a refreshed wayfinding approach to enable locals and visitors to identify some of the unique natural and cultural assets in Hamilton
		The project should focus on illustrating the major origins and destinations within Hamilton and ways that people can make journeys between places
		The aim should also be to encourage more passive modes of transport by providing information regarding distances, times and what you will find there.
		This will include locations as well as walks and trails
		Proposed to be a joint project between the Shire and the CMA
			2025	Medium	Community and leisure services
					Economic development and tourism
					GHCMA

Design and delivery	• Undertake a pilot to test the new signage approach (propose Lake Hamilton) • Expand the program based on feedback, to install signage across the locations developed during the concept phase • Update Council website to include wayfinding information • Undertake a launch, encouraging cycling and walking between locations, with free coffee / BBQ at nominated locations	The aim will be to have consistent information across the town and on the website to direct, particularly visitors, to new locations This may highlight the need for improvements or addressing gaps in walking and cycling paths and may be undertaken in conjunction with that work (if required).	2027	Medium	Community and leisure services Economic development and tourism GHCMA

Grange Burn urban water quality improvement

Action	Sub actions / Description	Notes	Timing	Priority	Responsibility
Concept development	Prepare a concept design that identifies: • Urban catchments contributing stormwater runoff to the Grange Burn, downstream of Lake Hamilton • Identify and map drainage outlets to Grange Burn • Calculate pollutant loads entering the river and the likely footprint of a suitable WSUD asset/s (being wetland or biofilter) to meet or exceed best practice for that catchment • Identify an appropriate or potential location for additional WSUD assets • Prepare a concept level cost estimate for each asset • Prepare an asset prioritisation based on a $ / kg TN removed During this process, undertake a visual inspection with a qualified wetland professional to review the condition and function of the Grange Burn wetland to appreciate if further assessment or works may be required	The approach to this work will be similar to that set out under *Lake Hamilton blue green algae action plan,* however these works are proposed for downstream of the lake This should be combined with a condition and function assessment of the Grange Burn wetland It is proposed that this project would be undertaken in partnership with the GHCMA	2025	Low	Assets and engineering GHCMA
Design and construction	• Prioritise identified WSUD assets based on estimated cost and asset effectiveness and constructability • Agree budget sharing arrangement with GHCMA to prepare functional and detailed designs for a high priority asset, or a package of equally effective assets • Over time, continue to prepare asset designs • Commence a construction program for prioritised WSUD assets based on available funding • Include an allocation for maintenance • Draw on capacity building learnings from the Lake Hamilton water quality project	As part of the functional design incorporate informative community signage explaining the objective and role of the asset	2030	Low	Assets and engineering Civil works and operations GHCMA

Residential rainwater disconnection

Action	Sub actions / Description	Notes	Timing	Priority	Responsibility

Concept and planning	• Wannon Water to undertake sewerage catchment analysis to identify high inflow catchments that could be the subject of a trial
	• Undertake some background costs analysis to indicate (if possible) what stormwater connections in Hamilton cost Wannon Water including how it might impact the timing of capital upgrades
	• Work with Council's community relations team to communicate with residents within the trial catchment and identify those who would be willing to have their connections investigated
	• Engage the local plumbing fraternity in this process so that they can visit locations and understand the environmental and economic impact of connecting stormwater to sewer
	• At the conclusion of this stage reassess the impact and community response to understand if the program should continue and be rolled up more broadly, based on prioritised catchments as identified by Wannon Water
	• Identify options for individual households including
	  ○ If possible, get works under warranty, or where the plumber can be identified, to have connection repaired
	  ○ Enforcement of repair
	  ○ An alternative incentive program, where things like rainwater tanks and onsite improvements might be offered if the householder repairs their connection
		As part of the workshop series this opportunity was not rated highly however some initial investigations could be undertaken by Wannon Water to understand if there is a catchment that could be an effective case study, pilot or trial
		The aim would be to do sufficient investigation to warrant (or not) further work to establish if there may be reasonable to significant capital or operating cost savings associated with reduced peak flows, and therefore if there is a business case to progress this opportunity.
		
		If not, then the step to educate local plumbers would be a worthy stand-alone exercise.
			2030	Low	Wannon Water
					Assets and engineering

7 Monitoring, evaluation, reporting and improvement (MERI) framework

A Monitoring, Evaluation, Reporting and Improvement (MERI) framework is a conceptual model designed to support Council to monitor the progress of their IWM Plan. This provides a basis for learning, improvement and accountability.

The framework supports the development of milestones and metrics by which to assess the progress of this plan over time; the relative effectiveness, efficiency and appropriateness of different actions and the extent to which an action has an impact on reaching our desired outcome, objective or target. The MERI framework makes changes transparent so that all parties can learn, through reflection and discussion, which interventions are most appropriate, effective and efficient.

For this project we will design the MERI against the vision, outcomes and objectives of the Strategic Directions Statement for the Great South Coast Region.

Table 5. MERI definitions and relationships

Framework level	Definition
Vision	A statement of the overall vision for the region and for Hamilton (as per the SDS)
Outcomes	The seven high level outcomes defined within the SDS
Objectives	Number of objectives defined under each of the seven outcomes
Actions	Management actions and physical changes that • lead to a change in condition • inform planning, investment, prioritisation and decision-making These are summarised within the action plan above

The MERI framework makes changes transparent so that all parties can learn, through reflection and discussion, which interventions are most appropriate, effective and efficient.

Guiding principles
The following principles will guide the development of the MERI framework.

- Aligned to the vision, outcomes and objectives of the IWM Forum
- Be clear, concise and simple to use
- Engage stakeholders
- Be flexible to the evolving priorities of the IWM network and
- Be realistic to what can be achieved and measured.

Approach
The approach of the MERI is to evaluate to:

- Focus on key issues to inform ongoing decision making
- Specify criteria for determining success
- Use evidence-based approach to assess performance
- Be reliable, useful and relevant to decision makers and stakeholders

- Be based on a mix of quantitative and qualitative indicators as well as case studies and lessons learned
- Clearly define roles and responsibilities
- Ensure clear and transparent reporting that outlines methods, assumptions and key findings
- Be timely.

Key evaluation questions

Key evaluation questions provide high-level guidance on what the evaluation is trying to address and help to shape the development of indicators and evaluation methods. To keep the assessment relatively easy to implement, the MERI framework will focus on the following questions:

- Did we do what we said we would? Why / Why not?
- To what extent were the desired outcomes achieved?
- What have we learned and how have we improved?

Table 7. Key evaluation questions

Question type (evaluation category)	Key evaluation question	Relationship to the plan	Frequency of review
Achievement **Reflection and learning** **(Effectiveness)**	**KEQ1. Did we do what we said we would?** Is the Program being implemented as intended? What factors are helping or hindering implementation? How could it be improved?	Opportunities (projects, policies and programs)	Annual
Reflection and learning **(Effectiveness and impact)**	**KEQ2. To what extent are the desired outcomes being achieved?** How well are we meeting the Great South Coast IWM Forum outcomes? How are plan outputs being used/applied? Which plan outputs are most useful? How has the plan changed in response to advice? Are there any unexpected or unintended outcomes?	Outcomes	Annual
Reflection and learning **(Efficiency)**	**KEQ3. What have we learned and how have we improved?** Are the identified combination of projects, programs and policies achieving the desired outcomes? What has, or should change and why?	Inputs, opportunities	3-yearly

Action plan

Actions can lead to biophysical, institutional and economic outcomes. The MERI framework supports and informs the action plan, setting out the level at which targets are set and how they should be monitored and reported on. In the case of this IWM Plan, the MERI has been developed based on an understanding of the prioritised opportunities.

Monitoring
Monitoring determines whether the actions have been achieved or suitably progressed based on the timelines expressed in the action plan. This will be understood by monitoring the progress against the action plan.

- *Monitoring asset condition* describes measuring changes in the state of and trends in the condition of assets and will generally correspond to whether asset design or construction milestones have been reached. This will correspond to annual review.
- *Monitoring plan performance* describes changes in people, organisations, institutions, practices and technologies that create an environment that is conducive to improving internal capacity. This will correspond to regular (e.g. every 3-5 years) check ins or reviews on how programs are performing based on requested feedback.

For the purposes of this plan, we will be predominantly concerned with monitoring program performance as against completion of design works and growth in organisational and community capacity and understanding along with a general awareness of council's water related projects and activities.

Reporting
Reporting can occur at all levels of management and within any timeframe depending on the intention and audience. The purpose of reporting is to communicate progress and performance on outcomes; challenges and learnings; and accountability and transparency to stakeholders, the community and within council.

It will be important for Council to report on the progress of the IWM Plan, both to indicate achievement internally and to share this work with the community. For the purposes of this plan the following reporting regime will be adopted:

1. Reporting on the achievement of individual actions:
    - Reporting on asset related actions every year.
    - Review of the plan performance every three years to allow Council to consider emerging social, environmental and economic trends to enable change and adaptation to policy positions at the state or national level. This will also provide an opportunity to review the progress of longer-term programs, such as the incorporation of Aboriginal knowledge into water related plans and policies.
2. Full review and update (if required) of the Plan at 5 years.
3. Fully review and update plan at nine years with new plan agreed by ten years (2030).

Improvement
Improvement involves ongoing review, learning and adaptation based on reflection of the plan's progress including the perceived effectiveness of actions and activities. Identified improvement actions can result in amendment to actions within the plan.

MERI schedule
A MERI Plan has been provided in Table 6 that sets out:

- Key evaluation questions
- Proposed frequency of review and evaluation
- Key indicators
- Reporting audience.

Performance indicators and measures
Performance indicators are measurable metrics that are reported for accountability, transparency, progress and achievement. Potential performance indicators and measures are shown in Table 6.

For many of these indicators a quantitative target for measuring progress or success may be developed e.g.

- "on track" = >5
- "attention required" = 1-4
- "off track" = <1

It is assumed that these measures will be adopted where data is not available and the assessment relies on feedback, interviews and other qualitative data. These assessments are best developed through internal collaboration to be reviewed annually. It is anticipated that potential indicators and measures will be further refined on consideration of the resourcing (budget, personnel) allocated to evaluation on an annual basis.

Table 6. *MERI Plan (KEQs, potential performance indicators and measures)*

Evaluation Question type	Evaluation Question	Potential performance indicators / measures	Data source/s	Review frequency
Achievement / effectiveness	**KEQ1. Did we do what we said we would?**			
	To what extent is the plan being implemented as intended?	Completion of planned deliverables Review meeting help and action items implemented (On track / attention required / off track)	Internal administrative data Internal stakeholder information	Annual
		Capability and capacity: Community events held / Number of attendees Informal feedback from community	Administrative data Interviews and feedback	Annual
	What factors are helping or hindering plan implementation? How could it be improved?	Identification of improvement opportunities	Internal stakeholder information	Annual
Reflection and learning (effectiveness and impact)	**KEQ2. To what extent are program outputs useful?**			
	How well is the plan meeting expectations internally and externally? By whom and in what ways are plan outputs being used/applied? Which plan outputs are most useful? Has the plan been adapted in response to feedback internally or externally? Are there any unexpected or unintended outcomes?	Degree to which the plan reflects the needs of key internal stakeholders Satisfaction with plan outputs Referencing of plan outputs in other documentation – i.e. website, other strategies, IWM Forum	Internal stakeholder information and feedback Document review Event (or post event) surveys	Annual

Accountability Achievement (effectiveness and impact)	**KEQ3. What have we learned and how have we improved?**			
	What environmental impacts have resulted from the plan?	Improved management of environmental issues - More efficient use of potable water - Reduced stormwater pollution - Increased use of non-potable sources on a fit-for-purpose basis - Improved WSUD asset performance	Data based on detailed design analysis and visual inspection of asset performance	3 yearly
	What social impacts have resulted from the plan?	Improved management of water for social benefit - Increase in community water literacy - Traditional owner knowledge is incorporated into projects and programs - Water projects incorporate liveability considerations	Data based on survey and feedback Document review (where do these elements appear)	3 yearly
	What economic impacts have resulted from the plan?	Improved management of water to support economic values - Improved the quality and condition of environmental assets - Improved urban liveability outcomes (e.g. green streetscapes and open spaces) - Urban development aligns with plan outcomes reducing council retrofits and required upgrade to developer assets	Internal stakeholder information and feedback Community and visitor feedback Asset inspection	3 yearly
	What could be improved to maximise efficiency and effectiveness plan implementation	Level of satisfaction with plan implementation and governance	Internal survey and feedback	3 yearly

8 Conclusions

The Hamilton IWM Plan has relied upon data, existing strategic work and engagement across the town's community to identify water cycle issues and opportunities. The SDS document and its vision and outcomes for the region guided that process, with the opportunities identified being unique to Hamilton.

The water cycle in Hamilton is unique with a relatively reliable potable water scheme and a recycled water and raw water network that supports the irrigation of open spaces across the town. This is a significant advantage as Hamilton greens its open space to enable recreation and cool the landscape. These non-potable sources will give Hamilton resilience to the changes in rainfall and streamflow predicted under climate change.

In additional to water sources, central to this plan is the protection of Hamilton's natural assets, principally Lake Hamilton and the Grange Burn. The treatment of stormwater from urban catchments is important here, as is collaborating with GHCMA to reduce nutrient loads from upstream catchments. What needs to be recognised is that improving water quality in Lake Hamilton is a multi-faceted issue, of which urban stormwater is one component. Fixed conditions like the lake's depth and high residence time are likely to be more significant factors.

The concept designs that have been prepared respond to priorities as seen by stakeholders and enable the Council to progress projects to their next logical step based on an understanding that they are technically feasible.

The remaining opportunities that have been identified are set out within the Action Plan that extends to 2030 and will be subject to periodic review as per the monitoring and evaluation plan included in Chapter 7.

9 References

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DELWP, Western Water, Hume City Council (2015), Preliminary Assessment Method (PAM) for Integrated Water Management Strategies

DELWP (2016), Guidelines for Assessing the Impact of Climate Change on Water Supplies

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Glenelg Hopkins Catchment Management Authority (2014), Waterway Strategy 2014-2022

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Attachment A
Great South Coast SDS Outcomes and Objectives

Vision and Outcome Areas for the Great South Coast IWM Forum Region

Our Vision

Water is life – we will work together with our communities to deliver integrated water outcomes contributing to the resilience of our environment, culture and economy.

IWM Outcome Areas

The region is seeking to achieve seven key outcomes through IWM. Each of these will have a significant role in shaping the liveability, prosperity and resilience of our cities and towns. These outcome areas provide indicators to assess the effectiveness of the various IWM opportunities, recognising that these outcomes are in themselves co-dependent.

Low-emission solutions

IWM opportunities that minimise the release of greenhouse gas (GHGs) emissions will be considered by the Forum as solutions are evaluated for implementation.

Outcomes						
Safe, secure and affordable supplies in an uncertain future	**Effective and affordable wastewater systems**	**Avoided or minimised existing and future flood risks**	**Healthy and valued waterways and marine environments**	**Healthy and valued landscapes**	**Community values are reflected in place-based planning**	**Jobs, economic benefits and innovation**
Objectives						
Secure water supply for industrial, economic, environmental, cultural and community needs	Meets public health and environmental standards	Communities, properties and infrastructure assets that are resilient to local flood risk	Improved ecological health and biodiversity of our urban waterways, water bodies and beaches	Active and passive recreation supported by sustainable water supply	Diverse urban landscapes that reflect local conditions and community values	Jobs and local economies, including industry, tourism and agriculture, supported by integrated water planning
Well-managed water demand and efficient use of water	Effective wastewater systems to meet the needs of economic and population growth		The economic value of ecosystem services is understood by our communities and recognised in planning processes	Urban landscapes retain moisture for cooler, greener cities and towns	Water sensitive communities that are empowered and engaged	Strong governance and collaboration models that evolve to deliver innovative solutions
A diverse range of water supplies and resources which are fit for purpose	Waste-to-resource opportunities are maximised		The whole-of-catchment context (upstream / downstream) is recognised in decision making.	Waterways and coastal environments accessible as valuable open space	Local water related risks and issues understood and managed by the community	Residents and visitors are attracted to our reliably green region and healthy waterways
Water quality meets regulatory standards and community expectations	Equitable access to effective wastewater systems		Improved connectivity and access for active transport links	Traditional Owner values associated with waterways are protected and enhanced	Traditional Owner values, needs and aspirations associated with water are understood, protected, enhanced and continued	
					Recognise the competing values that exist for community use of public open space	

Figure A 1. *GSC IWM Forum SDS Outcomes and Objectives*

Attachment B
Stormwater Modelling

1 Impervious fraction inputs

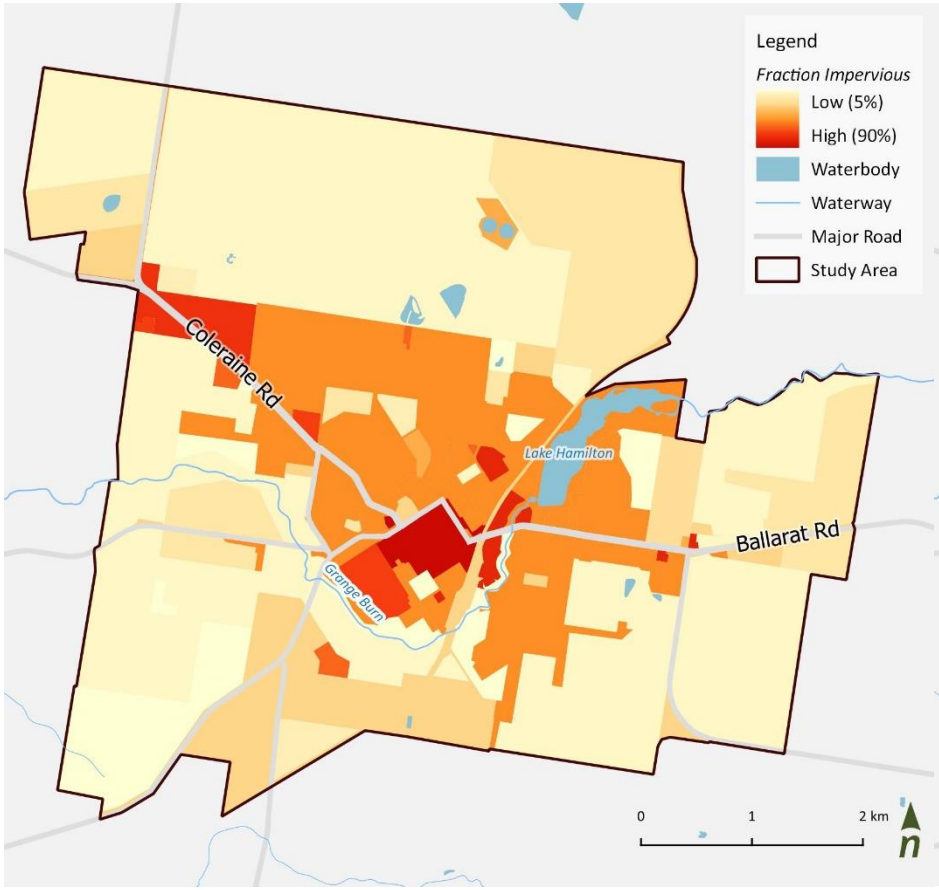

Figure B 1. *Current land use impervious fractions*

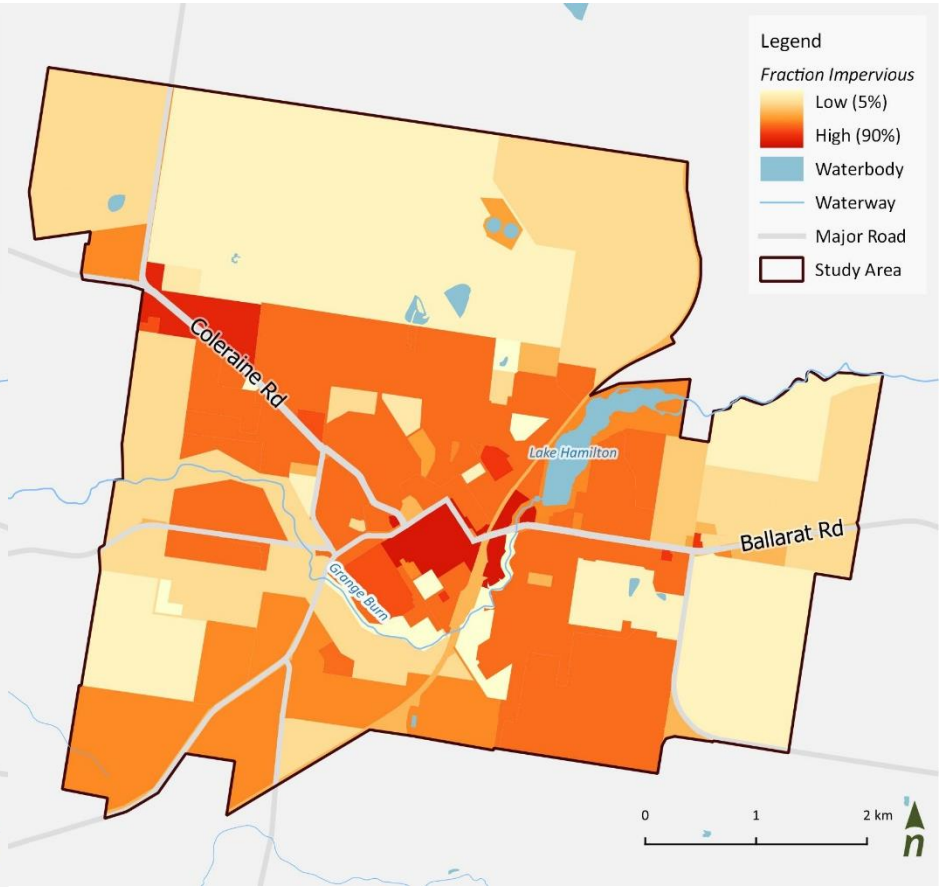

Figure B 2. *Projected future land use impervious fractions*

2 Model inputs and meteorology

Land use*	GCM "Time slice"	Area (ha)	Impervious area (ha)	Rainfall (mm/year)#	PET (mm/year)#
Existing	1995	3557	840	595	1200
Developed	1995	3557	1160	595	1200
Existing	2040	3557	840	565	1245
Developed	2040	3557	1160	565	1245
Existing	2065	3557	840	545	1280
Developed	2065	3557	1160	545	1280

* Based on planning zones – currently developed vs developed to extent of zones…

current (1995 "time slice") rainfall and PET taken from Casterton, 1980-1989 BOM data (via ewater). Future numbers scaled from this, based on DEWLP median scenarios for Glenelg River Basin, as per

Table B 1. *MUSIC model inputs*

3 Model results

3.1 Historical climate (1995 Time slice)

Table B 2. *Historical climate model. Pre-1750 land use, current land use, developed land use*

	Runoff (ML/year)	Total Suspended Solids (kg/year)	Total Phosphorus (kg/year)	Total Nitrogen (kg/year)	Gross Pollutants (kg/year)	Rainfall in (ML/year)	ET loss (ML/year)
Forested (pre-1750 land use)	190	1,560	6	150	0	21,220	21,040
Current land use	4,150	828,000	1,790	11,600	223,000	21,220	17,070
Future land use	5,640	1,170,000	2,230	16,400	313,000	21,220	15,580
Change current > future	1,490	342,000	440	4,800	90,000	0	-1,490
	36%	41%	25%	41%	40%	0%	-9%

3.2 2040 median

Table B 3. *2040 median scenario climate model. Pre-1750 land use, current land use, developed land use*

	Runoff (ML/year)	Total Suspended Solids (kg/year)	Total Phosphorus (kg/year)	Total Nitrogen (kg/year)	Gross Pollutants (kg/year)	Rainfall in (ML/year)	ET loss (ML/year)
Forested (pre-1750 land use)	80	660	3	60	0	20,160	20,080
Current land use	3,830	805,000	1,570	10,800	209,000	20,160	16,330
Future land use	5,230	1,110,000	2,150	14,700	295,000	20,160	14,930
Change current > future	1,400	305,000	580	3,900	86,000	0	-1,400
	37%	38%	37%	36%	41%	0%	-9%

3.3 2065 median scenario

Table B 4. *2065 median scenario climate model. Pre-1750 land use, current land use, developed land use*

	Runoff (ML/year)	Total Suspended Solids (kg/year)	Total Phosphorus (kg/year)	Total Nitrogen (kg/year)	Gross Pollutants (kg/year)	Rainfall in (ML/year)	ET loss (ML/year)
Forested (pre-1750 land use)	35	300	1	30	0	19,430	19,400
Current land use	3,630	748,000	1,560	10,400	198,000	19,430	15,810
Future land use	4,980	1,030,000	2,150	14,300	283,000	19,430	14,460
Change current > future	1,350	282,000	590	3,900	85,000	0	-1,350
	37%	38%	38%	38%	43%	0%	-9%

Attachment C
Opportunity Long List

	IWM Opportunity	Type	Description	Water supply	Wastewater	Flooding	Healthy waterways	Healthy landscapes	Community values	Economic benefit
1	Expansion of the recycled water network	Investigation	Recycled water produced at the Hamilton Water Reclamation Plant (WRP)is used for a range of irrigation purposes in Hamilton. Excess Class C recycled water is irrigated to the Monivae pasture. This is arguably a low value use for that water. Council has also noted that irrigation areas are becoming constrained given the impact of continued irrigation on soil. This opportunity is to investigate supplying recycled water for a higher-value purpose, whether that be social or economic. Possible higher end users include: - Future horticultural activities - Nurseries - Existing playing fields (such as the Croquet Club) - Ballarat Road irrigation area The investigation would involve: - Identifying end users, their demands and water quality requirements - Considering the opportunity for 'shandying' Class C with other sources (Class A, stormwater or potable water) to broaden potential applications - Identifying additional infrastructure needs including transfer and treatment - Identifying potential benefits (particularly economic) - Comparison of a cost per kL across different end use options	✓	✓			✓	✓	✓
2	'Old' Reservoir system investigation and augmentation options analysis	Investigation	Hamilton's Old Reservoir provides untreated or raw water for irrigation of parks, gardens and open spaces throughout Hamilton. The reservoir network transects the township providing potential opportunity for additional end users to tap into the network. This opportunity is to improve the understanding of the Old Res network, its capacity, potential to meet demands and in doing so identify system augmentations. Examples of additional demands or end uses include: - Irrigation of an urban green corridors as proposed within the Hamilton Masterplan (e.g. along Lonsdale St) - Supplying firefighting tanks and CFA competition track at the Hamilton Showgrounds - Irrigation of space around Lake Hamilton	✓		✓		✓	✓	
3	Shadeways / Urban Forest water use plan Streetscape WSUD?	Plan	The Hamilton structure plan shows green corridors throughout the town, with pedestrian and cycle paths shaded by street trees, providing links from the CBD to open spaces and natural areas like Grange Burn. This opportunity is to develop a plan to incorporate water sensitive urban design to support the proposed urban greening program. This would involve: - Identifying where the greening is proposed plus other priority locations (i.e. to provide shading around Lake Hamilton aligned with the Lake Hamilton Masterplan) - Identify opportunities for street-scale urban greening and stormwater treatment infrastructure such as street trees, vegetated swales, and bioretention systems that utilise runoff for irrigation and improve the quality of stormwater flowing into waterways - Identify additional small scale, urban greening opportunities such as green walls, vertical gardens and community gardens. The plan would respond to the existing structure plan, identifying street tree species, their shade benefits and watering requirements, with a preference for native species that have a lower demand and are self-sustaining after initial establishment. The plan would also identify opportunities for small scale stormwater detention infrastructure to mitigate against flash flooding in locations where it is known to occur (refer Hamilton Flood Study).	✓	✓			✓	✓	✓

	IWM Opportunity	Type	Description	Water supply	Wastewater	Flooding	Healthy waterways	Healthy landscapes	Community values	Economic benefit
4	Hamilton Showgrounds roof water harvesting for HILAC	Concept/ project	Hamilton Showground buildings have large roof areas that could potentially collect volumes of rainwater. The site itself has a relatively limited demand for water meaning there is potentially an excess of runoff coming from that site, with space for storage. The showgrounds are directly across from the road from the Hamilton Indoor Leisure and Aquatic Centre (HILAC), one of the largest potable water users in the area. The opportunity is to investigate the feasibility of harvesting rainwater from showground roofs to supplement the current potable demands of the HILAC, as well as other potential users in the vicinity. The investigation would: - identify potential demands (primarily within the aquatic centre) - storage requirements (and location for that storage) based on a water balance model - a potential transfer concept (i.e. how to get water from A to B) - the reliability of a rainwater supply and the potential volume of water saved.	✓			✓		✓	✓
5	Residential rainwater harvesting/sewer inflow investigation	Investigation / options analysis	Hamilton residents have a high rate of domestic rainwater tank ownership according to Wannon Water (58%), primarily for drinking and irrigation of gardens. Due to the seasonal nature of rainfall in Hamilton (experiencing particularly infrequent rain in summer), domestic rainwater tanks are unlikely to meet summer demands, but may be very effective in reducing potable demands over winter. At the same time, a significant number of households in Hamilton have their roofs connected to the sewer network resulting in excess flows to the system during wet weather. Wannon Water advise there is a ~30% increase in flows observed during storm events. This places stress (and additional cost) onto Wannon Water's network and treatment infrastructure to manage that peak. Wannon Water understand the areas of concern. This opportunity is to reduce the excess flow into the sewer from incorrectly connected stormwater pipes and improve the effectiveness of rainwater use by Council and residents. The investigation will consider: - Reviewing opportunities for rainwater harvesting on council buildings and sporting facilities focussing on consistent demands like toilets - Investigate incentives to replumb residential systems to toilet and laundry (particularly in winter when irrigation demands are low) - Potentially combine with community education, and disconnection from sewer opportunities discussed below. - Develop a strategy to identify and systematically disconnect household roofs from the sewerage network - Require residents to connect to stormwater, or offer incentives to connect to rainwater tank to reuse water onsite - The strategy would be supported by community consultation highlighting the impact of this on the Hamilton environment.	✓	✓		✓		✓	✓
6	Irrigation efficiency	Investigation / audit	While some parks and sports reserves have automatic sprinkler systems, manual watering is still required in some locations where irrigation systems don't meet satisfactory irrigation distribution requirements. The opportunity is to improve the efficiency of irrigation systems to support better practice across open spaces in Hamilton. This would involve: - Prioritising open spaces and irrigation demand - Auditing current systems to identify opportunities for irrigation system upgrades - Explore the use of smart irrigation systems and soil moisture probes (linking to the LoRaWAN network) to improve efficiency of irrigation - Undertake a cost benefit to understand highest priority works - At the same time, consider drought-tolerant or warm season grasses that can lower irrigation rates	✓				✓	✓	✓

	IWM Opportunity	Type	Description	Water supply	Wastewater	Flooding	Healthy waterways	Healthy landscapes	Community values	Economic benefit
7	'WaterWays': environmental and cultural wayfinding route	Project	The opportunity is to create a wayfinding program for Hamilton through maps and signage that directs people to and around the town's natural and cultural assets. This would include Lake Hamilton, waterways, botanic gardens, bandicoot enclosure, walking and cycling tracks (including along Grange Burn), areas of valuable habitat (platypus observation area) and green corridors (as proposed within the Hamilton structure plan). Wayfinding signage could also include Traditional Owner cultural and historical landmarks.				✓	✓	✓	✓
8	Wetland condition audit and stormwater harvesting study	Investigation/audit	Hamilton's Grange Burn Wetland was constructed in 2005 as a showcase community Partnership Project involving rehabilitation of 14 ha of wetlands to treat 70 per cent of Hamilton's stormwater before it enters the Grange Burn. Smaller wetlands have also been constructed on Tyers Street and Rippon Road. This opportunity is to: - undertake an audit of the wetlands to assess condition and performance to confirm that they are providing treatment levels as per its design - identify any additional management or maintenance requirements - identify alternative design options for the litter traps in the wetland - investigate the potential for stormwater harvesting at the Grange Burn Wetland to provide an additional source of water - identify suitable end uses for that water, and how this source might integrate with the recycled water and raw water networks in town - investigate stormwater runoff from the south of the Grange Burn between the spillway and Portland Road and opportunities point source stormwater treatment that also incorporate amenity values	✓			✓	✓	✓	
9	Lake Hamilton: Blue green algae action plan	Plan	Blue green algae is a persistent issue in Lake Hamilton, impacting the ecological, aesthetic and recreational quality of the lake. In 2012, A water quality investigation report was prepared by Alluvium Consulting and an action plan for the improvement of water quality was prepared by ALS Water Sciences Group. These reports provided a number of recommendations. The opportunity is to prioritise these recommendations into a program of works and actions. Additionally, the opportunity would investigate partnering with Wannon Water and Deakin University to adopt eDNA strategies to identify BGA types in both water column and sediment. Communication and knowledge sharing with Wannon Water and the community will be a major component of this opportunity, as there are often misconceptions about the processes driving blue green algae, proposed actions, costs and expected outcomes including timeframes, importantly noting the influence of the lake's large agricultural catchment and that actions can only reduce risk but not stop algal blooms. The option of dredging the lake was raised by the community, the opportunity will consider an investigation into this option and its efficacy in mitigating the proliferation of blue green algae.				✓	✓	✓	✓
10	Water for horticulture	Plan	Hugh Koch (Southern Grampians Shire), presented to the workshop on horticultural opportunities within Hamilton. While this needs to be better understood by Alluvium, the opportunity is to: - understand the water needs (volumetric and quality) associated with these activities - incorporate this into a water balance - do a feasibility analysis to understand the best way to support economic growth and activity without compromising other essential uses - incorporate a climate change scenario to anticipate future issues.	✓	✓			✓	✓	✓

	IWM Opportunity	Type	Description	Water supply	Wastewater	Flooding	Healthy waterways	Healthy landscapes	Community values	Economic benefit
11	Integrated networks	Plan and concept	Hamilton has a unique water cycle network incorporating potable water, raw water (from the 'Old Res'), Class C recycled water as well as opportunities to source Class A and stormwater. With the LoRaWAN network and smart systems, there is a unique opportunity to look at the integration of this system to increase to overall reliability of the network, and for water to go to its most valued use. For example, smart controls and valving may be able to direct recycled water through the raw water network is Old Res levels are low to ensure that those open spaces are irrigated. When treated stormwater is available at the wetland, the system may decide to use that water for horticultural irrigation, while maintaining raw water within the Old Res for use on another day. The opportunity is: - To investigate the feasibility of an integrated and smart water system for Hamilton that links existing non-potable networks and other opportunities (like stormwater) to improve overall reliability and value to the community - Taking into account the demands listed above (open space, greening Hamilton initiatives, horticulture), and assess the feasibility of an integrated Hamilton water network to meet those demands over wet and dry periods - Investigate the water quality implications of this with Wannon Water (e.g. can raw water and recycled water share a pipe while not compromising community health) - Identify where end users already have access to multiple water supply networks, or where a shared network is feasible, ensuring that cross contamination is avoided - Identify works that are likely to be required to enable that network.	✓	✓		✓	✓	✓	✓
12	Grange Burn Urban Water Quality Improvements	Investigation	There are a number of point source stormwater discharges into the Grange Burn below the Lake Hamilton spillway. There is potential to investigate a higher level of treatment before discharge as part of an updated Grange Burn masterplan. Grange burn The project will investigate urban runoff data – pollutants and hydrology? – to identify key sites for interventions. Reduce ecological stress Improve amenity Investigate urban flash flooding improvements				✓	✓	✓	✓