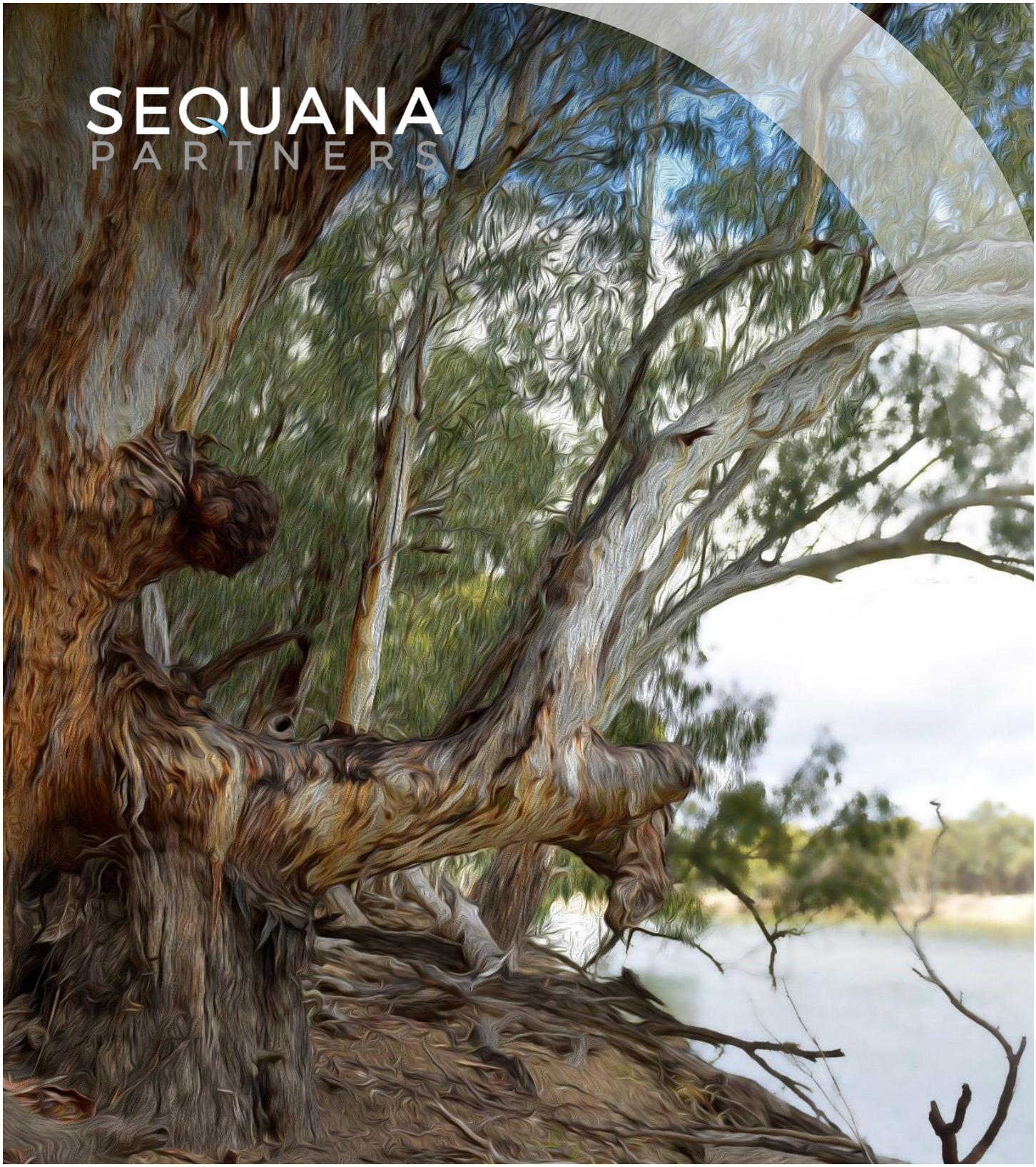

River Operations Report

Stage 1A Victorian Constraints Measures Program

Prepared for: Department of Environment, Land, Water & Planning
Date: 22 December 2022

Acknowledgement
Sequana acknowledges the Traditional Owners of Country throughout Australia and pays respect to and recognises the contribution from their Elders past and present.

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Stage 1A Victorian Constraints Measures Program

Revision control

Issue	Author	Reviewed	Approved	Signature
Final Draft	Paul Simpson	Gary Smith, Darren Nabbs	Frank Fisseler	

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Executive Summary

River operators traditionally aim to control river flows within the banks of the rivers and avoid overbank flows to avoid inundating private property. Delivering the environmental flows envisioned by the Victorian Constraints Measures Program (Victorian CMP) requires river operators to release water from storages at flow rates that will inundate low-lying areas of the floodplain.

The purpose of the River Operations work undertaken as part of this feasibility study was to consider possible mechanisms to mitigate the risk of flows delivered under relaxed constraints exceeding the target flow limits Exceeding the target flow limits may contribute to greater inundation than planned and cause unintended costs and disruption to the community.

There are existing operating arrangements (September 2020) for managing the delivery of environmental water within the Goulburn and Victorian Murray Systems. The Operating Arrangements are an established arrangement amongst the key Victorian stakeholders for the planning, ordering and delivery of environmental water.

It has been assumed the Victorian Environmental Water Holder Operating Arrangements, with suitable amendments to incorporate the expanded range of possible flows, will continue to be the basis for delivery of the environmental flows under relaxed constraints. The identified potential risks and mitigations associated with increased planned environmental flows under relaxed constraints were tested and explored against these guidelines.

Existing Operations Arrangements

Goulburn Operating Arrangements

Goulburn-Murray Water (GMW) operates the Goulburn system to meet demands for water from entitlement holders in accordance with the Bulk Entitlement Order. Planning for the release of water from Lake Eildon requires information about tributary inflows in the mid-Goulburn catchment which can contribute to meeting the total flow requirements for diversion and downstream flows at Goulburn Weir.

Estimates of tributary hydrographs and the response of the total catchment is required. This is currently done by monitoring data from the hydrometric network and through the operators' understanding of the catchment behaviour for the prevailing and forecast weather conditions.

As mentioned previously, the Operating Arrangements for the planning and delivery of both the Environmental Water Holdings of the Goulburn and Victorian Murray Systems were completed in September 2020.

GMW, Goulburn Broken Catchment Management Authority (GB CMA) and Victorian Environmental Water Holder (VEWH) are signatories to the Goulburn Operating Arrangements document, which sets out the roles and responsibilities of the parties for operating and risk management arrangements.

- the VEWH has primary responsibility for mitigating actions that relate to the demonstration of outcomes from environmental water delivery and portfolio management.
- GB CMA has primary responsibility for mitigating actions relating to engaging with the community in relation to environmental watering, adequate planning and monitoring of environmental water delivery and incorporating learnings into improved environmental water management.
- GMW has primary responsibility for mitigating actions relating to system operations associated with the delivery of environmental water.

Murray Operating Arrangements

The operating arrangements for the River Murray system are governed by the Water Act 2007 (Commonwealth) and the Murray Darling Basin Agreement. The Agreement sets out the water sharing arrangements for the River

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Murray system, and also provides for key water accounting and operational arrangements. The Agreement also empowers the Basin Officials Committee to set arrangements for the operation of the River Murray system.

The primary way this is done is through the approval of the Objectives and Outcomes for River Operations in the River Murray System (the O&O document). The O&O document sets out the operational limits and practices and any detailed water accounting procedures for all key points in the River Murray system. It has recently been extended to include arrangements for a range of environmental water delivery procedures (including accounting treatments). These arrangements also cover the measures necessary to implement the Prerequisite Policy Measures such as arrangements to allow 'piggybacking' storage releases onto unregulated events in the River Murray.

River operators have also developed a range of detailed procedures, manuals, and guidance material to assist in applying the O&O provisions in day-to-day operations.

Victorian Murray Operating Arrangements

- the VEWH has primary responsibility for mitigating actions that relate to the demonstration of outcomes from environmental water delivery and portfolio management.
- the relevant CMAs (Goulburn Broken, Mallee, North East and North Central) in their role as Waterway Managers have primary responsibility for mitigating actions relating to engaging with the community in relation to environmental watering within Victoria, adequate planning and monitoring of environmental water delivery and incorporating learnings into improved environmental water management.
- the Murray-Darling Basin Authority (MDBA) has primary responsibility for mitigating actions relating to system operations associated with the delivery of environmental water. The River Operator (MDBA) has the authority to reject or cease delivery of an order immediately if it reasonably believes it will create unacceptable risks to public safety or may expose the storage manager to liability for payments of claims for loss or damage to property.

Proposed Arrangements for Constraints Measures Program

Goulburn Operating Regime Changes

Constraints relaxation will require changes to how river operators, environmental water holders and CMAs plan and deliver environmental watering actions.

The Victorian CMP, as defined by the New Goulburn Constraints Measure Business Case (2017), proposed the operating flow targets at Shepparton of 17,000 ML/d, with a 3,000 ML/d buffer for uncertainty to 20,000 ML/d. These targets are higher than the current regulated operating flows in the Goulburn downstream of Goulburn weir. The current maximum regulated flow target at McCoy Bridge is 9,500 ML/d.

The current operational water delivery limit at Shepparton is 9,500 ML/day. The project aims to enable the delivery of higher in-channel flows of up to 20,000 ML/day (17,000 ML/day target with a 3,000 ML/day unregulated flow risk management buffer). The Community Consultative Committee has also requested that the benefits and impacts of flows up to a maximum of 25,000 ML/day, inclusive of the environment flow target plus any uncertainty buffer allowance, be investigated as part of this project.

The operational change required at Eildon is to maintain higher releases to achieve the flow targets at Goulburn Weir when rainfall is forecast rather than reduce releases as a precaution to the risk of flooding arising from high tributary flows. Eildon will be managed to avoid exceeding the adopted flow targets, but at present, when rain is forecast flows are cutback to conserve water.

In future, when there is a demand for environmental deliveries, Eildon releases and harvesting opportunities at Goulburn Weir will be managed in conjunction with tributary inflows to meet environmental water demands.

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Murray Operating Regime Changes

The Hume to Yarrawonga Constraints Business Case proposed increasing the regulated flow limit for environmental water releases in the Hume–Yarrawonga stretch of the river from the current 25,000 ML/d to 40,000 ML/day, as measured at the Doctor's Point gauge around 15 km downstream of Hume Dam.

Achieving flows of 40,000 ML/d would be based on coinciding releases from Hume Dam with inflows from the Kiewa River (and or the Ovens R). River operators have been using this type of approach for smaller flows through Barmah-Millewa Forest for a number of years, and it is relatively well proven at lower flows.

Accurate forecasting of tributary inflows over an extended environmental water delivery event is one of the key challenges in creating these higher flows and managing risks around unintended inundation of private (or public) land.

Risks

The risk identification and assessment process for the proposed new environmental flow arrangements involved a three step approach to identifying the risks. These included a literature review of existing risk assessment work on relaxing flow constraints, initial interviews with river operators, and a river operations risk assessment workshop.

The risk assessment process was undertaken using VEWH's risk management framework. This is used by the VEWH and other partner organisations that have a role in environmental water management. This framework is consistent with the Australian Standard for Risk Management (AS/NZS ISO 31000: 2018, *Risk Management: Principles and Guidelines*) and the Victorian Government Risk Management Framework (VGRMF).

The Operating Arrangements formed the basis for structuring the risk assessment. The key sections within the Operating Arrangement guideline that were tested and explored as part of the risk identification process included:

- Roles and responsibilities
- Planning for environmental water delivery
- Ordering and delivering environmental water

The key risk themes identified from this process included:

Roles and Responsibilities

- Implementation of higher environmental flows under relaxed constraints will require greater cooperation and coordination across a number of organisations and jurisdictions. Clearly defined roles and responsibilities are an important element of any coordinated approach.
- Operational notifications of flow forecasts were identified as an area where there was potential for overlap in roles between river operators and the Bureau of Meteorology and the State Emergency Service's traditional role of flood warning.
- Uncertainty about management of potential liability from overbank environmental flows, and unclear bounds for roles and responsibilities to manage this.
- A greater need for system wide and "landscape-scale" environmental water planning. It is not clear under current arrangements who would have the role of managing this expanded scale of environmental water planning.

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Planning for environmental water delivery

- Existing arrangements across agencies for environmental water planning would need to have a wider focus across valleys, and ensure that there was greater planning at a "landscape scale" rather than the current, more site-focussed approach.
- Landscape scale planning would face a number of challenges, including sharing of Murray flow capacity between tributaries, more trade-off decisions being required, and obtaining large numbers of individual site approvals under the current arrangements.
- Environmental water planning involves consultation with Traditional Owners, and it was noted that seeking consent was currently site focussed, and there are likely to be challenges in seeking consent for landscape scale actions. It was also identified that the Cultural Water Roadmap may change or increase environmental water planning consultation with Traditional Owners.
- Other challenges for environmental water planning, including planning for different climate conditions over a large area, and allowing for opportunistic use of natural tributary inflow events to help support higher environmental flows.

Ordering and delivering environmental water

- importance of enhanced flow forecasting tools, appropriate sizing of easements and other measures to create a flow buffer above the flows to be targeted,
- statutory and policy recognition and clarity regarding legal consequences if flows higher than the buffer were to occur despite the best efforts of river operators.
- overlap in the development of mitigations with the work being undertaken by the Enhanced Environmental Water Delivery SDL Adjustment Measure project (EEWD) and the NSW Reconnecting River Country (RRC) program.
- risk-based flow forecasting would become increasingly important to manage the uncertainty in weather forecasts during higher environmental flow events, and the range of climatic conditions that might occur when planning for these events.
- Concerns that risk based flow forecasting may not be well understood particularly by landholders and the public. In particular, there was concern that public expectations around the precision of flow forecasts may be unrealistic.
- Notifying landholders and the public about current and forecast flows was also considered an area of potential risk.
- The links between river operators and environmental water managers were recognised as being important to ensure higher environmental flows were well planned and delivered. When developing additional procedures for higher environmental flows, ensuring these links were maintained and even increased was seen as important.
- Resourcing is a key risk, with a lack of resourcing to develop the primary mitigation measures and to ensure testing, training and developing experienced staff.

A summary of the key risks is shown in Table 11 in Section 7.

Mitigations

These mitigation measures are described below, and summarised in Table 10.

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Statutory powers and roles for overbank environmental flows

Creating a clear statutory responsibility or function for river operator organisations to deliver overbank environmental flows, recognised as an important foundational measure in Stage 1A of the EEWD program, enables river operators to undertake relaxed constraints releases within agreed limits with the legal certainty that they require.

Addressing these matters may require changes to Victorian legislation (this was not identified in the initial business case) and consideration of MDBA powers and MDB Agreement provisions. It is noted that the EEWD and NSW RRC projects have also identified this as a critical issue, so it is already on the "radar" of all jurisdictions and was alluded to in our proposal.

Appropriate buffers included in easements

Incorporation of an additional area or "buffer" zone when determining primary mitigation measures such as landholder agreements (e.g. easements) and other works is proposed, recognising that, despite proposed work to improve river flow forecasting tools, there will still be residual forecasting uncertainty for river operations when targeting particular flows to achieve environmental outcomes.

Redress pathway if flows exceed limits

Implementing arrangements to provide compensation in the unlikely event that, despite river operator organisations complying with any agreed procedures and arrangements, river flows still exceed agreed limits is considered important to provide confidence to river operator organisations. This measure would provide a back-up or "fail-safe" mechanism for stakeholders and river operator organisations.

Develop operations tools to improve flow forecasting

Improve the tools and information available to river operators to enable better forecasting of river flows for overbank environmental flows in the agreed ranges for the Victorian relaxed constraints program. This recognises that, although existing tools used by river operator organisations provides some forecasting capability across a range of flows, they are primarily focussed on within-channel flows in the ranges required to meet irrigation demands.

Better information to support improved flow forecasting

This measure would provide more data to support better flow forecasting, such as river flow gauging stations, rainfall stations, and other information that could support forecasting of river flows. This measure could include a review of the rainfall and hydrometric (streamflow) gauge networks and telemetry access to data to ensure sufficient coverage in high-risk zones and add new sites if required.

Development and implementation of an effective event notification system to alert downstream stakeholders

To expand existing notification arrangements and ensure that landholders and the downstream community have the necessary notification of flow events to manage their activities and ensure there are no avoidable impacts. Notifications may need to take a number of forms, and consider a diverse range of downstream stakeholders and activities.

Staged implementation and trials

Staging the implementation of higher environmental flows and the use of trials is important, and this is recognised as an important mitigation measure. It is proposed that this mitigation measure includes appropriate monitoring and evaluation to support within event management and to capture key learnings from events.

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Coordinated landscape-scale environmental water planning and consultation process

A significant outcome of the workshops was the recognition that higher environmental flows would require a significant increase in the degree of coordination and collaboration required at a larger spatial scale between environmental water managers during the planning and consultation stages. This would include a greater emphasis on planning and consultation at the system scale, and coordination between river valleys.

Investment in capacity and capability of human resources

There is expected to be an increase in resourcing required to deliver higher environmental flows, including training, trials and potentially simulation exercises in the implementation stages, as well as developing comprehensive documented procedures to support staff capability and capacity.

More efficient/effective environmental water ordering

Development of pre-agreed processes and arrangements to facilitate quicker operational decision-making. This might include pre-planned events or "standing orders", and pre-agreed conditions for management of releases during events.

Operational mitigations

A number of specific operational actions and strategies have been identified that can assist with managing flows during higher environmental watering events. These include consideration of pre-lowering of weir pools (e.g. Lake Mulwala, Lake Nagambie), and use of off-river storages (including Waranga Basin) to manage unexpected inflows.

Program communication

Effective communication of the program mitigations was recognised as being important for operational implementation of higher environmental flows to build public support and ensure that other mitigation measures are effective. This includes communication of planned watering strategies and demonstrating environmental benefits, and ensuring that the risks are mitigated.

Develop relevant policies and procedures and provide appropriate public visibility / transparency

Appropriate policies and procedures will be important for river operators and environmental water managers to ensure best practice and quality assurance of new activities required to deliver higher environmental flows, and also to build understanding and confidence with stakeholders that risks are being managed appropriately.

The outputs of this work have resulted in a number of priority mitigations that have been endorsed by River Operators that required further investigation and scoping as part of Stage 1B if the CMP is proven to be feasible to continue to the next stage.

TO Engagement

Stage 1A offered the opportunity for dedicated consultation with each individual Traditional Owner Group (21), including both Recognised Aboriginal Parties (RAPs) and Non-RAP status groups with interests over unrecognised land. Engagement occurred through a range of forums from virtual, face to face, on country and through the Constraints Consultative Committee TO representative committee members. The purpose of engagement during Stage 1A was to understand Traditional Owner perspectives on the benefits and risks of relaxing constraints for the project area.

As a feasibility study, Stage 1A of the CMP does not provide water management responsibilities or cultural water allocations to Traditional Owners. The project did, however, provide an opportunity for Traditional Owners to state concerns and aspirations for the program, and to advise on that nature of future Traditional

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Owner involvement, roles and responsibilities, should the project proceed to a business case. This has been documented in a dedicated section within the Feasibility study.

Engagement with Traditional Owner Groups in regard to river operations and more widely the impacts on country will be a core focus on any future program stages.

Summary

In general, risks tended to increase with higher flow rates. However, there was no particular flow rate identified within the range of flows under consideration where risks were thought to increase significantly. The risk assessment indicates that managing higher environmental flows across the proposed flow ranges is feasible with the identified mitigation measures in place. The risk assessment also found that there was no significant change in feasibility across the range of flows up to the flow limits proposed for assessment in the Murray and Goulburn systems as part of the Victorian CMP Feasibility Study

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Contents

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1 Introduction

1.1 Overview

Current river operations, and potential changes to implement the relaxed constraints measures have been summarised via a desktop review, together with work under the related Enhanced Environmental Water Delivery (EEWD) and NSW Reconnecting River Country (RRC) programs. This summary was presented to a range of agencies involved in river operations, environmental water delivery, and related government programs at a river operations risk workshop, held on 8 June 2022. The workshop considered the potential risks associated with delivery of higher environmental flows under relaxed flow constraints and identified possible mitigation measures.

Following on from the risk workshop, a second workshop was held on 12 October. Consistent with the first workshop, the second workshop included representatives from river operator organisation, Victorian CMAs, DELWP, the environmental water holders and the NSW RRC program. This second workshop considered key risks arising from the first workshop and further work by the project panel, and then discussed a range of mitigation options to address the key risks.

1.2 The Victorian Constraints Measures program

At this time, the Victorian CMP is being implemented though a staged approach as described in Figure 1.

There are multiple stages and defined hold points in the Victorian CMP to ensure a transparent approach that is actively informed by community input, and progression to future stages guided by the Victorian Minister for Water. This staged approach aims to support a community co-design process.

The scope of Stage 1A is to develop a feasibility study; to investigate if there is sufficient evidence to warrant moving to the next stage of investigations where more detailed work will be undertaken. This involved the appointment of a Consultative Committee to provide a forum for the exchange and testing of views. This will build a shared understanding of key issues amongst committee members.

If the State of Victoria and the Australian Government agree to proceed with further Stages, in Stage 1B the CMP will engage with all affected Victorian landholders, confirm impacts, discuss possible mitigation activities and seek in-principal agreements. Concept designs and draft regulatory approvals will also be prepared.

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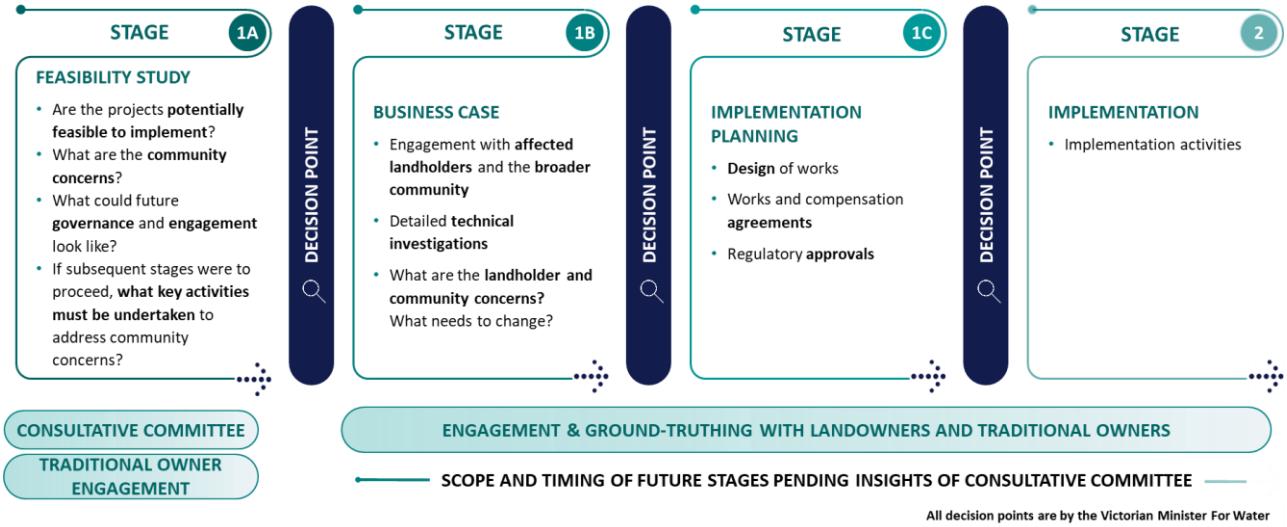
Figure 1 – Staged approach of the Victorian Constraints Measures Program



Stage 1A of the program consists of six workstreams:

- **Program Management** – The program management workstream will develop and maintain a master plan, which includes procurement, project management, high-level communications and risk management plans.
- **Delivery of technical work required for meaningful discussions** – The team will undertake a desktop analysis of existing material to prepare a gap analysis, and undertake the development of quality technical information including hydrological and hydraulic modelling, environmental and cultural assessments that will underpin the Victorian CMP
- **Community centric engagement** – Stage 1A of the Victorian CMP adopts a community centric engagement approach to provide insights and advice on the program to the Victorian Minister for Water. The Consultative Committee is a forum for the members to provide comment and input on the design and feasibility of the program.
- **Development of legal, policy and technical/operations advice –** The team will undertake desktop analysis of existing policy and operating arrangements and develop mitigations, frameworks and guidelines that ensures safe environmental water delivery of landholders and the public.
- **Hydrometric Network priority Works (within Goulburn key focus area)** – The team will scope and install additional streamflow and rainfall gauges to form part of the Goulburn River operational hydrometric network that can support rapid response to changes in unregulated catchment flows, support relaxed constraints storage release opportunities and manage potential third-party risks.
- **Feasibility study** - The Consultative Committee's advice, in conjunction with additional technical, legal and policy advice, will be used to develop a Stage 1A feasibility study, which will give both Commonwealth and Victorian Ministers for Water the information required to consider proceeding to Stage 1B.

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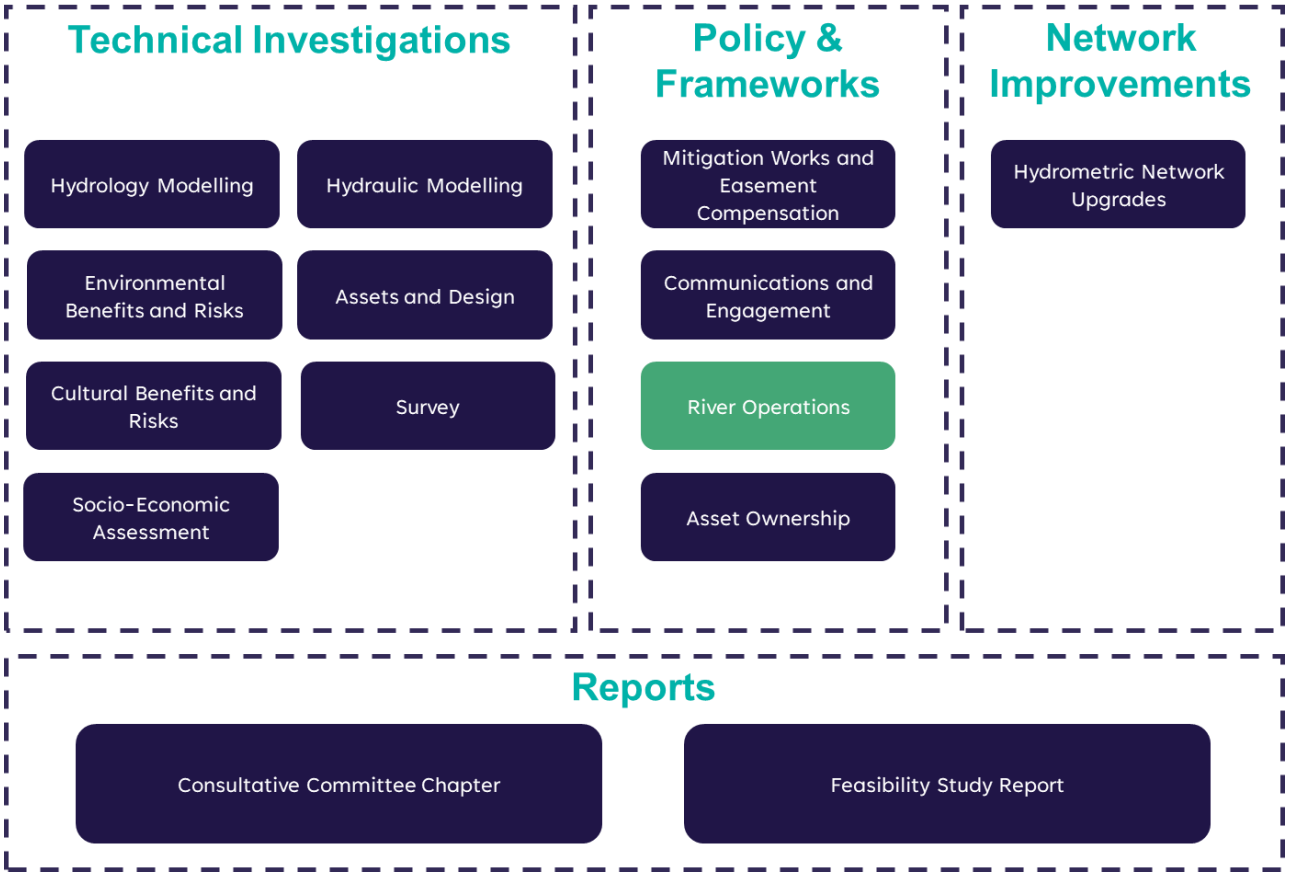
Figure 2 – Stage 1A Feasibility Study workstreams



River Operations

This workstream is to deliver options regarding the requirements for relaxed constraints river operations by reviewing the arrangements of the river operator organisations for the effective delivery of environmental water and identify and propose areas that may require additional work under a relaxed constraints regime. This includes having regard for the synergies and potential gaps with respect to the Enhanced Environmental Water Delivery (EEWD) project. It also includes consultation with NSW RRC Program.

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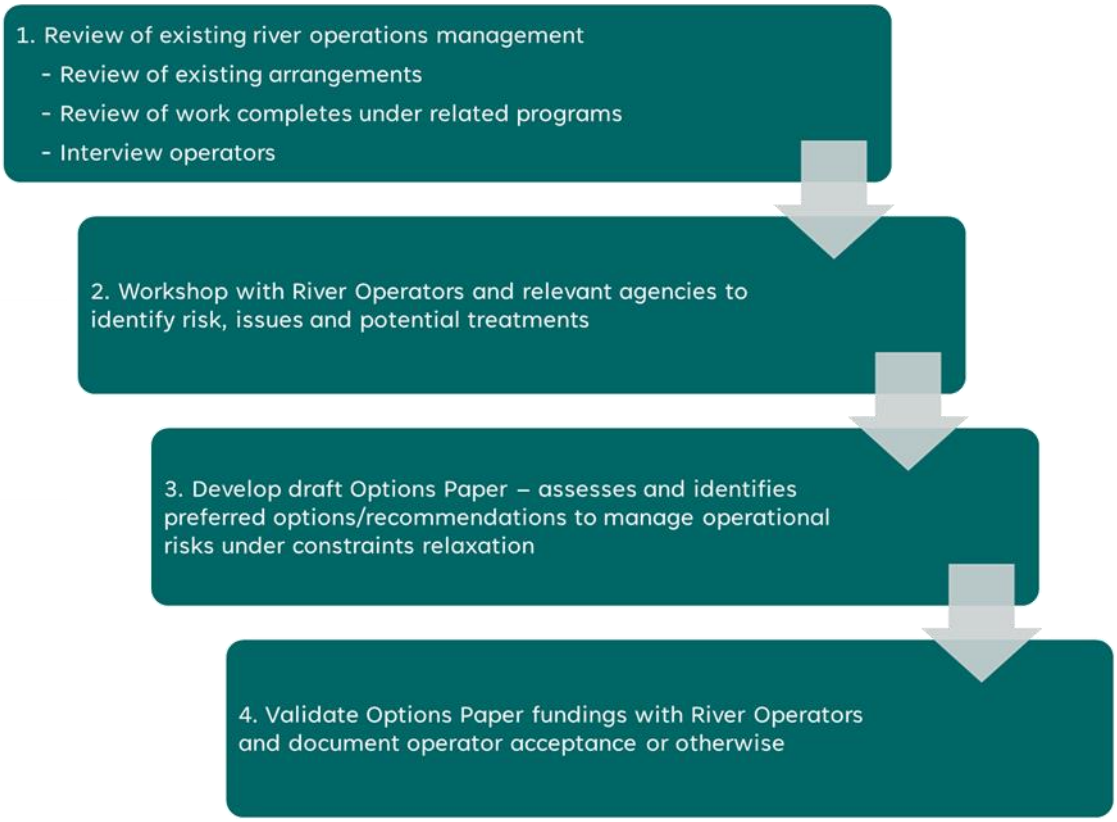
2 Project approach

The project approach for Workstream 4 (river operations) is described in Figure 3 below, showing the key steps, including an initial review of existing river operations management, confirmation of risks, and investigation of options to mitigate these risks.

Figure 3 – Project approach for Workstream 4 (River operations)



For the first step for Workstream 4 (river operations), a stocktake of existing river operations management has considered the existing statutory framework and the documented procedures for river operations and environmental water delivery.

Building on the stocktake completed in step one, a river operations risk workshop has been undertaken with river operator organisations, key government agencies involved in environmental water delivery, and representatives from the EEWD and RRC programs. The objective of the workshop was to confirm potential risks and possible mitigation measures.

A second workshop was held with representatives from the same organisations to identify suitable mitigations to address the risks identified in the first workshop.

This paper summarises the risks and sets out a series of proposed mitigations. These mitigations will require further investigation and scoping as part of Stage 1B if the CMP is proven to be feasible to continue to the next stage.

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3 River operations arrangements

3.1 Current river operations arrangements

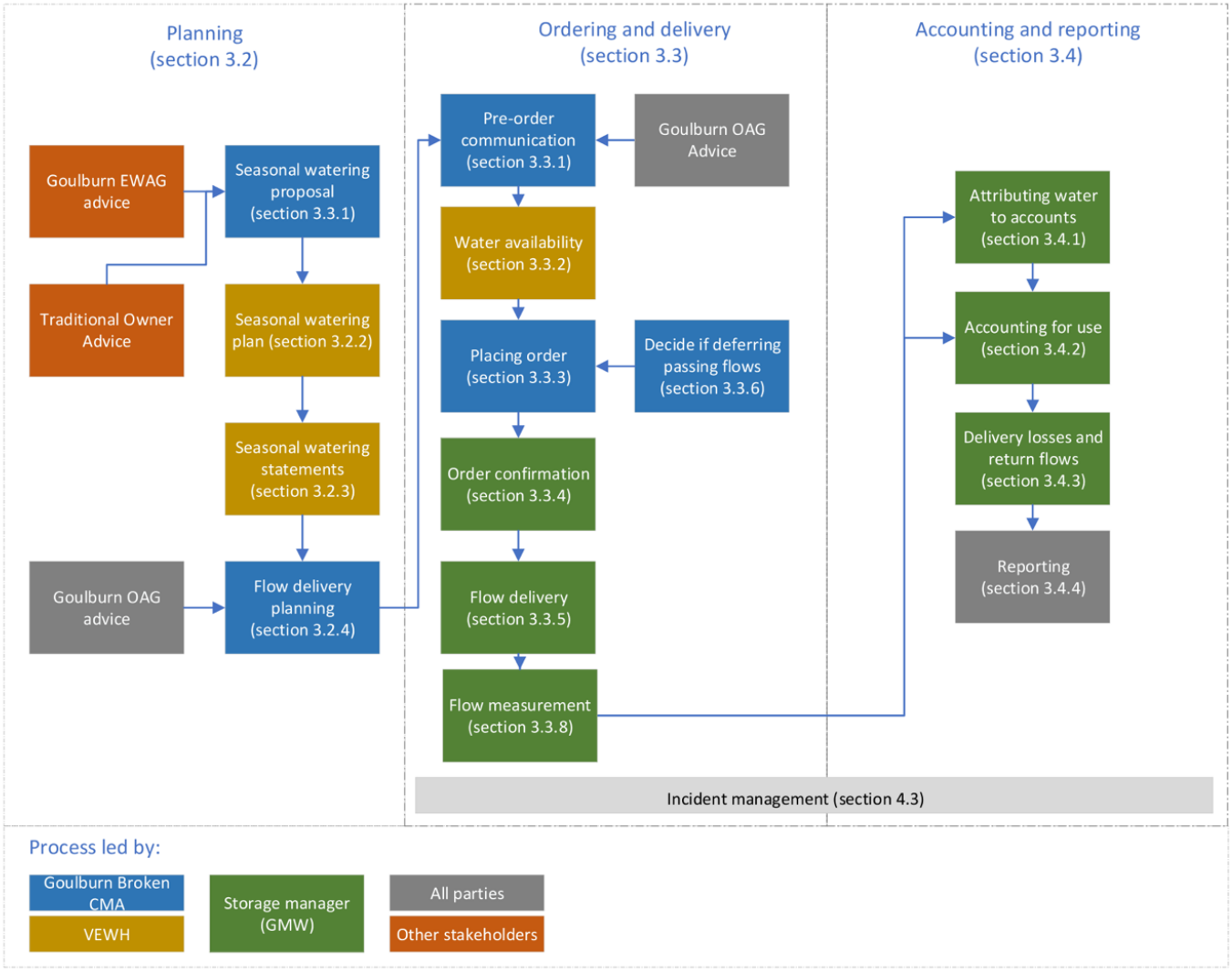
3.1.1 Goulburn System

Goulburn-Murray Water (GMW) operates the Goulburn system to meet demands for water from entitlement holders in accordance with the Bulk Entitlement Order. Planning for the release of water from Lake Eildon requires information about tributary inflows in the mid-Goulburn catchment which can contribute to meeting the total flow requirements for diversion and downstream flows at Goulburn Weir. Estimates of tributary hydrographs and the response of the total catchment is required. This is currently done by monitoring data from the hydrometric network and through the operators' understanding of the catchment behaviour for the prevailing and forecast weather conditions.

The Operating Arrangements for the planning and delivery of both the Environmental Water Holdings of the Goulburn and Victorian Murray Systems were completed in September 2020 and are shown diagrammatically in Figure 4 below. GMW, Goulburn Broken Catchment Management Authority and Victorian Environmental Water Holder are signatories to the Goulburn Operating Arrangements document, which sets out the roles and responsibilities of the parties for operating and risk management arrangements. They cover all aspects of managing the Environmental Water Holdings including confirming objectives, planning, ordering delivery and water accounting. Importantly the operator's right to reduce releases to manage risk, if unexpected circumstances arise, is recognised within the document.

Figure 4 – Process map for environmental water management in the Goulburn system.

(Source: VEWH (2020) Operating Arrangements For The Environmental Water Holdings Of The Goulburn System. Final: September 2020. Unpublished.)



Goulburn Operating Arrangements

- the VEWH has primary responsibility for mitigating actions that relate to the demonstration of outcomes from environmental water delivery and portfolio management.
- Goulburn Broken CMA has primary responsibility for mitigating actions relating to engaging with the community in relation to environmental watering, adequate planning and monitoring of environmental water delivery and incorporating learnings into improved environmental water management.
- GMW has primary responsibility for mitigating actions relating to system operations associated with the delivery of environmental water. GMW as storage manager may defer delivery of passing flows for dam safety and operational purposes. The storage manager has the authority to reject or cease delivery of an order immediately if it reasonably believes will create unacceptable risks to public safety or may expose the storage manager to liability for payments of claims for loss or damage to property.

3.1.2 Murray System

The operating arrangements for the River Murray system are governed by the Water Act 2007 (Commonwealth) and the Murray Darling Basin Agreement. The Agreement sets out the water sharing arrangements for the River Murray system, and also provides for key water accounting and operational arrangements. The Agreement also empowers the Basin Officials Committee to set arrangements for the operation of the River Murray system.

The primary way this is done is through the approval of the *Objectives and Outcomes for River Operations in the River Murray System* (the O&O document). The O&O document sets out the operational limits and practices and any detailed water accounting procedures for all key points in the River Murray system. It has recently been extended to include arrangements for a range of environmental water delivery procedures (including accounting treatments). These arrangements also cover the measures necessary to implement the Prerequisite Policy Measures such as arrangements to allow 'piggybacking' of storage releases on unregulated events in the River Murray.

River operators have also developed a range of detailed procedures, manuals, and guidance material to assist in applying the O&O provisions in day-to-day operations.

Victorian Murray Operating Arrangements

- the VEWH has primary responsibility for mitigating actions that relate to the demonstration of outcomes from environmental water delivery and portfolio management.
- the relevant CMAs (Goulburn Broken, Mallee, North East and North Central) in their role as Waterway Managers have primary responsibility for mitigating actions relating to engaging with the community in relation to environmental watering within Victoria, adequate planning and monitoring of environmental water delivery and incorporating learnings into improved environmental water management.
- the MDBA has primary responsibility for mitigating actions relating to system operations associated with the delivery of environmental water. The **Storage Manager** (GMW, LMW) has the authority to reject or cease delivery of an order immediately if it reasonably believes will create unacceptable risks to public safety or may expose the storage manager to liability for payments of claims for loss or damage to property.

3.2 Proposed river operations arrangements

3.2.1 Goulburn Operating Regime Changes

The Victorian CMP, as defined by the New Goulburn Constraints Measure Business Case (2017), proposes the operating flow targets at Shepparton of 17,000 ML/d, with a 3,000 ML/d buffer for uncertainty to 20,000 ML/d. These targets are shown in Table 1, and are higher than the current operating flows in the Goulburn downstream of Goulburn weir. The current maximum regulated flow target at McCoy Bridge is 9,500 ML/d.

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The current operational water delivery limit at Shepparton is 9,500 ML/day. The project aims to enable the delivery of higher in-channel flows of up to 20,000 ML/day (17,000 ML/day target with a 3,000 ML/day unregulated flow risk management buffer). The Consultative Committee has also requested that the benefits and impacts of flows up to a maximum of 25,000 ML/day, inclusive of the environment flow target plus any uncertainty buffer allowance, be investigated as part of this project.

The operational changes to achieve the higher flows are the suspension of diversions at Goulburn Weir to Waranga Basin and, if necessary, augmentation of flows by additional releases at Eildon.

Releases at Eildon to augment flows downstream of Goulburn Weir will be within the current operation flow range of up to 9,500 ML/d maximum regulated release and a maximum target flow of 9,000 ML/d at Alexandra. This is driven by the physical constraint of the Goulburn River at Molesworth of 9,500 ML/d.

The operational change required at Eildon is to maintain higher releases to achieve the flow targets at Goulburn Weir when rainfall is forecast rather than reduce releases as a precaution to the risk of flooding arising from high tributary flows. Eildon will be managed to avoid exceeding the adopted flow targets, but at present, when rain is forecast flows are cutback to conserve water.

In future, when there is a demand for environmental deliveries, Eildon releases and harvesting opportunities at Goulburn Weir will be managed in conjunction with tributary inflows to meet environmental water demands.

An operational flow forecasting model is required to mitigate the risk of flooding made incrementally worse by releases from Eildon for which GMW could be potentially liable. To forecast system flows an operational flow model, as described in the Goulburn Constraints Business case is required. The model would have features such as inputs from the Bureau of Meteorology (BoM) rain and flow forecasts for the gauged catchment, estimates of inflows from ungauged catchments and river reach routing to provide accurate flow forecasts at key constraint locations and the inflow to Goulburn Weir. Additionally, the model would be capable of estimating improved flow forecasts from lower Goulburn catchments to improve the accuracy of Goulburn Weir releases planning to meet the higher constraints measures targets at Shepparton.

3.2.2 Murray Operating Regime Changes

The Hume to Yarrawonga Constraints Business Case proposed increasing the regulated flow limit for environmental water releases in the Hume–Yarrawonga stretch of the river from the current 25,000 ML/d to 40,000 ML/day, as measured at the Doctor's Point gauge around 15 km downstream of Hume Dam.

Achieving flows of 40,000 ML/d would be based on coinciding releases from Hume Dam with inflows from the Kiewa River (and or the Ovens R). River operators have been using this type of approach for smaller flows through Barmah-Millewa Forest for a number of years, and it is relatively well proven at lower flows.

Accurate forecasting of tributary inflows over an extended environmental water delivery event is one of the key challenges in creating these higher flows and managing risks around unintended inundation of private land. The developments already undertaken by the MDBA in relation to rainfall runoff modelling and use of BoM seven day streamflow forecasts together with the Source operational modelling tool are still being developed but provides a sound base to build on.

Table 1 – Existing and proposed flow limits at key sites (ML/day)

River Reach	Hume to Yarrawonga (@ Doctor's Point)	Yarrawonga to Wakool (D/S Yarrawonga Weir)	New Goulburn (@ Shepparton)
Existing Operational Constraint (2022)	25,000	15,000	9,500
Proposed Flow (Business Case)	40,000	30,000	17,000

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River Reach	Hume to Yarrawonga (@ Doctor's Point)	Yarrawonga to Wakool (D/S Yarrawonga Weir)	New Goulburn (@ Shepparton)
Additional flow modelling	-	30,000 – 50,000	25,000

3.3 Approach to identifying Risks

The risk identification and assessment process is an important part of this work stream. A three step approach to identifying risks has been undertaken that includes: a literature review of existing risk assessment work on relaxing flow constraints, initial interviews with river operators, and a river operations risk assessment workshop 1.

Existing risk assessments have been reviewed to inform the initial understanding of risks. Key sources include:

- Detailed risk assessments were prepared and documented for both the Goulburn and Hume to Yarrawonga constraints business cases.
- The VEWH runs an extensive annual program of risk assessment involving all the watering partners to identify and assess shared risks that may arise from the proposed watering actions for the coming season. This provides a starting point for identification of operational risks which can be extended and updated to reflect the changes in risk that might arise from the higher environmental flows under relaxed constraints.
- The NSW RRC program has recently undertaken a risk assessment for the Murray and Murrumbidgee River systems
- The EEWD program managed by the MDBA on behalf of the partner governments, including Stage 1A scoping investigations.

RRC is the NSW-led constraints measure funded under the over-arching SDL Adjustment Mechanism program, and is the NSW equivalent to the Victorian CMP. The RRC program has also been investigating potential risks associated with higher environmental flows, and also undertook a similar river operations risk assessment with the NSW, Victorian and MDBA river operators in the first half of 2022.

The EEWD program is investigating potential strategies for higher releases. This work will influence the frequency, timing, and duration of higher flows, as well as the strategies for making releases of environmental water on a larger geographical scale than the individual constraints measures programs. Strategies for making releases of environmental water from storages could include making releases to coincide with downstream tributary inflow peaks, making releases as downstream tributary inflows are receding (to maintain a particular flow rate), or when there are no substantial downstream tributary inflows. Release strategies will also need to include releases of higher environmental flows planned across other river systems, and how they will combine.

This EEWD work will influence the severity of some of the risks identified as part of the Victorian Constraints Measures program. Where there is uncertainty, the identification of risks will be conservative and assess all potential risks initially across the potential variety of release strategies for higher environmental flows.

3.3.1 Risk Categories

As part of this risk assessment process, each risk that has been identified has been grouped into one of five broad risk categories. These risk categories are shown in Table 2**,** and are used to group risks into the broad activity areas for river operations and the delivery of environmental water.

[1] Described further in Section 4.

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Table 2 – Description of risk categories

Risk category	Description
Governance and coordination	Risks related to: legislation, policies, procedures and documentation that ensure appropriate legal and policy settings, organisational roles and responsibilities clear and coordination arrangements.
Environmental flow planning	Risks related to environmental flow planning across appropriate temporal and spatial scales, with required input from all appropriate organisations.
Flow forecasting and delivery	Risks related to appropriate data, tools and processes in place to support operational management of higher environmental releases
Public communication and education	Risks related to ongoing consultation to support environmental water planning and notifications for operational delivery of higher environmental flows.

3.3.2 Approach to assessing risks

There are a number of frameworks that have been developed for assessing risks, and there is an Australian Standard for Risk Management (AS/NZS ISO 31000: 2018, *Risk Management: Principles and Guidelines*) and the Victorian Government Risk Management Framework (VGRMF).

The VEWH has developed a comprehensive environmental watering program. An important element of the Victorian environmental watering program is the risk management framework developed by the VEWH, which is used by the VEWH and other partner organisations that have a role in environmental water management. This framework is consistent with the Australian Standard for Risk Management (AS/NZS ISO 31000: 2018, *Risk Management: Principles and Guidelines*) and the Victorian Government Risk Management Framework (VGRMF).

Risks have been identified through review of previous risk assessments, interviews with river operators, and the risk assessment workshop, and have been categorised and assessed using the VEWH risk management framework.

Risks are usually characterised by two key parameters: the likelihood of a risk occurring, and the consequence if the risk does occur. This risk assessment for the river operations workstream uses the same descriptions and ratings for likelihood and consequence as the VEWH risk management framework. The likelihood descriptions and ratings are shown in Table 3, and the consequence descriptions and ratings are shown in Table 4. These definitions and ratings were used to assess the risks identified in the river operations risk workshop.

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Table 3 – VEWH Risk Management Framework risk likelihood table

Likelihood		Description	Probability (%)
1	Almost certain	The event is expected to occur in most circumstances and/or Risk will occur within the next 6 months/or several times a year and/or Controls associated with the risk are extremely weak and/or non-existent and without control improvement the risk will eventuate.	75% - 100%
2	Likely	The event is likely to occur in most circumstances and/or Risk will occur in the next 12 months/or once or twice a year and/or The majority of the controls associated with the risk are weak and without control improvement it is likely the risk will eventuate.	50% - 74%
3	Possible	The event might occur and/or Risk will occur in the next 24 months/or once in two years and/or Some controls need improvement and if there is no improvement it is possible the risk will eventuate.	25% - 49%
4	Unlikely	The event could occur at some time and/or Risk will occur in the next 60 months/or once in five years and/or Controls environment is strong with few control gaps and requires assurance check to maintain control effectiveness.	0% - 24%

Table 4 – VEWH Risk Management Framework risk consequence table

Rating		Environment	Business costs	People		Political / Reputational	Legal and compliance	Service delivery	Cultural heritage
				Safety and well being	People and culture				
Minor	1	Limited effect on the natural and/or built environment and/or the environment suffers harm for up to 5 years Environmental recovery on a minor scale up to 5 years. Mostly impacts environmental values at a single location in an individual system.	Cost impact on total budget of up to 5%	Minor injuries or illness (physical/mental) requiring first aid or medical attention of staff, visitor, contractor, or member of the public	Staff complaints, passively upset, and uncooperative 10 – 15% staff turnover with minor loss of skills, knowledge, and expertise	Adverse localised public and political interest Limited attention on a single issue in local media over a short period	Non-compliance with legislation or breach of duty of care, identified externally and either: Resolved internally with no further escalation; or Resulting in minor compensation, and/or negative precedent	Minor short-term impact on business unit's delivery of services/functions Customers/stakeholders/communities slightly inconvenienced Up to 1 day impact on business unit's critical activities Minor impact (up to 10% delay) on project or program milestones	Limited potential impact on heritage sites/artefacts Exposure of previously unknown cultural heritage items
Moderate	2	Moderate effect on the natural and/or built environment and/or environment suffers harm for 5-10 years Environmental recovery on a small scale and/or over a period 5-10 years Impacts environmental values at multiple locations in an individual system	Cost impact on total budget between 5 -10%	Significant injury or illness (physical/mental) requiring in patient hospitalisation of staff member, visitor, contractor, or member of the public	Low morale, disengagement, increased absenteeism, and workplace conflict 15 – 25% staff turnover with resignations of key staff Staff are not skilled to meet priorities	Adverse localised negative public and political attention Short term negative local media attention Local community concern on a single issue over a sustained period	Non-compliance with legislation or breach of duty of date resulting in: External investigation or report to responsible authority; and/or Prosecution or civil action, with one or moderate level of compensation or moderate level of negative precedent	Moderate impact on business unit's delivery of services/functions Customers/stakeholders/communities inconvenienced Up to 3 days impact on business unit's critical activities Significant impact (up to 10 – 20% delay) on project or program milestones	Moderate potential impact on heritage sites/artefacts Damage to previously unknown cultural heritage items or values
Major	3	Major effect on the natural and/or built environment suffers harm for 10-20 years Environmental recovery on a large scale and/or over a period of 10-20 years impacts regional environmental values or affects connected systems	Cost impact on total budget between 10 -20%	Extensive and/or permanent injury or illness (physical/mental) of staff member, visitor, contractor, or member of the public	Major morale issues, high absenteeism 25 – 50% staff turnover with resignations of key staff Staff are not skilled to meet priorities	Serious adverse public attention at a State/Nation wide level Negative State National media on one or more issues over a prolonged period Repeated displeasure by the Minister Medium-term negative public interest (correspondence and phone calls) and political interest (in Parliament)	Non-compliance with legislation or breach of duty of care resulting in: External investigation or report to responsible authority Public inquiry (i.e., Royal Commission / Parliamentary Committee); Prosecution or civil action with high level compensation and high-level negative precedent; and/or Sanctions imposed by external regulator	Ongoing difficulties in delivering the business unit's services/functions Major impact on customers/stakeholder/communities Up to 10 days impact on business unit's critical activities Major impact (20 – 50% delay) on project or program milestones	Major potential impact on heritage sites/artefacts Damage to known cultural heritage items or values
Extreme	4	Very serious effect on the natural and/or built environment and/or environment suffers long term harm (20+ years) Environmental recovery on a very large scale and/or over a long period (20+ years) Impacts environmental values statewide	Cost impact on total budget of up to >20%	Single of multiple deaths or severe permanent disability or illness (physical/mental) of staff, visitor, contractor, or member of the public	Organisation wide morale issues and absenteeism >50% staff turnover Staff are not skilled to meet core corporate requirements	Very serious public outcry at State/Nation wide level Negative State/National media over a prolonged period Breakdown of public confidence in the Government / department / Minister of key project/program On-going or prolonged negative public interest (correspondence and phone calls) and political interest (in Parliament)	Non-compliance with legislation or breach of duty of care resulting in: Prosecution or civil action leading to imprisonment of an officer; Public inquiry (i.e., Royal Commission / Parliamentary Committee); Uninsured compensation payments Negative precedent requiring very serious impact and major reform to the department; and/or Sever sanctions imposed by external regulator	Long term and sever impact on delivery of services/functions Severe impact on customers/stakeholders/communities More than 10 days impact on business unit's critical activities Vital or very serious delays (>50% delay) to project/program delivery or project/program objective is not met	Very serious potential impact on heritage sites/artefacts Destruction of cultural heritage items or values

4 River operations risk workshop

Risks can arise in making releases into natural river systems in many ways. Existing river operations procedures have evolved over a long period of time to manage these risks. To transition to operation under relaxed constraints, the existing risks can sometimes be magnified, or new risks arise. Some prior work has already been undertaken through the New Goulburn Business Case and, more recently, via the NSW RRC program. To test this work and assess river operations risks from a Victorian perspective across the various organisations that have a role in environmental water delivery, a risk workshop was undertaken.

4.1 Workshop overview

A risk workshop was held on 8 June 2022 to discuss and identify key river operations risks and mitigations that need to be considered if operational flow constraints on environmental water are to be relaxed. The workshop included representatives from river operator organisations (GMW, MDBA, and WaterNSW), Victorian CMAs, DELWP, the VEWH and the RRC program. The NSW RRC program conducted a similar workshop in the first half of 2022 for the Murray and Murrumbidgee systems that involved the same river operator organisations.

The workshop focussed on the ongoing "dynamic" risks and mitigations that will vary over time and typically arise as part of river operations, rather than the "static" risks and mitigations that do not change over time (e.g. establishment of easements or modifications to infrastructure), and would be addressed via other workstreams as part of any future implementation of the Victorian CMP.

The workshop program covered the following key areas:

- Consideration of the draft principles for operational delivery of relaxed constraints developed by the RRC program, from a Victorian perspective.
- Potential risks and mitigations for delivering higher environmental flows, based on the existing VEWH Operating Arrangements. The Operating Arrangements are an established arrangement amongst the key Victorian stakeholders for the planning, ordering and delivery of environmental water, which formed the basis for structuring the risk workshop. The key sections within the Operating Arrangement guideline that were tested and explored at the workshop included:
  - Roles and responsibilities
  - Planning for environmental water delivery
  - Ordering and delivering environmental water.

Participants were given an initial set of general questions for each part of the workshop, and asked to identify risks and potential mitigations as written comments via the on-line collaboration tool "Miro". These were subsequently discussed as part of the workshop to confirm an understanding of comments and to test the support among workshop participants.

Across the workshop there were over 100 written comments posted. These comments were later reviewed and, where appropriate, translated into initial risk descriptions with a causal mechanism and consequence description. Many of the risk descriptions related to similar risk types, so these were grouped under a summary risk description. This resulted in 74 initial risk descriptions being grouped into 15 summary risk descriptions.

Many causal mechanisms identified had the potential to produce two opposite consequences. For example, uncertainty in flow forecasting (a frequently identified risk) could lead to either too much inundation of riparian land, or too little inundation of riparian land. Where there was potential for this dual consequence to occur, it was assumed that river operators would take a cautious and conservative approach that avoided the potential for too much inundation, and that too little inundation would be the more likely outcome. The buffer design and selection is likely to be a key mitigation for the exceedance of target flows.

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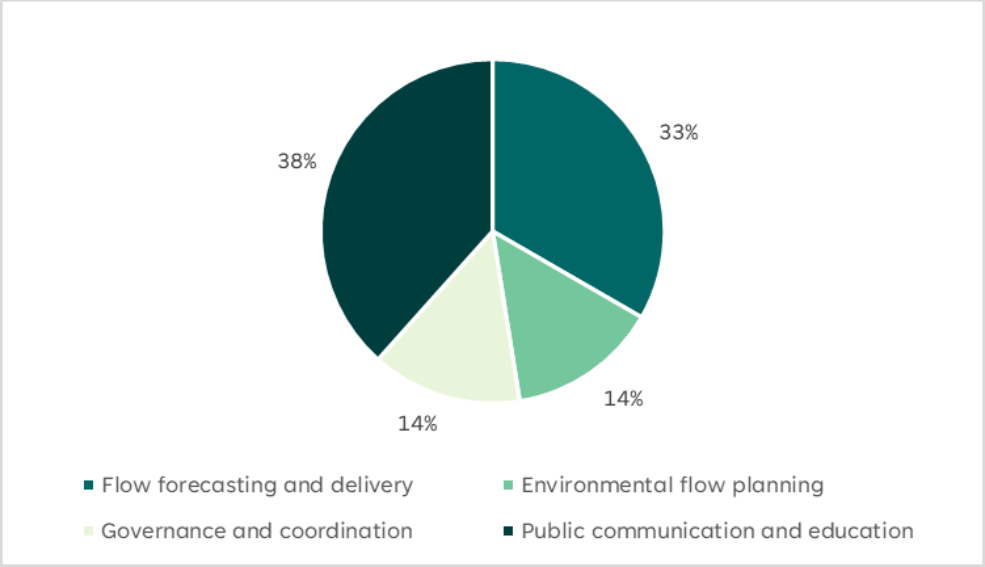
A summary of the number of key risks identified by risk category (see Table 2) is shown at Figure 5. The areas with more risks were the public communications and flow forecasting categories.

Figure 5 – Number of key risks by risk category



4.2 River operations principles

The implementation of higher environmental flows requires a coordinated approach across a number of organisations which have different objectives. Agreeing a set of guiding principles can assist management of higher flows and the risks involved, by providing consistency in decision-making, including where there may be unexpected operational circumstances that can arise. Guiding principles for operational delivery of higher flows are also likely to provide clarity and reassurance for stakeholders, and therefore are of importance for the program implementation more broadly.

The NSW RRC program in NSW identified six draft river operations principles for implementation of its relaxed constraints. These draft principles were used as a basis for discussion with River Operators and the Victorian Constraints Measures Program Consultative Committee.

Engagement with the Consultative Committee on the draft river operations principles supported the following feedback from committee members:

- It would be beneficial to tie the outcomes being sought by environmental delivery with the communications so that it is clearly communicated whether the outcomes are achieved
- The committee noted that there is a key difference between making information available and ensuring the community and landholders are aware and understanding of river operations.
- It was noted that it is important to advise stakeholders as to ‘why’ the river level is changing, not just ‘when’ and ‘where’. It is important that stakeholders understand what the flows are being used for.
- It was identified that acknowledgement of the risk to private land and the authorisation for inundation of land should be added to the principles.
- It was noted that there is a risk of a mismatch between community expectations and what may be observed in the rivers, especially in relation to damage from erosion. There needs to be clarity around what is happening in order to manage expectations. It was agreed that it is important that it is clearly

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communicated to stakeholders what may be expected under changed environmental water delivery regimes.

Workshop feedback

The feedback on the draft principles from participants at the workshop is collated in Table 5 below. In general, there was broad support for agreeing a set of principles, and the draft principles presented were generally considered reasonable. A key theme not directly addressed in the draft principles was the importance of coordination to the CMP, and the high degree of coordination at multiple levels that will be required. The concept of good faith was also unclear, with feedback indicating that further work was required to provide clarity about what this concept means in practice.

Based on this feedback, the following guiding principles were developed for the purposes of Stage 1A:

1. River operators will apply and demonstrate good faith in the planning and delivery of Program flows to meet the flow, timing and duration specified by environmental water managers and holders.
2. Delivery of Program flows will have appropriate regard for protection of human safety and property
3. Risks associated with delivery of program flows should be identified, assessed and mitigated. Documentation of the risk assessment and mitigation will be publicly available and transparent.
4. Delivery of program flows should be based on accepted good practice for river operations, which will include repeatable, auditable and defensible processes and procedures supported by suitable quality assurance processes, forecasting and observations. Documentation of these procedures and processes should be made publicly available to the extent that is reasonable and efficient to do so.
5. Impacted or interested stakeholders should be able to easily access or receive timely and relevant notification of planned, forecast or actual program flows. Notifications should be available in a range of delivery channels and should be communicated in a manner that is meaningful to stakeholders. Effectiveness of notification approaches and experience from implementation should be reviewed at a reasonable frequency and continuous improvement implemented.
6. Delivery of program flows involves the use of valuable public land and water assets, and a high degree of transparency and accountability should be provided to the community in relation to river operations actions undertaken, outcomes achieved, and issues experienced (noting that broader outcomes are a matter for broader monitoring and evaluation rather than river operations).

The feedback also highlighted the value of developing some type of explanatory guide to accompany the principles to provide background context and examples of application of the principles to river operations situations. This will be addressed in Stage 1B if the CMP proceeds to further implementation.

Table 5 – Collation of workshop feedback on draft principles

Draft principle	Workshop feedback
Overall	• Real world examples of what these mean would be helpful for clarity and ensure consistency of messaging and interpretation. • Principles need to consider existing processes and roles for agencies • Coordination is important: – across jurisdictions – across constraints programs and EEWD – across river reaches – between River Operators, Waterway Managers and Water Holders • Who's planning each event: waterway manager, water holder, consumptive demand? Does each party consider the specific risks to the other parties' aspirations. No process for this currently.
River operators will apply and demonstrate good faith in the planning and delivery of Program flows to meet the flow, timing and duration specified by environmental water managers and holders.	Need to be clear what good faith means What good faith look like for each agency and stakeholders information sharing and transparency between river operators and environmental water holders is part of what good faith means Notion of 'good faith' triggers a conversation and allows exploration of requirements Community obligations and good faith may be an area for the consultative committee to consider and report on
Delivery of Program flows will have appropriate regard for protection of human safety and property	Important consideration for inter-jurisdictional coordination
Risks associated with delivery of program flows should be identified, assessed and mitigated. Documentation of the risk assessment and mitigation will be publicly available and transparent.	Important consideration for inter-jurisdictional coordination It was noted that there can be impacts below minor flood levels
Delivery of program flows should be based on accepted good practice for river operations, which will include repeatable, auditable and defensible processes and procedures supported by suitable quality assurance processes, forecasting and observations. Documentation of these procedures and processes should be made publicly available to the extent that is reasonable and efficient to do so.	Processes and procedures need to allow flexibility when required. We need to avoid having a very specific procedure that doesn't allow for adjustment based on observed conditions. This means a 'repeatable' objective may be a step too far.
Impacted or interested stakeholders should be able to easily access or receive timely and relevant notification of planned, forecast or actual program flows. Notifications should be	Water Literacy - Many in our community do not understand the entitlement scheme, river regulation etc. This is important to understand when communicating.

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Draft principle	Workshop feedback
available in a range of delivery channels and should be communicated in a manner that is meaningful to stakeholders. Effectiveness of notification approaches and experience from implementation should be reviewed at a reasonable frequency and continuous improvement implemented.	
Delivery of program flows involves the use of valuable public land and water assets, and a high degree of transparency and accountability should be provided to the community in relation to river operations actions undertaken, outcomes achieved, and issues experienced (noting that broader outcomes are a matter for broader monitoring and evaluation rather than river operations).	The principles may require some publication of the operating intent prior to the commencement of relaxed constraints flows

4.3 Roles and responsibilities

Implementation of higher environmental flows will require cooperation and coordination across a number of organisations and jurisdictions. The current Operating Agreements between delivery partners - VEWH, CMAs and storage managers/system operators sets out roles and responsibilities for each organisation for current watering activities. The roles and responsibilities of each organisation under the proposed operating arrangements will need to be considered to ensure that any risks from delivery of higher environmental flows are appropriately managed.

The following questions were posed to workshop participants:

- Will the roles and responsibilities identified in the existing Operating Arrangements need to change under a relaxed constraints environment?
- What are the risks/gaps to your organization's roles and responsibilities under a relaxed constraints environment

Workshop participants were also provided with a table of key risks from the RRC program.

Table 6 – Key roles and responsibilities risks based on RRC risk assessment

	Key Risk
1	Lack of understanding regarding roles and responsibilities and interface risks
2	Unclear statement of river operational objectives, expectations levels of service for proposed flows
3	Function or power of River Operators to deliver proposed flows
4	Lack of certainty regarding liability as well as different risk appetites resulting in lack of endorsement for seasonal watering projects

Workshop feedback

As noted above, implementation of higher environmental flows will require greater cooperation and coordination across a number of organisations and jurisdictions. Clearly defined roles and responsibilities are an important element of any coordinated approach.

Communications was an area that workshop participants identified as likely to be subject to risks arising from the implementation of higher environmental flows. Operational notifications of flow forecasts were identified as an area where there was potential for overlap in roles between river operators and the Bureau of Meteorology and the State Emergency Services' traditional roles in flood warning. More broadly, risks were noted in relation to coordination of communications where higher environmental flow events spanned across the southern connected basin. It was also noted that individual CMAs may need engagement support where planned flows primarily provided benefits outside their own regions.

Many workshop participants indicated that there was uncertainty about management of potential liability from overbank environmental flows, and were seeking clear bounds for roles and responsibilities to manage this. There are likely to be a range of program components that are intended to manage liability, including easements or works, appropriate sizing of flow buffers to manage operational uncertainties, and clarity about how any exceedance of flow limits would be managed (redress pathways). These issues were mostly outside of the scope of the workshop, but are noted as being important in terms of roles and responsibilities of agencies more widely.

A greater need for system wide and "landscape-scale" environmental water planning was noted by a number of workshop participants, and is discussed further in the following section. However, it was not clear under current arrangements who would have the role of managing this expanded scale of environmental water planning.

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Workshop participants were able to provide written and verbal comments through the workshop process, and there was a group discussion to help clarify and test comments. Comments were subsequently reviewed to develop a risk description, which includes the causal event and the nature of the consequence. The derived risk descriptions were then categorised into the five categories described in Section 3.3.1. A listing of the risk descriptions and risk categories is shown in Table 9**.**

4.4 Planning for environmental water delivery

Planning for environmental water delivery involves preparation of seasonal watering proposals and planning at environmental sites to identify the desired environmental water use under a range of climate and water availability scenarios. This planning takes into account relevant information, including long term watering plans, technical reports, any site monitoring data, and consultation with key stakeholders.

Environmental water delivery planning includes the following key functions:

- Timing, duration, magnitude and frequency of releases
- Consulting and coordinating consent for watering private land where existing agreements are not already in place.
- Consulting public land managers regarding planned releases and attaining formal approval from the public land manager for site access and works associated with watering
- Preparing a delivery plan for diversions of water onto land such as wetlands and floodplains, to provide information such as the delivery mechanism, confirmation of landholder approvals, delivery costs and evaluation of any risks.
- Consulting the delivery infrastructure operator to ensure there are no planned maintenance activities that may impact ability to deliver environmental flows
- Providing information and advice regarding system operations and third party impacts
- coordination and/or participation in operational advisory groups (OAGs) to coordinate operational delivery planning risk management among partner agencies throughout the season.

The following questions were posed to workshop participants:

1. What are the risks associated with the planning function under relaxed constraints – will community or other stakeholder engagement/acceptance be more time consuming or difficult to achieve?
2. Is there a risk that Environmental Water Advisory Groups will not support the proposed higher environmental flows?
3. Will any of the existing flow delivery planning functions be riskier under higher proposed flows?

Table 7 – Key environmental flow planning risks based on RRC risk assessment

	Key Risk
1	Community input and engagement proves more difficult for acceptance of seasonal plans
2	Environmental Water requirements underestimated and expected benefits not achieved
3	Lack of understanding of the community and stakeholders on impacts of higher flows within published seasonal plans
4	Resourcing and budgets are stretched resulting in inadequate planning to deliver environmental flows

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Workshop feedback

There was significant concern that existing arrangements across agencies for environmental water planning would need to have a wider focus across valleys, and ensure that there was greater planning at a "landscape scale" rather than the current, more site-focussed approach. This would require system-wide planning, and collaborative planning processes between environmental water planning organisations.

Feedback from workshop participants indicated that a greater landscape scale focus would face a number of challenges, including sharing of Murray flow capacity between tributaries, more trade-off decisions being required, and obtaining large numbers of individual site approvals under the current arrangements. It was also noted that engagement for site and landscape scale planning may need to be undertaken concurrently. It was suggested that there would likely be a need for increased discussion across CMAs during the planning of environmental flows.

Environmental water planning involves consultation with Traditional Owners, and it was noted that seeking consent was currently site focussed, and there are likely to be challenges in seeking consent for landscape scale actions. It was also identified that the Victorian Aboriginal Water Program may change or increase environmental water planning consultation with Traditional Owners.

More broadly, some participants noted that there would be other challenges for environmental water planning, including planning for different climate conditions over a large area, and allowing for opportunistic use of natural tributary inflow events to help support higher environmental flows.

4.5 Ordering and delivering environmental water

The process of ordering and delivering higher environmental flows will be significantly more complex than for the existing environmental and consumptive demands. This will include the prior development of orders for releases to be targeted under a range of potential climatic conditions, the arrangements for approving the commencement of those releases, and the procedures for managing the delivery as climatic conditions unfold during the releases. Accordingly, ordering and delivery of higher environmental flows is the key program area that is expected to have the most risk, and managing these is the focus of most of the static mitigation measures for the program.

Based on prior risk assessments and the work undertaken in the NSW RRC program, the following potential areas of risk were posed to workshop participants:

Pre Ordering Communication - Does this change under relaxed Constraints?

Public Notice to Release

- Enhanced notification services;
  - Landholders and communities need to be able to receive timely info on proposed flow events
    - Annual plans, proposed events advice, actual event info
    - Enables people to avoid risk – move stock, portable assets, put any preparations in place
- Are the notification systems and processes adequate under relaxed constraints?

Ordering and Confirmation

Is the existing system and processes adequate given the larger flows and possible scrutiny of this activity?

Should there be an ultimate group of decision makers (authorisation) for go/no go for bigger riskier events?

Overshooting or falling short

Are there adequate tools and techniques to manage and/or monitor this and what are the impacts?

Workshop participants were also provided with a table of key risks from the NSW RRC program.

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Table 8: Key ordering and delivery risks based on RRC risk assessment

	Key Risk
1	Resourcing is stretched for daily operations and development of documentation
2	River Operations policies, plans, protocols, decision making, and risk management documentation may not be adequate for proposed flows
3	Forecasting and river management tools are not adequate
4	Insufficient tools and information for new flow ranges benefits not achieved
5	Unclear policy or position if flow limit and buffer were exceeded
6	Function or powers of river operators to deliver proposed flows
7	Lack of visibility (publicly available) of procedures and protocols for proposed flows

Workshop feedback

The key risks based on the NSW RRC program in Table 8 above were generally supported by workshop participants.

Workshop participants noted the importance of enhanced flow forecasting tools, appropriate sizing of easements and other measures to create a flow buffer above the flow limits to be targeted, statutory and policy recognition and support of the environmental water delivery function, and clarity about legal consequences if flows higher than the buffer were to occur despite the best efforts of river operators. These arrangements will fundamentally alter the level of risk that river operators (and river communities) face, and need to be recognised. It was also recognised that these primary mitigation measures are generally being developed via other workstreams in the program to be implemented before commencing higher environmental flows, should the CMP proceed. Some comments were made that there is significant overlap in the development of these mitigations with the work being undertaken by EEWD and the NSW RRC program.

Participants were asked to consider risks that may arise during river operations assuming that the mitigations discussed above were in place.

A number of workshop participants noted that risk-based flow forecasting would become increasingly important to manage the uncertainty in weather forecasts during higher environmental flow events, and the range of climatic conditions that might occur when planning for these events. It was noted that there were risks that this approach may not be well understood by some environmental water managers, and particularly by landholders and the public. In particular, there was concern that public expectations around the precision of flow forecasts may be unrealistic, and that flow forecasts would need to be carefully communicated. As a potential mitigation measure, additional communications to improve the general understanding of how flow forecasting is undertaken, and the potential for a range of flow outcomes to occur was considered important.

Notifying landholders and the public about current and forecast flows was also considered an area of potential risk, with the current weekly notifications via SMS (Murray only) unlikely to be sufficient during higher environmental flows. As noted in the discussion around roles and responsibilities, clear roles and collaborative arrangements with the Bureau of Meteorology will be important.

The links between river operators and environmental water managers were recognised as being important to ensure higher environmental flows were well planned and delivered. When developing additional procedures for higher environmental flows, ensuring these links were maintained and even increased was seen as important.

Resourcing was a risk identified by many workshop participants, with a lack of resourcing to develop the primary mitigation measures and to ensure testing, training and developing experienced staff seen as a source of risk. A need for an increased level of resourcing to undertake higher environmental flows was identified, with

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higher initial levels of resourcing having the potential to reduce over time as procedures and were refined and operational experience gained.

In general, risks tended to increase with increasing flows, and there was no particular flow rate identified within the range of flows under consideration where risks were thought to increase significantly.

A draft risk register has been developed for the key risks identified from the workshop. An initial assessment of the key risks and has been undertaken to determine a rating prior to any mitigation measures, but assuming the primary mitigations being developed in other workstreams are in place (e.g., easements and works). A summary of the key risks is shown in Table 9.

Workshop participants suggested a number of potential mitigations, including:

- lowering of weir pools ahead of large flows to provide some ability to augment or reduce environmental flow events as they travel along the river system,
- ensuring sufficient resourcing to develop and implement new arrangements, including:
  - flow forecasting tools and procedures (including verification of these tools),
  - training and documentation,
  - the increased requirements for flow notifications, and
  - communication and education regarding higher environmental flows and flow forecasting.

Suggested potential mitigations relating to specific risks have been used as input to the development of mitigation measures, as described in Section 5**.**

Table 9 – Initial risk register

Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating
1.0	Flow forecasting and delivery	Higher environmental flows increase impacts during subsequent natural flow events	Financial	Possible	Moderate	Medium (4)
2.0	Flow forecasting and delivery	Inability to quickly plan complex events over one or more river systems results in missed opportunities for environmental watering events	Environment and conservation	Almost certain	Moderate	High (8)
3.0	Public communication and education	Insufficient or ineffective flow notifications during relaxed constraints flow events results in public or private impacts	Health and safety	Unlikely	Major	Low (3)
3.1	Public communication and education	Insufficient or ineffective flow notifications during relaxed constraints flow events results in public or private impacts	Financial	Possible	Moderate	Medium (4)
3.2	Public communication and education	Insufficient or ineffective flow notifications during relaxed constraints flow events results in public or private impacts	Reputation and trust	Almost certain	Moderate	High (8)
3.3	Public communication and education	Insufficient or ineffective flow notifications during relaxed constraints flow events results in public or private impacts	Legal (including liability) and compliance	Possible	Moderate	Medium (4)
4.0	Public communication and education	Insufficient or uncoordinated consultation and engagement results in environmental flow actions that do not match community and landholder expectations	Reputation and trust	Possible	Major	Medium (6)
5.0	Public communication and education	Insufficient understanding of flow forecasts by landholders and public	Reputation and trust	Likely	Moderate	Medium (6)
5.1	Public communication and education	Insufficient understanding of flow forecasts by landholders and public	Health and safety	Possible	Major	Medium (6)
6.0	Environmental flow planning	Lack of coordination between agencies results in missed environmental watering opportunities.	Environment and conservation	Likely	Moderate	Medium (6)
7.0	Public communication and education	Lack of effective consultation and/or communication, resulting in increased concern and opposition	Reputation and trust	Likely	Minor	Low (3)
8.0	Governance and coordination	Lack of existing/clear agency roles and/or procedures leads to missed environmental watering opportunities.	Environment and conservation	Likely	Moderate	Medium (6)
9.0	Governance and coordination	Lack of existing/clear agency roles and/or procedures leads to unintended/unmanaged inundation.	Reputation and trust	Possible	Major	Medium (6)

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating
9.1	Governance and coordination	Lack of existing/clear agency roles and/or procedures leads to unintended/unmanaged inundation.	Environment and conservation	Likely	Moderate	Medium (6)
10.0	Environmental flow planning	Lack of resourcing and capability to undertake landscape planning and coordination.	Environment and conservation	Likely	Moderate	Medium (6)
11.0	Environmental flow planning	Lack of resourcing leads to missed opportunities for environmental releases at higher flows.	Environment and conservation	Likely	Moderate	Medium (6)
12.0	Flow forecasting and delivery	Uncertainty in flow forecasting leads to lack of inundation and reduced environmental outcomes	Environment and conservation	Likely	Moderate	Medium (6)
13.0	Flow forecasting and delivery	Uncertainty in flow forecasting leads to unintended/unmanaged inundation.	Reputation and trust	Possible	Moderate	Medium (4)
13.1	Flow forecasting and delivery	Uncertainty in flow forecasting leads to unintended/unmanaged inundation.	Environment and conservation	Likely	Moderate	Medium (6)
13.2	Flow forecasting and delivery	Uncertainty in flow forecasting leads to unintended/unmanaged inundation.	Legal (including liability) and compliance	Likely	Moderate	Medium (6)
14.0	Flow forecasting and delivery	Water ordering and delivery process inefficient or ineffective	Environment and conservation	Possible	Moderate	Medium (4)

5 River operations mitigations workshop

Developing and assessing appropriate mitigation measures is a key component of the risk management process. Initial assessment of mitigations at this stage of the process is important for assessing whether it is possible for the identified risk to be appropriately treated. The degree of mitigation may change in subsequent stages of the project, as mitigation measures are further developed.

5.1 Workshop overview

Following on from the risk workshop held in June 2022 that discussed and identified key river operations risks, and some initial mitigations that need to be considered if operational flow constraints on environmental water are to be relaxed, a second workshop was held on 12 October. Consistent with the first workshop, the second workshop included representatives from river operator organisations (GMW, MDBA, and WaterNSW), Victorian CMAs, DELWP, the VEWH and the NSW RRC program. This second stage of consultation considered a set of 15 key risks arising from the first workshop and further work by the CMP river operations project team, and then discussed a range of mitigation options to address the key risks.

As with the first workshop, discussion focussed on the ongoing "dynamic" risks and mitigations that will vary over time and typically arise as part of river operations, rather than the "static" risks and mitigations that do not change over time, and would be addressed via other workstreams as part of the implementation of the Victorian CMP. However, to ensure there are no gaps and to acknowledge the likely requirement for river operations input, this river operations workstream has included some mitigations that are also associated more broadly with work across the Victorian CMP, including statutory powers and roles for delivery of overbank environmental flows, buffer zones within easements, and the potential for developing redress pathways for compensation as a "fail safe" or back-up to the other mitigations.

The workshop program consisted of two main parts that covered the following key areas:

- Reviewing key risks, and a draft summary risk register to ensure the following
  - the outcomes of the first workshop had been captured appropriately,
  - that there were no gaps or omissions in the summary risk register, and
  - to consider an initial set of ratings for the identified risks, based on the Victorian Environmental Watering Program Risk Management Framework2, developed by the VEWH.
- Validating potential options for mitigations required to support delivery of higher environmental flows, including;
  - An initial set of mitigation options, including draft descriptions
  - Responsibilities for leading the development of each mitigation, and also of supporting roles for organisations and programs.
  - Potential actions for the next stage (Stage 1B) of this program to progress each mitigation, if the CMP proceeds to further implementation.

As with the first workshop, participants were given an initial set of general questions for each part of the second workshop, and asked to identify any issues, errors, or omissions as written comments via the on-line virtual whiteboard collaboration tool. These were subsequently discussed as part of the workshop to confirm an understanding of comments and to test the support among workshop participants.

[2] Victorian Environmental Watering Program: Risk management framework, Victorian Environmental Water Holder, 2021

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5.2 Potential river operations mitigation measure options

Based on the feedback from the first workshop, work already undertaken to develop the initial business case, and the outcomes of the recent river operations risk assessment undertaken as part of the NSW RRC program, the project team prepared a set of river operations mitigation measure options for consideration at the second workshop. These mitigation measures are described below, and summarised in Table 10.

Statutory powers and roles for overbank environmental flows

Work undertaken for Stage 1A of the EEWD program has identified that there is not currently an explicit statutory responsibility or role to deliver overbank environmental flows for all jurisdictions. Creating a clear statutory responsibility for river operator organisations to deliver overbank environmental flows, recognised as an important foundational measure in Stage 1A of the EEWD program, enables river operators to undertake relaxed constraints releases within agreed limits with the legal certainty that they require.

This mitigation measure has been included in the river operations workstream as it has particular significance for river operator organisations, although it is recognised that there may be implications across other workstreams of this program, and there are links to other programs such as EEWD.

- Clearly define the roles and liability implications of environmental water delivery as a part of water flows
- Provide confidence to operators by having clear decision framework with authority to work within adopted risk tolerance

Appropriate buffers included in easements

Incorporation of an additional area or “buffer” zone when determining primary mitigation measures such as landholder agreements (e.g. easements) and other works is proposed, recognising that, despite proposed work to improve river flow forecasting tools (see mitigation measure 4 below), there will still be residual forecasting uncertainty for river operations when targeting particular flows to achieve environmental outcomes. As with mitigation measure 1, work undertaken for Stage 1A of the EEWD program and in the initial business cases has identified buffers as an important mitigation measure to provide confidence to operators to be able to target agreed flows for environmental outcomes.

This mitigation measure has been included in the river operations workstream as it has particular significance for river operator organisations, although it is recognised that there may be implications across other workstreams of this program, and there are links to other programs such as EEWD.

Redress pathway if flows exceed limits

Implementing arrangements to provide compensation in the unlikely event that, despite river operator organisations complying with any agreed procedures and arrangements, river flows still exceed agreed limits and buffers is considered important to provide confidence to river operator organisations. This measure would provide a back-up or “fail-safe” mechanism for stakeholders and river operator organisations.

This mitigation measure has been included in the river operations workstream as it has particular significance for river operator organisations, although it is recognised that there may be implications across other workstreams of this program, and there are links to other programs such as EEWD.

Develop operations tools to improve flow forecasting

A key risk mitigation is to improve the tools and information available to river operators to enable better forecasting of river flows for overbank environmental flows in the agreed ranges for the Victorian relaxed constraints program. This recognises that, although existing tools used by river operator organisations provides some forecasting capability across a range of flows, they are primarily focussed on within-channel flows in the ranges required to meet irrigation demands. This measure may include improving existing tools as well as

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developing new tools such as Source or hydraulic models, or rainfall-runoff models. This is recognised as a technically complex mitigation measure, and that there are linkages with the EEWD program.

As part of this mitigation measure, it is proposed that provisions would be made for capacity building and continuous improvements over time, and the potential for risk-based forecasting of river flows to better understand the range of potential outcomes as river flow events unfold.

Better information to support improved flow forecasting

This measure would provide more data to support better flow forecasting, such as river flow gauging stations, rainfall stations, and other information that could support forecasting of river flows. This measure could include a review of the rainfall and hydrometric (streamflow) gauge networks and telemetry access to data to ensure sufficient coverage in high-risk zones and add new sites if required.

Some additional hydrometric stations have already been proposed as part of the initial Goulburn constraints business case and are planned to be installed and commissioned as part of Stage 1A of the Victorian CMP.

Development and implementation of an effective event notification system to alert downstream stakeholders

This has been identified as a key mitigation measure to expand existing notification arrangements and ensure that landholders and the downstream community have the necessary notification of flow events to manage their activities and ensure there are no avoidable impacts. Notifications may need to take a number of forms, and consider a diverse range of downstream stakeholders and activities.

This is recognised as a complex mitigation measure, and that there will need to be linkages with existing notification systems, and also with the NSW RRC program and the South Australian relaxed constraints program.

Staged implementation and trials

River operators and stakeholders have previously indicated that staging the implementation of higher environmental flows and the use of trials is important, and this is recognised as an important mitigation measure. It is proposed that this mitigation measure includes appropriate monitoring and evaluation to support adjustment of flows during an event and to recognise key learnings from events. This would include commencing with a more conservative release strategy and building towards agreed limits over time, as well as ensuring that program management includes structured adaptive management processes.

Coordinated landscape-scale environmental water planning and consultation process

A significant outcome of the workshops was the recognition that higher environmental flows would require a significant increase in the degree of coordination and collaboration required at a larger spatial scale between environmental water managers during the planning and consultation stages. This would include a greater emphasis on planning and consultation at the system scale, and coordination between river valleys. This mitigation measure would also include investigation of streamlining environmental watering approvals, and arrangements for effective community consultation and communication across a larger spatial scale.

It is recognised that there may be implications across other workstreams of this program, and there are links to other programs such as EEWD.

Investment in capacity and capability of human resources

There is expected to be an increase in resourcing required to deliver higher environmental flows, including training, trials and potentially simulation exercises in the implementation stages, as well as developing comprehensive documented procedures to support staff capability and capacity. It is also recognised that, over

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the longer term, submissions to pricing regulators will be important, and it is noted that formal recognition of a responsibility to provide higher environmental flows under mitigation measure 1 will be important for this.

More efficient/effective environmental water ordering

Water ordering and event planning and coordination between environmental water managers and river operators is particularly important to achieving the intended environmental outcomes from higher environmental flows, and avoiding missed opportunities or unexpected inundation. This mitigation measure includes developing pre-agreed processes and arrangements to facilitate quicker operational decision-making. This might include pre-planned events or "standing orders", and pre-agreed conditions for management of releases during events. It is recognised that there are linkages between this mitigation measure and activities within the EEWD program.

Operational mitigations

A number of specific operational actions and strategies have been identified that can assist with managing flows during higher environmental watering events. These include consideration of pre-lowering of weir pools (e.g. Lake Mulwala, Lake Nagambie), and use of off-river storages (including Waranga Basin) to manage unexpected inflows.

Program communication

Effective communication of the program mitigations was recognised as being important for operational implementation of higher environmental flows to build public support and ensure that other mitigation measures are effective. This includes communication of planned watering strategies and demonstrating environmental benefits, and ensuring that the risks mitigated. Key challenges are expected to be building understanding and acceptance that higher managed flows can provide mitigation of flows in subsequent natural flow events and communicating operational uncertainty and the how risks are managed by river operators.

Develop relevant policies and procedures and provide appropriate public visibility / transparency

Appropriate policies and procedures will be important for river operators and environmental water managers to ensure best practice and quality assurance of new activities required to deliver higher environmental flows, and also to build understanding and confidence with stakeholders that risks are being managed appropriately.

Workshop feedback

Across the workshop there were numerous written comments posted. These comments were later reviewed and, where appropriate, used to add or modify key risks and mitigations, including responsible agencies or programs and actions for the next stage of the program, should the CMP proceed furhter. This resulted in the initial 15 key risks being reduced to 14 key risk descriptions (two were merged), and a set of 13 primary mitigations that applied across the key risks.

Many of the identified mitigations were found to apply across more than one key risk, with some key risks having a set of mitigations that would be required to address the risk. For example, eight of the 13 primary mitigations were identified as being relevant to the key risks regarding uncertainty in flow forecasting, including: legal and statutory mitigations (appropriate buffers included in easements, redress pathway), developing operational tools and better information to improve forecasting, trials and operational strategies, appropriate resourcing, and communications.

The table below provides a description of the mitigations.

Table 10 – Proposed actions for further development of river operations mitigation measures

Mitigation	Description	Responsibility lead and support	Stage 1B river operations action	Context / Guidance / Requirements
Statutory powers and roles for overbank environmental flows	Legislation provisions to give clear power to be able to deliver overbank environmental flows Clearly define the roles and liability implications of ewater delivery as a part of water flows Provide confidence to operators by having clear decision framework with authority to work within adopted risk tolerance	EEWD and Constraints programs (Mitigation works and easement compensation workstream)	Coordination and input EEWD / mitigations workstream	This is a central element of workstream 5 of measure 4 within the EEWD program, and there would need to be a coordinated approach across jurisdictions Legal advice likely to be required for VCMP and Victoria to contribute to development of a coordinated approach.
Appropriate buffers included in easements	Include an appropriate allowance for operational forecast uncertainties when determining primary mitigation measures (easements and works). Additional extent for easements and works where appropriate	Mitigation works and easement compensation workstream together with support from the Hydrology and modelling workstream, and river operators	Input to design of buffers (establish reasonable uncertainty limits for targeting flows, taking into account reaction times for tributary inflows, and any available mitigations)	Modelling advice expected to be a key input. Balance between mitigation and cost may need to be considered
Redress pathway if flows exceed limits	Implement a clear process, including funding, for stakeholders to seek redress if flows exceed agreed limits.	EEWD and Constraints programs (Mitigation works and easement compensation workstream)	Input to development of redress pathway	Appropriate records and processes to support a redress pathway program Potentially an element of workstream 5 of the EEWD program, and there would need to be a coordinated approach across jurisdictions Legal advice likely to be required for VCMP and Victoria to contribute to development of a coordinated approach.
Develop operations tools to improve flow forecasting	New tools and data that improve flow forecasting skill. Invest in tools to allow for capacity building and improved accuracy and development/improvement over time	River operators supported by EEWD and CMAs	Functional design, scoping of tools, user acceptance criteria	May need to consider implications across Victoria, and whether there should be a wider strategy: e.g. moving towards a consistent platform across Victoria over time (e.g. Source). This is the most technically complex mitigation measure

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Mitigation	Description	Responsibility lead and support	Stage 1B river operations action	Context / Guidance / Requirements
	Improve existing tools, Source and hydraulic model calibration Develop operational river models including rainfall-runoff models for the Goulburn River and its tributaries Risk-based forecasting/decision-making			Requirement for Goulburn specific analysis to support development of tools, in coordination with EEWD This is a central element of workstream 1 and 2 of measure 4 within the EEWD program
Better information to support improved flow forecasting	Specific recent review for part of Goulburn catchment (Goulburn BC mitigation to expand the rainfall monitoring and stream gauging network in the mid-Goulburn) Review coverage of rainfall and streamflow gauge networks and telemetry access to data to ensure sufficient coverage in high-risk zones and add new sites if required Objective to inform Murray main stem decisions (RRC) Links to EEWD	River operators Supported by EEWD DELWP (hydrometric monitoring partnership)	Specifications for improved data requirements Linked to EEWD stage 1B	Will likely need to be progressed in concert with Mitigation 4. Consider partnerships: BoM streamflow forecast products
Development and implementation of effective event notification system to alert downstream stakeholders	Provide proposed watering plans annually (All RRC) Mapping and identification of camp sites that will be affected at different flow levels Consider rates of rise that reduce safety risks to campers Prominent signage which is well maintained at key access points Apps and automated text warning services Media alerts Local councils and National Park Service to close known camping sites prior to events Consider the need to use notification systems during natural events so river users have consistent information Community engagement in Notification Program design	River operators, BoM (operational notifications) EWMs (annual/seasonal watering plans) Communications and engagement workstream	Develop a notification strategy Design flow advice products	Notification strategy will require a coordination of scope and approach: across agencies in Victoria - potential for collaboration (e.g. “all risks” warning app) across jurisdictions (Murray River) with broader communications about environmental watering – annual/seasonal planning Development of flow advice products based on: Consultation and feedback with landholders and community capabilities of new operational tools

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Mitigation	Description	Responsibility lead and support	Stage 1B river operations action	Context / Guidance / Requirements
	Centralised end-to-end notifications (one place for flow notifications and also environmental watering plans/updates) Implementation of ongoing communication and engagement plan (including education) Consider a Victorian "all risks" warning system/app			
Staged implementation and trials	Structured adaptive management processes (learning from doing) including initially conservative release strategy (e.g. avoid peak enhancement). This could include ongoing monitoring and evaluation using satellite imagery to compare events to inundation mapping (RRC) Structured adaptative management processes, particularly within event monitoring and adjustments to event duration/volume.	River operators, and EWMs	Operational design of stages/trials	Objective: fine tune operations and coordination. In collaboration with development of environmental watering regime, consider appropriate staging for implementation Scoping of smaller events initially that still provide environmental outcomes and opportunities to test operational delivery and communications. Develop a coordinated approach across jurisdictions (potentially via EEWD) and Victorian agencies.
Coordinated landscape-scale environmental water planning and consultation process	Coordination between valleys/catchments required. Inter-agency coordination at a landscape scale required. Coordinated landscape-scale planning process to ensure consultation covers all potential actions. Collaborative planning at the system scale. Commence upstream environmental watering planning early enough to allow timely downstream planning to occur. More streamlined, less resource-intensive approvals process for environmental watering (explore ways of rationalising or grouping assets and coordinating across the border at specific flow bands / flow rates).	VEWH to lead CMAs River Ops Inter-jurisdictional coordination (e.g. SCBEWC) VEWH DELWP	Design of enhanced environmental water planning and consultation process	Enhance existing processes, in collaboration with appropriate agencies, to provide coordination of environmental water planning across sites and between river valleys. Appropriate coordination across jurisdictions will be required. Coordination required with EEWD: Broader environmental water planning coordination (Measure 2, Activities 8 and 9 in Stage 1A)

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Mitigation	Description	Responsibility lead and support	Stage 1B river operations action	Context / Guidance / Requirements
	Consider development of arrangements for closer community involvement in decision-making and improve communication of the rationale behind decision Risk-based planning Links to EEWD.			
Investment in capacity and capability of human resources	Training, drills/trials/simulation exercises. Comprehensive, documented procedures More staff/resources, Submissions to pricing regulators to secure funding requirements (Statutory powers will support funding applications - link to mitigation 1)	River operators and EWMs	Scope requirements for capability building and documentation Development of draft resource and funding plan Statutory recognition	Identifying responsibilities / obligations and associated ongoing resourcing requirements for river operator and environmental water manager organisations, including: potential funding sources funding requirements over time. Links to mitigation 13
More efficient/effective ewater ordering	Pre-planned events have "standing orders", pre-planned options for carryover and trade provisions for managing environmental water Adaptive delivery targets developed prior to the event with options for changes to release rates and flow targets in the event of rain (RRC) Develop environmental water ordering arrangements (agreements) that include pre-agreed conditions for within event water ordering (RRC) Update/expand existing arrangements to cover full range of anticipated e-flows. Links to EEWD	EEWD, input from EWMs and river ops.	Design enhancements to existing processes for ordering environmental water.	Design of enhancements should consider: pre-agreed design of flow events/orders, including alternative options for changed conditions enhancing systems to facilitate more complex environmental flow orders operational arrangements for decision making leading up to and during flow events (including inter-jurisdictional arrangements)
Operational mitigations	Pre-lowering of weir pools (e.g. Lake Mulwala, Lake Nagambie),	River operators EWMs	Input to River operators' operational procedures (e.g. O&Os on Murray)	Further conceptualise potential operational mitigations, and scope likely benefits and impacts (including water reliability risks)

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Mitigation	Description	Responsibility lead and support	Stage 1B river operations action	Context / Guidance / Requirements
	Use of off-river storages (including Waranga Basin) Links to mitigation 10 (pre-planned events and actions) and mitigation 9 (coordinated seasonal planning) Monitoring and adjusting releases during events			Investigate and identify required procedures and processes.
Program communication	Project comms to effectively communicate the benefits of static mitigations Build public support / acceptance that higher managed flows will provide flood mitigation benefits in subsequent natural events. Communicate modelling of watering strategies to demonstrate benefits / ensure risks mitigated. communicating the nature of a highly uncertain operating environment and the how risks are managed 3rd party benefits around reliability	Communications and engagement workstream Supported by Hydraulic and hydrologic modelling workstream Links to EEWD	Input to communications products	Participate in the development of a plan to communicate and (where appropriate) seek feedback on: program objectives, rationale, and benefits the environmental watering strategy for each valley operational arrangements that will be implemented, including roles and responsibilities, communications processes.
Develop relevant policies and procedures and provide appropriate public visibility / transparency	Enhance existing Valley OAs (VEWH) Internal GMW procedures CMA procedures Policies reflecting the proposed statutory changes Include an annual audit process Formalised procedure for regular documented risk identification, assessment and management	DELWP, VEWH, River operators, CMAs	Identify and scope the policies and procedures (at least in summary) for development and/or release.	Investigate and identify required procedures and processes required for: Appropriate governance and QA within government Public confidence in and understanding of arrangements in place to deliver higher environmental flows.

6 Summary risk register

A summary risk register developed for the key risks identified from the first workshop, including an assessment of the key risks prior to any proposed river operations mitigation measures, but assuming the primary static mitigations being developed in other workstreams are in place such as easements and works(refer Table 11). The proposed mitigations from Workshop 2 are also shown on the right side of the summary risk register (Table 11). All key risks were then reassessed assuming the identified mitigations were in place to confirm that they would be expected to reduce risks to a low or tolerable level.

In general, risks levels tended to increase with higher flow rates. However, there was no particular flow rate identified within the range of flows under consideration where risks were thought to increase significantly. The risk assessment indicates that effectively managing higher environmental flows across the proposed flow ranges is feasible with the identified mitigation measures in place. The risk assessment also found that there was no significant change in feasibility across the range of flows up to the flow limits proposed for assessment in the Murray and Goulburn systems as part of the Victorian CMP Feasibility Study.

Table 11 – Summary risk register

Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Mitigations
1.0	Flow forecasting and delivery	Higher environmental flows increase impacts during subsequent natural flow events	Financial	Possible	Moderate	Medium (4)	M4 - Develop operations tools to improve flow forecasting M5 - Better information to support improved flow forecasting M9 - Investment in capacity and capability of human resources
2.0	Flow forecasting and delivery	Inability to quickly plan complex events over one or more river systems results in missed opportunities for environmental watering events	Environment and conservation	Almost certain	Moderate	High (8)	M7 - Staged implementation and trials M8 - Coordinated landscape-scale environmental water planning and consultation process M9 - Investment in capacity and capability of human resources

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Mitigations
							M10 - More efficient/effective e-water ordering Links to EEWD.
3.0	Public communication and education	Insufficient or ineffective flow notifications during relaxed constraints flow events results in public or private impacts	Health and safety	Unlikely	Major	Low (3)	M6 - Development and implementation of an effective event notification system to alert downstream stakeholders
3.1	Public communication and education	Insufficient or ineffective flow notifications during relaxed constraints flow events results in public or private impacts	Financial	Possible	Moderate	Medium (4)	M6 - Development and implementation of an effective event notification system to alert downstream stakeholders
3.2	Public communication and education	Insufficient or ineffective flow notifications during relaxed constraints flow events results in public or private impacts	Reputation and trust	Almost certain	Moderate	High (8)	
3.3	Public communication and education	Insufficient or ineffective flow notifications during relaxed constraints flow events results in public or private impacts	Legal (including liability) and compliance	Possible	Moderate	Medium (4)	
4.0	Public communication and education	Insufficient or uncoordinated consultation and engagement results in environmental flow actions that do not match community and landholder expectations	Reputation and trust	Possible	Major	Medium (6)	M8 - Coordinated landscape-scale environmental water planning and consultation process M12 - Program communications M13 - Develop relevant policies and procedures and provide appropriate public visibility / transparency.

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Mitigations
5.0	Public communication and education	Insufficient understanding of flow forecasts by landholders and public	Reputation and trust	Likely	Moderate	Medium (6)	M6 - Development and implementation of effective event notification system to alert downstream stakeholders M7 - Staged implementation and trials
5.1	Public communication and education	Insufficient understanding of flow forecasts by landholders and public	Health and safety	Possible	Major	Medium (6)	
6.0	Environmental flow planning	Lack of coordination between agencies results in missed environmental watering opportunities.	Environment and conservation	Likely	Moderate	Medium (6)	M8 - Coordinated landscape-scale environmental water planning and consultation process M10 - More efficient/effective e-water ordering
7.0	Public communication and education	**Lack of effective consultation and/or communication, resulting in increased concern and opposition – merged with Key Risk 4.0**					
8.0	Governance and coordination	Lack of existing/clear agency roles and/or procedures leads to missed environmental watering opportunities.	Environment and conservation	Likely	Moderate	Medium (6)	M1 - Statutory powers and roles for overbank environmental flows M15 - Develop relevant policies and procedures and provide appropriate public visibility / transparency.
9.0	Governance and coordination	Lack of existing/clear agency roles and/or procedures leads to unintended/unmanaged inundation.	Reputation and trust	Possible	Major	Medium (6)	M1 - Statutory powers and roles for overbank environmental flows M8 - Coordinated landscape-scale environmental water planning and consultation process
9.1	Governance and coordination	Lack of existing/clear agency roles and/or procedures leads to unintended/unmanaged inundation.	Environment and conservation	Likely	Moderate	Medium (6)	

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Mitigations
							M13 - Develop relevant policies and procedures and provide appropriate public visibility / transparency.
10.0	Environmental flow planning	Lack of resourcing and capability to undertake landscape planning and coordination.	Environment and conservation	Likely	Moderate	Medium (6)	M8 - Coordinated landscape-scale environmental water planning and consultation process M9 - Investment in capacity and capability of human resources
11.0	Environmental flow planning	Lack of resourcing leads to missed opportunities for environmental releases at higher flows.	Environment and conservation	Likely	Moderate	Medium (6)	M9 - Investment in capacity and capability of human resources
12.0	Flow forecasting and delivery	Uncertainty in flow forecasting leads to lack of inundation and reduced environmental outcomes	Environment and conservation	Likely	Moderate	Medium (6)	M4 - Develop operations tools to improve flow forecasting M5 - Better information to support improved flow forecasting M7 - Staged implementation and trials M9 - Investment in capacity and capability of human resources
13.0	Flow forecasting and delivery	Uncertainty in flow forecasting leads to unintended/unmanaged inundation.	Reputation and trust	Possible	Moderate	Medium (4)	M2 - Appropriate buffers included in easements. M3 - Redress pathway if flows exceed limits
13.1	Flow forecasting and delivery	Uncertainty in flow forecasting leads to unintended/unmanaged inundation.	Environment and conservation	Likely	Moderate	Medium (6)	

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Mitigations
13.2	Flow forecasting and delivery	Uncertainty in flow forecasting leads to unintended/unmanaged inundation.	Legal (including liability) and compliance	Likely	Moderate	Medium (6)	M4 - Develop operations tools to improve flow forecasting M5 - Better information to support improved flow forecasting M7 - Staged implementation and trials M9 - Investment in capacity and capability of human resources M11 - Operational mitigations
14.0	Flow forecasting and delivery	Water ordering and delivery process inefficient or ineffective	Environment and conservation	Possible	Moderate	Medium (4)	M10 - More efficient/effective e-water ordering

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7 Next steps

The next steps for establishing effective mitigations for the risks associated with higher environmental flow limits requires further investigation and development of the identified measures in this report, as part of a subsequent stages of the Victorian CMP, if the program proceeds further.

In general, risks tended to increase with the higher flow rates. However, there was no particular flow rate identified within the range of flows under consideration where risks were thought to be unmanageable. The risk assessment indicates that managing higher environmental flows across the proposed flow ranges is feasible with the identified mitigation measures in place.

The risk assessment also found that there was no significant change in feasibility across the range of flows up to the flow limits proposed for assessment in the Murray and Goulburn systems as part of the Victorian CMP Feasibility Study .

Table 10 provides a description of the mitigation, who should lead or support the mitigation to ensure it meets the end users' needs and what should be considered in progressing the action.

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Appendix A: Appendix A: Draft Risk Register

Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Comment	Mitigations	Residual Likelihood	Residual Consequence	Residual Risk	Rationale
1.0	**Flow forecasting and delivery**	**Higher environmental flows increase impacts during subsequent natural flow events** • This is the "heightened flood risk" concern following a relaxed constraints release • Comment: this may be a broader risk that arises from implementation of the whole program	Financial	Possible	Moderate	Medium (4)	Is this an Ops risk or something to be considered more broadly (i.e. legal risk)? Also likely to be a Reputation and trust consequence.	• M4-Develop operations tools to improve flow forecasting • M5-Better information to support improved flow forecasting • M9-Investment in capacity and capability of human resources	Unlikely	Moderate	Low (2)	Mitigations likely to have a modest impact only, as natural event following a relaxed constraints release is beyond River Ops control. Further analysis required: - Effects of pre-wetting of floodplain in the range of flows contemplated by this project, - potential for increased flood mitigation following relaxed constraints releases, which may reduce consequence
2.0	**Flow forecasting and delivery**	**Inability to quickly plan complex events over one or more river systems results in missed opportunities for**	Environment and conservation	Almost certain	Moderate	High (8)	Beyond a resourcing issue, this is also a practicality issue. We could assume that	• M7-Staged implementation and trials • M8-Coordinated landscape-scale environmental	Unlikely	Minor	Low (1)	Effective tools and processes will reduce the likelihood. Can we also assume that effective tools and processes

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Comment	Mitigations	Residual Likelihood	Residual Consequence	Residual Risk	Rationale
		environmental watering events • Existing planning and ordering processes are impractical for larger environmental flow events					environment/conservation risk will be borne out in the first instance as operators would take risk-averse approach.	water planning and consultation process • M9-Investment in capacity and capability of human resources • M10-More efficient/effective ewater ordering Links to EEWD.				will avoid more serious impacts, or is consequence unchanged? Have assumed it will lower consequence to next lower category.
3.0	**Public communication and education**	**Insufficient or ineffective flow notifications during relaxed constraints flow events results in public or private impacts** • Many potential impacts that can arise from higher flows can be simply avoided with warning • Avoidable health and safety impacts could include unexpected inundation of low lying areas where recreation	Health and safety	Possible	Major	Medium (6)	Notifications aren't reaching people.	• M6-Development and implementation of effective event notification system to alert downstream stakeholders	Unlikely	Major	Low (3)	There may be technical feasibility issues with mitigation, but an effective notification system will reduce the likelihood. Can we also assume that an effective notification system will avoid more serious impacts, or is consequence unchanged? Have assumed it will lower consequence to next lower category.

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Comment	Mitigations	Residual Likelihood	Residual Consequence	Residual Risk	Rationale
		occurs (e.g. campsites)										
3.1	**Public communication and education**	**Insufficient or ineffective flow notifications during relaxed constraints flow events results in public or private impacts** • Avoidable financial impacts could include moving pumps or farming equipment out of the way	Financial	Possible	Moderate	Medium (4)	Notifications aren't reaching people.	• M6- Development and implementation of effective event notification system to alert downstream stakeholders	Unlikely	Minor	Low (1)	There may be technical feasibility issues with mitigation, but an effective notification system will reduce the likelihood. Can we also assume that an effective notification system will avoid more serious impacts, or is consequence unchanged? Have assumed it will lower consequence to next lower category.
3.2	**Public communication and education**	**Insufficient or ineffective flow notifications during relaxed constraints flow events results in public or private impacts** • Avoidable Reputation an trust impacts could include	Reputation and trust	Almost certain	Moderate	High (8)	Notifications aren't reaching people. Maybe lower in Goulburn as IVT notifications have improved over recent years. Potential for overlap with	• M6- Development and implementation of effective event notification system to alert downstream stakeholders	Possible	Minor	Low (2)	There may be technical feasibility issues with mitigation, but an effective notification system will reduce the likelihood. Can we also assume that an

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Comment	Mitigations	Residual Likelihood	Residual Consequence	Residual Risk	Rationale
		widespread media criticism if higher flows occurred without much public forewarning					BoM notification responsibilities .					effective notification system will avoid more serious impacts, or is consequence unchanged? Have assumed it will lower consequence to next lower category.
3.3	**Public communication and education**	**Insufficient or ineffective flow notifications during relaxed constraints flow events results in public or private impacts** • Avoidable legal impacts could include litigation by landholders or the public following one of the above consequences occurring	Legal (including liability) and compliance	Possible	Moderate	Medium (4)	Notifications aren't reaching people.	• M6- Development and implementation of effective event notification system to alert downstream stakeholders	Unlikely	Minor	Low (1)	There may be technical feasibility issues with mitigation, but an effective notification system will reduce the likelihood. Can we also assume that an effective notification system will avoid more serious impacts, or is consequence unchanged? Have assumed it will lower consequence to next lower category.

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Comment	Mitigations	Residual Likelihood	Residual Consequence	Residual Risk	Rationale
4.0	**Public communication and education**	**Insufficient or uncoordinated consultation and engagement results in environmental flow actions that do not match community and landholder expectations** • Landholders and community may not know what to expect when events occur • There may be potential opportunities or impacts that government is not aware of • Potential for opponents of the program to raise further criticism	Reputation and trust	Possible	Major	Medium (6)	• Possible, on basis that large events would not generally occur annually • Given there could be widespread concern and political comment at the landscape level (hence Major consequence) • - Unlikely that any "gap" in representation would involve a significant number of stakeholders. Includes previous Key Risk 7.0	• M8- Coordinated landscape-scale environmental water planning and consultation process • M12 - Program communications • M13-Develop relevant policies and procedures and provide appropriate public visibility /transparency."	Unlikely	Moderate	Low (2)	Mitigations reduce likelihood. Assume that consequence is reduced, as only smaller mismatch b/w events and expectations.
5.0	**Public communication and education**	**Insufficient understanding of flow forecasts by landholders and public** **- Flow forecast advice is potentially complex to**	Reputation and trust	Likely	Moderate	Medium (6)	Notifications are reaching people, but not being understood or interpreted correctly. May also result	• M6- Development and implementation of effective event notification system to alert	Unlikely	Moderate	Low (2)	Mitigations reduce likelihood. Consequence unchanged

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Comment	Mitigations	Residual Likelihood	Residual Consequence	Residual Risk	Rationale
		communicate, and there are risks in not getting this right • Reputational risk if public advice is not clear or understood					in legal action but, assuming government has acted in good faith, and EEWD Mandate mitigations are in place, then liability is unlikely.	downstream stakeholders • M7-Staged implementation and trials • M12-Program communications				
5.1	**Public communication and education**	**Insufficient understanding of flow forecasts by landholders and public Flow forecast advice is potentially complex to communicate, and there are risks in not getting this right** • Potentially a health and safety issue if advice not clear	Health and safety	Possible	Major	Medium (6)	It may not be possible to significantly improve "water literacy" for the general population.		Unlikely	Major	Low (3)	Mitigations reduce likelihood. Consequence unchanged
6.0	**Environmental flow planning**	**Lack of coordination between agencies results in missed environmental watering opportunities or environmental impacts**	Environment and conservation	Likely	Moderate	Medium (6)	Impacts at multiple locations - moderate consequence. Also seen as an Environmental flow planning risk.	• M8-Coordinated landscape-scale environmental water planning and consultation process • M10-More efficient/effectiv	Possible	Minor	Low (2)	Assume that coordinated landscape scale planning will mean that only minor missed opportunities or impacts occur, as process will most likely deal with any more

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Comment	Mitigations	Residual Likelihood	Residual Consequence	Residual Risk	Rationale
		• Planning at the "landscape scale" required where flow events occur across wide areas and affect multiple environmental water managers • Operational and seasonal activities need greater coordination than is currently required					Coordination between valleys/catchments required.	e ewater ordering				significant issues. May still be inter-jurisdictional issues - not sure of this part of EEWD process was confident in solving issues. (hence possible not unlikely)
7.0	**Public communication and education**	~~Lack of effective consultation and/or communication, resulting in increased concern and opposition~~	~~Reputation and trust~~	~~Likely~~	~~Minor~~	~~Low (3)~~	~~Unlikely that any "gap" in representation would involve a significant number of stakeholders.~~				#N/A	
8.0	**Governance and coordination**	**Lack of existing/clear agency roles and/or procedures leads to missed environmental watering opportunities** • Planning currently done	Environment and conservation	Likely	Moderate	Medium (6)	Impacts at multiple locations - moderate consequence. Clear governance and role definition to provide the right	• M1-Statutory powers and roles for overbank environmental flows • M15-Develop relevant policies and procedures and provide	Possible	Minor	Low (2)	As per Key Risk 6.0

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Comment	Mitigations	Residual Likelihood	Residual Consequence	Residual Risk	Rationale
		at the local scale rather than the broader ("landscape") scale required where flow events occur across wide areas and affect multiple environmental water managers • Clear agency roles needed to provide the right foundation / framework to enable coordination • Clearly define the roles and liability implications of ewater delivery as a part of water flows • Operational and seasonal activities need greater coordination than is currently required					foundation / framework to support the more operational and seasonal planning. There is an inter-jurisdictional component to this risk.	appropriate public visibility / transparency.				
9.0	**Governance and coordination**	**Lack of existing/clear agency roles and/or procedures leads to unintended /**	Reputation and trust	Possible	Major	Medium (6)	Coordination between valleys/catchments required. Also rated the	• M1 - Statutory powers and roles for overbank	Unlikely	Minor	Low (1)	Assume that mitigations will significantly reduce likelihood and consequence.

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Comment	Mitigations	Residual Likelihood	Residual Consequence	Residual Risk	Rationale
		unmanaged inundation • Higher environmental flows in usptream valley can be counterproductive at times in the downstream valley • Opposite consequence of Key Risk 8.0					environment and conservation consequence as Likely / Moderate with a Medium (6) rating as well.	environmental flows • M8 - Coordinated landscape-scale environmental water planning and consultation process • M13 - Develop relevant policies and procedures and provide appropriate public visibility / transparency.				No technical feasibility issues to overcome to implement mitigations.
9.1	**Governance and coordination**	Lack of existing/clear agency roles and/or procedures leads to unintended/unmanaged inundation. - Higher environmental flows in usptream valley can be counterproductive at times in the downstream valley - Opposite	Environment and conservation	Likely	Moderate	Medium (6)		• M1 - Statutory powers and roles for overbank environmental flows • M8 - Coordinated landscape-scale environmental water planning and consultation process • M13 - Develop relevant policies and	Unlikely	Minor	Low (1)	Assume that mitigations will significantly reduce likelihood and consequence. No technical feasibility issues to overcome to implement mitigations.

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Comment	Mitigations	Residual Likelihood	Residual Consequence	Residual Risk	Rationale
		consequence of Key Risk 8.0						procedures and provide appropriate public visibility / transparency.				
10.0	**Environmental flow planning**	**Lack of resourcing and capability to undertake landscape planning and coordination** • Recognition that *planning* larger environmental flow events will take more time and effort than current business as usual	Environment and conservation	Likely	Moderate	Medium (6)		• M8- Coordinated landscape-scale environmental water planning and consultation process • M9- Investment in capacity and capability of human resources	Possible	Minor	Low (2)	Assume mitigation reduces both likelihood and consequence.
11.0	**Environmental flow planning**	**Lack of resourcing leads to missed opportunities for environmental releases at higher flows** • Recognition that delivering larger environmental flow events will take more time and	Environment and conservation	Likely	Moderate	Medium (6)	Likely under current resourcing (already an issue), and will impact multiple sites. Assumption is that lack of resourcing would force river operators to avoid or limit releases	• M9- Investment in capacity and capability of human resources	Possible	Minor	Low (2)	

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Comment	Mitigations	Residual Likelihood	Residual Consequence	Residual Risk	Rationale
		effort than current business as usual					rather than result in unintended inundation.					
12.0	**Flow forecasting and delivery**	**Uncertainty in flow forecasting leads to lack of inundation and reduced environmental outcomes** • Existing flow forecasting tools and available operational data not suited to higher flows above the normal operational range • Uncertainty would result in more conservative releases	Environment and conservation	Likely	Moderate	Medium (6)	Risk will be modified by addressing buffers and redress pathways.	• M4-Develop operations tools to improve flow forecasting • M5-Better information to support improved flow forecasting • M7-Staged implementation and trials • M9-Investment in capacity and capability of human resources	Likely	Minor	Low (3)	Mitigation will have technical feasibility issues to address - EEWD Workstream 1 Assume likelihood of forecasting uncertainty will be the same, but that the magnitude of uncertainty (consequence) will be moderated by improved tools.
13.0	**Flow forecasting and delivery**	**Uncertainty in flow forecasting leads to unintended/unmanaged inundation** • Existing flow forecasting tools and available	Reputation and trust	Possible	Moderate	Medium (4)	Also financial risk, but rated minor. Risk will be modified by addressing buffers and redress pathways.	• M2-Appropriate buffers included in easements. • M3-Redress pathway if flows exceed limits	Possible	Minor	Low (2)	As above

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Risk ID	Risk category	Key Risk Description	Consequence category	Likelihood	Consequence	Risk Rating	Comment	Mitigations	Residual Likelihood	Residual Consequence	Residual Risk	Rationale
		operational data not suited to higher flows above the normal operational range • Uncertainty may result in flows that are higher than forecast, and loss of confidence / criticism from landholders and community					Complexity of floodplain inundation within broader static mitigations is not well understood.	• M4-Develop operations tools to improve flow forecasting • M5-Better information to support improved flow forecasting • M7-Staged implementation and trials • M9-Investment in capacity and capability of human resources • M11-Operational mitigations • M12–Program communications (for Key Risks 13.0 and 13.2)				
13.1	**Flow forecasting and delivery**	**Uncertainty in flow forecasting leads to unintended/unmanaged inundation** • Uncertainty leads to inundation that is greater than targeted	Environment and conservation	Likely	Minor	Low (3)	In absence of mitigations, likely we will fall short of flow targets at times. Originally assessed as Moderate consequence as occurs	• M2-Appropriate buffers included in easements. • M3-Redress pathway if flows exceed limits	Likely	Minor	Low (3)	As above

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		for environmental outcomes • Results in over-watering and environmental harm					across multiple locations, but re-assessed as Minor following workshop 2.	• M4-Develop operations tools to improve flow forecasting • M5-Better information to support improved flow forecasting • M7-Staged implementation and trials • M9-Investment in capacity and capability of human resources • M11-Operational mitigations M12–Program communications (for Key Risks 13.0 and 13.2)				
13.2	**Flow forecasting and delivery**	**Uncertainty in flow forecasting leads to unintended/unmanaged inundation** • Uncertainty in forecasting river flows results in flows that	Legal (including liability) and compliance	Likely	Moderate	Medium (6)	Based on $5-10m costs arising from flows above Minor Flood level but not reaching Moderate Flood level.	• M2-Appropriate buffers included in easements. • M3-Redress pathway if flows exceed limits • M4-Develop operations	Likely	Minor	Low (3)	As above

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		exceed the flow buffers • Results in financial impacts (e.g. pumps or farming, public infrastructure) that lead to legal action						tools to improve flow forecasting • M5-Better information to support improved flow forecasting • M7-Staged implementation and trials • M9-Investment in capacity and capability of human resources • M11-Operational mitigations • M12–Program communications (for Key Risks 13.0 and 13.2)				
14.0	**Flow forecasting and delivery**	**Water ordering and delivery process inefficient or ineffective** • Water ordering for relaxed constraints is more complex than for	Environment and conservation	Possible	Moderate	Medium (4)		• M7-Staged implementation and trials • M10-More efficient/effective ewater ordering"	Unlikely	Moderate	Low (2)	Added an additional mitigation for this Key Risk. Have assumed that the mitigation (enhanced/streamlined ordering process between river operators and

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		"normal" water ordering • Potential for delays in making releases, or releases not able to achieve some of the outcomes intended										environmental water managers) would address likelihood but not consequence.

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