



Lake Wellington Land and Water Management Plan

A plan for sustainable irrigation in the
Lake Wellington Catchment

2018-2028



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Executive Summary

The vision for the Lake Wellington Land and Water Management Plan (LWMP) is for

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

This vision reflects the catchment's status as an attractive and highly productive irrigation region and the aspiration for irrigated agriculture to be profitable, environmentally sustainable and resilient in the face of continued changes and challenges. It also highlights the value placed on the social and cultural connections to land and Country among irrigators, Traditional Owners and the broader catchment community.

This new Plan for irrigation land and water management in the Lake Wellington catchment supersedes the previous LWMP for the Macalister Irrigation District (MID). It will build on the successes and achievements of the previous Plan and seek to extend its culture of innovation and collaboration in irrigation land and water management to the remainder of the catchment. The new Plan seeks to involve the catchment's irrigators in programs which save water, increase production and retain nutrients and soil on farms. As has been demonstrated for the MID, implementing these kinds of activities reduces the impacts of irrigated agriculture on local waterways and the Gippsland Lakes and helps to stabilise water tables and contain the effects of irrigation-induced salinity.

The Lake Wellington LWMP responds to new directions in water and environmental policy provided by the Victorian Government's: *Water for Victoria: Water Plan*; *Climate Change Framework*; *Climate Change Adaptation Plan*; and the new State Environmental Protection Policy (SEPP) for Victoria's water resources and water environments. These guide the Plan to:

- Maximise the value generated by the use of water in irrigated agriculture;
- Develop robust business cases to support government investment;
- Respond to climate change, by seeking to develop more climate resilient farming systems and reducing the greenhouse gas emissions intensity of irrigation;
- Improve water quality and the health of local waterways and Lake Wellington; and
- Recognise Indigenous cultural values and social values associated with the catchment's waterways and the uses of water.

The Lake Wellington LWMP will support the West Gippsland Regional Catchment Strategy and contribute to the objectives and priorities of the *Gippsland Lakes Ramsar Site Management Plan*. It was developed through consultation with irrigators, government agencies, industry representatives, Traditional Owners and other community members.

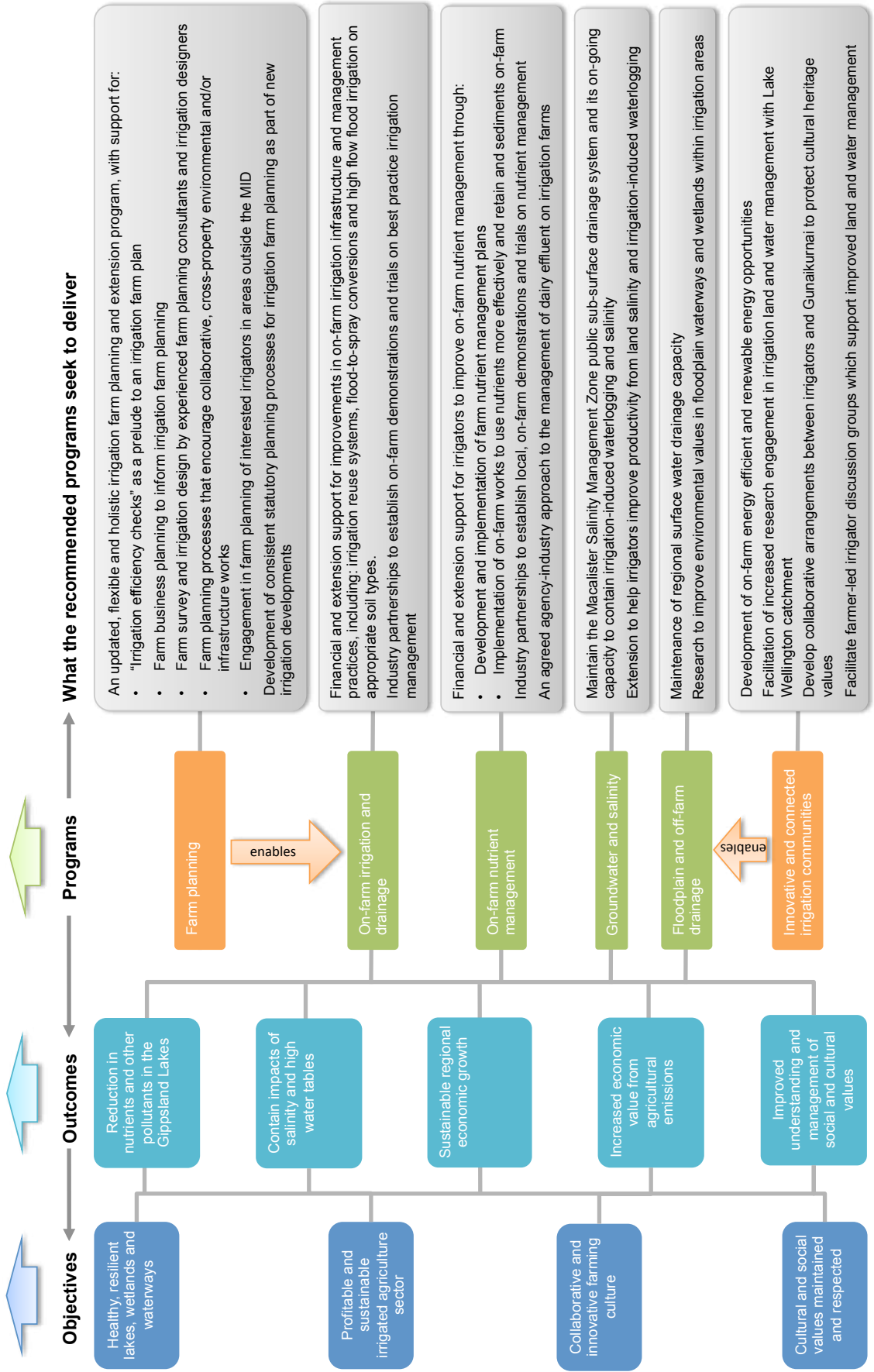
Implementation of this Plan will initially focus on irrigated dairying in the MID and adjoining areas. As implementation proceeds, opportunities to involve vegetable growers and other irrigators from across the catchment will be explored and developed. Programs and activities described in the Plan may be adapted and new activities introduced through the Plan's adaptive management processes following engagement with other industries and irrigators. With irrigation projected to expand within the catchment and the intensity of irrigation land use to increase, the Plan's programs will need to be fully implemented to achieve the new SEPP water quality improvement targets.

The programs which are described in this Plan have been influenced by cost-benefit analysis. Investment by irrigators, government and other parties in this 10 year Plan will provide a range of public and private benefits that will accrue over coming decades. Although not all costs and benefits are readily quantified in financial terms, cost-benefit analysis suggests that the value of benefits will significantly exceed the cost of implementing this Plan.



Lake Wellington Land and Water Management Plan at a glance:

Vision: a highly productive and sustainable irrigation community that values and protects its natural and cultural assets





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Southern shore of Lake Wellington, photo by Andrew Franks

1 A plan for sustainable irrigation in the Lake Wellington catchment

1.1 Why do we need a Land and Water Management Plan?

Water is an essential resource for agriculture, communities and the natural environments of the Lake Wellington catchment. Irrigated agriculture is vital to the region's community and economic prosperity, contributing over \$650 million annually through food production and processing in the MID alone. Irrigated agriculture in the catchment is diverse and expanding. While dairy production remains the major irrigated agricultural land use, horticultural production is increasing. Lake Wellington catchment's status as an attractive and highly productive irrigation region means that the future for agriculture is promising, although not without its challenges.

This Lake Wellington Land and Water Management Plan (LWMP) supersedes the 2008 Macalister LWMP and 2005 West Gippsland Salinity Management Plan (SMP). Programs delivered under these plans have, with irrigators, contributed to;

- Improvements in the quality of water in waterways within the Macalister Irrigation District (MID);
- Reduced nutrient and sediment inputs into Lake Wellington;
- Containment of waterlogging and irrigation-induced salinity;
- Water savings that have been reinvested by irrigators to improve farm productivity and profitability.

Pressures on profitability, changing population, climate variability, water security and changing consumer preferences are among the important factors influencing the future of irrigated agriculture. By working together, irrigators, government agencies and the community in the Lake Wellington catchment can tackle these challenges and take full advantage of future opportunities.

The Plan provides a roadmap of priorities and programs for sustainable irrigation. It builds on the programs and successes of the Macalister LWMP, capitalise on the advantages provided by the catchment's rich soils, favourable climate and secure water supplies and intends to contribute to Lake Wellington catchment remaining among Australia's premier irrigation regions.

The Plan has four key roles:

- Describing the programs and actions to achieve its vision and targets;
- Providing for agency collaboration and accountability to ensure that public funds align with government and community priorities;
- Guiding investment from the Victorian Government's Sustainable Irrigation Program (SIP);
- Establishing adaptive management, monitoring and reporting processes to demonstrate progress and achievements.

It also supports the West Gippsland Regional Catchment Strategy and contributes to the objectives and priorities of the *Gippsland Lakes Ramsar Site Management Plan*.

This is the main Land and Water Management Plan document. A series of technical appendices have also been prepared to provide further detail on irrigation land and water management under the new Plan. These have been collated into a single companion document, which is available from the West Gippsland Catchment Management Authority (WGCMCA).



1.2 Lake Wellington catchment

Lake Wellington catchment (Figure 1.1) extends from Lake Wellington to the slopes of the Great Dividing and Strzelecki Ranges. It includes almost 1.2 million ha of land in the catchments of Latrobe, Thomson, Macalister and Avon Rivers and runs from Noojee and Warragul in the west to Stratford in the east. Lake Wellington is the most westerly of the Gippsland Lakes and forms part of the Gippsland Lakes Ramsar site, a wetland complex of international conservation significance.

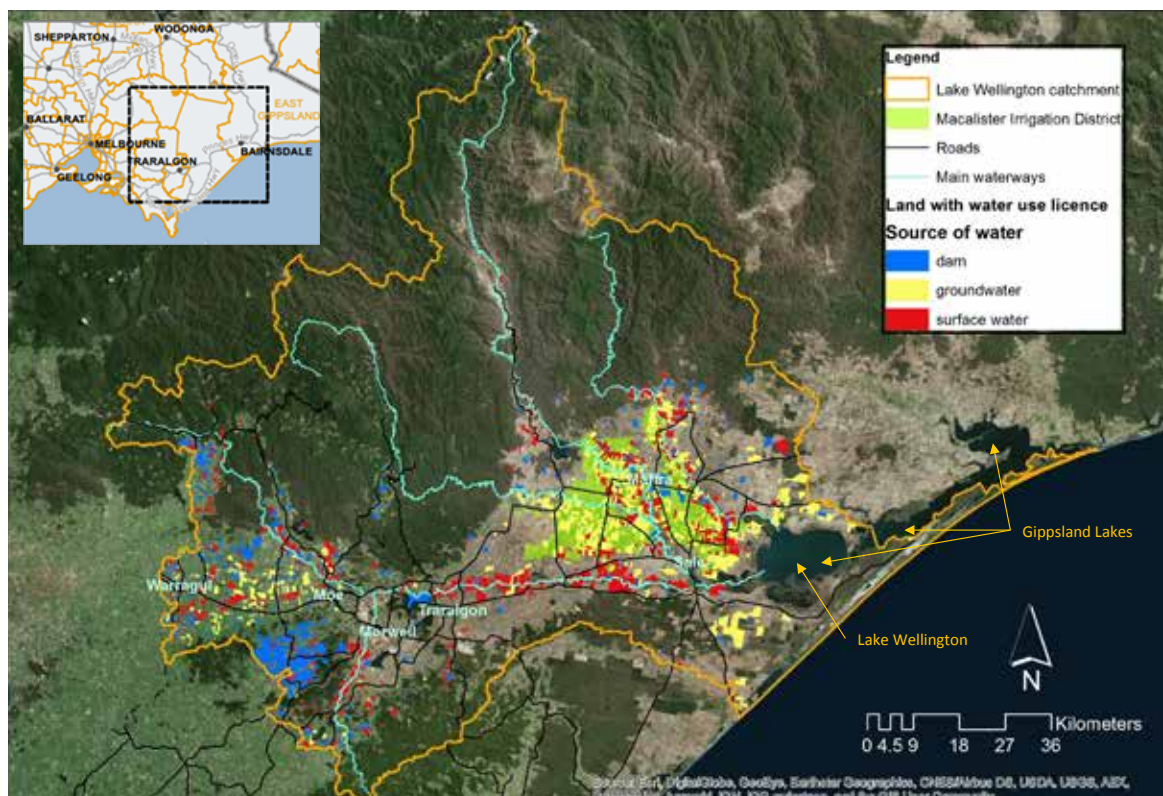


Figure 1.1 Lake Wellington catchment and the distribution of irrigated agriculture.

Lake Wellington catchment includes parts of seven local government municipalities. Baw Baw Shire, Latrobe City and Wellington Shire occupy most of the catchment. While more than half of the catchment's 160,000 residents live in the five main population centres of Moe, Morwell, Sale, Traralgon and Warragul, a significant proportion make their homes in towns and smaller settlements which are underpinned by irrigated agriculture.

The Macalister Irrigation District (MID) is the major irrigation hub in the Lake Wellington catchment (Figure 1.1). Irrigated dairy, horticulture and other forms of irrigated livestock production and cropping support the local economy and community, particularly in towns such as Maffra and Sale. The MID's secure surface water and groundwater supplies, mild climate and productive soils have cemented irrigated agriculture as a key contributor to the local economy and underpins its attractiveness as an irrigation region. The area of land with a water use licence or take-and-use licence and able to be irrigated within Lake Wellington catchment is approximately 100,000 ha, about 25% of which is located within the MID.

Irrigation is also widespread in the Thorpdale area and along the floodplains of the Latrobe River. Irrigation in these areas supports vegetable production, as well as dairying and other forms of livestock production.

Much of the irrigated area is used for pasture production, mainly to support dairy production. Smaller areas of irrigated pastures support beef cattle and sheep production. Most of the remaining area of irrigated land is used for vegetable production, mixed farming and cropping.

Agriculture within the Lake Wellington catchment produces commodities worth about \$750 million each year, with much of this supported by irrigation. About 7% of the catchment population are employed in the agriculture, forestry and fisheries sector, with many others employed in related manufacturing and service industries. Irrigation in the MID (alone) supports over \$650 million in overall economic activity annually.

Tourism and recreational activities associated with the Gippsland Lakes are also critical to the regional economy and are an important source of employment.

1.3 Understanding the impacts of irrigated agriculture on the Gippsland Lakes

Lake Wellington is the largest, shallowest, and most westerly of the Gippsland Lakes. It is now a well-mixed, brackish ecosystem, although it was a freshwater lake prior to the opening of the permanent channel to the sea at Lakes Entrance. The Lake is surrounded by highly valued wetlands and marshes and forms part of the Gippsland Lakes Ramsar site. Lake Wellington is connected to the eastern Gippsland Lakes via the McLennan Strait.

A comprehensive scientific review (included in the Plan's technical appendices) has considered the possible pathways for nutrient and pollutant transport from land to the Gippsland Lakes and how, in the catchment's irrigation areas, these may be managed. This review has informed the Plan's priorities and implementation programs.

Inflows of freshwater and inputs of nutrient, sediment and other pollutants are delivered to Lake Wellington by the Latrobe, Thomson and Macalister rivers in the west and Avon River in the north. While sediments in Lake Wellington have large natural stores of phosphorus, these have been supplemented since European settlement. The Lake's major tributaries now carry phosphorus, nitrogen and sediment loads which are up to three times their pre-development levels.

The accumulation and resuspension of nutrient and sediments in Lake Wellington encourages algal blooms. These may be toxic to people, fish and other animals and detract from recreational and other uses of the lake. High nitrogen-phosphorus ratios following floods suit nitrogen-dependent green algae and may trigger blooms. As these green algae decompose, phosphorus is released from lake sediments, which may trigger blooms of nitrogen-fixing, blue-green algae.

Traditional Owners of the Gippsland Lakes catchments

The Gunaikurnai are recognised as Traditional Owners over approximately 1.33 million ha in Gippsland – extending east-west from near Warragul to the Snowy River and north-south from the Great Dividing Range to the coast and sea country.

Gunaikurnai have lived in the valleys, on the fertile plains and up in the mountains of their traditional country for many thousands of years. They see their land (Wurruk), waters (Yarnda), air (Watpootjan) and every living thing as one. All things come from Wurruk, Yarnda and Watpootjan and they are the spiritual life-giving resources, providing the people with resources and forming the basis of their cultural practices.

Gunaikurnai culture and identity is embedded in Country. Aboriginal heritage is strong across the Lake Wellington catchment, and cultural sites and artefacts can be found along Gunaikurnai songlines, and trade routes, mountain ridges and waterways. They remind the Gunaikurnai about the ways of their ancestors and show their close and continuing connection to Country.

The Gunaikurnai people are actively pursuing their cultural responsibilities to care for country through the management and protection of cultural and natural assets and values within the Lake Wellington catchment area.

The impact of nutrients movement within a catchment is influenced by the degree of connectivity between the sources (e.g. paddocks) and the receiving waters. Intervening wetlands, dams, lakes or riparian buffers may reduce connectivity and act as “sinks” for nutrients. Constructed drains may increase connectivity.

Nutrient losses from farms are influenced by a combination of systemic factors (reflecting inherent landscape or production system characteristics) and incidental factors (which are more avoidable and reflect management). Systemic losses can dominate in well-managed operations, but less effective management can result in large incidental losses in storms or following irrigation.

Nutrient intensive farming creates a nutrient-rich landscape. Nutrient losses in dairy farms are mainly from phosphorus-rich soils, urine patches and dairy effluent. Nutrient losses from vegetable-growing operations are from highly fertilised soils and areas of bare ground that are exposed to erosion during intense rainfall and associated overland flow events. Losses of phosphorus and nitrogen from irrigation areas are both critical to the health of Lake Wellington and other Gippsland Lakes.

Off-farm nutrient losses can be reduced by sound planning, optimising production per unit of input and direct actions to contain losses via dairy effluent and/or soil erosion. Planning begins with ‘stock-taking’: whole property nutrient budgets, risk assessments, ‘best practice’ assessment; with all of these integrated into the farm plan.

Impacts of algal blooms in the Gippsland Lakes have driven nutrient reduction programs in Lake Wellington’s catchment (see Box 1).

Box 1: A phosphorus reduction target for the Lake Wellington catchment

A new State Environment Protection Policy (SEPP) for water is being prepared by the Victorian Government. It aims to protect water quality for “beneficial uses” that include agriculture, human consumption, recreation and the environment. The SEPP (Waters) will replace existing SEPPs for surface waters and groundwater.

The existing SEPP (Waters of Victoria) was amended in 1996 in response to concerns about the condition of Lake Wellington. A target was introduced for total phosphorus (TP) inputs to the Lake to be less than 115 t/y for median annual streamflow and for phosphorus discharges from irrigation drains in the MID to fall by 40%. These were intended to reduce the risk of algal blooms and be achieved by:

- Implementing best practice irrigation following the preparation of irrigation farm plans;
- Reducing irrigation runoff through the adoption of more efficient irrigation techniques and the construction of reuse systems; and
- Increased diversion of drainage flows.

These actions were incorporated into the Macalister LWMP in 2008.

Recent analyses for the Environment Protection Authority (EPA) found that reducing TP inputs to Lake Wellington to 115 t/y would not adequately reduce the risk of algal blooms. Reductions by at least a further 15 t/y would be required to largely prevent the periodic blooms of blue-green algae which affect the Lake. The SEPP (Waters) (2018) has set a target to reduce average annual TP 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 through implementation of this Plan.**

1.4 Other environmental risks and challenges

In addition to reducing the effects of off-farm nutrient losses on the health of Lake Wellington and other Gippsland Lakes (as above), this Plan has also been developed to address other key environmental threats associated with irrigation land and water management, namely:

- **Irrigation-induced salinity:** this Plan supersedes the West Gippsland Salinity Management Plan and incorporates key on-going actions. The incidence of elevated water tables, waterlogging and salinity within and adjacent to irrigation areas ebbs and flows. During wetter climate phases, water tables rise and there is a need to operate the regional sub-surface drainage (SSD) infrastructure (a network of groundwater pumps) to contain shallow water tables and salinity.
- **Off-farm losses of sediment:** the loss of soil from the catchment's irrigation areas affects soil health and productivity. Sediments and the nutrients they carry also affect the health of local waterways and wetlands and may contribute to algal blooms in the Gippsland Lakes. Sediment loading into Lake Wellington is estimated to have doubled since European settlement.
- **Agricultural flooding:** many lowland irrigation areas are exposed to river flooding and overland flows during extreme rainfall events. The Plan's floodplain and off-farm irrigation drainage program supports WGCMA's floodplain management program in managing adverse impacts from flooding.
- **Climate change:** Lake Wellington catchment's mild climate and relatively reliable rainfall confer some measure of resilience to climate change, particularly when compared with irrigation regions in northern Victoria and southern NSW. Despite this, climate change poses a long-term challenge to irrigation land and water management.

The catchment's climate is projected to become warmer and drier, with more intense extreme rainfall events. Without effective adaptation, these changes have potential to increase sediment and nutrient movement into Lake Wellington and may exacerbate algal blooms. They may also mean that less water is available for irrigation, which will affect the structure and profitability of irrigation.

1.5 Involving stakeholders and the community

The Plan was developed in three main stages, as illustrated in Figure 1.2 and outlined below. Consultants engaged by WGCMA to undertake the review of the Macalister LWMP (Stage 1) and develop and finalise the Lake Wellington LWMP (Stages 2 and 3) worked closely with a Technical Working Group (TWG) comprising agency, local government and industry representatives, and an irrigator and farm-advisor Stakeholder Advisory Group (SAG).

Some aspects of the Macalister LMWP review and Lake Wellington LWMP formulation process are discussed in Chapter 2. The final outputs of Stage 2 were two versions of a consultation paper on the Plan. One version provided an overview of the Plan development process and details on the Plan's vision, objectives, programs and adaptive management arrangements. This version was written for technical stakeholders and was the basis for this community version of the final Plan. The second consultation paper was a four-page non-technical summary of the main consultation document. Both versions of the consultation paper included questions to guide and encourage community and stakeholder feedback on the Plan.

The consultation papers were widely circulated among irrigators and stakeholder groups within Lake Wellington catchment. This was accompanied by activities to engage with irrigators and elicit feedback on the proposed Plan and its programs.

Further details on the review of the Macalister LWMP and the processes to develop this Plan are provided in the Plan's technical appendices.

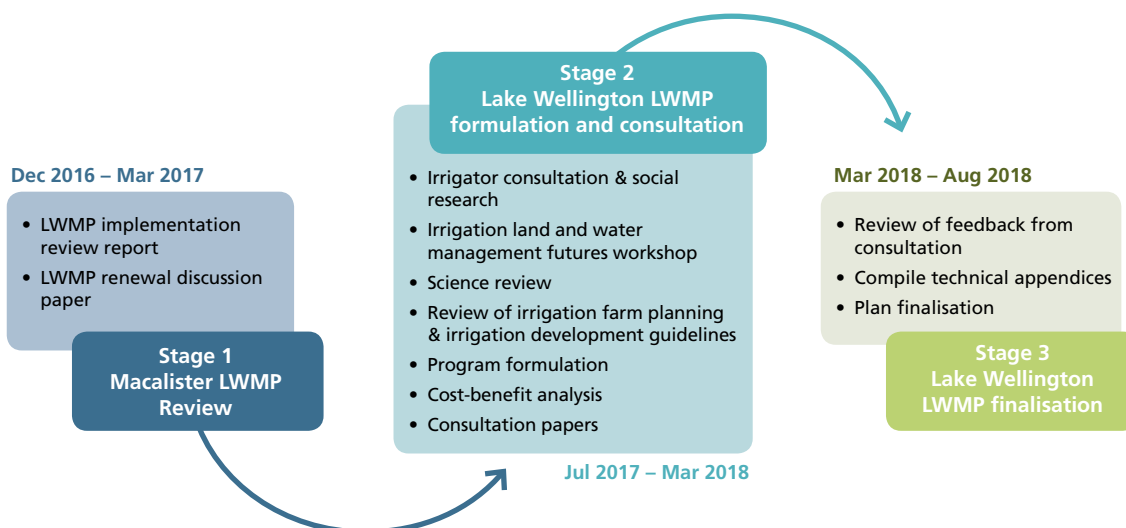


Figure 1.2 Approach to developing the new Lake Wellington Land and Water Management Plan

Box 2: Irrigation farm planning makes a difference

Farm planning has been a key element of the irrigation land and water management programs in the MID and will continue to be emphasised as part of the new Lake Wellington LWMP.

A 2018 survey of 41 irrigators who had participated in the farm planning program found:

- **Farm planning is valued:** 90% of survey respondents said they changed something or were planning to change something in their business because of the farm planning process.
- **Plans are useful for the entire farm business:** an irrigator wrote that, “the plan helps with everything – cows, irrigation, reuse, the whole business”.
- **Plans lead to good decisions:** one irrigator commented that farm planning, “helped to work out where to put dirt and reuse dam; we had differing opinions, the plan helped decide”.



- **Farm planning opens opportunities:** an irrigator considered that the plan was the “best money spent”. They found that, “ideas changed rapidly with someone else looking at the farm. Around the river we realised how much dirt we would need to move for flood; (it) makes more sense to spray and we’ll have less soil disturbance”.
- **Plans lead to production and/or irrigation efficiency improvements:** an irrigator wrote, “pivots are growing a heap more feed, production benefits are huge. It helps us decide our next move.”

1.6 About this document

The remainder of the Plan is divided into four main chapters, as follows:

- **Chapter 2 Looking back to go forward:** a discussion of the origins of the Plan, the achievements of the earlier Macalister LWMP and of some of the changes and challenges which are projected to influence the direction of irrigation land and water management in the future.
- **Chapter 3 A vision for irrigation land and water management:** which states the vision, objectives and long-term resource conditions targets (RCTs) for the Plan and its programs.
- **Chapter 4 Achieving the vision and objectives:** which describes the six programs by which it is proposed that the Plan's objectives, outcomes and targets are achieved.
- **Chapter 5 Adaptive management and measuring success:** which describes the arrangements for governance, monitoring, and improvement, and highlights knowledge gaps

The Plan's programs and actions were assessed financially and against its objectives and outcomes (Figure 4.2; Table 4.1). The financial analysis shows that the benefits from implementing the Plan are estimated to significantly exceed the costs of doing so, with the overall benefit-cost ratio (BCR) calculated to be approximately 1.6. Sensitivity testing indicated that while the BCR varies with some of the assumptions underpinning the analysis, it exceeds one and the Plan remains financially attractive under a wide range of conditions.

Costs and benefits associated with the programs vary. The main enabling programs (farm planning, innovative and connected irrigation communities) are critical to the success of the Plan, but as discussed in Chapter 4.2, provide minimal direct (financial) benefit and have limited direct impact on natural resource condition. The main on-ground works programs (on-farm irrigation and drainage, on-farm nutrient management, groundwater and salinity) deliver the actions that directly provide the financial benefits accounted for in the CBA. These programs also incur most of the implementation costs, with these mainly shared between irrigators and the State Government.

The programs also vary in their expected contribution to the Plan's objectives and long-term outcomes (Table 4.1). The key enabling programs (farm planning, innovative and connected irrigation communities) have high enabling benefit for most objectives and outcomes, but do not directly cause the objectives or outcomes to be achieved. The main works implementation programs, particularly on-farm irrigation and drainage and on-farm nutrient management, include important enabling activities (e.g. extension, trials and demonstrations), as well as on-ground works that will directly contribute to achieving the Plan's objectives and outcomes.

Implementation of the Plan, including both the key enabling and on-ground works activities, at the level of adoption and support proposed, should contribute to the achievement of at least the two primary resource condition targets:

- reduce phosphorus loadings into Lake Wellington by 7.5 t/y
- contain the area affected by shallow water tables and salinity to the 2012 benchmark area.

2 Looking back to go forward

2.1 Looking back: achievements of the Macalister Land and Water Management Plan

The 2008 Macalister LWMP was borne out of the need to renew the 1998 *Macalister Irrigation District Nutrient Reduction Plan* and integrate many overlapping land and water management issues not covered by other plans at the time. It also incorporated MID-specific components of the 2005 *West Gippsland Salinity Management Plan*.

The Macalister LWMP focussed on improving the health of the Gippsland Lakes and the condition of many high value environmental assets across the MID, while supporting agricultural, environmental, industrial and urban uses or services.

The review of the Macalister LWMP highlighted its achievements and provided useful insights and directions for the new Plan. Total government investment in the Macalister LWMP was about \$8.7 million. This was lower than hoped for, reflecting the general withdrawal of Commonwealth funding for irrigation land and water management and decreased State investment between 2008-09 and 2014-15. Commodity price cycles and seasonal conditions, at times, affected private investment in support of improved irrigation land and water management, particularly by dairy producers.

Despite these challenges, the review found that the Macalister LWMP had been successful in several key areas (Figure 2.1), including:

- Bringing irrigators and agencies together to implement the Plan;
- Building a strong management ethic, which considers both production and environmental outcomes;
- Extending the area covered by irrigation farm plans;
- Using farm plans to guide works which improved production and irrigation efficiency, achieved real water savings and retained nutrients on farm.

The Macalister LWMP set an ambitious target for phosphorus export reduction from the MID. While this was not achieved, the water quality target set in 1996 under the SEPP (Waters of Victoria) – for average phosphorus exports from the MID to be reduced to 42 t/y (a 40% reduction on baseline conditions) – was met in 10 out of 16 years from 2000.



Celebrating success in land and water management

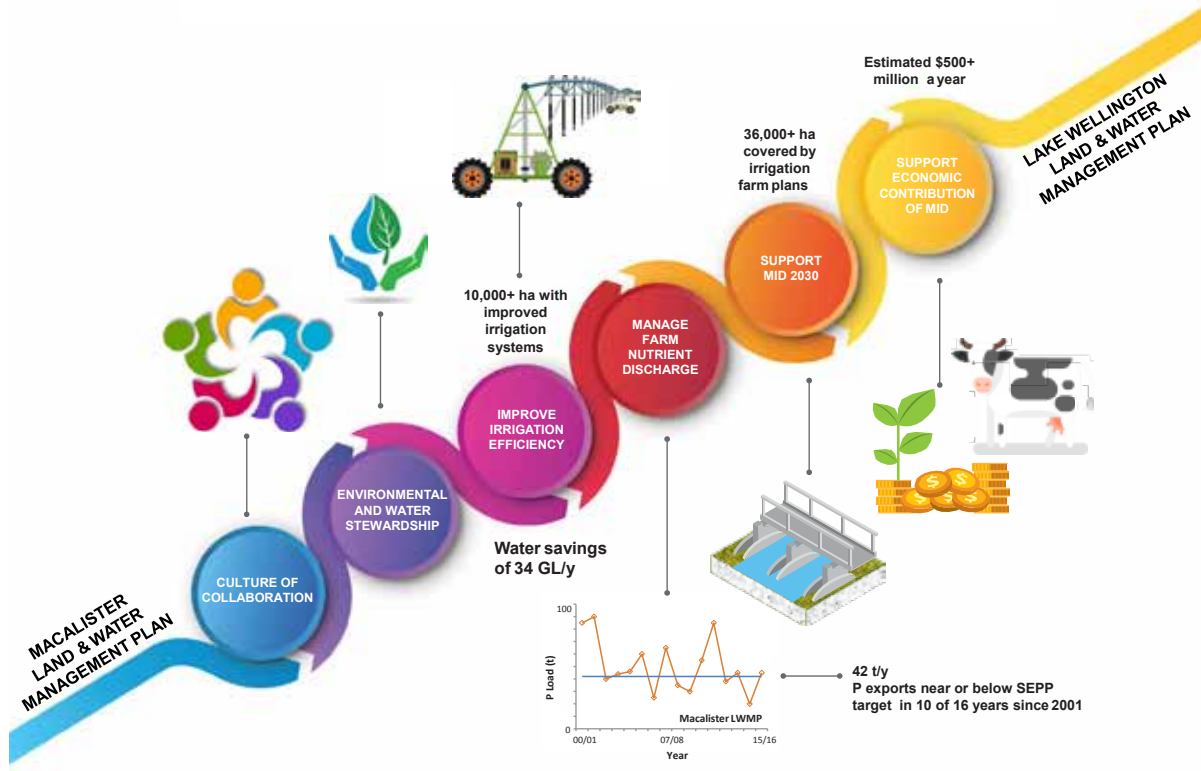


Figure 2.1 An overview of the achievements of the Macalister Land and Water Management Plan

2.2 New policy directions and clear advice

New directions and clear advice on water and environmental policy for Victoria have been provided in the Government's: *Water for Victoria: Water Plan*; *Climate Change Framework*; *Climate Change Adaptation Plan*; and the SEPP (Waters). This policy and strategic framework guide the Plan to:

- Maximise the value generated by the use of water;
- Develop robust business cases to support government investment;
- Respond to climate change by reducing greenhouse gas emissions and building climate resilience in irrigation farming systems;
- Improve water quality and the health of local waterways and Lake Wellington; and
- Recognise Indigenous cultural values and social values associated with waterways and the uses of water.

These have influenced and are reflected in this Plan's objectives, targets and programs.

2.3 Future changes, challenges and opportunities

This Plan aims to support on-going irrigation land and water management in the Lake Wellington catchment. Insights into the important drivers of change in irrigation land and water management have influenced the Plan's development and programs. The Plan incorporates robust adaptive management processes (Chapter 5) to ensure it remains relevant and flexible regardless of how the future unfolds.

Various factors may influence the future of irrigation land and water management. These present both challenges and opportunities. During the Plan’s development, workshops and interviews were held with irrigators, industry and agency stakeholders to consider how the catchment’s future may unfold (see Figure 2.2 for a summary). Some potential aspects of the catchment’s future that were raised in these discussions are outlined below.

Change in demographics

The Plan recognises that future changes in the local community may affect land and water management. Key trends include the rising number of corporate and amalgamated farms and the movement of irrigators into the area as they look to “future-proof” their businesses. These changes may provide opportunities for intergenerational succession on family farms or at least for younger people to enter the industry as workers and managers.

These changes also have flow-on effects, including increasing land prices, changing land use patterns and, perhaps, introducing new insights into irrigation technology.

Changes in industry mix

The Plan recognises the trend of increasing intensification of agriculture and of land use change from irrigated dairy and beef to vegetable growing in places throughout the catchment. Irrigation farming is becoming increasingly intensive, with greater inputs of fertilisers, feed, capital and management. These changes may increase the challenges to environmental management by irrigators and have been considered by the Plan.

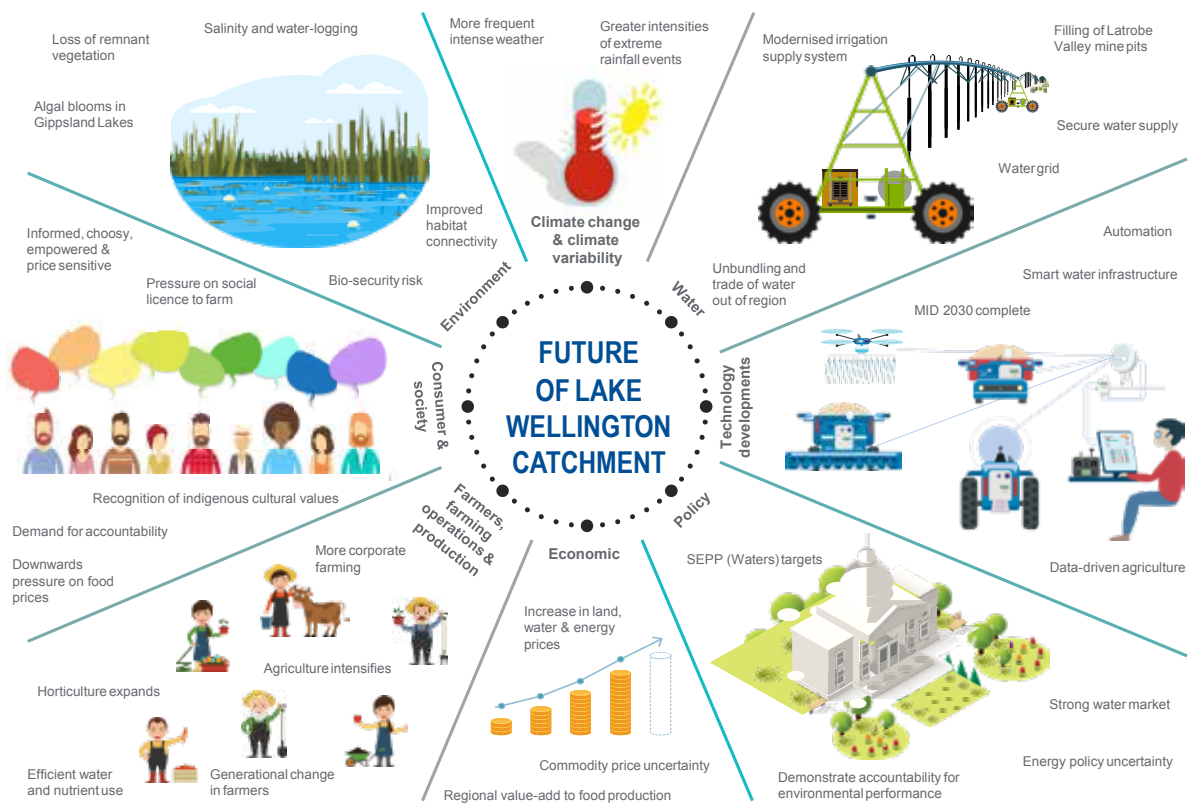


Figure 2.2 Some potential future influences on irrigation land and water management in Lake Wellington catchment

Consumers and society

Consumers are likely to have a growing influence on food production as they become more informed, choosy and empowered to demand certain ethical or environmental standards, provenance, health attributes and environmental accountability. Enabling sustainable and productive irrigated agriculture is the vision of this Plan (see Chapter 3): being able to demonstrate progress towards this will be crucial in maintaining agriculture's social licence with consumers and the Lake Wellington community.

The Plan considers the increasing pressure to improve practices, monitor and report on land-use impacts, as well as the role of technology and good governance processes in collecting and sharing information and managing relationships.

Climate change

Although the region experiences less uncertainty in water supply than most other competitor regions in Australia, it is exposed to droughts, floods, fires and reliability issues linked to the limited irrigation storage capacity. Seasonal climate variability offers periodic challenges to farmers in the Lake Wellington catchment, and climate change is anticipated to exacerbate its effects. The Plan aims to build resilience into the catchment's irrigation farming systems so that they will be able to adapt to climatic and other changes that arise.

Climate change may also influence key drivers of water quality and algal bloom issues in the Gippsland Lakes, through effects on extreme rainfall events, flooding, bushfire incidence and water temperatures. These challenges mean that it will be increasingly important to build the resilience of the Lakes' ecosystems by reducing inputs of sediment and nutrients from irrigation areas.

Water

The Plan recognises that secure water supplies are essential for the viability of irrigation operations and food processing facilities within Lake Wellington catchment. It aims to support MID irrigators in taking advantage of the opportunities to manage water more effectively which arise from connecting to the improved irrigation water supply system developed through Southern Rural Water's (SRW's) MID2030 program.

The Plan also reflects that improved water quality is essential for the health of the Gippsland Lakes and its tributary waterways and that this provides benefits for recreational users, drinking water supplies and food producers. The Plan's focus is on making best possible use of the available irrigation water. This recognises that water quality and the security of water supplies for agriculture may be challenged by factors such as: climate change, competition with other uses and trade in water.

Changing land use and management

Irrigation land uses and management practices are changing, particularly in lowland irrigation areas around the MID. Vegetable production is expanding and there is a general trend for larger and more intensive dairy farms. These changes have potential to increase baseline nutrient and sediment losses from the catchment's irrigation areas and could make the SEPP (Waters) target to reduce TP loads to 100 t/y more challenging.

Analyses undertaken for the Plan (and reported in the Plan's technical appendices) suggested that trends in land use change and intensification of nutrient use could slightly increase the baseline TP loading into Lake Wellington from its current average level of 115 t/y. However, the analyses found that with high levels of adoption of the nutrient management practices supported by the Plan, it should be possible to reduce TP loads from irrigation areas to about the level targeted by the SEPP (Waters).

Baseline Total Nitrogen (TN) loading may also increase slightly, but this is anticipated to be more than offset by reduced nitrogen losses resulting from implementing the Plan.

Box 3: Improved dairy effluent management reduces risks and enhances productivity

The Lamb family run a 200 ha, 600 cow dairy operation. Their farm is flood irrigated and has a reuse dam to capture and recycle irrigation runoff. Dairy effluent is stored in two ponds with 2 ML capacity. Effluent from the second pond was used to flood irrigate 38 ha of pasture.

This was a risky set up:

- Application of nutrients to the 38 ha effluent reuse area was excessive;
- Effluent ponds were undersized for the size of herd; and
- Low storage capacity mean that effluent irrigation occurred through the year, even when soils were wet and runoff could occur.

Through participation in CORE 4, a program that helps farmers keep nutrients and sediments on farm, the Lambs made two key changes. They increased the capacity of their ponds to 5 ML, allowing them to store effluent over winter and eliminating the risk of direct effluent runoff. They also increased the effluent application area to 100 ha, which spread the nutrient loading and shared the benefits of effluent reuse to about half of the farm.

Kate Lamb commented:

Applying for the CORE 4 project was extremely easy. The process went smoothly from attending the first workshop and registering interest right through to the very end in which we were fortunate enough to be selected in this round of funding. The CORE 4 team explained everything in great detail, answered all questions, and did all the ground work required to lodge the application.



As a busy dairy farmer all we had to do was gather our quotes together for the required work to be done and make time available to meet with a CORE 4 member to get some background on our farming methods. It is fantastic to see the government helping farmers out by investing money back into the land and also helping to make sure we can keep farming practices in line with environmental guidelines.

2.4 Irrigator perspectives on future challenges and opportunities

The initial phase of stakeholder consultation undertaken during Stage 2 of the LWMP review and renewal process comprised a series of small focus group discussions and individual interviews with irrigators and their advisers. These consultations focused on challenges and opportunities for irrigation land and water management within the catchment and were also informed by a review of recent social research on the catchment's key industries (dairy, horticulture and beef production).

A summary of the key messages, organised by industry, is given in Table 2.1.

Table 2.1 Irrigator and adviser perspectives on challenges and opportunities for irrigation land and water management

INDUSTRY		
DAIRY	HORTICULTURE	BEEF
Current and future challenges for irrigation land and water management:		
Changes in land use from dairy to vegetables	Nutrients, sediment and pathogens generated on dairy farms	Seasonal variability in rainfall and irrigation water supply
Changed demographics, with increased corporate farming and reduced population	Water availability and security Government regulation	Uncertainty in irrigation allocations
Water availability and security	Aging irrigation water supply infrastructure	
Cost and supply reliability of electricity	Potential impacts from sand mining at Glenaladale and Stockdale	
Current and future opportunities for irrigation land and water management:		
Construction of another major water storage to increase irrigation supply	Continued expansion of horticulture	
Water savings via MID2030 infrastructure upgrades	Cooperative or collaborative arrangements between growers	
Responsiveness to consumer demands on food quality and environmental credentials of supply system	Increased organic production	
	Expansion in covered/protected cropping	
	Use of “big data” to drive production efficiency	
	Competitive advantage of Lake Wellington catchment compared with other irrigation regions with climate change	
Opportunities for improved irrigation land and water management:		
Enterprise profitability	Improved irrigation system efficiency	Increased use of soil nutrient testing
Complexity in managing irrigation systems	Soil and tissue testing to inform nutrient management	Farm planning
Regulation and “red tape”	Soil health improvement	Improved irrigation layout
Improving electricity supply reliability	Improved use of farm advisers by smaller, independent growers	Upgraded irrigation outlets
Improved irrigation practices, with more frequent, higher flow irrigation	Drainage and cultivation to ensure crops are grown at optimum soil moisture levels	Use of timers in irrigation
	Management of soils during intense rainfall events	
	Use of groundwater for irrigation in conjunction with water from channels	

3 A vision for irrigation land and water management

3.1 Vision

The vision for the Plan (below) recognises the vital role that irrigated agriculture has in the region's economy. It describes a promising future where agriculture is profitable, resilient and innovative, where community aspirations for waterway health, social and cultural connections are achieved.

A vision for irrigation land and water management in the Lake Wellington catchment:
A highly productive and sustainable irrigation community that values and protects its natural and cultural assets.

3.2 Objectives and outcomes

Consultation during Stage 2 of the Plan review and renewal process (Chapter 1.5) indicated that the envisioned concept of a *sustainable irrigation community* was interpreted broadly by stakeholders. This meant that in addition to the focus on reducing nutrient exports to the Gippsland Lakes and containing irrigation-induced salinity and high water tables, they wanted to ensure the Plan also seeks to contribute to:

- Sustainable economic growth with the Lake Wellington catchment;
- Improvements in the economic value derived from greenhouse gas emissions associated with irrigation land and water use;
- Maintaining a culture of collaborative and innovative irrigation farming; and
- Community understanding and management of social and cultural values, including Indigenous cultural values.

These values have been reflected in this Plan's objectives and outcomes, as presented in Figure 3.1.

Strong support for reducing greenhouse gas emissions from irrigation was received in responses to the Plan's consultation paper. This support is consistent with Water for Victoria's requirement for the water sector to provide leadership in making progress towards the State's 2050 net zero emissions (NZE) target. The Plan recognises that NZE would be a very challenging ambition for an irrigation region that is dominated by dairy production. However, the Plan advocates for actions to improve energy efficiency, generate renewable energy and reduce agricultural emissions associated with effluent and nitrogenous fertiliser use. Adoption of these measures should enable significant improvements in the economic value generated by greenhouse gas emissions resulting from irrigation land and water use.



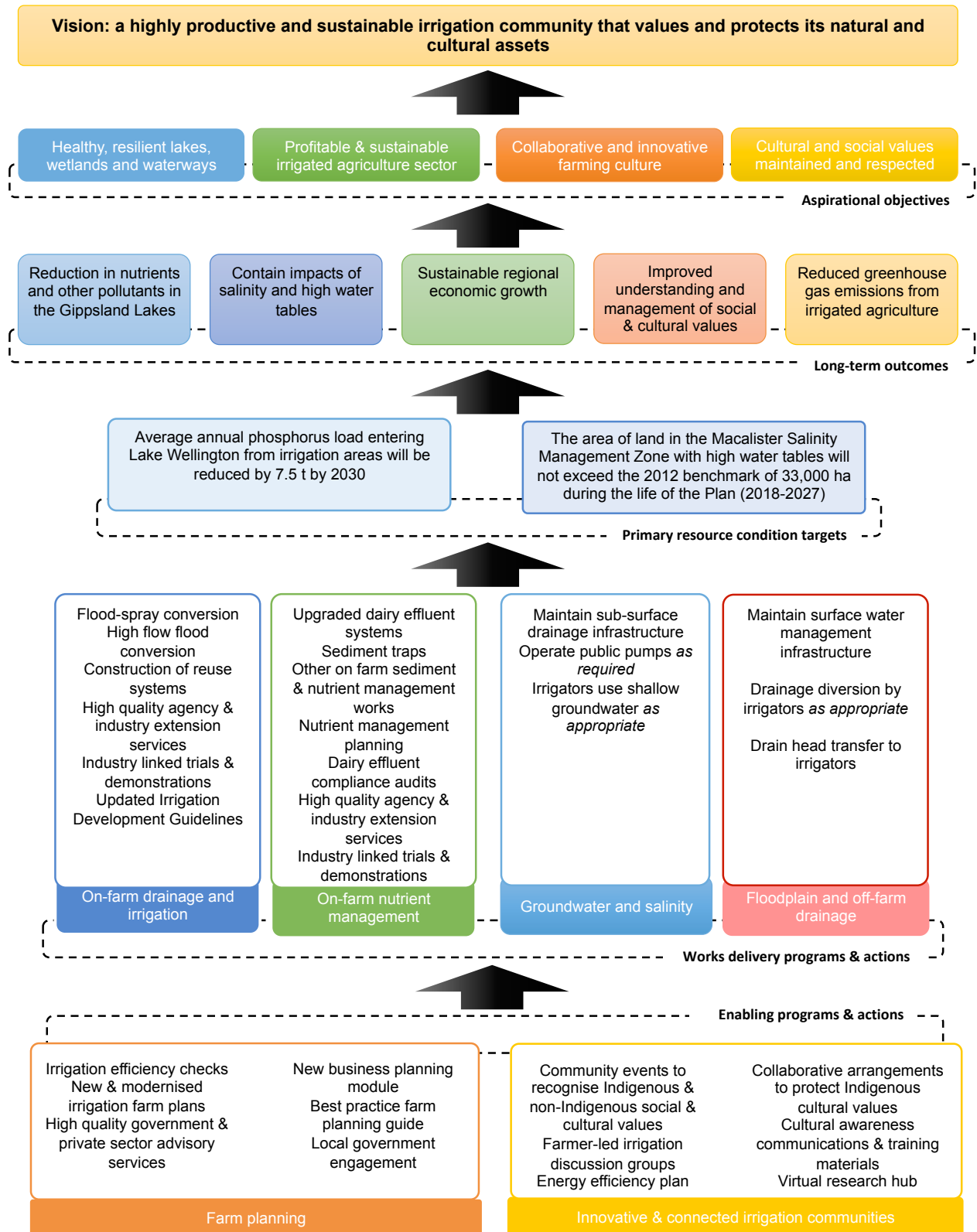


Figure 3.1 Program logic for Lake Wellington Land and Water Management Plan, linking the Plan’s programs and activities, with long-term outcomes, objectives and vision.

3.3 Long-term targets

The Plan's vision and objectives (Figure 3.1) reflect its aspirations and, as such, are not specific. However, as the Plan will be a conduit for public and private investment in those aspirations, it must also be accountable for making concrete progress. Five long-term outcomes have been defined for the Plan, each of which takes up part of the vision statement or one of the objectives. These provide a basis for setting measurable, long-term resource condition targets (RCTs) against which progress may be tracked.

The proposed long-term targets for the Plan and the programs it will deliver (Table 3.1) are grouped into two categories:

- **Primary targets:** the two primary targets relate to the Plan's main functions of improving the quality of water leaving irrigation areas and containing risks from irrigation -induced salinity and shallow water tables. These targets reflect outcomes that are most directly influenced by the programs that will be implemented under the Plan.
- **Secondary targets:** specific measures which demonstrate progress towards elements of the vision and the associated objectives and outcomes, beyond nutrient export reduction and containment of salinity and waterlogging. Progress towards the secondary targets will generally be less directly influenced by the Plan; which will be one of many influences that potentially drive or block progress towards the respective objectives and outcomes.

Table 3.1 Long-term resource condition targets for the Lake Wellington Land and Water Management Plan

PRIMARY TARGETS:	RATIONALE
Average annual phosphorus load entering Lake Wellington from irrigation areas will be reduced by 7.5 t by 2030.	<p>The target reflects the contribution that this Plan is required to make to SEPP (Waters) phosphorus load reduction target for Lake Wellington.</p> <p>Analyses undertaken during preparation of the Plan indicate that the target is achievable if its programs are successfully implemented. Pressures from expansion in irrigation and intensification of nutrient use are likely to increase the baseline phosphorus loads in the catchment, making achievement of the target more difficult if key Plan activities are not successfully implemented.</p> <p>While the target only addresses phosphorus, the Plan also seeks to reduce off-farm losses of nitrogen, sediment and pesticides. Targets for these may be developed as implementation progresses.</p>
The land area within the Macalister Salinity Management Zone with high water tables will not exceed the 2012 benchmark of 33,000 ha during the life of the Plan (2018-2027).	Salinity and groundwater issues within the MID are effectively in "care and maintenance". The Plan seeks only to contain the extent and impact of shallow water tables and irrigation-induced salinity, rather than control them. The target area is the upper range recorded since the end of the Millennium Drought.

Table 3.1 Long-term resource condition targets for the Lake Wellington Land and Water Management Plan *continued*

SECONDARY TARGETS:	RATIONALE
<p>The gross value of production from irrigated agriculture will increase by an average of 5% p.a. during the life of the Plan (2018-2027).</p>	<p>Actions in the Plan support improved on-farm production and profitability and will contribute to growth and resilience in the regional economy.</p> <p>This is a secondary target because the value of agricultural production is largely determined by factors which are outside the Plan's influence, such as: commodity prices, interest and currency exchange rates and climate variability and change.</p>
<p>By 2027, 70% of participants report increased knowledge and awareness of the Indigenous and non-Indigenous social and cultural values associated with Lake Wellington catchment irrigation areas.</p>	<p>This target relates to survey results following participation in targeted social and cultural awareness raising, engagement or capacity building activities, as outlined in the <i>Innovative and connected irrigation communities</i> program (Chapter 4.8). Surveys to benchmark understanding of social and cultural issues will be undertaken to verify progress towards this target.</p>
<p><i>Reduction in emissions or emissions intensity from irrigation land and water management.</i></p>	<p>The Plan's aim is to reduce greenhouse gas emissions intensity for irrigated agriculture. While this was supported by stakeholders, no emissions target has been set at this stage. There are several key challenges in setting such a target, including: the lack of baseline information for production systems other than dairying and the absence of means to capture data to either set or monitor progress against such a target.</p>

4 Achieving the vision and objectives

4.1 Program overview

This section summarises the programs and actions that will guide implementation of the Lake Wellington LWMP. The programs include support for on-ground works and enabling interventions, such as planning, extension service provision, research and monitoring.

Actions to implement the Plan have been grouped into six program themes, as depicted in Figure 4.1. Two programs – *farm planning and innovative and connected irrigation communities* – are primarily enabling activities, which support the four main implementation programs. While the latter include a mix of works and enabling activities, they are primarily responsible for delivering the actions by which the Plan’s objectives will be achieved.

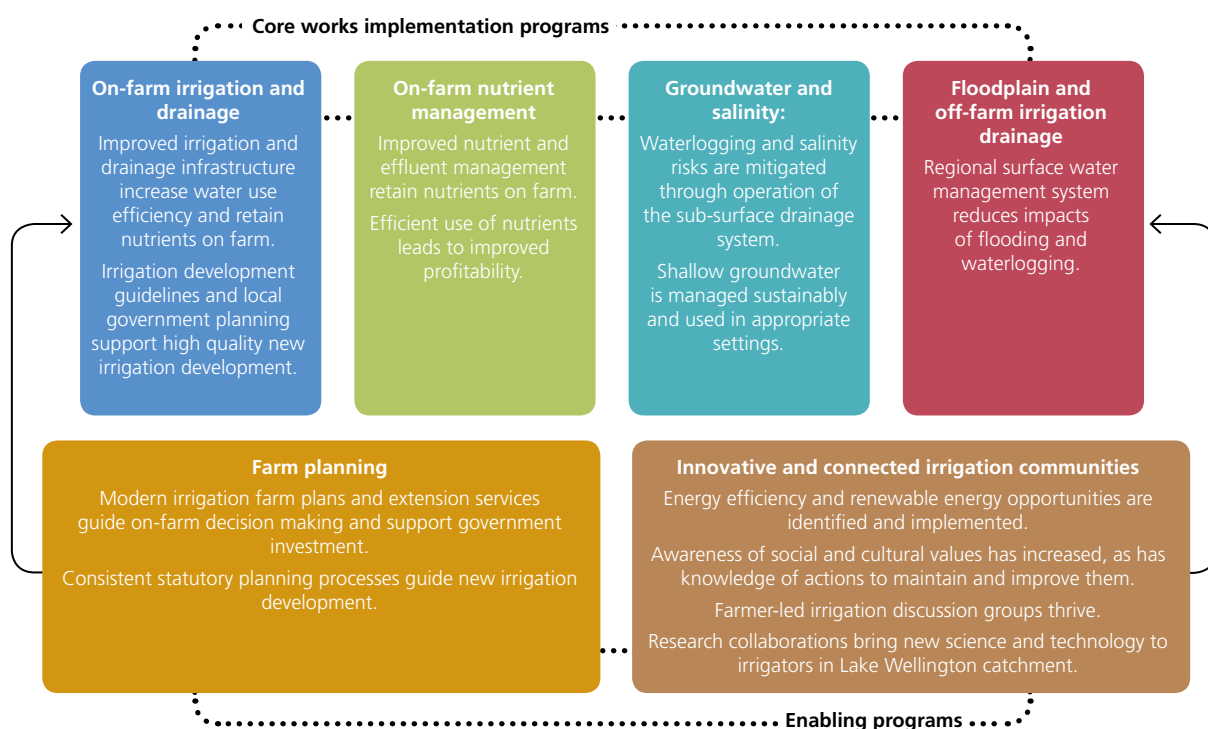


Figure 4.1 Lake Wellington Land and Water Management Plan programs and program outcomes

The Plan’s programs are described below (Chapters 4.3-4.8). These descriptions reiterate the program outcomes (from Figure 4.1), provide the rationale and context for the program, highlight the activities that the Plan advocates for and notes the delivery mechanisms. Further details of the programs, their underpinning assumptions and an analysis of their costs and benefits are given in the Plan’s technical appendices.

The Lake Wellington LWMP will initially continue the Macalister LWMP’s focus on irrigated dairying in MID and adjoining areas. As the Plan is implemented, opportunities to involve vegetable growers and other irrigators from across Lake Wellington catchment will be explored and developed. The activities described in the following sections may be adapted and new activities introduced through the Plan’s adaptive management processes (Chapter 4.9) following engagement with other industries and irrigators from across the catchment.

4.2 Prioritising actions

There is strong competition for government funding for natural resource management. In choosing where to allocate resources, decision-makers need to consider community interests, environmental and cultural values and risks to the environment. The process to assess and prioritise actions used in developing the Plan is summarised in Figure 4.2. and outlined below. Further details are provided in the Plan's technical appendices.

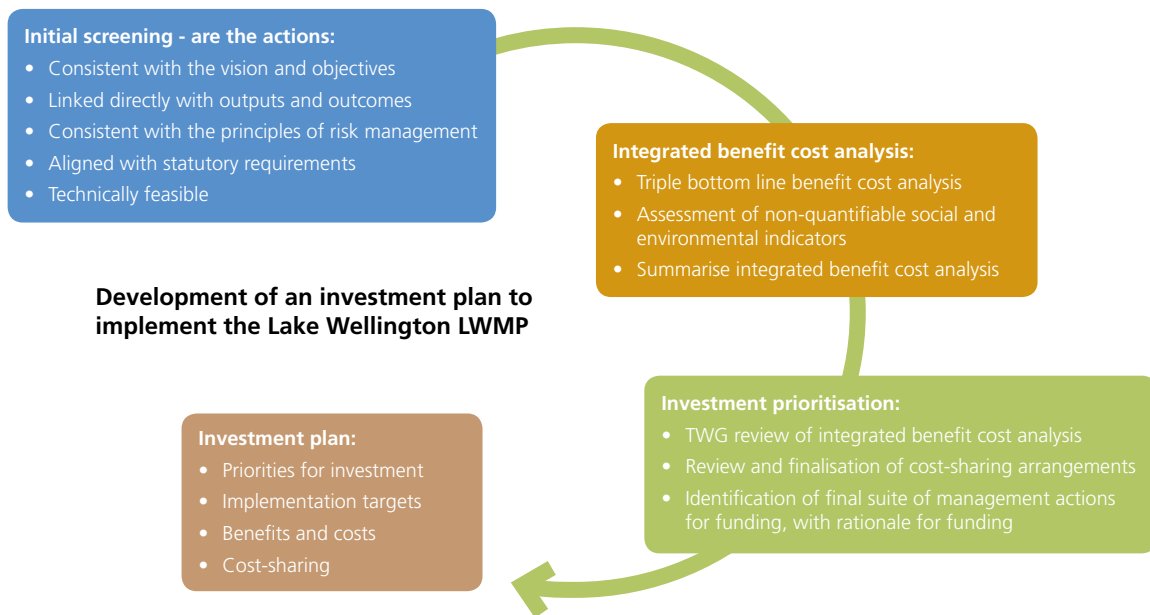


Figure 4.2 Steps in formulating the work program and investment plan for Lake Wellington Land and Water Management Plan

Recommended actions for each program were prioritised on the basis of assessments of:

- **How well they help to meet the Plan's objectives:** each of the programs was assessed in terms of their contribution to the Plan's objectives and long-term outcomes. This assessment considered the level of benefit of both enabling activities (e.g. planning, extension, capacity building) and on-ground works (Table 4.1).
- **Relative costs and benefits:** a cost-benefit analysis (CBA) was undertaken to confirm that the actions to implement the Plan are effective and cost-effective in managing any adverse effects of irrigation. Cost estimates include both capital and annual operating costs of actions over the 10 year life of the Plan (discounted to present value; PV). Public and private benefits of actions were considered in the CBA where they could be reasonably estimated (in dollar terms). Those included in the assessment were:
 - Increased pasture productivity;
 - Reduced irrigation labour requirements;
 - Water savings.

Plan benefits were assumed to be accrue over 30 years, with their value also discounted to PV. Benefits of the Plan primarily result from on-ground works. While programs and actions such as farm planning and extension enable on-ground works, they generally do not directly cause the benefit.

Reduced off-farm phosphorus discharges were estimated, but as they were not denominated in dollars, they were not included in the CBA.

- Overall cost: the cost of actions in relation to reasonable estimates of overall public investment in the Plan were considered in prioritising actions, determining targets for the amount of a given action (the management action targets, MATs) and in scheduling actions over the 10 year life of the Plan.
- Likely adoption by irrigators: priorities and MATs were also influenced by consideration of the likely level of the adoption of individual actions. Actions that were unlikely to be attractive to irrigators were either screened out or linked with other actions that would support their adoption.

The work program was developed in conjunction with the Plan's TWG. Each of the programs is described in the following sections, with further detail provided in the technical appendices.

Realising the benefits of irrigation system upgrades

A 2018 review of projects for which incentives were provided to improve on-farm irrigation efficiency measured the benefits of these upgrades.

- **Conversion of surface flood to spray irrigation:** resulted in a 75% reduction in water applied per irrigation (0.85 ML/ha to 0.21 ML/ha), with irrigation time cut in half. This allowed an extra 37 ha to be irrigated. At the same time salinity was reduced, pasture production improved and labour demands dropped.

"The return on investment is there ... the pivot paid for itself through extra irrigation and growth from extra grazings." Michael Whittaker, farm owner.

- **Best practice surface irrigation:** resulted in a 33% reduction in water applied per irrigation (0.66 ML/ha to 0.43 ML/ha), with irrigation time cut by two thirds.

"Because the flow rates are high ... we can continually recycle that irrigation water. When all the work is complete two, paddocks will be irrigated entirely from water caught on farm. Previously all this water was lost or our neighbours would benefit from it. Now we get to keep it all." Zane Carnachan, farm owner.



4.3 Farm planning program

INTENDED PROGRAM GOALS	OVERVIEW
<ul style="list-style-type: none"> • Modern irrigation farm plans guide on-farm decision making and support government investment. • Consistent statutory planning processes guide new irrigation development. 	<p>A new irrigation farm planning framework have been developed to support implementation of the Plan (see Box 4). This recognises the critical role farm planning plays in realising the economic and environmental opportunities which result from improved farm layout, irrigation supply system modernisation and upgraded irrigation systems and methods.</p>
<p>RATIONALE</p> <p>Farm planning is a tool to support irrigators as they consider their long-term objectives and drive infrastructure investments and the farm management activities that will help to achieve them.</p> <p>Farm plans help irrigators take full advantage of opportunities associated with the land and water available to them and the irrigation supply and drainage systems to which they may connect – including supply systems upgraded under MID2030. They lead to on-ground action which can improve productivity, deliver water and labour savings and enable more efficient use of fertilisers.</p> <p>Farm planning is a critical enabling action and is essential in setting a framework for practices and on-ground works that contribute directly to the Plan’s objectives and long-term outcomes.</p>	<p>After some initial outreach and adaptation activities, the farm program will be expanded from its current MID-dairy irrigator base to include non-dairy irrigators in the MID and irrigators in other parts of the Lake Wellington catchment (e.g. Thorpdale potato growers).</p> <p>Development of an IFP is essential if an irrigator wishes to access financial incentives for irrigation system improvements, where these are available under the Plan.</p> <p>AgVic extension personnel and private sector farm planners and designers will continue to support irrigators in developing and implementing their IFPs.</p> <p>Under the <i>Gippsland Irrigation Development Guidelines</i> (IDGs), an irrigation farm plan must be developed for all new irrigation developments and some major redevelopments. These Guidelines are to be revised to align with the renewed farm planning framework.</p>
<p>DELIVERY</p> <p>Leads: AgVic, WGCMA</p>	<p>WGCMA will also engage with local governments in the Lake Wellington catchment to ensure statutory planning processes for new irrigation developments are consistent and lead to high quality developments.</p>
<p>KEY ACTIONS</p>	
<ol style="list-style-type: none"> 1 Deliver a flexible and holistic irrigation farm planning and extension program that will support: <ul style="list-style-type: none"> • Irrigators in undertaking an “irrigation efficiency check” and implementing practical, low cost actions as they develop their farm plan; • Farm survey and irrigation layout/design by experienced farm planning consultants; • Farm plans that, where appropriate, include collaborative, cross-property environmental and/or infrastructure works 2 Develop farm business planning tools to support irrigation farm planning. The tools will assist irrigators in articulating their business and farm management goals, as a basis for effective farm planning. 	<ol style="list-style-type: none"> 3 Adapt irrigation farm planning concepts to upland irrigation settings, drawing on lowland irrigation farm planning and dryland whole farm planning processes. 4 Develop best practice guidelines and standards for farm planning and irrigation, based on the insights and experiences of local farm planners, designers and extension staff, as well as requirements under the Gippsland IDGs. 5 Develop consistent statutory planning processes for irrigation farm planning with local governments in the Lake Wellington catchment to help ensure high quality new irrigation developments.

Box 4. Renewed irrigation farm planning framework for the Lake Wellington Land and Water Management Plan

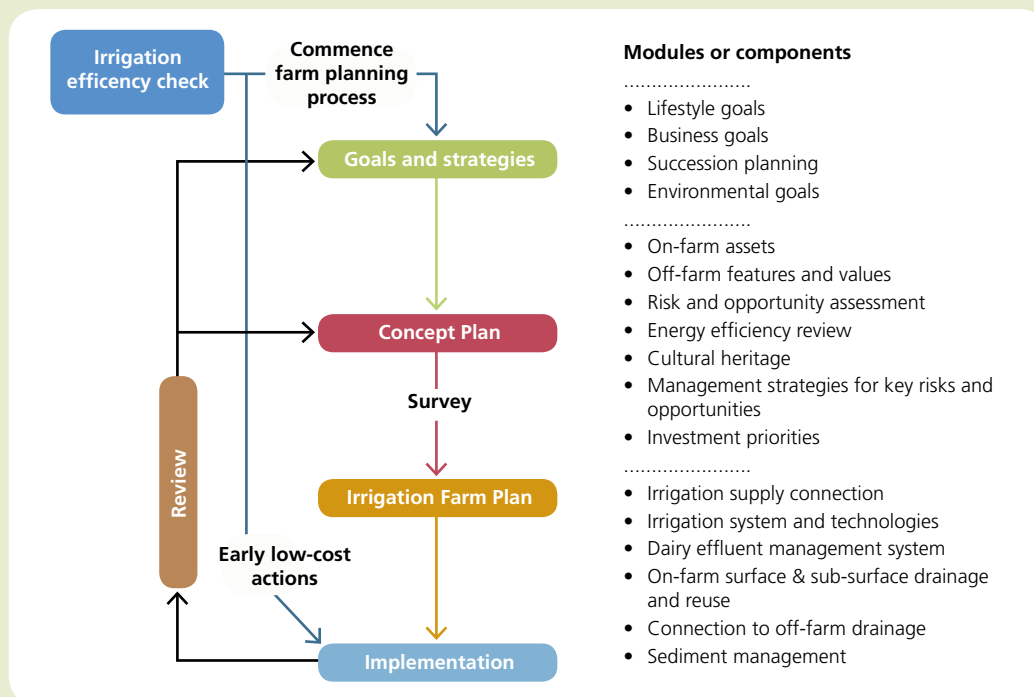


Figure 4.3 Renewed irrigation farm planning framework

The renewed farm planning framework recognises the critical role farm planning plays in realising the economic and environmental opportunities which can result from improved farm layout, irrigation supply system modernisation and upgraded irrigation systems and methods.

Key features of the renewed approach are depicted above. This is a guide to the overall process: irrigators will have considerable flexibility in selecting the components that best relate to their operations and needs. The farm plan should be reviewed periodically to ensure it remains relevant to the irrigator's goals and strategies and that the concept plan, irrigation design and management systems are all working effectively.

The farm planning process will continue to be delivered by AgVic extension staff and private irrigation planners and designers. The main components are:

- **Irrigation efficiency check:** an AgVic extension officer will undertake a check on the efficiency of current irrigation systems and (for dairy operations) the management and operation of effluent systems. A brief report will advise on low cost early actions to address key risks and/or opportunities.
- **Goals and strategies:** an AgVic extension officer will work with the irrigator to define or understand goals and objectives to help set directions for the concept plan and irrigation farm plan.
- **Concept plan:** maps and text which describe on-farm assets (of all kinds) and the landscape setting for the farm. The concept plan will reflect risks and opportunities associated with native vegetation, flooding, high water tables, waterways, irrigation and drainage systems etc. It will inform how farm layout and management (etc.) can address key risks and take up opportunities. It could include energy audits and planned energy efficiency measures, as well as joint works with neighbours across property boundaries, where this is appropriate.
- **Irrigation farm plan (IFP):** a detailed topographic survey will be undertaken to inform the development of the IFP. It will address the management and movement of water around and from the property and all key risks (including nutrient and sediment movement) associated with this. The IFP may address: irrigation delivery and layout, earthworks, irrigation system design and management (including reuse), dairy effluent management systems and sediment trap locations and operation.

4.4 On-farm irrigation and drainage program

INTENDED PROGRAM GOALS	OVERVIEW
<ul style="list-style-type: none"> • Irrigation and drainage infrastructure improve water use efficiency & retain nutrients on farm. • Irrigation development guidelines and local government planning support high quality new irrigation development. 	<p>Historically, this program has delivered works (within the MID) which have provided significant water savings and reduced off-farm nutrient and sediment losses. This has improved production and benefited local waterways and Lake Wellington.</p>
<p>RATIONALE</p> <p>The program will be the Plan's main delivery program. It supports the implementation of works and measures described in irrigation farm plans and, within the MID, it enables irrigators to take advantage of irrigation supply systems which have been upgraded under MID2030.</p> <p>This program enables irrigators to improve irrigation water use efficiency and generate water savings which can then be used to drive on-farm production and profitability improvements. Related activities under this program also reduce labour requirements, thereby lowering costs and/or improving work-life balance for irrigators.</p> <p>Planning requirements for new irrigation developments and major redevelopments under the Gippsland IDGs are coordinated under this program.</p>	<p>The program will be expanded to include dairying and other irrigated livestock operations in areas outside the MID and irrigated vegetable-growing or (other) horticultural operations throughout Lake Wellington catchment.</p> <p>The program will support:</p> <ul style="list-style-type: none"> • Construction of irrigation reuse systems on properties with flood irrigation; • Conversion of conventional flood irrigation systems to spray, pressurised drip or high flow flood irrigation systems (where these are appropriate to the soil type); • Application of technologies (e.g. soil moisture sensors, controllers for irrigation system automation) and practices which improve water efficiency and/or reduce labour requirements; • MID irrigators connecting to SRW's upgraded irrigation supply system. <p>A collaborative model of extension service provision is proposed, whereby public and private service providers and industry organisations support each other and integrate across the all key aspects of irrigation farming and irrigation land and water management.</p>
<p>DELIVERY</p> <p>Leads: AgVic, WGCMA, SRW</p>	
<p>KEY ACTIONS</p>	
<ol style="list-style-type: none"> 1 Provide high quality extension services and, as appropriate, financial incentives to support improvements in on-farm irrigation infrastructure and management practices to improve irrigation water use efficiency. 2 Provide high quality extension services and financial support for the construction or expansion of irrigation reuse systems and related works to help retain nutrients and sediment on-farm. 3 Provide extension services and coaching for irrigators to enable on-going improvements in irrigation efficiency. 	<ol style="list-style-type: none"> 4 Develop industry partnerships to establish local, on-farm demonstrations and trials of best practice irrigation management. Where appropriate, these will integrate across on-farm irrigation and drainage and on-farm nutrient management. <p>Priorities for trials and demonstrations will be developed in conjunction with industry partners and irrigators and apply to dairy and horticulture sector.</p> <ol style="list-style-type: none"> 5 Revise and update the Gippsland IDGs to set best practice standards for on-farm irrigation systems and practices for new or modified irrigation developments. 6 Investigate the issues, benefits and impacts of a proposal to increase reuse dam size limits.

4.5 On-farm nutrient management program

INTENDED PROGRAM GOALS	OVERVIEW
<ul style="list-style-type: none"> Improved nutrient and effluent management retain nutrients on farm. Efficient use of nutrients leads to improved profitability. 	<p>This program supports achievement of the SEPP (Waters) target for reduction of phosphorus inputs from irrigation land and water management in Lake Wellington catchment. It also aims to reduce off-farm losses of nitrogen and sediments, which also affect the health of the Gippsland Lakes and local waterways and wetlands.</p>
<p>RATIONALE</p> <p>This program is a new initiative of the Lake Wellington LWMP. It reflects the objectives of the Plan and its key role in meeting the SEPP (Waters) phosphorus load reduction target for Lake Wellington.</p> <p>The program makes sense from an irrigator's perspective: given the cost-price pressures they face, it is essential that they maximise the effectiveness of their investments in fertiliser and use other sources of nutrients (purchased feed, dairy effluent) to best effect.</p> <p>By improving the efficiency of nitrogen use within irrigation farming systems, the program also has potential to reduce emissions of nitrous oxide, which is a potent greenhouse gas.</p>	<p>The nutrient management program will be underpinned by:</p> <ul style="list-style-type: none"> Farm planning: to guide actions which manage off-farm movement of nutrients and sediment; On-farm irrigation and drainage management: which allow nutrients to be captured and reused on farm; Trials and extension services: to support adoption of current best practices for nutrient management and to trial and demonstrate emerging practices which may further improve nutrient use efficiency and reduce off-farm losses; Research and monitoring: to better understand the sources and movement of nutrients in Lake Wellington catchment and assess the effectiveness of this Plan.
<p>DELIVERY</p> <p>Leads: AgVic, WGCMA, GippsDairy, EPA, horticultural industry</p>	<p>Partnerships will be developed to establish local, on-farm demonstrations and trials of best practice nutrient management. As applicable, these will be integrated with demonstrations and trials of best practice in irrigation management.</p>
<p>KEY ACTIONS</p>	
<ol style="list-style-type: none"> Provide financial incentives to irrigators to be trained to develop and implement nutrient management plans for their properties. Provide extension services and financial incentives to improve the design and management of dairy effluent systems and undertake other measures that retain nutrients and sediment on farm. Develop industry partnerships to establish local, on-farm demonstrations and trials of best practice nutrient management (as appropriate, with on-farm irrigation and drainage). Priorities for trials and demonstrations will be developed in conjunction with industry partners and irrigators and apply to dairy and horticulture sector. 	<ol style="list-style-type: none"> EPA will continue compliance monitoring to ensure that dairy effluent management systems conform to regulatory standards. Research to improve understanding of the sources and movement pathways of nutrients lost from irrigation farms and how these may be affected by horticultural expansion and potential new irrigation developments. Provide financial incentives for vegetable growers to construct silt (sediment) traps to capture sediments and nutrients that would otherwise be lost from their farms. Develop an agreed agency-industry position and approach on the management of dairy effluent on irrigation farms.

4.6 Groundwater and salinity program

INTENDED PROGRAM GOALS	OVERVIEW
<ul style="list-style-type: none"> Waterlogging and salinity risks are mitigated through operation of the regional SSD system. Shallow groundwater is managed sustainably and used in appropriate settings. 	<p>Groundwater is a significant source of water for irrigation in the Lake Wellington catchment, particularly around the Macalister SMZ. Management of the resource is complex.</p>
RATIONALE	<p>Groundwater is typically taken from shallow “shoe string” sand aquifers and is used to supplement surface water supplies. During extended wetter periods, the water table in these aquifers approaches the land surface, leading to waterlogging and land salinisation. These threaten agricultural productivity, environmental features and infrastructure (particularly roads).</p>
<p>This program implements the successful strategy for irrigation salinity of the West Gippsland SMP (2005). It applies to the Macalister Salinity Management Zone (SMZ), which includes the MID and its immediate environs (Figure 4.3).</p> <p>Irrigation-induced salinity is primarily addressed by reducing groundwater recharge, via improvements in irrigation efficiency. Groundwater pumping (via the regional sub-surface drainage infrastructure and private pumps) is implemented where high value assets will either not be protected by recharge control methods or will not be protected in a timely way.</p> <p>Salt tolerant crops and pastures are encouraged to improve productivity and reduce soil erosion in areas not serviced by groundwater pumping or recharge control.</p>	<p>Since their peak in the 1990s, water tables have fallen across the MID. This reflects the influence of the Millennium drought and major improvements in irrigation efficiency. However, water table levels may rise rapidly during wetter periods and continue to pose a threat in some areas.</p>
DELIVERY	<p>SSD provided by public and private groundwater pumps in the MID has helped to manage salinity risks, particularly during wetter climate phases. This program aims to ensure SSD infrastructure has the capacity and operational readiness to respond to wetter climate phases and contain the effects of salinity and waterlogging.</p>
<p>Leads: SRW, AgVic, WGCMA</p>	<p>Salinity issues are also present outside of the Macalister SMZ. If new incidences of irrigation-induced salinity develop to the point where they threaten key environmental or infrastructure assets, responses will be developed through the Plan’s adaptive management processes (Chapter 4.9).</p>
KEY ACTIONS	
<ol style="list-style-type: none"> Maintain the Macalister SMZ’s public SSD infrastructure, including renewing bores and pumping systems as they reach the end of their operating lives. SRW is encouraged to apply an asset management framework for the sub-surface drainage system and review energy efficiency and/or renewable energy opportunities associated with its operation. Irrigators with groundwater licences will be encouraged to continue to use shallow groundwater for irrigation, when it is available and of suitable quality, in accordance with local groundwater management rules. 	<ol style="list-style-type: none"> Periodic reviews of management arrangements for the use of shallow groundwater to ensure these support effective use of the resource and management of salinity risks. Provide high quality extension services to support farmers in areas of salinity and shallow water tables to “live with salinity”. This includes providing advice to support the establishment and sustainable management of appropriate, generally salt-tolerant pastures, fodder or crops.

4.7 Floodplain and off-farm irrigation drainage program

INTENDED PROGRAM GOALS	OVERVIEW
<p>Regional surface water management system reduces impacts of flooding and waterlogging.</p>	<p>The MID is drained by a system of natural waterways and constructed drains. These collect and remove rainfall run-off, excess irrigation water, outfalls from irrigation channels and discharges from public groundwater pumps.</p>
<p>RATIONALE</p> <p>The program primarily addresses irrigation drainage management within the MID in accordance with the priorities of the Victorian Irrigation Drainage Program.</p> <p>WGCMA's Floodplain Management Strategy and the Victorian Rural Drainage Strategy (Draft) address rural drainage and floodplain management issues elsewhere in Lake Wellington catchment.</p> <p>The irrigation drainage system helps to reduce the effects of flooding on farming land and infrastructure and is the primary route by which nutrients and sediments lost from irrigation farms find their way into local waterways and wetlands and, ultimately, Lake Wellington.</p>	<p>Construction of irrigation reuse systems, improvements in irrigation water use efficiency and irrigation supply system upgrades under MID2030 have reduced drain flows. These and drier climate conditions have helped to lower water tables and reduced the need for SRW to operate the sub-surface drainage system. Under non-flood conditions, drains now discharge fewer nutrients and less salt into natural waterways and Lake Wellington.</p> <p>The Plan will continue to support diversion of drain flows for irrigation in appropriate settings. However, the relevance of drain diversion is expected to continue to decline with on-going irrigation efficiency improvements, increased reuse and further MID2030 supply system upgrades.</p> <p>Transfer of SRW drain heads to irrigators to enable irrigation reuse will continue to be supported.</p> <p>Some Victorian CMAs are working with irrigators to reinstate natural floodplain flow pathways as a means of improving surface drainage and the health of waterways and wetlands. In conjunction with WGCMA's floodplain management program, the Plan will support consideration of opportunities to improve the health and function of natural waterways and water bodies on irrigation farms.</p>
<p>DELIVERY</p> <p>Leads: SRW, AgVic</p>	
<p>KEY ACTIONS</p>	
<ol style="list-style-type: none"> 1 Continuation of transfers of SRW drain heads to irrigators to enable tail water to be harvested and reused on farms. 2 Diversion of drainage water by irrigators where it is available and water quality is suitable. 3 Consideration of planning and funding mechanisms to improve the health and function of the natural and constructed surface drainage systems and health of waterways and wetlands. 	<ol style="list-style-type: none"> 4 Research to investigate opportunities for drains and floodplain waterways and wetlands to be managed to capture or use nutrients carried off-farm during small-medium floods/rain flow events. 5 Research to quantify changes in streamflows resulting from on and off-farm irrigation and drainage management activities supported by the Plan and to assess their impacts. 6 On-going maintenance of regional surface water drainage system that is retained under SRW operational control.

4.8 Innovative and connected irrigation communities program

INTENDED PROGRAM GOALS	OVERVIEW
<ul style="list-style-type: none"> • Energy efficiency and renewable energy opportunities are identified and implemented. • Awareness of social and cultural values has increased, as has knowledge of actions to maintain and improve them. • Farmer-led irrigation discussion groups are thriving. • Research collaborations bring new science and technology to irrigators. 	<p>Innovative irrigation</p> <p>Irrigation land and water management programs can reduce emissions by more efficient use of water, energy and nitrogenous fertilisers, better management of dairy effluent and on-farm renewable energy generation. Adoption of these technologies will be supported in farm planning and by developing an irrigation energy efficiency plan. These measures may also help to overcome issues of poor electricity supply reliability that are faced by some irrigators and challenges associated with high energy prices.</p>
<p>RATIONALE</p> <p>New thinking and adaptive management are required to enable the catchment's irrigation sector to be sustainable, profitable and resilient.</p> <p>Shifts in land use and new technology are driving changes to farming practices and improving real-time management. Climate variability and climate change, consumer preferences and market forces are shaping irrigation industries. New policy seeks to strengthen links between land and water management and the social and cultural values of local communities and Traditional Owners.</p> <p>This program consolidates the Plan's responses to the changing environment for irrigation land and water management.</p>	<p>A network will be formed to facilitate engagement of the science and technology community in irrigation land and water management research that is relevant Lake Wellington catchment.</p> <p>Connected irrigation communities</p> <p>The Plan recognises cultural and social values associated with land and water. Gunaikurnai and farmers are custodians of land in the catchment. Activities will be supported that bring irrigation communities together to share perspectives, appreciate each other's connections to land and Country and collaborate in protecting areas with high cultural value.</p> <p>Collaborative relationships between irrigators will allow them to learn from each other as they innovate and trial new equipment and practices. Farmer-led irrigator discussion groups to support farm planning, irrigation efficiency, nutrient management planning and implementation will be supported.</p>
<p>DELIVERY</p> <p>Leads: WGCMA, AgVic, GLaWAC, local governments</p>	
<p>KEY ACTIONS</p>	
<p>Innovative irrigation</p> <ol style="list-style-type: none"> 1 Develop an on-farm energy efficiency and renewable energy module for delivery within the farm planning framework. 2 Prepare an irrigation energy efficiency plan for Lake Wellington catchment to document how appropriate renewable energy and energy efficiency opportunities appropriate can be developed. 3 Develop a farm planning module for cultural heritage planning and management. 4 Facilitate irrigation land and water management research collaborations that address regional research priorities. 	<p>Connected irrigation communities</p> <ol style="list-style-type: none"> 5 Develop communications and cultural awareness training materials related to Indigenous cultural values, Native Title and protection of cultural heritage for irrigation areas. 6 Develop and support collaborative arrangements between irrigators and Gunaikurnai to protect cultural heritage values. 7 Hold annual community events which recognise Indigenous and non-Indigenous cultural and social values associated with Lake Wellington irrigation areas. 8 Facilitate farmer-led irrigator discussion groups which support (e.g.) farm planning, irrigation efficiency, nutrient management planning and implementation. 9 Engage with financial and other support services about irrigation land and water management issues.

4.9 Overall evaluation of Land and Water Management Plan programs

The Plan's programs and actions were assessed financially and against its objectives and outcomes (Figure 4.2; Table 4.1). The financial analysis shows that the benefits from implementing the Plan are estimated to significantly exceed the costs of doing so, with the overall benefit-cost ratio (BCR) calculated to be approximately 1.6. Sensitivity testing indicated that while the BCR varies with some of the assumptions underpinning the analysis, it exceeds one and the Plan remains financially attractive under a wide range of conditions.

Costs and benefits associated with the programs vary. The main enabling programs (farm planning, innovative and connected irrigation communities) are critical to the success of the Plan, but as discussed in Chapter 4.2, provide minimal direct (financial) benefit and have limited direct impact on natural resource condition. The main on-ground works programs (on-farm irrigation and drainage, on-farm nutrient management, groundwater and salinity) deliver the actions that directly provide the financial benefits accounted for in the CBA. These programs also incur most of the implementation costs, with these mainly shared between irrigators and the State Government.

The programs also vary in their expected contribution to the Plan's objectives and long-term outcomes (Table 4.1). The key enabling programs (farm planning, innovative and connected irrigation communities) have high enabling benefit for most objectives and outcomes, but do not directly cause the objectives or outcomes to be achieved. The main works implementation programs, particularly on-farm irrigation and drainage and on-farm nutrient management, include important enabling activities (e.g. extension, trials and demonstrations), as well as on-ground works that will directly contribute to achieving the Plan's objectives and outcomes.

Implementation of the Plan, including both the key enabling and on-ground works activities, *at the level of adoption and support proposed*, should contribute to the achievement of at least the two primary resource condition targets: to reduce phosphorus loadings into Lake Wellington by 7.5 t/y and contain the area affected by shallow water tables and salinity to the 2012 benchmark area.

4.10 Cost sharing

Establishing that the Plan is efficient and should improve community welfare was a critical first step before considering how implementation should be paid for and by whom. Three potential models of cost-sharing were considered:

- **Polluters pay:** where entities whose actions are causing the effects (e.g. poor water quality in Lake Wellington, shallow water tables and irrigation-induced salinity) that create the need to implement the Plan share the costs of doing so.

Turning dairy effluent into energy

Innovative biodigester technologies are being developed to generate renewable energy from dairy effluent. This offers the prospect of

- Managing odours associated with the application or reuse of dairy effluent;
- Reducing greenhouse gas emissions by capturing and burning methane to produce electricity. While the combustion process produces carbon dioxide, this has just 4% of the global warming potential of methane;
- Reducing reliance on sometimes unreliable grid electricity supplies; and
- Retaining nutrients in the biosolids for use on-farm.

The technology, which has been adapted from systems generating energy from piggery effluent, is being developed by Ballarat-based engineering firm Gecko and is being trialled on a large dairy farm at Bungaree.

Table 4.1 Summary of overall evaluation of Lake Wellington Land and Water Management Plan programs.

FINANCIAL COSTS & BENEFITS ¹		CONTRIBUTION TOWARDS PLAN OBJECTIVES AND OUTCOMES ^{2,3,4}									
Programs:	Objectives					Outcomes					
	Costs	Direct benefits	Profitable agriculture ¹	Healthy waterways ²	Culture of innovation ³	Cultural values ⁴	Economic growth ^A	Contain salinity ^B	Cultural values ^C	Reduced nutrients ^D	Reduced emissions ^E
Farm planning	\$2.2M	\$0M	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●
On-farm irrigation & drainage	\$25.4M	\$49.9M	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●
On-farm nutrient management	\$22.6M	\$22.3M	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●
Groundwater & salinity	\$1.2M	\$8.5M	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●
Floodplain & off-farm drainage	\$0.5M	\$0M	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●
Innovative & connected irrigation communities	\$0.9M	\$0M	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●	●●●●
Total	\$51.8M	\$80.7M									

Note:

- Costs: capital and annual operating costs over 10 year life of Plan, discounted to PV. Benefits – value of benefits over 30 years, discounted to PV. Both public and private costs and benefits are included. Note that benefits from reduced off-farm nutrient exports have not been monetised.
- Objectives: 1 – Profitable and sustainable irrigated agriculture sector; 2 – Healthy, resilient lakes, wetlands and waterways; 3 – Collaborative and innovative farming culture; 4 – Cultural and social values maintained and respected.
- Outcomes: A – Sustainable regional economic growth; B – Contain impacts of salinity and high water tables; C – Improved understanding and management of social and cultural values; D – Reduction in nutrients and other pollutants in the Gippsland Lakes; E – Reduced greenhouse gas emissions from irrigated agriculture.
- Level of benefit for enabling actions: ●●●● no benefit – ●●●● high benefit
- Level of benefit for on-ground works: ●●●● no benefit – ●●●● high benefit

- **Beneficiaries pay:** where entities who would benefit from implementation of the Plan (e.g. local governments whose roads are protected from salinity and waterlogging) share the costs of implementation.
- **Government pays:** in situations where there is evidence of market failure, public good involvement and/or information failure, a case may be argued for government investment.

The case for government cost-sharing was assessed for each of the proposed actions under the Plan. Cost-sharing was considered to generally be appropriate for enabling programs and activities (e.g. farm planning, research, capacity building activities, monitoring), usually on the basis of market failure and the limited direct private benefit. Government cost-share is also recommended for on-ground works programs and actions that provide significant public benefit, but minimal private benefit. Where the actions provide significant private benefit (exceeding the cost of the action), government cost-share is only recommended for the enabling extension services.

The Plan recommends that government cost-sharing is provided to support several types of activities that are proposed to be undertaken by irrigators, as per Table 4.2. Cost-share support for these activities (if any) will be determined by WGCMA, in conjunction with investors, including DELWP's Sustainable Irrigation Program. The availability of cost-share support for some activities (e.g. irrigation system upgrades) may be limited to particular soil types. Costs share availability will be reviewed periodically as part of the Plan's adaptive management process (Chapter 5).

Table 4.2 Proposed irrigator-implemented actions to receive government cost-share support

PROGRAMS:	IRRIGATOR ACTIONS PROPOSED FOR GOVERNMENT COST-SHARE SUPPORT
Farm planning	Irrigation efficiency check; new and modernised irrigation farm plans.
On-farm irrigation and drainage	Construction of irrigation reuse systems (properties with flood irrigation); flood to spray (or drip) conversion, best practice surface irrigation on appropriate soils.
On-farm nutrient management	Participation by dairy irrigators in nutrient management planning programs; implementation of applicable nutrient management actions by dairy irrigators; construction of silt traps by horticultural irrigators

5 Adaptive management and measuring success

5.1 The adaptive management process

A Monitoring Evaluation Reporting and Improvement (MERI) Plan (summarised here) has been developed to improve confidence and embed adaptive management processes in the implementation of the Lake Wellington LWMP (see the LWMP's Technical Appendices). It provides the structured evaluation, reporting and improvement processes to support the Plan's implementation (Figure 5.1) and:

- Defines the program logic underpinning the Plan's targets and outcomes (summarised in Figure 3.1);
- Identifies measures and monitoring requirements by which progress towards outcomes and targets may be tracked; and
- Describes data collection approaches and processes for evaluation, reporting and adaptive management.

The MERI plan has been informed by several existing frameworks, including those developed for natural resource management programs by the Australian and Victorian Governments.



Figure 5.1 Adaptive management process for the Lake Wellington Land and Water Management Plan.

Adaptive management processes for the LWMP occur across three phases:

- **Strategy and planning:** planning for irrigated land and water management in the Lake Wellington catchment is guided by a legislative and strategic framework that includes:
 - Applicable legislation, including the *Environment Protection Act 1970*, *Planning and Environment Act 1987*, *Water Act 1989*, *Catchment and Land Protection Act 1994*, *Traditional Owner Settlement Act 2010*;
 - Regulations, particularly the SEPP (Waters) and local government planning schemes;
 - Victorian Government policy, particularly as described in *Water for Victoria*, the state's Water Plan;
 - Regional priorities for natural resource management as described in WGCMA's *Regional Catchment Strategy* and local government planning schemes and environmental strategies.

Community and stakeholder perspectives, together with this legislative and strategic framework, inform the priorities, targets and programs which are developed to achieve the Plan's objectives.

- **Implementation and monitoring:** implementation of the Plan follows Victorian Government investment planning processes. An annual works program will be developed and delivered with partner organisations, including AgVic and SRW. Monitoring of implementation, assessment of change in environmental or resource condition and targeted research all form important components of the Plan's implementation phase.
- **Evaluation, reporting and improvement:** evaluation and reporting will occur regularly throughout the ten-year life of the Plan, follow agreed and documented MERI processes and build on the program logic developed for the Plan (summarised in Figure 3.1). These processes will provide the basis for measuring the success of the Plan, reporting to government on progress towards targets and informing adjustments to program design and annual work programs.

Evaluation and reporting activities will be carried out over three timescales:

- **Annual review:** to consider the activities which have been undertaken and their direct outputs. It will identify new knowledge gained from implementation, research or monitoring and may propose changes or adjustments to planned activities in response to this knowledge. An annual progress report will be produced that outlines implementation highlights and achievements and any challenges.
- **Mid-term review (5 years):** to consider implementation achievements and progress towards program goals and overall Plan outcomes. It will also consider how the key influences on irrigation land and water management within the Lake Wellington catchment are changing. New knowledge and information gathered through this review will inform changes to delivery approaches and intended program outcomes. The review report will describe progress towards RCTs, achievement of MATs, any lessons learned and will propose improvements in programs and program delivery.
- **Final review and evaluation (10 years):** an overall assessment of the Plan's achievements and progress towards outcomes and targets will be conducted. It will provide the evidence base of lessons learned and improvements implemented over the life of the Plan and provide a basis for future land and water management planning processes. The final review report will describe the Plan's overall achievements, including in relation to the MATs, RCTs and other, longer term outcomes. It will comment on the effectiveness, impact, appropriateness and efficiency of implementation, program legacies and any emerging needs and priorities for future plans.

5.2 Land and water management program governance

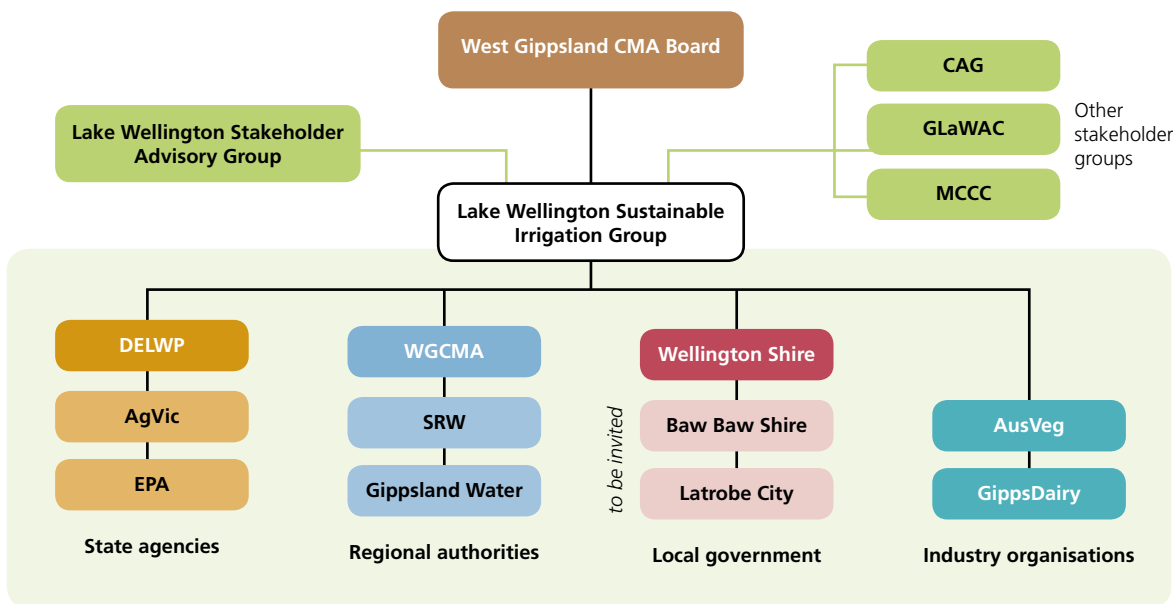
The MERI Plan will be supported by robust governance arrangements, with leadership provided by WGCMA in conjunction with the proposed Lake Wellington Sustainable Irrigation Group (LWSIG, see below). The LWSIG will engage with stakeholder groups, as required, to inform adaptive management. The SAG formed to support development of this Plan will be renewed, with new membership providing a formal avenue of advice and feedback through the Plan’s implementation phase. The composition and roles of the two groups are outlined below:

- Lake Wellington Sustainable Irrigation Group:** program governance for the new LWMP will operate under a the LWSIG (Figure 5.2). This group will focus on adaptive management of the Plan’s programs, coordinate MERI processes and drive collaborative research and innovation activities.

The LWSIG will continue to engage with the current MID stakeholder groups and will also reach out to GLaWAC to facilitate engagement with the catchment’s Traditional Owners, and to industry and irrigator groups in other parts of the Lake Wellington catchment.

Composition of the LWSIG is outlined in Figure 5.2. It will initially comprise the former MID Sustainable Irrigation Group, with representations from the organisations forming the TWG the development of this Plan. Given that the geographic scope of the Plan includes the entire Lake Wellington catchment, it is proposed that Baw Baw Shire and Latrobe City Council be invited to participate in the LWSIG (with Wellington Shire). The LWSIG will report and be accountable to WGCMA’s Board.

- Lake Wellington Stakeholder Advisory Group:** a new and ongoing SAG will be formed to help guide implementation of the Plan and ensure its programs remain relevant to the needs of irrigators. The group will initially include irrigators from the MID. Participation from horticultural irrigators in the MID and irrigators in other parts of the catchment will be sought as the Plan is implemented.



DELWP	Department of Environment, Land, Water & Planning	SRW	Southern Rural Water
AgVic	Agriculture Victoria	CAG	Catchment Advisory Group
EPA	Environment Protection Authority	GLaWAC	Gunaikurnai Land and Water Aboriginal Corporation
WGCMA	West Gippsland Catchment Management Authority	MCCC	Macalister Customer Consultative Committee

Figure 5.2 Proposed governance arrangements for Lake Wellington Land and Water Management Plan

5.3 Knowledge gaps

The Lake Wellington LWMP has been developed using the best available information, including a detailed review of the Macalister Irrigation District LWMP and a review of the science about impacts of irrigation land and water management on the health of the Gippsland Lakes.

The process of developing this Plan has highlighted several important knowledge gaps. These are to be addressed through a variety of research and development activities, the development of best practice guides, establishment of on-farm trials and demonstrations and new or expanded resource condition monitoring. Each of the recommended activities is included in the program descriptions in Chapters 4.3-4.8, but have been summarised in Table 5.1. These activities will play an important role in adaptive management and improvement processes as the Plan is implemented.

Under the innovative and connected irrigation communities program, it is proposed to develop a network for irrigation land and water management research collaboration. Its aim will be to facilitate increased research engagement in the catchment's irrigation land and water management challenges. The network will be co-ordinated through the LWSIG.

Table 5.1. Summary of proposed activities to fill key irrigation land and water management knowledge gaps

TYPE OF ACTION	RECOMMENDED ACTIVITY AND RATIONALE
Research and investigation initiatives	<ul style="list-style-type: none"> • Nutrient sources and movement pathways: research to improve understanding of the sources and movement pathways of nutrients lost from irrigation farms and how these may be affected by horticultural expansion and potential new irrigation developments. Despite a long history of research, there remain important gaps in understanding of on-farm sources of nutrients reaching the Gippsland Lakes from irrigation farms and of their movement pathways. This initiative will build on existing science and water quality to provide new insights into how to reduce the impacts of irrigation on the health of local waterways and the Lakes, particularly in the face of land use and management practice change. • Off-farm nutrient management: an investigation of opportunities for drains and floodplain waterways and wetlands to be managed to capture or use nutrients carried off-farm during small-medium floods/rain flow events. There is strong evidence from the literature that wetlands and other vegetated environments can be used to remove nutrients from water flows. While they will have limited effectiveness during flood events, this investigation will explore opportunities to use and manage local wetlands and waterways to capture nutrients that move off-farm during smaller flow events, before they can reach Lake Wellington. • Flow impacts of improved irrigation efficiency: on-farm irrigation efficiency measures supported by the plan, including irrigation reuse reduce off-farm movement of water. This investigation will seek to quantify these changes and assess their significance for riparian and waterway environments. • Planning and funding mechanisms for floodplains: a review of opportunities to improve, through alternative planning arrangements, the function of the natural and constructed surface drainage systems and health of waterways and wetlands.
On-farm trials and demonstrations	Local, on-farm trials and demonstrations of best farming practice systems will be established. These will address on-farm irrigation and drainage and the management of sources of nutrient and sediments in pasture and vegetable production systems. These will involve collaboration with industry, with priorities determined through irrigator and industry engagement. Trials will support extension and capacity building activities with irrigators.

Table 5.1. Summary of proposed activities to fill key irrigation land and water management knowledge gaps *continued*

TYPE OF ACTION	RECOMMENDED ACTIVITY AND RATIONALE
New farm planning modules & best practice guides	<p>Several new farm planning modules are proposed to align with the revised irrigation farm planning framework developed for this Plan and the Plan's vision and objectives. These will be available to irrigators as part of the implementation of the farm planning program. Some be adapted from existing tools and information sources:</p>
	<p>Business planning tools: to support the initial stage of farm planning, by helping irrigators articulate and develop their business and farm management goals.</p> <ul style="list-style-type: none"> • Upland irrigation: guidance on irrigation management is typically for "lowland" irrigation areas like the MID and Goulburn Murray Irrigation District (GMID). This module will provide guidance that is relevant to irrigation in upland environments in the Lake Wellington catchment, including the Thorpdale area. • On-farm energy efficiency and renewable energy: this is intended to assist irrigators who are looking to reduce energy costs, their exposure to effects of unreliable or inadequate local grid electricity sources, as well as greenhouse gas emissions associated with their operations. • Cultural heritage: this module will look to help farmers pro-actively identify and maintain Aboriginal artefacts and cultural values associated with their properties – with assistance from Traditional Owners. • Best practice irrigation planning guide: an overall guide for irrigators on best practice irrigation farm planning that draws on the insights and experiences of local farm planners, designers and extension staff.
Monitoring	<p>The Plan supports monitoring that helps to track progress towards RCTs and provides insights that support adaptive management. Recommended monitoring activities include:</p> <ul style="list-style-type: none"> • Surface water quality: there is a long history of surface water quality monitoring in the MID. This has traditionally focussed on phosphorus, reflecting the SEPP (WoV) target. It is proposed that phosphorus monitoring be maintained and that is extended to include nitrogen, which also has an important influence on the health of the Gippsland Lakes. • Groundwater: there is a similarly long history of groundwater monitoring within and around the MID. This informs operation of the regional SSD system and is important in ensuring that the impacts of irrigation-induced salinity and waterlogging are contained. • Land use change: there is no current, reliable picture of irrigation land use within Lake Wellington catchment. It is proposed that a program of land use and land use change monitoring be implemented to identify all areas of irrigation land use, how this is changing and any shifts from livestock-pasture irrigation to vegetable production or other forms of horticulture. This will provide insights that will help the Plan to identify and address any important emerging trends in irrigation land and water management.



6 Glossary

AgVic	Agriculture Victoria, an agency of the Department of Economic Development, Jobs, Transport and Resources.
BCR	Benefit-cost ratio, an economic index of the financial suitability of an investment. If the BCR exceeds one, financial benefits exceed financial costs.
CBA	Cost-benefit analysis, an economic analysis tool that calculates and compares the present value equivalents of cost and benefit streams accruing from projects or other forms of investment.
CMA	Catchment Management Authority.
DELWP	Department of Environment, Land, Water and Planning.
Emissions intensity	Quantity of output or value created from each unit of greenhouse gas emitted by a production process of activity (e.g. value of agricultural output per t CO ₂ equivalent).
EPA	Environment Protection Authority.
GLaWAC	Gunaikurnai Land and Waters Aboriginal Corporation. The body established to further the aspirations of Gunaikurnai Traditional Owners and Native Title holders.
GMID	Goulburn-Murray Irrigation District.
IDGs	Irrigation Development Guidelines, as described in WGCMA 2011. Regional directions for Irrigation Development in Gippsland.
IFP	Irrigation Farm Plan.
Lowland irrigation area	Irrigation area located on a riverine or coastal plain or other flat, low lying area (e.g. the MID).
LWMP	Land and Water Management Plan.
LWSIG	Lake Wellington Sustainable Irrigation Group. Proposed lead governance group for implementation of the Lake Wellington LWMP.
MAT	Management action targets. Specific and measurable targets for activities implemented under the Plan.
MERI	Monitoring, evaluation, reporting and improvement. MERI processes underpin adaptive management processes under the Plan.
MID	Macalister Irrigation District.
MID2030	SRW-led program to modernise the irrigation supply system within the MID.
ML	Megalitre
Program logic	A diagram which describes the cause and effect relationships between activities undertaken by the Plan and their intended outcomes. A set of assumptions, modelling and best available knowledge provides the evidence base to link the layers in the program logic.

PV	Present value, the current value of a future stream of costs and/or benefits, accounting for the discount rate.
RCT	Resource condition targets. Long-term targets for change in aspects environmental (or social/economic) condition which are influenced by the Plan.
Resilience	The ability to recover from stressful or challenging experiences (e.g. drought, market downturn, flood). It involves being able to adapt to changes and approach challenging situations constructively.
SAG	Stakeholder Advisory Group, which was formed to provide formal irrigator input into this Plan. The SAG will be maintained as part of the Plan's adaptive management process.
SEPP	State Environment Protection Policy.
SEPP (Waters)	The State Environment Protection Policy (2018) which, among other things specifies quality targets for rivers and other water bodies throughout Victoria. SEPP (Waters) has set a target for phosphorus exports to Lake Wellington from irrigation areas to be reduced by an average of 7.5 t/y by 2030. The SEPP (Waters) replaces the current SEPP (Waters of Victoria [WoV]) and SEPP (Groundwaters of Victoria [GoV]).
SMP	Salinity Management Plan.
SMZ	Salinity Management Zone.
SRW	Southern Rural Water.
SSD	Sub-surface drainage, the service provided by the MID's network of public (and private) groundwater pumps.
TN	Total nitrogen, the total amount of all chemical forms of nitrogen exported from farms to local waterways.
TP	Total phosphorus, the total amount of all chemical forms of phosphorus exported from farms to local waterways.
TWG	Technical Working Group. Working group of agency and industry representatives which was formed to support development of this Plan. Membership is largely that of the LWSIG.
Upland irrigation area	Irrigation area located in the upper reaches of a catchment (e.g. in the Thorpdale area).
WGCMA	West Gippsland Catchment Management Authority.



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