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Southern Gulf: Queensland water plans and settings

A technical report from the CSIRO Southern Gulf Water Resource
Assessment for the National Water Grid

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The Assessment was guided by two committees:

- i. The Governance Committee: CRC for Northern Australia/James Cook University; CSIRO; National Water Grid (Department of Climate Change, Energy, the Environment and Water); Northern Land Council; NT Department of Environment, Parks and Water Security; NT Department of Industry, Tourism and Trade; Office of Northern Australia; Queensland Department of Agriculture and Fisheries; Queensland Department of Regional Development, Manufacturing and Water
- ii. The Southern Gulf catchments Steering Committee: Amateur Fishermen's Association of the NT; Austral Fisheries; Burketown Shire; Carpentaria Land Council Aboriginal Corporation; Health and Wellbeing Queensland; National Water Grid (Department of Climate Change, Energy, the Environment and Water); Northern Prawn Fisheries; Queensland Department of Agriculture and Fisheries; NT Department of Environment, Parks and Water Security; NT Department of Industry, Tourism and Trade; Office of Northern Australia; Queensland Department of Regional Development, Manufacturing and Water; Southern Gulf NRM

Responsibility for the Assessment's content lies with CSIRO. The Assessment's committees did not have an opportunity to review the Assessment results or outputs prior to their release.

This report was reviewed by Dr Chris Stokes (CSIRO), Dr Justin Hughes (CSIRO) and Dr Ian Watson (CSIRO).

Acknowledgement of Country

CSIRO acknowledges the Traditional Owners of the lands, seas and waters, of the area that we live and work on across Australia. We acknowledge their continuing connection to their culture and pay our respects to their elders past and present.

Photo

River systems near Burketown. Source: Imagery ©2021 CNEW / Airbus, Lands / Copernicus, Maxar Technologies, Map data © 2021

Director's foreword

Sustainable development and regional economic prosperity are priorities for the Australian, Queensland and Northern Territory (NT) governments. However, more comprehensive information on land and water resources across northern Australia is required to complement local information held by Indigenous Peoples and other landholders.

Knowledge of the scale, nature, location and distribution of likely environmental, social, cultural and economic opportunities and the risks of any proposed developments is critical to sustainable development. Especially where resource use is contested, this knowledge informs the consultation and planning that underpin the resource security required to unlock investment, while at the same time protecting the environment and cultural values.

In 2021, the Australian Government commissioned CSIRO to complete the Southern Gulf Water Resource Assessment. In response, CSIRO accessed expertise and collaborations from across Australia to generate data and provide insight to support consideration of the use of land and water resources in the Southern Gulf catchments. The Assessment focuses mainly on the potential for agricultural development, and the opportunities and constraints that development could experience. It also considers climate change impacts and a range of future development pathways without being prescriptive of what they might be. The detailed information provided on land and water resources, their potential uses and the consequences of those uses are carefully designed to be relevant to a wide range of regional-scale planning considerations by Indigenous Peoples, landholders, citizens, investors, local government, and the Australian, Queensland and NT governments. By fostering shared understanding of the opportunities and the risks among this wide array of stakeholders and decision makers, better informed conversations about future options will be possible.

Importantly, the Assessment does not recommend one development over another, nor assume any particular development pathway, nor even assume that water resource development will occur. It provides a range of possibilities and the information required to interpret them (including risks that may attend any opportunities), consistent with regional values and aspirations.

All data and reports produced by the Assessment will be publicly available.



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Project Director

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Shortened forms

SHORT FORM	FULL FORM
AVL	annual volumetric water
DNRME	Department of Natural Resources, Mines and Energy
DRDMW	Department of Regional Development, Manufacturing and Water
DVL	daily volumetric limit
EFO	environmental flow objective
GAB	Great Artesian Basin
GABORA	Great Artesian Basin and Other Regional Aquifers
GABORA water plan	Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017
general reserve	an unallocated water reserve specified within the Gulf water plan which may be granted for any purpose
GDE	groundwater-dependent ecosystem
Gulf resource operations plan	Gulf Resource Operations Plan June 2010 (Amendment August 2015)
Gulf water plan	Water Plan (Gulf) 2007
Framework	legislative framework
HUF	headworks utilisation factor
Indigenous reserve	an unallocated water reserve specified within the Gulf water plan which may be granted for “helping Indigenous communities... to achieve their economic and social aspirations”
multisource licence	water licences that authorise the taking of watercourse water and overland flow water under a single licence
QCA	Queensland Competition Authority
Regulation	Water Regulation 2016
state purpose	defined by the Gulf water plan as meaning a coordinated project, a project of regional significance, town water supply or ecotourism (in specific areas)
strategic reserve	an unallocated water reserve specified within the Gulf water plan which may be granted for a state purpose
WASO	water allocation security objective
Water Act	Queensland Water Act 2000

Units

UNIT	DESCRIPTION
km	kilometre
m	metre
ML	megalitre
GL	gigalitre

Preface

Sustainable development and regional economic prosperity are priorities for the Australian, NT and Queensland governments. In the Queensland Water Strategy, for example, the Queensland Government (2023) looks to enable regional economic prosperity through a vision that states ‘Sustainable and secure water resources are central to Queensland’s economic transformation and the legacy we pass on to future generations.’ Acknowledging the need for continued research, the NT Government (2023) announced a Territory Water Plan priority action to accelerate the existing water science program ‘to support best practice water resource management and sustainable development.’

Governments are actively seeking to diversify regional economies, considering a range of factors, including Australia’s energy transformation. The Queensland Government’s economic diversification strategy for North West Queensland (Department of State Development, Manufacturing, Infrastructure and Planning, 2019) includes mining and mineral processing; beef cattle production, cropping and commercial fishing; tourism with an outback focus; and small business, supply chains and emerging industry sectors. In its 2024–25 Budget, the Australian Government announced large investment in renewable hydrogen, low-carbon liquid fuels, critical minerals processing and clean energy processing (Budget Strategy and Outlook, 2024). This includes investing in regions that have ‘traditionally powered Australia’ – as the North West Minerals Province, situated mostly within the Southern Gulf catchments, has done.

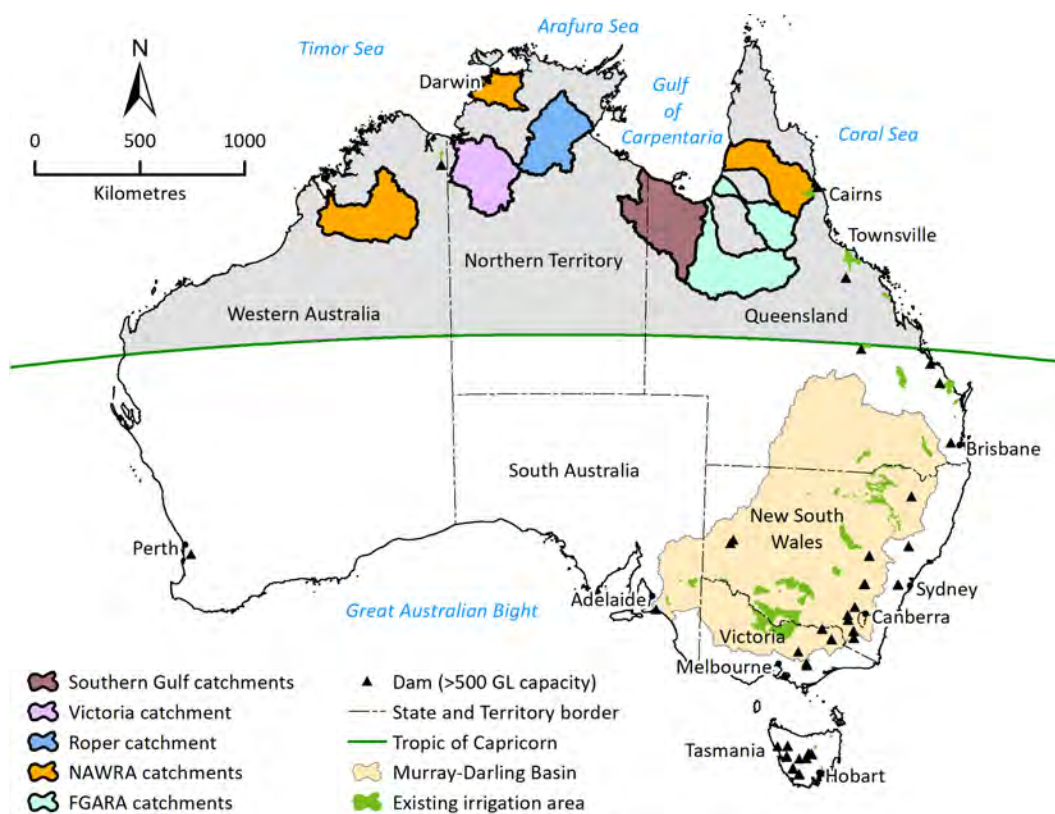
For very remote areas like the Southern Gulf catchments (Preface Figure 1-1), the land, water and other environmental resources or assets will be key in determining how sustainable regional development might occur. Primary questions in any consideration of sustainable regional development relate to the nature and the scale of opportunities, and their risks.

How people perceive those risks is critical, especially in the context of areas such as the Southern Gulf catchments, where approximately 27% of the population is Indigenous (compared to 3.2% for Australia as a whole) and where many Indigenous Peoples still live on the same lands they have inhabited for tens of thousands of years. About 12% of the Southern Gulf catchments are owned by Indigenous Peoples as inalienable freehold.

Access to reliable information about resources enables informed discussion and good decision making. Such information includes the amount and type of a resource or asset, where it is found (including in relation to complementary resources), what commercial uses it might have, how the resource changes within a year and across years, the underlying socio-economic context and the possible impacts of development.

Most of northern Australia’s land and water resources have not been mapped in sufficient detail to provide the level of information required for reliable resource allocation, to mitigate investment or environmental risks, or to build policy settings that can support good judgments. The Southern Gulf Water Resource Assessment aims to partly address this gap by providing data to better inform decisions on private investment and government expenditure, to account for

intersections between existing and potential resource users, and to ensure that net development benefits are maximised.



Preface Figure 1-1 Map of Australia showing Assessment area (Southern Gulf catchments) and other recent CSIRO Assessments

FGARA = Flinders and Gilbert Agricultural Resource Assessment; NAWRA = Northern Australia Water Resource Assessment.

The Assessment differs somewhat from many resource assessments in that it considers a wide range of resources or assets, rather than being a single mapping exercises of, say, soils. It provides a lot of contextual information about the socio-economic profile of the catchments, and the economic possibilities and environmental impacts of development. Further, it considers many of the different resource and asset types in an integrated way, rather than separately.

The Assessment has agricultural developments as its primary focus, but it also considers opportunities for and intersections between other types of water-dependent development. For example, the Assessment explores the nature, scale, location and impacts of developments relating to industrial, urban and aquaculture development, in relevant locations. The outcome of no change in land use or water resource development is also valid.

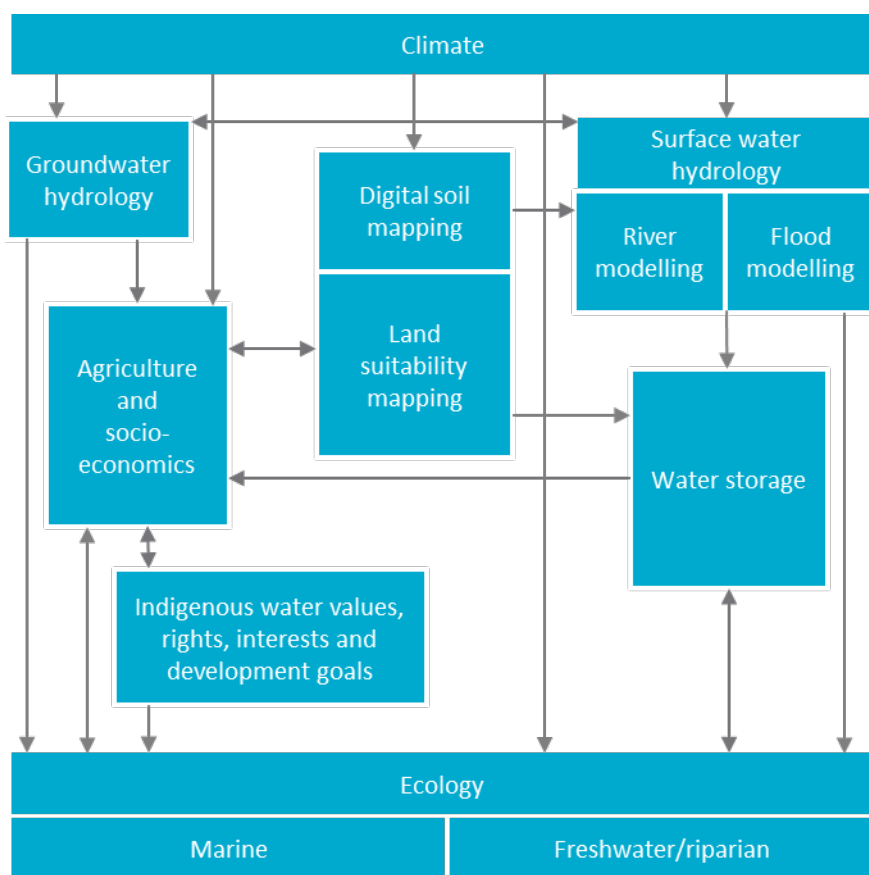
The Assessment was designed to inform consideration of development, not to enable any particular development to occur. As such, the Assessment informs – but does not seek to replace – existing planning, regulatory or approval processes. Importantly, the Assessment does not assume a given policy or regulatory environment. Policy and regulations can change, so this flexibility enables the results to be applied to the widest range of uses for the longest possible time frame.

It was not the intention of – and nor was it possible for – the Assessment to generate new information on all topics related to water and irrigation development in northern Australia. Topics

not directly examined in the Assessment are discussed with reference to and in the context of the existing literature.

CSIRO has strong organisational commitments to Indigenous reconciliation and to conducting ethical research with the free, prior and informed consent of human participants. The Assessment allocated significant time to consulting with Indigenous representative organisations and Traditional Owner groups from the catchments to aid their understanding and potential engagement with its requirements. The Assessment did not conduct significant fieldwork without the consent of Traditional Owners. CSIRO met the requirement to create new scientific knowledge about the catchments (e.g. on land suitability) by synthesising new material from existing information, complemented by remotely sensed data and numerical modelling.

Functionally, the Assessment adopted an activities-based approach (reflected in the content and structure of the outputs and products), comprising activity groups, each contributing its part to create a cohesive picture of regional development opportunities, costs and benefits, but also risks. Preface Figure 1-2 illustrates the high-level links between the activities and the general flow of information in the Assessment.



Preface Figure 1-2 Schematic of the high-level linkages between the eight activity groups and the general flow of information in the Assessment

Assessment reporting structure

Development opportunities and their impacts are frequently highly interdependent and, consequently, so is the research undertaken through this Assessment. While each report may be read as a stand-alone document, the suite of reports for each Assessment most reliably informs discussion and decisions concerning regional development when read as a whole.

The Assessment has produced a series of cascading reports and information products:

- Technical reports present scientific work with sufficient detail for technical and scientific experts to reproduce the work. Each of the activities (Preface Figure 1-2) has one or more corresponding technical reports.
- A catchment report, which synthesises key material from the technical reports, providing well-informed (but not necessarily scientifically trained) users with the information required to inform decisions about the opportunities, costs and benefits, but also risks, associated with irrigated agriculture and other development options.
- A summary report provides a shorter summary and narrative for a general public audience in plain English.
- A summary fact sheet provides key findings for a general public audience in the shortest possible format.

The Assessment has also developed online information products to enable users to better access information that is not readily available in print format. All of these reports, information tools and data products are available online at <https://www.csiro.au/southernngulf>. The webpages give users access to a communications suite including fact sheets, multimedia content, FAQs, reports and links to related sites, particularly about other research in northern Australia.

Executive summary

All surface water and groundwater resources within the Queensland part of the Southern Gulf area are subject to the provisions of Queensland's legislative water planning framework. This framework is administered by the Department of Regional Development, Manufacturing and Water (DRDMW). Queensland's Water Act requires that all decisions about water allocation and management be consistent with this framework. This includes, for example, decisions relating to licensing, water trading and releases of unallocated water.

The Gulf water plan applies to surface water in the plan area including all water in watercourses and lakes, as well as overland flows and springs that are not connected to the Great Artesian Basin (GAB). The Gulf water plan also applies to all artesian and non-artesian groundwater except GAB water. The Queensland part of the Southern Gulf study area encompasses the Settlement Creek, Nicholson River, Leichhardt River and Morning Inlet catchment areas which are all contained within the Gulf water plan area.

The Gulf water plan identifies three groundwater management areas, two of which intersect with the Queensland part of the Southern Gulf study area viz. the Nicholson groundwater management area (which underlies part of the Nicholson River catchment area) and the Great Artesian groundwater management area (which extends over the majority of the Gulf water plan area). The Great Artesian groundwater management area relates to any aquifers overlying the GAB rather than to groundwater in the underlying GAB aquifers.

The Gulf water plan also establishes groundwater in an aquifer within 1km of a prescribed watercourse to be water in a watercourse except where DRDMW is satisfied that the aquifer is not hydraulically connected to the watercourse. Prescribed watercourses are described in the Gulf water plan. Prescribed areas within the Queensland part of the Southern Gulf study area include sections of the Nicholson and Gregory Rivers as well as the Leichhardt River. This means that any groundwater within 1km of a watercourse in these catchments can only be taken under the authority of a surface water licence.

Groundwater from the Great Artesian Basin is allocated and managed under the Great Artesian Basin and Other Regional Aquifers (GABORA) water plan and water management protocol. Although the GABORA water plan deals with GAB aquifers underlying an extensive area of Queensland, the GAB aquifers underlying the Queensland part of the Southern Gulf study area include the Carpentaria South Gilbert River aquifer (which is part of the Hooray sandstone groundwater unit), the Normanton groundwater unit and the Carpentaria South Wallumbilla part of the Rolling Downs groundwater unit. Most GAB water is used for stock and domestic purposes.

There are two supplemented water supply schemes within the Queensland part of the Southern Gulf area – viz. Moondarra Dam and Julius Dam water supply schemes – that are both located on the Leichhardt River. These supply a total of 75,150 ML of supplemented water allocations to urban, industrial and mining customers in the region around Mount Isa and Cloncurry.

There are approximately 2,252 ML of unsupplemented groundwater licences and 29,843 ML of unsupplemented surface water licences within the Queensland part of the Southern Gulf area.

Although unmetered, the current utilisation of these water entitlements appears to be very low (less than 1%). The reason for this low level of utilisation is unclear. However, anecdotal reports based on recent discussions with landholders in the adjacent Flinders River catchment suggest that the primary reason for holding a water licence is to improve the value of the land to which they attach, with any plans for the future development of irrigation on properties only described either as a medium to long-term prospect or only in vague terms.

The Gulf water plan identifies volumes of unallocated water for three types of reserve. These are:

- Indigenous reserve which may be granted for “helping Indigenous communities... to achieve their economic and social aspirations”
- Strategic reserve which may be granted for a “state purpose” which is defined by the Gulf water plan as meaning a coordinated project, a project of regional significance, town water supply or ecotourism (in specific areas)
- General reserve which may be granted for any purpose.

There is approximately 2,550 ML of unallocated water remaining in the Indigenous reserve, 22,266 ML of unallocated water remaining in the strategic reserve and 17,400 ML of unallocated water remaining in the general reserve within the Queensland part of the Southern Gulf area.

The requirements that apply to releases of unallocated water are specified within the Gulf water plan. These include meeting environmental flow objectives and water allocation security objectives, as well as a range of other matters. The administrative processes for releasing unallocated water are set out in the Queensland Water Regulation 2016. DRDMW may release unallocated water by public auction, tender, fixed price sale or a grant for a particular purpose.

DRDMW typically apply a suite of criteria to prioritise and select preferred tenders (which sometimes includes consideration of the bidder’s tender price like an auction). It is notable that a key condition in a recent release in 2020 was that all new licences would be conditioned so that infrastructure capable of taking at least 50% of the nominal entitlement in a water year must be installed within 3 years from the licence issue date (i.e. despite an expiry date of 30 June 2111 a licence could be cancelled after the third anniversary of the licence issue date if DRDMW is satisfied intent to use the water has not been demonstrated). This is in response to earlier unallocated water releases that appeared to result in landowners securing new water licences without any strong obligations to, or penalties for not, beneficially use the entitlements.

The costs to secure a water licence from an unallocated water reserve may be set by DRDMW as part of a published Terms of Release and/or set by the prevailing water market at the time. For example, in 2020 DRDMW published a Terms of Release that specified property-based volumetric limits and other conditions relating to their release of new water entitlements within the Leichhardt, Nicolson and other catchments within the Gulf water plan area. The Terms of Release also specified fixed price terms that could either be paid as a \$125.00 per megalitre upfront charge or an annual charge of \$13.00 per megalitre per year for 10 years.

In 2016 DRDMW published a Tender Assessment Report relating to the release of unallocated water from the Great Artesian Basin in 2015 under the GABORA water plan. This reported a minimum purchase price of \$1,420 per ML of nominal entitlement.

These water licence purchase prices are for unsupplemented water entitlements. The upfront purchase price to buy in to a new supplemented water supply scheme would be likely to be significantly more than this and be comprised of a number of elements including:

- cost of acquiring water entitlements (i.e. either associated with purchasing new entitlements from an unallocated water release and/or the purchase and relocation of an existing water entitlement)
- a contribution to the upfront capital costs of the new water infrastructure within the scheme less
- any government grants towards the upfront capital costs.

A range of water fees and charges apply to unsupplemented water licences including an annual water licence fee of \$86.80 to cover some of government's administrative costs associated with its water planning and water resource management activities.

Supplemented water entitlements come with ongoing charges relating to the operations and maintenance costs of the water supply scheme, asset renewal/depreciation costs etc. Such ongoing charges are usually structured in terms of a mix of variable and fixed annual charges, with the exact mix and scale of charges determined on a scheme by scheme basis.

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1 Queensland's water planning framework applicable to the Southern Gulf Catchments

1.1 Summary

This chapter sets out the general water planning framework, and specific water allocation and management provisions, applicable to the allocation and management of surface water resources and Great Artesian Basin (GAB) groundwater resources within the Queensland part of the Southern Gulf area.

The commentary and observations in this chapter are based on a desktop study that references the suite of existing statutory instruments and other published documents and data available in the public domain.

The chapter also draws from, and updates, previous descriptions of Queensland's water planning framework prepared by Badu Advisory (Badu Advisory, 2020) and (Badu Advisory, unpublished draft).

The key questions that this chapter seeks to address for the Queensland part of the Southern Gulf area include:

- What are the general and specific water planning instruments applicable to the area?
- What types of entitlements are in the area and to what extent are they utilised?
- What are the unallocated water provisions applicable to the study area?
- What water charges apply both with respect to the purchase of new water entitlements as well as the ongoing water charges in the study area?

1.2 Overview of Queensland's water planning framework

This section presents a summary of the various components of Queensland's general water planning framework.

1.2.1 Queensland's Water Act 2000

Queensland's Water Act 2000 ('Water Act') establishes the ('framework') for planning the sustainable allocation and management of Queensland's water resources (State of Queensland, 2021b). The framework consists of:

- water plans (formerly referred to as water resource plans)
- water entitlements
- resource operations licences and distribution operations licences
- operations manuals and water management protocols (which are progressively replacing resource operations plans).

The Water Act requires that all decisions about water allocation and management are consistent with this framework. It is administered by the Department of Regional Development, Manufacturing and Water (DRDMW).

Figure 1-1 illustrates the relationships between key components of the framework that are described in the sections below.

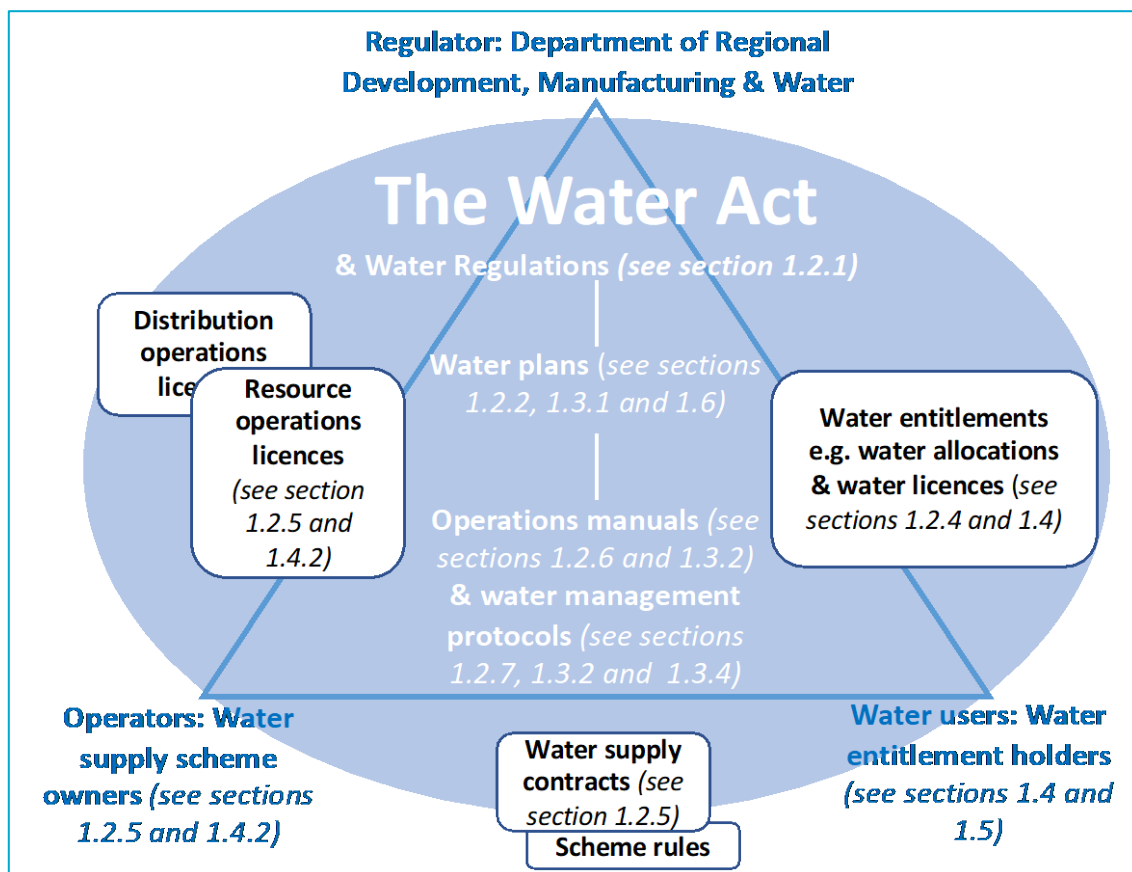


Figure 1-1 Queensland's bulk water allocation framework

Source: Adapted from (Badu Advisory, unpublished draft)

1.2.2 Water plans

Water plans define the long-term availability of surface water or groundwater for different purposes including environmental and consumptive water uses. Water plans include:

- outcomes or aspirational targets that represent what government and the community want to achieve over time
- strategies and requirements to guide the management of environmental flows
- environmental flow objectives, water allocation security objectives and associated performance indicators to be considered when making water allocation and management decisions
- strategies that specify the groups, types and volumes of water allocations (authorities to take water) that may exist within the plan area
- strategic, general and Indigenous water reserves that establish volumes, locations and allowable uses of unallocated water available in the plan area and which may be issued as new water allocations.

1.2.3 Unsupplemented versus supplemented water

Unsupplemented water

Unsupplemented water refers to water taken from natural flows or groundwater which are not supplemented by water supplied from instream water storage infrastructure. Unsupplemented water entitlements are not supplied under a resource operations licence and include water licences and unsupplemented water allocations.

Examples of water unsupplemented water includes overland flows, water harvesting (i.e. which relates to the taking of water from a watercourse during periods of high natural flow) and other opportunistic sources (e.g. relating to the taking of naturally occurring water within instream waterholes). With the exception of a few supplemented groundwater schemes, most groundwater in Queensland is also considered to be unsupplemented water.

Supplemented water

Supplemented water refers to water taken from natural flows or groundwater which are supplemented from time to time by water supplied from instream water storage infrastructure (i.e. dams, weirs and/or barrages). A water supply scheme describes the collection of instream water storage and other infrastructure that is used to supply water to supplemented water entitlements.

1.2.4 Water entitlements

Queensland's framework establishes the foundation for a range of types of water entitlements. These include:

- water licences
- water permits
- water allocations
- other activities authorised under the Water Act.

These are described in detail on the Queensland Government's website (Queensland Government, 2021a) and summarised below.

Water licences

A water licence is an authority granted under the Water Act to take water, interfere with water or both where these two activities are inextricably linked. A licence holder may only take or interfere with water on the land to which the licence is attached. A water licence may only not be attached to land in cases where it is granted to a prescribed entity (such as a local government or a water authority). Water licences are subject to the provisions of a water plan and water management protocol. Water licences may be converted to water allocations where a water plan contains provisions for enabling this to occur.

A water licence may authorise the taking or interfering with:

- surface water in a watercourse, lake or spring

- underground water in groundwater management areas or sub-artesian management areas established either through a Water Regulation under the Act or a water plan, or
- overland flow water as/if identified in a water plan for a particular catchment within Queensland.

A water licence may be amended, renewed, reinstated, relocated, transferred, amalgamated, subdivided, surrendered, cancelled or repealed. Although water licences are usually attached to land, in some parts of Queensland they can be relocated permanently or seasonally.

A water licence must state an expiry date, the water to which the licence relates, the location from or at which the water may be taken or interfered with, and any specific conditions that must be met by the holder. Prior to expiry, each licence holder is reminded to submit an application form to renew their licence. Licences are typically renewed without changes to conditions other than to update references to prevailing water planning instruments or water regulations. Recent licence renewals have also extended the licence term to 90 years. Although the Queensland Government could signal its intention to become more stringent in the future with respect to tightening licence conditions in the future, to date this has not happened.

Water licences are typically issued for long-term activities for taking water. Purposes may include (for example) stock or domestic use, irrigation, industrial or commercial use, storing water behind a weir, impounding water behind a storage structure, storing water in excavations that are within or connected to a watercourse.

Irrigation licences may either specify the area of land that can be irrigated, a volume of water that may be taken and/or specific flow conditions that must be met in the watercourse before water can be taken. Non-irrigation licences are typically specified in terms of a volume of water that may be taken subject to specific flow conditions.

Water permits

Water permits are issued for temporary activities with a foreseeable end date. Permits cannot be relocated, traded, amended, renewed or suspended. Permits specify the location of take, an expiration date and the conditions attached to the permit.

Water allocations

Water allocations may be established by a water plan usually through the conversion of existing water licences or the creation of new water allocations associated with the release of unallocated water. Unsupplemented water allocations are similar to water licences in that they authorise the taking of water that is not supplied from water supply schemes (e.g. water harvesting). Supplemented water allocations are supplied from water supply schemes.

All water allocations are similar to water licences in that they authorise the holder to take a certain volume of water from a particular source, such as a watercourse or groundwater aquifer. However, unlike water licences or permits, water allocations are assets separate from land, tradeable and perpetual in tenure. Water allocations are personal property rights, are a mortgageable asset and may be treated differently from – and transferred separately to – land assets after the death of the allocation holder.

A water allocation's title is a separate title to land. This means that a water allocation can be bought and sold separately to land via a water trading market. Water allocation trades can be either permanent or temporary (referred to as a seasonal assignment) but are only available in water plan areas where trading is permitted – and trading rules or limitations are specified – within the relevant water planning instrument. Trading is voluntary and prices are set by the market. Water trading enables entities to buy water or allocations to expand their operations or to sell water or allocations they don't need.

Other activities authorised under the Act

Some activities are authorised under the Act and do not require a water entitlement. These include taking water that is used for:

- emergencies, firefighting or routine testing of firefighting equipment
- camping
- watering travelling stock
- traditional activities or cultural purposes by Aboriginal and Torres Strait Islander people.

There are special requirements that may attach to authorisations for mining, petroleum and gas projects. These requirements regulate the water use of resources projects to ensure any impacts are properly assessed and managed. The requirements differ according to the type of water (e.g. surface water, underground water) and whether the water is being taken in the process of extracting the resource or for other uses (Queensland Government, 2021d).

Associated water is groundwater that is taken or interfered with in the process of carrying out activities under a resource authority. Examples of associated water include water removed from coal seams to release coal seam gas or dewatering mine pits to allow continued mining activity. Petroleum and gas authority holders have statutory rights to associated water (underground water rights) provided under the Petroleum and Gas (Production and Safety) Act 2004 (State of Queensland, 2020a) or the Petroleum Act 1923 (State of Queensland, 2021a). Groundwater impacts for such resource authorities, mining leases or mineral development licences are assessed upfront and generally conditioned under their environmental authority.

Other underground water used in resource projects (non-associated water) is managed in the same way as surface water and overland flow water as outlined above. This includes, for example, water taken from a bore or a watercourse specifically for mining camps or dust suppression.

1.2.5 Water supply schemes

Supplemented water allocations

Supplemented water allocations are specified in terms of:

- a nominal volume
- the location from which water may be taken (generally described in terms of zones)
- the purpose for which water may be taken
- the water plan and operations manual under which it is managed
- the priority group to which it belongs (e.g. high priority or medium priority)
- other conditions or matters.

Resource operations licences

Supplemented water allocations within a water supply scheme are supplied under the authority of a resource operations licence. A resource operations licence allows the owner of a water supply scheme to take, or interfere with the flow of, water in order to distribute it (typically via instream releases and/or systems of offstream channels or pipelines) to supplemented water allocation holders. A holder of a resource operations licence is also authorised to interfere with the flow of water in order to construct and operate water infrastructure.

The owner of an instream dam or weir that supplies water to multiple supplemented water allocation holders must hold a resource operations licence. If the owner of a distribution network (e.g. pipeline or channel) that is used to supply water to supplemented water allocation holders is a different entity to (and not a subsidiary of) the owner of the instream water storage (e.g. dam, weir or barrage), then the distribution network owner would need to separately hold a distribution operations licence.

Operations licences typically include conditions related to operating arrangements and water supply requirements. The holder of an operations licence is also required to comply with the provisions of the relevant water plan and operations manual.

High and medium priority water and sharing rules

There are two main types of supplemented water allocations viz. high priority and medium priority groups. These names reflect the relative priority by which groups of supplemented water allocations are assigned a share of the water stored within a water supply scheme (Sunwater, 2019a).

Water sharing rules are specified within a water supply scheme's operation manual that define how stored water supplies are shared between high and medium priority supplemented water allocations. The sharing rules are usually described in terms of a set of equations that are used to determine the percentage of each water allocation's nominal volume that announced as being available to be taken within the current water year (referred to as announced allocation). A water year is a twelve month period that typically extends from 1st July through to the 30th of June in the subsequent year.

The announced allocation for high priority water allocations are determined first and are usually calculated by starting with the useable volume that is currently stored in a scheme's storages, then deducting a volume for projected losses (storage evaporation and seepage plus distribution losses) for the remaining months in the water year, then sharing the remaining volume between the high priority water allocations in proportion to their nominal volumes. The high priority announced allocation is expressed as the percentage of volume of water available to high priority allocations divided by the total nominal volumes of the high priority water allocations. The high priority announced allocations are capped at a maximum of 100%.

The announced allocation for medium priority water allocations are calculated in a similar way except that the volume that has already been announced for high priority water allocations is deducted from the useable volume. Sometimes an additional volume is deducted from the useable volume to account for a reserve of water that must be set aside for high priority water allocations for a future water year. The medium priority announced allocation is expressed as the percentage of volume of water available to medium priority allocations divided by the total

nominal volumes of the medium priority water allocations. The medium priority announced allocations are again capped at a maximum of 100% and cannot be less than 0%.

There are many variations between water supply schemes in way that high and medium priority announced allocations are calculated. The high and medium priority announced allocations are maintained or increase (i.e. do not reduce) as the water year proceeds mainly because the volume set aside for projected losses within the remaining months of the water year decreases. However, some schemes have cut-off rules that suspend medium priority releases from storages irrespective of whether a medium priority announced allocation has been determined and announced or not.

In many schemes, carryover arrangements exist which allow water allocations holders to “carry over” a proportion of their unused announced allocation from one water year to the next subject to conditions specified in the operations manual (e.g. carryover is usually only available for a specified number of months and resets to zero if the dam spills). Carryover is seen as a means to encourage water users to be more efficient with their water rather than use it or lose it prior to the end of a water year. Where carryover provisions exist, the carryover volume is calculated at the end of the water year and then deducted from the useable volume before any high and/or medium priority announced allocations are calculated. In other words, carry-over provisions can adversely impact on the high and/or medium priority announced allocation percentages at the start of a water year.

High priority announced allocations generally do not fall below 100% until the point at which medium priority announced allocations are 0%. High priority water allocations are therefore the most reliable water allocation and are typically held by entities for town water supply, industrial use — including mining and power generation — and for high-value cropping. High priority water allocation holders can usually access water more frequently and with fewer restrictions than holders with medium priority water. During extended dry periods, high priority water allocations are the last group to be placed on restrictions. High priority water allocation holders pay higher fees and charges than those with medium priority water allocations because they have more reliable access (Sunwater, 2019a). This is discussed further in Section 1.7.3.

Medium priority water allocations generally have lower priority of access to water stored within a water supply scheme than high priority water allocations and are mainly used for agriculture. This means that when storage levels are low during drier conditions, these water allocations are the first to be restricted. Medium priority water allocation holders pay lower fees than those with high priority water allocation holders. The fees and charges for medium priority water allocation are regulated and set by the Queensland Competition Authority (Sunwater, 2019a).

In most schemes, the lower cost and greater nominal volumes associated with medium priority water allocations means they are better suited for agriculture. However, some agricultural enterprises may choose to buy additional (limited) volumes of high priority water to mitigate risk e.g. to sustain permanent crops, such as trees, in times of water scarcity. In addition, some high value agricultural water users may choose to purchase surplus allocations of medium security water as a way of preserving their high priority water and thereby increase the overall reliability of their water portfolio.

Depending on the water supply scheme, water allocation trading rules may permit conversion of medium priority to high priority and vice versa, using conversion factors subject to limits that vary between water supply schemes (Sunwater, 2019a).

Water supply contracts

The Act requires the existence of a water supply contract between the operations licence holder and each holder of a supplemented water allocation. A supply contract sets out the arrangements by which water is to be stored for, and supplied to, an allocation holder as well as the financial obligations imposed on the allocation holder from being part of the water supply scheme. A water supply contract may also reference detailed scheme rules such as service level targets, local supply constraints and water ordering arrangements.

1.2.6 Operations manuals

An operations manual is prepared under the Act where required as a condition of a resource operations licence or distribution operations licence.

An operations manual is developed by the holder of a water supply scheme's resource operations licence in consultation with stakeholders but must be approved by the chief executive of DRDMW. It includes the day to day operation rules for supplemented water schemes such as:

- water releases from dams to ensure that infrastructure is operated efficiently to provide sufficient flows for downstream industry, agriculture and town water supply uses, and to meet non-consumptive requirements relating to hydro-power generation, environmental flows, recreation and aesthetic needs, as well as flood event operations
- water sharing rules for supplemented water in order to provide equitable sharing of water between water users supplied by the scheme (as discussed above)
- seasonal (temporary) water assignment rules for supplemented water allocations.

1.2.7 Water management protocols

Water management protocols generally include specific rules and requirements in order to achieve the outcomes stated in a water plan.

A protocol is developed by DRDMW and approved by its chief executive.

Key matters included within a water management protocol include:

- the processes for releasing, and the specific volumes, purposes and locations of, unallocated water within a water plan area
- water sharing rules for unsupplemented water in order to provide equitable sharing of such water between water users
- permanent water trading rules, seasonal (temporary) water assignment rules and permissible change rules for unsupplemented water allocations
- permanent water trading rules and permissible change rules for supplemented water allocations
- other water dealing rules.

1.3 Specific water planning instruments applicable to the area

This section presents an overview of the specific statutory water planning instruments that are applicable to the allocation and management of water resources and GAB water within the Queensland part of the Southern Gulf area.

1.3.1 The Gulf Water Plan

Water in the Gulf Streams is allocated and managed under the Water Plan (Gulf) 2007 (the ‘Gulf water plan’) (State of Queensland, 2017b).

The Gulf water plan applies to surface water in the plan area including all water in watercourses and lakes, as well as overland flows and springs that are not connected to the GAB. The Gulf water plan also applies to artesian and non-artesian groundwater except GAB water (which is dealt with separately as discussed in Section 1.3.3).

Figure 1-2 shows the plan area for the Gulf water plan.



Figure 1-2 Gulf water plan area

Source: Adapted from (Queensland Government, 2021b)

The Queensland part of the Southern Gulf study area encompasses the Settlement Creek, Nicholson River, Leichhardt River and Morning Inlet catchment areas which are all contained within the Gulf water plan area. The Gulf water plan further subdivides the Nicholson River catchment area into the Gregory River and remaining Nicholson River subcatchment areas. Similarly, the Leichhardt River catchment area is divided into the Upper Leichhardt and Lower Leichhardt subcatchment areas.

The Gulf water plan also identifies three groundwater management areas as illustrated in Figure 1-3. Two of the groundwater management areas intersect with the Queensland part of the Southern Gulf study area viz. the Nicholson groundwater management area (which underlies part of the Nicholson River catchment area) and the Great Artesian groundwater management area (which extends over the majority of the Gulf water plan area). The Great Artesian groundwater management area relates to any aquifers overlying the GAB rather than to groundwater in the underlying GAB aquifers which fall under jurisdiction of a separate water plan for GAB water (as detailed in Section 1.3.3 below).

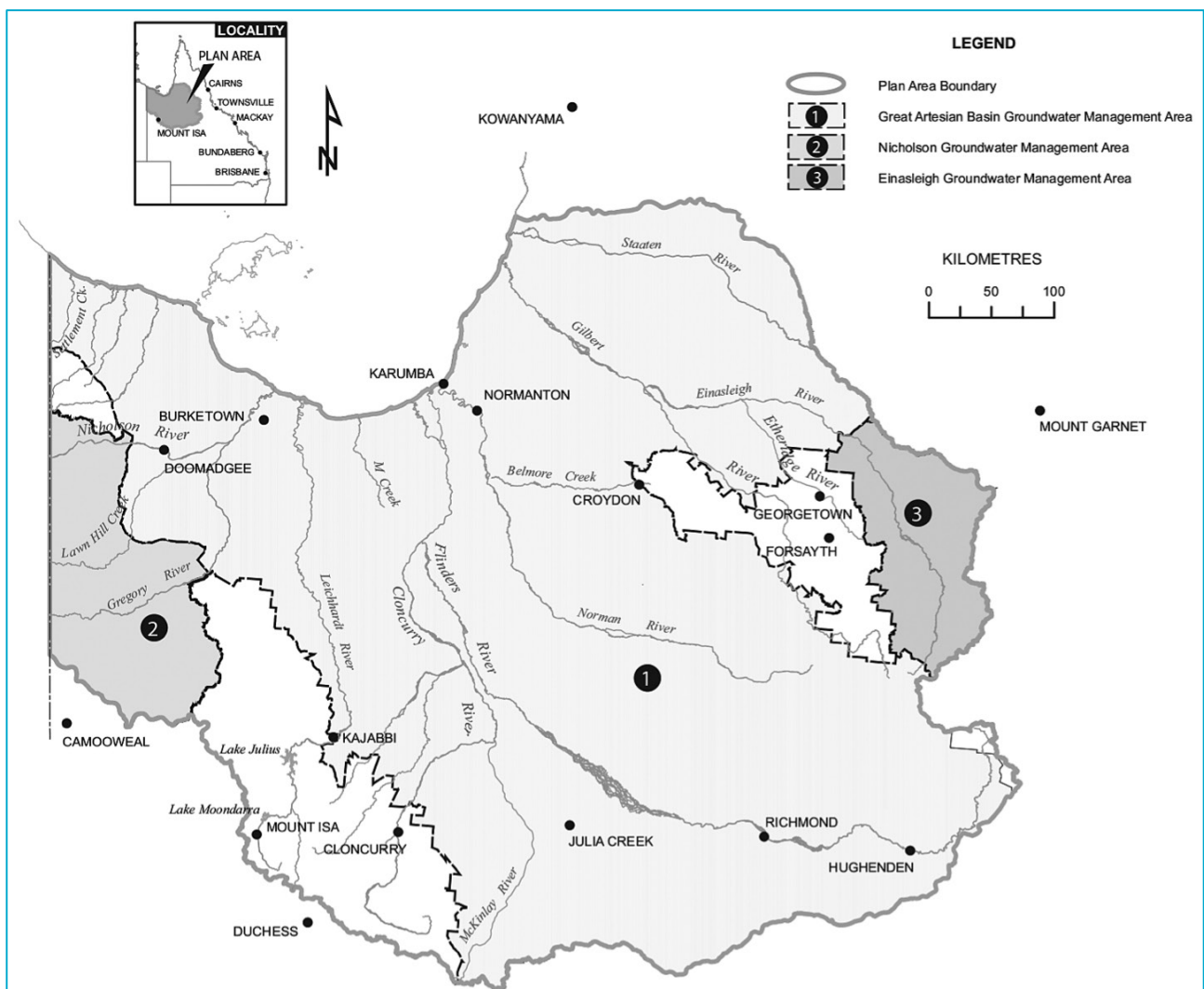


Figure 1-3 Groundwater management areas

Source: Adapted from (Queensland Government, 2021b)

The Gulf water plan also establishes groundwater in an aquifer within 1km of a prescribed watercourse to be water in a watercourse except where DRDMW is satisfied that the aquifer is not hydraulically connected to the watercourse. Prescribed watercourses are described in the Gulf water plan. Prescribed areas within the Queensland part of the Southern Gulf study area include sections of the Nicolson and Gregory Rivers as well as the Leichhardt River. This means that any groundwater within 1km of a watercourse in these catchments can only be taken under the authority of a surface water licence.

1.3.2 Gulf resource operations plan

Neither a water management protocol nor any operations manuals currently apply to the Gulf water plan area. DRDMW have indicated that a Gulf water management protocol, two resources operations licences and one distribution operations licence and associated manuals are currently in preparation as part of their implementation of the updated water planning framework described in sections 1.2.6 and 1.2.7 (Queensland Government, 2021b). In the meantime, the Gulf resource operations plan presently fulfills the functions of these instruments (Department of Natural Resources Mines, 2015).

1.3.3 GABORA water plan

GAB water is allocated and managed under the Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017 (the 'GABORA water plan') (Queensland Government, 2017).

Figure 1-4 shows the plan area for the GABORA water plan.

Although the GABORA water plan deals with GAB aquifers underlying an extensive area of Queensland, the GAB aquifers underlying the Queensland part of the Southern Gulf study area include:

- the Carpentaria South Gilbert River aquifer which is part of the Hooray sandstone groundwater unit
- the Normanton groundwater unit
- the Carpentaria South Wallumbilla part of the Rolling Downs groundwater unit.

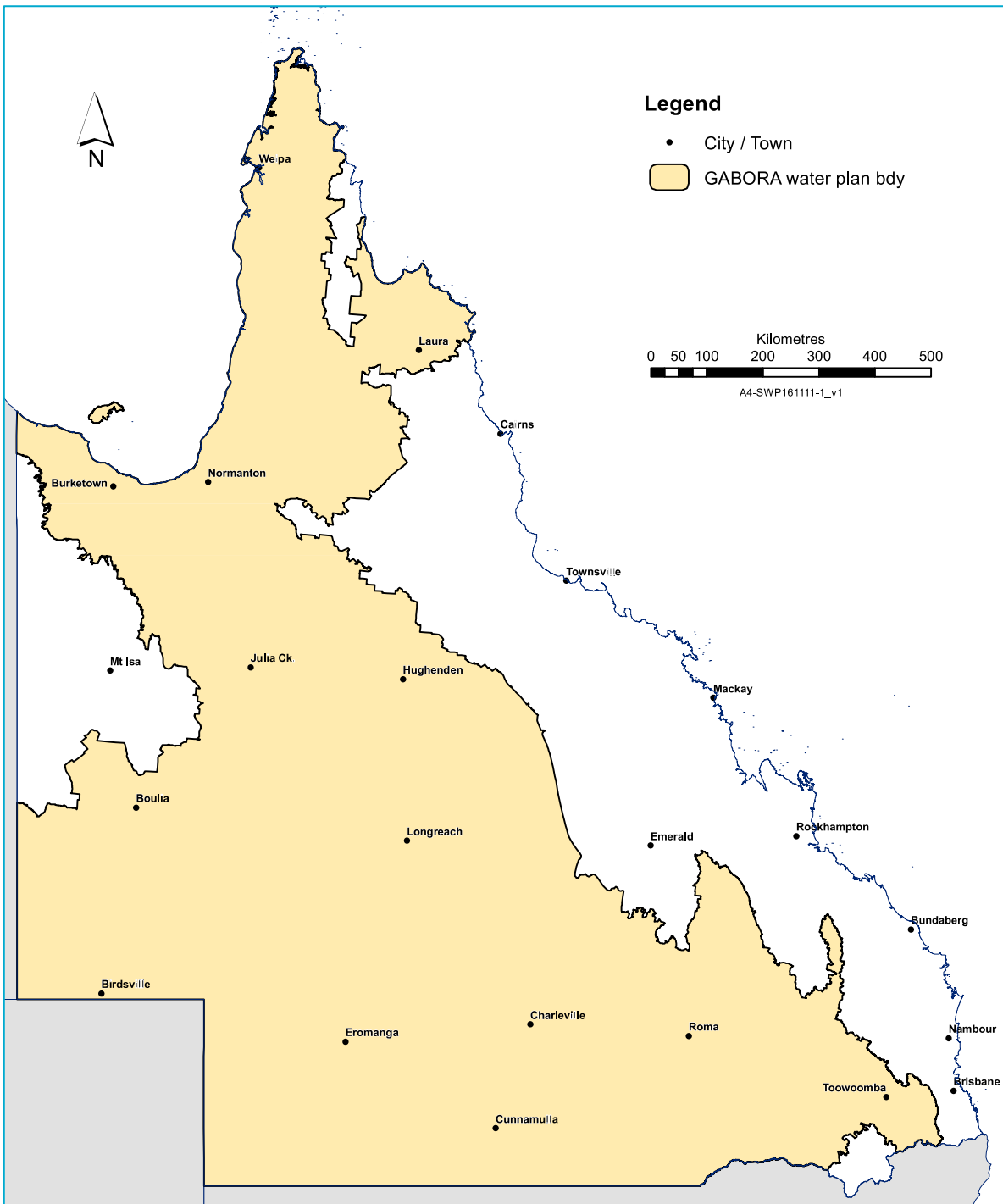


Figure 1-4 GABORA water plan area

Source: From Schedule 1 of the GABORA water plan (Queensland Government, 2017)

1.3.4 GABORA water management protocol

The Great Artesian Basin and Other Regional Aquifers water management protocol (the ‘GABORA water management protocol’) (State of Queensland, 2019) sets out provisions associated with, and relating to the management and allocation of GAB water in accordance with, the GABORA water plan.

The GABORA water management protocol defines:

- zones (which are the same as the groundwater units mentioned in Section 1.3.3) plus limitations to the volumes of unallocated GAB water that may be granted (or other water licence dealings that can occur) in those zones
- ways for protecting flows to groundwater dependent ecosystems and/or protecting existing water entitlements including for example through imposing limitations to maximum drawdown distances, or imposing minimum separation distances between GAB bores
- rules for relocating GAB water licences
- water sharing rules for GAB water
- seasonal water assignment rules for GAB water
- monitoring and reporting requirements.

Interference with GDEs and existing water bores

The GAB is a multilayered aquifer system. Except in areas where an aquifer outcrops near the margins of the basin, an aquifer will be overlain by a low permeability confining layer and potentially additional overlying aquifers and confining layers. Where an aquifer is confined, water is stored through elastic compression of the aquifer and stored water. The recoverable amount of water stored under these conditions may be much smaller than for an unconfined aquifer.

The significance of this is that the water pressure impact of water extraction from a bore tapping a confined aquifer spreads a long distance away from the bore, potentially affecting the flow of water to groundwater dependent ecosystems (GDEs), which are ecological assemblages associated with GAB springs and aquifer fed sections of watercourses, as well as the operation of other water bores.

The GABORA water plan establishes arrangements to protect GDEs and the supply from existing water bores. These factors can be limiting on the potential to increase the water extraction at a location through grant of unallocated water or through water trading (Badu Advisory, unpublished draft).

Interference with GDEs

Under the GABORA water plan, DRDMW is required to maintain a register of GDEs and the cumulative impact of water extraction at each GDE. The GABORA water plan sets the maximum cumulative impact at a registered GDE, over the long term, at 0.4m. The GABORA water protocol sets out the way this can be calculated using lookup tables, although there is provision for a proponent to propose a calculation using site-specific hydraulic parameters (Badu Advisory, unpublished draft).

Interference with existing water bores

The GABORA water plan sets a maximum drawdown impact at the location of existing bores. It requires that the licensed take from any new water bore is not to cause a water pressure reduction at an existing bore of more than 5m. The GABORA water protocol sets out arrangements to give effect to this requirement in the form of minimum separation distance between bores for different extraction rates. It provides a lookup table for each aquifer giving the relationship between bore separation distance and licensed annual extraction rates, although there is also provision for site-specific calculations (Badu Advisory, unpublished draft).

1.4 Water entitlements present in the area

This section sets out the various types of – and associated water management rules and specifications applicable to – existing and potential water entitlements within the Queensland part of the Southern Gulf area.

1.4.1 Unsupplemented surface water licences

Flow conditions

Section 70 of the Gulf water plan specifies that a water licence to take unsupplemented surface water must state:

- the purpose for which water may be taken under the licence
- the maximum rate at which water may be taken under the licence
- the daily volumetric limit (DVL) for the licence
- the annual volumetric limit (AVL) for the licence.

The water licence may also state a flow condition or a condition about storing water taken under the licence. Such conditions vary from licence to licence. Flow conditions are typically specified in terms of an instream flow threshold at a specified location that must be exceeded before the taking of water is allowed.

Licence holders have reported that sometimes flow conditions on a licence are specified in terms of locations that are a significant distance downstream of the location of the land to which the licence is attached, making it difficult to actually take the water when the flow condition to be met.

Relocation of unsupplemented surface water licences

The Gulf water plan allows the transfer of surface water licences within the plan area. The water plan states limitations in terms of the maximum volumes of water licences that may be transferred into specific zone. However, there are no zones specified for the Queensland part of the Southern Gulf area which means the area may be considered an unzoned area.

The rules for transfer to or within an unzoned area are specified in sections 115D, 115F and 115G of the Gulf resource operations plan. These effectively enable DRDMW to grant an application to transfer all or part of a licence to land within an unzoned area providing the resulting licence states an AVL, DVL and flow condition that has been determined by the DRDMW taking into account:

- the likelihood of accessing water under the resulting licence
- the potential effects of the transfer on downstream entitlements including seasonal assignments, the water needs of the environment, the water available for town water supply, and unallocated water reserves.

Seasonal assignment of water licences

Section 120 and 121 of the Gulf resource operations plan only provide for seasonal assignment of water licences in the Morning Inlet catchment area, Settlement Creek catchment area, Gregory

River subcatchment area. Seasonal assignments are only allowed within these areas for licences granted from the Indigenous reserve that state that seasonal assignments are allowed.

1.4.2 Supplemented water allocations

Water supply schemes

There are two supplemented water supply schemes within the Queensland part of the Southern Gulf area:

- Moondarra Dam water supply scheme (for which a Resource Operations Licence is held by Mount Isa Mines) – the dam is located upstream of Julius Dam on the Leichhardt River (shown on Figure 1-5) and supplies water for Mount Isa Mines operations and to the Mount Isa community (Glencore, 2021)
- Julius Dam water supply Scheme (for which a Resource Operations Licence is held by Sunwater) – the dam is located at the junction of Paroo Creek and the Leichhardt River (shown on Figure 1-5) and provides back-up supplies to Lake Moondarra for urban water needs as well as water for the Cloncurry Council and mines in the North West Mineral Province (Sunwater, 2021b).

The Moondarra Dam water supply scheme supplies 26,300 ML of medium priority supplemented water allocations. There are no high priority water allocations in this scheme (Glencore, 2021).

The Julius Dam water supply scheme supplies 48,850 ML of high priority supplemented water allocations. There are no medium priority water allocations in this scheme (Sunwater, 2021b).

Rifle Creek Dam (which is on Rifle Creek upstream of Lake Moondarra) and East Leichhardt Dam (which is on the East Leichhardt River upstream of Julius Dam) are not owned by Sunwater and not technically part of the Julius Dam water supply scheme. However, these two smaller dams (shown on Figure 1-5) are authorised to have water taken from them under unsupplemented water licences and are effectively operated alongside Julius Dam and Lake Moondarra to supply water to the region.

As there are only a single priority group in each of these schemes, the water sharing rules do not need to distinguish, or prioritise, between high and medium priority water users.

Trading rules for supplemented water allocations

Section 92 of the Gulf resource operations plan prohibits the change of location of supplemented water allocations in both the Moondarra Dam and the Julius Dam water supply schemes. Section 95 of the resource operations plan provides for seasonal assignment of supplemented water allocations within the two schemes subject to the consent of the resource operations licence holders (Department of Natural Resources Mines, 2015).

1.4.3 Overland flows

Rules for overland flows

The Gulf water plan applies to overland flow water which may not be taken except:

- for stock or domestic purposes

- for any purpose using works that allow the taking of overland flow water and have a capacity of not more than 250ML
- under a water licence
- of not more than the amount necessary to satisfy the requirements of an environmental authority issued under the *Environmental Protection Act 1994* or a development permit for carrying out an environmentally relevant activity (other than a mining or petroleum activity) under the *Environmental Protection Act 1994*
- if the overland flow water is contaminated agricultural runoff water
- for overland flow works that were existence on 6 June 2003 (noting that this date is subject to a range of specific conditions or variations) where the landowner has completed a notification process but is awaiting the granting of a water licence.

Relocation of overland flow licences

Section 115B of the Gulf resource operations plan provides for overland flow licences to be transferable under rules that are similar to those for unsupplemented surface water licences discussed above.

1.4.4 Multisource licences

The Gulf resource operations plan also recognises the potential for multisource licences. These relate to water licences that authorise the taking of watercourse water and overland flow water under a single licence (Department of Natural Resources Mines, 2015). They are subject to the same conditions and rules as unsupplemented water licences.

1.4.5 GAB water licences

Relocation of GAB water licences

Most water licenses to extract water from the GAB are restricted to the purpose of 'stock watering' (which excludes feed lot operations). Stock watering licences do not have volumetric limits. The volume of water that can be taken is limited by the restriction on the purpose to the watering of stock, and bore owners are being progressively required to control artesian bores and distribute water to stock through piped systems.

GAB water licences for all purposes other than stock watering have an AVL. The water licences attach to land operates to the benefit of the land to which it attaches. However, the Act provides for a GAB water licence to be relocated to attach to other land if a water plan or water management protocol allow for relocation. Relocation then becomes a form of 'permanent trading' of water entitlements that can operate before the eventual conversion of water licences to tradeable water allocations separate from land.

The GABORA water plan and the GABORA water management protocol allow for relocation of a GAB water licence that has a volumetric limit in whole or in part. If an application were made to relocate a water licence the impact of the increased take of water at the receiving location on GDEs and existing water bores would be the primary consideration.

GAB water licences resulting from a release of water from the state reserve cannot be traded to other land for use for some purpose other than the purpose proposed in seeking the release. If a water licence granted from the state reserve was no longer required, it would revert to the state.

The water available under a GAB water licence in any water year can be seasonally assigned by the licensee to another entity if the licensee does not intend taking the water. This process is sometimes referred to as 'temporary trading'. Although as previously mentioned a water licence granted to a licensee from the state reserve cannot be traded permanently to another entity on other land, the water available can be seasonally assigned (Badu Advisory, unpublished draft).

Despite the opportunities described above, in 2015 the Minister's Performance Assessment Report for the water resources of the GAB observed that there had actually been very few permanent licence relocations or temporary seasonal water assignments of GAB water in the plan area since the commencement of the GAB ROP. A total of 20 relocations and five seasonal water assignments had occurred up to that time with total volumes of approximately 2,200ML and 1,500ML respectively (Department of Natural Resources and Mines, 2015).

Uncontrolled artesian GAB bores

The GAB has a legacy of uncontrolled artesian bores discharging into a system of open bore drains to distribute water for stock watering. Many of the bores have been repaired or replaced to enable flow to be controlled, and many of the bore drain systems have been replaced by piped systems, however many remain. The GABORA water plan sets in place measures to require that by 2027 bore owners bring the remaining bores under control and replace bore drains with watertight stock water distribution systems, although there is provision for time extensions.

When a bore owner completes the required work without any government funding, 30% – and potentially more than 30% – of the volume saved can be converted to a volumetric GAB water licence. The licence can then be relocated to other land (Badu Advisory, unpublished draft).

Carryover provisions for GAB water licences

Water licences to take GAB water for purposes (other than for stock watering) set an AVL. For each GAB water licence DRDMW maintains a water account for which any unused portion of the AVL is carried over as a credit to the subsequent year for use by the licence holder. The carryover itself can only accumulate up to a maximum equal to the volumetric limit, therefore maximum combined of volumetric limit plus carryover would be twice the volumetric limit (Badu Advisory, unpublished draft).

Deep gas and oil

Deep unconventional oil and gas resources in Queensland have been known about for some time but little explored due to the limitations of extraction technology. New technologies such as fracking and horizontal drilling have renewed exploration for these resources. Many of Queensland's geological basins hold potential shale or tight gas resources including the so-called Isa Superbasin which underlies the study area. Deep gas and oil developments generally target much deeper formations (below 2,500 metres) than for coal seam gas. Fracking is almost always used for extraction and production, requiring potentially large volumes of water (Department of Natural Resources and Mines, 2015).

Petroleum and gas companies do not require a water authorisation under the Water Act 2000 to take water for fracking as the industry has a right to water subject to underground water obligations established under Chapter 3 of that legislation. As a result, the GABORA water plan has no role in defining water access arrangements for the shale gas industry. However the plan may need to deal with the predicted new take of water by the industry in the future, in order to maintain long-term security of access for other water users and to maintain the flow of water to springs in the plan aquifers around the potential deep oil and gas areas (Department of Natural Resources and Mines, 2015).

1.5 Utilisation of entitlements

This section describes, and presents commentary relating to, the utilisation of existing water entitlements within the Queensland part of the Southern Gulf area.

1.5.1 Unsupplemented surface water

Table 1-1 presents the volumes of unsupplemented water licences within the Queensland part of the Southern Gulf area (State of Queensland, 2018).

Table 1-1 Volumes of unsupplemented water licences

CATCHMENT	UNSUPPLEMENTED GROUNDWATER LICENCES (ML)	UNSUPPLEMENTED SURFACE WATER LICENCES (ML)	TOTAL UNSUPPLEMENTED WATER LICENCES (ML)
Gregory-Nicholson	1,943.0	6,222.0	8,165
Settlement Creek	0	0	0
Leichhardt River	129.6	20,521.4	20,651
Norman River	180.0	3,100.0	3,280
Total	2,252.6	29,843.4	32,096.0

Source: (State of Queensland, 2018)

As discussed earlier, water licences tenures are typically being extended out to around 90 years as part of their renewal application and approval process.

The other specific flow conditions and other conditions that attach to each licence varies. Some information about the terms that attach to each water entitlement is available through DRDMW's website via their water entitlement viewer (Queensland Government, 2020b). A full search of water licences and their detailed terms and conditions can also be undertaken by submitting a 'Request for water entitlement data attached to land' form to DRDMW (Queensland Government, 2021c).

Unsupplemented water licences in these catchments are yet to be metered as they are not metered entitlement areas or users have not activated their take. However, it appears that utilisation of such entitlements is likely to be low as indicated by the level of use in the adjacent Gilbert River catchment which in 2018 reported a utilisation of only around 0.7% of the total 34,972 ML of water licences in that catchment at that time (State of Queensland, 2018).

The reason for this low level of utilisation is unclear. However, anecdotal reports based on recent discussions with landholders in the adjacent Flinders River catchment suggest that the primary reason for holding a water licence is to improve the value of the land to which they attach, with any plans for the future development of irrigation on properties typically described by landholders as only relatively medium to long-term prospects.

1.5.2 Supplemented surface water

Table 1-2 presents the volumes of supplemented water entitlements within the Queensland part of the Southern Gulf area. The overall low level of use indicates that the demand for water is not high and current water needs can be met within existing levels of entitlements for the two schemes (State of Queensland, 2018).

Table 1-2 Volumes of supplemented water entitlements and their utilisation

CATCHMENT	WATER YEAR	WATER ALLOCATIONS (ML)	WATER TAKEN (ML)	PERCENTAGE OF WATER ALLOCATION TAKEN
Julius Dam water supply scheme	2016-17	High Priority: 48,850	1,815	3.7%
	2015-16		5,072	10.4%
	2014-15		11,037	22.6%
	2013-14		11,666	23.9%
	2012-13		8,676	17.8%
	2011-12		8,037	16.5%
	2010-11		7,922	16.2%
Moondarra Dam water supply scheme	2016-17	Medium Priority: 26,300	13,957	53.1%
	2015-16		14,733	56.0%
	2014-15		16,966	64.5%
	2013-14		11,334	43.1%
	2012-13		19,487	74.1%
	2011-12		18,037	68.6%
	2010-11		17,540	66.7%

Source: (State of Queensland, 2018)

1.5.3 GAB water licences

In 2005, water use from all GAB water plan aquifers throughout Queensland was estimated at 451,000ML per year. Stock and domestic water for the pastoral industry was estimated to comprise 78% of that water use. Groundwater from the plan aquifers is often the only reliable supply available to regional towns and properties for their stock or domestic watering requirements and some towns are wholly reliant on that water while others use a combination of plan aquifer water and surface water (Department of Natural Resources and Mines, 2015).

1.6 Unallocated water

This section outlines the unallocated water provisions (including volumes of unallocated water reserves available for strategic, general, Indigenous and/or other uses) and associated constraints and process-related requirements relevant to securing unallocated water within the Queensland part of the Southern Gulf area.

1.6.1 Types and volumes of unallocated water reserves

The Gulf water plan identifies volumes of unallocated water reserves for the plan area (State of Queensland, 2017b).

Three types of unallocated water reserve are identified in the Gulf water plan:

- Indigenous reserve – may be granted for “helping Indigenous communities... to achieve their economic and social aspirations”.
- Strategic reserve – may be granted for a “state purpose” which is defined by the Gulf water plan as meaning a coordinated project, a project of regional significance, town water supply or ecotourism (in specific areas) and
- General reserve – may be granted for any purpose.

The Gulf water plan enables DRDMW to consider a particular project to be a project of regional significance subject to having regard to:

- the outcomes of the Gulf water plan
- the economic or social impact the project will have on the region
- the public interest and the welfare of people in the region
- any other relevant consideration.

Unallocated water granted from a strategic reserve for either a coordinated project or a project of regional significance may only be granted for the life of the project. On conclusion of the project the volume of water must return to the strategic reserve.

The volumes of unallocated water made available by the Gulf water plan and remaining volumes available after previous releases of unallocated are listed for each catchment area in Table 1-3 for the Queensland part of the Southern Gulf area (Truii, 2020). There is approximately 2,550 ML remaining in the Indigenous reserve, 22,266 ML remaining in the strategic reserve and 17,400 ML remaining in the general reserve in this area. The Gulf water plan specifies unallocated water volumes in terms of AVLS which is defined for a water licence to mean the maximum volume of water that may be taken under the licence in the water year for the licence. There is no specific reserve for unallocated groundwater licences (as these are included within subcatchment totals below).

Table 1-3 Volumes of unallocated water in the Queensland part of the Southern Gulf area, prior to water release in 2020

CATCHMENT/SUBCATCHMENT AREA	UNALLOCATED WATER RESERVE TYPE	UNALLOCATED VOLUME IDENTIFIED IN THE GULF WATER PLAN (ML)	VOLUME OF UNALLOCATED WATER REMAINING (ML)
Morning Inlet catchment area			
	Indigenous Reserve	50	50
	Strategic Reserve	1,000	1,000
Settlement Creek catchment area			
	Indigenous Reserve	1,500	1,500
	Strategic Reserve	1,000	1,000
Norman River catchment area			
	Strategic Reserve	1,000	0
	General Reserve	3,000	3,000
Gregory River subcatchment area			
	Indigenous Reserve	1,000	1,000
	General Reserve	2,500	0
Lower Leichhardt River subcatchment area			
	Strategic Reserve	15,000	15,000
	General Reserve	15,000	10,000
Nicholson River subcatchment area			
	Strategic Reserve	4,282	4,166
	General Reserve	4,400	4,400
Lake Mary Kathleen (east Leichhardt River)			
	Strategic Reserve	1,100	1,100

Source: (Truui, 2020)

1.6.2 Process for granting unallocated water

Section 29 of the Gulf water plan states that the process for granting unallocated water is a process stated in part 2, division 2, subdivision 2 of the Water Regulation 2016 (the 'Regulation') (State of Queensland, 2021c).

Section 16 of the Regulation prescribes processes for releasing unallocated water by:

- public auction
- tender
- fixed price sale
- a grant for a particular purpose.

Section 17 of the Regulation states that the chief executive must publish a notice about the availability of water released by auction or tender. However a public notice is optional for water released by fixed price sale and not mentioned as being required for water released as a grant.

1.6.3 Matters to be considered prior to granting unallocated water

Prescribed model for testing plan objectives

The Gulf water plan stipulates that its environmental flow objectives and water allocation security must be assessed using the department's computer program. The prescribed assessment computer program for the Flinders and Gilbert River catchments is the department's Source computer program and for the Leichhardt River catchment is the department's IQQM computer program. These programs are taken to include the associated statistical analysis and reporting programs that simulate daily stream flows, flow management, storages, releases, instream infrastructure, water diversions, water demands and other hydrological events in the plan area.

Objectives are not specified in the Gulf water plan for the other catchments in the plan area.

Although the department's models in the Gulf water plan area may have been extended to June 2011, the water plan defines the simulation period for testing the achievement of plan objectives as from 1 January 1890 to 20 November 2003.

Water allocation security objectives

The plan also requires assessment against water allocation security objectives (WASOs). WASOs are only currently specified for supplemented surface water allocations in existing water supply schemes which are located in the Upper Leichhardt subcatchment area.

Section 19 of the water plan states that the WASO performance indicators for taking supplemented surface water are:

- the **annual supplemented water sharing index** which, for water allocations to take supplemented surface water in a particular priority group, is defined to mean the percentage of years in the simulation period in which the allocations are fully supplied
- the **monthly supplemented water sharing index** which, for water allocations to take supplemented surface water in a particular priority group, is defined to mean the percentage of months in the simulation period in which the allocations are fully supplied.

Table 1-4 presents the WASOs that apply to the Queensland part of the Southern Gulf area. As there are no unsupplemented water allocations in the plan area, there are no unsupplemented water allocation security objective defined in the water plan.

Table 1-4 Water allocation security objectives for the Queensland part of the Southern Gulf area

WASO PERFORMANCE INDICATORS	WATER ALLOCATION SECURITY OBJECTIVES		DEFINITION OF METRICS
	MANDATORY MINIMUM	TARGET PERFORMANCE	
Julius Dam water supply scheme			
annual supplemented water sharing index	Be at least 95%	Minimise the extent to which it is less than 100%	<i>annual supplemented water sharing index, for water allocations to take supplemented surface water in a particular priority group, means the percentage of years in the simulation period in which the allocations are fully supplied.</i>
monthly supplemented water sharing index	Be at least 95%	Minimise the extent to which it is less than 100%	<i>monthly supplemented water sharing index, for water allocations to take supplemented surface water in a particular priority group, means the percentage of months in the simulation period in which the allocations are fully supplied</i>
Moondarra Dam water supply scheme			
annual supplemented water sharing index	Be at least 58%	Minimise the extent to which it is less than 65%	<i>annual supplemented water sharing index, for water allocations to take supplemented surface water in a particular priority group, means the percentage of years in the simulation period in which the allocations are fully supplied.</i>
monthly supplemented water sharing index	Be at least 78%	Minimise the extent to which it is less than 85%	<i>monthly supplemented water sharing index, for water allocations to take supplemented surface water in a particular priority group, means the percentage of months in the simulation period in which the allocations are fully supplied</i>

Source: Adapted from (State of Queensland, 2017b)

Note that WASOs are effectively required long-term performance outcomes that are achieved through the water sharing rules, volumes and other characteristics of water entitlements as well as the configuration and operations of infrastructure in the catchment. In other words, the water sharing rules are not managed as a means of meeting the WASOs each and every year but are designed and optimised to achieve the WASOs over the long term.

Assessing impacts on other existing water users

As there are no unsupplemented water allocations in the Flinders River catchment at this time, WASOs are not currently specified for unsupplemented water licences. However, the Gulf water plan requires that DRDMW consider “the impact the proposed taking of, or interfering with, the water may have on existing water users in the plan area” (State of Queensland, 2017b). This means that attention must be given to examining the potential impacts on water entitlement (licence) holders downstream of a proposed project.

Although not specified within the Gulf water plan, potential impacts are typically considered in terms of the effect on mean annual flows at an initial project feasibility stage, then may be examined in terms of the impacts to annual frequencies of the entitlement’s opportunity to take water during a later more detailed project design phase.

Environmental flow objectives

Section 17 of the water plan specifies performance indicators at specific river locations (referred to as ‘nodes’) for environmental flow objectives (‘EFOs’) for:

- periods of low flow
- periods of medium to high flow and

- periods of wet-season flow.

The Gulf water plan currently specifies nodes at the following locations within the Queensland part of the Southern Gulf area:

- Leichhardt River at Miranda Creek at AMTD 357.3km (node 1)
- Nicholson River near Doomadgee at AMTD 159km (node 2)
- Lawn Hill Creek near its confluence with Widdallion Creek at AMTD 105.5km (node 3)
- Gregory River near Riversleigh Station at AMTD 148km (node 4).

Figure 1-5 shows the location of EFO nodes in the Gulf water plan area.

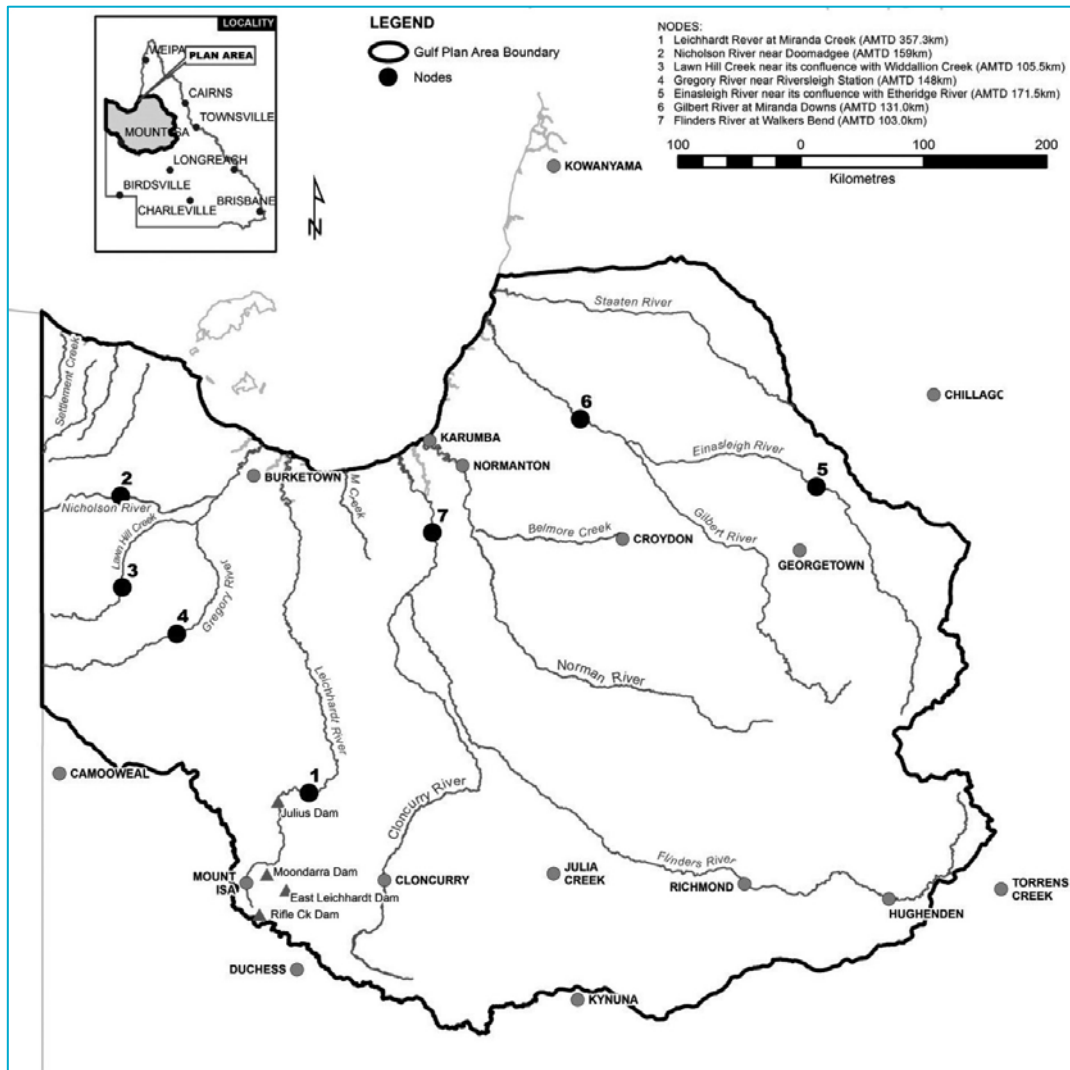


Figure 1-5 Location of nodes for assessing achievement of environmental flow objectives in the Gulf water plan area

Source: Adapted from (State of Queensland, 2017b)

EFOs are a generally defined as a set of required values for a suite of hydrological statistics that are each calculated using the prescribed computer program and expressed in terms of percentages of the hydrological values calculated for the pre-development flow pattern. The Gulf water plan defines the pre-development flow pattern to mean the pattern of water flows during the simulation period that is decided by DRDMW using the prescribed assessment computer program as if there were no dams or other water infrastructure in the plan area, and no water was taken under authorisations in the plan area.

EFOs for the Flinders River are specified within Schedule 5 of the Gulf water plan. Table 1-5 sets out the performance indicators and required values of the EFOs specified by the water plan for the Queensland part of the Southern Gulf area. Not all EFOs apply to all nodes; in this part of the Gulf water plan area EFOs only apply to node 1 (Leichhardt River at Miranda Creek at AMTD 357.3km).

Table 1-5 Environmental flow objectives for the Queensland part of the Southern Gulf area

EFO PERFORMANCE INDICATORS	ENVIRONMENTAL FLOW OBJECTIVES				DEFINITION OF TERMS USED WITHIN DESCRIPTION OF METRICS
	NODE 1	NODE 2	NODE 3	NODE 4	
Low-flow objectives					
the number of periods of no flow of more than 1 month but less than 6 months in the simulation period	be not more than 150	n/a	n/a	n/a	<i>a period of no flow, for a node, means a period in which the watercourse has ceased to flow at the node</i>
the number of periods of no flow of 6 months or more in the simulation period	be not more than 80	n/a	n/a	n/a	
the number of days on which the daily flow equals or exceeds the median non-zero daily flow, expressed as a percentage of the number of days on which the daily flow for the pre-development flow pattern equals or exceeds the median non-zero daily flow, in the simulation period	be at least 50%	n/a	n/a	n/a	<i>the median non-zero daily flow, for a node, means the daily flow, at the node, that is equalled or exceeded on 50% of the flow days for the node in the pre-development flow pattern</i>
Medium to high flow objectives					
the mean annual flow in the simulation period, expressed as a percentage of the mean annual flow for the pre-development flow pattern in the simulation period	be at least 63%	n/a	n/a	n/a	<i>the mean annual flow means the total volume of flow in the simulation period divided by the number of years in the simulation period</i>
the median annual flow ratio in the simulation period, expressed as a percentage of the median annual flow for the pre-development flow pattern in the simulation period	be at least 37%	n/a	n/a	n/a	<i>the median annual flow means the annual flow volume that is equalled or exceeded in 50% of years in the simulation period</i>
the 1.5 year daily flow volume in the simulation period, expressed as a percentage of the 1.5 year daily flow volume for the pre-development flow pattern in the simulation period	be at least 37%	n/a	n/a	n/a	<i>the 1.5 year daily flow volume means the daily flow that has a 67% probability of being reached at least once a year</i>
the 5 year daily flow volume in the simulation period, expressed as a percentage of the 5 year daily flow volume for the pre-development flow pattern in the simulation period	be at least 70%	n/a	n/a	n/a	<i>the 5 year daily flow volume means the daily flow that has a 20% probability of being reached at least once a year</i>
the 20 year daily flow volume in the simulation period, expressed as a percentage of the 20 year daily flow volume for the pre-development flow pattern in the simulation period	be at least 72%	n/a	n/a	n/a	<i>the 20 year daily flow volume means the daily flow that has a 5% probability of being reached at least once a year</i>
Wet-season flow objectives					
the median wet-season flow in the simulation period, expressed as a percentage of the median wet-season flow for the pre-development flow pattern in the simulation period	n/a	n/a	n/a	n/a	<i>the median wet-season flow, for a node, means the total volume of flow during the months of January, February and March that is equalled or exceeded in 50% of years in the simulation period</i>

Source: Adapted from (State of Queensland, 2017b)

Other matters

Sections 23 and 30 of the Gulf water plans set out the matters that the chief executive must consider in preparing and implementing such a process (State of Queensland, 2017b). These include:

- the purpose for which the water is required
- the efficiency of existing and proposed water use practices
- the extent to which water in the plan area is being taken under authorisations
- the availability of an alternative water supply for the purpose for which the water is required
- the impact the proposed taking of, or interfering with, the water may have on existing water users in the plan area
- whether the proposed taking or interfering is likely to have a direct adverse effect on groundwater flows
- the matters mentioned in Section 23(1)(a) i.e. streamflows required to maintain:
 - the longitudinal connectivity of low-flow habitats throughout river systems in the plan area
 - the wetted habitats at riffles and other streambed features
 - the natural seasonality of flows and zero flows
 - the replenishment of refuge pools that enable movement of instream biota
 - groundwater flows
 - the contributions from aquifers to the flow of water in watercourses
 - the lateral connectivity between rivers in the plan area and their adjacent riverine environments, including floodplains
- the matters mentioned in Section 23(1)(b) i.e. the impact the taking of, or proposed taking of, or interfering with, water may have on:
 - water quality
 - the natural movement of sediment
 - the bed and banks of a watercourse or lake
 - the inundation of habitats
 - the movement of fish and other aquatic animals
 - the recreation and aesthetic values of the plan area and
 - cultural values including, for example, cultural values of local Aboriginal or Torres Strait Islander communities.

The above list does not limit the matters the chief executive may consider in preparing and implementing a process for granting unallocated water.

In addition, the Gulf Resources Operations Plan (Department of Natural Resources Mines, 2015) requires that:

- (under Section 31) a submission for unallocated water where the water is proposed to be used under a water entitlement for irrigation must be accompanied by information that

demonstrates the potential suitability of the land for sustainable irrigation having regard to the following matters that may constrain the extent and location of any irrigation development:

- the availability of land where a vegetation clearing application may be made under the Vegetation Management Act 1999 (State of Queensland, 2017a)
 - the occurrence of ecological assets and other high value environmental features such as wetlands
 - suitability of the topography, including the slope of the land intended to be irrigated
 - known cultural heritage sites
 - attributes of the soil, including potential salinity, sodicity and drainage concerns
- (under Section 35) when deciding an application for unallocated water, the chief executive must consider the effect of granting from the unallocated water reserves on Indigenous cultural values and the social and economic wellbeing of local Indigenous communities.

1.7 Water charges

This section describes, and presents commentary relating to, water charges applicable to existing and new water entitlements within the Queensland part of the Southern Gulf area.

1.7.1 Upfront costs associated with securing unallocated water

The costs to secure a water licence from an unallocated water reserve may be set by DRDMW as part of a published Terms of Release and/or set by the prevailing water market at the time (rather than on any principle or basis of returning a resource rent to the state from the sale of the new entitlement).

For example, in 2020 DRDMW published a Terms of Release that specified property-based volumetric limits and other conditions relating to their release of new water entitlements within the Leichhardt, Nicolson and other catchments within the Gulf water plan area (State of Queensland, 2020c). Figure 1-6 illustrates the volumes of water that were made available for landowners to apply for in this release. In this instance, the Terms of Release specified fixed price terms that could either be paid as a \$125.00 per megalitre upfront charge or an annual charge of \$13.00 per megalitre per year for 10 years.

DRDMW may apply a suite of criteria to prioritise and select preferred tenders (which sometimes includes consideration of the bidder's tender price like an auction). It is notable that a key condition in the 2020 release was that all new licences would be conditioned so that infrastructure capable of taking at least 50% of the nominal entitlement in a water year must be installed within 3 years from the licence issue date (i.e. despite an expiry date of 30 June 2111 a licence could be cancelled after the third anniversary of the licence issue date if DRDMW is satisfied intent to use the water has not been demonstrated). This is in response to earlier unallocated water releases that appeared to result in landowners securing new water licences without any strong obligations to, or penalties for not, beneficially use the entitlements.

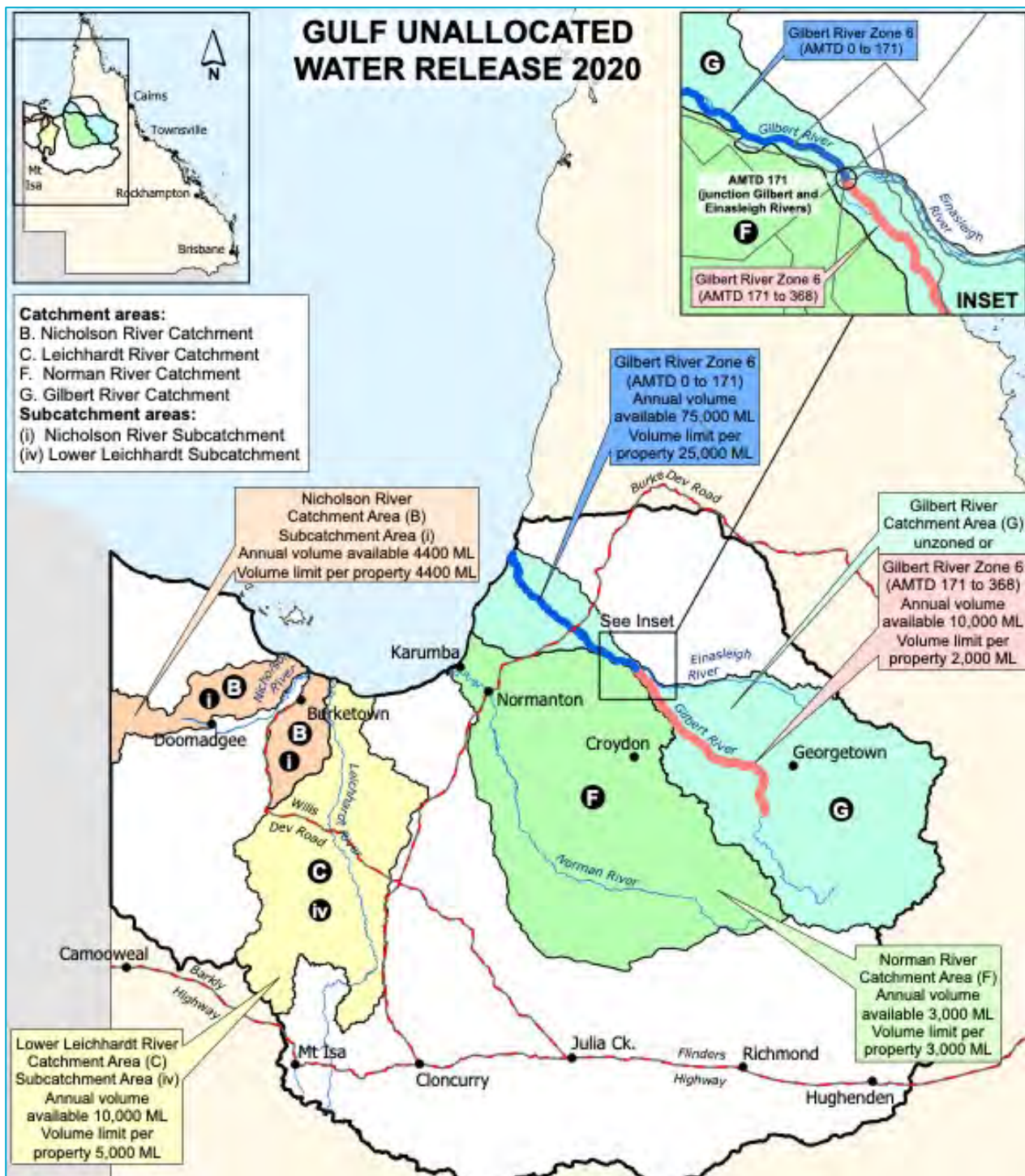


Figure 1-6 Unallocated water release in the Gulf catchment in 2020

Source: (Queensland Government, 2020a)

Each time DRDMW completes an unallocated water release, a report is published summarising the results of the release process. For example, in 2016 DRDMW published a Tender Assessment Report relating to the release of unallocated water from the GAB in 2015 (State of Queensland, 2016). The report noted that 18,200 ML of water was made available from 27 of the 32 management units established under the GABORA water plan at a minimum purchase price of \$1,420 per ML of nominal entitlement. Although this did not result in any new GAB water licences being issued in the Queensland part of the Southern Gulf area (but did release water elsewhere in

the Gulf water plan area and beyond throughout Queensland), it provides an indication of the purchase price for GAB water at that time.

1.7.2 Upfront charges for new supplemented water supply schemes

It should be noted that the water licence purchase prices mentioned above are for unsupplemented water entitlements.

The upfront purchase price to buy in to a new supplemented water supply scheme is typically significantly more than this and is comprised of a number of elements including:

- cost of acquiring water entitlements (i.e. either associated with purchasing new entitlements from an unallocated water release and/or the purchase and relocation of an existing water entitlement). These are likely to be similar to the water entitlement purchase prices mentioned in Section 1.7.1)
- a contribution to the upfront capital costs of the new water infrastructure within the scheme less
- any government grants towards the upfront capital costs.

Establishing new supplemented water allocations requires substantial upfront capital investment in bulk water infrastructure (e.g. dams, weirs, fishways, pumpstations, pipelines, open channels, roads, bridges, power transmission lines etc.). In the past, governments adopted a “build it and they will come” approach in which government effectively paid for 100% of the cost of the water supply scheme and then sought to sell water allocations to customers over a period of some years and usually at a significantly discounted price.

Today, governments expect project proponents to secure strong commitments from prospective customers for a substantial upfront contribution to the capital cost of a project as a precondition to seeking approval to commence construction. Payment is expected at the completion of construction prior to the issue of the water entitlements. This requirement provides an important indication of the extent to which a project has the serious backing of its prospective customers. Of course, it does not preclude government from also making significant grants towards the capital cost of a project.

The percentage contribution of the Australian Government to the capital cost of a project is not a given and will vary from project to project. The Rookwood Weir water supply scheme and the Granite Belt Irrigation Project are two examples of recently approved projects that have each attracted a 50% grant contribution to the upfront capital cost from the Australian Government. This appears to be influencing other similar project proponents’ expectations re the Australian Government’s contribution to the upfront capital cost of Queensland water projects.

The Queensland Government’s contribution also varies from project to project. Although there is again no fixed policy position, anecdotal reports suggest that proponents of supplemented water supply schemes have an expectation that the Queensland Government might cover the remaining proportion of upfront capital costs after accounting for the grant from the Australian Government grant plus any total private upfront contributions of the new customers of the new scheme. This means that proponents hope that the Queensland Government’s might contribute up to 25% of upfront project costs.

Recent examples of new water supply schemes indicate that upfront scheme costs (in \$ per ML) vary depending on the project's context (cost of building the scheme, extent of government grants, reliability/mix of high and medium priority water products, the type of agricultural production in the area etc.) and include:

- The Granite Belt Irrigation Project which will include a 12,074 ML dam at Emu Swamp plus 126km of pipeline throughout the Granite Belt and deliver a yield of 3,900ML per year at 90% monthly (relatively high) reliability water to approximately 50 customers (Granite Belt Irrigation Project, 2021). The project will underpin high value agricultural production in the Stanthorpe area with an annual production valued at \$238 million per year.

The upfront contribution from irrigators will reportedly be \$23.4 million (or an upfront contribution of \$6,000 per ML of supplemented water allocation) which is around 28 per cent of the cost of the scheme, making it the highest proportion of private investment in water infrastructure in Queensland's history. The Australian Government has contributed \$47 million and the Queensland Government has made a conditional commitment of \$13.6 million (Granite Belt Irrigation Project, 2020).

- The Water for the \$160 million Lockyer project which is proposed to include a pipeline from Wivenhoe Dam and deliver an interruptible supply up to 50,000 ML that equates to an average monthly reliability over time of about 75%.

The Lockyer Valley and Somerset Water Collaborative signalled that the upfront contribution by irrigators for the new water would be a \$1,600 per ML to own the water right comprised of 2% deposit on signing of a water sales contract, a further 8% deposit when government approves construction and the remaining 90% upon practical completion of the scheme (Lockyer Valley and Somerset Water Collaborative, 2020).

- The Rookwood Weir water supply scheme which will be a 74,325 ML weir on the Fitzroy River 66km south-west of Rockhampton and deliver approximately 86,000 ML of medium priority water at 82% monthly reliability (Sunwater, 2019b). The weir will reportedly cost \$352.2 million with the Australian and Queensland governments each investing \$176.1 million (Ben Harden, 2020) which means that the total cost of water is \$4,095 per ML.

Although the upfront purchase prices, or contributions by prospective users, of medium or high priority water have not been disclosed, if customers were assumed to contribute, say, 25% of the total costs in this scheme then this might mean an average upfront cost to medium priority customers of around \$1000 per ML.

The conversion factors for describing the relationship between medium priority water and high priority water vary from scheme to scheme but are typically in the range of 1.5 to 3.0 (i.e. 1 ML of medium priority water is equivalent to a high priority volume of 1 ML divided by the conversion factor). Typically there are also limits on the maximum volume of medium priority water that may be converted to high priority water. These conversion factors are a useful indicator of the relationship between the upfront prices that high and medium priority customers might expect to pay to buy in to a new supplemented scheme.

The relative proportion of the volume of high priority water allocations and medium priority water allocations is generally determined through demand studies conducted during the project development phase coupled with project assessments to determine the likely scheme costs and

hydrological modelling to ensure compliance with water plan objectives and requirements. The conversion factors are also informed by this modelling.

It is clear that there is no single “rule-of-thumb” for predicting the upfront cost per ML for buying into a new water supply scheme. However, the examples above suggest that if water users contribute between 25% and 50% of the upfront costs of a scheme, the upfront cost typically ranges between \$1,000 to \$1,600 per ML for medium priority water allocation (with monthly reliabilities up to 85%) and range between \$1,600 to \$6,000 per ML for high priority water allocation (with monthly reliabilities of greater than or equal to 90%).

1.7.3 Ongoing water charges

Unsupplemented water fees and charges

The Queensland Government undertakes a number of water planning and management activities to manage the state's water resources. To cover some of the costs of these activities, water users in Queensland are subject to the following fees and charges:

- water-related application and administrative fees
- water licence fees
- water harvesting charges
- meter service charges.

Fees are charged for:

- applications relating to water licence dealings
- applications and lodgement of documents relating to water allocations
- applications for water bore driller's licences
- development applications relating to operational work (Queensland Government, 2021e).

These fees and charges are payable to the Department of Regional Development, Manufacturing and Water (DRDMW) on application. A full list of these fees is found in schedule 12 of the Water Regulation 2016 (State of Queensland, 2021c). Some examples include:

- annual water licence fee – \$86.80/year
- application for a seasonal water assignment for a water allocation or a seasonal water assignment – \$184.00
- application to relocate a licence – \$405.10.

Supplemented water charges

Supplemented water entitlements come with ongoing charges relating to the operations and maintenance costs of the water supply scheme, asset renewal/depreciation costs etc.

Ongoing supplemented water charges are usually structured in terms of a mix of fixed and volumetric tariffs, with the exact mix and scale of charges determined on a scheme by scheme basis.

Sunwater (Queensland’s regional bulk water provider and owner of water supply schemes throughout the state) note that:

- fixed tariffs are charged quarterly or six monthly in advance, according to the nominal volume of water allocation held by the customer, regardless of the amount of water taken in the year. Fixed tariffs are also known as Part A tariffs in bulk water supply schemes and Part C tariffs in off-river distribution schemes. Bulk water scheme customers pay Part A and distribution scheme customers pay Part A and Part C fixed tariffs, and
- volumetric tariffs are charged per megalitre of water taken by the customer, measured at the water meter or ‘offtake’. Volumetric tariffs are also known as Part B tariffs in bulk water supply schemes and Part D tariffs in off-river distribution schemes. Bulk water scheme customers pay Part B and distribution scheme customers pay Part B and Part D fixed tariffs (Sunwater, 2021c).

Fixed (Parts A & C) and volumetric (Parts B & D) charges for irrigation customers are set by the Queensland Government based on recommendations from the Queensland Competition Authority (QCA). In February 2020, the QCA completed its investigation into water prices to apply to irrigation customers from 1 July 2020 to 30 June 2024, following a public consultation process (Sunwater, 2021c).

Irrigation prices for existing water supply schemes are set – and effectively subsidised – by the state government to implement its policy objective that irrigation prices should balance the legitimate commercial interests of the Water Businesses with the interests of their customers, provide a signal for efficient water usage, and ensure where possible pricing outcomes are simple and transparent. Prices aim to recover, or transition towards recovering, the irrigation share of the scheme’s prudent and efficient operating, maintenance and administrative costs and an appropriate allowance for renewing existing assets commissioned prior to 1 July 2000. Where revenue from irrigation prices do not fully cover a scheme’s operational costs, a community service obligation is paid by the government to the relevant water utility (State of Queensland, 2020b).

Some examples of selected irrigation water charges for three Sunwater water supply schemes in 2021-22 are presented in Table 1-6.

Table 1-6 Water charges for irrigation customers as at 2021-22 for selected Sunwater schemes

WATER SUPPLY SCHEME	WATER CHARGES			
	PART A	PART C	PART B	PART D
	BULK-FIXED	OFF-RIVER FIXED	BULK – VOLUMETRIC	OFF-RIVER – VOLUMETRIC
	(\$/ML OF WATER ALLOCATION)		(\$/ML OF WATER TAKEN)	
Bundaberg water supply scheme (for the Sunwater headworks / channel system)	\$8.58	\$39.18	\$0.86	\$46.20
Burdekin water supply scheme (for the channel system)	\$3.26	\$35.78	\$0.28	\$19.79
Mareeba Dimbulah water supply scheme (for the channel relift system)	\$4.69	\$34.51	\$0.51	\$74.93

Source: 2021-22 water supply scheme fees and charges for rural irrigation water (Sunwater, 2021c)

The Queensland Government has also recently introduced a 15% discount on Part A, B, C & D charges for irrigation customers who are eligible for regulated prices. Horticultural growers may also be eligible for an additional 35% rebate (i.e. a 50% cut in total) on their Part A, B, C & D charges (Sunwater, 2021a).

Commercial charges set by Sunwater are based on the full recovery of operational, maintenance and administrative costs, externalities, taxes and a return of, and on, capital investment. These charges are escalated annually, are based upon the terms and conditions of specific contracts and are generally commercial in confidence (Sunwater, 2021a).

Headworks Utilisation Factors ('HUFs') are used by the QCA as a key input to their consideration about how water charges might be assigned between high priority and medium priority water allocations. HUFs give an indication of the percentage of a water supply scheme's storage headworks volumetric capacity that is effectively utilised by each priority group of water entitlements in that scheme during critically low periods within the historical simulation period. HUFs are used in allocating the relevant ongoing capital costs (i.e. asset value and renewal costs) to various supplemented water allocation holders that are associated with a scheme's bulk water assets. They are also a useful descriptor of the extent to which headworks storage supports the performance of medium priority water allocations relative to high priority water allocations (Sunwater, 2018).

Table 1-7 presents the medium priority and high priority HUFs and other parameters for the same three water supply schemes mentioned above (Queensland Competition Authority, 2020). Table 1-7 illustrates how the proportion of headworks storage effectively utilised by medium priority water allocations is typically lower than their proportion of the total nominal volume of all water allocations within a scheme. This illustrates the effect of the high and medium priority water sharing rules described in Section 1.2.3.

Table 1-7 Headworks utilisation factors for selected Sunwater schemes

WATER SUPPLY SCHEME	PROPORTION OF TOTAL NOMINAL VOLUME OF WATER ALLOCATIONS IN THE SCHEME		HEADWORKS UTILISATION FACTORS	
	MEDIUM PRIORITY WATER ALLOCATIONS	HIGH PRIORITY WATER ALLOCATIONS	MEDIUM PRIORITY WATER ALLOCATIONS	HIGH PRIORITY WATER ALLOCATIONS
Bundaberg water supply scheme (for the Sunwater headworks / channel system)	90%	10%	62%	38%
Burdekin water supply scheme (for the channel system)	91%	9%	79%	21%
Mareeba Dimbulah water suppl scheme (for the channel relift system)	93%	7%	47%	53%

Source: From QCA's final report on its review into Sunwater's rural irrigation prices 2020-24 (Queensland Competition Authority, 2020) and (Sunwater, 2018)

References

Badu Advisory (unpublished draft) Flinders River water strategy report.

Badu Advisory J (2020) Gilbert River Irrigation Project: Detailed Business Case - Appendix H: Badu Advisory Water Strategy Report Available online: <<https://www.etheridge.qld.gov.au/development/economic-development/gilbert-river-agricultural-scheme>>.

Ben Harden (2020) Rookwood Weir gets \$176.1 million funding boost. Queensland Country Life.

Budget Strategy and Outlook (2024) Budget 2024-25. A future made in Australia. Viewed 11 September 2024, <https://budget.gov.au/content/factsheets/download/factsheet-fmia.pdf>.

Department of Natural Resources and Mines (2015) Minister's Performance Assessment Report: Water Resource (Great Artesian Basin) Plan 2006 and Great Artesian Basin Resource Operations Plan 2007.

Department of Natural Resources Mines (2015) Gulf Resource Operations Plan June 2010 (Amendment August 2015).

Department of State Development, Manufacturing, Infrastructure and Planning (2019) North west Queensland economic diversification strategy 2019. Viewed 12 September 2024, <https://www.statedevelopment.qld.gov.au/regions/regional-priorities/a-strong-and-prosperous-north-west-queensland/north-west-queensland-economic-diversification-strategy>.

Glencore (2021) Water resource management. Viewed 6 December 2021, <<https://www.glencore.com.au/operations-and-projects/qld-metals/sustainability/environment/water-resource-management>>.

Granite Belt Irrigation Project (2020) Granite Belt Irrigation Project water sales finalised (Media Statement). Viewed 13 December 2021, <<https://granitebeltirrigationproject.com.au/index.php/2020/12/01/granite-belt-irrigation-project-water-sales-finalised/>>.

Granite Belt Irrigation Project (2021) Key Facts. Viewed 13 December 2021, <<https://granitebeltirrigationproject.com.au/index.php/facts/>>.

Lockyer Valley and Somerset Water Collaborative (2020) Frequently Asked Questions. Viewed 13 December 2021, <<https://lvandswatercollaborative.com.au/project-faqs>>.

NT Government (2023) Territory Water Plan. A plan to deliver water security for all Territorians, now and into the future. Viewed 6 September 2024, https://watersecurity.nt.gov.au/__data/assets/pdf_file/0003/1247520/territory-water-plan.pdf.

Queensland Competition Authority (2020) Final report: Rural irrigation price review 2020–24 Part B: Sunwater. Available online: <<http://www.qca.org.au/wp-content/uploads/2020/02/irrigation-price-review-part-b-sunwater-final-report.pdf>>.

Queensland Government (2017) Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017. Queensland Government.

Queensland Government (2020a) Map of Gulf unallocated water release 2020.

Queensland Government (2020b) Water Entitlement Viewer.

Queensland Government (2021a) Authorisations in water areas. Viewed 15 November 2021, <<https://www.business.qld.gov.au/industries/mining-energy-water/water/authorisations/water-areas>>.

Queensland Government (2021b) Gulf water plan area. Viewed 3 December 2021, <<https://www.business.qld.gov.au/industries/mining-energy-water/water/catchments-planning/water-plan-areas/gulf>>.

Queensland Government (2021c) Water Act 2000 – Form W2F108: Request for water entitlement data attached to land.

Queensland Government (2021d) Water authorisations for industry and government. Viewed 15 November 2021, <<https://www.business.qld.gov.au/industries/mining-energy-water/water/authorisations/industry-government>>.

Queensland Government (2021e) Water management fees in Queensland. Viewed 15 November 2021, <<https://www.business.qld.gov.au/industries/mining-energy-water/water/authorisations/fees>>.

Queensland Government (2023) Queensland Water Strategy. Water. Our life resource. Viewed 11 September 2024, <https://www.rdmw.qld.gov.au/qld-water-strategy/strategic-direction>.

State of Queensland (2016) Water Resource (Great Artesian Basin) Plan 2006 — Sale of general reserve unallocated water: Tender assessment report.

State of Queensland (2017a) Vegetation Management Act 1999 (Current as at 3 July 2017— revised version).

State of Queensland (2017b) Water Plan (Gulf) 2007 (Current as at 2 September 2017).

State of Queensland (2018) Minister’s Performance Assessment Report Water Plan (Gulf) 2007. Available online: <<https://www.etheridge.qld.gov.au/downloads/file/404/gulf-m-1-pdf>>.

State of Queensland (2019) Great Artesian Basin and Other Regional Aquifers — Water Management Protocol (September 2017).

State of Queensland (2020a) Petroleum and Gas (Production and Safety) Act 2004 (Current as at 1 October 2020).

State of Queensland (2020b) Queensland Government Gazette — Extraordinary.

State of Queensland (2020c) Unallocated water held in general reserve — Fixed price Terms of Release Water Plan (Gulf) 2007. Available online: <https://www.rdmw.qld.gov.au/__data/assets/pdf_file/0007/1486600/gulf-water-release-terms.pdf>.

State of Queensland (2021a) Petroleum Act 1923 (Current as at 2 November 2021).

State of Queensland (2021b) Water Act 2000 (Current as at 18 June 2021).

State of Queensland (2021c) Water Regulation 2016.

Sunwater (2018) Irrigation Price Review Submission: Appendix J — Headworks Utilisation Factors Technical Paper. Available online: <https://www.qca.org.au/wp-content/uploads/2019/05/34198_SunWater-Submission-Irrigation-Price-Review-Appendix-J-Headworks-Utilisation-Factors-technical-paper.pdf>.

Sunwater (2019a) Announced Allocations. Sunwater. Viewed 15 November 2021, <<https://www.sunwater.com.au/customer/announced-allocations/>>.

Sunwater (2019b) Rookwood Weir Project. Viewed 13 December 2021, <<https://www.sunwater.com.au/projects/rookwood-weir-project/>>.

Sunwater (2021a) Bundaberg Water Supply Scheme: Fees and charges schedule – effective 1 July 2021. Viewed 14 December 2021, <https://www.sunwater.com.au/wp-content/uploads/Home/Customer/Fees-Charges/Bundaberg_Water_Supply_Scheme_Fees_and_Charges_2021-2022.pdf>.

Sunwater (2021b) Operational Report: Announced Allocation: Julius Dam WSS. Available online: <https://www.sunwater.com.au/wp-content/uploads/Home/Schemes/Julius-Dam/Operational_Report_Julius_Dam_effective_2021_07_01.pdf>.

Sunwater (2021c) Water pricing. Sunwater. Viewed 14 December 2021, <<https://www.sunwater.com.au/customer/fees-and-charges/>>.

Truii (2020) Natural Resources Inventory for Queensland. Department of Natural Resources Mines and Energy,. Viewed 15 November 2021, <https://inventory.dnrme.qld.gov.au/water?p1=water&p2=queensland&p3=mp_w_wpres&&p5=true>.

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