Australian Government
Commonwealth Environmental Water Office

Commonwealth Environmental Water

Portfolio Management Plan

Gwydir River Valley

2019–20

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Acknowledgement of the traditional owners of the Murray-Darling Basin

The Commonwealth Environmental Water Office respectfully acknowledges the traditional owners, their Elders past and present, their Nations of the Murray-Darling Basin, and their cultural, social, environmental, spiritual and economic connection to their lands and waters.

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Commonwealth environmental water portfolio management planning

Commonwealth Environmental Water Holder

The Commonwealth Environmental Water Holder is a statutory position established under the *Water Act 2007* and is responsible for managing the Commonwealth's environmental water holdings. This water must be managed to protect and restore the rivers, wetlands and floodplains (and the native animals and plants they support) of the Murray–Darling Basin. Ms Jody Swirepik is the current Commonwealth Environmental Water Holder. She is supported by staff of the Commonwealth Environmental Water Office, which employs six local engagement officers who live and work in regional centres across the Murray–Darling Basin.

Commonwealth environmental water

Commonwealth environmental water holdings are water entitlements that have been acquired by the Australian Government through investments in water-saving infrastructure and purchases from willing sellers on the water market. The holdings are a mix of entitlement types held across 19 catchments. The rules governing the entitlements vary across states and across catchments. Commonwealth environmental water entitlements are subject to the same fees, allocations, carryover and other rules as equivalent entitlements held by other water users.

There are broadly three options for managing Commonwealth environmental water:

- delivering water to a river or wetland to meet an identified environmental demand
- leaving water in storage and carrying it over for use in the next water year (referred to as 'carryover')
- trading water, that is, selling water and using the proceeds to buy water in another catchment or in a future year, or investing in complementary 'environmental activities'.

Purpose of the document

This document sets out the plans for managing the Commonwealth environmental water portfolio in the Gwydir Valley for 2019–20. Efficient and effective management of Commonwealth environmental water requires the utilisation of all portfolio management options. By taking a multi-year approach to planning, portfolio management tools such as use, carryover and trade can be managed for maximising environmental outcomes.

The portfolio management plans support transparent, coordinated and adaptive management of Commonwealth environmental water, consistent with the Basin-wide environmental watering strategy and having regard to the Basin annual environmental watering priorities.

To learn more about the planning approach see *Portfolio Management Planning: Approach to planning for the use, carryover and trade of Commonwealth environmental water, 2019–20* (available at: http://www.environment.gov.au/water/cewo/publications under 'Planning approach').

Delivery partners

Commonwealth environmental water is managed in conjunction with and delivered by a range of partners. This portfolio management plan has been developed in consultation with our delivery partners, including New South Wales Department of Planning, Industry and Environment (DoPIE and was formerly known as the Office of Environment and Heritage (NSW OEH), Department of Primary Industries – Water (DOI-Water), and Water NSW, and after considering advice from the Gwydir Environmental Water Advisory Group known as the Environmental Contingency Allowance Operations Advisory Committee (ECAOAC).

Your input

The management of Commonwealth environmental water relies on considerable advice and assistance from others. Individuals and groups within the Murray–Darling Basin community are encouraged to submit suggestions for the management of Commonwealth environmental water. Please contact the Commonwealth Environmental Water Office via: ewater@environment.gov.au.

Table of contents

1. Environmental watering in Gwydir River Valley

1.1. The Gwydir catchment

Flows in the Gwydir Valley are predominantly driven by rainfall in the upper catchment. Almost the entire runoff for the catchment is generated above Pallamallawa, with the western floodplains contributing minimal runoff due to low slopes, absorbent soils and high evaporation rates. Copeton Dam is the major regulated water storage in the Gwydir Valley with a storage capacity of 1,364 GL (active storage in Copeton Dam is 1,345 GL). It regulates about 55 percent of Gwydir system inflows. There are downstream re-regulating structures at Tareelaroi, Boolooroo and Tyreel which divert flows from the Gwydir River into the Mehi River, Carole Creek and Lower Gwydir River/Gingham Watercourse. There are also re-regulating structures on the Mehi River at Combadello and Gundare which control low to medium flows to the regulator structure between the Mehi and the Moomin Creek and the Mallowa Creek respectively . There is also a significant amount of on farm storage dam with around a 600 GL permanent storage irrigation capacity in on farm storages on the lower Gwydir floodplain. A number of unregulated tributaries flow into the Gwydir River below the dam; the Horton River is the primary source of unregulated flows into the Gwydir River.

The principal wetland areas of the Gwydir River Valley targeted by environmental water are the Lower Gwydir, Gingham Watercourse and Mallowa Wetlands. The Gwydir Wetlands is a key asset in the Gwydir River Valley, which forms an inland terminal wetland in the downstream reaches of the Gwydir River and Gingham Watercourse, below Moree. Four sites within the Lower Gwydir and Gingham are internationally recognised under the Ramsar Convention and other international agreements for migratory species. (JAMBA, ROKAMBA, CAMBA) for their special habitat value for waterbirds. These are 'Old Dromana' on the Lower Gwydir Watercourse as well as 'Goddard's Lease', 'Windella' and 'Crinolyn' on the Gingham Watercourse . When flooded, the wetland sustains up to hundreds of thousands of breeding colonial waterbirds. The primary ecological features of the wetlands and reasons for its Ramsar listing are large expanses of vegetation, including large areas of coolibah woodland, water couch and the largest stand of marsh club-rush in New South Wales (NSW). The environmental demands identified subsequently are important for helping support the ecological character of the Ramsar sites.

Several native fish species identified as threatened in NSW and/or Commonwealth legislation have been observed or are predicted to occur in the Gwydir systems . These include olive perchlet and freshwater catfish (endangered populations) and purple spotted gudgeon (endangered species) listed under the *Fisheries Management Act 1994* (NSW) (FM Act) and silver perch and Murray cod (respectively critically endangered and vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*). The aquatic community of the Gwydir also forms part of the *Lowland Darling River aquatic ecological community*, which is listed as endangered under the FM Act. This community includes 21 native fish species and hundreds of native invertebrate species that are found within the Darling River and its associated streams, wetlands and anabranches within NSW.

The Mallowa Creek breaks off the Mehi River approximately 50 km downstream of Moree. Prior to the construction of the Mallowa Regulator in 1983, many fresh flows would have passed through Mallowa Creek and sections of the floodplain. These fresh flows are now diverted down the Mehi River. While not as extensive as the Gingham and Lower Gwydir Wetlands, the Mallowa Wetlands supports a diverse wetland and floodplain vegetation assemblage that is representative of native vegetation of the Gwydir River Valley. Importantly, it also has less of a Lippia (weed) presence than the Gwydir Wetlands. The native vegetation of the Mallowa Creek provides valuable habitat for waterbirds, woodland birds and other fauna.

The Gwydir and Mallowa Wetlands play a substantial part in the biological and ecological functioning of the Murray-Darling Basin, as the major wetlands in the Basin are not often inundated simultaneously and therefore habitat availability varies across the Basin spatially and temporally. Since flooding in the Gwydir system is not always synchronous with flooding of other Murray-Darling Basin wetlands, such as the Macquarie Marshes or Narran Lake, the Gwydir play an important role on a broad scale.

The Mehi River and Carole Creek are major distributaries of the Gwydir River. Moomin Creek branches off the Mehi River downstream of Moree and re-joins the Mehi River just before its confluence with the Barwon River upstream of Collarenebri. Carole Creek connects to the Barwon River through the Gil Creek in the

Border Rivers catchment. The Mehi River and Carole-Gil Gil Creek transport about 6 per cent of the average flow at Pallamallawa to the Barwon River.

The Sustainable Rivers Audit found that the lowland zone of the Gwydir Valley was rated as poor for both fish and macroinvertebrates. Native fish populations in the Gwydir catchment and across the Murray-Darling Basin have been affected by changes in the natural flow regime, reduction in habitat quality and availability, as well as barriers to migration and introduced pest species. Changes in the frequency, size, duration and timing of flow events have negatively affected the availability of food, habitat and breeding opportunities for native fish. The majority of native fish species in the lower Gwydir catchment spawn during the spring and summer season with rises in water temperature and/or water levels. Up to 20 native fish species occur in the Gwydir catchment with most species still occurring in the middle reaches.

A number of the rivers and creeks in the Gwydir River Valley may contribute water to the Barwon-Darling at various times. The Northern Connectivity Event in 2017-18 and the Northern Fish Flow in 2018-19 are two examples. The Barwon-Darling connects rivers, lakes and wetlands across the northern Basin, providing critical drought refuge and a movement corridor for fish and waterbirds, and habitat for other aquatic species including turtles, mussels, and shrimp. Flows that connect the Barwon-Darling and the northern tributaries may help to support healthy and diverse populations of native fish and other fauna, including in the rivers of the Gwydir. More information about the Barwon-Darling is described in the *Commonwealth Environmental Water Portfolio Management Plan: Barwon-Darling 2018–19.*

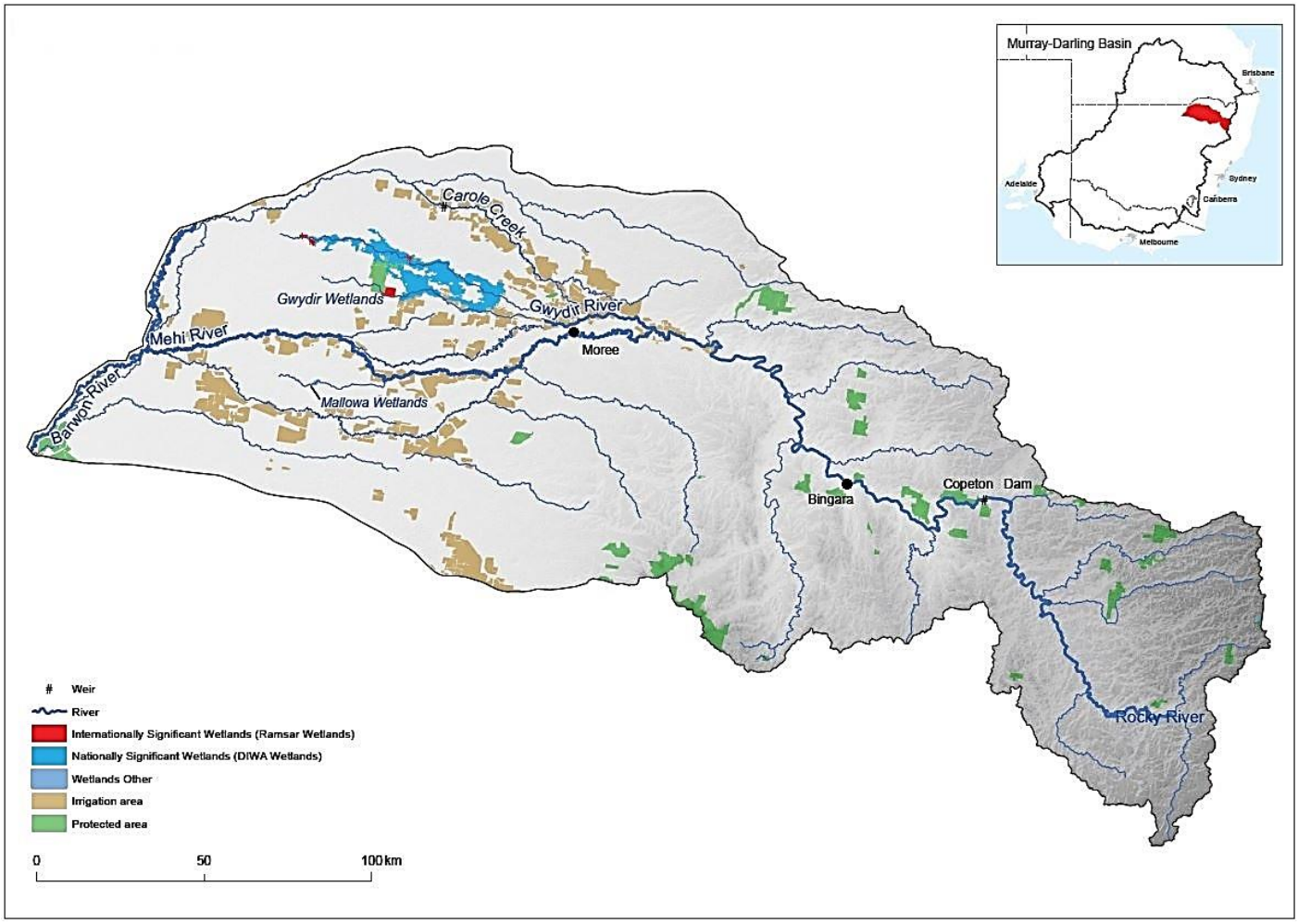

Figure 1: Map of the Gwydir River Valley

The Gwydir catchment is within the traditional lands of the Gomeroi/Kamilaroi people. The Gomeroi is a large Nation, which extends from around Singleton in the Hunter Valley through to the Warrumbungles in the west, and up through the Namoi and Gwydir valleys to just over the Queensland border.

Land use in the eastern catchment is dominated by extensive grazing for cattle and sheep production, with lucerne and pasture grown on the narrow alluvial floodplains of the upper Gwydir River for grazing enterprises. Dryland and irrigated cropping occurs predominantly on the plains. For dryland cropping wheat is the main crop, but a range of other cereals, legumes and oilseeds are also grown. For irrigation cropping cotton is the main crop grown, but also significant areas of irrigated pecan and oranges.

Alluvial groundwater is generally suitable for irrigation, stock and domestic use throughout the valley, with the exception of small areas in the lower Gwydir catchment where the water is brackish or saline. The Great Artesian Basin also underlies most of the valley and is used for stock and domestic purposes as well as tourism (hot artesian baths) in the western Gwydir catchment.

1.2. Environmental objectives in the Gwydir River Valley

The long-term environmental objectives for the Murray-Darling Basin are described in the Basin Plan's environmental watering plan and the Basin-wide environmental watering strategy, which includes 'quantified environmental expected outcomes' at both a Basin-scale and for each catchment. The expected outcomes relevant for the Gwydir River Valley are described in Attachment A.

Basin state governments are also developing long-term water plans for each catchment. These plans will identify the priority environmental assets and ecosystem functions in the catchment, the objectives and targets for these assets and functions, and their watering requirements. Once developed, these plans will provide important information on the long-term environmental water demands in the catchment. Prior to the development of long-term water plans, the Commonwealth Environmental Water Office will continue to draw on existing documentation on environmental water demands developed by state governments, local natural resource management agencies and the Murray–Darling Basin Authority, including draft long-term water plans.

Based on these strategies and plans, and in response to best available knowledge drawing on the results of environmental watering monitoring programs, the objectives for environmental watering in Gwydir Valley are summarised in Table 1 below. The objectives for water-dependent ecosystems will continue to be revised as part of the Commonwealth Environmental Water Office's commitment to adaptive management.

Table 1: Summary of objectives being targeted by environmental watering in the Gwydir River Valley

BASIN-WIDE OUTCOMES (Outcomes in red link to the Basin-wide Environmental Watering Strategy)	**EXPECTED OUTCOMES FOR GWYDIR ASSETS**					
	IN-CHANNEL ASSETS			**OFF-CHANNEL ASSETS**		
	Mehi River	**Carole Creek**	**Lower Gwydir river channel**	**Gingham Wetlands**	**Gwydir Wetlands**	**Mallowa Wetlands**
OVERALL	Contribute to flow variability, hydrological connectivity, in-stream habitat condition and diversity, water quality, primary productivity, native aquatic species condition and reproduction. In response to extended periods of sustained nil or very low inflows, provide deliveries for low flow hydrological connectivity to in-stream habitat, to ensure the persistence of pools as refuge; and to reduce the risk of degrading water quality conditions (particularly low dissolved oxygen levels).			Promote recovery of wetland vegetation, provide habitat for threatened species as well as survival and reproduction opportunities for a range of waterbird and native aquatic species (e.g. fish, frogs, turtles, invertebrates).		
VEGETATION	Contributed to native riparian vegetation diversity, extent and condition.			Support the condition and extent of core wetland vegetation communities		

BASIN-WIDE OUTCOMES (Outcomes in red link to the Basin-wide Environmental Watering Strategy)	EXPECTED OUTCOMES FOR GWYDIR ASSETS					
	IN-CHANNEL ASSETS			OFF-CHANNEL ASSETS		
	Mehi River	Carole Creek	Lower Gwydir river channel	Gingham Wetlands	Gwydir Wetlands	Mallowa Wetlands
				including water couch and spike rush marshlands, cumbungi and marsh club-rush tall meadows and lignum and river cooba wetland shrublands, including colonial nesting waterbird breeding habitat and feeding areas. Enable recruitment and survival of trees and support growth of understorey species within river red gum, and wetland coolibah communities in wetland on lower floodplains areas that can be supported at least partially by deliveries of water for the environment.		
WATERBIRDS	Improve the abundance and diversity of the Basin's waterbird population Support waterbird breeding events (reproduction and fledging) to successful completion.					
FISH	Improve flow regimes and connectivity to maximise the ecological function of the Gwydir system rivers and occasionally contribute to the Barwon-Darling river system for native fish Support viable populations of threatened native fish and maximise opportunities for range expansion and the establishment of new populations.					
MACROINVERTEBRATES	Support recruitment and maintain macroinvertebrate diversity and habitat.					
PROCESSES	Hydrological connectivity, including end of system flows Mobilisation and dispersal of biotic and abiotic materials Primary production, decomposition, nutrient and carbon cycling.			Primary production, decomposition, nutrient and carbon cycling.		
WATER QUALITY	Maintain water quality within channels and pools, including dissolved oxygen.					
RESILIENCE	Provide drought refuge habitat (particularly for fish and other aquatic fauna).					

Information sourced from: CEWO 2014, MDBA 2012, MDBA 2014 (a and b)

1.3. Environmental flow requirements

Environmental demands can be be met through the use of discretionary, planned, supplementary,held environmental water as well as regulated water deliveries for consumptive purposes and rules that protect portions of natural (unregulated) flows. Some demands can only be met by the remaining portions of the larger unregulated/natural flows events, which are beyond what can be delivered within operational constraints and the volumes of Held Environmental Water. Figure 2 shows the broad environmental demands that are in scope for Commonwealth environmental water. Importantly, these are broad, indicative demands and individual watering events may contribute to particular opportunities, such as using infrastructure to deliver water to individual wetlands that would otherwise not be possible due to constraints. Also, there may be opportunities for Basin State governments to remove or modify constraints, which will

improve the efficiency and/or effectiveness of environmental watering. Further information on delivery constraints are described in Attachment B.

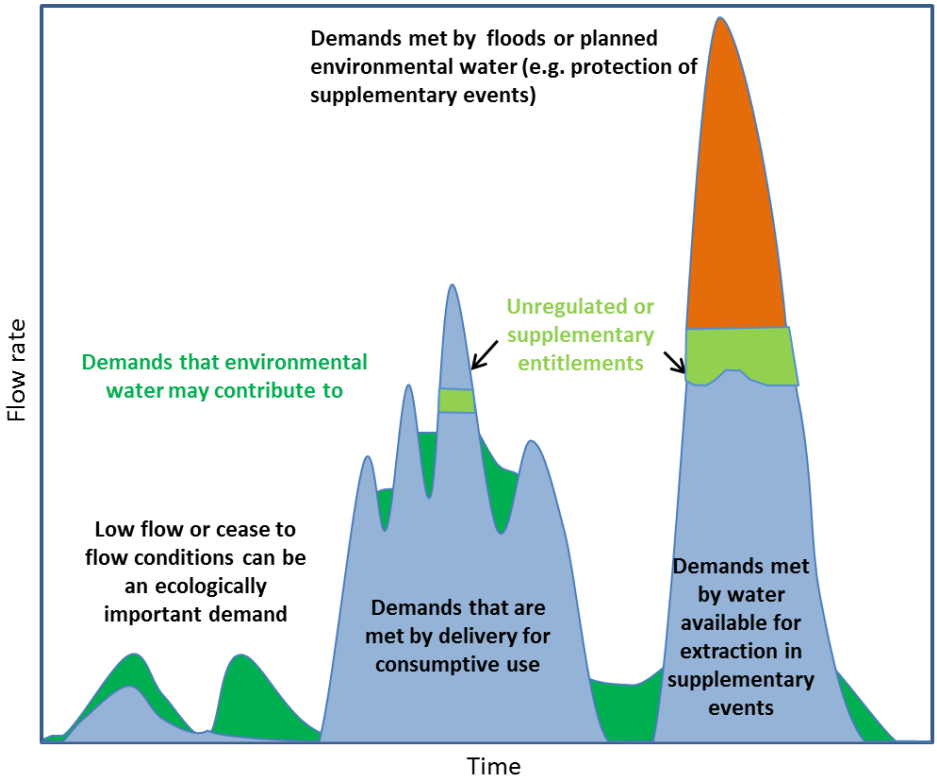

Figure 2: Scope of environmental demands that environmental water may contribute to in the Gwydir River Valley.

Based on the above objectives and delivery constraints, specific watering requirements (flow magnitude, duration, timing and frequency) have been identified as being in scope for Commonwealth environmental water. These water requirements are described in Table 3. As with the objectives, the environmental water requirements will continue to be reviewed and revised in response to new knowledge.

2. Portfolio management in 2019–20

In planning for the management of Commonwealth environmental water, the Commonwealth Environmental Water Office in partnership with NSW OEH aims to maximise the outcomes achieved from the available water. This includes consideration of the urgency of demands (based on targeted objectives and watering requirements, watering history and asset condition) and the available supply under different resource scenarios. Plans for water delivery, trade and carryover are then made in a multi-year context, with an assessment also undertaken of need for water in future years.

This planning process is outlined in full in Table 3 below and summarised in the sections below.

2.1. Lessons from previous years

Outcomes from monitoring and lessons learned in previous years is a critical component for the effective and efficient use of Commonwealth environmental water. These learnings are incorporated into the way environmental water is managed.

The Commonwealth Environmental Water Office works with the Murray–Darling Basin Authority, state agencies, research organisations, regional organisations, local groups and others, such as landholders to collect and collate relevant monitoring information and evaluation results that facilitates adaptive management and changing our practices where needed. This continual review of information and outcomes is helping to build knowledge about the best way to get positive outcomes on a larger scale, based on what works and what doesn't work.

The Commonwealth Environmental Water works with University of New England (previously Eco Logical) and other partner agencies in the Gwydir River Valley in order to conduct ecological monitoring and evaluation of environmental watering effectiveness. Key findings and recommendations from the 2017-18 Gwydir Long Term Intervention Monitoring project include:

- The findings from the 2017-18 water year suggest that the current practice of delivering water for the environment based on natural flow cues and ecological needs is working in the lower Gwydir catchment system, and that the long-term environmental watering strategy continues to be effective for maintaining ecological communities within the Selected Area.
- Flow events delivered earlier in the water year (winter/spring) improve water quality, stimulate fish to move through the system and encourage the development of diverse invertebrate communities. Primary and secondary production during flows at this time of year are limited by colder water temperatures.
- Flows delivered over the summer/autumn period tend to improve water quality, and promote primary and secondary production, thus supporting animals further up the food chain such as fish, frogs and waterbirds.
- Providing flows to the wetlands has been shown to promote invertebrate production, waterbird populations and vegetation condition.
- The fish population in the Gwydir River system remains under stress, with many native species and endangered species in low abundance. This may reflect the carrying capacity of the system in its current state. While some species appear to be breeding and recruiting, others, especially some of the more iconic species such as golden perch, freshwater catfish and Murray cod, are not recruiting sufficiently to improve their populations. Along with providing environmental flows, other options such as habitat rehabilitation, restocking and barrier remediation should be considered to improve the fish communities of the Selected Area.

The outcomes from these monitoring activities are used to inform portfolio management planning and adaptive management decision-making.

2.2. Antecedent and current catchment conditions and the demand for environmental water in 2019–20

Between 2002 and 2010 the Gwydir River Valley experienced an extended period of drought, which, coupled with river regulation and a lack of significant volumes of held water for the environment had a significant impact on the environmental condition of the valley. The combination of improved natural inflows in 2010-12 and 2016 combined withenvironmental watering through 2010–19 has helped improve:

- wetland vegetation extent
- wetland vegetation condition, particularly for water couch-spike rush meadows, marsh club-rush sedgelands and coolabah woodlands. These areas are key to maintaining the ecological condition of Ramsar sites within the Gwydir.

Monitoring in the Gwydir has shown that the wetland vegetation extent and condition of communities, such as the marsh club-rush sedgeland (listed as critically endangered under the NSW *Threatened Species Conservation Act 1995*), have recovered well. Improved inflows also supported recruitment of native fish and frog species in the Gwydir system.

Watering in the Gwydir River Valley currently operates a rolling three-year planning cycle, that acknowledges both the need to respond to rainfall, flow triggers and cues but also take action when a series of those triggers has been insufficient to meet the ecological requirements.

There are a series of factors that impact the ability for delivery of environmental water to mimic natural flow conditions to best support environmental health. The Gwydir catchment system is now highly regulated, with a major upstream river storage (Copeton Dam) and a large irrigation industry downstream. In addition,

much of the remaining wetland assets are surrounded by an extensive broadacre cropping/farming agricultural system on the western floodplain.

While small frequent flows to the Gingham and Lower Gwydir wetlands can occur both from protected portions of natural flows and small deliveries of water for the environment, these small flows tend to only reach into the more eastern portions, and do not result in effective inundation of the central and western portions of wetlands in the Gingham and Lower Gwydir. A larger volume event, be it by natural flooding or a larger delivered volume from dam accounts is required at least once every three years to preserve and conserve the water dependent assets over time. The Mallowa wetlands rely solely on environmental water deliveries for all inflows except for inflows that occur from the larger natural flooding events.

Whilst it is preferred to use natural flow triggers for a 'reactive' use of water for the environment to inundate the east, central and western portions of the wetlands in the western Gwydir catchment, it is important to ensure that the wetlands within Valley receives water across their entire length at least once every three years. Where a 'reactive' approach is insufficient to achieve inundation in the three-year period, a 'proactive' approach, involving the use of a larger delivered volume from dam accounts into the wetlands, is then undertaken to ensure the continued health of the wetlands. This proactive approach reflects the available water, constraints and modifications of the system.

Gwydir Wetlands

Larger scale proactive environmental water deliveries in 2014–15 and 2018-19 promoted the recovery of wetland vegetation in the Lower Gwydir and Gingham Watercourses. Other years following, delivery of environmental water has been guided by natural cycles of drying and wetting to maintain and protect the internationally important Gwydir Wetlands. In summer 2015–16, environmental water was delivered to the Gingham and Lower Gwydir Wetlands following a series of small supplementary events and a small flooding event in the Gingham system during September 2016. The strategy of using natural cues, supported by periodic proactive watering in areas that are unable to receive regular historical inundation due to regulation, has been supported by the Gwydir Environmental Water Advisory Group (EWAG), called the ECAOAC.

In September 2016, large flows occurred mainly into the Gingham Watercourse with lower flows into the Lower Gwydir wetlands as a result of heavy spring rainfall. This small natural flood event in the Gingham system initiated generalist waterbird breeding activity. To build on this inundation environmental water was delivered from storage to the Gingham and Lower Gwydir wetlands over the warmer summer months to extend wetland inundation. Water for the environment (30GL) delivered into the Gingham (around 18 GL) and Lower Gwydir (around 12 GL) wetlands prolonged the inundation in the semi-permanent wetland areas by several months, maintained resources for waterbird and supported frog breeding.

During 2017–18 a small contribution of environmental water (8 GL) was provided to the Gingham and Lower Gwydir Wetlands (4 GL each). In 2018-19 a large scale action (60 GL) with 30 GL each to the Gingham and Lower Gwydir was conducted which successfully inundated the Old Dromana and Goddard's Lease Ramsar sites helping to support areas of coolabah woodland, water couch and march club-rush. The delivery of environmental water saw sufficient flows into the lower Gingham to enable parts of the Crinolyn and Windella sites to be inundated. However but due to structures these sites remained largely without any inundation, and supported frog breeding and migrating waterbirds.

Due to significant watering and natural inflows over all the previous seasons into the Gingham and Lower Gwydir wetlands environmental demand is very low for the 2019-20 season.

Mallowa Wetlands

The Mallowa Wetlands have been a target for environmental flows following the cessation of the stock and domestic replenishment flows deliveries into the Mallowa system as part of water efficiency and recovery projects. The restoration of wetland vegetation in the system began with deliveries of water for the environment in 2012–13, 2013–14, 2014–15, 2015-16 and 2016-17. Environmental water was delivered to at first improve and then maintain the extent of wetland vegetation and to improve conditions in the system to a more healthy, dynamic and resilient condition providing important refuge habitat for a range of native species.

Monitoring has shown that watering in the Mallowa has initiated a very good vegetation and waterbird response and also resulted in a frog breeding event. The Mallowa Wetlands were the only large wetland site north of the Macquarie Marshes watered during the summer of 2013–14 and provided important drought refuge for foraging waterbirds. Monitoring and reports from landholders noted that a large diversity of waterbirds were observed in the area. In 2015–16 environmental water contributed to small reactive watering of the Mallowa during the hotter summer months. During January – April 2017 Commonwealth environmental water was provided to the Mallowa Wetlands, in order continue support of wetland vegetation recovery.

The Mallowa wetlands received large scale inundation with 17 GL of water for the environment delivered n 2018-19, with flows inundating significant portions of wetlands throughout the system and resulted in small connecting flows into the Moomin at the end of the Mallowa system. The last large-scale watering occurred in 2014–15 with a delivery over 10 GL. Due to the recent large-scale watering, the environmental demand in the Mallowa is lower in 2019-20, with only reactive watering as possible, unless a substantial change in water availability occurs. The Mallowa will remain a priority in future years should operational and compliance issues continue to be manageable issues.

River channels

In addition to the wetland recovery in the Gwydir Valley, environmental water managers are working towards building a healthier in-stream ecological environment by contributing environmental water to in-stream freshes in the mainstream and effluent watercourses of the Gwydir system. These flows are provided in a way that mimics the natural timing for flows and for the rates of rise and recession to stimulate fish breeding activity and successful recruitment. Monitoring of the first fish flow trial showed that Commonwealth environmental water was successful at stimulating breeding in populations of bony bream, and spangled perch. During 2015–16, environmental water contributed to a small reactive delivery for in stream aquatic ecology by following natural flow cues.

In-stream environmental watering actions in the Mehi River and Carole Creak in 2013–14 and 2014–15 also achieved good connectivity with the Barwon-Darling River contributing to environmental outcomes for native fish during low flow conditions. Benefits of these flows included connectivity between refuge pools and water quality (salinity).

In autumn 2016, spring 2018 and autumn 2019, river refuge pools protection flows were undertaken following a sequence of dry months. The flow was provided to provide to the main Gwydir River, Gingham and Lower Gwydir Watercourse, Mehi River and Carole Creek. These flows were delivered as low flows that slowly fed into the system during April / early May in 2016 and 2019 and in September 2018 to refresh refuge waterholes in order to protect in-stream aquatic ecology. In April and May the 2019 river refuge pools protection flows along the Mehi River preceded the Northern Fish Flow. The combination of the two flow event provided low flow connection into and along the Barwon River as well as refuge benefits along the Mehi and Barwon Rivers.

Findings from the Long Term Intervention Monitoring evaluations of environmental flows in the Gwydir have contributed to the adaptive management of flows targeting native fish abundance and condition. In particular, in-channel flow strategies that aim to effectively 'charge' the system with resources to facilitate recruitment may be of more benefit than those that target flow releases purely at stimulating breeding and/or dispersing larvae. Responding to this demand, an early season stimulus flow was implemented in the Mehi and Gwydir Rivers and Carole Creek during spring 2017, with preliminary indications suggesting that the flow achieved the desired outcomes. In addition, monitoring of endangered freshwater catfish during 2016-17 showed recruitment in the Lower Gwydir and Mehi for the first time during since environmental watering began. To support this population of native fish, our science partners suggested we provide a low stable flow during late spring / early summer to provide favorable habitat conditions for the freshwater catfish to breed and recruit. Again, all early Fish monitoring in March 2018 suggests that the strategy was successful, with new freshwater catfish recruits being observed (CEWO 2018).

Barwon-Darling

There is a growing awareness of the importance of connecting flows across the northern Basin, to support habitat, water quality, native fish and other aquatic species in the Barwon-Darling and its tributary systems, including the Gwydir Valley Rivers. Two large scale actions for the Barwon-Darling has been undertaken in

conjunction with the NSW Government through OEH with 23 GL ordered in 2018 (18 GL Gwydir) and 36 GL (28 GL Gwydir) delivered in 2019, in order to support aquatic species during extended and severe dry times. These actions were considered successful with 2018 stimulating fish movement along the Barwon-Darling and the 2019 action providing low connections flows to maintain critical drought refuge.

If dry conditions continue across the northern Basin, the requirement for inflows into the Barwon-Darling system is likely to remain high. The environmental demands in the Barwon-Darling are described in the *Commonwealth Environmental Water Portfolio Management Plan: Barwon-Darling 2019–20*. Without increased water availability, the ability for the Gwydir system to contribute to coordinated watering actions in the Barwon Darling during the 2019-20 water year will be extremely limited.

Murray–Darling Basin-wide environmental watering strategy and 2019–20 annual priorities

The Murray–Darling Basin Authority publish the Basin annual environmental watering priorities each year and have published multi-year priorities since 2017-18. There are no specific 2019–20 Basin annual environmental watering priorities relevant to the Gwydir catchment, however the rolling annual priorities are applicable.

Rolling, multi-year priorities

The rolling, multi-year priorities for river flows and connectivity are to:

- Support lateral and longitudinal connectivity along the river systems.

The rolling, multi-year priorities for native vegetation are to:

- Maintain the extent, improve the condition and promote recruitment of forests and woodlands.
- Maintain the extent and improve the condition of lignum shrublands.

The rolling, multi-year priorities for waterbirds are to:

- Improve the abundance and maintain the diversity of the Basin's waterbird population.

The rolling, multi-year priorities for native fish are to:

- Improve flow regimes and connectivity in northern Basin rivers to support native fish populations across local, regional and system scales.
- Support viable populations of threatened native fish, maximise opportunities for range expansion and establish new populations.

2.3. Water availability in 2019–20

Forecasts of Commonwealth water allocations

The volume of General Security Commonwealth environmental water likely to be carried over in Gwydir Valley for use in 2019–20 is estimated to be around 12 GL. Within the Gwydir, the Commonwealth holds 20.4 GL of supplementary entitlements. Access to supplementary events is based on an announcement system with the level of access being dependent of the size of the event. To ensure equitable access for all supplementary entitlement holders, access to supplementary events is also determined through a roster system.

Allocations against Commonwealth water entitlements in the Gwydir Valley are determined by state governments and will vary depending on inflows. The following forecasts in Table 2 are based on the best available information including State forecasts and historical inflow scenarios.

Table 2: Forecasts of Commonwealth water allocations (including carryover) in 2019–20 in the Gwydir Valley as at 31 May 2019.

Entitlement type	Forecasts of Commonwealth water allocations (including carryover) in 2019–20 (GL)					
	Very dry ← → Very wet					
	95 percentile	90 percentile	75 percentile	50 percentile	25 percentile	10 percentile
Gwydir (general/high security)	16	16	16	18	21	26
Gwydir (supplementary)	Up to 20.5	Up to 20.5	Up to 20.5	Up to 20.5	Up to 20.5	Up to 20.5

Notes:
1. Forecasts for regulated catchments are given to the nearest whole gigalitre except where the entitlement held by the Commonwealth is below 1 GL.
2. Allocation rate scenarios are based on long term average allocation rates.
3. Carryover is not available for High Security entitlements. General security entitlements have continuous accounting and water will be forfeit whenever the amount of water in storage exceeds 150 per cent of entitlement. Use limits of 300 per cent of entitlement and 300 per cent of entitlement over 3 years also apply.

Information on allocations to Commonwealth environmental water holdings can be found at http://www.environment.gov.au/water/cewo/portfolio-mgt/holdings-catchment and is updated monthly.

Water resource availability scenarios

Commonwealth environmental water is not managed in isolation. When considering the available resource to meet environmental demands, it is necessary to also factor in the resources managed by other entities and available to contribute to environmental outcomes. Relevant resources include NSW held environmental water and Environmental Contingency Allowance, planned environmental water from natural and unregulated flows, conveyance water and consumptive water. Further detail on sources of environmental water in the Gwydir Valley is provided in Attachment C.

By combining the forecasts of water held by the Commonwealth with streamflow forecasts, as well as taking into account operational considerations, water resource availability scenarios can be developed ranging from very low to very high. Based on available information a low resource availability scenario is in scope for 2019–20.

Due to the dry nature of the system, water deliveries in autumn 2019 were accounted for at Copeton storage. Without significant inflows, environmental water deliveries during the 2019-20 water year are likely to be accounted for high in the system (if delivered in conjunction with other system deliveries) or from storage. If this occurs the volume of water required to meet environmental demands will increase.

There is a current shortfall for essential supplies and the general delivery loss account in Copeton Dam. The shortfall in essential supplies is likely to lead to pressures on ability to use water outside of block releases or accounting at the Dam wall. There is unlikely to be additional allocations until shortfalls are all made up (at least 50GL of inflows).

2.4. Overall purpose of managing environmental water based on supply and demand

Environmental water needs (demand) and water availability (supply) along with antecedent conditions and previous watering histories, influence the overall purpose of Commonwealth environmental water management. Under different combinations, the management purpose can range from 'avoiding damage' to the environment to 'improving' ecological health. This in turn informs the mix of portfolio management options that are suitable for maximising outcomes.

The overall 'purpose' for managing the Commonwealth's water portfolio in the Gwydir catchment for 2019-20 is to protect critical refuges for fish and vegetation in wetlands and river reaches, avoiding irreversible loss and ensuring their ecological capacity for recovery. Figure 3 shows how current demands and forecasted supply considered together.

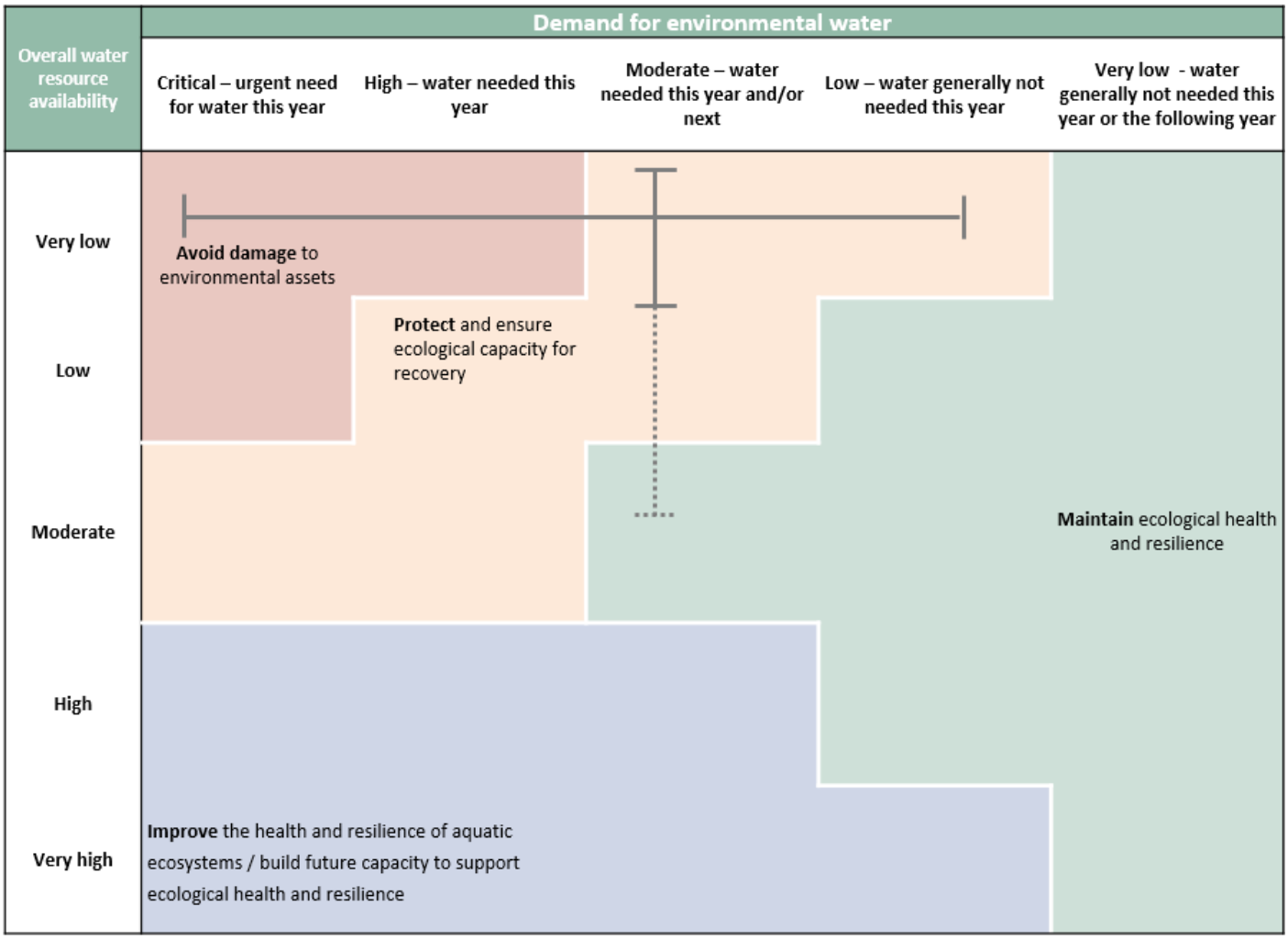

Figure 3: Determining a broad purpose for portfolio management in the Gwydir River Valley for 2019–20. Note: grey lines represent potential range in demand and water resource availability.

Further detail on how the overall purpose for portfolio management changes under different supply and demand scenarios is provided in *Portfolio Management Planning: Approach to planning for the use, carryover and trade of Commonwealth environmental water, 2019–20* (available at: http://www.environment.gov.au/water/cewo/publications).

2.5. Water Delivery in 2019–20

Consistent with the demands and purpose described above, the Commonwealth Environmental Water Office, in partnership with NSW OEH, is considering supplying environmental water to the following watering actions for 2019–20 (see also Table 3 for supporting information regarding the basis for determining these watering intentions).

The Commonwealth Environmental Water Office begins 2019-20 with low relative water availability of 16.1 GL. While water allocations are low, the current environmental demand in the Gwydir wetlands areas is lower than normal due to large scale proactive watering of the Gingham, Lower Gwydir and Mallowa wetlands in 2018-19. The late season river and creek low flows for instream river pools drought refuge flows will mean that under a continued very dry scenario demand in the 2019-20 season will initially be low but will potentially become critical several times during the 2019-20 season. Watering in 2019-20 is likely to be focused on drought and refuge protection actions in key target reaches of main rivers and creeks, with the

possibility of reactive watering and other supportive actions for some wetland areas should additional allocations or supplementary flows occur.

Drought and refuge protection

During extended drying sequences, maintaining drought refuges to support aquatic ecology is a key part of ensuring the ongoing health of the system. Should conditions remain dry during 2019-20, providing environmental water to refresh drought refuges in the Gwydir catchment and reduce the risk of poor water quality will be a core action. As part of these actions, it is likely that environmental water will be accounted from storage or very high up in the system if delivered in conjunction with other system deliveries (such as high security irrigation deliveries during the year).

Reactive Watering and Other Supportive Actions

Should water availability during the water year increase as a result of inflows into storage or the announcement of supplementary water, a range of additional actions may be undertaken.

Within the Mallowa, Gingham and Gwydir systems, environmental watering may seek to support semi-permanent wetland communities by protecting a portion of supplementary water flowing from one or more of the systems unregulated tributaries. Should supplementary water access be made available, a proportion of the Commonwealth supplementary licence may be activated based on the following:

- Up to 10,000 ML in the Mehi /Mallowa being made available with priority given to the Mallowa system.
- Balance of available supplementary water being provided to the Gingham and Gwydir systems.

To complement the supplementary flows, and to offset a component of the natural flow that may be extracted from event, a small volume of General Security water may also be provided on the tail of the flows. Supplementary water may also be used or directed to a range of other environmental assets, depending on the scale and timing of supplementary access.

Under improved conditions environmental watering may also seek to provide in-stream flows to support native fish populations and aquatic ecological processes. The flows make seek to:

- support breeding and recruitment
- provide an early season stimulus flow in late winter/early spring
- build instream carbon/other nutrient levels so that conditions are primed for fish breeding should natural conditions provide an opportunity later in the season.

The demand for in-stream flows beyond drought refuges will be elevated into 2020-21 should there be no natural unregulated events to provide productivity in 2019-20.

Should colonial waterbird breeding commence within the Gwydir Wetlands, environmental water can be made available to augment natural flows to support key waterbird species to complete life cycles in low lying wetlands, for example to support a natural waterbird breeding event through to completion (a NSW reserve volume of 10–15 GL is maintained for this purpose).

Stakeholder Feedback

The Gwydir Valley Environmental Water Advisory Group (EWAG) called the Gwydir ECAOAC met in April 2019 to consider the priorities and targets for environmental watering in the Gwydir catchment. The ECAOAC focused on how to best manage existing carryover to:

- Ensure sufficient volumes will be available to meet critical environmental demands should dry conditions prevail over the forthcoming water year
- Meet possible critical requirements and considerations for the following two years under a continued very dry scenario (the 3-year forward planning).
- Supported the distribution of additional supplementary flows into the Mallowa and Mehi systems with less supplementary water being made available for the Gingham and Gwydir wetland areas.

The ECAOAC supported carrying over 8-10 GL of Commonwealth environmental water from the 2018-19 water year into the 2019-2020. The ECAOAC also supported carrying over 20-25 GL of NSW Environmental Water Account in the Gwydir known as the ECA, meaning the total carry over of environmental water will be around 28-35 GL. With this in mind, the ECAOAC recommended a 'reactive' approach to wetland watering during 2019–20, due to low account volumes and large system wide watering of the Gwydir Wetlands and Mallowa Watercourse in the previous year.

A consensus plan for management was informed by discussions between the ECAOAC members and observers which includes Gwydir valley landholders, water users, scientists, independent environmental advisors and Aboriginal representatives. The demands and priorities identified in this report are consistent with advice from the ECAOAC on the approach.

2.6. Trading water in 2019–20

The Water Act 2007, requires the Commonwealth Environmental Water Holder to trade for the purpose of protecting and restoring the environment. In addition to the obligations of the Water Act 2007, the CEWH and Commonwealth Environmental Water Office staff are required to comply with a wide range of existing legislative requirements. This includes: financial management arrangements for Commonwealth agencies; freedom of information; and policies relating to information management, auditing, employee conduct and accountability.

Planning on water trade considers supply and demand within the catchment and across the Basin. As part of the planning process, the Commonwealth Environmental Water Office undertakes a Basin-wide analysis to identify opportunities to use allocation trade to better match differing demands across catchments. Consideration is given to the water available to meet both current and future environmental needs. Additionally these decisions are influenced by current climatic conditions, as well as implications of trade for commercial outcomes in communities.

Large parts of the northern Basin are currently experiencing pressures from water scarcity, with low storage levels and rainfall deficiencies evident in most northern catchments. It is likely that insufficient water resources will be a major constraint on achieving proposed actions however acquisition to meet environmental needs is unlikely to be feasible until water availability improves. Significant rainfall is required to break the drought and large shortfalls in reserves need to be captured in storage before new allocations can be made.

No specific trade of water in the Gwydir Valley has been identified for 2019-20. Trade opportunities will be reviewed in the valley throughout the water year and as conditions change. Further information will be provided to the market ahead of any trade of Commonwealth environmental water at: http://www.environment.gov.au/water/cewo/trade

For more information on the rules and procedures governing the trade of Commonwealth environmental water, see the *Commonwealth environmental water Trading Framework* available at: http://www.environment.gov.au/water/cewo/publications/water-trading-framework-nov2016

2.7. Carrying over water for use in 2020–21

The volume of water carried over for use in 2020–21 will depend upon resource availability and demand throughout the year. A minimum carryover target of 12 GL is being reserved to meet minimum water requirements such as maintenance of in stream and wetland drought refuges should low inflows result in low allocations. As documented in Table 3 below, potential demands in 2020–21 include:

- Low flows to protect critical in-stream and floodplain refuge habitat in the Gwydir and Gingham as well as Carole and Mehi systems from extended dry periods

- Small delivery into the Mallowa Creek system to provide inundation of core wetland areas especially western wetland areas and lateral and longitudinal connectivity along the system

Estimated carryover into 2020-21 assumes low inflows and is likely to be exceeded. A minimum allocation of 4.5 GL to high security accounts is likely in each water year. Also, opportunities to use supplementary water

during 2019–20 may mean less water is drawn from water in storage to meet the demands in 2019-20 and additional allocations to General Security accounts is also possible. As documented in Table 3 below, potential demands in 2019–20 include flows to protect critical in-stream and floodplain refuge habitat in the Gwydir and Gingham as well as Carole and Mehi systems during extended dry periods.

Carryover volumes will be adjusted throughout the year as the season unfolds in response to both current and future demands and the water available to meet these demands. These decisions will be based upon best information available at the time.

More information on how the Commonwealth makes decisions on carryover is here:
http://www.environment.gov.au/water/cewo/portfolio-mgt/carryover

2.8. Identifying Investment Opportunities

Under the *Water Act 2007*, the Commonwealth Environmental Water Holder (CEWH) has the flexibility to use the proceeds from the sale of water allocations to fund environmental activities in the Basin.

'Environmental activities' must be consistent with the CEWH's obligation to exercise their function to protect and restore environmental assets. Environmental activities must also improve the capacity of the CEWH to meet the objectives of the Basin Plan environmental watering plan, and be directly linked to current or future delivery of water for the environment.

The option of investing the proceeds in environmental activities will be considered alongside other available water management options, such as purchasing water at another time or place. The CEWH is finalising an Investment Framework and an Annual Investment Plan to inform future investment in environmental activities.

Table 3: Environmental demands, priority for watering in 2019–20 and outlook for coming year in the Gwydir River Valley.

Environmental assets		Indicative demand (for <u>all sources of water</u> in the system)		Watering history	2019–20		Implications for future demands
		Flow/Volume	Required frequency (maximum dry interval)	(from all sources of water)	Environmental demands for water	Potential Commonwealth environmental water contribution?	Likely environmental demand in 2020–21 if watering occurred as planned in 2019–20
Drought Refugia	**Protect critical in-stream refuge habitat during extended drying sequences** Native fish refuge habitat	Between 8 - 14 GL to maintain critical refuge pools within target reaches of the Gwydir, Gingham, Carole and Mehi systems	As required, All years Generally cease to flow for 40-50 days	Flows to protect critical aquatic refuge habitat in Gwydir, Carole and Mehi met demands in April – May 2016. The northern connectivity event in April – May 2018 contributed to meeting this demand in the Mehi River and Carole Creek. Flows to protect critical aquatic refuge habitat in Gwydir, Carole and Mehi met demands in 2018-19 water year. Due to current conditons being exceptional dry, demand has been assessed as high.	High	Respond to natural conditions to protect critical aquatic refuge habitat, if required	High
	Protect critical floodplain refuge habitat during extended drying sequences • Native fish refuge habitat • Refuge habitat for frogs and other aquatic species • Waterbird habitat and refuge	Between 4 - 8 GL to maintain critical refuge waterholes and lagoons within target floodplain areas within Gwydir, and Gingham, and Mehi systems	As required, All years	Gingham Waterhole under nil inflows into the Gingham system at Tillaloo may reach very low levels during the summer of 2019-20 and will require assessment as to whether it will be a priority and feasible to delivery flows into the Waterhole. Demand has been assessed as high but is likely to require using multiple sources of water (e.g. unregulated flows).	High	Respond to natural conditions to protect critical floodplain refuge habitat, if required	High
Wetland Watering	**Gwydir Wetlands** **(Gingham and Lower Gwydir Watercourse and wetlands)** • Areas of Ramsar listed wetlands* • Nationally significant wetlands • Waterbird breeding and habitat • Habitat and breeding ground for frogs • Native fish habitat • Endangered ecological communities	45 GL ideally during October to March 60 GL ideally during October to March 80 GL ideally during October and March, (constraints currently limiting ability to deliver to this demand with regulated flows)	7/8 in 10 years (1.5 years) 6 in 10 years (2 years) 4 in 10 years (3 years)	In 2016-17 spring rainfall resulted in a broad area of inundation mainly across the Gingham wetlands and lower floodplains and to a much smaller extent in the Lower Gwydir wetlands. The Gingham and Lower Gwydir wetlands experienced drier conditions during 2017-18. During 2018-19 a large extended delivery of 60 GL watering event occurred into the wetlands. Therefore, the environmental demand has been assessed as low.	Low Watering has occurred for 3 of the last 3 water years	A low to moderate priority for watering using supplementary access in 2019–20.	Assuming no supplementary access, demand is moderate to high as watering will not have occurred for 2 of the last 3 years
	Mallowa • Waterbird breeding and habitat • Habitat and breeding ground for frogs • Endangered ecological communities	3 – 8 GL ideally during Oct to March 8-15 GL ideally during Oct to March 15 - 22 GL ideally Sep to March	9-10 in 10 years (1.5 years) 7 - 9 in 10 years (2 years) 5 - 7 in 10 years (3 years)	Small contributions (around 8 GL) of environmental water were provided to the Mallowa Creek wetlands in 2016-17. Environmental demands could not be met in 2017-18 due to delivery complications. During 2018–19 around 17 GL flowed into the Mallowa Creek system providing lateral and longitudinal connectivity. The Mallowa Creek system has received environmental water twice over the 3 years, therefore the environmental demand has been assessed as moderate.	Moderate	A high priority for watering using supplementary access in 2019–20, depending operational feasibility.	Assuming no supplementary access, demand is high as watering will not have occurred for 2 of last 3 years
Aquatic in-stream ecology	**Mehi River** • Waterbird habitat and refuge under very dry conditions • Habitat and refuge for frogs • Native fish habitat, breeding, recruitment and refuge	7–10 GL, all year (most likely winter / spring) (breeding / stimulation flow) 5 GL demand for maintenance all year	5 in 10 years Second and thrid year following a stimulation / breeding event flow	Early season stimulus and stable fish flow delivered during 2017–18. The Northern Fish Flow successfully contributed to meeting the maintenance demand during 2018–19. The requirement for the maintenance demand has been assessed as moderate	Moderate	Environmental water for other actions could contribute to this demand	Moderate
	Carole Creek • Waterbird habitat and refuge • Habitat and refuge for frogs • Native fish habitat , breeding, recruitment and refuge	5–10 GL, all year (most likely spring to autumn)	5 in 10 years	Small to moderate River pulse achieved in 2016-17. Early season stimulus and stable fish flow delivered during 2017–18. Very low and cease-to-flow conditions during 2018 - 19. Therefore, the environmental demand has been assessed as moderate.	Moderate	Watering to occur only if resource availability increases	Moderate

	Ballin Boora • Water bird habitat and refuge • Habitat and breeding ground for frogs • Native fish habitat	0.6 GL all year (most likely spring to autumn)	Subject to further examination	Environmental flows were delivered to the Ballin Boora system during 2018-19. For the 3 water years preceding 2018-19 no environmental flows had been delivered. Watering is subject to further examination of environmental demand and operational requirements)	Moderate	Watering to occur only if resource availability increases	Moderate
	Gwydir River Downstream of Copeton Dam • Native fish habitat	Improve natural character of flows downstream of the dam	All years (Spring to Autumn)	Required volumes met. Natural flow pattern not met. Therefore, the environmental demand has been assessed as moderate.	Moderate	Environmental water could partially contribute to this demand. For the 2019-20 water year, environmental flows will form the majority of the regulated deliveries so there will be a greater opportunity to influence the character of the releases.	Moderate
Bird breeding support flows	**Support large scale colonial waterbird breeding events** • Waterbird breeding and habitat	10–15 GL	As required, All years	Colonial waterbird breeding requirement has not been triggered in the past 6 years, and requires large scale natural flows event to trigger, therefore the demand has been assessed as moderate. However under extend very dry conditions this contingency is likely to be used to meet critical environmental water needs	Moderate	Respond to naturally triggered bird breeding, if required	Moderate
					Carryover potential	The volume of General Security Commonwealth environmental water likely to be carried over in Gwydir Valley for use in 2019–20 is estimated to be around 12 GL	A low to moderate proportion of available allocations may be carried over to 2020–21
					Trade potential	No specific commercial trade of water has been identified for 2019-20. Trade opportunities will be reviewed in the valley throughout the water year and as conditions change	Potential to trade will depend on environmental demands, resource availability and market conditions.

* Four sites in the lower Gwydir and Gingham are internationally recognised under the Ramsar Convention and other international agreements for migratory species and for their special habitat value for waterbirds. These are 'Old Dromana' on the Lower Gwydir system as well as Goddard's Lease', 'Windella' and'Crinolyn' on the Gingham Watercourse and '. The primary ecological features of the wetlands include large areas of coolibah woodland, water couch and marsh club-rush. By maintaining this wetland vegetation, other critical components of the Ramsar site may be supported, including waterbird breeding and foraging habitat.

Key - potential watering in 2019–20

- High priority for Commonwealth environmental watering (likely to receive water even under low water resource availability)
- Secondary priority for Commonwealth environmental watering (watering to occur only if natural trigger is met, or under moderate – high water resource availability); or water demand likely to be met via other means
- Low priority for Commonwealth environmental watering (under high – very high water resource availability)
- Unable to provide Commonwealth water due to constraints

Key - environmental demands

- critical demand i.e. urgent need for water in that particular year to manage risk of irretrievable loss or damage
- high demand for water i.e. needed in that particular year
- moderate demand for water i.e. water needed that particular year and/or next
- low demand for water i.e. water generally not needed that particular year
- very low demand for water i.e. water generally not needed that particular year or the following year

Note that demand is considered at a generalised scale; there may be specific requirements that are more or less urgent within the flow regime

3. Next steps

3.1. From planning to decision making

It is important to distinguish between planning and operational decision making. As shown in Figure 4, planning allows the Commonwealth Environmental Water Office to manage the environmental water portfolio in a holistic manner and is an exercise in developing a broad approach or intention, based on the key drivers (demand and supply).

Decision making throughout each year builds on the intention by considering in more detail the specific prevailing factors and additional factors such as costs, risks, and constraints to water delivery and market conditions.

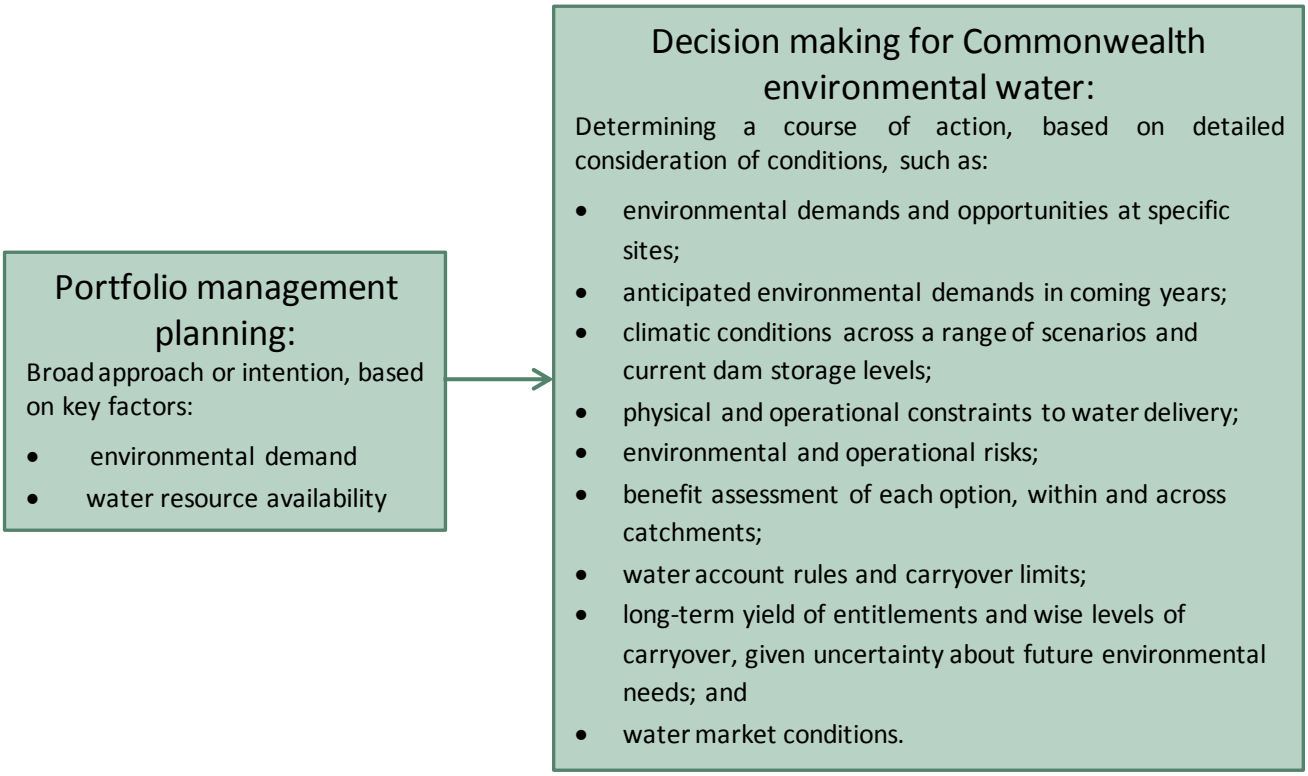

Figure 4: Planning and decision making for Commonwealth environmental water use

3.2. Monitoring

Operational monitoring is undertaken for all Commonwealth environmental watering actions and involves collecting on-ground data with regard to environmental water delivery such as volumes delivered, impact on the river systems hydrograph, area of inundation and river levels. It can also include observations of environmental outcomes.

The five year Long Term Intervention Monitoring (LTIM) Project (2013–2014 to 2018–19 has the Gwydir River Valley region as a focus area. It has aimed to understand the environmental response from Commonwealth environmental watering with respect to the targeted objectives by carrying out monitoring of site condition over many years. This monitoring will be continued under the CW MER 3 year program from 2019–20 onwards. Monitoring is also undertaken by other organisations in the Gwydir and this is also used to inform planning and operational decisions.

Information on the monitoring activities is available http://www.environment.gov.au/water/cewo/catchment/gwydir/monitoring . Monitoring information is also provided by state governments.

3.3. Further information

For further information on how the Commonwealth Environmental Water Office plans for water use, carryover and trade, please visit our web site: http://www.environment.gov.au/water/cewo

or the sites below:

- Water use: www.environment.gov.au/topics/water/commonwealth-environmental-water-office/assessment-framework
- Carryover: http://www.environment.gov.au/topics/water/commonwealth-environmental-water-office/portfolio-management/carryover
- Trade: http://www.environment.gov.au/water/cewo/trade/trading-framework
- Gwydir LTIM monitoring: http://www.environment.gov.au/water/cewo/catchment/gwydir/monitoring

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Attachment A – Expected outcomes from the Basin-wide environmental watering strategy

Expected outcomes from the Basin-wide environmental watering strategy (MDBA 2014) that are relevant to the Gwydir are described below.

RIVER FLOWS AND CONNECTIVITY

Baseflows are at least 60 per cent of the natural level.

Contributing to a 10 per cent overall increase in flows in the Barwon–Darling.

A 10–20 per cent increase in the frequency of freshes, bankfull and lowland floodplain flows.

VEGETATION

Maintain the current extent of water-dependent vegetation near river channels and on low-lying areas of the floodplain.

No decline in the condition of river red gum, black box and coolibah.

Improve condition of lignum shrublands in the lower Gwydir catchment.

Improved recruitment of trees within black box, river red gum and coolibah communities.

Increased periods of growth for non-woody vegetation communities that closely fringe or occur within the river and creek channels, and for marsh club-rush and water couch in the Gwydir Wetlands.

Vegetation extent

Area of river red gum (ha)	Area of black box (ha)	Area of coolibah (ha)	Shrublands	Non–woody water dependent vegetation
4 500	600	6 500	Lignum in the Lower Gwydir	Closely fringing or occurring within the Gwydir River and marsh club-rush and water couch in the Gwydir Wetlands

WATERBIRDS

Maintain current species diversity.

Increase Basin-wide abundance of waterbirds by 20–25 per cent by 2024.

A 30–40 per cent increase in nests and broods (Basin-wide) for other waterbirds.

Up to 50 per cent more breeding events (Basin-wide) for colonial nesting waterbird species.

Important Basin environmental assets for waterbirds in the Gwydir River Valley

Environmental asset	Total abundance and diversity	Drought refuge	Colonial waterbird breeding	Shorebird abundance	In scope for C'th e-watering?
Gwydir Wetlands	Yes	Yes	Yes (for supporting habitat maintenance and successful completion of natural events	N/A	Yes

FISH

No loss of native species.

Improved population structure of key species through regular recruitment, including:

- Short-lived species with distribution and abundance at pre-2007 levels and breeding success every 1–2 years.
- Moderate to long-lived with a spread of age classes and annual recruitment in at least 80 per cent of years.

Increased movements of key species.

Expanded distribution of key species and populations.

Key species for the Gwydir River Valley include:

Species	Specific outcomes	In-scope for C'th e-watering?
Freshwater catfish (*Tandanus tandanus*)	Expand the core range of existing populations in the Gwydir	Yes
Golden Perch (*Macquaria ambigua*)	A 10–15 per cent increase of mature fish (of legal take size) in key populations	Yes
Murray cod (*Maccullochella peelii*)	A 10–15 per cent increase of mature fish (of legal take size) in key populations	Yes
Olive perchlet (*Ambassis agassizii*)	-	Yes
River blackfish (*Gadopsis marmoratus*)	Expand the range of current populations in the upland systems of the Gwydir	No
Southern purple-spotted gudgeon (*Mogurnda adspersa*)	Expand the range (or core range) of populations in the Gwydir. Establish additional populations	Yes

Attachment B – Operational details for watering

Operational considerations in the Gwydir River Valley

The delivery of environmental water in the Gwydir River Valley is currently constrained by the release capacities from storages, channel capacity, proximity of cropping to watercourses, control structures and various operating practices and system constraints. These constraints have been identified in the MDBA's constraints management strategy (MDBA 2013).

The distribution of regulated flow in the low-lying wetlands depends on the amount of extraction between the control structures and the wetlands. Where possible, environmental deliveries will be planned to mimic patterns of natural inundation and ensure core wetland areas receive water during the warmer summer months for a sufficient period of time. However, spring and early summer deliveries of environmental water to the wetlands are constrained by risks to crops within wetland areas during the harvest period.

During periods of peak demand channel capacity is a significant constraint in meeting both consumptive and environmental demand. Where channel capacity is likely to be exceeded river operators may rationalise available capacity between water users. This can be compounded by cropping and harvest cycles pushing environmental water deliveries later in the season reducing the available time window for delivery to core wetland areas. Under these circumstances the ecological objectives of environmental water may be at risk due to compromised delivery of environmental water.

In-stream watering actions, particularly in the Mehi River and Carole Creek, may be timed to occur prior to the main period for the delivery of irrigation water. Delivery of irrigation water following an in-stream action may contribute to environmental outcomes. While environmental objectives for such actions target the length of the system the environmental water delivery must be accounted for at a single point in the system. Extractions downstream of the accounting point may reduce the environmental outcomes in the lower reaches of the system. In-stream deliveries to the Mehi River and Carole Creek have the potential to contribute to environmental outcomes in the Barwon-Darling system.

Operational considerations such as delivery methods, opportunities, constraints and risks will differ depending on the inflow scenario. These considerations will be assessed throughout the year as decisions to make water available for use are made and implemented. This includes refining the ecological objectives, assessing operational feasibility and potential risks and the ongoing monitoring of the seasonal outlook and river conditions.

Environmental water may be made available for some watering options from NSW OEH either as adaptive environmental water or discretionary planned environmental water to deliver common and complementary environmental outcomes.

Watering options have been developed in consideration of the release capacities outlined in the *Water Sharing Plan for the Gwydir Regulated River Water Source*. The Murray-Darling Basin Authority has recently published *Preliminary Overview of Constraints to Environmental Water Delivery in the Murray–Darling Basin* (MDBA, 2013b)and *Constraints Management Strategy 2013 to 2024* (MDBA, 2013a) which also provide further information about constraints to environmental water delivery in the Gwydir catchment.

Potential watering actions under different levels of water resource availability

Under certain levels of water resource availability, watering actions may not be pursued for a variety of reasons, including that environmental demand may be met by unregulated flows and that constraints and/or risks may limit the ability to deliver environmental water. Table 4 identifies the range of potential watering actions in Gwydir Valley River and the levels of water resource availability that relate to these actions.

Table 4: Summary of potential watering actions for the Gwydir River Valley

Broad Asset	Indicative demand	Applicable level(s) of water resource availability				
		Very Low	Low	Moderate	High	Very High
1. Wetland watering	**Gwydir Wetlands**	Provide base flows to protect core semi-permanent wetland vegetation and maintain drought refuge habitat			Contribute to base flows and freshes to provide connectivity between wetlands, maintain vegetation extent and condition, and support opportunities for reproduction for a range of waterbird and other native aquatic species.	
	Mallowa Wetlands	Contribute to base flows and freshes to provide connectivity between wetlands, maintain vegetation extent and condition, and support opportunities for reproduction for a range of waterbird and other native aquatic species.				
2. In stream aquatic ecology	**Gwydir River, Mehi River, Carole Creek and Ballin Boora Creek**	Contribute to base flows to refresh drought refuges and reduce the risk of degrading water quality.			Contribute to natural and/or regulated flows to support hydrological connectivity increasing fish habitat availability, supporting ecosystem processes, improving native fish condition and supporting opportunities for breeding.	
	In-stream low flow base flow (downstream of	Contribute to base flows to refresh drought refuges and reduce the risk of degrading water quality.				

	Copeton Dam to lower Mehi River)			
3. Dry river flows or bird breeding support flows	**Waterbird reproduction and fledging contingency**		If required, augment natural flows to support key species to complete life cycles in low lying wetlands for example water bird reproduction and fledging.	

Note: Under certain resource availabilities, options may not be pursued for a variety of reasons including that environmental demand may be met by unregulated flows, and that constraints and/or risks may limit the ability to deliver environmental water.

Potential watering actions – standard operating arrangements

Table 4 identifies the range of potential watering actions in Gwydir River Valley n the Murray-Darling Basin that give effect to the long-term demands and flow regime identified as being in scope for the contribution of Commonwealth environmental water in any given year. The standard considerations associated with these actions are set out below.

1. Wetland vegetation maintenance following natural cycles of wetting and drying

Watering action: Contribute to wetland watering of Gwydir, Gingham and Mallowa watercourses following natural cycles of drying and wetting.

Standard operational considerations:

- Contributing to wetlands vegetation maintenance by proactive watering – delivery of an approved volume of held environmental water called from storage to inundate semi-permanent wetland vegetation in the Gwydir Wetlands and/or Mallowa Watercourse

- If supplementary water access is made available, take a proportion of the Commonwealth supplementary licence for each watercourse (up to 14 100 ML in the Gingham/ Gwydir and up to 5 000 ML in the Mehi / Mallowa)

Typical extent: This watering action could contribute flows required to inundate small areas of wetland vegetation in the Gwydir, Gingham and Mallowa wetland systems.

Approvals: This option will be coordinated with NSW OEH to ensure complementary delivery. NSW OEH manages held and planned environmental water for NSW (the Environmental Contingency Allowance). Achieving the target flows outlined above will require an initial announcement of supplementary water access and proportional split between watercourses. Approval to order General Security water will also be required, with coordination between NSW OEH and the Commonwealth to apportion any shared volumes of held in environmental water proposed for use.

2. Contributing to in-stream aquatic ecology

Watering action: Contributing to in-stream flows to maintain in-stream aquatic ecology to protect the habitat for aquatic species (fish, frogs, crustaceans and macroinvertebrates) and aquatic and riparian vegetation maintenance by reactive watering - activating access to supplementary water

Standard operational considerations:

- Contributing to in-stream and riparian vegetation maintenance by reactive watering - activating access to supplementary water when it is called

- When supplementary water access is made available, take a proportion of the Commonwealth supplementary licence for each watercourse (up to 14 100 ML in the Gingham/ Gwydir and up to 5 000 ML in the Mehi / Mallowa)

Typical extent: This watering action could contribute flows within channel in the lower Gwydir River, Mehi River and Carole Creeks. In moderate to high water resource scenarios flows in the Mehi River and Carole Creek may provide connectivity with the Barwon-Darling River.

Approvals: This option will be coordinated with NSW OEH to ensure complementary delivery. NSW OEH manages held and planned environmental water for NSW (the Environmental Contingency Allowance). Achieving the target flows outlined above will require an initial announcement of supplementary water access and proportional split between watercourses. Approval to order General Security water will also be required, with coordination between NSW OEH and the Commonwealth to apportion any shared volumes of held in environmental water proposed for use.

3. Dry river flows or bird breeding support flows

Watering action: Provide environmental water from storage to:

- contribute to base flows to refresh drought refuges and reduce the risk of degrading water quality to assist survival of aquatic species during dry periods; or

- augment natural flows to support key waterbird species to complete life cycles in low lying wetlands, for example to support a natural waterbird breeding event through to completion.

Standard operational considerations:

- *Very dry to dry scenario:* Contribute to in-stream baseflows in the Gwydir River for drought refuge – release from storage during periods of extreme low flows. Releases would be small and within release capacities, even at low storage levels. Where practicable releases would be coordinated with small tributary inflows to maximise environmental benefit.

- *Moderate to very high scenario:* Augment flows to the Gwydir Wetlands to support the completion of a waterbird breeding event where there is a risk of changing water levels compromising breeding outcomes (e.g. risk of nest abandonment).

Typical extent: This watering action could contribute flows within the Gwydir River (for in-stream baseflow contingency) or the lower Gwydir and Gingham watercourses (for waterbird breeding contingency).

Approvals: These options will be coordinated with NSW OEH to ensure complementary delivery. NSW OEH manages held and planned environmental water for NSW (the Environmental Contingency Allowance).

Attachment C – Long-term water availability

Commonwealth environmental water holdings

The Commonwealth holds the following entitlements in the Gwydir River Valley:

- Gwydir (high security)
- Gwydir (general security)
- Gwydir (supplementary)

The full list of Commonwealth environmental water holdings can be found at www.environment.gov.au/topics/water/commonwealth-environmental-water-office/about-commonwealth-environmental-water/how-much and is updated monthly.

Other sources of environmental water

Other potential sources of held environmental water that may be used to complement Commonwealth environmental water delivery in the Gwydir include:

- Environmental Water Allowance (ECA) (NSW OEH) (discretionary Planned Environmental Water)
- NSW RiverBank Environmental Water Licences (NSW OEH)

Other sources of water that support environmental outcomes

In addition to water entitlements held by environmental water holders, environmental demands may also be met via natural or unregulated flows and water provided for the environment under rules in state water plans (referred to as 'planned environmental water') as well as from other deliveries from Copeton Dam for irrigation or other deliveries.

The *Water Sharing Plan for the Gwydir Regulated River Water Source* 2016 provides for planned environmental water and stock and domestic releases (replenishment flows).

Planned Environmental Water

The water sharing plan sets water aside in an 'environmental contingency allowance' (ECA) of 45 000 ML, multiplied by the available water determination for general security access licences (e.g. if the general security allocation is 20 per cent 9 000 ML will be set aside [45 000 ML x 0.2 = 9 000 ML]). The maximum ECA account balance, at any time, is limited to 90 000 ML. Releases may be made for a wide range of purposes related to wetland or river health or for the direct benefit of birds, fish or other fauna. The ECA account is managed by the NSW OEH with advice provided by the Gwydir ECAOAC.

The Gingham and Lower Gwydir watercourses and wetlands often benefit from unregulated tributary flows (downstream of Copeton Dam) protected under the water sharing plan. The water sharing plan protects up to 500 ML/day of inflows from tributaries downstream of Copeton Dam for the Gwydir Wetlands (referred to as 3T Low Flow rule water).

In addition a maximum of 50 per cent of natural tributary flows (supplementary events) downstream of Copeton Dam can be extracted under supplementary licences (up to a maximum of 178GL/year) with the rest of the natural flow being protected for the environment and may benefit various areas with the Gwydir system downstream of Copeton dam. These regulated and unregulated flows may offer opportunities to piggy back or to follow on with Commonwealth environmental water and increase the potential for environmental objectives to be achieved. In unregulated systems PEW is protected by rules about when water can be accessed, often specific flows or heights or volumes at gauges or sites.

Stock and domestic replenishment flows

- Regulated stock and domestic replenishment flows are provided for *in Water Sharing Plan for the Gwydir Regulated River Water Source* 2016, these are: up to 4 GL per water year to Thalaba Creek.
- Up to 6 GL per water year for BLR S&D (location not specified in WSP)