ABSTRACT
The review of the operation of the Wimmera-Glenelg bulk and environmental entitlements (the Review) in 2013/14 addressed complex issues and competing interests using a collaborative approach.

The Review found that after three years of operation the supply system is being managed in line with storage management objectives.

Unanimous support was achieved for the 40 recommendations of the review, which included changes to headworks operation and water allocation processes.

Community feedback highlighted the importance of recreation water. The Review was able to achieve improved recreation outcomes in what is a constrained system.

INTRODUCTION
The Bulk and Environmental entitlement orders required a review of Wimmera-Mallee system operations be undertaken after three years of operation post completion of the Wimmera Mallee Pipeline. This Review was conducted in 2013/14 to assess the effectiveness of the headworks system operation of the against the eleven storage management objectives for the system.

The storage management objectives describe the main goals in operating the system. GWMWater in performing its role of Storage Manager GWMWater must aim to achieve these storage management objectives. Storage management rules put the objectives into practice by explaining operation of the system in more detail.

The Review also considered the need for extra water for recreational lakes in the pipeline serviced areas. Ongoing and reliable access to recreational water was a key expectation of the Wimmera Mallee community from the Wimmera Mallee Pipeline to offset the loss of open water generally within the footprint of the domestic and stock system network.

GWMWater undertook the review which was overseen by the Entitlement Holder and Key Stakeholder Council and Executive (EHKSC). The consultative process was facilitated by an independent Chair with members from:

- Grampians Wimmera Mallee Water (GWMWater)
- Glenelg-Hopkins Catchment Authority (GHCMA)
- Mallee Catchment Management Authority (MCMA)
- Wimmera Catchment Management Authority (WCMA)
- North Central Catchment Management Authority (NCCMA)
- Victorian Environmental Water Holder (VEWH)
- Commonwealth Environmental Water Holder
- Coliban Water (CEWH)
- Wannon Water
- Department of Environment and Primary Industries

Public submissions to the review were called for in October 2013. The majority of the 60 submissions received were concerned with preserving and or restoring the recreational amenity that existed prior to completion of the WMPP, although a broad range of topics was discussed. The submissions were considered when finalising the review.

The Review came at the end of a 20-year period where massive changes have been made to infrastructure, governance, operating rules and water sharing between rural and urban water consumers, the environment and recreation. The region also endured its worst drought on record and damaging floods over the time which tested system performance and community resolve.

BACKGROUND
The region
The Wimmera and Mallee region (Figure 3) of northwest Victoria is among the driest in Victoria. Highly variable river flow means the region predominantly relies on reservoirs around the Grampians in the south, and diversions from the Murray River in the north. GWMWater provides water and wastewater services to 71,000

1 Now the Department of Environment, Land, Water & Planning
customers on farms or in one of the 71 towns. The community places very high value on the availability of opportunities for water-based recreation. Given the dry nature of the region, these opportunities are limited to reservoirs, weirs on the Wimmera River and smaller local lakes.

Rainfall and inflow
Average rainfall in the region varies from approximately 600 mm in the southern Wimmera to 300 mm in the Northern Mallee.

Extremes of rainfall and runoff have been experienced. All but two years of the last eighteen years have recorded below average rainfall. Rainfall during the Millennium Drought was 10-25% below average. This translated to reduction in runoff and stream-flow in the order of 40-90%; worse than the maximum predicted by climate change models.

From 1934 to 2014 an average 287,000 ML/year of inflow was received the system. Above average inflows were last received in 1996. Inflows for 2000-2014 are shown in Figure 2.

Consequently total storage levels are again declining (Figure 2).

If the conditions of the last two decades reflect the new ‘climate reality’ for the region, the implications are significant and challenge water resource managers and entitlement holders.

The Wimmera-Mallee System
The Wimmera-Mallee supply system began operation in 1887 with the construction of Lake Wartook, with the last major storage; Lake Bellfield; constructed in 1966. The system harvests water from the upper reaches of the Wimmera, Glenelg and Wannon River catchments in western Victoria. Water is harvested into headworks storages around the Grampians (Figure 2).

The Northern Mallee Pipeline (NMP) and Wimmera Mallee Pipeline (WMP) projects transformed water supply to the region from open channels to pipelines and achieved significant water savings to improve water security and return water to rivers, lakes and wetland systems. Completion of these projects reset the water equation for the region and redefined the rights for the sharing of water between water authorities and the environment. Some reservoirs were also removed from operation as they were no longer required for water supply.

System operation
The Wimmera-Mallee supply system is operated by GWMWater under formal water sharing instruments and agreed operating rules. GWMWater is an entitlement holder in its own right but also performs the complementary roles of ‘Storage Manager’ and ‘Resource Manager’, responsible for harvesting,
storing, distributing and accounting for deliveries to entitlement holders.

System operation is governed by the following:
- Bulk and environmental entitlements
- Storage Manager Instrument
- Resource Manager Instrument
- Storage Management Rules
- Carryover Instrument

GWMWater consults with a Storage Manager Reference Group made up of entitlement holders and key stakeholders. This group is fundamental to the transparent and effective operation of the system, and the identification and implementation of operational improvements.

Water entitlements
Shares in 126 GL of water resources in the Wimmera-Mallee system are formally defined in bulk entitlements (Figure 4) for GWMWater, Coliban Water and Wannon Water, and in an environmental entitlement held by the Victorian Environmental Water Holder. The Commonwealth Environmental Water Holder has a Supply by Agreement with GWMWater for the supply of water.

Entitlements in the system (Table 1) were first issued in 2004, with the completion of the Northern Mallee Pipeline. The entitlements were subsequently amended and reissued in 2010 to allocate all water supplied from the Wimmera-Mallee headworks, including savings from the Wimmera-Mallee pipeline.

Table 1: Entitlements

<table>
<thead>
<tr>
<th>Entitlement</th>
<th>Volume (ML)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWMWater</td>
<td></td>
</tr>
<tr>
<td>System operating water:</td>
<td>2,960</td>
</tr>
<tr>
<td>Commonwealth Environmental Water Holder</td>
<td>28,000</td>
</tr>
<tr>
<td>Glenelg compensation flow</td>
<td>3,300</td>
</tr>
<tr>
<td>Recreation</td>
<td>3,090</td>
</tr>
<tr>
<td>Wimmera-Mallee Pipeline product</td>
<td>44,720</td>
</tr>
<tr>
<td>Coliban Water</td>
<td>300</td>
</tr>
<tr>
<td>Wannon Water</td>
<td>2,120</td>
</tr>
<tr>
<td>Environment</td>
<td></td>
</tr>
<tr>
<td>Wetlands</td>
<td>1,000</td>
</tr>
<tr>
<td>Wimmera-Mallee Pipeline product</td>
<td>40,560</td>
</tr>
</tbody>
</table>
| Total                           | 126,050     

Entitlement holders are allocated water based on available water in storage and predicted inflows and losses. Unused allocation is able to be carried over to the subsequent season. This means entitlements generally have a high reliability of supply, or likelihood of receiving 100% of entitlement volume in any given year from allocations and available carryover.

The environment’s entitlement includes passing flows and unregulated water. Unregulated flows include natural river flows and spills from harvesting weirs and storages in excess of passing flows. Passing flows are defined in entitlements in the form of rules rather than a specific annual volume, as they are dependent on annual flows.

GWMWater’s Recreation entitlement secures supply to eleven lakes and weirs across the region.

Storage Management Objectives
The storage management objectives for the system are summarised below:
1. Maintaining the structural and operational integrity of the headworks
2. Delivery of water in a timely, transparent and efficient manner
3. Accounting for water stored and delivered
4. Maintaining the security of supply, planning for water shortages and reducing water losses
5. Facilitating the transfer of entitlement and allocations between holders
6. Environmental watering under operating plans
7. Achieving other environmental outcomes and mitigating adverse environmental events
8. To manage water quality so that it is fit for purpose
9. To provide opportunities for recreation
10. To manage floods to conserve water and protect communities
11. To facilitate protection of cultural heritage.

Storage Management Rules
These rules define how the system and individual storages should be operated in order to achieve the storage management objectives.

The rules also clarify the basis for:
- Managing accumulated passing flows
- Calculating the system reserve
- Declaring a ‘low risk of spills’

Future Use of Reservoirs Review
The 2007-08 ‘Future Use of Reservoirs Review’ recognised that fewer reservoirs and other water supply assets would be required after the completion of the Wimmera Mallee Pipeline Project. It recommended removal of several storages from...
the headworks system in order to deliver on the project's business case commitments in relation to water savings.

The Future use of Reservoir work was reassessed concurrently with the BE Operations Review. As a result, the role of Green Lake in the operation of the system was changed to become a receiving point for water from its own catchment that comes predominantly off agricultural land holdings and headwater from transfers that are of poorer water quality.

**REVIEWING THE SYSTEM OPERATION**

**Purpose**

The purpose of the review was to identify potential improvements to the future operation of the Wimmera-Mallee system to enhance the efficiency, effectiveness and security of supply bulk and environmental entitlements and recreational use of storages. This was achieved by reviewing the performance of the system against the eleven storage management objectives.

**Key deliverables**

Key deliverables for the project were:
- Confirm system description and operational status of headworks storages.
- Confirm the reliability of entitlement products
- Identify opportunities for supplying additional water for recreation where compatible with other objectives.
- Recommend improvements to the operation of the system.

**Commencement**

The Review commenced in March 2013 with the inaugural meeting of the Project Steering Group (PSG); made up of representatives from entitlement holders, catchment management authorities, CEWH and the Department of Primary Industries and Environment.

The PSG provide technical reference for the project and assisted the preparation and review of discussion papers and project reports.

A sub-group from GWMWater and DEPI coordinated a sub-project to update the system model.

**Project governance**

The overall delivery of the project was overseen by the Entitlement Holder and Key Stakeholder Council (EHKSC) made up of Board and Executive representatives. The Executive Committee from the EHKSC also met to discuss and provide direction on the process for achieving key outcomes from the review.

**REALM modelling**

Consultants SKM were engaged to update the existing Wimmera–Glenelg Resource Allocation Model (REALM) to include recent climate data and changes to system operations.

The revised model confirmed the reliability of entitlements products. It was also used to simulate a range of alternative supply system configurations and operating rules. These scenarios included changes to the distribution of water between reservoirs, changes to maximum and minimum operating levels, changes to carryover, introducing constraints on environmental flow releases from reservoirs with relatively high demands, and supplying non-water supply storages (GWMWater, 2014a).

The model was applied to assess each of the scenarios under historic climate demands and full entitlement level of demand on a monthly time step over a 121 year climate period. A range of metrics were developed to benchmark results against the baseline case in relation to meeting objectives for maintaining structural integrity, security of supply, environmental watering, recreation and flood impacts. Results indicated the need for further modelling of the response of the system under future climate scenarios.

As the model makes many assumptions, the results are approximate and indicative of the actual response of the system. The results were considered alongside other factors such as changes in water quality, operational costs and recreational or cultural values.

**Key Challenges**

GWMWater (2014b) outlines the following challenges which were identified and addressed through the review:
- The efficient operation of the Wimmera-Mallee system requires maintenance of key structures. Recent drought and flood events had degraded the condition of some structures limiting operations.
- The delivery of water to rural and urban customers is well understood and readily managed. Delivery of large volumes of water for the environment is a new challenge with operations improved with each year of operational experience.
- Three years is a short period to evaluate and improve arrangements in the modernised system. Carryover is a valuable tool that allows entitlement holders to better manage the risks of water. The Glenelg River Compensation Flow was originally intended to ‘compensate’ users downstream of Rocklands Reservoir for loss of natural flows. Its purpose has evolved to include supporting environmental releases. A
volume of carryover was ‘orphaned’ by the sale of the irrigation entitlement.

- To optimise the operation of reservoirs and transfer channels to improve the security of supplies following wide ranging changes to system configuration and operating rules. Higher operating levels can improve security but impact on losses and spills frequency.

- There is little or no trade between entitlement holder products in the Wimmera. There is a need to understand the early steps required to prepare for and encourage increased water trading.

- Delivery of large volumes of water for the environment. Lessons must be learnt and changes made to improve operations and manage risks (from planned and unplanned events). Opportunities for value adding to existing transfers must also be identified.

- To determine water quality goals across a complex system with many storages and waterways and varying customer needs. To improve responses to extreme events such as fires and floods that may have uncontrollable water quality impacts.

- Providing recreation opportunities that meet the expectations of communities and stakeholders as a result of implementation of the Wimmera Mallee Pipeline Project, but are also compatible with primary objectives of maintaining water quality, environmental flows and managing water security. Green Lake, Horsham and Walkers Lake, near Donald were priorities for improving recreation opportunities.

- Improving response to flood management in a system designed and operated primarily for water supply. For example, reservoirs have limited inlet and outlet capacities that constrain the capture and release of large flows.

**Community feedback**

Consultation during the development of the original bulk and environmental entitlements was limited to entitlement holders and state and regional government agencies responsible for water policy and environmental water.

The Review included an opportunity for the public to provide feedback on operation of the system in relation to the storage management objectives. Sixty responses were received. Many commented on multiple objectives; however the majority of responses were in relation to recreation, environmental watering and water security.

Whilst not specifically asked, many of the submissions provided comments in relation to the operation of specific reservoirs, and particularly the desire to improve recreation and associated benefits.

The general themes from the submissions were:

- Water in lakes has multiple benefits.
- Environmental watering should be balanced with other needs.
- There must be sufficient water available [increased allocation] for recreational activities in lakes.
- There was an expectation that the review would ‘create’ new water or change entitlements.
- Clarity is needed around the future operating purpose for reservoirs.

There is generally limited ‘public’ understanding of bulk entitlements, stakeholder responsibilities and system operation. This was partially addressed through web-based fact sheets developed to support the communications strategy for the review. Currently a joint web-portal is being developed to enable consistent messaging from stakeholders.

**Finalisation**

The Review report was developed over six months by integrating information from:

- Technical discussion papers for each of the storage management objectives
- Modelling scenario results
- Feedback from stakeholders and the community

The report was independently reviewed for technical accuracy. A summary version was also produced for public information.

Draft recommendations from the Review were extensively discussed through the PSG and EHKSC and finally agreed for submission to the Minister for Water in March 2014.

Subsequently the report was approved and the necessary amendments prepared for the key instruments governing operation of the system. These amendments received Ministerial approval in October 2014.

**Key findings**

The review found that the Wimmera-Mallee system is being managed in line with the system management objectives and rules. The review outcomes balanced the need to maintain current security of supplies, protect environmental values and support recreation opportunities.

Forty recommendations were identified to improve system operation, including changes to headworks operation and water allocation processes.

The key recommendations of the review were:

- Maintenance to priority channel and structure maintenance to make the system safer to
operate with less water loss and more timely and accurate deliveries.

- Investigation of the environmental watering needs and passing flow requirements for additional locations.

- Increasing GWMWater’s Recreation entitlement from 2590ML to 3090 ML, to primarily secure supplies for Walkers Lake and Lake Marma, making them valuable recreation lakes.

- Increasing flows in the Richardson River by keeping water previously diverted into Lake Batyo Catyo for recreation, in the river.

- Reincorporating Green Lake into the headworks system, principally, to assist with managing water quality. It is expected that Green Lake water levels may be suitable for recreation in about 70 percent of years.

- Natimuk Lake not be supplied as a recreation lake.

- Increasing the maximum operating level of water held in Rocklands Reservoir to improve flexibility in delivering water to customers.

- Undertaking a review to clarify the purpose of the Glenelg River Compensation flow.

- Absorbing GWMWater’s ‘orphaned’ irrigation entitlement carryover into its other primary entitlements so that it can be accounted for appropriately.

**Next Review**
The next review of entitlement operations is scheduled for 2019.

**CONCLUSION**
The Review found that after three years of operation the supply system is being managed in line with storage management objectives.

Collaboration at both the technical and strategic levels was critical to resolving complex issues and dealing with competing interests. Significantly, unanimous support was achieved for the review’s recommendations. The recommendations are currently being implemented in conjunction with entitlement holders and stakeholders.

A continuation of the current dry cycle will present further challenges for system operation and water resource management. Further modelling and operational experience will inform future reviews of the system operating rules and water sharing arrangements.
Figure 3 Wimmera Mallee Water Supply System
Figure 4 Wimmera-Mallee System Bulk Entitlements