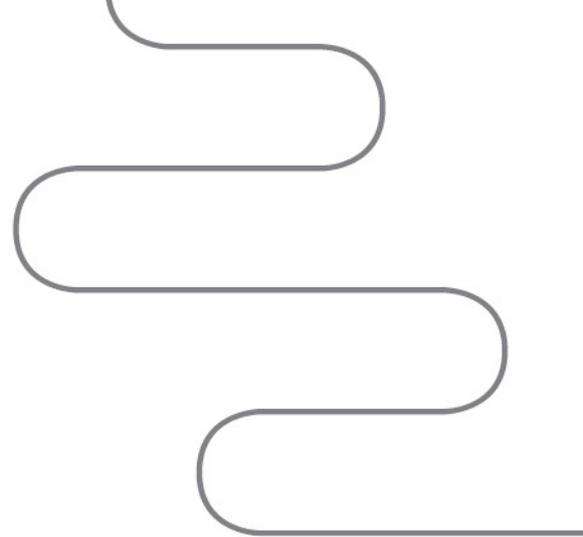




Australian Government



Gwydir region reach report

Constraints Management Strategy



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Acknowledgement of the Traditional Owners of the Gwydir region

MDBA acknowledges and pays its respects to the Gamilaroi people who are the Traditional Owners of the Gwydir Region described in this report. MDBA recognises and acknowledges that the Traditional Owners and their Nations have a deep cultural, social, environmental, spiritual and economic connection to their lands and waters. MDBA understands the need for recognition of Traditional Owners' knowledge and cultural values.

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Summary

For the past century, the Murray–Darling Basin (the Basin) has been developed with a focus on delivering water for productive use. Large dams have been built to capture and store as much water as possible to be used later for consumption and irrigation. There have also been many rules put in place across the Basin around how the rivers and dams are managed.

These structures and practices are of great benefit to our industries and have greatly supported the building of our nation, our Basin communities and our economy. However, the changes we have made have affected how, when and where the Basin's rivers flow, and how healthy they are. Water that once flowed downstream is now often stored and delivered in regular patterns at times that suits production, not necessarily in a more natural variable way that most benefits and supports the environment. Only when dams are full and spill over are there any significant overbank flows downstream.

For many floodplain areas of the Basin, the time between drinks is now too long for floodplain plants and animals. Small overbank flows that connect the river to its floodplain are vital to the environment. These overbank flows improve water and soil quality, recharge groundwater, and support native plant and animal species. Before rivers were regulated, these flows were far more common. The lack of these flows is affecting long-term river and floodplain health, and, ultimately, Basin communities and businesses who rely on healthy waterways.

Environmental watering has been successfully done for many years in some parts of the Basin, and is one way we can deliver water to benefit the environment. However, there would be many environmental benefits if we could deliver slightly higher flows in the future (mostly up to minor flood level) to reach the floodplains. So, the Basin governments requested that the Basin Plan include a Constraints Management Strategy (the Strategy) to explore how this might be done.

The Constraints Management Strategy

The Strategy is about ensuring that water can flow onto the floodplain, while mitigating any effects this water may have on property and people.

For the purpose of the Strategy, constraints are river rules, practices and structures that restrict or limit the volume and/or timing of regulated water delivery through the river system. Implementing the Strategy will support governments to operate our highly regulated rivers in smarter ways to increase the frequency and duration of small overbank flows to sustain and improve floodplain health.

Given consumption and irrigation needs, it is not possible, nor is it the goal, to return regulated rivers to their 'natural' or 'without development' flows. The Strategy is also not trying to create or change how often moderate and major floods occur. The idea is to make modest regulated releases from storages, generally when higher flows downstream would have occurred if dams were not there. That is, the small overbank flows being proposed will 'top-up' natural rainfall or unregulated tributary flows, to increase either their peak or duration.

In 2013 and 2014, we completed the first phase of work — the pre-feasibility phase — which involved looking at seven areas of the Basin in more detail. The Murray–Darling Basin Authority (MDBA) collected information about how small overbank flows, typically up to around minor flood

level, affect the environment and people who live and work along this section of the River Murray. We also collected information about how such flows can be managed, and what sorts of protective measures are needed first.

This report was released for public comment in November 2014. Subsequently there were no comments for changes to be made or new information to be included.

The Gwydir region

The Gwydir region is one of seven areas of the Basin that MDBA is studying for the Strategy.

The Gwydir Valley is located in north-west New South Wales, west of the Great Dividing Range. The region includes the Gingham Watercourse, Lower Gwydir River and wetlands, and the Mallowa Watercourse and wetlands. The wetlands are listed in the *Directory of important wetlands in Australia* (Environment Australia 2001). The region is recognised as an important site for waterbirds and some sections have been listed under the Ramsar Convention (see 'Environmental values and objectives'). The wetlands also support threatened wetland plant communities and acts as a refuge for native fish in dry times.

River regulation in the Gwydir region has significantly changed the landscape and ecology of the region during the past 40 years. The construction of Copeton Dam has resulted in a significant reduction in the frequency of flows that fill the wetland and wet the floodplain in the Lower Gwydir. Water used to flow naturally to the wetlands approximately 8 of every 10 year for around six months during spring and summer. Today, less water reaches the wetlands for a shorter period of time. This has made grazing less productive, and supported a shift towards dryland farming and a reduction in native vegetation and wetland areas. The reduced inundation has led some farmers to crop right to the edge of waterways and in the wetland.

Delivering water to these environmental assets is currently restricted by timing and volume. Water managers need to plan environmental water delivery around harvest and peak irrigation delivery times. The limitations in water delivery threaten the health of Gwydir ecosystems, and are the reason the Gwydir region was identified as a key focus area in the Strategy in 2013.

There is limited information upon which to base an assessment of the effects of potential higher flows in the Gwydir region. Should investigations in the Gwydir region proceed, more information will be needed about how water moves through the landscape, its effects on private land and potential options to address any negative impacts.

The community

This reach report reflects MDBA's current knowledge base after talking with people in the Gwydir.

MDBA and the New South Wales Office of Environment and Heritage met with landholders in the region in a series of group and face-to-face meetings from May to July 2014. We met with approximately 90% of landholders in the region that are directly adjacent to the creeks and wetlands.

Landholders identified the following effects associated with the delivery of environmental water:

- inundation of crops at the wrong time of year can prevent harvest
- if the duration is too long, it can prevent sowing
- inundation prevents access to crops and people cannot spray crops.

A number of other issues were raised in relation to environmental water in the wetlands:

- Landholders were worried that when the wetlands are full, rain events will cause unintended flooding and damage to crops.
- Keeping water too long in wetlands can cause issues like preventing stock access and increasing mosquito breeding.
- Water can spill out of watercourses and prevent access in some regions.

Although landholders identified a number of possible effects on their land, they recognised the need for further work and the progression of constraint investigations to the next phase.

Next steps

This is the start of a 10-year process and Basin governments are still finding out what the issues and opportunities are, to support future decision-making.

This reach report:

- provides a context and background to the MDBA work on constraints, which seeks increased flexibility to connect rivers with their floodplains, as part of the implementation of the Basin Plan
- outlines the types of changes needed to achieve the river flows being investigated
- reports on community feedback on possible changes to managed river flows.

The MDBA released the reach reports for all seven regions on our website through October–December 2014. The reports were made available for feedback until March 2015 to add to our knowledge base and refine our understanding of what flows mean for communities.

Information from all seven areas of the Basin was included in the annual report, which made recommendations to Basin governments about further investigations. The annual report was made available from the MDBA website in late 2014.

In late 2014, Ministers decided to continue investigations in all of the seven priority areas. This means proceeding with the collection of more information, including technical and community studies, to better understand the feasibility of small overbank flows and the mitigation measures needed for delivering the proposed flows. In the Gwydir, we are continuing to investigate the feasibility and impact of specific flow rates. The 2014 decision was not a green light to build, do or change anything about how the river is managed.

The next decision, in 2016, is about whether to start putting mitigation measures in place, based on recommendations from the feasibility studies. Actions would take place between 2016 and 2024 to ensure mitigation measures are in place — such as formal arrangements with landholders, rule or management practice changes, asset protection, and infrastructure upgrades — before any managed overbank flows are delivered.

What is the Constraints Management Strategy?

At a glance

The Constraints Management Strategy looks at ways to allow rivers to connect to their floodplains more often to improve and maintain the environment, while avoiding, managing or mitigating effects on local communities and industries.

In a river, 'constraints' are the things that stop water from reaching some areas.

The constraints can be:

- physical structures, such as bridges, roads or outlet works
- river management practices.

The Constraints Management Strategy (the Strategy) is about ensuring that our rivers — and the environments and communities they support — stay healthy and sustainable.

In particular, it is about investigating how to connect rivers with their floodplains more often, while avoiding, managing or mitigating effects to local communities and industries.

By carefully managing constraints, we can ensure that water continues to sustain our vital river environments and communities, both now and in the future.

What areas are being looked at

The Strategy is looking at seven areas of the Murray–Darling Basin (Figure 1). These areas were chosen because we are likely to get the best environmental benefits by changing constraints to increase regulated flows in these areas. The areas are:

- Hume to Yarrawonga
- Yarrawonga to Wakool Junction
- Goulburn
- Murrumbidgee
- Lower Darling
- River Murray in South Australia
- Gwydir region.

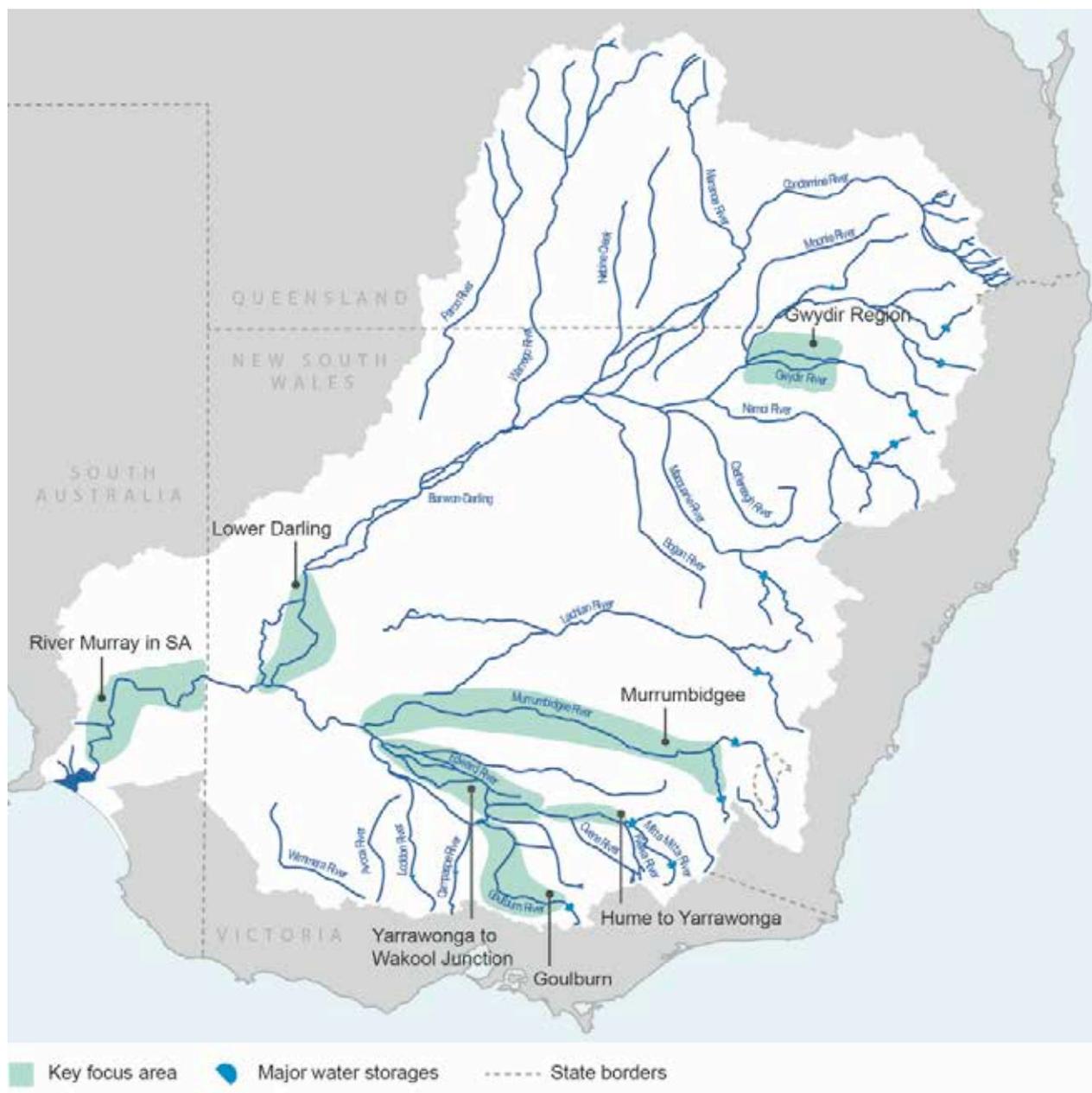


Figure 1: Areas in the Murray–Darling Basin affected by the Constraints Management Strategy

Background to the Strategy

The Strategy is part of the implementation of the Murray–Darling Basin Plan. The Basin Plan seeks to move towards a healthier environment, as well as maintain healthy communities and agriculture. Basin state governments asked the Murray–Darling Basin Authority to develop the Strategy to see whether there are opportunities to get better environmental outcomes by changing the way river structures are managed and revisiting some of the management practices in place, while still retaining the benefits of river regulation.

The Australian Government has committed \$200 million to carry out approved mitigation works that are identified as priorities by the Basin states during the next 10 years.

The Strategy was published in November 2013 and outlined the steps required to address issues in the seven focus areas. The document sets out a 10-year timeline to address key constraints.

Guiding principles for developing constraints projects

The Strategy included overarching principles that have been central to its development and should also guide its roll-out. These are:

- The Strategy aims to maximise environmental outcomes that can be obtained from managing all water available for environmental use (and managing water for other purposes en route).
- Affected communities — including landholders and managers, water entitlement holders, Traditional Owners, management agencies and local governments — need to be involved from the beginning to identify potential impacts and solutions.
- In pursuing environmental outcomes through the relaxation or removal of constraints, solutions need to:
 - recognise and respect the property rights of landholders and water entitlements holders
 - not create any new risks on the reliability of entitlements
 - be identified, in consultation with affected parties, to determine if impacts can be appropriately addressed and mitigated to enable changes to proceed
 - identify and aim to achieve net positive impacts for the community
 - be worked through in a fair, transparent and equitable way
 - work within the boundaries defined by the *Water Act 1989* (Cwlth), the Basin Plan, and relevant state water access and planning systems.
- All water holders, whether existing consumptive users or environmental water holders, should be able to use their water efficiently to meet the needs of that use, while not adversely affecting other entitlements.
- Potential changes will be worked through with relevant Basin governments and relevant stakeholders to resolve issues before changes to river management practices or on-ground arrangements are made.

- Decisions to proceed with removing constraints will be made by Basin governments with investment being decided by the Australian Government on the collective advice of governments. Investment should:
 - prioritise addressing the constraints that will provide the best Basin-wide environmental outcomes, taking into account economic and social considerations
 - focus on lasting solutions to provide certainty and protection to stakeholders over time
 - focus on avoiding and addressing any impacts to third parties.

Why is the Strategy important?

At a glance

Connecting rivers to their floodplains sustains the local environment and provides benefits to communities, such as improved soil and water quality. River development and regulation have reduced the overbank flows that provide this connection. The Constraints Management Strategy aims to put back some water to the environment to boost riverine productivity, and increase health and resilience.

Rivers before and after river regulation

In unregulated river systems, there are no constraints to overbank flows caused by high rainfall and catchment run-off, which regularly spread out across the floodplain and reach floodplain creeks, wetlands and billabongs.

In regulated river systems, dams and weirs capture and control rain water, which significantly reduces the amount of water that flows downstream. The size of flows downstream is reduced and the flows last for a shorter amount of time. The time between flow events can be longer than would happen naturally. Figure 2 shows the type of flows that tend to occur each year before and after regulation. 'Pre-regulation' (grey line) flows used to be more frequent, larger and last longer compared with post-regulation flows (green line).

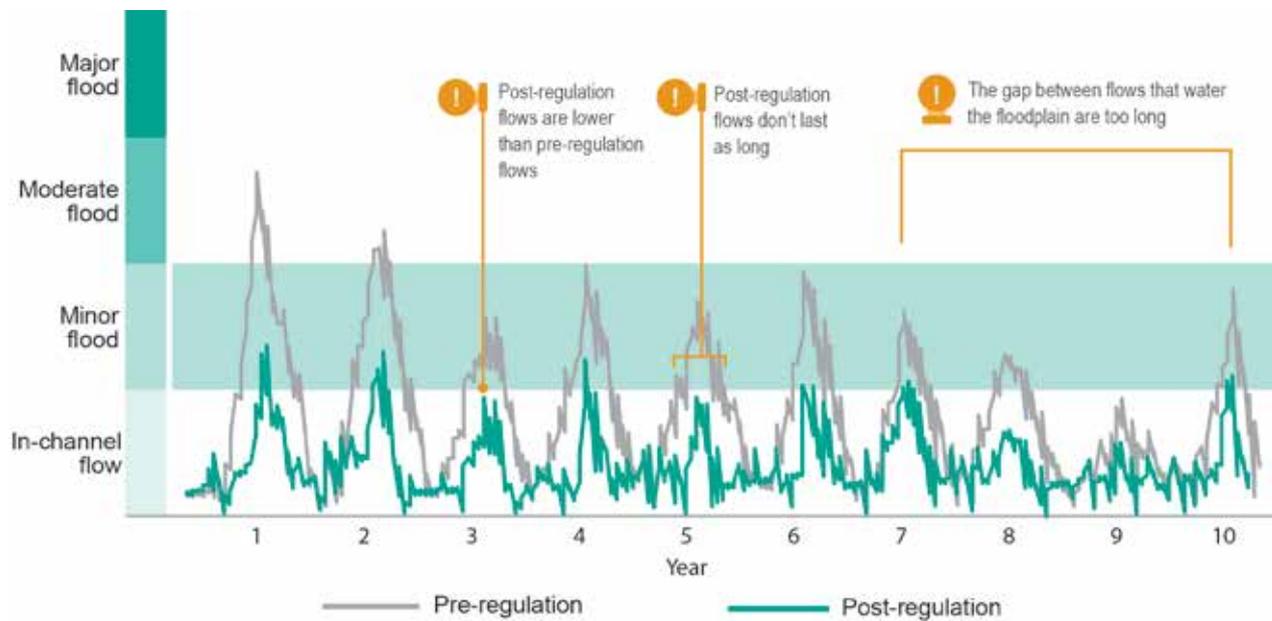


Figure 2: Changes to a river’s hydrology after river regulation

In the regulated system, water is released from dams most of the time so it stays within the channel and doesn't reach the floodplain (Figure 3). From time to time, water needs to reach the floodplain and its creek network, wetlands and billabongs, as many plant and animal species rely on flows to trigger a range of biological processes (feeding, breeding, moving) and stay healthy.

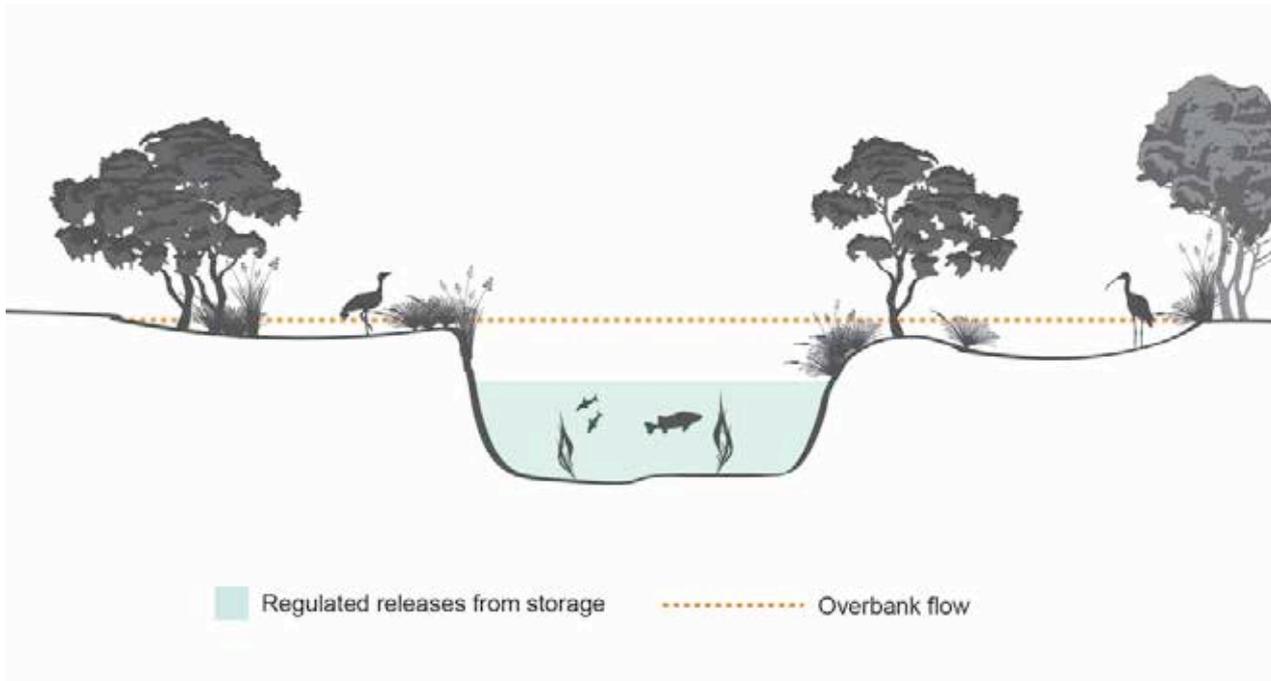


Figure 3: Regulated releases from storage are mostly restricted to in-channel flows

Connecting rivers to their floodplains

Changing the seasonal flow pattern disrupts the natural cycles of feeding, growing and breeding for many plants and animals. Because of this, many native species have significantly declined in the Murray–Darling Basin system.

Allowing the river to connect with its floodplain and wetlands will rejuvenate these areas. Some of the benefits are listed below and described in Figure 4.

Connecting rivers to their floodplains:

- **improve water quality and supplies**, by
 - flushing out the salt along riverbanks and floodplains
 - helping recharge groundwater supplies
- **improve soil quality and reduce erosion**, by
 - moving carbon and nutrients between rivers and floodplains
 - stabilising riverbanks through better vegetation growth, thus reducing erosion into the river
- **support native species**, by
 - triggering plants to seed or germinate — for example, river red gums need flooding for their seeds to germinate
 - supporting habitat and breeding of aquatic bugs and insects (the primary source of the river food chain)

- stimulating animals like native fish to feed and breed — for example, golden perch need high river flows to spawn, and floodplains make great nursery habitats to rear young fish
- allowing plants and animals to move throughout river systems and colonise new areas.

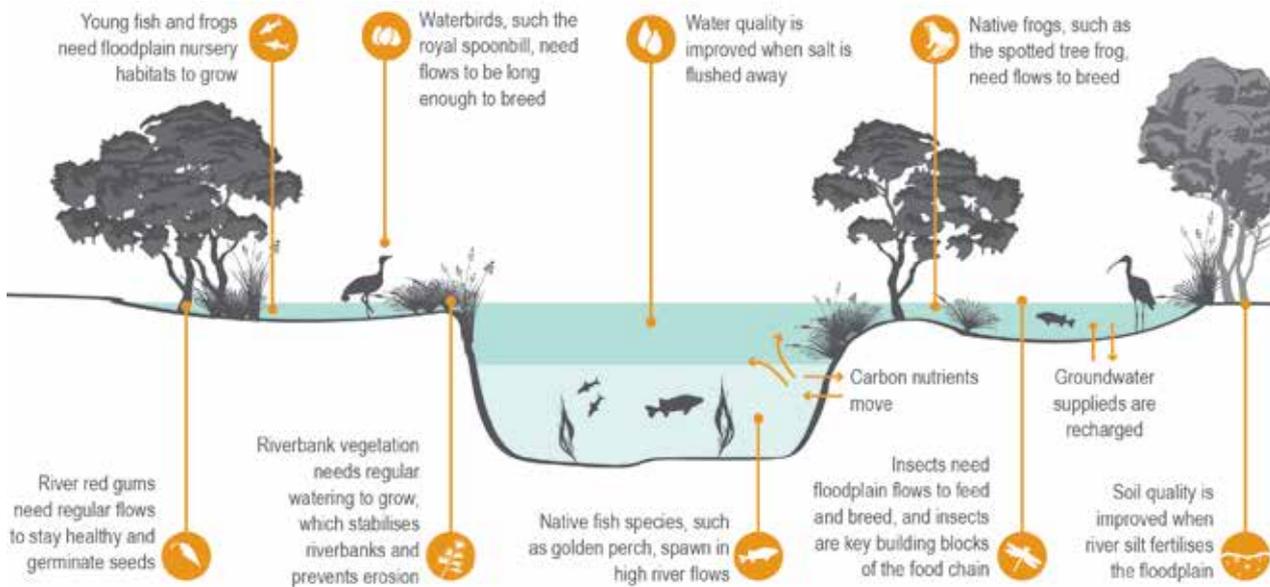


Figure 4: The environmental benefits of overbank flows

Many environmental processes, such as breeding and migration, occur with particular flow conditions in rivers (e.g. faster river flows, overbank flows or receding water levels). Remarkably, several riverine plants and animals use weather conditions, such as high rainfall, as triggers in anticipation of a certain flow event that will stimulate their breeding or need to migrate. Coordinating water releases from dams with rainfall events and catchment run-off will help riverine plants and animals make use of natural ecological cues and improve the outcome. Figure 5 shows how these flows could be achieved.

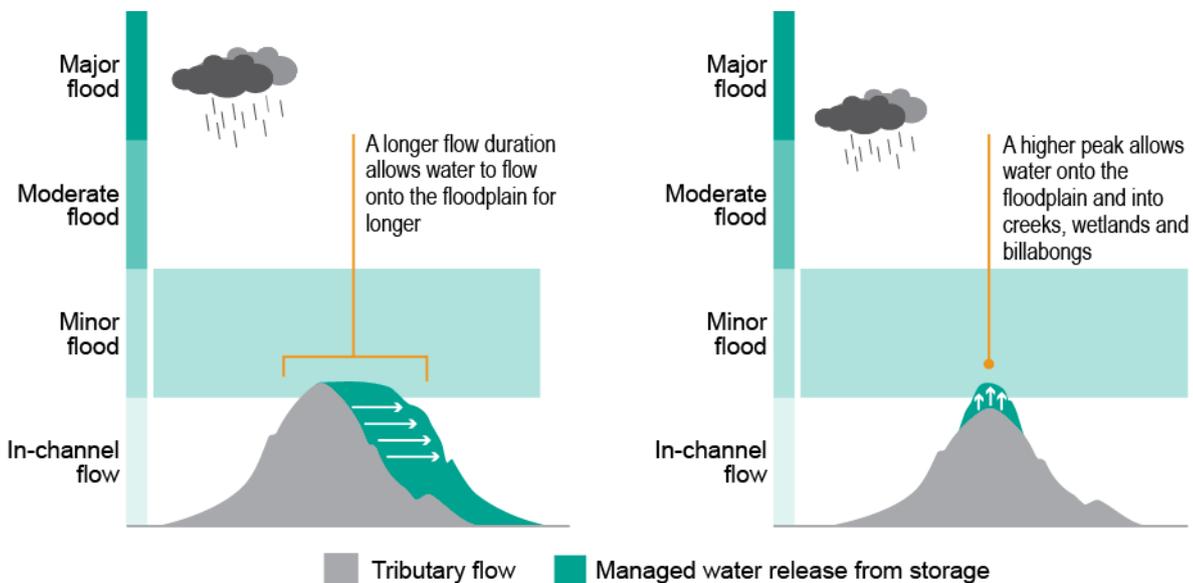


Figure 5: 'Topping-up' unregulated tributary flows (water already in creeks from rain events) with regulated releases (out of dams) to create small overbank flows

What is happening in the Gwydir region?

Catchment characteristics

The Gwydir catchment covers an area of approximately 26,600 km² and is located in the north-west of New South Wales, lying to the south of the Border Rivers region (separated by Mastermans Range) and to the north of the Namoi region (separated by the Nandewar Range), with the Barwon–Darling region located to the west (DECCW 2011). The Moree region is located within a semi-arid, low rainfall environment, receiving around 585 mm average rainfall per year.

The Gwydir floodplain forms a series of irregular inundated wetlands covering more than 1000 km² (when fully flooded) and forming an inland terminal delta (Figure 6).

The main water storage in the Gwydir Valley is Copeton Dam, which was built in 1976 in the upper catchment near the town of Inverell. The Gwydir River begins near the town of Uralla and flows westward towards Copeton Dam, receiving tributary inflows from Moredun and Georges creeks. Downstream of Copeton Dam, the Gwydir River flows westwards onto the plains passing the towns of Bingara and Pallamallawa, and the river is fed by tributaries including the Horton River, and Myall, Mosquito, Warialda and Macintyre creeks.

Weirs now divert flow from the Gwydir River into the Mehi River, Moomin Creek and Carole Creek to supply irrigators with water. The Mehi breaks off first before the township of Moree, followed by Carole Creek. The Moomin comes off the Mehi downstream of Moree. Flows from the Mehi River, Carole Creek and Moomin Creek continue westward and join the Barwon River near Collarenebri during times of moderate to high flow.

The Gwydir River continues to flow until it is redirected when it reaches a region known as ‘The Raft’, approximately 20 km west of Moree. The Raft is a large build-up of fallen trees, silt and large debris extending across 15 km that has accumulated since widespread clearing began in the region in the late 1900s (DECCW 2011). It has partially blocked the Gwydir River and caused the river to split into the Gingham Watercourse to the north and the Lower Gwydir (also known as ‘Big Leather’) to the south.

Water moves west through the mosaic of wetlands along the Gwydir River and Gingham Watercourse and tends to end in the western-most wetlands unless it is a flood event. Significant volumes of water, those that are only seen during large floods, are required to contribute to flows in the Barwon–Darling system. The Gwydir Wetlands are a western-flowing, semi-arid floodplain wetlands system.

The amount of water that reaches the region is highly variable and dependent on rainfall in the upper catchment. In drought, water can be scarce and the wetlands can remain dry for extended periods. Small flows to the wetlands come from rainfall events or environmental releases from Copeton Dam.

In wetter years, flooding is common. Typically, the major floods occur in January and February, with occasional smaller floods in winter (DECCW 2011). Spring–summer floods are important for providing optimal growing conditions for wetland plants that requires warm, moist soils. Winter floods fill the floodplain soil profile in preparation for plant growth in the warmer months. The wetlands growing season is generally from September through to April, and the core wetland

vegetation communities require a consecutive wet season to build vigour after an extended dry period.

The distribution of water in the wetlands is strongly dependent on how much water is already in the soil profile. For example, if it is very dry, the wetlands take longer to fill as water fills the soil profile. Estimates of water take-up in dry wetlands soil range from 3 to 5 ML per hectare. Alternatively, when the soil profile is full, any water entering the wetlands will tend to spread further.

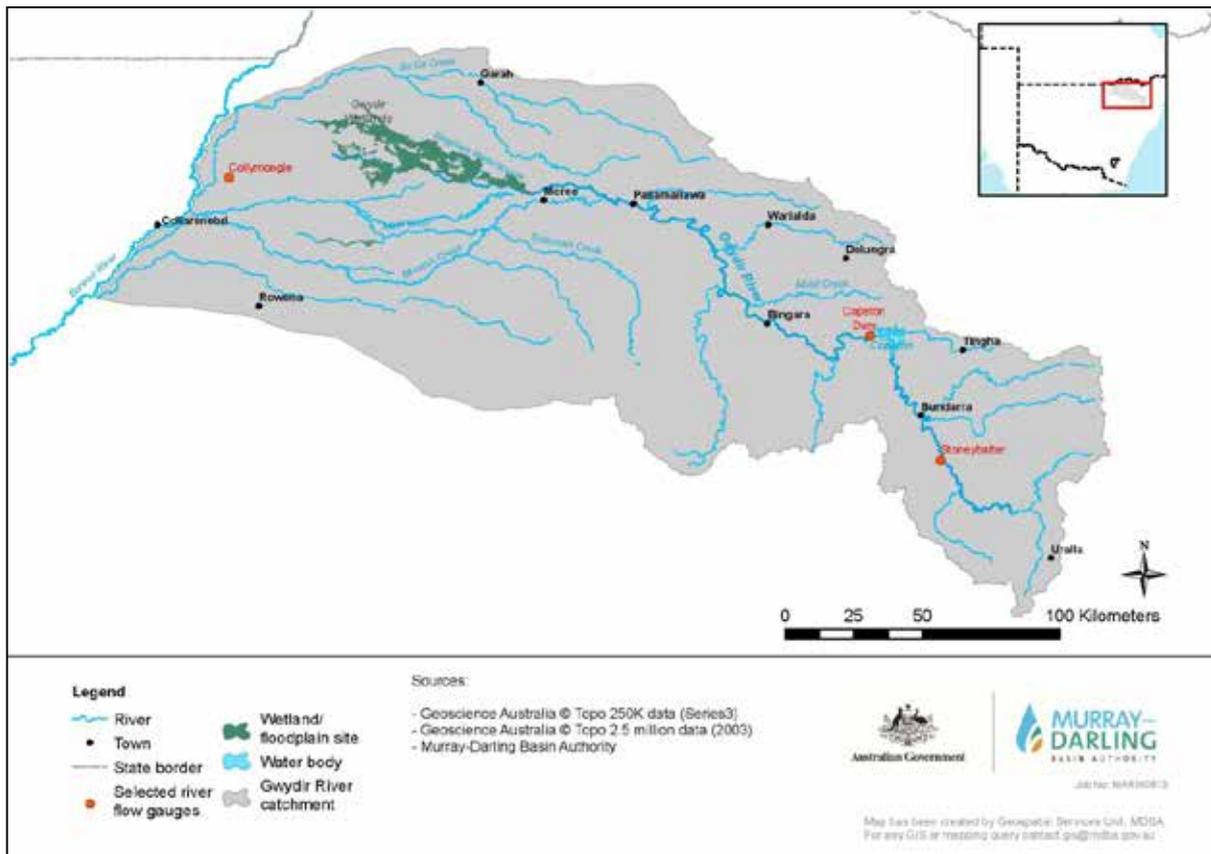


Figure 6: The Gwydir River and surrounding region

People and economy

Most of the land in the Gwydir region is used for agriculture. In the past 40 years, there has been a steady shift from grazing to cropping. Agricultural enterprises in the Gwydir region are vital to the economies of the region and surrounding towns, including Moree, Ashley and Mungindi.

Cotton is the dominant irrigated crop by area and value in the region. The total area of irrigated farming fluctuates each year primarily in response to water availability (DECCW 2011). The cotton industry is important to the local economy and provides local employment on-farm and within the nine cotton gins within the Gwydir catchment.

Dryland cropping activities in the region are dominated by wheat combined with chickpeas, sorghum and cereal crops. After cotton, wheat is the second highest-value broadacre crop in the Gwydir region and is a vital driver for the regional economy.

Grazing enterprises are also an important primary industry in the Gwydir region, although its prominence (particularly sheep) has diminished in recent years. Cattle remain an important part of the local grazing industry and many farmers in the region have been successful producers of cattle and calf products for several generations.

The Gamilaroi people are the Traditional Owners of the Gingham floodplain, Gwydir Wetlands and most of the length of the Gwydir River. The Gwydir region contains many cultural sites and values that are important to the local Aboriginal community, including cultural modifications such as Coolamon scars to living trees that are flood-dependent species (DECCW 2011).

How the Gwydir region is managed

The only major regulating storage in the Gwydir region is Copeton Dam (1,364 GL capacity) on the Gwydir River near Inverell. Together with a series of minor weirs located further downstream, Copeton Dam provides a reliable water supply to the irrigators in the region under the Water Sharing Plan for the Gwydir Regulated River Water Source. The dam supplies water to users on the Gwydir River (three regulated effluents: Mehi River; Carole Creek, which flows north-west and eventually joins Gil Gil Creek; and Moomin Creek), and replenishment flows to the Lower Gwydir, Gingham Watercourse and Mallowa Creek. Water is also provided for the environment, stock, domestic and town water supplies. The key structural features and in the Gwydir region are shown in Figure 7.

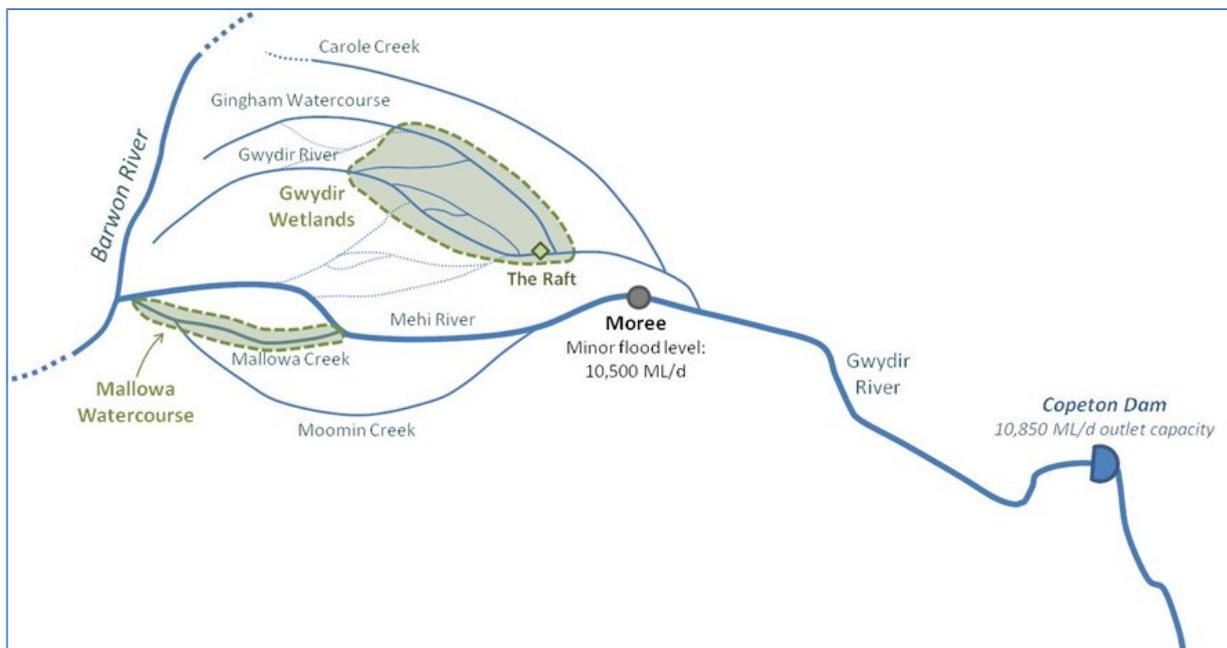


Figure 7: Key structural and flow constraints in the Gwydir region

On-farm storages are used extensively throughout the Gwydir system to store water for irrigation. The storages can be filled early in the irrigation season from waters stored in Copeton Dam, or from the rivers and watercourses when excess water is available during high flow periods. These storages hold large volumes of water to provide additional flexibility in the management of irrigated crops.

There is a variety of environmental water sources available for use in the Gwydir Wetlands. The New South Wales Water Sharing Plan provides a 45 GL allocation in the environmental

contingency allowance, and unregulated flows from tributaries downstream of Copeton Dam for basic aquatic and river requirements. The Commonwealth Environmental Water Holder (CEWH) and New South Wales Government together hold 127 GL of regulated environmental water in entitlements.

Managed environmental water is focused on the floodplain area west of Moree where the Gwydir River branches into four main systems:

- Gingham Watercourse
- Lower Gwydir watercourses
- Mallowa
- Mehi and Carole creeks.

These areas contain a mosaic of wetland types from semi-permanent marshes and waterholes to floodplain woodlands that are only inundated during large floods.

Decisions on how the environmental contingency allowance and environmental water held by New South Wales are used are made by the New South Wales Office of Environment and Heritage (NSW OEH), with advice from the Environmental Contingency Allowance Operations Advisory Committee (ECAOAC) and other stakeholders. Decisions on Commonwealth environmental water use are made by the CEWH. In making decisions, the CEWH takes into account advice from NSW OEH, ECAOAC and other stakeholders. The ECAOAC is made up of representatives from the:

- Aboriginal community
- Border Rivers-Gwydir Catchment Management Authority
- Gingham Watercourse landholders
- Gwydir Valley Irrigators Association
- independent environmental group
- independent scientists
- New South Wales Department of Primary Industries
- Lower Gwydir Water Users Association
- New South Wales Office of Water
- NSW OEH
- State Water
- Australian Government Department of the Environment (observer status).

The Local Land Services North West chairs the committee.

How the Gwydir region has changed

River regulation and the introduction of irrigation has altered the hydrology and the landscape of the Gwydir region during the past 40 years.

Water regulation has caused significant reduction in the moderate to high flows in the region. For example, before the construction of the dam, the Gwydir and Mallowa wetlands received water in most years and the water typically remained in the wetland areas for around six months (DECCW 2011). Now the water that reaches the wetland is either from high flood events or small flows delivered from the dam. These only happen occasionally and are not prolonged events.

Since 1976 (when Copeton Dam was commissioned), there has been a 75% increase in the average length of time between flood events and a 64% increase in the maximum length of time between flood events (a rise from 7 to 11.5 years) (CSIRO 2007). The reduction in flood frequency means that the average annual flooding volume has been reduced by 42% (CSIRO 2007).

River regulation has influenced the types of agricultural practices in the Gwydir region, including facilitating the development of irrigation in the district. The combination of the storage and diversion of water to other areas has produced drier conditions in the Gingham Watercourse, Lower Gwydir River and wetlands, and Mallowa Watercourse and wetlands. A reduction in inundation has caused grazing to become less productive in the floodplain and wetland areas, and contributed to the more general shift from grazing to dryland farming. The reduced inundation in the wetland and floodplain areas has led some farmers to crop to the edge of waterways and in the wetland.

The shift towards dryland farming in areas closer to the creeks and in the wetlands has resulted in native vegetation being removed in these areas. The replacement of native, dense stands of reeds, grasses and trees has changed the way water moves through this system during minor flooding events. The construction of tracks to access cropping land and small banks protecting crops has also influenced the movement of water during minor floods or low flows required to deliver water to the wetlands.

Environmental values and objectives

Significance of the Gwydir region

The Gwydir system remains a very significant wetland ecosystem. The Gwydir system contributes to the environmental health of the whole Murray–Darling Basin, as it provides refuge and breeding habitat for migratory birds. It also contains diverse wetland vegetation communities including the endangered marsh club rush (*Bolboschoenus fluviatilis*) community. Four sites totalling 823 ha within the Lower Gwydir and Gingham Management Unit have been listed as wetlands of significant international importance under the Ramsar Convention.¹ These include three parcels of privately owned land and one property of 4,292 ha (including 600 ha of the Gwydir Wetlands Ramsar site) acquired by the New South Wales Government in 2010.

The wetlands are widely recognised as a refuge for waterbirds in dry times and for supporting some of the largest waterbird breeding colonies recorded in Australia (DECCW 2011). Records of major breeding events date back to the 1920s when the Gwydir Wetlands were thought to hold the largest heronry in New South Wales, with hundreds of thousands of breeding birds (Spencer 2010). There have been 75 waterbird species recorded in the Gwydir Wetlands, including species listed as threatened both in New South Wales and nationally, and species listed on the Japan–Australia Migratory Bird Agreement, China–Australia Migratory Bird Agreement and Republic of Korea–Australia Migratory Bird Agreement (Spencer 2010; DECCW 2011).

The permanent and semi-permanent waterholes on the Gwydir River, Gingham Watercourse, Mehi River, Carole Creek, and the Gwydir and Mallowa wetlands are also important for

¹ The Ramsar Convention (formally, the Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable use of wetlands, recognising their fundamental ecological functions and their economic, cultural, scientific and recreational value. It is named after the city of Ramsar in Iran, where the Convention was signed in 1971.

supporting native fish and play a vital role as a drought refuge. The photographs below are of some of these wetland areas.

The Murray–Darling Basin Authority recognises the Gwydir Wetlands as having Basin significance and listed the wetlands as a Basin environmental watering priority in 2014–15.

Restoring and protecting the Gwydir and Mallowa wetlands through environmental watering will provide many environmental benefits, including:

- maintaining habitat suitable for waterbird breeding
- contributing to restoration of the ecological character of sites listed as internationally important under the Ramsar Convention
- protecting and restoring endangered ecological communities
- maintaining wetland refuges for a range of species
- improving the condition and extent of permanent and semi-permanent wetland vegetation communities
- maintaining adequate soil moisture in core wetlands to allow a progression of improved responses to water deliveries
- assisting the recovery of the wetland plant marsh club rush, a critically endangered ecological community.



The Boyanga Waterhole, in the Gwydir region, provides a home and food resources for thousands of resident and migratory birds. Photo: Kelly Marsland, MDBA.



The Gingham Waterhole, in the Gwydir region, plays an important role as a refuge for fish during dry times.
Photo: Kelly Marsland, MDBA.

Environmental objectives

New South Wales rules for the use of environmental water in the Gwydir aim to achieve specific management objectives, as well as maintaining the general health of the Gwydir Wetlands (DECCW 2011). These objectives include:

- supporting native bird breeding events that have started in the Gwydir Wetlands following natural flood inundation
- providing additional inundation in the Gingham and Lower Gwydir wetlands during or following periods of extended dry climatic conditions
- inundating higher-level benches in the river reaches between Copeton Dam and the Gwydir River at Gravesend
- providing short-term inundation of the wetlands to prevent germination of hyacinth as part of a weed management strategy involving a wetting and drying cycle
- providing flows for environmental purposes in effluent streams
- supporting native fish populations and habitat
- supporting invertebrates and other aquatic species
- supporting threatened species
- maintaining aquatic ecosystem health.

What consultation has been done in the Gwydir?

Who we talked to

In May 2014, the Murray–Darling Basin Authority (MDBA) commenced discussions with landholders in the Gwydir region in collaboration with the New South Wales Office of Environment and Heritage, which manages environmental water and monitors the wetlands, following their completion of consultation associated with the development of the draft floodplain management plan for the Gwydir Valley.

During this consultation, we met with most (90%) of the landholders and land managers adjacent to the watercourses and wetlands to introduce our work and understand the breadth of impacts that landholders experience when the wetlands are full of water.

To understand the issues around delivering environmental water during these discussions, we asked landholders and managers about the types of effects they have experienced when the wetlands areas are full of water and during recent natural events. Several issues were raised that varied depending on the location of the property, and the type and location of agriculture being practised. The issues raised are summarised in the next section.

In these discussions, we also outlined the next steps and asked people whether they saw value in the project moving to the next phase to start to explore solutions to the issues raised. Overall, people were happy to see the project progress and wanted further involvement in the next phase. Several people mentioned the need for further information and data collection as an important task for improving understanding of flow behaviour in the area.

What we learnt through consultation

A summary of the issues discussed is presented below. This information informed the recommendations for the next steps in the Gwydir region.

The landholders and managers recommended that more work be done to develop modelling tools to identify the flow paths and inundation extents for the small to medium flows required to maintain and support the wetland areas. In particular, greater understanding is required of the impediments to water flow in the system, as natural flow paths have changed in some areas.

A range of investigations could be undertaken, such as fine-scale geomorphic assessments and aerial surveys of flows.

Issues raised

- Inundation of crops at the wrong time of year can prevent harvest.
- If paddocks are inundated for too long it can prevent the sowing of crops.
- If paddocks are inundated at the wrong time of year or for too long, it can prevent access for cultivation and spraying.
- People worried that rain events when the wetlands are already full will cause unintended flooding and damage to crops.
- Keeping water too long in wetlands can cause issues such as:
 - preventing stock access
 - breeding of mosquitos.

- Competition for channel capacity between environmental water and irrigation orders is an issue that needs to be worked through with users along the Lower Gwydir (see below).
- Water can spill out of watercourses and prevent access in some regions. Improving water crossings can address the issue (e.g. reinforce rock crossings to allow heavy vehicles to pass).
- Levee banks or low-lying roads were suggested as methods to keep water away from crops during small to moderate flow events (e.g. those that are required to fill the wetlands); however, there can be issues associated with these, including:
 - Inundation of paddocks at the right time of year can be beneficial to farming enterprises and the construction of levee banks would prevent water from inundating paddocks. Inundation of paddocks increases soil moisture, which can be retained for several months and assist the growth of future plantings. Additionally, in dry years, the water can directly benefit and improve cropping yields.
 - Levee banks around paddocks may cause prolonged pooling of water by preventing the water from draining away.
 - Levees alter flow paths and this can affect downstream neighbours.
 - Once implemented, the valley-wide floodplain management plan will preclude the construction of structures that influence flows within the area most frequently inundated.

Benefits of overbank flows

People also recognised the benefits of overbank flows to their farming enterprises. In particular, overbank flows promote plant growth that is needed to support grazing enterprises. Dryland farmers also saw overbank flows as important for maintaining high-quality crops as overbank flows improve soil quality and recharge groundwater.



Crops adjacent to wetland areas are at higher risk of inundation when the wetlands are full of water. Effects may include damage to crops or roads, or prevent access to parts of land for landholders or stock. Some examples are pictured below. *Photo: Kelly Marsland, MDBA.*



Many sections of the creeks do not have steep banks to keep the water in the channel. When crops have been planted in the low-lying areas adjacent to the creek, they are at risk of inundation. *Photo: Kelly Marsland, MDBA.*



Access by vehicles including large road trains and stock (cows in this photo) can be prevented when the wetlands are full of water. *Photo: Kelly Marsland, MDBA.*

Channel-sharing competition

The Lower Gwydir River is a small, shallow river that has limited capacity to carry large volumes of water at one time (see photograph below). At times of high water demand, this limited capacity to hold water requires river operators to coordinate the delivery of water orders across multiple users to ensure orders are met. MDBA understands that there have been times when environmental water delivery has been restricted due to the channel capacity restrictions and irrigation orders taking precedence. This is despite that the principal environmental and irrigation entitlements should maintain the same rights during these times. There may be opportunities for investigating these issues and improve the delivery of environmental water at times of high channel usage.



The Lower Gwydir River is shallow and not very wide in many places, and has limited capacity to hold large volumes of water. Photo: Kelly Marsland, MDBA.



One of the irrigation offtakes along the Lower Gwydir. *Photo: Kelly Marsland, MDBA.*

What happens next?

Computer modelling to assess changes in flow patterns

Modelling of flow patterns in the Gwydir Valley has been done to inform the valley-wide floodplain management plan (OoW 2014). However, this modelling considered the extent and frequency of flood events based on the small 2004 and large 2012 flood events. The flows required to inundate the Gwydir, Gingham and Mallowa wetlands during low flow years are much smaller than those that are experienced during floods (and modelled for the floodplain management plan). Currently, there is insufficient modelling or inundation mapping available for the types of lower flows required to deliver water to the wetlands.

Landholders and land managers requested that more work be done to understand the movement of water through the system, particularly at the kind of flows that fill the wetlands. This work would inform further more detailed discussion around the potential effects of higher flows, as well as allow for the identification of strategies to address any negative impacts.

This work will be challenging, given the flat nature of the region and the numerous flow paths and channels consistent with it being a broad delta system. Investigation would need to include an assessment of the ground formations, blockages to flow and area of creekbeds.

Some examples of the types of things we need to understand are shown in the photographs below.





Many impediments to water flow exist along the network of creeks and flow paths; this makes modelling flow movement difficult and further survey work is required to improve understanding. *Photo: Kelly Marsland, MDBA.*



Some flow paths have been built by people both recently and a long time ago. As they can influence the way water flows in the system, we need to understand where they are and how much water they can carry. *Photo: Kelly Marsland, MDBA.*

Other considerations

The New South Wales Government has developed a floodplain management plan for the region, which has identified and designated particular areas that are subject to regular flooding. In the area most frequently flooded, landholders and managers cannot construct anything that would influence flows or floods (e.g. levee banks). This zone includes the wetlands and the adjacent farming areas that are affected by environmental water.

Timelines for the Constraints Management Strategy

The publication of this reach report and the development of recommendations in the annual report are just the start of a much longer process (Figure 8). There will be no change to current river operations in the Gwydir for some years to come, if at all.

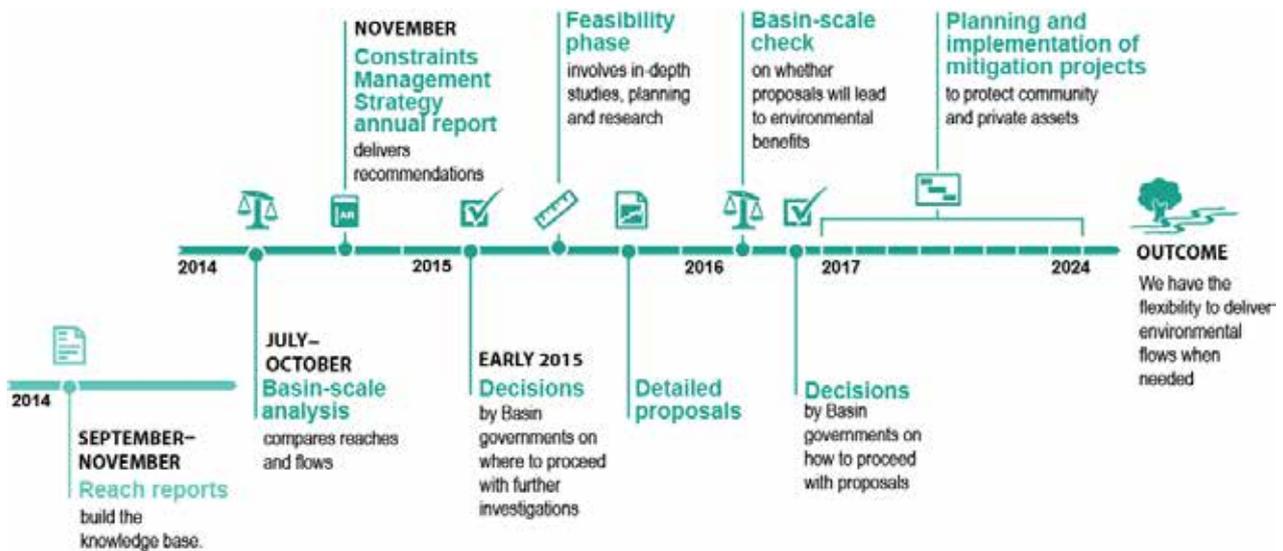


Figure 8 Phases of the Constraints Management Strategy

2014 Phase 1 — Pre-feasibility

Phase 1 of the Strategy was about collecting information about the management and effects of higher flows. MDBA:

- investigated options to modify constraints, looking at different potential flows
- assessed the effects of these changes, including talking to landholders and communities about how different flows might affect them
- identified options to avoid or mitigate inundation effects (e.g. building bridges, upgrading roads or buying easements).

At the end of Phase 1, MDBA recommended to Basin governments that they continue to explore the potential to relax constraints in each of the seven key focus areas through the feasibility phase (2015 to June 2016).²

Basin ministers (state and federal) have agreed that detailed investigations should proceed for higher managed flows in all seven key focus areas as part of feasibility investigations. The flow rates are still under investigation for the Gwydir. This is a commitment to undertake further studies, not a commitment to go ahead with planning and implementation of mitigation measures to allow higher managed flows.

2015–16 Phase 2 — Feasibility

The Australian Government Department of the Environment has made funding available for the key focus areas to provide states with the resources needed to conduct detailed studies and prepare business cases.

In Phase 2 of the Strategy, MDBA and Basin states will need to:

- do more detailed hydrologic analysis to determine the best flow rates to relax constraints to in each key focus area

²

www.mdba.gov.au/media-pubs/publications/cms-annual-progress-report-to-ministers-2014

- assess inundation impacts and options to mitigate those impacts
- improve cost estimates
- undertake further community consultations.

Ministers have requested that further studies be done on constraint measures in all key focus areas. In the Gwydir, further investigations will be carried out by the NSW Government.

Business cases for constraints projects in the key focus areas will be finalised by November 2015. Information in the draft business cases will be available for communities and other stakeholders to review before it is finalised.

2016–24 Phase 3 — Planning and implementation

State and federal governments will decide by mid-2016 about whether to go ahead with easing constraints (planning and implementing mitigation measures that then allow higher managed flows). This decision will be based on the environmental gains, whether any effects on communities can be overcome, and the costs involved.

If constraint measures move ahead to planning and implementation (mid-2016 to 2024), it is likely the states will undertake this work.

To ease constraints, proponent states would need to negotiate and pay for land-based agreements with landholders, such as easements, to allow water to flow onto private land (for flows to reach an environmental asset or allow sufficient water to flow down a channel).

Post 2024 Higher managed flows will only be possible when packages of mitigation options are fully implemented

It is essential that measures are in place to mitigate the adverse effects on private landholders and community assets before overbank flows can be considered.

MDBA has commissioned independent consultants to develop a consistent and standardised methodology to cost mitigation measures. MDBA is concentrating on estimating the indicative costs of allowing small overbank flows on private land and what infrastructure upgrades (roads and bridges) are needed in the seven different regions of the Basin. However, these are not the only types of mitigation activity that may be needed, and further engagement with the community will assist in determining the right combinations of mitigation measures that meet local needs.

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