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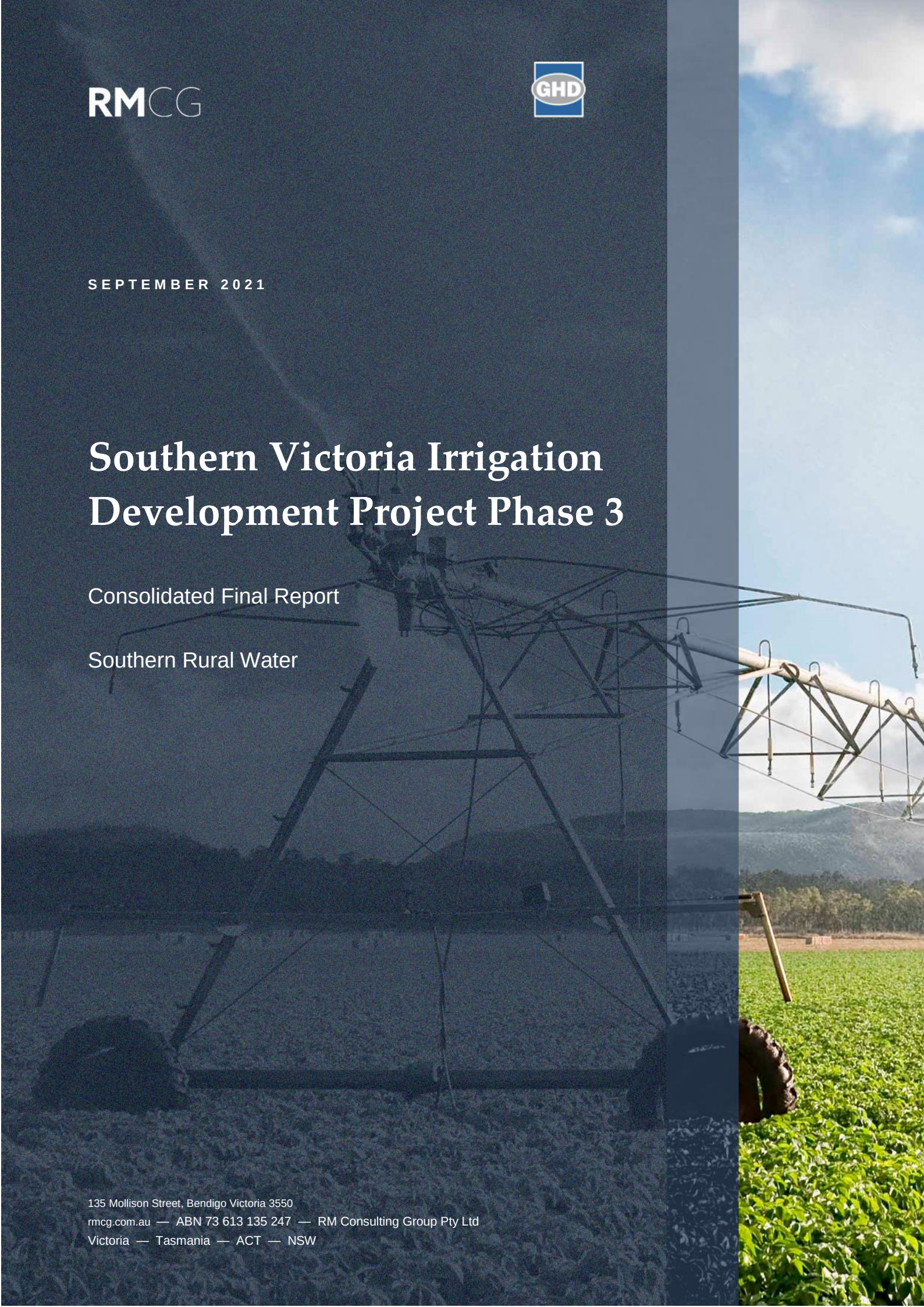
Southern Victoria Irrigation Development Project Phase 3

Consolidated Final Report

Southern Rural Water



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Acknowledgements

We acknowledge the Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) as representatives of the Traditional Owners of the Country on which this project was conducted. We recognise their continuing connection to land, waters and culture and pay our respects to their Elders past, present and emerging.

We express gratitude for the knowledge and insight that Traditional Owner and other Aboriginal and Torres Strait Islander people contribute to our shared work.

We also acknowledge the important contribution of the following stakeholders to the development of this report through their work on the Stakeholder Reference Group.

Agriculture Victoria
Department of Land, Water, Environment and Planning
Regional Development Victoria
Food and Fibre Gippsland
Latrobe River Irrigators Inc.
Gippsland Water
Latrobe City Council
Wellington Shire Council
West Gippsland Catchment Management Authority
Gunaikurnai Land and Waters Aboriginal Corporation
Victorian Farmers Federation
Southern Groundwater Rivers Forum
Southern Rural Water
Irrigator Representatives

Executive summary

Phase 3 of the Southern Victoria Irrigation Development (SVID) project has investigated infrastructure options to enable irrigation development in two study areas – along the Latrobe River from Yallourn to Longford, and east of the Avon River near Llowalong.

This report builds upon the findings of Phase 1 and Phase 2 of the SVID project. It brings together the outcomes of recent water availability, environmental, cultural, demand and willingness to pay assessments, with stakeholder feedback, concept design and economic analysis.

KEY OVERALL FINDINGS

Willingness to invest in agriculture is currently strong in central Gippsland given high demand for quality food supply, low interest rates, good access to markets and the natural resources of the area. This was reflected in the high level of interest in additional irrigation water within the Avon and Latrobe study areas. Landholders are actively looking to expand and diversify in the immediate future and access to additional water supplies will be a key component in enabling this development.

It is important to consider the value of irrigation to secure/increase production in the context of a drying climate. There will be a future with less water, and to ensure food production we need to think about irrigating more than ever.

The regional development and employment resulting from irrigation development is critical to central Gippsland given the closing of local power stations and coal mines and the need for industry transition. There is also potential to build on the significant investment in irrigation modernisation in the neighbouring Macalister Irrigation District (MID).

DEMAND

Water availability or reliability was identified as the main barrier to expansion of agriculture in the Avon and Latrobe study areas. Current irrigation water entitlements are fully allocated. Average use is less than entitlements, but irrigators generally hold the excess licence volume for use in dry years as a way of managing supply reliability. In the Latrobe River study area, current supply is partially regulated, but the ratio of storage share to total entitlement volume is relatively small. This means there is limited back-up when unregulated flow in the Latrobe River is insufficient to meet peak demand. The Avon system is unregulated and river flows are highly variable from year to year, which has limited the investment in irrigation to date.

An increase in water availability and water security will increase investment in irrigation.

Consultation participants expressed strong demand for additional irrigation water in both study areas and this is considered an accurate reflection of potential for these areas. Demand identified ranged from 6,100 to 8,100 ML/year in the Avon area (which is an increase on the demand in Phase 2 consultation) and from 9,250 to 13,040 ML/year in the Latrobe area. These demands are in addition to current supplies.

Survey coverage was approximately 65% for the Avon area and 40% for the larger Latrobe area. Based on land capability and industry analysis, it is projected that the demand could grow to 10,000 ML/year in the Avon area and 20,000 ML/year in the Latrobe area. The analysis undertaken assumes this projected level would be reached within a conservative 15 year time period, although consultation outcomes suggest it could be sooner.

The key demands for water are expected to come from vegetables, dairy, beef and fodder cropping. Other enterprise types could occur, but are likely to be at a comparatively small scale and/or have low demand for water supply. Vegetable producing businesses are currently targeting the Avon River area – of the surveyed demand 60% was proposed to be used for vegetables. The Avon study area has proven good quality soils and existing large producers on the west side of the River are actively looking to expand. Development of vegetables could also occur along the Latrobe River but this is likely to be at a lower percentage of the total irrigation development. A Latrobe River scheme would be focussed on strengthening the current dairy and beef industries through more intensive production and/or return of higher quality produce.

WILLINGNESS TO PAY

Capacity to pay, and consequently willingness to pay, for additional irrigation water varies according to the type of crops to be grown. Vegetable producers have a greater capacity to pay. This is a higher value crop and the cost of water is much lower as a proportion of total production costs, but water is essential to production and therefore, to development.

The majority of consultation participants currently irrigate and have a solid understanding of the costs and benefits of irrigation development. Current water prices both locally and regionally are a key point of comparison for those looking to invest. Consideration will also be given to security of supply, water quality and the level of service[1] provided in determining the comparative value.

Historically, large scale irrigation developments have been undertaken based on significant government contribution to capital costs. Irrigators have an expectation that this will continue to occur in the future.

ENVIRONMENT

The study area environments have been highly modified with most land cleared for agriculture. Patches of native vegetation and scattered trees remain along roadsides, watercourses and occasionally throughout private property. There is opportunity to avoid these areas through appropriate pipeline network and irrigation design.

The Latrobe River and the Avon River are major regional waterways that feed into the Gippsland Lakes Ramsar site and include areas of floodplain. There is potential for impact to downstream water quality and hydrology. Each irrigation property will need to prepare an irrigation and drainage plan to demonstrate adoption of Best Practice Environmental Management.

For the Latrobe area there is a potential for conflict between the desire to expand irrigation along the Latrobe floodplain, and to allow for the migration of freshwater habitats up the Latrobe floodplain from the Gippsland Lakes Ramsar Site. Leaving room for, and facilitating the latter, is a major focus of the Gippsland Lakes Priorities Plan overseen by the Gippsland Lakes Coordinating Committee.

For the purpose of this study, Blue Rock Reservoir is considered the likely water source for an irrigation scheme on the Latrobe River. This is to assist in concept design and costing and does not preclude other water source options being explored in the future. Further investigation will be required to understand the impact of increased supply and regulation of the Latrobe River.

An Avon River scheme will need to access water savings arising from MID modernisation. If as part of this scheme there is replacement of current surface water or shallow groundwater licences, there is potential for increased environmental flows in the Avon River.

A collaborative approach to design will enable reduced overall environmental impacts and potentially realisation of some benefits.

[1] Level of service combines a number of factors including, but not limited to: flow rate; supply pressure; temporal access (e.g. year round or summer only); and ordering required (on-demand supply or order X days in advance).

CULTURAL VALUES

Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) is the Registered Aboriginal Party and represents Traditional Owners across the study areas.

Aboriginal cultural sites and artefacts can be found along the waterways of the Avon River and the Latrobe River. They provide evidence and insights into the way the Gunaikurnai people lived. There are many cultural artefacts and significant places that are yet to be recorded and there is a need to keep filling in the gaps and continuing to learn about the Gunaikurnai. A mandatory Cultural Heritage Management Plan (CHMP) would be triggered for the proposed works.

The Gunaikurnai culture is not just about archaeological sites. It is also about philosophies and principles. There are many cultural values associated with waterways and the surrounding landscape. Traditional, customary, and spiritual connection is something that cannot be seen, but nevertheless exists strongly.

Protecting Gunaikurnai cultural values does not mean taking away the rights of the broader community. The approach to managing Country is to balance resource use with conservation. There is opportunity, through this project, to work within a quadruple bottom line framework. This involves evaluating performance across cultural, economic, environmental and social needs.

It is recommended that on Country consultation should be undertaken with Gunaikurnai Traditional Owners. This will provide an opportunity for participants to access and discuss cultural values of the study area. Traditional Owners should be engaged early and throughout all stages of the process to allow self-determination regarding their involvement.

LATROBE RIVER FEASIBILITY

The Latrobe River study area covers approximately 30,000 ha. It is defined by:

- Proximity to the Latrobe River as the likely water supply source
- The boundary is defined in various locations by the urban areas of Traralgon and Sale, the Macalister Irrigation District and the Holey Plains State Park
- Consultation with landholders, particularly Latrobe River Irrigators Inc, has identified potential demand from Yallourn to Longford
- The boundary is not fixed in all directions. There is potential for expansion in response to demand, cost and potential benefits.

Water for irrigation development is most likely to come from Latrobe Basin surface water entitlements. However, all surface water in the Latrobe is currently allocated and changes to the existing water allocation framework would be required for additional water entitlements to be allocated. For design purposes, it is assumed that water will be accessed through run of river flows influenced by regulation from Blue Rock Reservoir. This will be a higher reliability product than that received by existing Latrobe irrigators.

Consultation participants expressed strong demand for irrigation water in the Latrobe study area, ranging from 9,250 to 13,040 ML/year[2] in addition to current supplies. This demand is mainly focussed on strengthening the current dairy and beef industries through more intensive production and/or return of higher quality produce. Development of vegetables could also occur up to an estimated 15% of the total irrigation water use.

For design purposes it is assumed that water will be accessed from the Latrobe River through run of river flows influenced by regulation from Blue Rock Reservoir. This will provide higher reliability than that received by

[2] Demand is expressed in this report as the volume of water that irrigators want supplied to their property. This is not necessarily equivalent to the volume of entitlement. The difference between the two varies according to reliability / security of supply.

existing Latrobe irrigators. Previous climate change modelling, indicates that supply of 12,000 ML/yr demand volume with a high reliability water product would require a higher volume of storage capacity in Blue Rock Reservoir. Initial estimates suggest a 10% share of Blue Rock inflows and storage capacity share may be required, corresponding to a storage capacity share of around 20,000 ML.

Supply could occur via individual direct access for properties right along the River. This option would not require public investment in shared infrastructure. Spatial analysis indicates that 8,000 to 10,000 ML/year could be readily accessed by properties directly connected or very close to the Latrobe River.

To reach the full projected demand of 20,000 ML/year, infrastructure would be required to supply water to properties further from the River. Projected future demand is likely to be clustered in parts of the study area where land capability is higher – on the north side of the river to the east of Glengarry and to the east of Kilmany. If infrastructure development is to occur it should focus on these areas. There is potential for at least two medium scale pipeline schemes delivering 8,000 ML/year each (subject to development intensity) at a capital cost of approximately $15 million each.

Cost benefit analysis indicates that irrigation development along the Latrobe River is economic – benefits are likely to exceed costs. The development intensity, uptake of water and level of vegetable production are important conditions for viability. The benefit cost ratio of a 10,000 ML direct access scheme, with individual farmers pumping direct from the river, is 2.4. The benefit cost ratio of an 8,000 ML modular pipeline network scheme is 1.7 (assuming a development intensity similar to the MID, 15% vegetables and a 15 year period to peak water use).

The employment created by the irrigation development is as outlined in Table ES-1. The outcome is proportional to the level of water available for development. Estimates assume 15% of water is used for vegetable production and this creates the bulk of additional employment. Vegetables are much more labour-intensive compared to dairy and beef farming. A significant proportion of the additional employment is casual and contract type work such as vegetable picking.

Table ES-1: Latrobe employment created – direct and flow on (FTE)

EMPLOYMENT TYPE	2 X MODULAR SCHEME 1A (16 GL)	DIRECT RIVER ACCESS (10 GL)
Direct Local employment	138	84
Direct Non-local and OS employment	66	40
Flow on employment (source: REMPLAN)	115	69
Total local employment	**253**	**153**
Total employment	319	193

The indicative annual prices that would need to be charged for the key concept schemes (based on standard regulatory practice) range from $109/ML up to $320/ML. This covers irrigation supply infrastructure capital and operating costs. It does not include the cost to buy water entitlements. It is not calculated for the Direct River Access option as infrastructure would be installed and owned by the irrigators. Substantial grant funding would be required for the supply infrastructure to achieve a price per ML equivalent to the current MID price, which is approximately $50/ML. However, the proposed schemes may provide a level of service to customers that is better than the level of service to MID customers, and this would give reason for a higher price to be charged.

Direct river access by individual farmers provides the highest economic returns (per ML). This makes best use of the River itself as the main supply “channel”. The drawback of this option is that it limits access to those proximate to the River and it is therefore unlikely to enable the full projected demand to be achieved.

Direct river access could be considered as a Stage 1 development. It could then be combined with a modular pipeline network approach to expand development further from the river as Stage 2 (or beyond). Provision of easements to enable individuals to expand further from the river could be an alternative Stage 2. This is, of course, subject to water resources being available for development.

AVON RIVER FEASIBILITY

Approximately 6,000 ha of land is located within the Avon River study area. The study area is defined by:

- Proximity to the MID as the potential water supply source – in particular proximity to the Main Northern Channel
- Topography – there is a significant increase in elevation within approximately 2km of the river (and/or the Freestone Creek)
- Soil type / land capability – the area of high capability Class 1 and 2 loam and sandy loam soils is limited to a relatively small area along the Avon River and the Freestone Creek.

Current land use includes dairy, beef and fodder, and vegetable production. The potential for growth of high value vegetable production is considered high because of the favourable soil types and proximity to more extensive vegetable production on the neighbouring west side of the Avon River.

The Avon River flows are highly variable from year to year and the interconnected shallow groundwater is similarly unreliable. This has limited the investment in irrigation to date. There is potential to expand the area irrigated provided there is access to additional and more secure water supplies.

Consultation participants expressed strong demand for additional irrigation water, ranging from 6,100 to 8,100 ML/year in addition to current supplies. Based on land capability and industry analysis, it is projected that this demand could grow to 10,000 ML/year.

The preferred option for the concept design for the Avon River scheme is to extend supply from the Main Northern Channel with a siphon pipeline under the Avon River, a balancing storage and distribution via a gravity pipe network. This option would provide access to MID modernisation savings. The Phase 2 concept design has been reviewed and updated due to the increased demand identified in Phase 3 consultation. More intensive development is expected along the initial pipeline network and the network could be extended to the east along the Freestone Creek, as well as further to the south of Llowalong. This will increase the capital cost of the scheme to approximately $35 million.

The increased cost of development will be offset by the increased benefits of substantially higher vegetable production. Phase 2 included 15% of water use for vegetables, while Phase 3 consultation indicated this was much higher at 60%. The benefit cost ratio for the scheme is estimated to range from 1.7 to 2.2 depending on the time taken to peak water usage (the higher figure is for uptake over 5 years).

The need for balancing storage to supply the Avon scheme can provide additional benefits through winter supply to existing vegetable growers in the Boisdale area and improved operation efficiency for the Main Northern Channel. If the new supply can replace existing surface water and shallow groundwater licences, there could also be improved environmental flows for the Avon River. These benefits have not been quantified within the cost-benefit analysis undertaken in this study.

The employment created by the irrigation development is outlined in Table ES-2. The high percentage of vegetable production in this scheme leads to significant employment as this is a labour-intensive industry. A significant proportion of the additional employment is casual and contract type work such as vegetable picking.

Table ES-2: Avon employment created – direct and flow on (FTE)

EMPLOYMENT TYPE	AVON (10 GL)
Direct Local employment	279
Direct Non-local and OS employment	161
Flow on employment (source: REMPLAN)	217
Total local employment	**495**
Total employment	657

The indicative annual prices that would need to be charged for the Avon concept scheme range from $150/ML to $380/ML. This covers irrigation supply infrastructure capital and operating costs. It does not include the cost to buy water entitlements. This indicates that substantial grant funding would be required for supply infrastructure to achieve a price per ML equivalent to the MID price, which is approximately $50/ML. However, the proposed scheme may provide a level of service to customers that is better than the level of service to MID customers, (e.g., winter supply) and this would give reason for a higher price to be charged.

Development of irrigation along the east side of the Avon River is feasible. It will provide significant regional development and employment benefits, as the area is being targeted for increased vegetable production. The balancing storage required to supply the scheme could also provide improved levels of service for irrigators on the west side of the River.

PROPOSED NEXT STEPS

Each study area will need to follow a different pathway to completion. The key initial steps for each scheme are:

- Latrobe Study Area:
  - Water resource assessments including modelling flow impacts, water product analysis / comparison, risk assessment and climate change sensitivity. Determine water available for development.
  - Review type and scale of concept subject to water resource availability (in collaboration with potential customers)
  - Continued engagement with stakeholders
- Avon Study Area:
  - Investigate and determine suitable storage location (including Geotech) and secure appropriate land
  - Confirm availability of water savings and analyse impact to security of supply and price for existing MID users
  - On ground environment and cultural assessments
  - Continued engagement with stakeholders
  - Customer protocols determined with comprehensive customer engagement. Intent is to increase surety of investment from customers.
  - Prepare DTF compliant business case.

1 Introduction

1.1 PROJECT PURPOSE AND SCOPE

The Southern Victoria Irrigation Development (SVID) Project aims to investigate infrastructure options that could expand irrigated agriculture in West and Central Gippsland. The Victorian Government has provided funding for Phase 3 of the project. This builds on work undertaken by Southern Rural Water (SRW) in 2017 and 2018.

The objectives of the project are to:

- Investigate infrastructure options that could expand irrigated agriculture in West and Central Gippsland
- Build upon the findings of Phase 1 and Phase 2 of the SVID project and undertake this work in a way that ensures comparative outcomes with previous phases of SVID
- Provide decision makers with necessary information to make responsible, strategic investment decisions related to rural water infrastructure
- Demonstrate alignment with the Water for Victoria strategic plan, including the 'Principles for public investment in rural water infrastructure projects'
- Lay a foundation to inform a future business case(s).

This is the final consolidated report for Phase 3 of the SVID Project.

1.2 SUMMARY OF PREVIOUS WORK

Phase 2 of the SVID project identified demand for additional irrigation water across four selected focus areas, Avon, Latrobe East, Dutson and Toongabbie, plus an area in proximity to Kilmany.

Concept designs were pursued for a Latrobe East scheme (i.e. the eastern end of the Latrobe study area), the Avon River focus area and the Toongabbie area.

The Dutson area, the Kilmany area and the Latrobe West area were not taken forward to concept design as the preferred options were the status quo – i.e. individual groundwater access for Dutson and individual river access for Kilmany/Latrobe West through trading with existing licence holders or additional licence access if it were to be made available.

The Avon River and Latrobe East schemes were found to be economic (a benefit cost ratio of > 1.0; i.e. benefits exceed costs) under base case assumptions and it was therefore concluded that they could be considered for further investigation. The benefit cost ratios were 1.6 for Latrobe East and 1.5 for the Avon River scheme.

1.3 CHANGES SINCE PHASE 2

Since Phase 2 was completed, there have been a number of water resource and economic development studies undertaken in the Latrobe Basin and the Gippsland Region more broadly, including:

- Investigation of options for coal mine rehabilitation, with the mine operator's preference being to fill, or partly fill, the mine voids with water
- The Long Term Water Resource Assessment identified an overall decline in water availability across the central Gippsland catchments, which has impacted the environment's share more than the consumptive share.

In early 2020, landholders along the Latrobe River formalised as the Latrobe River Irrigators Inc. This group is interested in water security and greater irrigation water availability. The Latrobe focus area investigated in SVID Phase 2 was between Glengarry and Rosedale on the north side of the Latrobe River. The Kilmany area was also considered. The Latrobe River Irrigators recommend consideration of a broader study area – extending much further to the east, as well as across the south side of the River.

1.4 PHASE 3 ASSESSMENT APPROACH

The approach taken to this Phase 3 assessment is summarised in the following flowchart. It involved a number of steps to build on and add to the work completed in Phases 1 and 2 of the project.

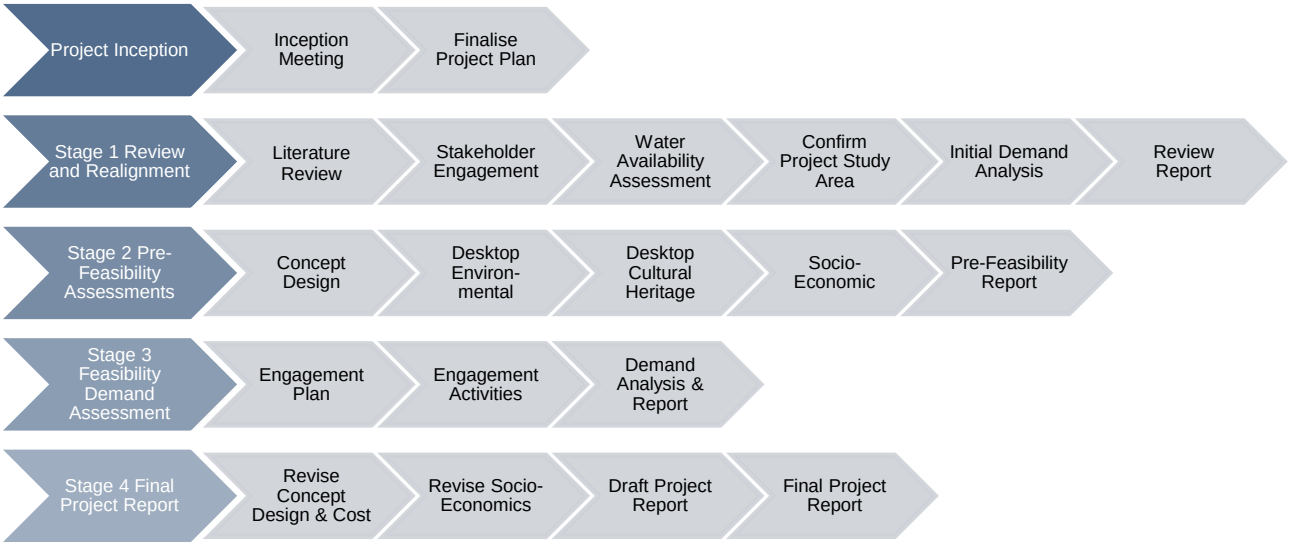

Figure 1-1: Summary of project work packages

Work was undertaken by a consortium from RMCG and GHD, and included collaboration with SRW, DELWP and the Stakeholder Reference Group.

1.5 POLICY CONTEXT

Any proposed irrigation development project must demonstrate alignment with the Water for Victoria strategic plan. This acknowledges that:

> *Rural water infrastructure is vital to support agriculture and its future growth. Successive governments have invested in irrigation districts; the focus has been on reducing the amount of water required to operate the irrigation systems and enabling increased value of agricultural production.*
>
> *Climate change will increase the need for existing infrastructure to be more efficient and for new infrastructure that gives communities access to the water grid.*

The Victorian Government will invest in rural water infrastructure, subject to available funds, guided by the following principles:

- Long-term viability:
  - Net benefits will be achieved under a range of future water availability scenarios
  - User demand and support for the proposed service is demonstrated, including commitment to meet all future operation and maintenance costs, and costs to source water through the new infrastructure

- It is consistent with regional strategic plans, regional growth plans, regional catchment strategies and land use planning
- It is consistent with any relevant land use suitability assessments and agricultural policy

- Net public benefit:
  - No adverse impact on reliability and capacity to deliver existing entitlements
  - The health of the environment must be maintained or improved
  - Net public benefits to the Victorian economy and community values must be demonstrated
- Value for money:
  - It has undergone a positive cost-benefit analysis of social, cultural, economic and environmental outcomes, including water savings and market value of water, economic growth and environmental sustainability
  - Cost-share with proponents for construction is proportionate to the public and the private benefits (‘user pays’ principle).

2 The Region

2.1 AGRICULTURE AND WATER USE

Agricultural land occupies 28% of the Latrobe-Gippsland[3] region. In 2019–20, the gross value of agricultural production in the region was $2.5 billion, which was 14% of agricultural output in Victoria and 6% of the total regional output. The key agricultural commodities produced in the region are milk ($1,036 million in 2019-2020), followed by cattle and calves ($826 million) and vegetables ($246 million). The agriculture, forestry and fishing sector employ around 10% of the region's workforce (just under 12,000 people), and the region contains 16% of all farm businesses in Victoria.[4]

Willingness to invest in agriculture is currently strong in central Gippsland given high demand for quality food supply, low interest rates, good access to markets and the natural resources of the area. This is reflected in the high level of interest in irrigation water within the Avon and Latrobe study areas. Landholders are actively looking to expand and diversify in the immediate future and access to additional water supplies will be a key component in enabling this development.

Central Gippsland's key strengths that underpin future growth opportunities in agriculture, include:

- Well located to access Melbourne and national and international markets via road, rail and air
- Fertile soils, a moderate climate, reasonable rainfall and access to supplementary water resources
- Less severely affected by climate change than other Australian regions
- Already home to a diverse range of renowned products and production systems – strong supply chains in place
- Access to a strong, skilled workforce.

The key demands for water are likely to come from vegetables, dairy, beef and fodder cropping. Other enterprise types could occur, but are likely to be at a comparatively small scale and/or have low demand for water supply.

HORTICULTURE

The central Gippsland region is considered a priority area (within the horticulture industry) for expansion of horticulture (particularly vegetable) production due to the favourable conditions of soil quality, low pest and disease pressures, climatic conditions and reliability of irrigation water. Increased supply of irrigation water to the region provides the potential to strengthen the growth of vegetable production in the area.

Horticulture has expanded rapidly in the area over the last 10 years in terms of value and tonnes of production as shown in Table 2-1. There is a strong chance of outside horticulture companies purchasing land or current farmers switching to vegetables if additional irrigation water becomes available. COVID-19 has had a positive impact on the local vegetable industry – the overall demand for vegetables has boomed because people were doing more cooking at home. Vegetable companies have a good reputation locally, providing quality housing and quickly addressing any labour issues that arise.[5]

[3] Statistical Area Level 4 covering the six local government areas of Bass Coast, Baw Baw, East Gippsland, Latrobe, South Gippsland and Wellington.

[4] https://www.abs.gov.au/statistics/industry/agriculture/value-agricultural-commodities-produced-australia/latest-release; https://www.agriculture.gov.au/abares/research-topics/aboutmyregion/vic-latrobe; https://app.remplan.com.au.

[5] Mark Coleman, 27 April 2021; Michelle Anderson, RDV, 20 April 2021.

Table 2-1: 10-year trends in the West Gippsland region vegetable industry (ABS various)

ITEM	WEST GIPP. 2008–09	WEST GIPP. 2013–14	WEST GIPP. 2018–19	CHANGE (%) 2009–2019	VIC. 2018–19	REGIONAL CONTRI-BUTION TO STATE (%) 2018–19
Gross value ($)	65,031,132	119,209,780	135,404,741	108%	1,089,804,413	12%
Area (ha)	5,282	6,318	5,310	1%	31,172	17%
Production (t)	80,831	121,174	101,635	26%	686,777	15%

Businesses would require the following to make development of vegetables viable:

- A minimum of 100 ha and a corresponding 500 ML of water, to make investment in land preparation and infrastructure development worthwhile
- Soils within the study areas that are sandy, flat and not flood or frost prone.

The Avon area is a key target for vegetable producers as it has proven good quality soils, and existing large producers on the west side of the River are actively looking to expand. The Latrobe area, by comparison, has limited current vegetable production. However, approximately 10% of the study area has been identified as meeting the ideal criteria listed above. Vegetable producing businesses are more likely to target the Avon River area. Development of vegetables in a Latrobe River scheme could still occur but at a lower percentage of the total irrigation development.

The economic analysis (refer to Sections 3.7 and 4.7) shows that attracting vegetable growers would substantially increase the economic feasibility of the irrigation development scheme/s.

Other forms of horticulture such as fruit and nut trees, ornamental nurseries and greenhouse production may occur, but are likely to be on a small scale. For many fruit varieties this region would not be considered to have an ideal climate (it is not warm enough).

DAIRY

Dairy is the largest existing industry within the Central Gippsland area. Enterprises are predominantly pasture-based, which is a low-cost, high quality milk production system.

The longer-term outlook for the dairy industry remains positive as world demand is expected to continue to grow. Australia will need to remain competitive through embracing technology to remain efficient (both on-farm and in manufacturing). The dairy industry is expected to remain strong in Gippsland due to the natural resource opportunities and existing infrastructure.

Key opportunities for the focus areas (subject to water availability) are:

- Expansion and/or intensification of production for existing dairy properties in the study areas
- Production of fodder crops for supply of feed to existing operators in the MID (or dairy properties to the south and west)
- New greenfield development on the larger landholdings that are less encumbered by existing MID infrastructure and/or on soil types that are not in demand for vegetable production.

BEEF/SHEEP

The beef and sheep meat industries have a strong presence in the study area and are likely to remain a dominant land use. For the Latrobe focus area in particular, beef is the current dominant land use.

Irrigated production for these enterprises is generally used to ensure a secure feed supply. Landholders are likely to irrigate a portion of their property to minimise the need for external feed supply, thereby reducing their cost and risk. These properties may also look to produce fodder for sale to other nearby properties – particularly the dairy industry or premium equine segment.

The survey identified that current beef and sheep producers may improve the quality of their produce (e.g. prime beef), and therefore the prices they receive, through access to irrigation.

INTENSIVE ANIMALS

Intensive animal industries include piggeries, poultry and egg production. This sector is growing overall at a state and national level in response to increasing consumer demand. Discussions with local government, and some landholders, indicates current interest for poultry development in the area. There are developments currently occurring in or near the Latrobe study area.

A key driver of growth is sufficient physical scale and planning protection to provide buffer zones for odour management and animal health protection.

A high-quality and secure water supply is critical both for drinking (animal welfare) and cooling purposes. However, a large proportion of this water is supplied through rainfall runoff capture. The large-shed roofs enable this enterprise to be relatively self-sufficient in this climate zone.

RURAL RESIDENTIAL

There will continue to be demand for rural land for amenity rather than production purposes. The proximity to the Great Dividing Range and the Gippsland Lakes, results in Central Gippsland having significant amenity values that will attract migrants from towns. Key targets within the focus areas are:

- In the Latrobe area, in proximity to Traralgon, Sale and Rosedale and also in the foothills west of the Traralgon-Maffra Road
- In the Avon area, in proximity to Stratford and Briagolong.

This will reduce the demand for agricultural irrigation supply to these areas. But there will be an offset demand for rural residential supply, for garden and hobby farm type uses. The result may be multiple small volume demands. This is not likely to drive development of a new supply system, given the existing supplies available (farm dams; D&S bores and surface water licences). However, landholders along infrastructure routes are likely to take advantage of the supply.

OTHER

Bioenergy was identified as an alternative market for fodder crops such as maize. This involves use of feedstocks from agriculture to produce renewable electricity, heat and liquid fuels. The focus is usually on agricultural waste (e.g. stubble) to minimise competition with food and fibre production.

Hemp was identified as a potential future crop. AgriFutures Australia[6] has identified hemp as a high potential emerging industry. It can be used for fibre, food and medicinal purposes.

[6] https://www.agrifutures.com.au/farm-diversity/industrial-hemp/

IRRIGATION PRACTICE CHANGE

Based on our work in the irrigation industries across south-eastern Australia, particularly in the horticulture and dairy areas, we note the following rapid adaptations occurring:

- Paying much more for entitlements is accepted by irrigators particularly for High Security products. Security of water is worth paying a (large) premium for in many industries, because the cost of the rest of the farm, and the fixed non-water farm operating costs are both so high.
- Where water is used for a high value crop on good soils, annual infrastructure charges to get access to that water are usually a small percentage of the total input costs
- Investing on-farm in smarter water application is more common, even without subsidies
- Bulk water is being piped, in larger volumes and over longer distances than was the case not long ago. Despite the higher cost per ML, piping, even from the river/main right to the crop, provides much better water use efficiency, better farm access & management and better control of supply, by comparison to use of channels.
- People's attitudes after two or three wet years, are quite different to those living through a drought in terms of demand for new infrastructure, or water security.

It is important to consider the value of irrigation to secure/increase production in the context of a drying climate. There will be a future with less water, and to ensure food production we need to think about irrigating more than ever.

There is also potential to build on the significant investment in irrigation modernisation in the neighbouring Macalister Irrigation District (MID).

2.2 THE BROADER ECONOMY

The regional development and employment resulting from irrigation development is critical to central Gippsland given the closing of local power stations and coal mines and the need for industry transition.

In Latrobe City, the Electricity, Gas, Water & Waste Services industry sector makes the greatest contribution to economic output. At $2.9 billion it accounts for about 23% of total output. The Health Care & Social Assistance industry sector is the region's largest employer, supporting an estimated 5,385 jobs. In Wellington Shire, the Mining industry sector makes the greatest contribution to economic output in the region. At $1.1 billion it accounts for around 16% of total output. The Agriculture, Forestry & Fishing industry sector is the region's largest employer, supporting an estimated 2,570 jobs.[7]

Table 2-2 provides insight into the socio-economic status of areas affected by the proposed irrigation, as per ABS 2016 Socio-Economic Indexes for Australia (SEIFA) publication. Figures given indicate the % ranking within Victoria – for example Morwell (SA1) is in the 44th percentile in Victoria for IRSD. The lower the number the more disadvantaged. Index of Relative Socio-economic Disadvantage (IRSD) is a general socio-economic index derived from Census variables related to disadvantage, such as low income, low educational attainment, unemployment, and dwellings without motor vehicles. Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) is a continuum of advantage (high values) to disadvantage (low values) which is derived from Census variables. Index of Economic Resources (IER) summarises variables relating to the financial aspects of relative socioeconomic advantage and disadvantage. Index of Education and Occupation (IEO) summarises variables focused on the skills of the people in an area, both formal qualifications and the skills required to perform different occupations.

The targeted areas are, overall, below the state average for all indexes, with the exception of the Index of Economic Resources. The Index of Education and Occupation indicates the Latrobe study area (particularly around Rosedale) is well below the state average.

[7] https://app.remplan.com.au

Table 2-2: Socio-economic indices of affected towns (% ranking in Victoria), 2016[8]

SCHEME	SA1 CODE	SUBURB	IRSD	IRSAD	IER	IEO
Avon	20505110130	Briagolong	61	53	76	51
Avon	20505110136	Briagolong	27	24	27	34
Latrobe	20504109638	Morwell	44	39	62	28
Latrobe	20504109730	Flynn	61	46	82	27
Latrobe	20504109765	Traralgon	78	67	77	54
Latrobe	20504109775	Traralgon	74	62	81	31
Latrobe	20504109813	Tyers	61	56	79	45
Latrobe	20505110006	Stradbroke	41	44	73	34
Latrobe	20505110010	Longford	38	34	58	27
Latrobe	20505110202	Rosedale	48	39	67	24
Latrobe	20505110205	Rosedale	12	7	21	3
Latrobe	20505110211	Rosedale	23	19	26	22
Latrobe	20505110212	Rosedale	39	31	56	22
Average - Avon scheme			44	39	52	43
Average - Latrobe scheme			47	40	62	29
Average - total			47	40	60	31

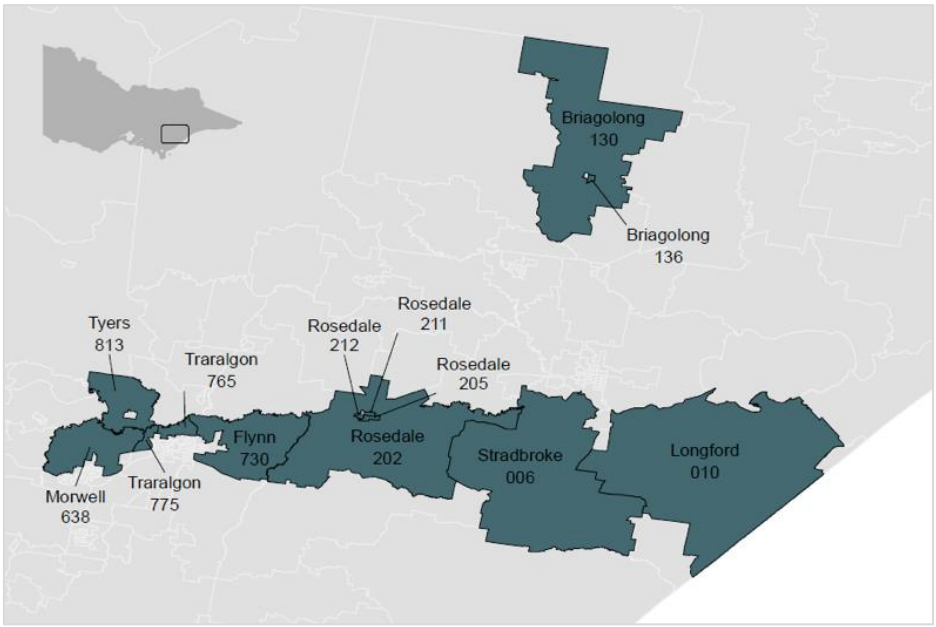

Figure 2-1: Map showing statistical areas level 1 as described in Table 2-2

[8] *Socio-Economic Indexes for Areas (SEIFA), Australia, 2016*.

The latest labour statistics for the Gippsland region (a much larger area than the study areas for this project) are provided in Table 2-3. The region's unemployment rate is similar to the Victorian and Australian averages. The region has a low labour participation rate. The region's employment in the Agriculture, Forestry & Fishing sector has decreased substantially (by just over 25%) in the last 5 years[9], potentially due to transition from a labour-intensive to a more mechanised approach.[10]

Table 2-3: Key labour statistics for Latrobe-Gippsland region (12-month average to March 2021)[11]

REGION	WORKING AGE POPULATION (15–64)	EMPLOYMENT RATE (15–64)	PARTICIPATION RATE (15+)	UNEMPLOYMENT RATE (15+)	YOUTH UNEMPLOYMENT RATE (15–24)
Latrobe-Gippsland	160,200	71.1	55.4	5.8	13.0
Victoria	4,394,200	74.4	66.9	6.1	15.4
Australia	16,604,800	74.8	86.3	5.6	11.8

Unemployment figures for selected Gippsland shires are provided in Figure 2-2, with unemployment increasing across the board since January 2020.

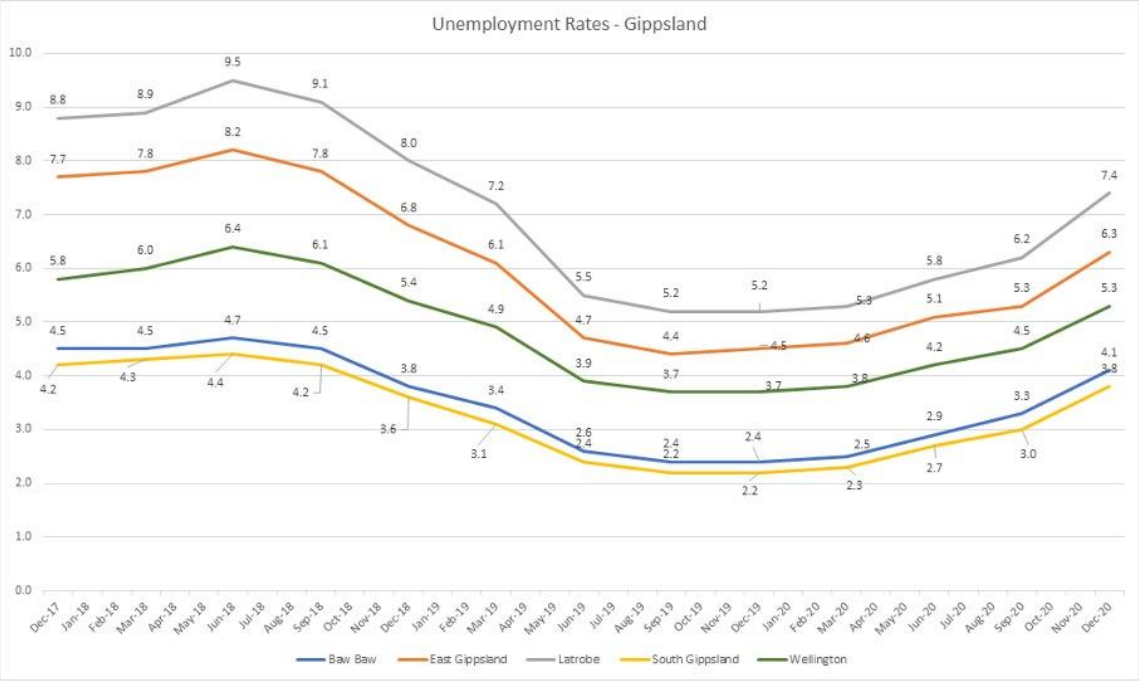

Figure 2-2: Unemployment in selected Gippsland shires, December 2017–December 2020[12]

9 https://lmip.gov.au/PortalFile.axd?FieldID=2739722&.xlsx.
10 KPMG 2016, 'Gippsland Regional Workforce Plan'.
11 *https://lmip.gov.au/PortalFile.axd?FieldID=2739719&.xlsx.*
12 Mark Coleman, Wellington Shire Council.

2.3 THE ENVIRONMENT

The study areas are within the West Gippsland Catchment Management Area and the Gippsland Plain Bioregion.

The Latrobe River and the Avon River are major regional waterways and are within the Lake Wellington catchment – the westernmost part of the Gippsland Lakes. The vision for irrigation land and water management in the Lake Wellington catchment is[13]:

> *'A highly productive and sustainable irrigation community that values and protects its natural and cultural assets.'*

The study area environments have been highly modified with most land cleared for agriculture. Patches of native vegetation and scattered trees remain along roadsides, watercourses and occasionally throughout private property. There is opportunity to avoid these areas through appropriate pipeline network and irrigation design.

The study areas being considered are proximate to major waterways that feed into the Gippsland Lakes Ramsar site and include areas of floodplain (particularly along the Latrobe River). There is potential for impact to downstream water quality and hydrology. For the Latrobe area, there is a potential conflict in the future between the desire to expand irrigation along the Latrobe floodplain, and to allow for the migration of freshwater habitats up the Latrobe floodplain from the Gippsland Lakes Ramsar Site. Leaving room for, and facilitating the latter, is a major focus of the Gippsland Lakes Priorities Plan overseen by the Gippsland Lakes Coordinating Committee.

For the purpose of this study, regulated flows from Blue Rock Reservoir are considered the likely water source for an irrigation scheme on the Latrobe River. This is to assist in concept design and costing and does not preclude other water source options being explored in the future. Further investigation will be required to understand the impact of increased supply and regulation of the Latrobe River.

An Avon River scheme will need to access water savings arising from MID modernisation. If, as part of this scheme, there is replacement of current surface water or shallow groundwater licences there is potential for increased environmental flows in the Avon River.

A collaborative approach to design will enable reduced overall environmental impacts and potentially realisation of some benefits.

LEGISLATIVE IMPLICATIONS

The following summarises the legislative implications for the potential irrigation development projects at their current development stage:

- Development of the project design and an ecological site assessment is required to determine whether the project is likely to require referral under the EPBC Act for potential impacts to the Gippsland Lakes, a Wetland of International Importance, or for impacts to Matters of National Environmental Significance
- The FFG Act[14] will apply where study sites include public land. Permits to 'take' (kill, injure or disturb) listed threatened vegetation flora and/or protected flora may be required following review of the project design and site investigation
- Where the removal of native vegetation is unavoidable, a planning permit will be required and appropriate offsets will need to be secured. A permit for the removal of native vegetation (under the Planning and Environment Act) would need to follow the Detailed assessment pathway.

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[13] *Lake Wellington Land and Water Management Plan*, WGCMA, 2018.

[14] The Flora and Fauna Guarantee Amendment Act 2019 (FFG Amendment Act) is in effect. This act amends the Flora and Fauna Guarantee Act (FFG Act) to provide a modern and strengthened framework for the protection of Victoria's biodiversity. Currently, the FFG Amendment Act guidelines are still being developed.

- Any works undertaken in and around waterways and their floodplains will need to be undertaken in accordance with the Water Act (1989). Licences will be required for works on waterways. If the project requires grant of a Bulk Entitlement or permanent trade, matters under Section 40 of the Water Act (a-o) are required to be considered by the Minister for Water. These matters include permissible consumptive volume, impact on other water users, water quality, need to protect the environment, drainage regime and so on.
- Development of the project design and a site assessment is required to determine the presence of fauna habitat (e.g. presence of hollow-bearing trees). A permit under the Wildlife Act 1975 is likely to be required for salvage of native fauna that may be at risk of harm during construction.
- Mitigation measures to eradicate and/or control noxious weeds should be incorporated into a project specific environmental management plan to prevent their spread or further introduction, in accordance with the Catchment and Land Protection Act
- The Gippsland Irrigation Development Guidelines require each irrigation property to prepare an irrigation and drainage plan (IDP). The IDP must provide the information necessary to demonstrate how the development meets the necessary standards to minimise the impacts of water use on other persons and the environment (in particular waterlogging, salinity and nutrient impacts). An application for a new water use licence or for a variation to a water use licence must be accompanied by an irrigation and drainage plan.

2.4 GUNAIKURNAI CULTURAL VALUES

Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) represents Traditional Owners from the Brataualung, Brayakaulung, Brabralung, Krauatungalung and Tatungalung family clans, who were recognised in the Native Title Consent Determination, made under the new Traditional Owner Settlement Act 2010, the first such agreement under that Act. GLaWAC is the Registered Aboriginal Party for the Gunaikurnai claim area, as decided by the Victorian Aboriginal Heritage Council under the Aboriginal Heritage Act, 2006.

The Gunaikurnai Whole of Country Plan (GLaWAC, 2015) states the following Vision.

We are Gunaikurnai, the First People of our Country. We have survived for tens of thousands of years, often against great adversity. We have looked after our Country and passed on our stories and traditions through countless generations. We continue to survive and thrive, maintaining connection to our Country and to our ancestors.

The future we see is one where Gunaikurnai stands proud and strong, where our people have strong connections to their culture and Country, where our businesses and relationships are based on solid foundations and where we are self-sufficient and highly respected. In our future, our mob is united – the five clans of Gunaikurnai working together to support each other.

The study areas being considered in this project – along the Avon (Dooyadang) and Latrobe (Dartyowan) rivers – are within Brayakaulong Country. All river systems rely on rain (willang/willung) and without rain the water does not flow. Heavy rain events cause floods which overflow banks, spread across flood plains and renourish the land.

Examples of cultural values associated with waterways are as follows:

- Waterways provide plentiful food, medicine, water and materials for survival
- Waterways are important meeting places for families and communities to come together for cultural, social and recreational activities, and to teach culture to young people
- The waterways and lakes system are a transport network – Gunaikurnai ancestors would use bark canoes to move from one spot to another
- Rich in wildlife, waterways are home to several totem species, as well as a number of rare and endangered species. The creation story follows Borun (pelican) and Tuk (musk duck) who were the

father and mother of the five clans and traversed the Country from the mountains to the sea. The belief system is based on water cosmology. They followed the waterways creating songlines and storylines.

- The value of the waterways in the region is embedded in the surrounding landscape. The Gunaikurnai, see their land (Wurruk), waters (Yarnda), air (Watpootjan) and every living thing as one. They are the spiritual life-giving resources and form the basis of their cultural practices.
- The health of waterways (and lands and biodiversity) is a key factor in the ability of the Gunaikurnai to practice their traditional ceremonies and customs and develop economically as a community
- The health of these waterways (the Avon and Latrobe) is also key to the health of the floodplains, and the downstream Lakes and wetlands
- There is a need to secure rights for the Gunaikurnai to use water for cultural and economic purposes.
- Traditional Owners should not be restricted in accessing their traditional Country
- Aboriginal cultural sites and artefacts can be found along waterways. They provide evidence and insights into the way the Gunaikurnai people lived. There are many cultural artefacts and significant places that are yet to be recorded. There is a need to keep filling in the gaps and continuing to learn about the Gunaikurnai.
- The Gunaikurnai culture is not just about archaeological sites. It is also about philosophies and principles. Traditional, customary and spiritual connection is something that cannot be seen, but nevertheless exists strongly.
- The Gunaikurnai peoples' skills and knowledge in managing Country are recognised, actively sought and respected.

The Murray Lower Darling Rivers Indigenous Nations (MLDRIN) has investigated cultural values associated with water and developed a cultural flows assessment methodology. MLDRIN notes that:

> *'The natural flow of water sustains aquatic ecosystems that are central to our spirituality, our social and cultural economy and wellbeing. The rivers are the veins of Country, carrying water to sustain all parts of our sacred landscape. The wetlands are the kidneys, filtering the water as it passes through the land.'*

Whilst the Gunaikurnai people are not part of MLDRIN, they acknowledge the alignment with the cultural values identified by MLDRIN.

It is also important to note that protecting Gunaikurnai cultural values does not mean taking away the rights of the broader community. The approach to managing Country is to balance resource use with conservation. Take only what you need – leave some for others.

There is opportunity, through this project, to work within a quadruple bottom line framework. This involves evaluating performance across cultural, economic, environmental and social needs.

3 Latrobe study area

3.1 PHASE 3 STUDY AREA

The Latrobe River study area covers approximately 30,000 ha. It is defined by:

- Proximity to the river as the likely water supply source
- The urban areas of Traralgon and Sale, the Macalister Irrigation District and the Holey Plains State Park define the boundary in various locations
- Previous consultation with landholders, particularly Latrobe River Irrigators Inc, had identified potential demand from Yallourn to Longford.

The Latrobe study area for the Phase 3 pre-feasibility assessment (Figure 3-1) is an expansion on the Latrobe East scheme considered during Phase 2. It reflects strong community interest for enhanced water security and increased allocations from existing irrigation businesses from Yallourn to Longford.

Consideration has been given to current land use, land capability and distance from the river, to refine/define the study area further.

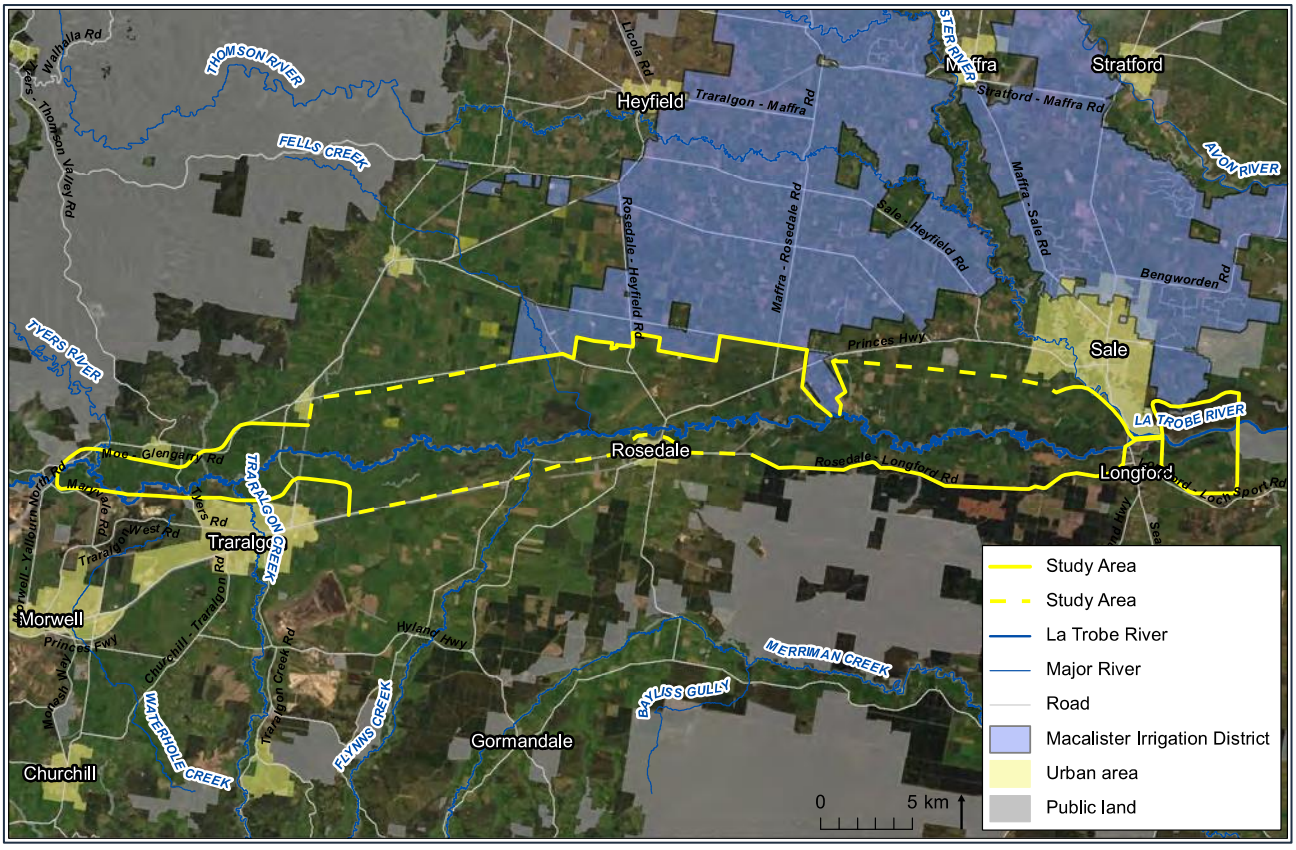


Figure 3-1: Aerial image with sketch of Latrobe study area (yellow line)

LAND NOT AVAILABLE

Spatial analysis was used to identify and effectively remove land that is clearly unavailable for irrigation, and therefore, out of the study scope. This includes public land, urban land, industrial sites and the existing Macalister Irrigation District.

DISTANCE FROM RIVER

Findings from the Phase 2 work suggested that the cost of supply to the Toongabbie and Dutson areas from the Latrobe River, were likely prohibitive. As a result, the main focus for the study area is delivery to sites that are under 5 km from the Latrobe River.

The boundary is not fixed in all directions. There is potential for expansion in response to demand, cost and potential benefits. Potential expansion areas are indicated by the dashed study area boundary in Figure 3-1 above. For completeness and comparison, the concept design has explored the costs involved in supplying areas further from the river.

SOILS AND LAND CAPABILITY

In SVID Phase 1, a multi-criteria analysis of land capability was completed. This incorporated assessment of multiple soil features, topography and flooding risk. Class 1 is very good capability with minimal limitations and no special management required. Class 5 is very poor capability and sustainable management is unlikely to be achieved.

Along the Latrobe River there are areas of Class 2 and 3 land capability and these are expected to be the target for irrigation development. The Class 4 areas can also be irrigated but are likely to be limited to pastures and fodder crops, which will reduce capacity to pay. Refer to Figure 3-2.

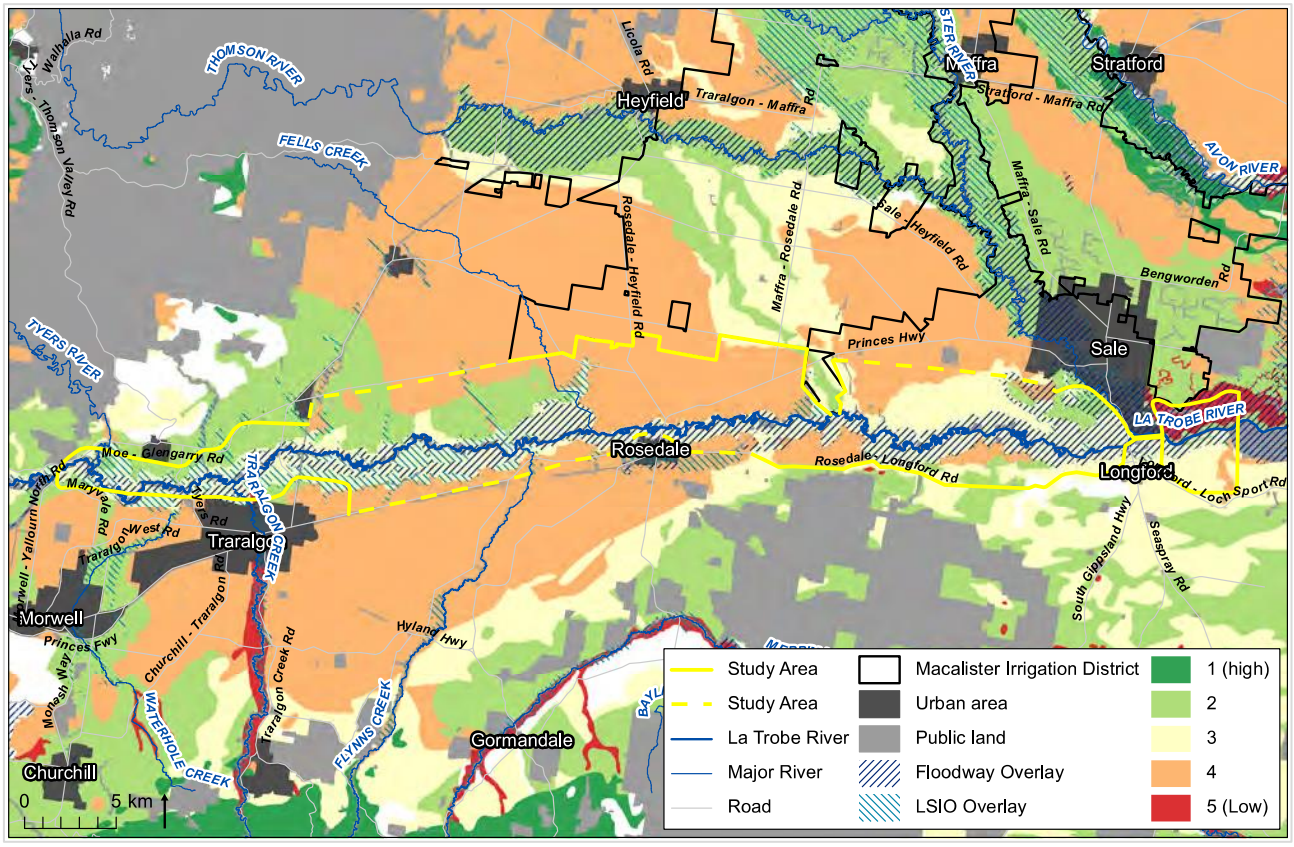


Figure 3-2: Latrobe land capability and flood risk

FLOOD RISK

Flooding occurs along the Latrobe River as indicated by the Floodway Overlay and the Land Subject to Inundation Overlay provided in the Planning Scheme (refer to Figure 3-2). Investment in infrastructure and selection of crops will be limited in flood prone areas. For instance, permanent plantings such as fruit crops, will not occur. The risk to the environment and cultural values is also higher on the flood plain.

The concept designs are focussed on supply to areas that are beyond the flood plain.

PROPERTY SIZE

A key constraint to agricultural development is land fragmentation and competition for rural land from rural lifestyle development[15]. Mapping of property size has been used to identify areas that are most prone to this competition (Figure 3-3). As expected, they tend to be in proximity to towns. The area to the west of Glengarry, for instance, is unlikely to see significant future irrigation development.

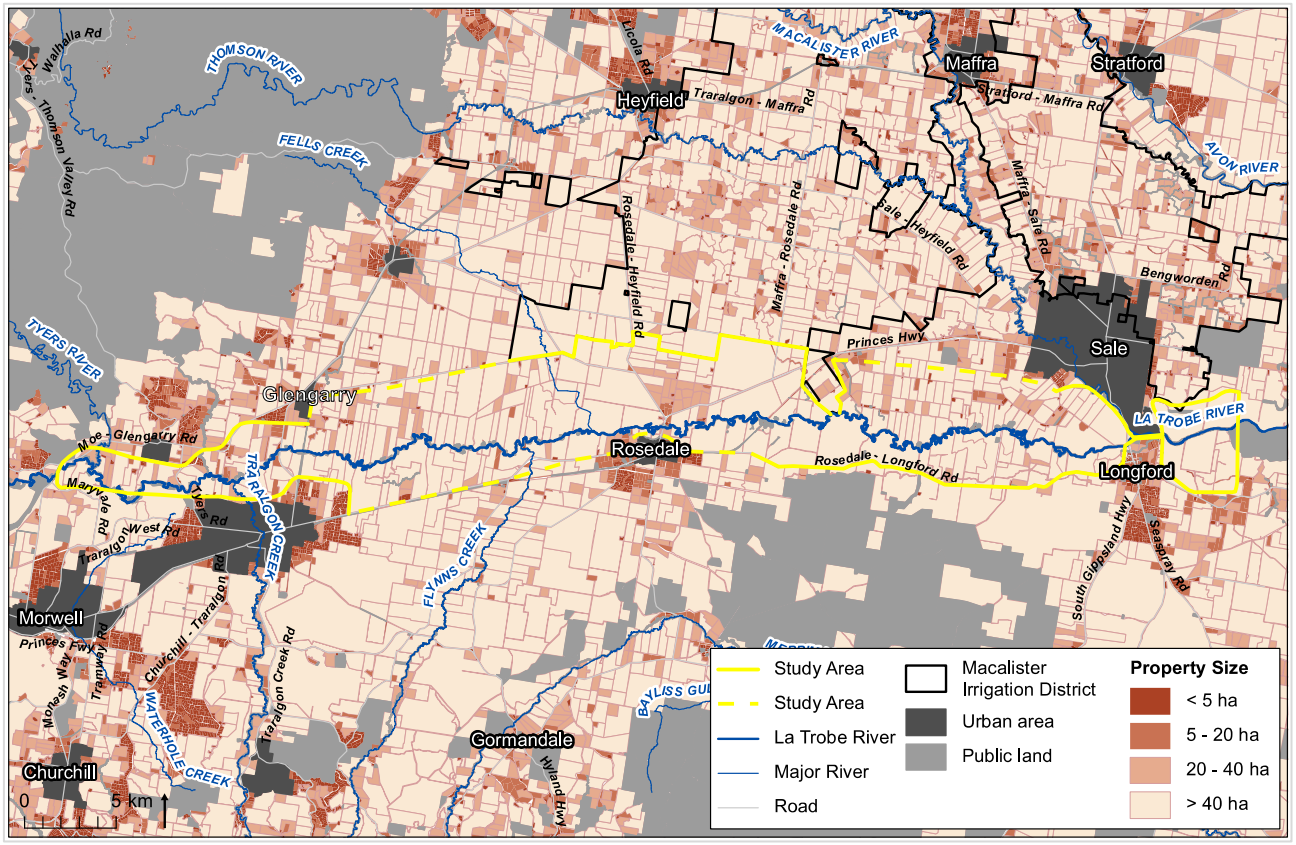


Figure 3-3: Latrobe property size

[15] As acknowledged *in Live Work Latrobe – Rural Land Use Strategy*, May 2019 (Latrobe City Council with support from Planisphere, RMCG and macroplan).

3.2 WATER SUPPLY

CURRENT LICENCES AND WATER USE

Private diverters along the lower Latrobe River harvest unregulated flows from the river directly and their supply can also be supplemented by water stored in Blue Rock Reservoir. Entitlements are classed as Section 51 Take and Use licences. SRW utilise a range of sources to supply private diverters along the lower Latrobe River including:

- Access to a share of inflows and storage capacity in Blue Rock Reservoir
- A share of unregulated Latrobe River flows, when natural flow in the river exceeds passing flow requirements
- A share of additional unregulated inflows to Lake Narracan if they are not used by other bulk or environmental entitlement holders
- A share of return flows from industry in the Latrobe Valley.

Note that Blue Rock Reservoir provides large reserves of water in storage, thereby providing entitlement holders security of supply during dry periods. However, SRW has only a very small share in Blue Rock and the ratio of storage share to total entitlement volume is considerably smaller than any other entitlement holder. This means that SRW has proportionally less water in reserve to provide a back-up when unregulated flow in the Latrobe River is insufficient to meet demand[16].

Current irrigation bulk entitlement allows for extraction of up to 13,400 ML/year for agriculture. However, the total volume of irrigation licences is less than this at 10,750 ML/year. The difference is only available to irrigators before mid-December and when flows are above environmental triggers. This is referred to as *off quota* water and is generally only available in wetter years.

Current average diversions from the river by irrigation licence holders are approximately 8,400 ML/year (including return flows) across the period 2015-2020. Average use was approximately 63% of available water. Discussions with SRW indicate usage increases significantly, by up to 30%, in drought years. This indicates that irrigators hold excess licence volume for dry years as a way of managing supply reliability.

Further irrigation development is not expected based on current entitlements.

Table 3-1: Lower Latrobe River irrigation licences and use[17]

REACH OR TRIBUTARY	LICENCE VOLUME (ML)	AVG. AVAILABLE (ML)	AVG. ANNUAL USE (ML)	USE (% OF VOL AVAIL)
Blue Rock Lake, Tanjil river to Lake Narracan	400	344	-	-
Lake Narracan to Rosedale	6,100	6,644	3,900	59%
Rosedale to Thomson River	3,700	5,657	4,200	74%
Thomson River to Gippsland Lakes	500	593	300	51%
Latrobe River Total	**10,700**	**13,248**	**8,400**	**63%**

[16] Information provided by DELWP based on background work for the LTWRA.

[17] *Latrobe River System Demands and Values Assessment*, Marsden Jacob, 2020, Draft final report (redacted version) prepared for DELWP, Nov 2020. See Appendix 9 – Agricultural water. Averages based on 5-year period 2015/16 to 2019/20.

Groundwater is also used for irrigation. In the Latrobe Basin (a much larger area than this Phase 3 study area) total groundwater licence volume is 22,938 ML/year for irrigation and dairy use. On average, usage is generally around 50% for most groundwater entitlements. Groundwater is typically used as a back-up supply to manage years of reduced rainfall. Usage increases in drought years by up to 20%[18].

RECENT WATER RESOURCE ASSESSMENTS

LTWRA For Southern Victoria

Completed between August 2018 and February 2020, the Long Term Water Resource Assessment (LTWRA)[19] was a formal process carried out by DELWP to determine:

- Whether water availability has declined for consumptive users and the environment
- Whether a reduction in water availability has been shared equitably between consumptive users and the environment
- Whether water-sharing arrangements need to respond to a deterioration in waterway health.

The LTWRA for the Latrobe system found that while there has been an overall decline in water availability in the basin, there has been an increase of 19.8 GL per year available to consumptive users (comprising industrial, local towns, and irrigation supply to licensed diversions) compared with the 2011 assessment for the Gippsland Region SWS[20]. The increase in allocation to consumptive users was the result of allocating a previously unallocated share of inflows to Blue Rock Reservoir. Over the same period, there has been a decline in water available to the environment of 48.0 GL per year. Based on a share of the available resource, the environment's share has reduced by 3% from 79% to 76%, while the consumptive share has increased by 3%. Although, the consumptive share has increased, this is skewed towards urban and industrial users who hold the vast majority of entitlements in the consumptive pool.

The LTWRA for the Thomson-Macalister Rivers found that there has been a decline of 50.3 GL per year to consumptive users in the basin (comprising urban supply to Melbourne and local towns, and irrigation supply to the MID and licensed diversions) compared with the 2011 assessment for the Gippsland Region SWS. Over the same period, there has been a decline in water available to the environment of 65.4 GL. Based on a share of the available resource, the environment's share has reduced by 1% from 54% to 53%, while the consumptive share has increased by 1%. Both consumptive users and the environment have experienced a decline, but this has been more significant for the environment.

Latrobe Valley Regional Rehabilitation Strategy – Regional Water Study

As part of the preparation of the Latrobe Valley Regional Rehabilitation Strategy (LVRRS), a water study was undertaken to assess the feasibility of using water to rehabilitate the Latrobe Valley brown coal mines to achieve safe, stable and sustainable rehabilitated landforms once mining ceases. The '*Latrobe Valley Regional Water Study'* assessed the impact of using Latrobe Basin water supplies to fill mine voids on other water users in the Latrobe Valley including urban, industrial, irrigation and the environment.

Surface water availability in the Latrobe River system was found to have decreased significantly in the past 20 years, from a long-term average of about 800 GL a year to about 600 GL a year since 1997. Due to uncertainties associated with climate change and projected water availability, any potential water supply for mine rehabilitation will need to account for uncertainty around future climate and water availability and plan for the expectation of a drier future[21].

[18] Marsden Jacob 2020, as above.
[19] DELWP (2020a) Long-Term Water Resource Assessment for Southern Victoria – Overview report.
[20] DELWP (2020b) Long-Term Water Resource Assessment for Southern Victoria – Basin-by-Basin results.
[21] DELWP (2019) Latrobe Valley Regional Rehabilitation Strategy – Regional Water Study Fact Sheet.

Further studies are currently underway to assess other options for mine rehabilitation, including accessing alternative water supplies such as recycled water or desalinated water.

It is noted that one of the implementation principles of the LVRRS is that any water used for mine rehabilitation should not negatively impact on Traditional Owners' values, environmental values of the Latrobe River system or the rights of other existing water users.

Blue Rock Reservoir - 1% inflow/storage share

In Action 6.1 of the Gippsland Region SWS (2011), the government made a commitment to provide a permanent share equivalent to 0.8 GL for purchase by irrigators along the lower Latrobe River. Instead of retaining this as unallocated water, the Minister for Water allocated this 1% inflow and storage share as part of the Latrobe Reserve BE (18.87% inflow/storage share), and this water is available in the meantime in line with the reserve rules.

Since 2011, SRW and DELWP have been investigating how this action could be implemented including an assessment of potential water products. The assessment included modelling of supply yield and reliability and how it could be operationalised. It was found that a yield of at least 800 ML/year could be supplied from the permanent share with a high degree of reliability. As this water would be solely supplied from Blue Rock Reservoir, this would be a different product to current irrigation entitlements on the Latrobe River which are supplied mostly from unregulated Latrobe River flows and industry returns, with the water from Blue Rock Reservoir used as a back-up supply during dry times. SRW is continuing to consider how to put this different product to market, including consideration of operational and administrative requirements and annual tariffs.

WATER AVAILABILITY

Water for irrigation development in the Latrobe study area, is most likely to come from the Latrobe Basin. However, all surface water in the Latrobe is currently allocated and changes to the current water allocation framework would be required for additional water entitlements to be allocated.

There is no surface water available for transfer from neighbouring basins (e.g. Thomson). A potential exception is water savings created from modernisation works in the MID.

While there is substantial groundwater use in the Latrobe basin, licences have been capped and any new groundwater would need to be traded from existing licence holders.

Complementary investigations are currently being undertaken on alternative water sources that could potentially be supplied into the Latrobe Basin, including desalination and recycled water. Development of these options is likely to be driven by the needs for mine rehabilitation in the Latrobe Valley. However, there may be flow on effects for irrigators if this frees up surface water entitlements for irrigation, or there is alternative water available once the initial filling of voids is complete (which is likely to be several decades away).

SUPPLY FROM BLUE ROCK RESERVOIR

For design purposes it is assumed that water will be accessed from the Latrobe River through run of river flows influenced by regulation from Blue Rock Reservoir.

The surveyed Latrobe demand (see Section 3.3) is around 12,000 ML/annum. Previous climate change modelling, indicates that supply of this volume with high reliability would require a higher volume of storage capacity in Blue Rock Reservoir. Initial estimates suggest a 10% share of Blue Rock inflows and storage capacity share may be required, corresponding to a storage capacity share of around 20,000 ML. It is noted that this will depend on the climate change scenario.

It is important to note that this concept design assumes a high reliability water product and this is higher than the reliability received by existing Latrobe irrigators, who receive supply from run-of-river and industry returns, with some supplementary supply from Blue Rock. As a result, water entitlement cost is also expected to be comparatively higher and operation of the system would need to change to deliver this effectively.

3.3 DEMAND ANALYSIS

An assessment has been undertaken of demand for water via consultation with current landholders and industry stakeholders in March and April 2021. Detailed results are provided in '*Southern Victoria Irrigation Development Project Phase 3 – Assessment of Demand and Willingness to Invest'* (RMCG, April 2021). This recent analysis is supported by previous agricultural and water industry assessments within the SVID Project and beyond.

Other recent relevant studies include:

- *Lake Wellington Land and Water Management Plan Technical Appendices* (WGCMA, Final draft Aug 2018) provides projected land use patterns for the Lower Latrobe. This suggests a doubling in area of irrigated horticulture (vegetables) from approximately 800 ha to 1600 ha, while irrigated dairy production remains approximately stable. It is presumed that these projections are based on current water resources only.
- *Latrobe River System Demands and Values Assessment* (Marsden Jacob Associates, 2020) includes a demand scenario involving expansion of irrigation along the Lower Latrobe River to include all potential sites. Approximately 60% of available land is assumed to be irrigated leading to demand for up to 44,800 ML/yr. If water use averages 4 ML/ha this means development of approximately 11,000 ha, which is a much larger scale than that identified through this phase of consultation.

There is strong interest from existing landholders within this study area for enhanced water security and increased allocations. Landholders have formed the Latrobe River Irrigators Inc to provide a clear voice for the area.

Consultation participants expressed strong demand for irrigation water in the Latrobe study area – between 9,250 - 13,040 ML/year. Approximately 70% of respondents in the Latrobe area are in an expansion phase and 60% are looking to diversify. They are considering purchasing or leasing additional land in the next 5 to 10 years. Water availability or reliability was identified as the main barrier to expansion of agriculture.

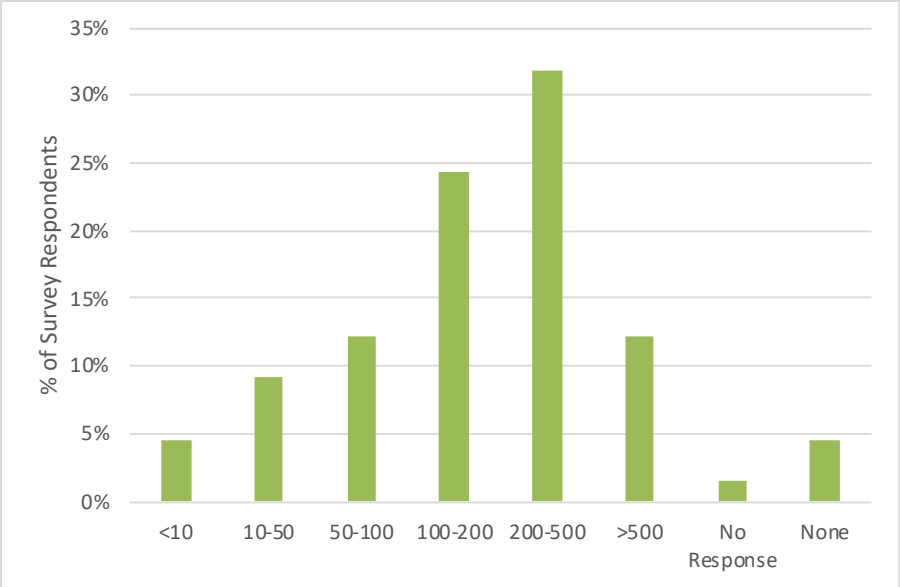


Figure 3-4: Latrobe average volume of additional irrigation water required (ML/year)

The demand expressed occurs along both sides of the Latrobe River from north of Traralgon to Longford (refer to Figure 3-6). There are clusters of demand on the north side of the river: from approximately Glengarry to Fells Creek; and from approximately Kilmany to Pearsondale.

Survey coverage was approximately 40% for the Latrobe area. The majority of survey participants are existing River licence holders and with landholdings located relatively close to the river. Based on land capability and industry analysis, it is projected that the demand could grow to 20,000 ML/year. This is likely to be clustered in parts of the study area where land capability is higher – on the north side of the river to the east of Glengarry and to the east of Kilmany. The additional projected demand is likely to come from new businesses moving into the study area and from current landholders located further away from the river.

Table 3-2: Latrobe surveyed and projected demand

FOCUS AREA	NO. SURVEYED	HECTARES SURVEYED	APPROX % OF FOCUS AREA	ML DEMAND SURVEYED	PREVIOUS DEMAND ESTIMATE	ML DEMAND PROJECTED
Latrobe	34	11,550	40%	9,250–13,040	13,000 (Pre-feasibility stage)	20,000

Based on the survey results and industry analysis, the key demands for water are expected to come from vegetables, dairy, beef and fodder cropping. Other enterprise types could occur but are likely to be at a comparatively small scale and/or have low demand for water supply. Vegetable producing businesses are currently targeting the Avon River area (see Section 4.3). Development of vegetables could also occur along the Latrobe River but this is likely to be at a lower percentage of the total irrigation development. A Latrobe River scheme would be focussed on strengthening the current dairy and beef industries through more intensive production and/or return of higher quality produce (refer to Figure 3-5).

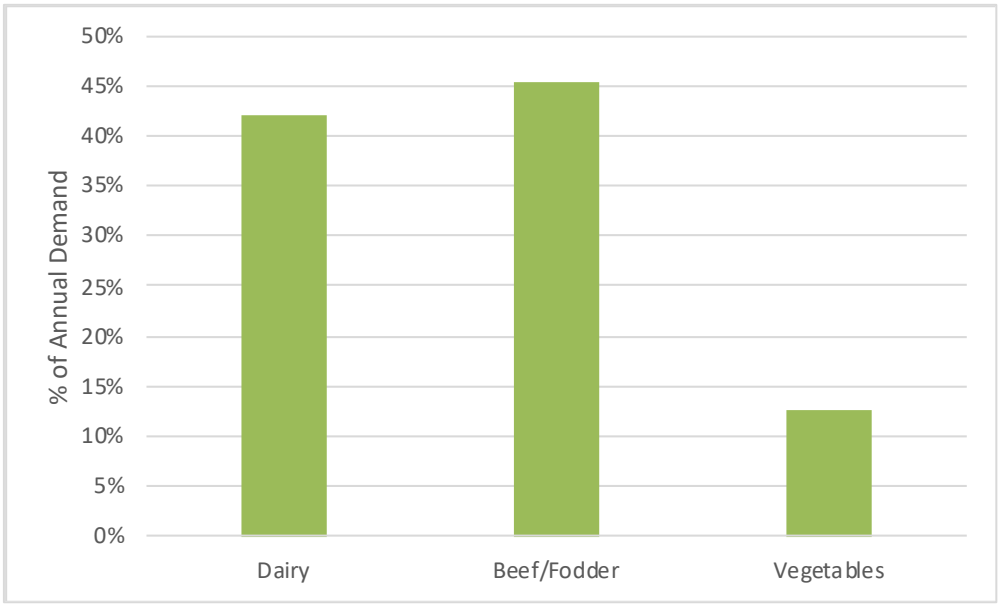


Figure 3-5: Latrobe demand by main enterprise type

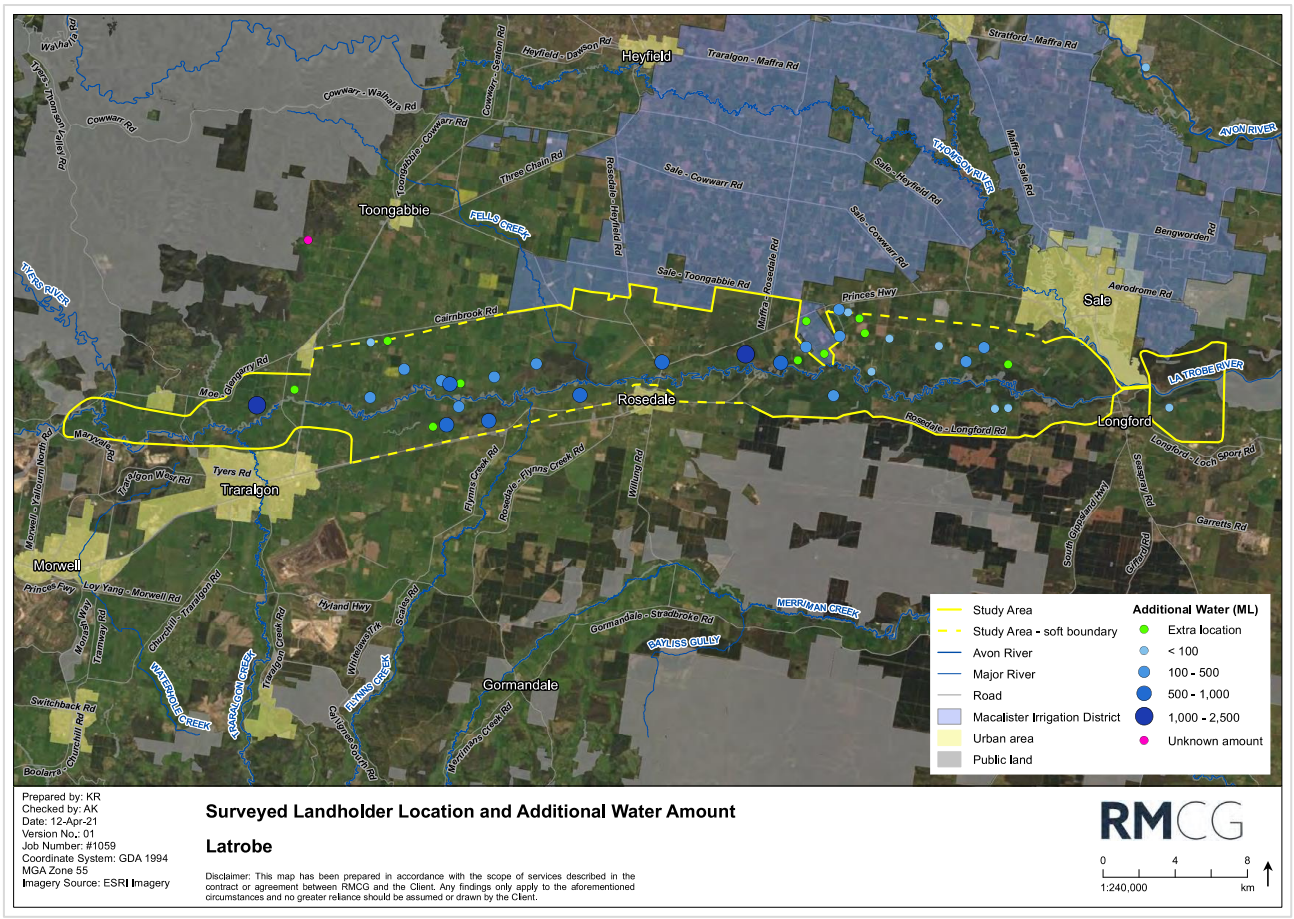


Figure 3-6: Latrobe map of surveyed demand

Spatial analysis of demand locations indicates that 8,000 – 10,000 ML of the projected demand could be readily accessed by properties directly connected, or very close, to the Latrobe River. To achieve the full projected 20,000 ML of demand would require supply infrastructure to properties further from the river.

3.4 CULTURAL HERITAGE

A desktop Cultural Heritage Due Diligence Assessment (CHDDA) was undertaken by GHD as part of the pre-feasibility assessments for Phase 3. Refer to '*Southern Victoria Irrigation Development Project – Phase 3 Cultural Heritage Due Diligence Assessment'*, GHD, 2021 (Draft B dated 30 April 2021). This helps to understand the potential for built, archaeological and intangible heritage values to be present in the study area and the associated heritage risks or legislative obligations for the project.

The assessment assumes proposed works include the installation of pump stations, pipelines and balancing storage, as well as expansion of irrigation area. This type of work is classified as a high impact activity under the *Aboriginal Heritage Regulations (2018).*

The Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) is the Registered Aboriginal Party (RAP) for the study area. Consultation with GLaWAC included a preliminary discussion with Russell Mullet (Cultural Heritage Manager, Elder, GLaWAC) and further consultation with Lisa Hocking and Sue Wesson to consider cultural values (as discussed in Section 2.4) and review the next steps for incorporating cultural assessment within the project.

Legislative considerations for the project have been assessed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), Planning and Environment Act 1987, Aboriginal Heritage Act 2006 and Heritage Act 2017. This CHDDA is a desktop assessment and does not constitute an approval under these Acts.

Within the Latrobe study area, there are 76 registered Aboriginal cultural heritage places. Artefact scatters and scarred trees are the most prevalent. This is based on limited archaeological assessment within the study area, so the actual number could be much higher.

Previous archaeological assessments undertaken within the wider region have shown that the majority of recorded Aboriginal places are located along, or within close proximity to the major, permanent sources of water within the region. Land within 200 m of a waterway and not subject to significant ground disturbance, is considered an area of cultural heritage sensitivity under the *Aboriginal Heritage Regulations (2018).*

The assessment concludes that a mandatory Cultural Heritage Management Plan (CHMP) would be triggered for the proposed works within the Latrobe study area. Overall, the risk for harm to Aboriginal cultural heritage material is high due to the permanent waterways and little evidence for significant ground disturbance within the study area.

Following discussions with GLaWAC, it is recommended that 'on Country' consultation with relevant Aboriginal stakeholders and knowledge holders should be undertaken to provide an opportunity to access and discuss cultural values of the study area. This process should be undertaken by the Gunaikurnai Traditional Owners.

Due the nature of agricultural land use in the region, historical heritage places are likely to be sparse in nature. The overall historic heritage risk low, as historical heritage places will likely be associated with agricultural practices and land use. Within the Latrobe study area, nine Heritage Overlay items are located within the Latrobe Planning Scheme and six within the Wellington Planning Scheme, and there are two items listed on the Victorian Heritage Inventory. Further historical heritage investigations and planning permit/s may be required if the proposed works are to impact the relevant properties.

3.5 ENVIRONMENT

A desktop environmental assessment was undertaken by GHD considering flora, fauna, waterway and groundwater values in the Latrobe study area – *SVID Phase 3 Environmental Assessment Draft*, GHD, May 2021. In addition, a field assessment of a smaller subset of the Latrobe River study area was undertaken by GHD in November 2017 as part of Phase 2 work.

The desktop assessment includes a 10 km buffer in addition to the area defined in Figure 3-1. The additional information captured has been used to provide context to assess the significance of ecological features identified within the study area, as well as whether they are part of a larger area, or whether there are potential impacts outside the study area.

FLORA AND FAUNA

Prior to conversion to agriculture, the vegetation in the region most likely consisted of grassy open forests, riparian forests and swamps, woodlands and grassland. Remnants of these vegetation communities remain. The Latrobe study area contains large areas of modelled native vegetation covering approximately 30% of the study site. However, parts of the larger study area have been more extensively converted to agriculture and there is very little modelled native vegetation remaining. For instance, the Glengarry East area has modelled native vegetation covering only 4% of this sub-area.

During the November 2017 field assessment, no rare or threatened species were recorded. It was deemed unlikely that suitable habitat existed to support rare or threatened species or threatened ecological communities. However, the current Latrobe River study area covers a much larger area, including a wider range of mapped EVCs and habitats.

Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed ecological values with the potential to occur in the study area include threatened ecological communities such as Gippsland Red Gum (*Eucalyptus tereticornis* subsp*. mediana*) Grassy Woodland and Associated Native Grassland, and threatened flora including *Dianella amoena* (Matted Flax-lily) and *Prostanthera galbraithiae* (Wellington Mint-bush). Threatened fauna that may occur include the Swift Parrot (*Lathamus discolor*), Dwarf Galaxias (*Galaxiella pusilla*) and Australian Grayling (*Prototroctes maraena*), and migratory fauna including the White-throated Needletail (*Hirundapus caudacutus*).

Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) listed fauna species e.g., Great Egret, Dwarf Galaxias and Australian Grayling, have the potential to occur and/or use habitat within the study area. FFG Act listed flora species with a high likelihood of occurrence includes Matted Flax-lily and Grey Billy-buttons. Declared noxious weeds also occur throughout the study area and are likely to trigger FFG Act potentially threatening processes.

The following measures can be taken to avoid and/or minimise the impact to flora and fauna:

- Refine design, including pipeline network, to avoid areas of native vegetation and fauna habitat, and retain as many Large Trees as practicable. For example, use areas of existing disturbance.
- Maintain a buffer along creek corridors to avoid impacts to riparian species and vegetation
- Adopt technologies (e.g., trenchless technology under water courses) that avoid and minimise impacts to ecological values
- Each irrigation property must have an irrigation and drainage plan and this must demonstrate consideration of the impacts on biodiversity, including the risk of consequential or cumulative losses
- Incorporate measures to prevent the spread and introduction of weed species – e.g. vehicle hygiene during construction.

It is recommended that a rapid field assessment is undertaken to map the extent of native vegetation across the sub-areas where works are likely to be undertaken. Once the project reaches a detailed design stage, a

detailed ecological field assessment could then be undertaken, mapping the extent and condition of native vegetation (including a Vegetation Quality Assessment) proposed to be impacted.

WATERWAYS AND WETLANDS

The Latrobe River runs through the centre of the study area. The river originates on the Baw Baw Plateau and passes through relatively flat to undulating plains cleared for agriculture, before flowing into Lake Wellington (the westernmost point of the Gippsland Lakes). The system includes major water storages – Blue Rock Reservoir, Moondarra Reservoir and Lake Narracan.

The Latrobe River was assessed as part of the Index of Stream Condition assessment[22]. The reaches closest to the focus area were in an overall poor or very poor condition. However, tributaries assessed within the study area (Flynns Creek, Eaglehawk Creek, Rintoul creek) were rated as in an overall moderate or good condition. The other waterways within the study area do not have an ISC assessment.

For the purpose of this study, regulated flows from Blue Rock Reservoir are considered the likely water source for an irrigation scheme on the Latrobe River. This is to assist in concept design and costing and does not preclude other water source options being explored in the future. Further investigation will be required to understand the impact of increased supply and regulation of the river both upstream and downstream of the irrigated areas.

There is also potential for irrigation runoff to impact on waterway flows and water quality and contribute to periodic algal blooms. The SEPP (Waters) (2018) has set a target to reduce average annual Total Phosphorus inputs to Lake Wellington from 115 t/y to 100 t/y by 2030. Half of this, or 7.5 tonnes of phosphorus per year, is to be achieved in irrigation areas (focussed on the MID as the main contributor) through implementation of the *Lake Wellington Land and Water Management Plan* (WGCMA, 2018).

There is a total of 489 current wetlands mapped by DELWP's NVIM tool that intersect with the Latrobe River study area. The numerous small wetlands are considered patches of native vegetation, and any impacts to areas mapped as current wetlands must be included in the extent of native vegetation removal calculations for a project and are subject to offsets.

There are also major current wetlands identified within or being intersected by the Latrobe River study area – Long Waterhole, The Heart Morass and Dowd Morass. Sale Common Nature Reserve is to the immediate east of the study area and consists of three parcels that form part of the Gippsland Lakes Ramsar site, which is an internationally and a nationally important wetland. Runoff from irrigation development has potential to reach the Gippsland Lakes via the Latrobe River.

The Latrobe River study area includes active floodplain in areas close to the River and its tributaries. There is a potential conflict in the future between the desire to expand irrigation along the Latrobe floodplain and allow for the migration of freshwater habitats up the Latrobe floodplain from the Gippsland Lakes Ramsar Site. Leaving room for, and facilitating the latter, is a major focus of the Gippsland Lakes Priorities Plan overseen by the Gippsland Lakes Coordinating Committee.

The following measures can be taken to avoid and/or minimise the impact to waterways, wetlands and the floodplain:

- Further investigation will be required to understand the impact of increased supply and regulation of the Latrobe River both upstream and downstream of the irrigated areas
- Further investigation is recommended into the potential conflict between expanding irrigation along the Latrobe floodplain and the migration of freshwater habitats up the floodplain from the Gippsland Lakes
- Adoption of Best Practice Environmental Management for runoff management – irrigation and drainage design and operation must include measures to prevent contamination of receiving waterways with

[22] Index of Stream Condition – the Third Benchmark of Victorian River Condition, DEPI 2013.

drainage return water containing high nutrients, suspended sediments, saline runoff and other pollutants

- Conduct a Risk Assessment to assess the potential threats to Gippsland Lakes Ramsar Site from the proposed works[23]
- Infrastructure location should avoid waterbodies and their associated habitat where possible, such as mapped Current Wetlands, streams and creeks.
- Maintain a buffer along creek corridors to avoid impacts to the riparian zone
- Include runoff and sediment control measures and implement during construction works to prevent soil and contaminants from entering waterways.

GROUNDWATER AND SALINITY

The Quaternary Aquifer (QA), and in some locations (e.g. around Longford) the Upper Tertiary / Quaternary Aquifer (UTQA), comprise the watertable aquifer across the study area. These aquifers comprise sand, gravels, clay and silts. Together, they occur at thicknesses greater than 50 metres depth below ground surface. The QA and UTQA are unconfined, however some local confinement of the UTQA by the QA, is possible.

Groundwater levels are typically shallow (less than 5 metres below ground surface) and potentially shallower immediately adjacent to the river. On this basis there is potential for groundwater levels in the study area to be impacted by irrigation.

Groundwater at shallow depths (<10 metres below ground surface) may under existing conditions, be in hydraulic connection with the Latrobe River. It is acknowledged that gaining, neutral and losing stream reaches could occur and could be temporally variable.

The aquifers generally exhibit relatively low salinity, typically less than 1,000 mg/L TDS (1,600 µS/cm EC), with higher salinity (less than 3,500 mg/L TDS) in some areas close to the Gippsland Lakes, such as Longford. The salinity of the irrigation supply from the Latrobe River is also relatively low, with a typical value of around 300 µS/cm EC, and ranging from a minimum of around 200 µS/cm EC to a maximum of around 600 µS/cm EC.

Given the shallow depth to the watertable, there is the potential for groundwater levels in the study area to be impacted by irrigation. However, it is anticipated that accessions to groundwater from irrigation will be relatively low, due to the utilisation of highly efficient irrigation technology.

Based on the relatively low groundwater salinity, anticipated low accession volumes from irrigation and possible existing hydraulic connection between the Latrobe River and the watertable aquifer, it is considered that groundwater levels and salinity in the area are unlikely to be impacted by irrigation expansion along the Latrobe River.

The following measures can be taken to avoid and/or minimise impact to groundwater and salinity:

- Promote (or even mandate) the adoption of efficient irrigation practices for the expanded irrigation area to ensure that groundwater recharge, and irrigation-induced salinity, is minimised
- A hydrogeological assessment may be required to identify any salinity risks associated with specific properties in the expanded irrigation area.

[23] As per Gippsland Lakes Ramsar Site Management Plan, East Gippsland Catchment Management Authority 2015.

NEXT STEPS

The proposed project has to potential to impact environmental values. Impacts and key risks include the removal of native vegetation, impacts to downstream water quality (during construction and operation), and changes to water regimes (such as changes to waterway hydrology due to increased regulation).

Given the extensive area being considered for irrigation development, it is recommended that a collaborative approach is taken during the next design phases of the project. The proposed project has the ability to reduce its overall impacts through design, by avoiding areas of native vegetation and wetlands, and through best practice irrigation measures.

3.6 IRRIGATION SUPPLY CONCEPT DESIGN

This section summarises the findings of the concept design work which is detailed in *SVID Phase 3 Concept Design Report*, GHD, Draft D May 2021.

CONCEPT SCHEME SELECTION

The Latrobe River study area is constrained in most directions by e.g. the MID to the north, public land, urban areas, and mining activity. This creates a long narrow study area with the Latrobe River running through the middle. It is unlikely that one pipeline network servicing the whole area will be economically feasible. Instead, the concept scheme design has focussed on a more likely scenario of the development of multiple medium scale schemes, each with a pumping point from the Latrobe River.

As a result, a concept area approach has been adopted which provides representations of small, modular systems that are scalable. These concept areas will be used to identify infrastructure requirements and cost estimates, that can then be applied across other parts of the study area.

The concept schemes identified represent two distinct types of development:

- **Concept Scheme 1** – Represents a medium sized irrigation development close to the river. The scheme would comprise low pressure supply from the river with a piped system supplying to landholdings covering approximately 2,000 ha. Static lift ~20 m
- **Concept Scheme 2** – Represents a scheme which is more distant from the river and covers a total area of approximately 4,200 ha. Comprises extension of Concept Scheme 1 to supply areas further from the river with an additional ~20-30 m static lift. The additional area would be supplied via a dedicated re-lift pump and balancing storage. Scheme 1 infrastructure would be upsized to supply additional flow rate into this additional area.

The following aspects have been investigated for these concept schemes:

- **Crop mixes and demands:** Peak demand was found not to be sensitive to the crop mixes selected. Therefore, a crop mix which largely represents intensification of existing land use patterns (dairy, beef and fodder cropping) has been adopted for pipe sizing and pump power consumption estimation. This will not limit future supply to new land use such as vegetables.
- **Water availability:** For design purposes it is assumed that water will be accessed from the Latrobe River through a run of river[24] pumped scheme influenced by regulation from Blue Rock Reservoir. It is likely to be a higher reliability supply than current irrigation licences and operation of the system will need to change to deliver this effectively.

[24] There is no need to create a weir pool to pump from.

- **Streamflow variability:** The flow rate required at pump station sites can be reliably delivered at a constant flow rate. Minimal buffer storage will be required to manage peak demands. For Concept Scheme 1 some on farm storage will be provided, but a system scale balancing storage would not be required. For Concept Scheme 2, a system scale balancing storage is incorporated to reduce costs to shift water further from the river. The design also takes into account flooding issues - e.g. submersible pump with electrics above flood level.

CONCEPT SCHEME DESIGN

Concept Scheme 1 comprises a pressure pipeline system which supplies water to a 2,015 ha area of land north of Latrobe River. The 14.2 km pipeline system supplies 26 properties via a small pipe network, which comprises a single rising main and four spur pipelines.

Concept Scheme 2 comprises a pressure pipeline system which supplies water to a 4,237 ha area of land north of Latrobe River (2,015 ha as per Concept Scheme 1, plus an additional 2,222 ha). The 27.6 km pipeline system supplies 55 properties via a small pipe network, which comprises two separate rising mains, the first with four spur pipelines, the second with six. A balancing storage connects the two rising mains.

In the case of both schemes:

- All pipelines have been located along road reserves, with options for installation either within the road reserve or within private property, as required to avoid impact on native vegetation
- The scheme has been designed to supply a peak flow rate to each property boundary at the highest point on the property to facilitate potential for gravity irrigation within the property. Alternatively, water could be supplied to private on-farm storage and/or interconnected with private pumped farm distribution systems.
- For the purpose of pipe sizing, a minimum customer flow rate of 6 ML/day has been adopted. Refinement of the customer flow rates would be possible in future stages of the project, to better match actual farm irrigation requirements
- It is assumed that water would be supplied via a rostering system. The system will be capable of delivering 100% of the annual scheme demand within a 150 day period (as provided in the MID).

Peak vs Average Demand

The concept design assumes supply of peak demand. An alternative would be to supply average demand, which would reduce the pipeline sizes required and therefore reduce capital cost. However, this would require larger on-farm storages for balancing supply and demand. Phase 2 investigations concluded that it would be more cost-effective to supply peak demand via the pipeline network.

Intensity of Development

The concept design is based on irrigation of 82% of the total area supplied by the pipeline network. This aligns with development intensity in the Macalister Irrigation District (assessed via spatial analysis). Consideration has also been given to the cost of a lower intensity scheme with irrigation of 50% of the total area.

Power Supply

There are numerous locations available along the Latrobe River for siting a pump station, which are accessible via road reserve corridors and in close proximity to existing power supply sources. There are no obvious opportunities or disadvantages regarding power supply proximity which would influence pump station siting.

The capacity of the existing power supplies and ability to meet the proposed pump station power load would need to be investigated in future phases of the project.

COST ESTIMATES

Capital costs

Preliminary cost estimates for each scheme have been developed for comparative purposes (Table 3-3). The cost estimates provided are based on the conceptual alignments and sizing described in the preceding sections. No detailed analyses or calculations have been undertaken to develop the adopted dimensions. Similar scale projects, pipeline rates provided by SRW and published estimates of construction costs have been used as a basis for costs. These costs are likely to change as the designs progress through the concept and detailed design phases. Therefore, these cost estimates should only be used for the purposes of cost comparison.

Scheme 1A assumes 82% development intensity similar to the MID. Scheme 1B has a lower development intensity at 50% and is rounded to a slightly smaller area of 2,000 ha.

Table 3-3: Latrobe scheme cost estimates

ITEM	CONCEPT SCHEME 1A – MEDIUM SCALE, CLOSE TO RIVER, MID INTENSITY	CONCEPT SCHEME 1B – MEDIUM SCALE, CLOSE TO RIVER, LOWER INTENSITY	CONCEPT SCHEME 2 – LARGER SCALE AND FURTHER FROM RIVER
Pump Station/s	$2,242,000	$2,000,000	$4,379,000
Balancing Storage			$3,575,000
Pipeline Network and Outlets	$6,192,000	$3,100,000	$17,281,000
Environment Offsets	$1,000,000	$1,000,000	$1,000,000
Construction Management	$453,000	$370,000	$2,084,000
Project Delivery Costs	$2,283,000	$1,400,000	$6,555,000
Contingency	$3,043,000	$2,000,000	$8,719,000
Total	**$15,212,000**	**$9,870,000**	**$43,594,000**
Water Supplied	8,300 ML	4,000 ML	18,200 ML
Unit Capital Cost	$1,833/ML	$2,468/ML	$2,395/ML

Annual operation and maintenance costs

SRW has well established processes, infrastructure and skilled resources in place to operate and maintain large bulk water irrigation delivery systems.

The annual operation and maintenance costs developed for the SVID Phase 3 project Table 3-4 represent the incremental costs that are expected to be incurred to SRW in delivering water to customers in the new development area of the Latrobe River Scheme.

Table 3-4: Latrobe summary of operation and maintenance costs

ITEM	CONCEPT SCHEME 1A – MEDIUM SCALE, CLOSE TO RIVER, MID INTENSITY			CONCEPT SCHEME 1B – MEDIUM SCALE, CLOSE TO RIVER, LOWER INTENSITY			CONCEPT SCHEME 2 – LARGER SCALE AND FURTHER FROM RIVER		
Annual operating costs	**Years 1–10**	**Years 11 onwards**		**Years 1–10**	**Years 11 onwards**		**Years 1–10**	**Years 11 onwards**	
Overheads	$10,000			$10,000			$10,000		
Maintenance – pump stations	$20,000	$20,000		$15,000	$120,000		$60,000	$450,000	
Maintenance – pipelines	$10,000			$10,000			$30,000		
Operation costs – pump stations	$20,000			$20,000			$40,000		
Operation costs – SCADA / telemetry	$10,000			$10,000			$20,000		
Refurbishment costs	**10 years**	**20 years**	**30 years**	**10 years**	**20 years**	**30 years**	**10 years**	**20 years**	**30 years**
Valves	$90,000			$70,000			$270,000		
Pumps	$15,000	$25,000		$15,000	$25,000		$45,000	$75,000	
Electrical instruments	$250,000			$250,000			$550,000		
Buildings			$400,000			$400,000			$850,000
Power use									
Latrobe River pump station	2.06 KWh/ML			4.0 KWh/ML			1.86 KWh/ML		
Balancing storage pump station							1.49 KWh/ML		

CONCEPT DESIGN CONCLUSIONS

- There are numerous locations available along the Latrobe River for siting a pump station, which are accessible via road reserve corridors and in close proximity to existing power supply sources. There are no obvious opportunities or disadvantages regarding power supply proximity which would influence pump station siting.
- Minimal buffer storage will be required to manage peak demands. For Concept Scheme 1 some on farm storage will be provided, but a system scale balancing storage is not needed. A system scale balancing storage is incorporated in Scheme 2 to reduce costs to shift water further from the river.
- There are opportunities to optimise the cost of the scheme to better reflect actual customer flow requirements and service delivery locations
- The unit cost increases by about 35% if less water is supplied over a similar area – i.e. lower development intensity of Scheme 1B
- The unit cost increases by about 30% to supply the additional development area covered by Scheme 2. This shows that it would possibly be more economical to supply each area independently, rather than design for expanded schemes.

Multiple concept modules are likely to be required to achieve the projected 20,000 ML of demand.

ALTERNATIVE: EXPANSION OF DIRECT RIVER ACCESS

Landholders along the Latrobe River could access additional irrigation water (if it were to be made available) through direct pumping from the Latrobe River. This option would not require public investment in shared infrastructure. As noted in Section 3.3, spatial analysis indicates demand in the range of 8,000 – 10,000 ML per year from properties proximate to the river.

A high-level cost estimate has been developed by RMCG and incorporates advice from GHD. This preliminary estimate is for comparative purposes only. A system scale balancing storage would not be required, although individual irrigators may consider on-farm storage.

Table 3-5: Latrobe cost estimate for direct river access

ITEM	UNIT COST	UNIT	QUANTITY	TOTAL COST
Pump Stations and Pumps	$150,000	item	35	$5,250,000
Pipelines	$90	m	52500	$4,725,000
Outlets including Meters	$30,000	item	35	$1,050,000
Project Admin, Overheads, Design, Offsets etc.	15%			$1,653,750
Contingency	15%			$1,901,813
Total Capital Cost				**$14,580,563**

Assumptions used in Table 3-5:

- Average use per property of 300 ML/yr. So approximately 35 irrigators for 10,000 ML/yr.
- Pipeline costs include supply and installation and allowance for valves etc.
- Pipeline costs approximately half the unit cost of shared (public) infrastructure assuming lower pipe class used and simpler installation standards.
- An average of 1500m pipe installed per property.
- Pump costs include supply and installation, including power supply.
- Power supply costs can be highly variable but a major distribution upgrade is unlikely to be required.
- Lower contingency used for private farm works and owners' costs assumed as zero.
- Refurbishment and operating costs are assumed to be approximately half of the costs associated with Concept Scheme 1A.

3.7 COST-BENEFIT ANALYSIS

APPROACH TO VALUING BENEFITS

The benefits of additional irrigated agricultural development are assessed using net margins. Net margins are gross margins (revenue minus variable costs) minus the annualised cost of irrigation capital (including on-farm storage).

ASSUMPTIONS ADOPTED FROM PHASE 2

To ensure the estimates were comparable with previous estimates, RMCG adopted the basic assumptions used to estimate benefits in Phase 2 of the project[25], including:

- In the cost benefit framework, the Without Project case is represented by the value derived from existing agricultural production on the land to be developed for irrigation. A value of $250 per ha was assumed for dryland / unirrigated production.
- A discount rate of 7%
- Scheme life of 50 years
- The net margins per ML are shown in Table 3-6. These margins demonstrate the economic importance of attracting vegetable growers to the new irrigation area.

Table 3-6: Net margins by enterprise type

CROP	NET MARGIN AFTER INFRASTRUCTURE COSTS
Vegetables	$917/ML
Dairy	$533/ML
Fodder	$179/ML
Beef	$93/ML

- The category vegetables is an average that represents a mix of vegetables that are typically grown in Southern Victoria including lettuce, broccoli, onions and carrots.
- The net margins are calculated from gross margins developed by Marsden Jacobs in Phase 2 and recently checked by RMCG[26].
- The on-farm infrastructure costs are subtracted from the gross margins. These are based on irrigation being undertaken by centre pivots for the majority of crops and include associated pipelines and pumping equipment. The cost per ha of this infrastructure is estimated at $8,200/ha (or $744/ha/annum based on a 20-year life and a 7% real discount rate). Development of vegetables is assumed to use drip or fixed sprinklers at an estimated cost of $15,000/ha (or $1,416/ha/annum).
- If there is spare capacity in existing on-farm infrastructure, the net margin could be increased. This is not expected to be the case for the majority of the estimated demand.
- It is assumed that some balancing storage would be provided on farm, with 25% of the demand to be stored at an annual weighted average cost of $27/ML. This is based on 75% of the storages being gully dams with a capital cost estimated at $1,200/ML (or $87/ML/annum based on 50-year life and 7% real discount rate) and 25% ring-tank storages with an estimated cost of $2,400/ML ($174/ML/annum).
- To convert from $/ha to $/ML the assumed irrigation rates were 4.5 ML/ha for dairy/fodder, 2.5 ML/ha for vegetables and 4.0 ML/ha for beef[27].

[25] Marsden Jacob (2018) *Southern Victorian Irrigation Development Project Consolidation Report* (report for Southern Rural Water).

[26] Through comparison with industry data from sources such as ABARES and DPIPWE Tasmania within Phase 3 of the SVID Project.

[27] Note that these water use per hectare figures are based on industry/statewide averages associated with the gross margins used in the analysis. Different figures are used in other parts of this report (e.g. calculation of regional employment) to reflect the likely water use intensity in these study areas – based on climate conditions and consultation responses.

ASSUMPTIONS NEW TO THIS ANALYSIS

The mix of enterprises is critical to the benefits achieved by the scheme, with vegetables yielding more per ML of water used than dairy, and dairy more than fodder and beef. Two enterprise mixes were modelled as shown in Table 3-7.

Table 3-7: Latrobe Mix of enterprise type by percentage of ML delivered

ENTERPRISE	MIX WITHOUT VEGETABLES	MIX WITH VEGETABLES
Vegetables	0%	15%
Dairy	50%	50%
Fodder	30%	20%
Beef	20%	15%

Updated concept designs and cost estimates have been provided by GHD. A summary of costs is shown in Section 3-6.

It is assumed that the schemes take 3 years to construct. The time taken to reach peak water use has been extended by comparison to Phase 2 estimates which looked at 5 years. For Schemes 1A and 1B and direct pumping we have assumed 15 years (from when construction is complete). For the larger Scheme 2, 25 years is assumed. The uptake time is likely to vary according to overall scale and the portion of the demand that is projected rather than current. Uptake could be quicker, which would make these assumptions conservative.

RESULTS

Summarised results of the economic analysis are shown in The results show that:

- Direct river access by individual farmers provides the highest economic returns. This makes best use of the river itself as the main supply “channel”. The drawback of this option is that it limits access to those proximate to the river. It is unlikely to enable the full projected demand of 20,000 ML/year to be achieved. Although creation of a series of easements could increase access for potential customers without river frontage.
- Concept Scheme 1 provides better economic returns than Concept Scheme 2. This is because Scheme 2 has three times the capital cost of Scheme 1, but only delivers slightly more than twice the quantity of water (assuming development intensity is the same). The present value of the costs is approximately $2,000 per ML for Scheme 1, but $2,500 per ML for Scheme 2.
- The development intensity and uptake of water is an important condition for viability. Scheme 1B has a much lower benefit cost ratio than Scheme 1A as the development intensity is only 50%. The overall costs are reduced due to a smaller sized pipe network. However, the unit cost per ML is higher at approximately $2,700 per ML.
- Vegetable production increases the viability of each scheme. Securing vegetable growers will significantly increase the economic returns. However, vegetable production is not necessary to create a viable scheme. Given sufficient development intensity, dairy and beef production alone provide enough benefits to create a viable scheme.

Table 3-8. Five scenarios are compared, which have different combinations of scheme design, demand volume, vegetable production and development intensity (ha irrigated as % of total area).

The costs and benefits listed are in present value terms – i.e. future values have been discounted to today’s dollars.

The results are shown in terms of a benefit cost ratio, where a ratio greater than 1 indicates a viable scheme (as the present value of the benefits exceeds the present value of the costs).

The results show that:

- Direct river access by individual farmers provides the highest economic returns. This makes best use of the river itself as the main supply "channel". The drawback of this option is that it limits access to those proximate to the river. It is unlikely to enable the full projected demand of 20,000 ML/year to be achieved. Although creation of a series of easements could increase access for potential customers without river frontage.
- Concept Scheme 1 provides better economic returns than Concept Scheme 2. This is because Scheme 2 has three times the capital cost of Scheme 1, but only delivers slightly more than twice the quantity of water (assuming development intensity is the same). The present value of the costs is approximately $2,000 per ML for Scheme 1, but $2,500 per ML for Scheme 2.
- The development intensity and uptake of water is an important condition for viability. Scheme 1B has a much lower benefit cost ratio than Scheme 1A as the development intensity is only 50%. The overall costs are reduced due to a smaller sized pipe network. However, the unit cost per ML is higher at approximately $2,700 per ML.
- Vegetable production increases the viability of each scheme. Securing vegetable growers will significantly increase the economic returns. However, vegetable production is not necessary to create a viable scheme. Given sufficient development intensity, dairy and beef production alone provide enough benefits to create a viable scheme.

Table 3-8: Latrobe cost-benefit analysis results

ITEM	CONCEPT SCHEME 1A – MEDIUM SCALE, CLOSE TO RIVER, MID INTENSITY	CONCEPT 1A (NO VEGETABLES)	CONCEPT SCHEME 1B – MEDIUM SCALE, CLOSE TO RIVER, LOWER INTENSITY	CONCEPT SCHEME 2 – LARGER SCALE AND FURTHER FROM RIVER	DIRECT RIVER ACCESS
Total Volume	8,200	8,200	4,000	18,300	10,000
Intensity	82%	82%	50%	82%	N/A
% Vegetables	15%	0%	15%	15%	15%
Time to peak use	15 years	15 years	15 years	25 years	15 years
Capital Cost	$14,238,524	$14,238,524	$9,238,380	$40,804,248	$13,647,495
Refurbishment	$329,149	$329,149	$329,149	$792,384	$142,250
Operating Cost	$1,638,239	$1,638,239	$1,430,519	$4,382,210	$790,977
Benefits	$28,297,837	$20,112,071	$13,803,823	$50,056,032	$34,509,557
Benefit Cost Ratio	**1.7**	**1.2**	**1.3**	**1.1**	**2.4**

3.8 IMPACT ON REGIONAL EMPLOYMENT

Estimates of additional employment to be generated by development of an irrigation scheme in the Latrobe study area are presented in Table 3-9. The bulk of additional employment is expected to be created through development of vegetables, which is much more labour-intensive compared to dairy and beef farming.

The labour intensity estimates are based on industry statistics, research and data from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), Dairy Australia and Agriculture Victoria.

Table 3-9: Latrobe projected employment due to irrigation[28]

ITEM	2 X MODULAR SCHEME 1A - MEDIUM SCALE, CLOSE TO RIVER, MID INTENSITY	DIRECT RIVER ACCESS
Total Water Volume	16,400 ML	10,000 ML
Vegetables %	15%	15%
Vegetables Area Ha @ 4 ML/ha	615	375
Vegetables Labour Intensity	3.5 ha/FTE	
Vegetables Employment Created FTE	177	108
Dairy %	42%	42%
Dairy Area Ha @ 5 ML/ha	1,378	840
Dairy Labour Intensity	62 ha/FTE	
Dairy Processing Labour Intensity	165 ha/FTE	
Dairy Employment Created FTE	30	19
Beef %	43%	43%
Beef Area Ha @ 4 ML/ha	1,763	1,075
Beef Labour Intensity	212 ha/FTE	
Beef Employment Created FTE	8	5
Minus Current Employment (Primarily Dryland Beef) FTE	12	7
Total Additional Employment FTE	**204**	**125**
Full time FTE	84	51
Part time FTE	10	6
Casual and contract FTE	110	67

The extent to which the local workforce is likely to take advantage of these employment opportunities was discussed with representatives of Regional Development Victoria[29] and the Wellington Shire Council.[30] In the local vegetable industry, pickers from Asia and the Pacific have a good reputation. In contrast, local labour is not attracted to picker jobs. Consequently, overseas labour is preferred and is likely to fill the employment gap if vegetable cultivation is expanded. In a number of recognised horticultural areas in Australia, with a 50 year plus history of employing pickers recently arrived from overseas, these pickers now represent a significant proportion of farm owner-operators.

A 2016 KPMG review of the agribusiness sector in Gippsland noted an apparent lack of community understanding of how modern agribusinesses operate and the extent of available career opportunities. Agribusiness is consequently seen as a low-skilled industry and a second choice destination.[31] While local

[28] Sources include: *Dairy Farm Monitor Project, 'Victoria - Annual Report 2018-2019; Livestock Farm Monitor Report 2019-2020; Dairy Australia, 'In Focus 2020 - The Australian Dairy Industry'; https://www.agriculture.gov.au/abares/research-topics/surveys/vegetables#detailed-physical-characteristics; https://www.agriculture.gov.au/abares/research-topics/labour; https://www.dairyaustralia.com.au/en/industry-statistics/cow-and-farms-data.*

[29] Michelle Anderson, RDV, 20 April 2021.

[30] Mark Coleman, 27 April 2021.

[31] KPMG 2016, 'Gippsland Regional Workforce Plan'.

workforce would be interested in high-level (managers) and middle-level (drivers, machine and greenhouse operators, and technicians) horticulture jobs, these require training which is not provided in the local TAFE[32]. Regardless, the overall number of middle-level jobs is likely to be modest (maximum 10-1 ratio to picker jobs).

The contraction of hospitality, tourism and airline industries due to COVID-19 and the recent phase-out of the 'JobSeeker' program are likely to result in an abundance of temporary and casual local labour in the near future, which presents an opportunity for agriculture. However, the aging population will work in the opposite direction, decreasing the size of the workforce.[33]

The creation of employment in agricultural businesses will stimulate flow on employment in the regional economy. Flow on employment includes employment in the upstream supply chain, for instance within transport companies, fertiliser producers, agronomy, tractor companies, tyre fitting and mechanic workshops, and engineering businesses. There will also be flow on employment that results from expenditure by employees (e.g. at supermarkets, on housing etc), a proportion of which is captured in the local economy.

Flow on impacts is shown in Table 3-10. These have been modelled using the REMPLAN input-output model which includes up-to-date and comprehensive local data.

There is little value-adding to horticultural produce in the region and there is a potential opportunity to expand this activity locally.[34]

Table 3-10: Latrobe flow on employment

EMPLOYMENT TYPE	2 X MODULAR SCHEME 1A (16 GL)	DIRECT RIVER ACCESS (10 GL)
Direct Local employment	138	84
Direct Non-local and OS employment	66	40
Flow on employment (source: REMPLAN)	115	69
Total local employment	**253**	**153**
Total employment	319	193

The Latrobe River Irrigators outlined additional job creation of 1,000 – 1,500 new jobs for the study area[35]. This was based on development of 30,000 ha initially and 20,000 ha further into the future. This calculates as 1 new job for approximately every 30 ha of development. By comparison, the figures in Table 3-10 estimate 1 new job for approximately every 12 ha of development (total employment). The schemes considered here are smaller in total scale.

3.9 WILLINGNESS TO PAY

Consultation undertaken in April and May 2021 included assessment of willingness to invest in agricultural irrigation development. Detailed results are provided in *Southern Victoria Irrigation Development Project Phase 3 – Assessment of Demand and Willingness to Invest* (RMCG, April 2021).

[32] This situation might change with a new TAFE complex being built just south of Sale (Mark Coleman, 27 April 2021).
[33] In 2016, 66% of the agribusiness workforce in the Gippsland region was over the age of 45 (KPMG 2016, 'Gippsland Regional Workforce Plan').
[34] Horticulture companies tend to be based outside the region, so they grow the product, package it and send it off for processing elsewhere (Mark Coleman, 27 April 2021).
[35] From a presentation by Latrobe River Irrigators to a meeting at Loy Yang 13.03.2020.

Consideration was given to both the cost of water entitlement (effectively the capital cost of water) and annual water charges (i.e. operating cost). Consultation participants were asked to comment on how their demand for water would vary based on selected price points for each aspect.

In the Latrobe area, just over half of the respondents, stated that their demand for additional water would stay the same or increase at entitlement costs of $2,000/ML. At $2,500/ML this reduced to just 8% of respondents. More than 50% of respondents stated that they would not purchase any water at all at $2,500/ML. No respondents in the Latrobe were willing to purchase the total original volume stated at costs of $3,000/ML, with more than 70% indicating they would not buy water at all.

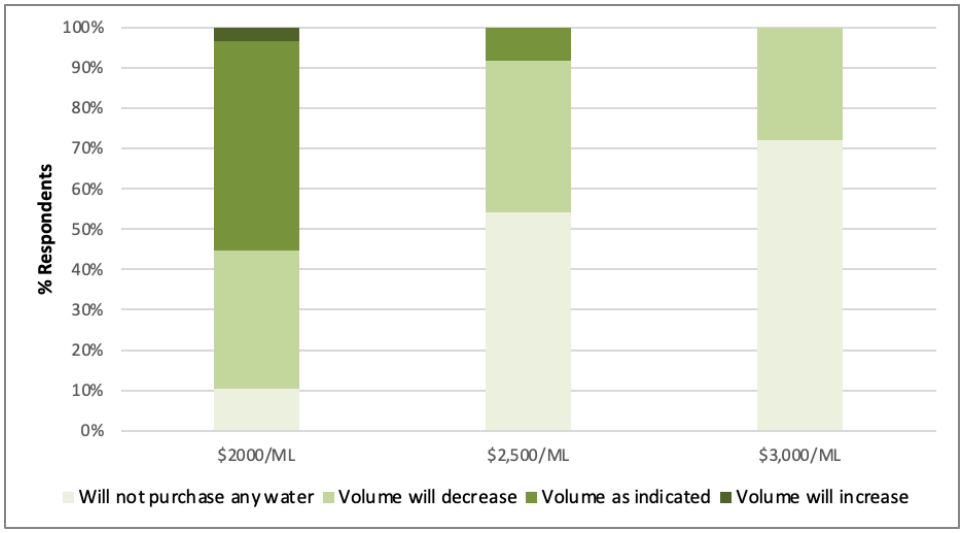


Figure 3-7: Latrobe – impact of water Entitlement cost on demand

The impact of annual charges on demand is less pronounced than the impact of entitlement costs, but followed a similar pattern, with a high proportion of demand in the Latrobe being impacted by increasing annual charges.

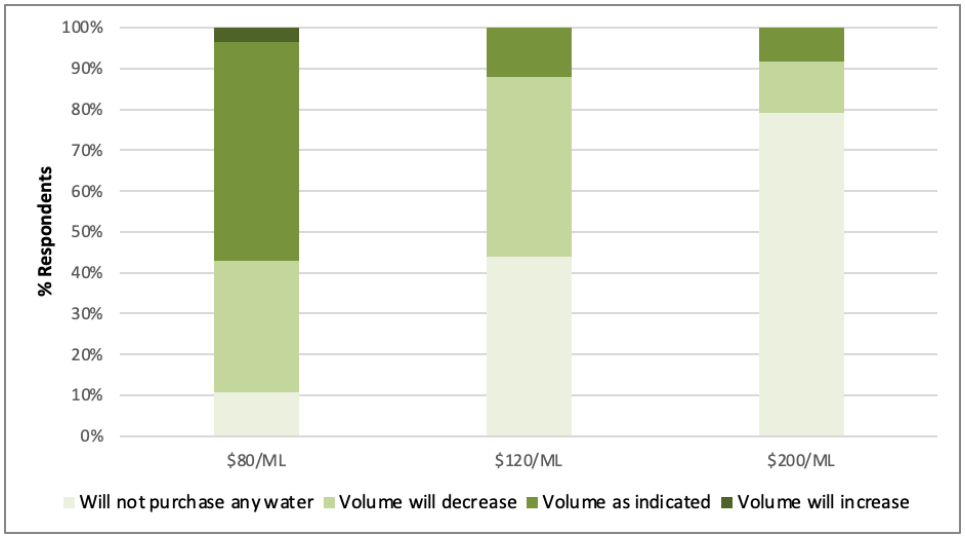


Figure 3-8: Latrobe – impact of annual charges on demand

Capacity to pay, and consequently willingness to pay, for additional irrigation water varies according to the irrigation end use. Vegetable production is typically a higher value end use than dairy, which in turn is higher value than beef (on a per ML basis). As the majority of demand in the Latrobe area was identified in dairy, beef and fodder type uses, this limits the capacity of irrigators to pay.

Historically, large scale irrigation developments have been undertaken based on significant government contribution to capital costs. Irrigators have an expectation that this will continue to occur in the future.

The majority of survey participants currently irrigate and have a solid understanding of the costs and benefits of irrigation development. Current water prices both locally and regionally are a key point of comparison for those looking to invest. Respondents in the Latrobe area made comparison to current costs for Latrobe River licences and generally do not see any reason to pay more than that (approximately $1,500/ML entitlement cost and $30/ML annual charges). Current costs for the MID are another key point of comparison. Some respondents also identified aspects such as security of supply, water quality and level of service in commenting on willingness to pay.

3.10 PRICING IMPACT

In accordance with standard regulatory practice, we have determined prices for the key concept schemes and the level of funding required for supply infrastructure to reduce these prices to align with current MID prices. These results should be read as indicative only and are provided to assist in comparison between the schemes.

The pricing analysis covers irrigation supply infrastructure capital and operating costs. It does not include the cost to buy water entitlements.

The first step in this analysis is determination of an annual revenue requirement. That is the revenue that must be collected by SRW from its customers to cover all expenses incurred in a given year. This is calculated using the building block approach which involves adding together:

- Operating expenses – including maintenance, power and overhead costs
- Regulatory depreciation – depreciation on the Regulatory Asset Base (RAB) which is the asset value after deducting contributed assets and grants
- A Return On Assets (ROA) – calculated as the Weighted Average Cost of Capital (WACC) multiplied by the depreciated RAB
- An allowance for tax – which is zero for SRW (in accordance with SRW's 2018 price submission).

The total annual revenue requirement is then divided by the forecast demand to determine a price per megalitre.

The prices vary over time because of asset depreciation and increasing demand. The concept schemes considered are likely to reach full take up at different times. We have therefore determined the price applicable in Years 5, 15 and 25. These three price points are intended as high-level indications for comparison purposes only. They are not pricing recommendations. As the ESC determines a revenue cap and does not regulate individual prices, SRW has discretion in how it will actually price individual schemes.

Results for each concept scheme are summarised in Table 3-11. This includes the revenue requirement for each scheme, the pricing impact, the equivalent MID Price per ML, and the capital grant that would be required to reduce scheme prices to align with the MID price.

The Direct River Access Option is not considered in this analysis as it is likely that all infrastructure (from the river supply point) would be installed and owned by individual irrigators.

The results indicate that all of the proposed schemes would require substantial grant funding for the supply infrastructure to achieve a price per ML equivalent to the MID price. In some cases (denoted in Table 3-11 in red text), the grant funding required is greater than the full capital cost of the scheme, indicating that the operating costs alone are greater than the revenue that would be recovered from the MID price.

The proposed schemes may provide a level of service to customers that is better than the level of service to MID customers. This would give reason for a higher price to be charged.

Table 3-11: Comparison pricing impact results

SCENARIO	CONCEPT SCHEME 1A – MEDIUM SCALE, CLOSE TO RIVER, MID INTENSITY	CONCEPT SCHEME 1B – MEDIUM SCALE, CLOSE TO RIVER, LOWER INTENSITY	CONCEPT SCHEME 2 – LARGER SCALE AND FURTHER FROM RIVER
Demand (ML/y)	8,200	4,000	18,300
Time to peak use	15 years	15 years	25 years
Capital costs	$15.2m	$9.9m	$43.6m
Annual Revenue Requirement			
Year 5	$941,870	$656,483	$2,634,293
Year 15	$1,006,000	$718,702	$2,843,699
Year 25	$891,328	$634,793	$2,530,531
Price per ML (annual revenue requirement/demand)			
Year 5	$229.72	$328.24	$411.29
Year 15	$122.68	$179.68	$228.52
Year 25	$108.70	$158.70	$138.28
MID Price per ML			
DS charge/ML	$36.33		
Usage charge	$9.95		
MID Price/ML	$46.28		
Capital grant required to align concept prices with MID price			
Year 5	$13.5m	$9.8m	$42.3m
Year 15	$13.0m	$10.9m	$47.3m
Year 25	$12.6m	$11.1m	$41.5m

Assumptions used in Table 3-11 include:

- The prices in this report do not include bulk water storage, outlets, meters, or any other price not directly related to the irrigation delivery infrastructure
- A WACC of 4.1% (real), extrapolated from SRW's 2018 pricing submission, adjusted for ESC's final decision regarding the cost of debt
- Corporate overheads of 30% have been applied to direct operating costs
- The following asset lives have been assumed:
  - Pump stations 25 years

  - Balancing storage 50 years
  - River crossings 50 years
  - Pipeline network and outlets 80 years
  - No depreciation of environmental offsets
  - Construction management, project delivery and contingencies have been allocated to asset categories based on the capital value of those assets in each scenario, then depreciated accordingly
- The 2020-21 MID Delivery Share (DS) charge has been converted to a price per ML by dividing the DS charge by the number of days in the irrigation season, adjusted for the difference between peak use and average use. The irrigation season is around 270 days, while the scheme design allows for 100% of annual demand to be supplied in just 150 days. Over time, it is possible that irrigators might reduce their demand without surrendering Delivery Shares, as has occurred in other irrigation districts. If so, this conversion technique might underestimate the price per ML of water actually used by the scheme in the longer term. However, the conversion to a price per ML is only to facilitate comparisons between prices and between schemes.

4 Avon study area

4.1 PHASE 3 STUDY AREA

Approximately 6,000 ha of land is located within the Avon River study area. The study area is defined by:

- Proximity to the MID as the potential water supply source – in particular, proximity to the Main Northern Channel
- Topography – there is a significant increase in elevation within approximately 2km of the river (and/or the Freestone Creek). Briagolong Rd, for example, is approximately 20m higher than the river flats
- Soil type / land capability – the area of high capability Class 1 and 2 loam and sandy loam soils is limited to a relatively small area along the Avon River and the Freestone Creek.

The Avon River focus area is located along the eastern side of the Avon River, mainly in the area near Llowalong and along the Freestone Creek. It is limited to a relatively small area of Class 1 and 2 loam and sandy loam soils. A map of the Avon River study area is shown in Figure 4-1.

Current land use includes dairy, beef and fodder, and vegetable production. The potential for growth of high value vegetable production is considered high because of the favourable soil types and proximity to more extensive vegetable production on the neighbouring west side of the Avon River.

Some irrigation already exists using groundwater supplies and direct pumping from the Avon River, which is unregulated. The Avon River flows are highly variable from year to year and the interconnected shallow groundwater is similarly unreliable. This has limited the investment in irrigation to date. In recent years a few of the landholders have constructed turkey nest dams on their property to access winter-fill and improve reliability.

There is potential to expand the area irrigated provided there is access to more secure water supplies.

The area is very close to the MID supply system. The preferred option for the concept design for the Avon River scheme (Phase 2) is to extend supply from the Main Northern Channel with a siphon pipeline under the Avon River, a balancing storage and distribution via a gravity pipe network. This option would rely on access to MID modernisation water savings.

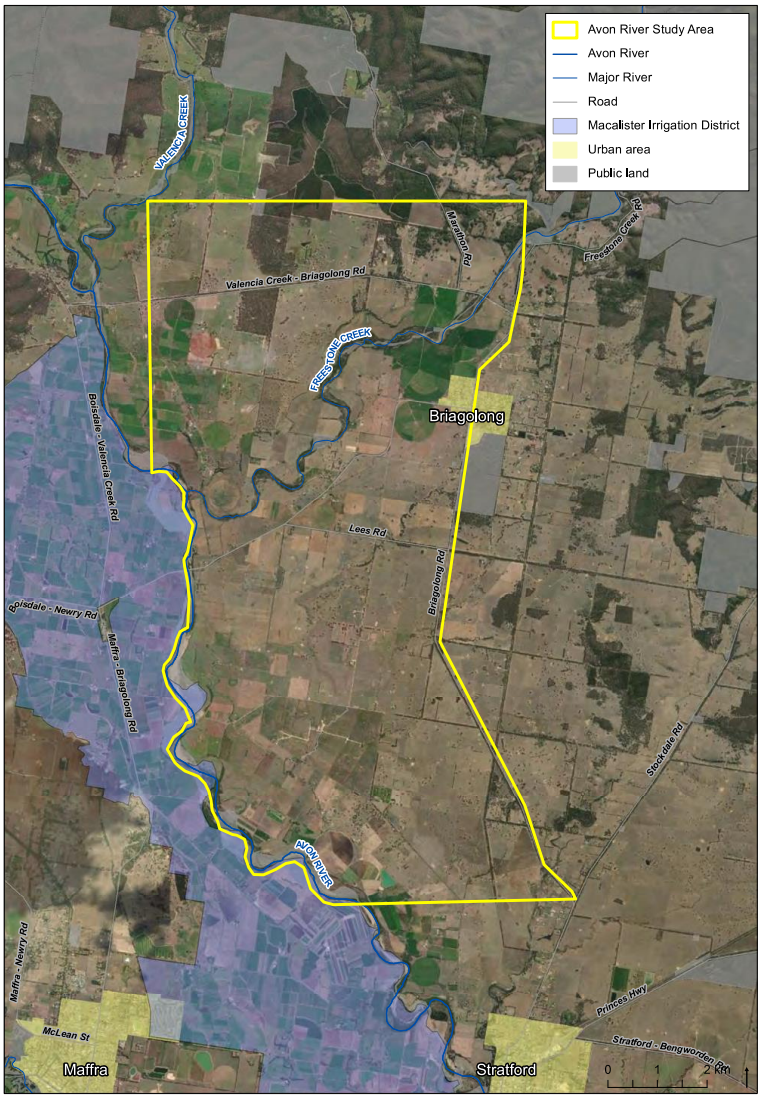


Figure 4-1: Avon River study area

4.2 CURRENT WATER SUPPLIES AND IRRIGATION

Projected potential streamflow impacts (relative to the long-term average) for the Avon River basin at year 2060 range from -23% in a medium climate change scenario to -35% in a high climate change scenario. Streamflow's over the recent drought were about half the long-term average[36].

The LTWRA for the Avon River (part of the Thomson basin)[37] found that there has been a decline in water available to the environment of 8.7 GL per year compared to the time of the SWS, with no change to the relatively small consumptive demand. Based on a share of the available resource, the environment's share has remained unchanged on 97%, while the consumptive share has remained at 3%.

Flows within the river can vary significantly from the top of the catchment to the bottom, depending on inflows. Rosters and restrictions are introduced in most years usually commencing from October through to May.

Table 4-1: Water supplies relevant to Avon Basin[38]

SOURCE	SYSTEM	NO. OF LICENCES	LICENSED VOL (ML)	AVERAGE USE (ML) 2014/15 – 2018/19
Surface Water	Avon River	86	6,760	3,296
	Valencia Creek	16	1,468	857
Watertable Aquifer	Wa De Lock GMA	237	26,310	7,047
Deeper Aquifers	Rosedale GMA	60	12,726	7,211
	Stratford GMA	9	836	34

Through trade, access could be obtained to approximately 2 GL of run of river flows (sleeper licences) or to small amounts of groundwater. However, the security and available volume of these supplies is not likely to promote development. River flows are highly variable from year to year, which has limited the investment in irrigation to date.

Modernisation works in the Macalister Irrigation District (MID) have and will create water savings totalling approximately 24 GL. The water savings are allocated based on the level of funding provided to the modernisation works. As a result, the Australian Government, the Victorian Government and SRW (as a proxy for irrigation customers) will each be allocated a share. The water savings are expected to be used to support increased environmental flows and increased agricultural production – for example the Victorian Government's share of the Phase 2 water savings is earmarked to support environmental flows in the Macalister River. There is potential to use a portion of the water savings to supply the Avon River study area and effectively extend the MID to the east side of the river.

[36] Gippsland Region Sustainable Water Strategy, DSE, 2011.
[37] DELWP (2020b) Long-Term Water Resource Assessment for Southern Victoria – Basin-by-Basin results.
[38] Thomson Basin – Local Water Report 2019, SRW.

4.3 DEMAND ANALYSIS

An assessment has been undertaken of demand for water and willingness to invest in agricultural irrigation development for the Avon study area. Data was gathered via consultation with current landholders and industry stakeholders in March and April 2021[39]. Detailed results are provided in *Southern Victoria Irrigation Development Project Phase 3 – Assessment of Demand and Willingness to Invest* (RMCG, April 2021).

Consultation participants expressed strong demand for irrigation water in the Avon study area – between 6,100 to 8,100 ML/year. More than 40% of participants are in an expansion phase and nearly 60% are considering purchasing or leasing land in the next 5 to 10 years. 30% were looking to diversify in the future. Water availability or reliability was identified as the main barrier to expansion of agriculture.

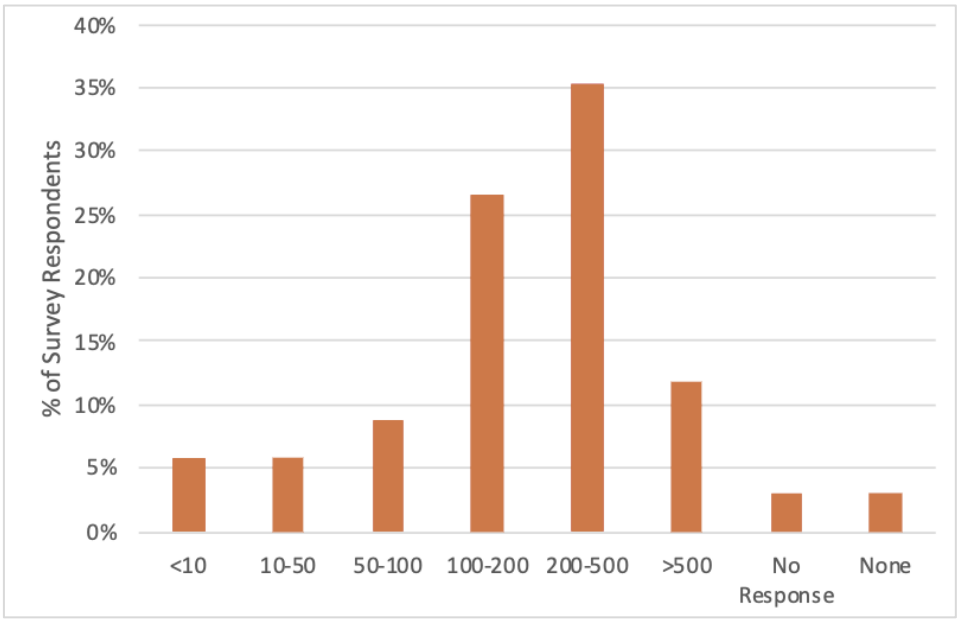


Figure 4-2: Avon average volume of additional irrigation water required (ML/year)

Demand occurs in a relatively narrow strip of land running along the east side of the Avon River between approximately Valencia Creek and Llowalong, and along the Freestone Creek upstream to approximately Briagolong (refer to Figure 4-4).

Survey coverage was approximately 65% for the Avon area. Based on land capability and industry analysis, it is projected that the demand could grow to 10,000 ML/year.

Table 4-2: Avon surveyed and projected demand

FOCUS AREA	NO. SURVEYED	HECTARES SURVEYED	APPROX % OF FOCUS AREA	ML DEMAND SURVEYED	PREVIOUS ML DEMAND ESTIMATE	ML DEMAND PROJECTED
Avon	17	3,560	65%	6,100 – 8,100	5,600 (Phase 2)	10,000

Based on the survey results and industry analysis, the key demands for water are expected to come from vegetables and dairy (refer to Figure 4-3). Other enterprise types could occur, but are likely to be at a comparatively small scale and/or have low demand for water supply.

Vegetable producing businesses are currently targeting the Avon River area. It has proven good quality soils and existing large producers on the west side of the river are actively looking to expand.

[39] Since the main consultation period ended there has been further interest and demand expressed. This data is not captured in the detailed numbers listed here, but it further highlights the high level of interest in the area and gives confidence to the projected demand figure of 10 GL.

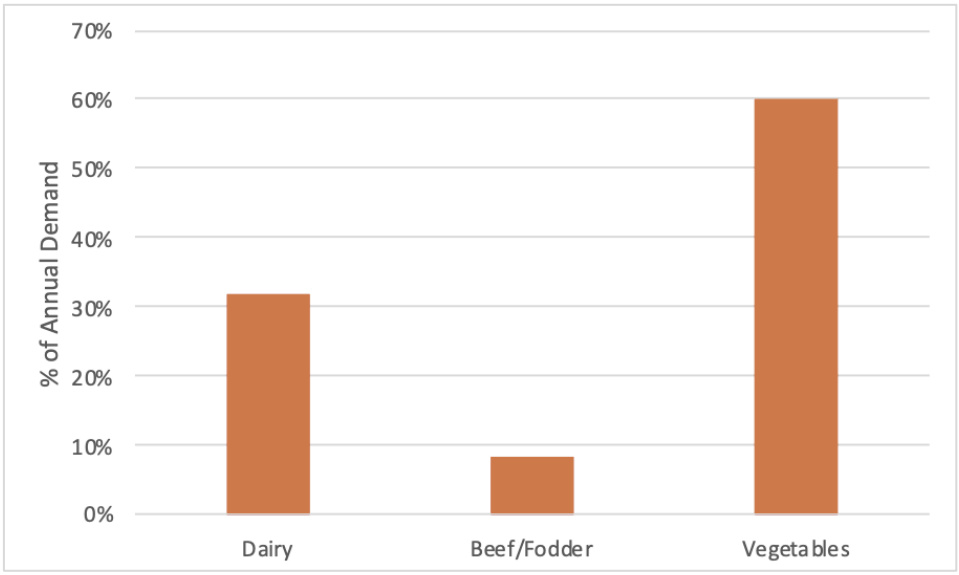


Figure 4-3: Avon demand by main enterprise type

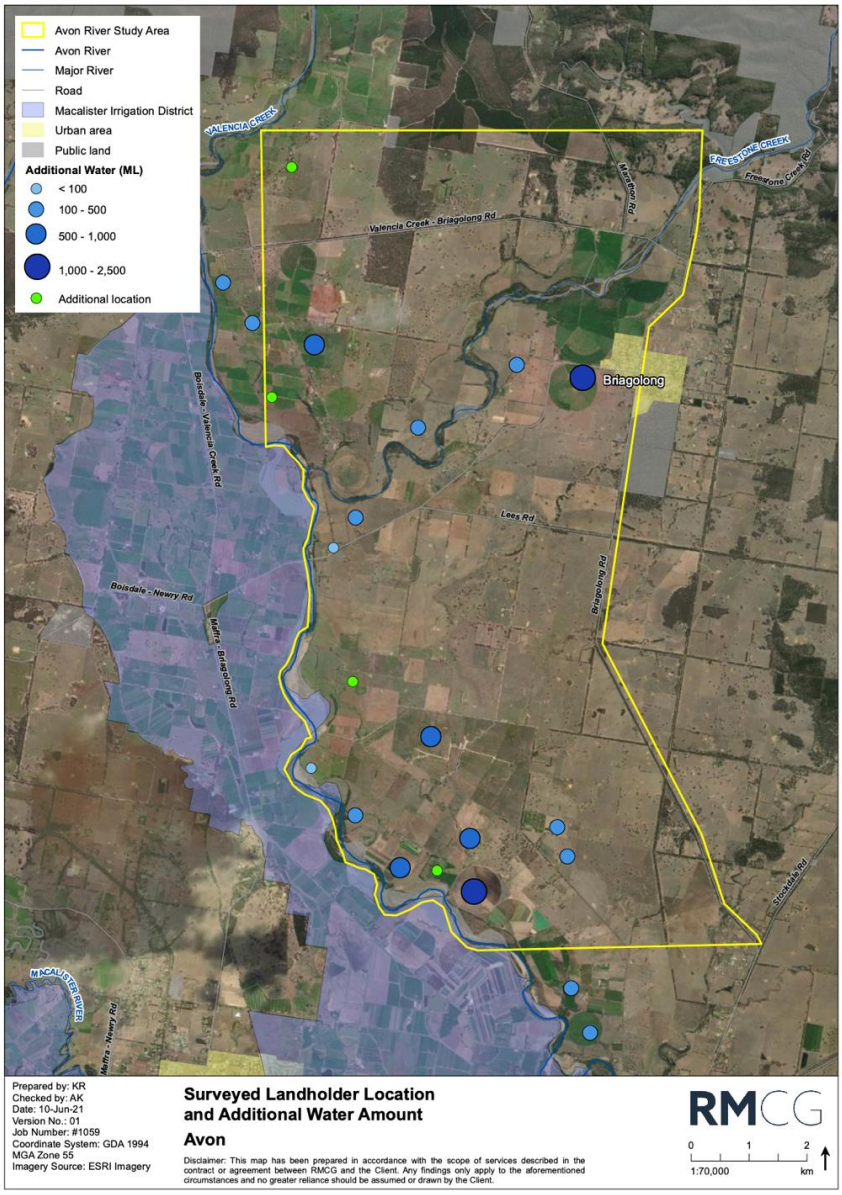


Figure 4-4: Avon map of surveyed demand

4.4 CULTURAL HERITAGE

In Phase 2 of the SVID project, a cultural heritage assessment was completed for four study areas and one of these was the Avon River area. This is documented in *Southern Victorian Irrigation Development Project – Cultural Heritage Due Diligence Assessment* (On Country Heritage and Consulting, 2017). The purpose of this work was to provide advice on the requirements for potential archaeological and cultural heritage relevant to the proposed development area.

The Phase 2 Avon River study area is similar to that being considered now in Phase 3. However, the increased demand may see extension of the area a bit further east along the Freestone Creek.

Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) is the Registered Aboriginal Party (RAP) for the Avon study area. GLaWAC was consulted in the preparation of the 2017 CHDDA. They provided comment on the cultural values of the study area, including the likelihood and types of sites that may be identified, and any known culturally significant locations.

GLaWAC comments specific to the Avon study area were:

- Valencia Creek and the Avon are locations where there is likely to be a high density of sites and large scatters. Also grinding grooves can be expected on exposed rock surfaces.
- Wooden objects said to be secret / sacred objects have been found on the Avon tucked into rock hollows on exposed rock faces
- Bushy Park is a significant location as this is where McMillan settled in the 1840s and it is also said to be where a staged battle took place between the Dargo clan and other clans egged on by settlers. The location of the battle is not known exactly.

Downstream of the study area is a highly significant site, The Knob Reserve, which was traditionally a common ground for the five clans of the Gunaikurnai. As noted in the Gunaikurnai Whole of Country Plan (GLaWAC, 2015):

> *'The bluff provided an ideal vantage point from which to look out for fish, animals or other people. Down by the river, people fished for eels, bream, flathead and prawns, which were an important part of the food supply. As well as being a source of food, Dooyeedang* [Avon River] *was a major transport route for the Gunaikurnai people. Bark canoes were used for fishing and travelling up and down the river between the mountains and the lakes. Cultural heritage sites in this small area are extensive, and there are many that are not yet recorded.'*

Three registered cultural heritage places are located in the study area. These are scarred trees. Deviation of pipeline routes may be required to avoid these places.

Very little heritage work has been conducted within the study area, so the lack of registered Aboriginal sites may be a reflection of the lack of archaeological investigation, rather than an absence of cultural material. Artefact scatters are more likely to occur in close proximity to major water sources or on high sandy rises overlooking water sources. A review of aerial imagery revealed several remnant sand ridges located within the study area as well as the Avon River, Freestone Creek and Middle Creek. These areas have high potential for containing cultural material. Given the intensity of agricultural activity in the area, it is likely that any cultural material present is now below the surface.

Area within 200 m of a waterway and not subject to significant ground disturbance, is considered an area of cultural heritage sensitivity under the *Aboriginal Heritage Regulations (2018).* There has been extensive disturbance to parts of the study area by agricultural activities and the construction of roads. However, there is no evidence to prove significant ground disturbance.

The assessment assumes proposed works include the installation of pump stations, pipelines and balancing storage, as well as expansion of irrigation area. This type of work is classified as a high impact activity under the '*Aboriginal Heritage Regulations (2018)'.*

Development within the Avon study area will require a mandatory CHMP and a complex Aboriginal cultural heritage assessment is required. The risk for harm to Aboriginal cultural heritage material is high due to the permanent waterways and no evidence for significant ground disturbance within the study area.

Following discussions with GLaWAC, it is recommended that 'on Country' consultation with relevant Aboriginal stakeholders and knowledge holders should be undertaken. The 'on Country' face-to-face interviews provide an opportunity for participants to access and discuss cultural values of the study area. This process should be undertaken by the Gunaikurnai Traditional Owners.

There is one non-Indigenous heritage place identified in the Avon study area from the Victorian Heritage Register (Mount View Homestead) and this also has a Heritage Overlay within the Wellington Planning Scheme. There is also one other Heritage Overlay item identified in the Planning Scheme. It is unlikely that these will be impacted by the proposed scheme – pipeline routes can be selected to avoid these areas.

4.5 ENVIRONMENT

A preliminary environmental assessment undertaken for SVID Phase 2 included consideration of the Avon study area. This is documented in *Southern Victoria Irrigation Development Project - Preliminary Environmental Assessment*, GHD, January 2018. Outcomes are summarised below, with minor edits to update for current information.

FLORA AND FAUNA

Prior to historical clearing, the Avon study area is likely to have mainly supported Plains Grassy Woodland (EVC 55), Plains Grassland (EVC 132), Riparian Shrubland (EVC 19), and Plains Grassy Woodland/Gilgai Wetland Mosaic (EVC 259). Much of this is now cleared.

Little vegetation that meets the definition of a remnant patch was seen during the 2017 field inspection. However, a number of scattered trees were identified that are all that remain of Plains Grassy Woodland. No Matters of National Environmental Significance or species listed as threatened under the FFG Act have been recorded within the Avon River study area. It is unlikely that suitable habitat exists to support rare or threatened species, or sufficiently intact patches of native vegetation that meet thresholds for any threatened ecological communities. However, at least one species protected under the FFG Act occurs alongside the study area on public land (Black Wattle). Some suitable habitats may also still exist for Blunt-leaf Pomaderris and Rough-grain Love-grass, since both were recorded within the last decade. The high proportion of weeds identified in 2017 also suggests that the project has potential to trigger threatening processes under the FFG Act.

A desktop search indicated three fauna species listed as threatened under one or more of the EPBC Act, FFG Act and DELWP Advisory Lists. 18 species listed as threatened and 13 species listed as Migratory under the EPBC Act are predicted to occur within 10 km of the study area. Most species identified by the desktop search are considered unlikely or highly unlikely to occur within the study area, generally due to the absence of suitable habitat. Occurrence of one fauna species of conservation significance is considered *possible* (White- throated Needletail *Hirundapus caudacutus*).

The following measures can be taken to avoid and/or minimise the impact to flora and fauna:

- Refine design, including pipeline network and storage location selected, to avoid areas of native vegetation and fauna habitat and retain as many large trees as practicable. For example, use areas of existing disturbance.
- Maintain a buffer along creek corridors to avoid impacts to riparian species and vegetation
- Adopt technologies (e.g., trenchless technology under water courses) that avoid and minimise impacts to ecological values
- Each irrigation property must have an irrigation and drainage plan and this must demonstrate consideration of the impacts on biodiversity, including the risk of consequential or cumulative losses
- Incorporate measures to prevent the spread and introduction of weed species – e.g. vehicle hygiene during construction.

WATERWAYS AND WETLANDS

The Avon catchment flows from the foothills of the Great Dividing Range to Lake Wellington. There are no large on-stream storages, making the Avon River the only one of the four main river systems that drain to Lake Wellington to remain unregulated. Lake Wellington is part of the Gippsland Lakes Ramsar site.

The study area is likely to contain moderate aquatic ecosystem values. The lower reaches of Valencia Creek and Freestone Creek were described as being in an overall moderate condition as part of the Index of Stream Condition assessment (DEPI 2013). The waterway reaches downstream from the focus area had lower ISC scores, but were also rated as moderate condition. The waterway reaches upstream from the focus area had higher ISC scores and were rated as good condition.

Four fish species are listed as threatened under one or more of the EPBC Act, FFG Act and DELWP Advisory Lists. The Australian grayling is considered likely to occur – the Avon River is considered an 'important population'. The Flinders Pygmy Perch (*Nannoperca* sp.1) a subspecies of Southern Pygmy Perch is known to occur within the Avon River area and is on the Victorian Advisory List of Rare or Threatened Flora (DEPI 2014).

There is potential for irrigation runoff to impact on waterway flows and water quality and contribute to periodic algal blooms in the Lakes. The SEPP (Waters) (2018) has set a target to reduce average annual Total Phosphorus inputs to Lake Wellington from 115 t/y to 100 t/y by 2030. Half of this, or 7.5 tonnes of phosphorus per year, is to be achieved in irrigation areas (focussed on the MID as the main contributor) through implementation of the *Lake Wellington Land and Water Management Plan* (WGCMA, 2018).

The following measures can be taken to avoid and/or minimise the impact to waterways and wetlands:

- Adoption of Best Practice Environmental Management for runoff management – irrigation and drainage design and operation must include measures to prevent contamination of receiving waterways with drainage return water containing high nutrients, suspended sediments, saline runoff and other pollutants
- Conduct a Risk Assessment to assess the potential threats to Gippsland Lakes Ramsar Site from the proposed works[40]
- Infrastructure location should avoid waterbodies and their associated habitat where possible, such as mapped current wetlands, streams and creeks
- Use trenchless technology for required waterway crossings
- Maintain a buffer along creek corridors to avoid impacts to the riparian zone
- Include runoff and sediment control measures and implement during construction works to prevent soil and contaminants from entering waterways.

[40] As per *Gippsland Lakes Ramsar Site Management Plan*, East Gippsland Catchment Management Authority 2015.

Consideration is being given to sourcing water from MID modernisation savings, which is not expected to have an increased impact on environmental flows. The project has the potential to lead to increased environmental flows if replacement of current surface water or shallow groundwater licences occurs. This is discussed further in Section 4.7.

GROUNDWATER AND SALINITY

The Quaternary Aquifer (QA) and the Upper Tertiary / Quaternary Aquifer (UTQA), comprise the water table aquifer across the study area. These aquifers comprise sand, gravels, clay and silt. In some areas (southern end of study area) this is underlain by an Upper Tertiary/Quaternary Aquitard, while in other areas there is expected to be close connection to the Upper Mid-Tertiary and the Lower Tertiary Aquifers.

Depth to the watertable varies from < 5 m in proximity to Freestone Creek to greater than 20 m. Salinity of the watertable is very low, ranging from 500 – 1,000 mg/L along the Avon to < 500 mg/L in proximity to Briagolong.

There is a high level of interaction between the shallow groundwater system near the Avon River and the Avon River itself. Groundwater discharge contributes 24-36% of annual average flow in the Avon River[41].

Given the shallow depth to the watertable, there is the potential for groundwater levels in the study area to be impacted by irrigation. However, it is anticipated that accessions to groundwater from irrigation will be relatively low, due to the utilisation of highly efficient irrigation technology.

Based on the relatively low groundwater salinity, anticipated low accession volumes from irrigation and the existing hydraulic connection between the Avon River and the water table aquifer, it is considered that groundwater levels and salinity in the area are unlikely to be impacted by irrigation expansion along the Avon River.

The following measures can be taken to avoid and/or minimise impact to groundwater and salinity:

- Promote the adoption of efficient irrigation practices for the expanded irrigation area to ensure that groundwater recharge, and irrigation-induced salinity, is minimised. Flood irrigation along the Avon River should be discouraged due to the permeable soils in the area.
- A hydrogeological assessment may be required to identify any salinity risks associated with specific properties in the expanded irrigation area.

NEXT STEPS

The proposed project has to potential to impact environmental values. Impacts and key risks include the removal of native vegetation and impacts to downstream water quality (during construction and operation).

It is recommended that a collaborative approach is taken during the next design phases of the project. Field based environmental assessments, and costing of required environmental offsets, will be required based on the functional design. The proposed project has the ability to reduce its overall impacts through design, by avoiding areas of native vegetation, utilising trenchless technology for waterway crossings and through best practice irrigation measures.

[41] Lake Wellington Land and Water Management Plan - Technical Appendices (WGCMA, 2018).

4.6 IRRIGATION SUPPLY CONCEPT DESIGN

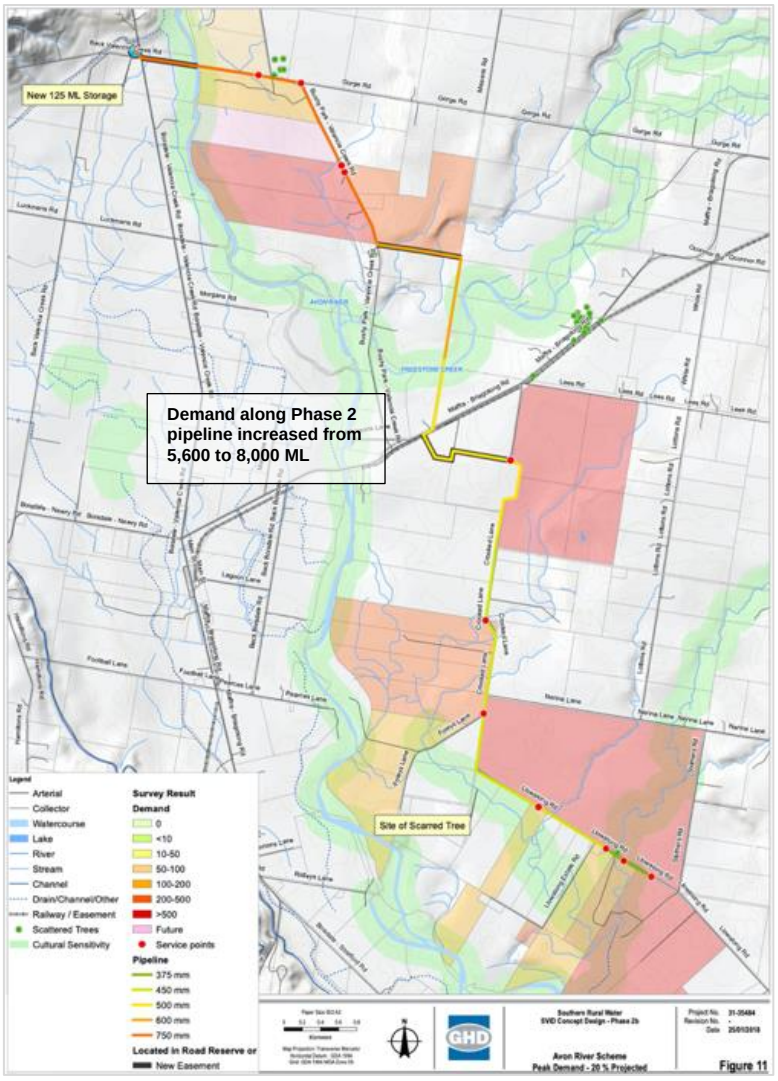
In Phase 2 a concept design was prepared as detailed in *SRW SVID 2b – Concept Design Report*, GHD, February 2018. The concept design comprised a gravity pipe distribution system as shown in Figure 4-5. Water for the scheme is sourced from the Valencia Creek outfall channel in the MID and a siphon installed under the Avon River.

The scheme is likely to be constrained by the hydraulic capacity of the upstream MID system, so it is likely to require a balancing storage. The inclusion of a 125 ML balancing storage also affords the opportunity to provide water during the winter period, which is currently not possible within the adjacent irrigation districts.

In Phase 2 the crop mix included vegetables, dairy, beef and fodder cropping. These have a similar demand pattern with a summer peak. The mix between the crops may vary, but the demand pattern used in the Phase 2 design remains applicable.

The concept design assumes supply of peak demand. An alternative would be to supply average demand, which would reduce the pipeline sizes required and therefore reduce capital cost. However, this would require larger on-farm storages for balancing supply and demand. Phase 2 investigations concluded that it would be more cost-effective to supply peak demand via the pipeline network.

All pipelines have been located along road reserves, with options for installation either within the road reserve or within private property, as required to avoid impact on native vegetation.



Additional demand towards Briagolong 1,000 ML

Additional demand to south 1,000 ML

Figure 4-5: Avon Phase 2 design and expected expansion

The Phase 2 concept design has been reviewed and updated due to the increased demand identified in Phase 3 consultation. The specific surveyed responses result in the following expansion of the area supplied by the SVID Phase 2 Concept (refer also to Figure 4-5):

- Infilling to supply allotments not previously connected to the pipeline scheme within the existing scheme (increase from 5,600 ML/yr. to 8,000 ML/yr.)
- Further irrigation development to the northeast along Freestone Creek, towards the Maffra-Briagolong Road (increase by 1,000 ML/yr.)
- Further irrigation development to the south along Llowalong Road, towards Stewarts Lane (increase by 1,000 ML/yr.)

Advice from SRW also indicates that alternative sites will need to be identified for the proposed balancing storage as the site identified during Phase 2 is unlikely to be acquired for the project.

COST ESTIMATES

The scheme costs have been updated in line with the increase in demand from 5,600 ML/yr. to 10,000 ML/yr., resulting in a capital cost increase from $18.0M to $35.2M.

The increase in scheme costs associated with infilling within the existing distribution network would largely be associated with upsizing of the pipe distribution network. As the density of the pipe network remains unchanged it is expected that the unit costs ($/ML/km) would largely remain the same. Therefore, it would be reasonable to assume that the costs for infilling would increase in direct proportion with the increase in demand.

The increase in scheme costs associated with pipeline extension is a function of the demand versus length of pipeline network. Preliminary analysis of the demand locations indicated that the ratio would increase by a factor of 1.5 to 2.0, which means that up to twice as much pipe length is required to supply each ML of water to these additional areas. For the purposes of this update, it is assumed that the unit rate for pipe costs would increase by a factor of 1.75 for a 2,000 ML/yr. expansion area (partly to the north-east and partly to the south).

The costs associated with the provision of the balancing storage in the SVID Phase 2 Scheme were minimised due to the close proximity between the storage and the MID channel network. It is likely that these costs would increase if the storage were moved further from either the MID supply point, or the downstream scheme distribution network, due to a likely increase in connecting pipework and possibly a re-lift pump station. For the purposes of this update, it is assumed that the unit rate for the provision of balancing storage would increase by 50%.

Table 4-3: Avon capital cost estimate update

ITEM	SVID PHASE 2 – AVON (5,600 ML)			SVID PHASE 3 – AVON (10,000 ML)		
	Unit	Unit Rate	Cost	Unit	Unit Rate	Cost
Balancing Storage	5,600	$393	$2,200,000	10,000	$589	$5,892,857
River crossings	2	$356,654	$713,309	3	$356,654	$1,069,963
Pipe Network & Outlets	5,600	$0.08	$6,358,896	8,000	$0.08	$9,084,137
Pipe Network & Outlets - extension				2,000	$0.14	$2,308,129
Environmental Offsets			$1,000,000			$1,000,000
Construction Management	14%		$1,415,838	14%		$2,671,002
Project Delivery Costs	28%		$2,716,567	28%		$6,167,305
Contingency	25%		$3,601,152	25%		$7,048,348
Total Estimate Project Cost			**$18,005,761**			**$35,241,741**

Table 4-4: Avon operation and maintenance costs Phase 3

ITEM	AVON		
Annual operating costs	**Years 1–10**	**Years 11 onwards**	
Overheads	$20,000		
Maintenance – pump stations	NA	NA	
Maintenance – pipelines	$20,000		
Operation costs – pump stations	NA		
Operation costs – SCADA / telemetry	$20,000		
Refurbishment costs	**Every 10 years**	**Every 20 years**	**Every 30 years**
Valves	$100,000		
Pumps	NA	NA	
Electrical instruments	$30,000		
Buildings			NA
Power use	NA		

4.7 COST-BENEFIT ANALYSIS

APPROACH TO VALUING BENEFITS

The benefits of additional irrigated agricultural development are assessed using net margins. Net margins are gross margins (revenue minus variable costs) minus the annualised cost of irrigation capital (including on-farm storage).

ASSUMPTIONS ADOPTED FROM PHASE 2

To ensure the estimates were comparable with previous estimates, RMCG adopted the basic assumptions used to estimate benefits in Phase 2 of the project[42], including:

- The value of existing agriculture was assumed to be $250/ha. This is the value of production in the without case.
- A discount rate of 7% and a scheme life of 50 years
- The net margins per ML are as shown in Table 3-6. These margins demonstrate the economic importance of attracting vegetable growers to the new irrigation area.

These assumptions are the same as those applied in the Latrobe Study Area and further detail is provided in Section 3.7.

[42] Marsden Jacob (2018) *Southern Victorian Irrigation Development Project Consolidation Report* (report for Southern Rural Water).

ASSUMPTIONS NEW TO THIS ANALYSIS

The mix of enterprises is critical to the benefits achieved by the scheme, with vegetables yielding more per ML of water used than dairy, and dairy more than fodder and beef. Following the Phase 3 demand assessment, the enterprise mix has been updated as shown in Table 4-5.

Table 4-5: Avon mix of enterprise type by percentage of ML delivered

ENTERPRISE	PHASE 3 MIX
Vegetables	60%
Dairy	30%
Fodder	5%
Beef	5%

Updated concept designs and cost estimates have been provided by GHD. A summary of costs is shown in Section 4.6.

It is assumed that the scheme takes 3 years to construct. The time taken to reach peak water use has been varied in the analysis, with consideration given to rapid uptake over 5 years and a longer 15 year period (from when construction is complete).

RESULTS

Summarised results of the economic analysis are shown in Table 4-6. Two scenarios are compared, with variation in the time to peak water use.

The costs and benefits listed are in present value terms – i.e. future values have been discounted to today's dollars.

The results are shown in terms of a benefit cost ratio, where a ratio greater than 1 indicates a viable scheme (as the present value of the benefits exceeds the present value of the costs).

Table 4-6: Avon cost-benefit analysis results

ITEM	AVON PHASE 3	AVON PHASE 3 – RAPID UPTAKE
Total Volume	10,000	10,000
% Vegetables	60%	60%
Time to peak use	15 years	5 years
Capital Cost	$32,985,789	$32,985,789
Refurbishment	$102,396	$102,396
Operating Cost	$597,939	$597,939
Benefits	$57,721,368	$74,435,575
Benefit Cost Ratio	**1.7**	**2.2**

The results show that:

- The time taken to reach peak water use impacts on how quickly the benefits are achieved and therefore the total value of the benefits over the 50 year assessment period. However, the benefit cost ratio remains positive even over the longer 15 year uptake period. The consultation undertaken suggested that development would occur quite quickly – in line with the rapid uptake scenario. It is our opinion that the timeframe to full uptake may be somewhere between the scenarios given above.
- This Phase 3 Avon Scheme supplies an increased scale of demand and therefore has an increased cost of development. However, this is offset by the increased benefits of a substantially higher proportion of vegetable production. The Phase 2 benefit cost ratio was 1.5 assuming a 5 year period to peak water use.

OTHER POTENTIAL BENEFITS

The Avon River scheme has potential for additional benefits that are not quantified in the cost benefit analysis.

Winter Supply to Boisdale and Improved Main Northern Channel Operations

The balancing storage proposed can provide additional benefits within the existing MID including:

- Improved management of the Main Northern Channel. The modernisation team is revisiting the operation of the Main Northern system because its configuration means it is not suited to total channel control so they run it in another mode. If the balancing storage can be located correctly it will improve the efficiency and operation of the Main Northern which may lead to water savings.
- Winter supply to Boisdale irrigators. The vegetable growers in the Boisdale/Nuntin area operate year-round. Crop water demand in the winter period is mainly provided by rainfall. However, irrigation supply would enhance production security for dry times. At present this is managed by a combination of approaches including use of on-farm storage, groundwater or Avon surface water supplies.

Avon Environmental Flows

The Avon River is a flow stressed system. There is an option to achieve environmental flow increases in the Avon River if the supply from MID modernisation savings can replace or reduce reliance on current surface water and shallow groundwater licences. Current licences that are no longer needed could be returned to the environment.

An indication of the volumes for surface water and shallow groundwater licences associated with the Avon River focus area is provided in Table 4-1. Only a portion of these volumes may be returned to the environment. Some current licence holders will be outside the study area, and even those landholders within the area may not be willing to surrender their entire licenced volume.

Landholders in the Avon area were asked additional questions in the demand survey in relation to willingness to exchange existing river or shallow groundwater licences for access to piped supply from the MID. There was a limited response to this question and for some it was irrelevant. For those who did respond, most were willing to consider this or negotiate further. Consideration would be given to value and security of the piped supply and volume available by comparison to their existing licence.

The concept of improving environmental flows through return of existing licences is complex. Work by Jacobs[43] on conceptual modelling of groundwater and surface water in the Avon catchment, suggests the following relationship between water use and environmental flows:

> *Low flow environmental flow rates (EFR) are not met in each reach of the Avon in most years. Surface water use is frequently a significant proportion of low flow streamflow's, however even a complete ban is unlikely to enable low flow EFR volumes to be achieved. Groundwater use is generally not expected to have a significant effect on streamflow's, although groundwater use in Freestone Creek … may be impacting streamflow. The benefits of banning groundwater use are difficult to identify, because of potential inaccuracies in the data, and no knowledge of lag times.*
>
> *Drought or climate change may encourage additional water use in the future, and since only 10% of groundwater and on average 60% of surface water entitlement volumes are currently used there is potential for future growth in water use from existing licences.*
>
> *Because the alluvial aquifer is connected to the Avon River, additional groundwater use has the potential to cause additional impacts to streamflow. Together with the significantly lower runoff expected under climate change, the potential for growth in water use is an added risk to in-stream habitats.*

It is presumed that the environmental benefit of licence exchange is most likely to be seen in peak usage months which tend to be in October/November and March/April (there are usually licencing restrictions in the low flow summer months).

4.8 IMPACT ON REGIONAL EMPLOYMENT

Estimates of additional employment to be generated by development of an irrigation scheme in the Avon study area are presented in Table 4-7. The labour intensity estimates are based on industry statistics, research and data from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), Dairy Australia and Agriculture Victoria.

Table 4-7: Avon projected employment due to irrigation[44]

ITEM	AVON SCHEME
Total Water Volume	10,000 ML
Vegetables %	60%
Vegetables Area Ha @ 4 ML/ha	1500
Vegetables Labour Intensity	3.5 ha/FTE
Vegetables Employment Created FTE	432
Dairy %	32%
Dairy Area Ha @ 5 ML/ha	640
Dairy Labour Intensity	62 ha/FTE

[43] Jacobs, 2016, Avon River groundwater and surface water study.

[44] Sources include: *Dairy Farm Monitor Project, 'Victoria - Annual Report 2018-2019; Livestock Farm Monitor Report 2019-2020; Dairy Australia, 'In Focus 2020 - The Australian Dairy Industry'; https://www.agriculture.gov.au/abares/research-topics/surveys/vegetables#detailed-physical-characteristics; https://www.agriculture.gov.au/abares/research-topics/labour; https://www.dairyaustralia.com.au/en/industry-statistics/cow-and-farms-data.*

ITEM	AVON SCHEME
Dairy Processing Labour Intensity	165 ha/FTE
Dairy Employment Created FTE	14
Beef %	8%
Beef Area Ha @ 4 ML/ha	200
Beef Labour Intensity	212 ha/FTE
Beef Employment Created FTE	1
Minus Current Employment (Primarily Dryland Beef) FTE	7
Total Additional Employment FTE	**440**
Full time FTE	163
Part time FTE	15
Casual and contract FTE	261

As for the Latrobe study area (see Section 3.8), overseas labour is preferred for vegetables and is likely to fill the employment gap particularly for picker jobs. The local workforce would be interested in high-level and middle-level horticulture jobs, but the overall number of these is likely to be modest (maximum 10-1 ratio to picker jobs).

The creation of employment in agricultural businesses will stimulate flow on employment in the regional economy. Flow on employment includes employment in the upstream supply chain, for instance within transport companies, fertiliser producers, tractor companies, tyre fitting and mechanic workshops, and engineering businesses. There will also be flow on employment that results from expenditure by employees (e.g. at supermarkets, on housing etc), a proportion of which is captured in the local economy.

Flow on impacts are shown in Table 4-8. These have been modelled using the REMPLAN input-output model which includes up-to-date and comprehensive local data.

There is little value-adding to horticultural produce in the region and there is a potential opportunity to expand this activity locally.[45]

Table 4-8: Avon Flow on Employment (FTE)

EMPLOYMENT TYPE	AVON (10 GL)
Direct Local employment	279
Direct Non-local and OS employment	161
Flow on employment (source: REMPLAN)	217
Total local employment	**495**
Total employment	657

[45] Horticulture companies tend to be based outside the region, so they grow the product, package it and send it off for processing elsewhere (Mark Coleman, 27 April 2021).

4.9 WILLINGNESS TO PAY

Consultation undertaken in April and May 2021 included assessment of willingness to invest in agricultural irrigation development. Detailed results are provided in 'Southern Victoria Irrigation Development Project Phase 3 – Assessment of Demand and Willingness to Invest' (RMCG, April 2021).

Consultation participants were asked to comment on how their demand for water would vary based on selected price points for the cost of water entitlement and annual water charges.

Over 90% of respondents in the Avon area stated that their demand for additional water would stay the same or increase at entitlement costs of $2,000/ML. Over 40% of respondents indicated their demand would also stay the same or increase at entitlement costs of $2,500/ML. More than 90% of respondents indicated their demand for water would reduce or they would not purchase any water if the cost of entitlements was over $3,000/ML.

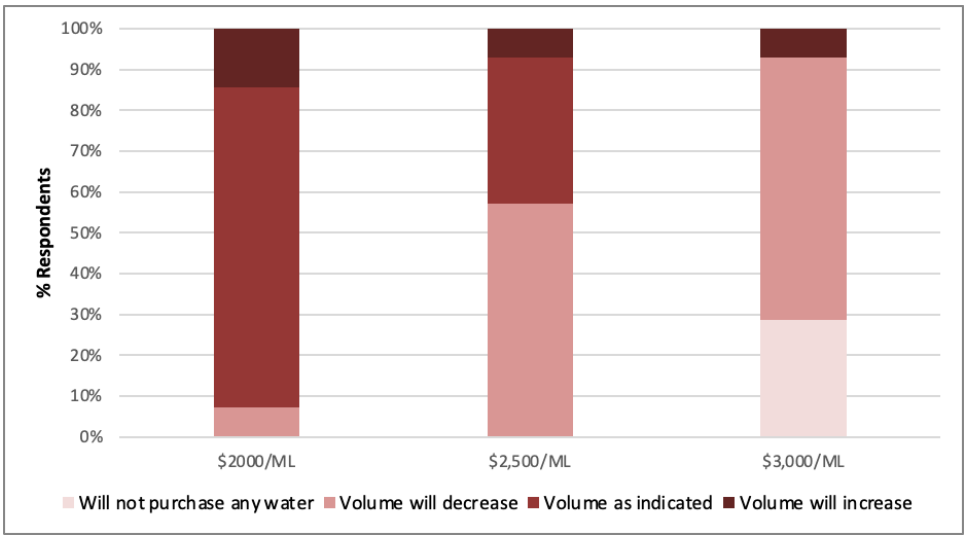


Figure 4-6: Avon – impact of water entitlement cost on demand

The impact of annual charges on demand is less pronounced than the impact of entitlement costs, but followed a similar pattern, with demand decreasing as the price increased.

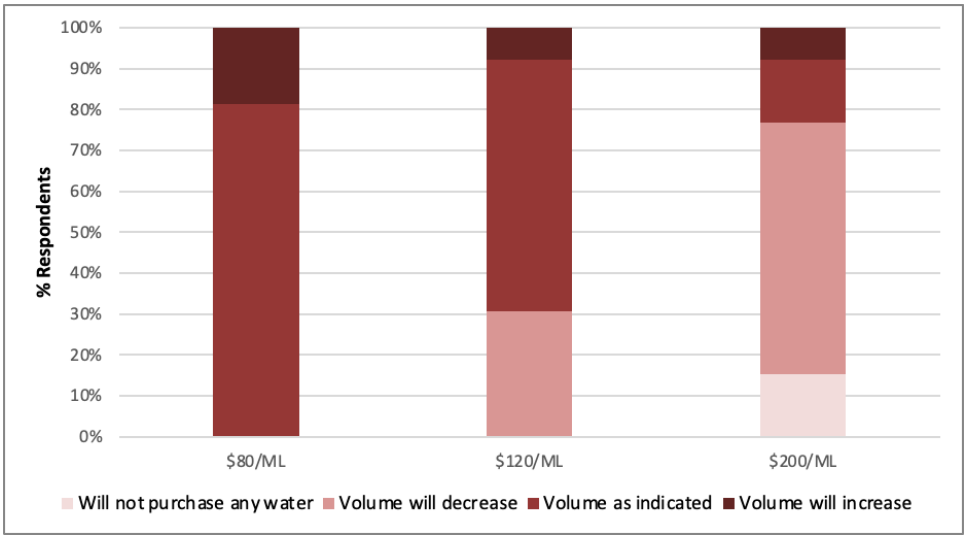


Figure 4-7: Avon – impact of annual charges on demand

Capacity to pay, and consequently willingness to pay, for additional irrigation water varies according to the irrigation end use. Vegetable production is typically a higher value end use than dairy, which in turn is higher value than beef (on a per ML basis). A large proportion of demand in the Avon area is for vegetable development and this means irrigators will have a reasonable capacity to pay.

Historically, large scale irrigation developments have been undertaken based on significant government contribution to capital costs. Irrigators have an expectation that this will continue to occur in the future.

The majority of survey participants currently irrigate and have a solid understanding of the costs and benefits of irrigation development. Current water prices both locally and regionally, particularly in the MID, are a key point of comparison for those looking to invest. Some respondents also identified aspects such as security of supply, water quality and level of service in commenting on willingness to pay.

4.10 PRICING IMPACT

In accordance with standard regulatory practice, we have determined prices for the Avon concept scheme and the level of funding required for supply infrastructure to reduce these prices to align with current MID prices. These results should be read as indicative only and are provided to assist in determining feasibility. The method and assumptions used in this analysis are the same as in the Latrobe study area as outlined in Section 3.10.

The pricing analysis covers irrigation supply infrastructure capital and operating costs. It does not include the cost to buy water entitlements.

Results for the Avon concept scheme are summarised in Table 4-9. This includes the revenue requirement for each scheme, the pricing impact, the equivalent MID Price per ML, and the capital grant that would be required to reduce scheme prices to align with the MID price.

The time taken to reach peak water use has been varied in the analysis, with consideration given to rapid uptake over 5 years and a longer 15 year period (from when construction is complete).

The results indicate that an Avon scheme would require substantial grant funding for the supply infrastructure to achieve a price per ML equivalent to the MID price.

The proposed Avon scheme has potential to provide a level of service to customers that is better than the level of service to MID customers. This would give reason for a higher price to be charged.

Table 4-9: Revenue requirement and comparison pricing

SCENARIO	AVON PHASE 3	AVON PHASE 3 – RAPID UPTAKE
Demand (ML/y)	10,000	10,000
Take up over	15 years	5 years
Capital costs	$35.2m	$35.2m
Annual Revenue Requirement		
Year 5	$1,927,637	$1,927,637
Year 15	$1,714,871	$1,714,871
Year 25	$1,499,440	$1,499,440
Price per ML (annual revenue requirement/demand)		
Year 5	$385.53	$192.76
Year 15	$171.49	$171.49

SCENARIO	AVON PHASE 3	AVON PHASE 3 – RAPID UPTAKE
Year 25	$149.94	$149.94
MID Price per ML		
DS charge/ML	$36.33	
Usage charge	$9.95	
MID Price/ML	$46.28	
Capital grant required to align prices with MID price		
Year 5	$32.1m	$27.7m
Year 15	$26.8m	$26.8m
Year 25	$25.5m	$25.5m

5 Summary of the schemes

Table 5-1: Overview of Latrobe River and Avon River schemes

PARAMETER	LATROBE	AVON
Water Resource	Latrobe surface water regulated from Blue Rock Reservoir, subject to further investigation.	Confirmed water savings from MID modernisation.
Scale (Approx.)	30,000 ha 10,000 – 20,000 ML demand	6,000 ha 8,000 – 10,000 ML demand
Existing Land Use	Dairy, beef and fodder production. Small areas of potatoes and emerging poultry. Irrigation in close proximity to Latrobe River with moderate supply reliability.	Dairy, vegetables, beef and fodder production. Small areas of vegetables. Some irrigation along Freestone Creek and Avon River but low reliability of supply.
Land Capability	Moderate to high. Sandy loam and clay loam topsoils of varying depth. Flood risk will limit type and intensity of development in proximity to River.	High. Loam and sandy loam soils along Freestone Creek and Avon River. Narrow flood plain to east of Avon.
Concept Design	Pumped pipeline network from Latrobe River. Potentially multiple modules. Balancing storage may not be required depending on extent of scheme. Alternative is individual direct access to River which would have a lower projected demand as it is limited to properties proximate to the River.	Supply from MID with siphon under Avon River and gravity pipe network. Balancing storage required.
Environment and Cultural Values	Mostly modified agricultural landscape, but some areas of remnant vegetation to be avoided. Further investigation will be required to understand the impact of increased supply and regulation of the Latrobe River. Proximity to waterways creates risk to cultural heritage and to downstream Gippsland Lakes.	Highly modified agricultural landscape. A number of scattered trees identified. Proximity to waterways creates risk to cultural heritage and to downstream environment, including Gippsland Lakes.
Cost Benefit Ratio	1.2 – 2.4 Depending on scale of demand, intensity of development, % vegetables and time to peak water use. Highest figure is for direct river access option.	1.7 to 2.2 Dependent on time to peak water use.
Potential for High Value Production	High potential for dairy and fodder production. Moderate potential for vegetables.	High potential for vegetables – matching development on west side of Avon River.
Employment Created – Direct and Flow-On (Majority Due to Horticulture)	153 – 253 FTE local employment 193 – 319 FTE total employment Relates to scale of demand – range is 10 – 16 GL.	495 FTE local employment 657 FTE total employment
Other Potential Benefits	May be opportunity to use spare capacity in existing on-farm irrigation infrastructure.	Increased environmental flows in the Avon through replacement of existing entitlements. Balancing storage could improve Main Northern Channel operation and provide winter supply to Boisdale area.
Other Potential Issues	Competition for land from lifestyle and rural residential uses as proximate to large regional centres of Traralgon and Sale.	Ability to find a suitable site for the balancing storage.

6 Conclusions and recommendations

6.1 CONCLUSIONS

LATROBE RIVER STUDY AREA

The Latrobe River study area covers approximately 30,000 ha and water for irrigation development is most likely to come from Latrobe Basin surface water entitlements. However, all surface water in the Latrobe is currently allocated and changes to the current water allocation framework would be required for additional water entitlements to be allocated.

Supply could occur via individual direct access for properties right along the river. This option would not require public investment in shared infrastructure. Spatial analysis indicates that 8,000 to 10,000 ML/year could be readily accessed by properties directly connected or very close to the Latrobe River.

To reach the full projected demand of 20,000 ML/year, infrastructure would be required to supply water to properties further from the river. Projected future demand is likely to be clustered in parts of the study area where land capability is higher – on the north side of the river to the east of Glengarry and to the east of Kilmany. If infrastructure development is to occur it should focus on these areas. There is potential for at least two medium scale pipeline schemes delivering 8,000 ML/year each (subject to development intensity) at a capital cost of approximately $15 million each.

Cost benefit analysis indicates that irrigation development along the Latrobe River is economic – benefits are likely to exceed costs. The development intensity, uptake of water and level of vegetable production are important conditions for viability. The benefit cost ratio of a 10,000 ML scheme with individual farmers pumping direct from the river is 2.4. The benefit cost ratio of an 8,000 ML modular pipeline network scheme is 1.7 (assuming a development intensity similar to the MID, 15% vegetables and a 15 year period to peak water use).

The employment created by the irrigation development is estimated at 319 FTE for a 16,000 ML scheme, or 193 FTE for a 10,000 ML scheme. Estimates include direct and flow-on employment and assume 15% of water is used for vegetable production, which creates the bulk of additional employment. Vegetables are much more labour-intensive compared to dairy and beef farming. A significant proportion of the additional employment is casual and contract type work such as vegetable picking.

The indicative annual prices that would need to be charged for the key concept schemes (based on standard regulatory practice) range from $109/ML up to $320/ML. This covers irrigation supply infrastructure capital and operating costs. It does not include the cost to buy water entitlements. It is not calculated for the Direct River Access option as infrastructure would be installed and owned by the irrigators. Substantial grant funding would be required for the supply infrastructure to achieve a price per ML equivalent to the current MID price, which is approximately $50/ML. However, the proposed schemes may provide a level of service to customers that is better than the level of service to MID customers, and this would give reason for a higher price to be charged.

Direct river access by individual farmers provides the highest economic returns (per ML). This makes best use of the River itself as the main supply “channel”. The drawback of this option is that it limits access to those proximate to the river. It is unlikely to enable the full projected demand to be achieved.

Direct river access could be considered as a Stage 1 development. It could then be combined with a modular pipeline network approach to expand development further from the river as Stage 2 (or more). Provision of easements to enable individuals to expand further from the river could be an alternative Stage 2. This is, of course, subject to water resources being available for development.

AVON RIVER STUDY AREA

Approximately 6,000 ha of land is located within the Avon River study area. The potential for growth of high value vegetable production is considered high because of the favourable soil types and proximity to more extensive vegetable production on the neighbouring west side of the Avon River.

The preferred option for the concept design for the Avon River scheme is to extend supply from the Main Northern Channel with a siphon pipeline under the Avon River, a balancing storage and distribution via a gravity pipe network. This option would provide access to MID modernisation savings. The Phase 2 concept design has been reviewed and updated due to the increased demand identified in Phase 3 consultation. More intensive development is expected along the initial pipeline network and the network could be extended to the east along the Freestone Creek, as well as further to the south of Llowalong. This will increase the capital cost of the scheme to approximately $35 million.

The increased cost of development will be offset by the increased benefits of substantially higher vegetable production. Phase 2 included 15% of water use for vegetables, while Phase 3 consultation indicated this was much higher at 60%. The benefit cost ratio for the Scheme is estimated to range from 1.7 to 2.2 depending on the time taken to peak water usage (the higher figure is for uptake over 5 years).

The need for balancing storage to supply the Avon scheme can provide additional benefits through winter supply to existing vegetable growers in the Boisdale area and improved operation efficiency for the Main Northern Channel. If the new supply can replace existing surface water and shallow groundwater licences, there could also be improved environmental flows for the Avon River.

The employment created by the irrigation development is estimated at 657 FTE including direct and flow on employment. The high percentage of vegetable production in this scheme leads to significant employment as this is a labour-intensive industry. A significant proportion of the additional employment is casual and contract type work such as vegetable picking.

The indicative prices that would need to be charged for the Avon concept scheme range from $150/ML to $380/ML. This covers irrigation supply infrastructure capital and operating costs. It does not include the cost to buy water entitlements. This indicates that substantial grant funding would be required for the supply infrastructure to achieve a price per ML equivalent to the MID price, which is approximately $50/ML. However, the proposed scheme may provide a level of service to customers that is better than the level of service to MID customers, and this would give reason for a higher price to be charged.

Development of irrigation along the east side of the Avon River is feasible. It will provide significant regional development and employment benefits, as the area is being targeted for increased vegetable production. The balancing storage required to supply the scheme could also provide improved levels of service for irrigators on the west side of the River.

6.2 PROPOSED NEXT STEPS

Each study area will need to follow a different pathway to completion. The recommended next steps, in priority order, are outlined below.

Latrobe Study Area

- Water resource assessments including modelling flow impacts, water product analysis / comparison, risk assessment and climate change sensitivity. Determine water available for development.
- Review type and scale of concept subject to water resource availability in collaboration with potential customers.
- Continued engagement with stakeholders

Subject to water availability the remaining steps may or may not be required.

- Functional design of pipeline network in collaboration with stakeholders to ensure impact to environment and cultural values minimised (or even benefits achieved). *Note: may not be required if water to be provided for direct farmer access*.
- On ground environment and cultural assessments based on revised design (likely to be an iterative process with previous step). Cultural assessment by GLaWAC. '*Note: may occur within farm irrigation and drainage plan development if water to be provided for direct farmer access'*.
- Customer protocols determined with comprehensive customer engagement. Includes water allocation framework, tariffs, contract terms and so on. Intent is to increase surety of investment from customers.
- Prepare DTF compliant business case
- Customers to undertake irrigation and drainage plan development (which incorporates design, environment and cultural assessments).

Avon Study Area

- Investigate and determine suitable storage location (including Geotech) and secure appropriate land
- Confirm availability of water savings and analyse impact to existing MID users
- On ground environment and cultural assessments (may be iterative process with pipeline functional design). Cultural assessment to be completed by GLaWAC. To include determination of cost associated with environmental offsets required.
- Continued engagement with stakeholders
- Functional design of pipeline network including value engineering and collaboration with stakeholders to ensure impact to environment and cultural values minimised (or even benefits achieved)
- Customer protocols determined with comprehensive customer engagement. Includes water allocation framework, tariffs, contract terms and so on. Intent is to increase surety of investment from customers.
- Prepare DTF compliant business case
- Customers to undertake irrigation and drainage plan development (which incorporates design, environment and cultural assessments).

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