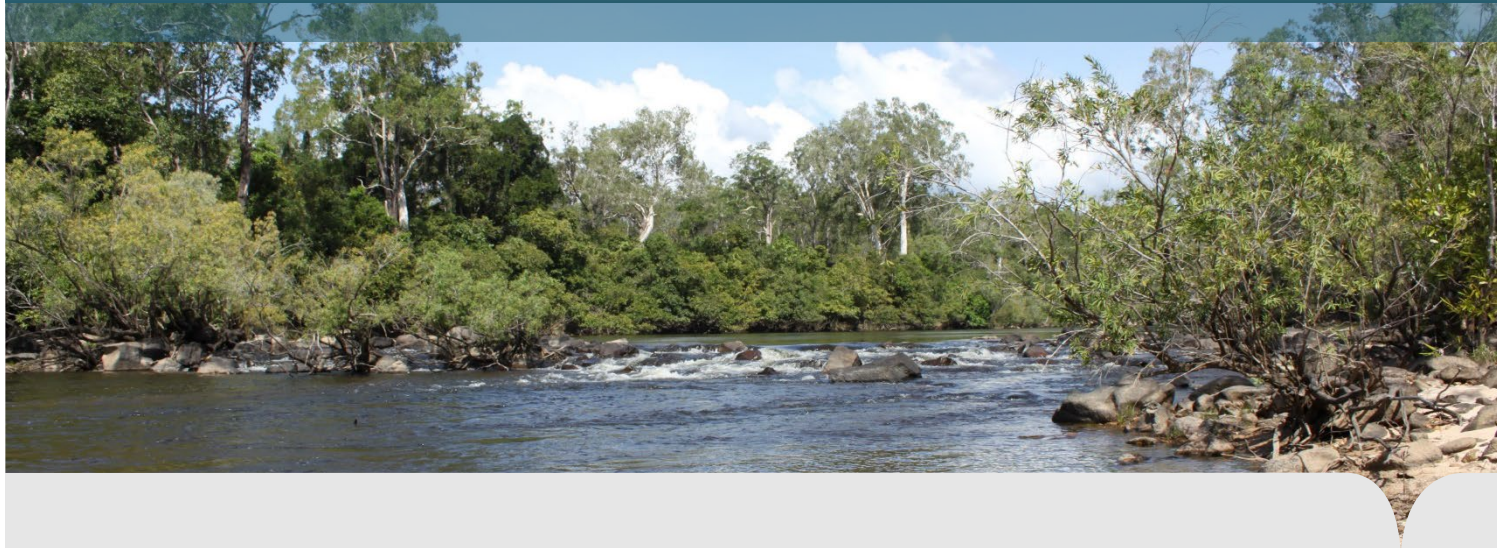




Queensland
Government

Department of Regional Development,
Manufacturing and Water



Water Plan (Cape York) 2019

Minister's Performance Assessment Report

June 2024

Acknowledgement of Traditional Owners

We respectfully acknowledge the Aboriginal and Torres Strait Islander peoples as the Traditional Owners and Custodians of this Country – the lands and seas on which we meet, live, learn, work and play. We acknowledge those of the past, the Ancestors whose strength has nurtured this land and its people, and we recognise their connection to land, sea, and community. We pay our respects to them, their culture and to their Elders past, present and emerging.

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Minister's foreword

I am pleased to publish the first performance report for the Water Plan (Cape York) 2019 (the Cape York water plan). Performance reports are an important part of the water planning process in Queensland for each of the state's 23 water plans. The current Cape York water plan is scheduled to expire on 1 September 2029.

This report confirms that the Cape York water plan and its implementation continue to be effective in advancing the sustainable management of water resources in the water plan area. No adverse impacts on water entitlement holders or natural ecosystems in the water plan area are expected from continuing with the current Cape York water plan until it expires on 1 September 2029.

In the meantime, my department will continue to implement the Cape York water plan. Ongoing monitoring will continue to enable new, emerging, or existing risks that are increasing in threat level, to be identified to ensure the plan continues to effectively allocate the water resources in the water plan area.

Residents in the Cape York water plan area can be assured that water resources in your region are being managed responsibly and sustainably. I encourage anyone with an interest in the management of water resources in the water plan area to read this report.

Hon. Mr Glenn Butcher MP

Minister for Regional Development and Manufacturing
Minister for Water

Executive summary

Under section 49 of the *Water Act 2000* (the Water Act), a Minister must prepare a report on each water plan at least every five years to assess its effectiveness and its implementation, in accordance with the requirements stated under section 22(4) of the *Water Regulation 2016* (the Regulation).

This report provides an assessment of the performance of the Water Plan (Cape York) 2019 (Cape York water plan), which is scheduled to expire on 1 September 2029. A summary of the assessment is provided in Table 1: Summary of the performance assessment of the Water Plan (Cape York) 2019.

The assessment shows that the Cape York water plan remains fit for purpose and continues to advance the sustainable management of water resources in the water plan area. It also shows that the implementation of the plan has been effective in achieving most of the plan's outcomes.

A risk assessment was undertaken to identify the issues that threaten the ability of the Cape York water plan to achieve its intended outcomes. Of the plan's 24 outcomes that were assessed, two were found to be medium risk, and the remaining 22 outcomes were deemed to be low risk over the remaining life of the Cape York water plan (Appendix A). For the two outcomes identified as at medium risk, one outcome related to the ability of the Cape York water plan to maintain the probability of being able to take water under an authorisation. The other outcome related to the facilitation of economic development through the growth and expansion of industries dependent on water resources. Both medium risks will be addressed by the:

- Provision of unallocated water (UAW) volumes for Cape York Peninsula Heritage Area (CYPHA), strategic and general reserves.
- Process for dealing with UAW.
- Establishment of volumetric surface water and underground water entitlements.
- Framework to support water trading.
- Performance indicators such as Water Allocation Security Objectives (WASOs), that are defined in the Cape York water plan.
- Waterhole protections through limitations on interference with water, environmental flow objectives (EFOs), and performance indicators.

The learnings gained from implementing the existing plan will be used to improve water management arrangements under the replacement Cape York water plan, as part of an adaptive management cycle based on revised future water needs, improved science knowledge and targeted stakeholder consultation.

Table 1: Summary of the performance assessment of the Water Plan (Cape York) 2019

Completed	On track	Some issues	
Some major issues	Not achieved	Insufficient information available	
Matters to be addressed	Comment	Section of the report	Status
Effectiveness of the plan in advancing the sustainable management of Queensland's water resources	Overall, this assessment indicates that the Cape York water plan is achieving the purposes of the Water Act.	Section 3	On track
Effectiveness of the implementation of the plan in achieving the plan outcomes	A risk assessment found that most plan outcomes have been achieved. Of the 24 outcomes, two were found to be medium risk and the rest were ranked as low risk.	Section 4	Some Issues
Summary of water usage and entitlements including those taken or interfered with under statutory authorisations	Information on water use under metered entitlements is collected and reported. No issues are identified as water use is low in the plan area, compared with the water availability.	Section 5	On track
Summary of research and monitoring findings	The department prioritises monitoring programs based on risk. Ecological monitoring was undertaken within the water plan area over the past five years. Knowledge gaps associated with aquatic plants and animals and their flow requirements, and the groundwater dependence of ecosystems and their biota have been identified through the risk assessment process. Filling these knowledge gaps would provide greater confidence in the future assessment of risks to plan ecological outcomes.	Section 6	On track
Summary of amendments to the plan since its commencement	No amendments have been made to the Cape York water plan since its commencement.	Section 10	On track
Summary of identified risks to plan outcomes	Of the 24 outcomes assessed, two were found to be medium risk and the rest were ranked as low risk.	Section 11	On track
Summary of non-compliances under a water entitlement or other authorisation in the plan area	Over the past five years, there have been 30 instances of non-compliance. Half of the incidents related to failure to supply a meter reading. All these issues have been resolved.	Section 13	On track
Overall status and recommendation for the plan	Overall, the Cape York water plan is fit for purpose and risks to water users and environment are considered to remain low within the lifetime of the plan (until 2029).	Section 14	On track

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1. Purpose of the report

The Water Act (s49) requires the Minister to prepare reports for each water plan, to ensure the implementation and effectiveness of each plan is regularly assessed as part of an adaptive management water planning cycle. This cycle involves water plan development, implementation, monitoring, reporting, and reviewing. Section 22(4) of the Water Regulation 2016 requires these reports to be prepared at least every five years and to address the following matters:

- Whether the water plan is advancing the sustainable management of Queensland's water resources.
- An assessment of the effectiveness of the implementation of the water plan in achieving the plan's outcomes.
- Information on water use and authorisations in the water plan area, including water entitlements and water taken or interfered with under statutory authorisations.
- A summary of the findings of research and monitoring for the water plan.
- Any identified risks to the water plan's outcomes.
- What amendments, if any, have been made to the water plan since its commencement.
- Any non-compliance under a water entitlement or other authorisation in the water plan area.

This report is prepared to assess the performance of the Cape York water plan and its implementation to meet the above statutory requirements, with an emphasis on progress since the implementation of the plan in 2019. It also identifies the potential drivers for change as well as issues that should be considered as part of the next performance assessment. Considerations were also given to whether the water plan's outcomes and strategies continue to be appropriate for the plan area.

A risk assessment was conducted in December 2023 to underpin this report. The risk assessment methodology incorporates the updated statewide risk assessment approach to water plans and is consistent with the ISO 31000:2018 Risk Management Guideline. This approach ensures a consistent, repeatable, and defensible consideration of risks and that outcomes of the assessment are documented for future reference. The details and outcomes of the risk assessment are provided in Section 11 - identification of potential risks to the water plan's outcomes, and Appendix A of this report.

2. Water plan area

The water plan area covers approximately 106,805 km² across the Cape York Peninsula region in Northern Queensland. The water plan area consists of 11 local government areas: Hope Vale Aboriginal Shire, Cook Shire, Kowanyama Aboriginal Shire, Pormpuraaw Aboriginal Shire, Aurukun Shire, Lockhart River Aboriginal Shire, Weipa, Napranum Aboriginal Shire, Mapoon Aboriginal Shire, Northern Peninsula, Torres Strait Shire. Key urban or regional centres include Cooktown, Lakeland, Pormpuraaw and Weipa (Figure 1).

The water plan area comprises of 15 different catchments: the Jardine, Jacky Jacky, Ducie, Wenlock, Olive-Pascoe, Embley, Lockhart, Watson, Archer, Stewart, Holroyd, Coleman, Normanby, Jeannie, Endeavour. The catchments on the eastern coast of the water plan area drain into the Great Barrier Reef (GBR), the western coast catchments into the Gulf of Carpentaria and the north-western catchments into the Torres Strait.

The water plan area also includes two underground water management areas (Figure 1), with six underground licence zones. However, the underground water resources of the Great Artesian Basin are not managed under this plan. These resources are managed under the Water Plan (Great Artesian Basin and Other Regional Aquifers) 2017.



- Underground water management area
- Town
- ▭ Cape York
- ▭ Cook
- ▭ Cook licence zone area
- - - Catchment boundary
- ~ Major drainage
- ⬭ Plan area

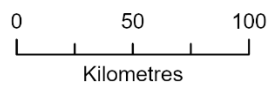


Figure 1: Water plan area boundary

Many of the catchments across the water plan area have near-natural flow regimes and river systems in pristine condition. Mean rainfall varies across the area from 800 millimetres (mm) around Lakeland to more than 3,000mm near Lockhart River.

Water in the water plan area supports several consumptive water industries including agriculture, grazing, mining, and town water supply. Water for these industries is sourced through unsupplemented surface water and underground water. There are no supplemented water schemes in the water plan area.

Non-consumptive water uses with a social, economic, or cultural value include tourism and recreation. The water plan area supports high environmental values, particularly in the GBR World Heritage Area and the biodiversity-rich rainforest in the proposed world heritage Cape York Peninsula Heritage Area (CYPHA). The CYPHA features diverse landscapes, including undisturbed eucalyptus-wooded savannahs, tropical rainforests and other habitats that are recognised and preserved for their global environmental significance. Freshwater flows are essential to the health and function of the wetlands and estuaries of these world heritage listed ecosystems.

Traditional Owners maintain strong ties and connections to land and water, with 39 successful native title determinations as of February 2024. These areas cover approximately 77% of the water plan area. Over 30 different languages are spoken in these areas. Waterways hold cultural significance for First Nations peoples, housing numerous different sites.

3. How the water plan advances the sustainable management of Queensland’s water resources

The Cape York water plan manages unsupplemented surface water, overland flow water and underground water and is implemented through the Cape York water management protocol (the protocol). It advances the sustainable management of Queensland’s water resources by establishing a framework for the allocation and management of water resources in the water plan area for the economic, physical, and social wellbeing of the people of Queensland. In particular, the Cape York water plan provides outcomes and strategies to advance the sustainable management of ecosystems, water quality, water-dependent ecological processes and biological diversity associated with watercourses, lakes, springs, aquifers, and other natural water systems. Table 2 provides a summary of the water plan’s framework and how it advances sustainable management of water. For a more detailed summary of the linkages between Cape York water plan outcomes, strategies, and rules, see Appendix A.

Table 2: The water plan’s framework for advancing the sustainable management of water

Water plan framework	How is this achieved?	Comment
Ecologically sustainable development	<p>The Cape York water plan includes ecological outcomes to ensure ecologically sustainable development (ESD) in the water plan area. These outcomes identify key ecological assets and functions and seek to minimise changes to flow regimes within the water plan area, particularly in areas of high ecological value. They also seek to minimise changes, as far as practicable, to the volume and seasonality of freshwater flows in the water plan area.</p> <p>The Cape York water plan also includes environmental flow objectives (EFO) for surface water to ensure ecologically</p>	<p>The Cape York water plan was developed based on a long-term hydrologic model to enable a better understanding of the patterns of water use and availability for both consumptive and non-consumptive uses. Ecological sustainable development is achieved through the social, economic, and environmental outcomes prescribed by the Cape York water plan that all development is required to accommodate.</p>

Water plan framework	How is this achieved?	Comment
	<p>sustainable development in the water plan area. The rules in the protocol implement the strategies in the Cape York water plan to protect environmental flows and to maintain the ecological integrity of the river systems to achieve plan outcomes.</p>	
<p>Allocation and use of water resources for economic, physical, and social wellbeing of the people of Queensland</p>	<p>The Cape York water plan provides a framework for taking water under the water entitlements, which balances the interest of all water users in the water plan area. It also provides a framework for the release of unallocated water (UAW) from the general, strategic, and CYPHA reserves, as well as a water trading framework, which enables both permanent and temporary trades. The trading rules and the process for the release of UAW is stated in the protocol.</p> <p>Water in the water plan area can also be accessed without a water entitlement for stock and domestic purposes outside of the Endeavour, Jeannie, and Normanby* catchments and for prescribed activities less than 5ML in a water year, subject to limitations outlined in the Cape York water plan, the Water Act, or the Regulation.</p> <p>* A water licence is required for stock or domestic take purposes in these catchments.</p>	<p>UAW volumes have been reserved for future development to promote economic development, while also supporting population and industry growth, as well as aesthetic, recreational and cultural values</p> <p>Since the plan commencement, there have been three releases of UAW from the CYPHA reserve totalling 9,479.24ML. For detailed information on UAW releases, see Section 5 of the report - information on water use and authorisations in the plan area.</p> <p>The risk assessment identified a medium risk to the capacity of the plan to meet growing demands for additional water from the existing UAW reserves, over the life of the current plan. See Appendix A.</p>
<p>Sustain the health of ecosystems</p>	<p>The Cape York water plan contains ecological outcomes which aim to support the ongoing protection of ecological assets and their habitats. It also includes Environmental Flow Objectives (EFOs) to sustain the health of ecosystems in the water plan area and other strategies for achieving ecological outcomes.</p>	<p>Targeted research and monitoring data helped to inform the current assessment. See Section 6 - research and monitoring findings</p> <p>Furthermore, the risk assessment identified that the ecological outcomes were achieved in the reporting period. It ranked the risks to sustaining the health of ecosystems in the water plan area as low. See Appendix A</p>
<p>Recognise the interests of First Nations peoples</p>	<p>The Cape York water plan contains outcomes to support water-related cultural values of the First Nations people in the water plan area and to help them achieve their economic and cultural aspirations as well as social, spiritual, and cultural values.</p> <p>The Cape York Water plan also includes strategies for minimising negative impacts of taking, or interfering with, water under the water entitlements on cultural values.</p> <p>The Cape York water plan also provides CYPHA UAW to help First Nations communities to achieve their economic and social aspirations.</p> <p>The Water Act allows First Nations parties to take or interfere with water for traditional activities or cultural purposes without an entitlement.</p>	<p>A risk assessment has been completed and considered. See Appendix A.</p> <p>The department is developing a First Nations water strategy from 2024 and has established a First Nations engagement team. Further, the department has partnered with the Cooperative Research Centre for developing Northern Australia in delivering a project titled “Activating Indigenous Peoples Water Rights Under the Cape York Water Plan”.</p>
<p>Enable water resources to be obtained through fair, transparent, and orderly processes</p>	<p>Water in the water plan area can be obtained through the water market or through access to the UAW reserved for specific purposes.</p> <p>The Cape York water plan identifies volumes of UAW available across the water plan area</p>	<p>The water trading and UAW frameworks were developed in consultation with all interested parties and aim to balance their water needs and interests.</p>

Water plan framework	How is this achieved?	Comment
	<p>and states a framework for establishing and dealing with UAW and limitations on granting UAW from a particular reserve (CYPHA, strategic or general). Fair and transparent processes for the release of UAW have been established under the protocol and the Regulation.</p> <p>The Cape York water plan also provides a water trading framework and the protocol outlines water trading rules.</p>	
<p>Build confidence regarding availability, security and value of water entitlements and authorisations</p>	<p>The Cape York water plan states outcomes which aim to provide, protect, and improve access to available water resources. The plan provides for the continued use of existing water entitlements and other authorisations (i.e., overland flow works) to take or interfere with water.</p> <p>The Cape York water plan's strategies and objectives provide certainty and security for current water users while also ensuring water is available to support towns, communities, and industrial growth.</p> <p>The Cape York water plan prevents any decision (excluding water permits or the release of the UAW reserve) regarding the allocation or management of water that would increase the average volume of water available be taken. This strategy protects existing water entitlements and authorisations.</p>	<p>There are many rural and rural residential properties that do not have access to water, run-of-river, or other storages. Due to the nature of the raw water sources, these water supplies can be more sensitive to changes in weather conditions, resulting in a quick decline of water security. Options for water supply during low water availability are varied.</p>
<p>Promote efficient use of water through water markets, allocation, risk assessments and community education</p>	<p>The Cape York water plan and the protocol provide for both permanent and temporary (seasonal water assignment) trading of water allocations and water licences to take unsupplemented water within certain zones. This allows users to value water as a secure asset, encourages water use efficiency, enables entitlement holders to sell water without selling land, enables users to increase water supplies and improve reliability and provides for new industries to acquire water without jeopardising the environment or affecting other water users.</p> <p>The water use efficiency of proposals is one of the considerations when granting water entitlements from UAW reserves. When the state releases UAW, a price may be set, encouraging the recognition of water as a valuable resource, and promoting its highest value for efficient use.</p>	<p>Water trading data for the reporting period is proved in <i>Section 5.3 - water trading</i>.</p> <p>Over the years, general community education about water saving practices has helped to promote more efficient use of water.</p> <p>Self-regulation due to factors outside of the Cape York water plan control (i.e. power costs, different crop requirements) also helps to encourage efficient use of water.</p>
<p>Facilitate community involvement in planning for the management and allocation of water</p>	<p>Community involvement is ensured through the consultation and engagement processes in developing and finalising the Cape York water plan and the protocol in line with the requirements of the Water Act.</p>	<p>The Cape York water plan and the protocol were developed in consultation with key stakeholders and all other interested parties. Further community consultation will occur to inform the plan review prior to its expiry and to underpin the development of the new plan.</p>

4. Assessment of the effectiveness of the implementation of the water plan in achieving its outcomes

Since the commencement of the Cape York water plan in 2019, the department has monitored its implementation to ensure it achieves its outcomes. Appendix A provides details of an assessment of the effectiveness of the Cape York water plan's implementation in achieving its outcomes since 2019. This assessment was based on analysis of data and new scientific information.

Overall, the risk assessment shows that implementation has been effective in achieving the Cape York water plan's outcomes. Of the 24 water plan outcomes assessed, two were found to be medium risk of not being achieved over the life of the plan and the remaining 22 were deemed to be low risk. The plan outcomes are met through:

- Making UAW available through reserves.
- A framework for releasing UAW reserves.
- The release of UAW from CYPHA reserves to support the interests of Aboriginal people and Torres Strait Islanders.
- Establishment of volumetric surface water and underground water entitlements.
- Establishment of tradable water allocations in the Endeavour catchment.
- Metering of active licences.
- Implementation of seasonal and permanent water trading provisions.
- Management of overland flow development.

5. Information on water use and authorisations in the water plan area

Water users have access to water taken under a water entitlement (e.g. water licence or water allocation) or under a statutory authorisation through the Water Act (e.g. low risk uses such as prescribed activities or stock and domestic use). UAW is reserved and can be made available for future use with consideration to protecting existing entitlements and the environment.

5.1 Water entitlements

Water entitlements in the water plan area include:

- Water allocations to take supplemented surface water,
- Water licences to take unsupplemented surface water,
- Water licences to take overland flow water,
- Water licences to take underground water in the Cape York and Cook groundwater management areas.

Appendix B-1 provides data on the number of specific entitlements and the values of water allocated under these entitlements. In summary:

- Out of the 99,095.72ML allocated under all entitlements, approximately 57.0% (56,394.74ML) has been allocated as unsupplemented surface water. Approximately 43% (42,700.98ML) has been allocated as water licences for underground water.
- The volume of unsupplemented water allocated to CYPHA licences corresponds to approximately 17% (9,479.25ML) of total surface water volumes.

5.2 Water use

In accordance with section 107 of the Water Regulation, all water entitlements in the Lakeland water licence zones 1 and 2, other than licences for stock or domestic purposes, and for which the annual volumetric limit is not more than 5ML, are metered entitlements. Of the 109 licences prescribed as metered entitlements in the water plan area, 49 had a water meter installed. The remainder have not yet activated their water take for purposes other than stock and domestic.

In the reporting period (2018/19 - 2022/23), the total metered water use in Lakeland zones 1 and 2 ranged from approximately 120% to 89.5% of the total allocated volumes (Appendix B-2). This level of use indicates that the demand for water in these zones is very high.

5.3 Water trading

There are three water markets currently in the water plan area:

1. Water allocation market (permanent trades) - trading of registered water allocation titles associated with unsupplemented water allocations in trading zones within the Endeavour catchment.
2. Seasonal water assignment market (temporary trades) - seasonal assignment of water licences associated with:
 - Surface water licence zone,
 - Underground water licence zone.
3. Relocatable water licence market (permanent trades) - transferring of water licences from one parcel of land to another associated with:
 - Surface water licence zone,
 - Underground water licence zone.

The establishment of these water markets provides certainty for the water users and creates a more secure business environment. Trading water entitlements can stimulate better decision making about usage and requirements. Over time, this promotes efficiency and can make businesses more profitable.

The overall benefits of trading water:

- Helps water users see the value of their water as a secure asset and obtain finance against its value.
- Encourages water-use efficiency by saving water to enable entitlement holders to sell or seasonally assign spare water.
- Enables business owners to sell their water without selling their land.
- Enables users to increase water supplies and improve the reliability of current allocations, and to switch to an alternative use of the water that may generate higher returns.
- Enables new industries to acquire water without jeopardising the environment or affecting other water users.

Over the last five water years, there has been 7 trades of unsupplemented water allocation trades in the Endeavour Water Management Area. No water trades (permanent nor temporary) of water allocations occurred in any other parts of the water plan area.

Part, or all, of a water licence in the water plan area can be seasonally assigned within zones subject to assessment. These zones include both underground water licence zones (Elderslie, Unbelievable, Helenvale, Carol Crossing, Lakeland water licence zone 1, and Lakeland water licence zone 2) and surface water licence zones (Mclvor, East Normanby, Laura, West Normanby, Bullhead).

The water management protocol sets out rules for seasonal water assignment. Permanent unsupplemented surface water allocation trades are available on the Market information Business Queensland website or via the following link: [Market information | Business Queensland](#).

There have been 4 seasonal water assignments since the plan the commenced as shown in Table 3, and no water licence relocations. Within the Cook Underground Water Management Area 303ML of water was seasonal assigned during the 2022 and 2023 water years, specifically in the Cook Unzoned Area and the Lakeland water licence zone 2.

Table 3: Seasonal water assignments 2022/2023 water years

Issue date	Volume (ML)	Management Group	Location
21/04/2022	3	Cook Underground Water Management Area	Cook Unzoned Area
02/06/2022	100	Cook Underground Water Management Area	Lakeland Water Licence Zone 2
01/02/2022	50	Cook Underground Water Management Area	Lakeland Water Licence Zone 2
01/12/2022	150	Cook Underground Water Management Area	Lakeland Water Licence Zone 2

Source: Business QLD Daily seasonal water assignment information Power BI

5.4 Entitlements granted from the unallocated water (UAW) reserve

The plan reserves volumes of UAW held in the CYPHA, strategic and general reserves to meet the potential future water demands over the lifetime of the plan. Total amounts of UAW currently held in the reserves are shown in Table 4.

Table 4: Total amounts of UAW currently held in a reserve

Type of reserve	Total Volumes (ML)
CYPHA reserve	457,820
Strategic reserve	25,000
General reserve	6,050

Since the plan commencement, there have been several releases of UAW across the plan area, all of which have been from the CYPHA reserve. Table 5 shows data for the release processes that have been completed to date from the CYPHA reserve.

Table 5: Completed UAW release processes for the plan area¹

Year of Release	Reserve	Area	Volume available for release (ML)	Volume granted (ML)
2021	CYPHA	Coleman	56,000	4,803
2021	CYPHA	Endeavor	16,000	3,748
2021	CYPHA	Normanby	16,000	927

¹ Volume available for release' refers to the amount of volume released during the process. 'Volume granted' refers to the amount of water granted during the release, which was less than the volume available due to either there being insufficient interest or applicants were unable to meet the criteria for purchase of the water.

The CYPHA UAW reserve can be granted to eligible persons (including an entity that holds Aboriginal freehold land or a native title holder such as a registered native title body corporate). The granted CYPHA UAW reserve can then be used by and/or leased to a third party, thereby providing a range of social and economic opportunities for First Nations peoples. The volumes of CYPHA reserves for each catchment are provided in Appendix B-2.

Known demand for current active projects seeking to access water from the strategic reserve is more than 15,000ML. The projects include mining activities in Embley and Jeanie catchments, and proposed expansion of irrigated agriculture in the Lakeland area.

There have been no releases to date from the General Reserve.

Interested parties can register their interest in UAW at any time. However, any person that requires access to water must investigate options for UAW from the CYPHA reserve where available in their respective catchment before seeking access to other UAW reserves.

5.5 Water taken or interfered with under statutory authorisations

The Water Act (sections 93 to 103) allows water to be taken or interfered with without an entitlement for certain purposes such as stock or domestic take and other low risk activities. The volume of water taken under a statutory authorisation is not required to be measured. This makes an accurate quantitative assessment difficult. However, by identifying broad trends in consumptive water use behaviour, it is possible to infer whether these trends are at risk of affecting existing water users' access to water or are a risk to the environment.

Appendix C provides an assessment of the risk to water users and the environment from the use of water under statutory authorisations. The assessment shows that take is unlikely to have changed significantly over the life of the plan.

6. Research and monitoring findings for the water plan

The water planning framework is supported by water monitoring activities, including monitoring of the quantity and quality of surface water and underground water systems across Queensland. Together with targeted ecological monitoring for water plans, this information is vital for continued improvement of water planning.

The Environmental Flows Assessment Program (EFAP) undertakes ecological monitoring to assess the effectiveness of each water plan in achieving its stated ecological outcomes. Ecological assets with critical links to flow that represent the plan ecological outcomes, and the various aspects of the flow regime, are selected as indicators of the broader ecosystem for monitoring. Information collected by EFAP is used by the Department of Environment, Science, and Innovation (DESI; formerly DES) to assess the effectiveness of the plan in achieving ecological outcomes, using a risk assessment approach (Marshall and McGregor, 2006).

6.1 Summary of ecological monitoring

Ecological monitoring relevant to environmental outcomes of the plan has been conducted by the department, other government agencies and external researchers. The 15 river basins that encompass the water plan area contain a diverse array of freshwater habitats (Cook et al, 2011). Appendix G summarises monitoring conducted within the water plan area from 2019-2023 for each environmental outcome stated in the plan.

The work conducted by the department in the water plan area has been guided by a Monitoring, Evaluation, Reporting Strategy (MERS) for environmental outcomes in the water plan area, and the flow threats assessment completed by DES (2018). The MERS identifies nodes where risk to flow regimes currently occur, or may occur in the future, and the ecological assets and outcomes at risk. Development of a MERS was a statutory requirement of the plan. The threats assessment by DES (2018) identified risks to no flow and low flow regimes in the Normanby basin (three nodes), Annan River (three nodes), Endeavour River (two nodes) and Gap-Russell Creek (one node). Threats to high flow regimes are limited to Norman Creek and the Coleman River.

Ecological monitoring by the department during the life of the plan has focussed on the Endeavour Water Management Area (Endeavour-Annan-Gap Creek), with particular emphasis on characterising fish fauna, riffle habitats and waterhole persistence. This information will be used by DESI to determine whether relevant outcomes of the plan are being achieved at plan review. The department has also investigated the ecological values of springs in the Lakeland district, south of Cooktown. Numerous springs in this area have been dammed due to the low availability of surface water. Consequently, these spring flows do not contribute to river flows in the Laura River, with impacts on downstream areas such as Crocodile Waterhole. This waterhole is downstream of the Laura River, downstream of Lakeland and has high ecological and cultural values. Departmental staff determined the bathymetry and volume of the waterhole (43.8ML) and collected data on waterhole recession rates to inform persistence estimates. It is possible that capture of spring flows at Lakeland has reduced inputs to the waterhole.

The water plan area contains 24 wetlands listed in the Directory of Important Wetlands of Australia (DIWA, DES, 2018). No research on these wetlands has been conducted during the life of the plan but work by the National Environment Science Program (NESP) in the southern Gulf is relevant to the DIWAs in the water plan area (see Appendix G). Further work on the hydro-ecological requirements of these systems is needed to inform potential future UAW releases in the water plan area.

The Reef 2050 Long-Term Sustainability Plan 2021-25 describes a long-term strategy to protect and manage the health and resilience of the GBR, with the goal of achieving end of basin water quality objectives by 2025 (DES, 2019). Several programs support implementation of the strategy, including the Reef 2050 Water Quality Improvement Plan 2017-2022 and the Paddock to Reef program. The GBR Marine Monitoring Program (MMP) supports the Paddock to Reef program. The MMP has three components – inshore water quality, coral and seagrass (<https://www2.gbrmpa.gov.au/our-work/programs-and-projects/marine-monitoring-program>). The water quality program assesses annual condition and long-term trends. There is currently insufficient data for the water plan area to assess long term water quality trends. Water quality monitoring within the water plan area includes the Pascoe, Stewart, Normanby-Kennedy, and Endeavour-Annan Rivers (Moran et al, 2023). The annual index is a combination of scores for three indicators – water clarity, productivity (chlorophyll-a and oxides of nitrogen) and particulate nutrients (combined scores of particulate nitrogen and phosphorus). The long term water quality score also includes a combination of scores for water clarity, chlorophyll-a,

oxides of nitrogen, particulate N and P

(<https://app.powerbi.com/view?r=eyJrIjoiaWVhZjE2LTM5MjQ0NGY4Ni04MDgxLTRlMWRkMTc2YjgzNiJ9>).

Sharks and Rays Australia (SARA) have commenced a sawfish-tracking program in Lakefield (Rinyirru) National Park, Normanby River in conjunction with Traditional Owners. Freshwater whiprays are also being targeted (<https://www.sharksandraysaustralia.com/expeditions/>).

Despite the volume of research conducted or underway in the water plan area, several significant knowledge gaps remain. The distribution of aquatic plants and animals within the water plan area, and their flow requirements, are still poorly known. Local (plan-specific) research to define eco-hydraulic rules for specific fish species and improve accuracy by incorporating locally relevant life history and catch data is needed, particularly to inform future releases of UAW in the water plan area. Environmental values of freshwater habitats in the water plan area need further investigation.

Most research and monitoring to date has focussed on eastern Cape rivers. Research in the southern Gulf by NESP is relevant to western Cape rivers, but targeted investigation of western Cape rivers such as the Holroyd and Coleman Rivers is required. This is particularly required given the large volumes of UAW available in these catchments (68,500 and 56,000ML respectively in the CYPHA reserve).

A further significant knowledge gap is the groundwater dependence of ecosystems and their biota, which remains poorly understood. Quantifying groundwater extraction, particularly from aquifers linked to dependent ecosystems, would support enhance risk assessment associated with water resource development. Further method development is needed to better assess surface water-groundwater interactions and connections between groundwater, dependent ecosystems, and biota.

6.2 Summary of water monitoring

The department manages, operates, and maintains 17 stream gauging stations in the water plan area. Streamflow measurements are an integral part of producing volumetric data at gauging stations, and measurements are taken throughout a full range of low and high flow conditions to enable derivation of accurate streamflow volumes.

The Cape York water plan manages underground water in two groundwater management areas, the Cook underground water management area and the Cape York underground water management area. There are 12 monitoring bores across the water plan area. These bores provide data that assist in improving hydrological understanding for the water plan area, including the understanding of surface water and underground water interaction. Water monitoring data can be accessed online at the [water monitoring portal](#).

7. Social and economic assessment

The Cape York water plan supports growth in population and industries and aims to maintain flows that support water-related social and economic values in the water plan area. The water plan area is sparsely populated with no major urban centres. The largest settlements are Weipa, Cooktown, and Aurukun. Data from the 2021 census was sourced from the Australian Bureau of Statistics and Queensland Government Statistician's Office to assess whether there were any significant changes in population rate or industry as fluctuations in these variables could indicate a change in water demand. The data was grouped using the Statistical Area, Level 2 (SA2) spatial extents of local government areas within in the water plan area. It is important to note that these SA2 boundaries are not consistent with the Cape York water plan boundaries and overlaps between the two exist however this socio-economic assessment is still expected to reflect the socio-economic status of the water plan area.

7.1 Population trends

The estimated population of the water plan area as of June 2022 was approximately 16,500 people with around 49% of the population identifying as Aboriginal or Torres Strait Islander. Over the past five years, the population has remained steady, experiencing a growth rate of 0.1% per year since 2017. The population of the water plan area is projected to increase to 16,919 people by 2026.

7.2 Economic profile

According to the ABS (2023), the top three industries for employment in the water plan area are mining (17.4%), health care and social assistance (13.6%) and public administration and safety (12.6%). Agriculture is an important driver in the economy of the water plan area particularly in the Lakeland and Cooktown areas. The primary agricultural products of the region are bananas, cereal crops, and livestock production (Balmoral Group Australia, 2023).

The water plan area is also host to several significant mining operations, with most mining sites located around the Weipa area. Minerals mined in the water plan area include bauxite, silica, and tungsten. Over 1,000 people are employed by the mining industry in the water plan area (ABS, 2023).

7.3 Land use

The water plan area is in a remote, relatively isolated region of predominantly rural nature with little land development (DES, 2021). The primary land use for the water plan area is conservation and natural environments, covering 6.6 million hectares of land. Other uses include production from dryland agriculture and plantations, production from irrigated agricultural and plantations, production from relatively natural environments, water use and intensive uses. Intensive uses include areas such as mining, intensive horticulture animal production. Land used for horticultural production totals 5,467 hectares, whilst land used for irrigated agriculture totals 3,379 hectares. 398,518 hectares of land is under mining leases.

8. Cultural values assessment

The Cape York water plan includes outcomes relating to supporting water related cultural, spiritual, and social values, to support the economic and social aspirations of First Nations peoples and to recognise the and respect their connection to water under sections 17(1)(e), 18(c) and 19. The established CYPHA reserve provides ongoing access to water for Aboriginal people and Torres Strait Islanders peoples to support their economic aspirations.

The department is also partnering with the Cooperative Research Centre for developing Northern Australia’s project “Activating Indigenous Peoples Water Rights Under the Cape York Water Plan”, which will facilitate the integration of knowledge about Aboriginal tradition, Island custom and science into the processes for making decisions about the future management, allocation, and use of water in the water plan area. Further, the department has established a First Nations engagement team and is developing a First Nations water strategy from 2024.

A cultural values assessment and consultation with First Nations peoples, will be undertaken by the department to further improve our understanding of their cultural values, aspirations and water uses to underpin the plan review and replacement.

9. Climate change assessment

The Queensland Government is committed to incorporating the best available science on climate change into water planning activities. The department aims to build a shared understanding with the community of the risk that projected climate change may pose to future availability of water resources, helping water users and businesses better manage the risk from an increasingly variable and extreme climate. This section outlines climate change trends in the water plan area over the reporting period (2019-2024) and provides an outlook of the anticipated future climate change patterns (climate change projections).

9.1 Recent climate variation in the water plan area

The climate events of most concern are those that reduce the availability and reliability of water supplies, including the occurrence of prolonged dry periods (droughts). The key climate variables are rainfall, temperature and evaporation, and their variability on daily, monthly, seasonal, and annual timescales.

Figures 2 through 4 show the average daily temperature, annual potential evapotranspiration, and annual rainfall for the Cape York catchments (Vitkovsky, 2023). The temperature shows a moderate increase since the commencement of the Cape York water plan, whereas the rate of evapotranspiration is generally similar to the preplan period. Recent rainfall has shown a slight increase compared to the long-term average.

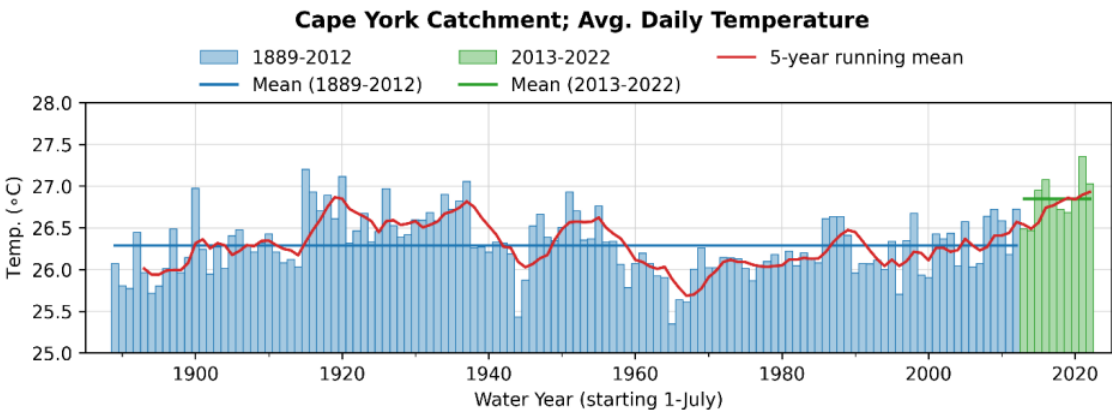


Figure 2: Cape York average daily temperature

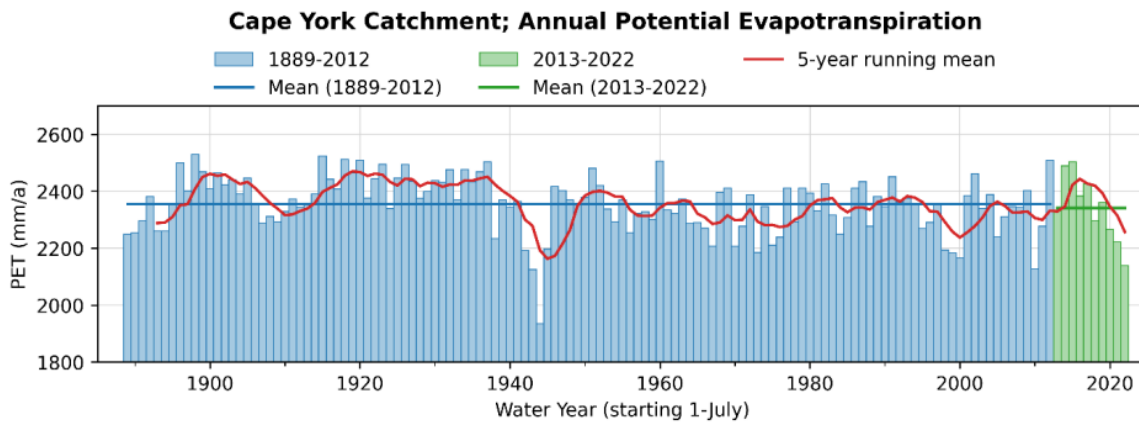


Figure 3: Cape York annual potential evapotranspiration

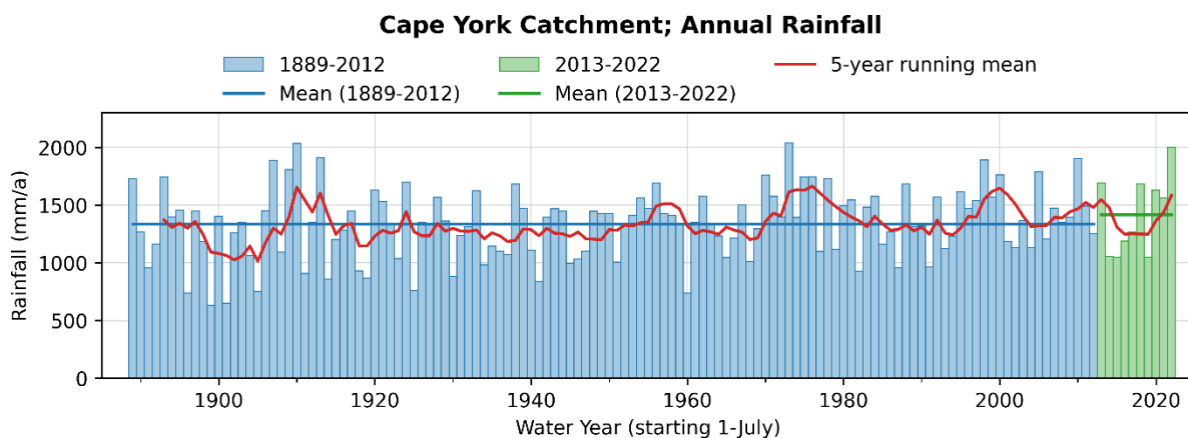


Figure 4: Cape York annual rainfall

9.2 Climate change projections for the water plan area

The climate is changing primarily because increasing amounts of greenhouse gases (GHG) in the atmosphere are trapping heat, warming the air and oceans. An assessment of the climate change projections for the Gulf water plan catchments was undertaken by DES to inform this report (DES, 2022). To determine the potential climate changes in the plan area, DES used global climate models to simulate the Earth's climate system.

9.2.1 Overview of assessment approach

General Circulation Models (GCM) were used to produce projections of climate variables such as average daily temperatures, annual potential evapotranspiration, and annual rainfall. The GCMs were sourced from the Coupled Model Intercomparison Project, phase 5 of the Intergovernmental Panel on Climate Change (IPCC), Assessment Report 5 (WCRP, 2022). The GCMs consider a trajectory of GHG emissions using numerous scenarios. Emission scenarios chosen for this assessment are Representative Concentration Pathway (RCP) 4.5 and RCP 8.5.

RCP 4.5 represents a future scenario of moderate GHG emissions where action is taken to reduce greenhouse gas emissions (for example, by way of technologies and strategies) resulting in a peak of emissions around 2040 and then followed by a decline.

RCP 8.5 represents a future scenario of continued very high GHG emissions where emissions continue to rise throughout the 21st century.

It is important to note that climate models are simulations of possible future outcomes depending on a range of assumptions. As such, these models are not perfect replicas of reality, but “what if” representations of possible real-life situations. All models have some degree of scientific uncertainty.

9.2.2 Overview of projected changes

Prior to considering possible future climate change events, it is useful to review historical climatic data to understand what has occurred climatically in the past, especially since the plan was first implemented. A time-of-emergence analysis was used on climate variables (e.g., air temperature, sea level, rainfall) to help identify the time when climate change may have caused local conditions to deviate from past conditions. The time-of-emergence analysis identifies when the signal of the variable emerges from the background “noise”, thereby reflecting the onset of change (Walker et al, 2022). The results of the time-of-emergence analyses undertaken for the water plan area indicates the historical temperature range is moderate and a temperature increase is weakly identified in the 2010s (Figure 5). The orange shading represents the time the signal emerged by one standard deviation. There was no emergence for annual evapotranspiration (Figure 6) or annual rainfall (Figure 7).

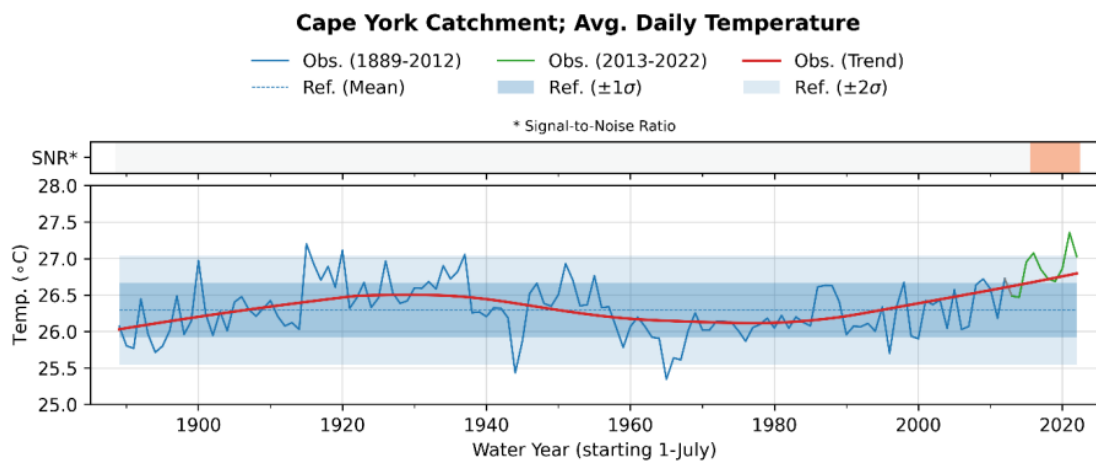


Figure 5: Time of emergence analyses: average daily temperature

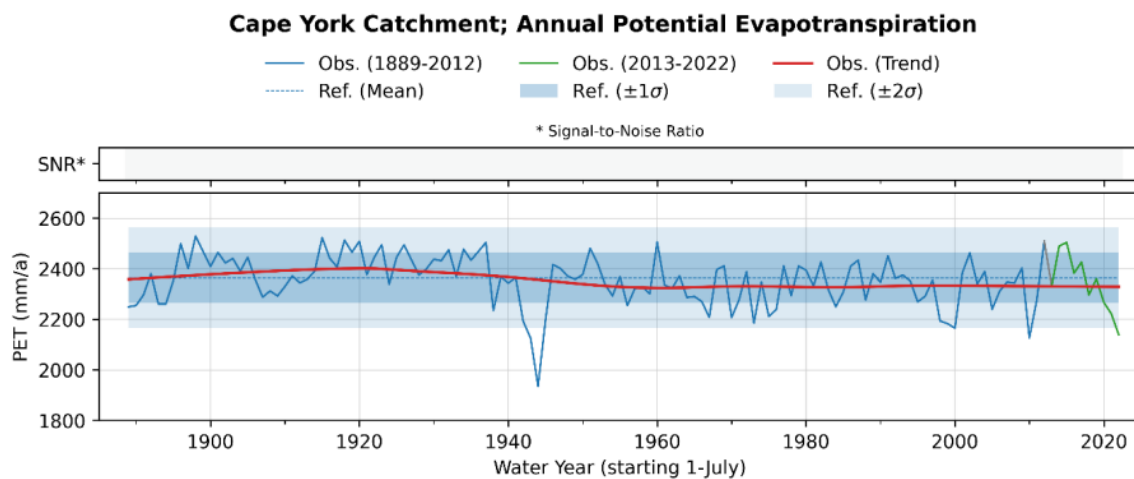


Figure 6: Time of emergence analyses: potential evapotranspiration

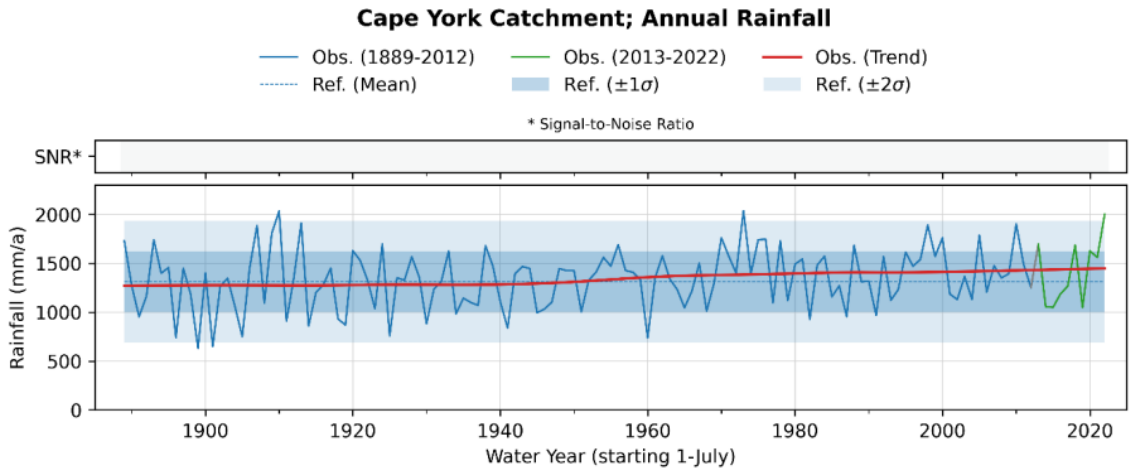


Figure 7: Time of emergence analyses: annual rainfall

Climate projections at the catchment scale using the GCMs are presented below. Temperature projections show an increase with the two scenarios diverging around 2030, suggesting an inevitable temperature rise (Figure 8). This temperature rise is accompanied by a corresponding increase in potential evapotranspiration throughout the catchment (Figure 9). In terms of annual rainfall, there is a slight downward trend amidst considerable uncertainty (Figure 10). The shaded coloured bands represent the uncertainties in the model structures. Notably, the observed climate in recent years aligns with the projected data. Furthermore, the projected rainfall in Queensland is uncertain as is common throughout the state.

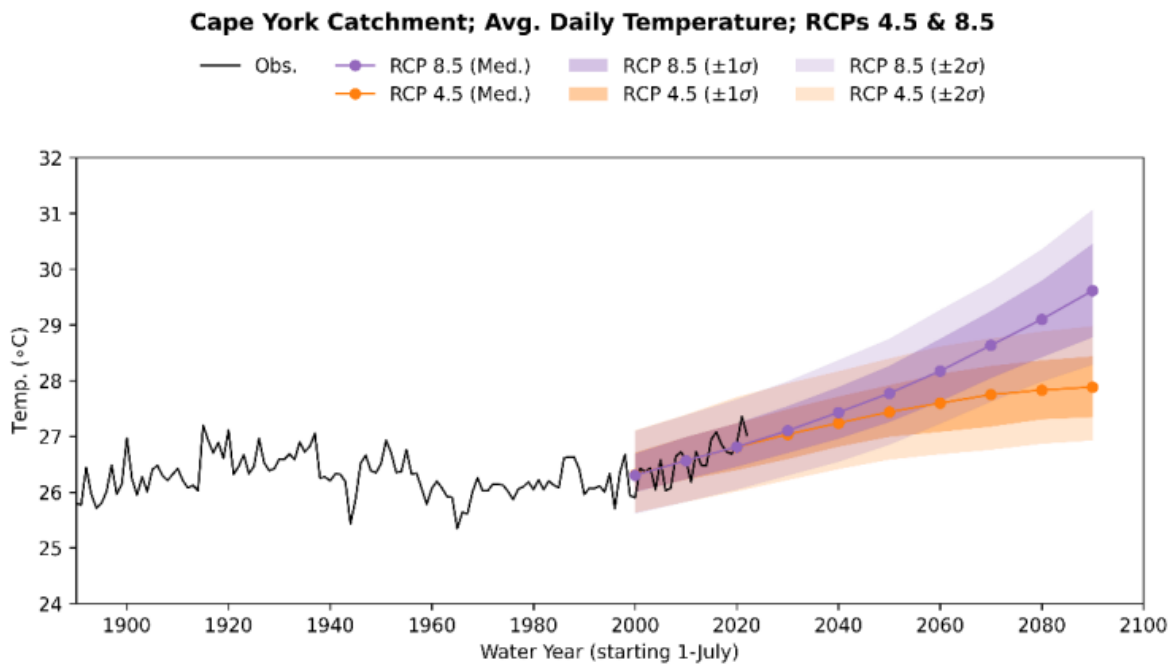


Figure 8: Observed and projected catchment average annual climate: average daily temperature

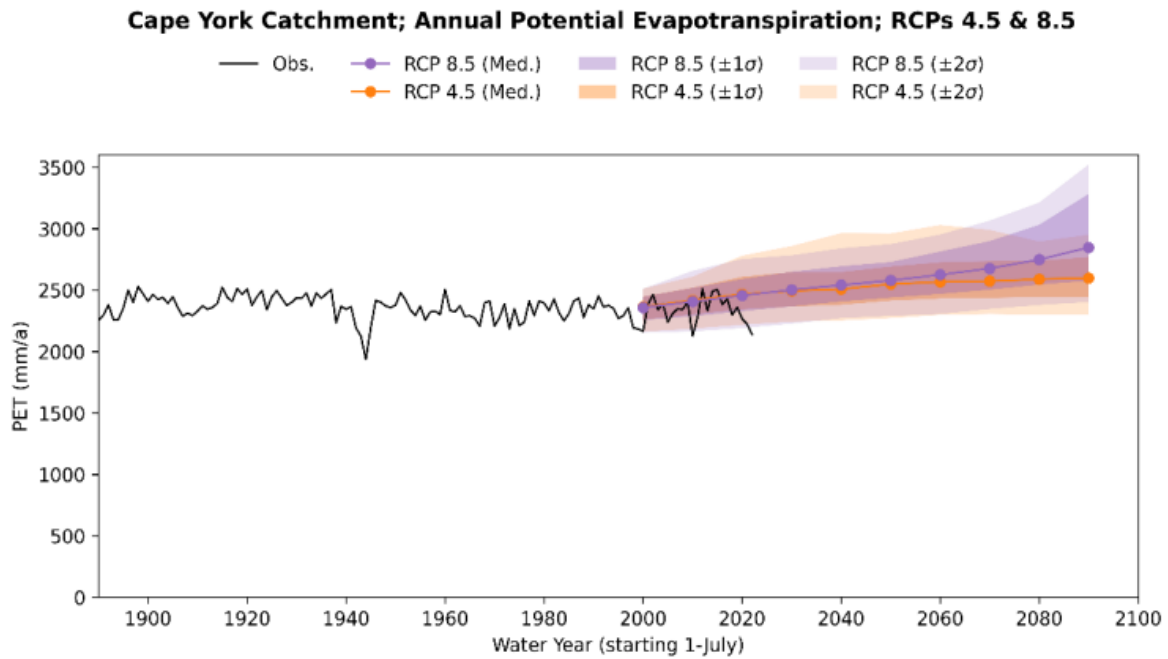


Figure 9: Observed and projected catchment average annual climate: annual potential evapotranspiration

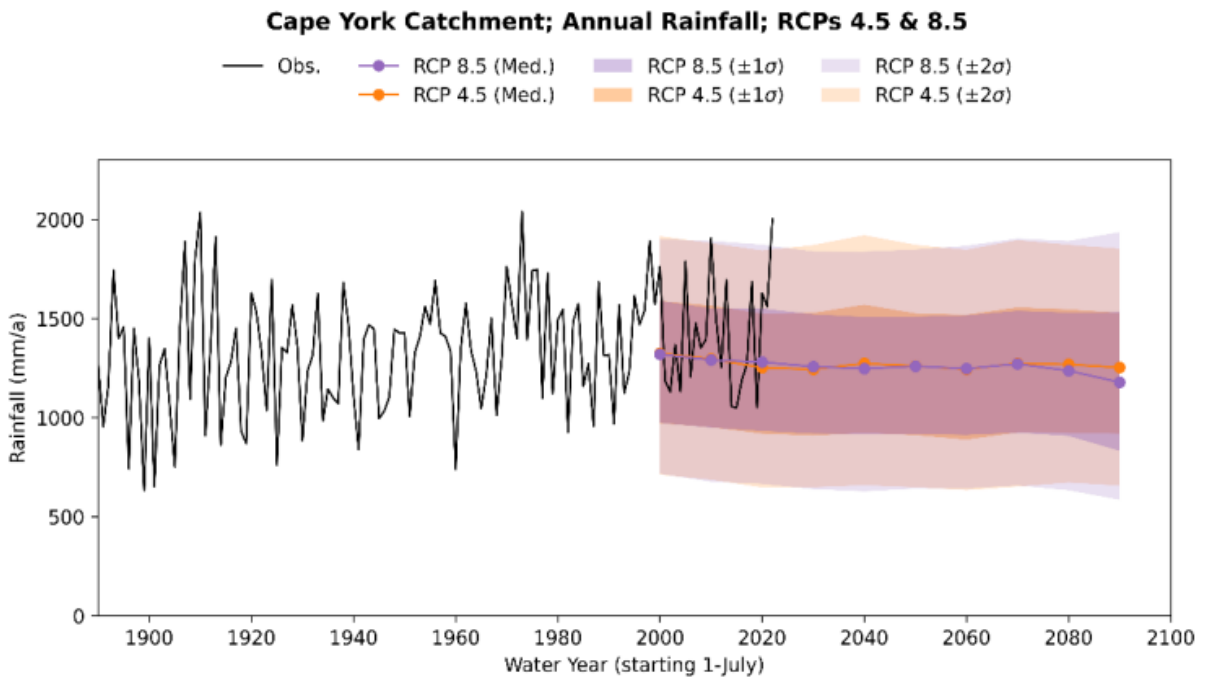


Figure 10: Observed and projected catchment average annual climate: annual rainfall

Projections were also undertaken to investigate seasonal changes in climate variables. Projections indicate a general increase in both temperature and potential evapotranspiration across all months. The monthly rainfall has more variability, but it is trending towards a small increase in dry season months for both projections and a decrease in the summer month. These anticipated changes are expected to lead to lower annual rainfall totals in the water plan area, thereby impacting the generation of streamflow from the catchment. It's worth noting that the water plan area historically experiences high levels of rainfall.

Finally, climate change analysis is an evolving field with new understandings, models and syntheses published regularly. The information presented in this brief represents the best understanding at the time and is subject to change as new science becomes available.

10. Water plan amendments and previous reports

There have been no amendments to the water plan or water management protocol since the plan commenced in 2019. The major milestones are detailed in Appendix D.

11. Identification of potential risks to the water plan's outcomes

In December 2023, a risk assessment was undertaken to identify any potential risks to the Cape York water plan's outcomes that could emerge within the lifetime of the plan (Appendix A). An analysis of changes in the water plan area over and beyond the life of the plan was used to identify future water demands, any potential risks, and emerging matters. Data and expert opinion were used to rank the likelihood and consequence of risk from a standardised list of threats, and the risk level and rationale for this ranking were documented. Under this assessment framework, the level of risk, along with other factors, such as a water plan's ability to achieve its outcomes were considered in proposing appropriate actions to mitigate the risks.

Of the 24 water plan outcomes assessed, two outcomes were ranked as medium risk and the remaining 22 were ranked as low risk.

One outcome identified as medium risk relates to the ability of the plan to facilitate economic development through the growth and expansion of industries dependant on water resources in the water plan area. It is expected there will be increased growth in mineral development over the remaining life of the plan. The [Queensland Critical Mineral Strategy](#) highlights the importance of critical minerals for Queensland's future sustainable economic prosperity – to mine and process mineral and manufacture the renewable technologies needed for the clean energy industrial revolution. The water plan area is well known for its production of bauxite and silica.

12. Opportunities and emerging matters

The risk assessment underpinning this report identified matters potentially emerging over or beyond the lifetime of the current Cape York water plan that should be considered under the water plan's framework. These include:

- The need to engage and consult with Aboriginal People and Torres Strait Islanders to support the ability of the plan to meet their economic and social aspirations. James Cook University has commenced a project that will partner with stakeholders (including the department) to build capacity of eligible persons who can hold a CYPHA water licence to know their rights and manage dealings either for their own cultural, economic, or social needs or those of third parties seeking to access this water on a temporary basis. Additionally, engagement with Aboriginal People and Torres Strait Islanders about the ability of the plan to meet their cultural, economic, and social needs can be undertaken as part of future UAW releases.
- The need to consider growing interest and water demand for emerging critical minerals developments and the associated impact on all water uses and values across the water plan area, including the environment. Silica has been designated a critical mineral under the Queensland Government's Critical Mineral Strategy. The department is aware of two

proposed silica mine projects in the Jeannie catchment around Cape Flattery that are seeking to access water from the Strategic reserve. The department will continue to work with these proponents to assist with their water needs.

- Consideration of climate change impacts on water availability in the water plan area. Scientific modelling projections conducted by the Queensland Government forecast an increase in temperature and evapotranspiration. These changes may result in similar overall annual rainfall totals, trending towards small increases in rainfall in the summer months and small decreases in the dry season. Changes in climate may lead to increases in consumption and losses from storages and watercourses and reduced persistence of waterholes through time.

It is proposed that these matters be monitored over the remaining five years of the plan and be considered as part of the next plan review process, noting that the Cape York water plan can be replaced earlier if required. The learnings gained from implementing the existing plan to date will be used to make improvements as part of an adaptive management cycle based on revised future water needs, enhanced scientific information, and targeted stakeholder engagement.

There is an ongoing process for including the Cape York Peninsula on Australia's World Heritage Tentative List. This is the first step in the pathway for World Heritage listing for the area. Consultation and engagement with First Nations peoples who are interested in including their Country in a Tentative List submission is ongoing with both the Queensland (DESI) and Federal governments. If successful, the process from inclusion on Australia's World Heritage Tentative List to successful inscription on the World Heritage List is likely to take several years. Any implications for water management would need to be addressed in a future plan review.

The department is aware of projects in the water plan area that would require UAW. One such project is the Lakeland Irrigation Scheme, which aims to expand irrigated agriculture in the Lakeland region, improving water access and reliability. This project has been identified as a key infrastructure project under the Federal Government's Tropical North Queensland Economic Development Strategy. The strategy identifies key priority development areas and infrastructure projects to strengthen economic, social, environmental, and cultural outcomes to help facilitate a strong, connected, economically prosperous and resilient regional Australia. UAW is available in the plan and the department will continue to assist proponents with their water needs.

13. Any non-compliance under a water entitlement or other authorisation in the water plan area

Over the past five years, there have been 30 non-compliance incidents, 12 of which were resolved without any compliance actions taken. Appendix E provides details on the number and type of alleged non-compliance incidents and the outcome of departmental investigations and compliance response that occurred over the reporting period (2018/19–2022/23 water years).

The department uses a range of methods to monitor for compliance against entitlements including field and desktop audits, metering and third-party notification. These activities support public confidence in how water is managed and protects the rights of all entitlement holders and the broader community.

To ensure the State's water resources are managed fairly and responsibly the department has developed a [Regulatory Strategy Water Resource Management – Water 2022 – 2024](#) that establishes a regulatory approach for the delivery of regulatory functions and activities. The strategy explains the principles underlying the regulatory approach, the tools utilised and compliance and enforcement pathway. The objectives and principles set out in the Regulatory Strategy sets the foundation for annual compliance planning.

The department's [Water Resource Management Annual Compliance Plan \(rdmw.qld.gov.au\)](#) identifies activities that support the department's compliance approach, including compliance outcomes,

performance measures, focus areas, activities, targets and measures. The compliance plan supports the department to take a risk-based, transparent and consistent approach to how we regulate Queensland's water resources.

In addition, the work being done under the [Rural Water Futures | Department of Regional Development, Manufacturing and Water \(rdmw.qld.gov.au\)](https://rdmw.qld.gov.au) will support improved compliance outcomes. Further information on the Rural Water Futures program and its initiatives can be found on the department's website.

14. Way forward

This assessment shows the Cape York water plan continues to be fit for purpose and there are no high risks to the achievement of the outcomes within its scheduled timeframe. The Cape York water plan is therefore expected to continue to be effective in advancing the sustainable management of water resources and minimise the adverse impacts on existing water entitlement holders and natural ecosystems in the water plan area.

The identified risks and emerging issues identified in the report may impact the Cape York water plan's continued effectiveness in the future. The emerging issues highlight the need for continued engagement of First Nations people in the management and allocation of water in the water plan area. Engagement with First Nations people can also be undertaken to seek greater uptake of CYPHA UAW reserves and facilitate economic, social, and cultural aspirations.

The Cape York water plan is due to expire on 1 September 2029. The department will continue to implement and monitor the Cape York water plan over the next five-year reporting period. The learnings gained through implementing the Cape York water plan will be used to re-evaluate the effectiveness of the plan prior to its expiry and determine if the plan can be extended.

15. References

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Appendix A Assessment of water plan outcomes

Table 6: Risk assessment for general and social outcomes in the plan

Plan outcome	Plan strategies that provide for outcomes	Water Management Protocol (WMP) rules that provide for outcomes	Qualitative risk ranking and assessment of outcomes
17 (1) The economic water plan outcomes for this plan are:			
(i) to maintain the probability of being able to take water to which this plan applies under an authorisation	<p>Performance indicators such as EFOs and Water Allocation Security Objectives (WASOs) are defined in the plan.</p> <p>The plan provides waterhole protections through limitations on interference with water, EFOs and performance indicators.</p> <p>The plan provides a framework to support water trading.</p> <p>Plan provides processes for dealing with UAW.</p>	<p>The protocol provides a process for the release of specified UAW reserves.</p> <p>The protocol specifies water sharing rules for water allocations in the Endeavour water management area.</p> <p>The protocol outlines the rules for water trading in the plan area.</p> <p>The protocol provides a monitoring and reporting strategy to support the assessment of the effectiveness of the plan and its implementation.</p>	<p>Medium risk</p> <p>There is limited information regarding existing flows. In areas with an expected increase in mining activities, access to water may be challenging.</p>
(ii) to support the effective and efficient operation of the market in water allocations and relocatable water licences	<p>The plan provides a framework to support water licence trading.</p> <p>Performance indicators such as EFOs and WASOs are defined in the plan.</p> <p>The plan specifies measures that contribute to specific economic and social outcomes.</p>	<p>The protocol provides a process for water trading, relocatable water licences and seasonal water assignments.</p>	<p>Low risk</p> <p>This outcome is being achieved. The plan provides a framework to support water licence trading.</p>
(iii) to facilitate economic development through the growth and expansion of industries dependant in water resources in the plan area	<p>The plan provides a framework to support water licence trading.</p> <p>The plan provides UAW volumes for CYPHA, strategic and general reserves.</p> <p>Performance indicators such as EFOs and WASOs are defined in the plan.</p>	<p>The protocol outlines the rules for water trading in the plan area.</p> <p>The protocol provides a process for the release of specified UAW reserves.</p>	<p>Medium risk</p> <p>UAW is available basin wide but may not be available in specific catchments where development is expected to occur.</p>

(iv) to maintain the availability of water to which this plan applies for industries dependent on water resources in the plan area, including, for example, grazing, irrigated agriculture, mining, fishing, and tourism	The plan provides UAW volumes for CYPHA, strategic and general reserves.	The protocol provides a process for the release of specified UAW reserves.	Low risk This outcome is being achieved. Control measures are effective, including compliance and protection of access to water.
(v) to make water to which this plan applies available to support the economic aspirations of Aboriginal people and Torres Strait Islanders;	The plan provides UAW volumes of CYPHA reserves that can be accessed by eligible persons. The plan provides UAW volumes for CYPHA, strategic and general reserves.	The protocol provides a process for the release of UAW.	Low risk This outcome is being achieved. The CYPHA reserve provides ongoing access to water for Aboriginal people and Torres Strait Islanders peoples to support their economic aspirations. The department is developing a First Nations water strategy from 2024 and has established a First Nations engagement team. Further, the department has partnered with the Cooperative Research Centre for developing Northern Australia in delivering a project titled “Activating Indigenous Peoples Water Rights Under the Cape York Water Plan”.
(vi) to provide a flow regime that supports the suitability of water for industries dependent on water resources in the plan area.	Performance indicators such as EFOs and WASOs are defined in the plan.	N/A	Low risk This outcome is being achieved. Control measures are effective, including compliance and protection of access to water.

18 The social water plan outcomes for this plan are:

(i) to maintain the availability of water to which this plan applies for the supply of urban water to towns and communities dependent on the water resources of the plan area	The water plan provides UAW volumes for the strategic reserve. The plan provides a framework to support water licence trading.	The WMP provides a process for providing UAW.	Low risk This outcome is being achieved. The strategic reserve provides ongoing access to water for urban communities.
(ii) to maintain the flows of water to which this plan applies that support water-related aesthetic, environmental, non-indigenous cultural and recreational values	The plan provides UAW volumes for CYPHA, strategic and general reserves. Performance indicators such as EFOs and Water Allocation Security Objectives (WASOs) are defined in the plan.	The protocol outlines the rules for water trading in the plan area.	

(iii) a flow regime that supports the suitability of water for water-related aesthetic, cultural and recreational values	The plan provides waterhole protections through limitations on interference with water, EFOs and performance indicators.		
(iv) to provide water to which this plan applies for domestic purposes in the plan area	Plan authorises underground water and non-riparian take in selected areas for domestic purposes without the need for entitlements. A water licence is required for stock and domestic take in the Endeavour, Jeannie, and Normanby catchments. Storages for domestic take must not exceed 20ML in the Endeavour, Jeannie, or Normanby catchments. All other catchments are subject to a storage limit of 250ML.	N/A	Low risk This outcome is being achieved. The water plan authorises underground water and non-riparian take in selected areas for domestic purposes. Surface water take for domestic purposes is authorised by the Act.
(v) to make water to which this plan applies available to support the social aspirations of Aboriginal people and Torres Strait Islanders.	The plan provides UAW volumes of CYPHA reserves that can be accessed by eligible persons. The plan specifies measures that contribute to specific economic and social outcomes.	The protocol provides a process for the release of UAW.	Low risk This outcome is being achieved. The CYPHA reserve provides ongoing access to water for Aboriginal people and Torres Strait Islanders peoples to support their social aspirations. The department has partnered with the Cooperative Research Centre for developing Northern Australia in delivering a project titled "Activating Indigenous Peoples Water Rights Under the Cape York Water Plan". This project is intended to support building the capacity of Aboriginal Corporations to access their water licences under the Water Plan and to understand how these licences may be used or leased.

19 The cultural water plan outcomes for this plan are:

<p>(i) to make water to which this plan applies available to support the cultural aspirations of Aboriginal people and Torres Strait Islanders</p>	<p>The plan provides UAW volumes of CYPHA reserves that can be accessed by eligible persons.</p>	<p>The protocol provides a process for the release of UAW.</p>	<p>Low risk</p> <p>This outcome is being achieved. The CYPHA reserve provides ongoing access to water for Aboriginal people and Torres Strait Islanders peoples to support their cultural aspirations.</p> <p>The department is developing a First Nations water strategy from 2024 and has established a First Nations engagement team. Further, the department has partnered with the Cooperative Research Centre for developing Northern Australia in delivering a project titled “Activating Indigenous Peoples Water Rights Under the Cape York Water Plan”.</p>
<p>(ii) to maintain the flows of water to which this plan applies that support the water-related cultural, spiritual, and social values of Aboriginal people and Torres Strait Islanders</p>	<p>The plan provides UAW reserves that maintain 97% of natural surface water flows.</p>	<p>The protocol provides a process for the release of UAW.</p>	<p>Low risk</p> <p>This outcome is being achieved. To meet this outcome, at least 97% of the average flows of freshwater will remain in the system, following total allocation of UAW reserves.</p>
<p>(iii) to support the continuation of the cultural knowledge and practices of Aboriginal people and Torres Strait Islanders that relate to water for future generations</p>	<p>The consultation undertaken in the development of the water plan and its future review support the understanding and communication on cultural knowledge and practices of Aboriginal people and Torres Strait Islanders that relate to water.</p> <p>The plan provides UAW volumes of CYPHA reserves that can be accessed by eligible persons.</p>	<p>The protocol provides a process for the release of UAW.</p>	<p>Low risk</p> <p>This outcome is being achieved. The department is developing a First Nations water strategy from 2024 and has established a First Nations engagement team. Further, the department is supporting the Cooperative Research Centre for developing Northern Australia’s project titled “Activating Indigenous Peoples Water Rights Under the Cape York Water Plan”, which will support the continuation of the cultural knowledge and practices of Aboriginal people and Torres Strait Islanders that relate to water for future generations.</p>
<p>(iv) to recognise and respect the cultural and spiritual connection to water of Aboriginal people and Torres Strait Islanders</p>	<p>The consultation undertaken in the development of the water plan was undertaken in recognition of the cultural and spiritual connection to water of Aboriginal people and Torres Strait</p>	<p>The protocol provides a process for the release of UAW.</p>	<p>Low risk</p> <p>This outcome is being achieved. The department is developing a First Nations water strategy from 2024 and has established a First Nations engagement team. Further,</p>

	<p>Islanders. The future review of the water plan will include further engagement which also will support ongoing recognition of this connection.</p> <p>The plan provides UAW volumes of CYPHA reserves that can be accessed by eligible persons.</p>		<p>the department has partnered with the Cooperative Research Centre for developing Northern Australia in delivering a project titled “Activating Indigenous Peoples Water Rights Under the Cape York Water Plan”.</p>
<p>(v) to engage Aboriginal people and Torres Strait Islanders, as the traditional custodians and owners of land, in the management and allocation of water in the plan area</p>	<p>The consultation undertaken in the development of the water plan and its future review support the ongoing engagement of Aboriginal people and Torres Strait Islanders in the management and allocation of water in the plan area.</p> <p>The plan provides UAW volumes of CYPHA reserves that can be accessed by eligible persons. Engagement for undertaking releases supports this outcome.</p> <p>Interested parties seeking to access UAW must explore options through the CYPHA reserve before the strategic and general reserves.</p>	<p>The protocol provides a process for the release of UAW.</p>	<p>Low risk</p> <p>This outcome is being achieved. The department is developing a First Nations water strategy from 2024 and has established a First Nations engagement team. Further, the department is supporting the Cooperative Research Centre for developing Northern Australia’s project titled “Activating Indigenous Peoples Water Rights Under the Cape York Water Plan”, which will facilitate the engaging of Aboriginal people and Torres Strait Islanders, as the traditional custodians and owners of land, in the management and allocation of water in the plan area.</p>
<p>(vi) integrate knowledge about Aboriginal tradition, Island custom and science into the processes for making decisions about the future management, allocation, and use of water in the plan area.</p>	<p>The consultation undertaken in the development of the water plan and its future review support the ongoing engagement of Aboriginal people and Torres Strait Islanders in the management and allocation of water in the plan area.</p>	<p>N/A</p>	<p>Low risk</p> <p>This outcome is being achieved. The department is developing a First Nations water strategy from 2024 and has established a First Nations engagement team. Further, the department is supporting the Cooperative Research Centre for developing Northern Australia’s project titled “Activating Indigenous Peoples Water Rights Under the Cape York Water Plan”, which will facilitate the integration knowledge about Aboriginal tradition, Island custom and science into the processes for making decisions about the future management, allocation, and use of water in the plan area.</p>

Table 7: Risk assessment to ecological outcomes in the water plan

Plan outcome	Plan strategies and Water Management Protocol rules that provide for outcome	Related ecological assets	Summary of monitoring and assessment	Qualitative risk ranking and preliminary assessment of outcomes
<p>(a) to minimise changes to flows of water, including natural variability of flows, in the plan area that support—</p> <ul style="list-style-type: none"> (i) waterholes as refugia; and (vi) riffle habitats 	<p>The Plan: Performance indicators such as EFOs and WASOs are defined in the plan.</p> <p>The WMP: Outlines the need for chief executive data collection and assessment.</p> <p>Outlines the need data collection and persistence monitoring of waterholes and flows to in the Endeavour water management area and water licence zones for the Normanby and Jeannie catchments.</p>	<p>Waterholes Riffles</p>	<p>The department has assessed riffle habitats in the Endeavour Water Management Area, including Carroll Creek, Annan River, Wallaby Creek, Waterfall Creek and Mungumby Creek. This information will determine whether flow thresholds specified in the Water Management Protocol will maintain suitable flows for riffles during the dry season. An additional site has been surveyed in the Normanby River at Battle Camp and additional surveys are planned for Laura River and Annan River to further support plan review.</p> <p>The department has estimated waterhole volumes at selected sites in the Endeavour Water Management Area. This information will support assessment of flow thresholds for cease to take,</p> <p>The department determined the volume of Crocodile Waterhole on the Laura River downstream of Lakeland. This waterhole has high cultural and ecological values. This information, combined with estimates of water level recession will help determine whether upstream water take has reduced the persistence time of this waterhole.</p>	<p>Low risk This outcome is being achieved.</p>
<p>(a) to minimise changes to flows of water, including natural variability of flows, in the plan area that support—</p> <ul style="list-style-type: none"> (ii) fish spawning, fish movement and fish recruitment; and (v) river-forming processes 	<p>The Plan: Performance indicators such as EFOs and WASOs are defined in the plan.</p> <p>The plan lists matters the chief executive must consider when deciding applications that interfere with water in a watercourse.</p> <p>The WMP:</p>	<p>Migratory fish Stable Low flow Spawning Fish Bankfull discharge</p>	<p>The plan area includes several migratory species of conservation, recreational and commercial significance, such as sawfish, speartooth shark, barramundi, and jungle perch. The department has conducted fish surveys at targeted locations during the life of the life of the plan as part of the Cape York MERS implementation plan.</p> <p>The department has not conducted research to validate bankfull discharge during the life of the plan. As there are few large storages in the plan area it is unlikely that bankfull discharges are being significantly impacted. Bankfull discharges will be determined and validated for plan review</p>	<p>Low risk This outcome is being achieved.</p>

Plan outcome	Plan strategies and Water Management Protocol rules that provide for outcome	Related ecological assets	Summary of monitoring and assessment	Qualitative risk ranking and preliminary assessment of outcomes
	<p>The protocol specifies water sharing rules for water allocations in the Endeavour water management area.</p> <p>The protocol outlines the rules for water trading in the plan area.</p> <p>The protocol provides a monitoring and reporting strategy to support the assessment of the effectiveness of the plan and its implementation.</p>			
<p>(a) to minimise changes to flows of water, including natural variability of flows, in the plan area that support—</p> <p>(iii) floodplain ecosystems; and</p> <p>(iv) wetlands</p>	<p>The Plan:</p> <p>Performance indicators such as EFOs and WASOs are defined in the plan.</p> <p>The WMP:</p> <p>The protocol specifies water sharing rules for water allocations in the Endeavour water management area.</p> <p>The protocol outlines the rules for water trading in the plan area</p>	<p>Floodplains</p> <p>Wetland</p>	<p>The department has not conducted monitoring relevant to these outcomes during the life of the plan. Flows capable of inundating floodplains have not been impeded by the construction of water infrastructure in the plan area.</p> <p>The plan area includes 24 wetlands listed in the Directory of Important Wetlands of Australia (DIWA). Future unallocated water releases will need to consider the flow requirements and environmental values of these wetlands.</p>	<p>Low risk</p> <p>This outcome is being achieved.</p>
<p>(a) to minimise changes to flows of water, including natural variability of flows, in the plan area that support—</p> <p>(vii) environmental values and water quality objectives established under the Environmental Protection (Water and Wetland Biodiversity)</p>	<p>The Plan:</p> <p>The plan specifies UAW volumes in each catchment.</p> <p>Overland flow is regulated across the plan area.</p> <p>The WMP:</p> <p>The protocol requires consideration of water quality aspects when making decisions on UAW and water licences.</p>	<p>All assets</p> <p>Water quality</p>	<p>Environmental values for water are qualities that make it suitable for supporting aquatic ecosystems and human water uses (DESI 2024). Environmental values have been established for Basins 101-107 on the eastern Cape (DES 2020a,b,c), but rivers on the western Cape have not been evaluated. All tidal and non-tidal waters, including wetlands, lakes, and groundwater, have environmental values (DESI 2024). Aquatic ecosystem health is an environmental value for Queensland waters.</p>	<p>Low risk</p> <p>This outcome is being achieved.</p>

Plan outcome	Plan strategies and Water Management Protocol rules that provide for outcome	Related ecological assets	Summary of monitoring and assessment	Qualitative risk ranking and preliminary assessment of outcomes
Policy 2019 for water in a catchment in the plan area, and water that flows from that catchment to the Great Barrier Reef and the Gulf of Carpentaria	<p>The protocol outlines contents, terms and conditions for water licences granted from any UAW reserves.</p> <p>The protocol specifies a process for authorising the continued take of overland flow water via existing works.</p>		Water quality objectives are stated for various flow bands, which typically include “baseflow” and “event”, with flow triggers established for each category.	
(b) to maintain an underground water regime in the plan area that supports ecosystems dependent on the underground water to which this plan applies	<p>The Plan: Plan specifies defined volumes of access to UAW. Metered take</p> <p>The WMP: Outlines the need for chief executive monitoring of changes in underground water levels for subartesian bores not connected to the Great Artesian Basin</p>	Groundwater-dependent ecosystems Baseflow streams and rivers	<p>During the life of the plan the department has conducted monitoring in the Lakeland district to support the Lakeland Monitoring, Evaluation and Reporting Strategy (MERS). Springs flows that may have contributed to flows in the Laura River have been captured, limiting opportunities to determine environmental values supported by springs.</p> <p>The plan area includes many perennial systems which are baseflow Groundwater-Dependent Ecosystems (GDEs). These include the Jardine River, Archer River, Mclvor River, Isabella Creek, Annan River, and Wallaby Creek.</p> <p>GDEs have not been mapped in the plan area.</p>	<p>Low risk This outcome is being achieved.</p>
<p>(c) to provide a flow regime that—</p> <p>(i) maintains the flow of fresh water from estuaries in the plan area to the marine waters of the Great Barrier Reef and the Gulf of Carpentaria; and</p> <p>(ii) supports productive ecosystems in the receiving waters of the Great Barrier Reef and the Gulf of Carpentaria</p>	<p>The Plan: Performance indicators such as EFOs and WASOs are defined in the plan.</p> <p>The WMP: Outlines the need for chief executive data collection and assessment.</p>	Estuarine productivity represented by banana prawn catch and barramundi year class strength	<p>Monitoring under the Marine Monitoring Program (MMP) indicates that during the life of the plan discharge into the Great Barrier Reef (GBR) lagoon from eastern Cape Rivers has been close to or exceeded the long-term median discharge. Discharge into the GBR from rivers during the 2018-2019 water year was greater than 3 times the long-term median discharge for several rivers. At present, the absence of large storages in the plan area means that freshwater inflows into the GBR lagoon are driven by rainfall and runoff.</p> <p>The QFISH database contains commercial and recreational fisheries catch data. Information in the database will be used to assess this outcome when the plan is reviewed.</p>	<p>Low risk This outcome is being achieved.</p>

Appendix B Water entitlements and use

B-1 Water entitlements

Table 8: Summary of water allocations licences in the water plan area

Water classification	Volume based water allocations		Area based water allocations		Other
	Total Number	Total nominal volume (ML)	Total Number	Total nominal volume (Ha)	Total Number
Surface water	26	2,936.30	-	-	-
Underground water	-	-	-	-	-

Table 9: Summary of water licences to take water in the water plan area

Water classification	Volume based water licences		Area based water licences		Other
	Total Number	Total nominal entitlement (ML)	Total Number	Total nominal entitlement (Ha)	Total Number
Surface water	34	56,394.75	-	-	-
Underground water	75	42,700.98	-	-	-

Table 10: Summary of all water licences to take water per purpose type

Total nominal entitlement (ML)					Number of water licences				
Any	CYPHA	Urban	Stock or Domestic	Relift	Any	CYPHA	Urban	Stock or domestic	Relift
81,466.48	9,479.25	8015.00	10.00	125.00	84	3	15	5	2

B-2 Water use

Table 11: Metered water use in the water plan area

Metered Area	Water Year	Number of metered entitlements	Authorised volume under metered entitlements (ML)	Metered water use (ML)	Water use as a percentage of authorised entitlement (%)
Cape York (Lakeland Zones 1 & 2 only)	2018-2019	6	2,415.00	2,643.31	109.45
	2019-2020	6	2,479.00	2,491.81	100.50
	2020-2021	6	2,479.00	2,774.68	119.93
	2021-2022	6	2,479.00	2,219.69	89.54

B-3 Unallocated water

Table 12: UAW reserves in the water plan area

Reserve name	Purpose	Area	Initial reserve (ML)	Remaining reserve (ML)
General	Any	Plan area	6,050.00	6,050.00
CYPHA	To support economic and social aspirations of Aboriginal people and Torres Strait Islander peoples	Plan area	485,300.00	475,820.75
Strategic	State	Plan area	25,000.00	25,000.00

Table 13: UAW reserved in the water plan area

Catchment	Volume of CYPHA reserve (ML)	Remaining reserve (ML)
Archer	89,000.00	89,000.00
Coleman	56,000.00	51,196.72
Ducie	46,000.00	46,000.00
Embley	8,000.00	8,000.00
Endeavour	16,000.00	12,251.86
Holroyd	68,500.00	68,500.00
Jacky Jacky	1,500.00	1,500.00
Jardine	49,000.00	49,000.00
Jeannie	0.00	0.00
Lockhart	6,300.00	6,300.00
Normanby	16,000.00	15,072.83
Olive-Pascoe	48,000.00	48,000.00
Stewart	5,000.00	5,000.00
Watson	0.00	0.00
Wenlock	76,000.00	76,000.00
Total	485,300.00	475,821.41

Appendix C Water taken or interfered with under statutory authorisations

Table 14: Information on water authorisations in the water plan area

Form of take	Catchment information sources
Authorisations that may not be limited by water planning instrument	
S.93 General authorisations to take water (e.g., firefighting, watering travelling stock)	There have been no major increases in take of water for incidences of firefighting. No known stock routes exist in the plan area.
S.94 General authorisations to interfere with overland flow water or interfere by impoundment for structures used for collecting monitoring data	<p>There was no significant increase in works taking overland flow water in the plan area. Most of the plan area has high reliable annual rainfall producing naturally large volumes of overland flow water, so there is little need for water users to store water.</p> <p>There are no new departmental gauging stations that interfere with water from a watercourse, lake, or spring by impounding for the purpose of collecting monitoring data. Monitoring data is collected at natural controls.</p>
S.95 First Nations parties	No impacts identified under this authority. These activities deal with very low quantities of water, which present a low risk to plan outcomes. The department is not aware of an increase in water take or interference for traditional activities or cultural purposes.
S.96 Landowners may take water for stock or domestic purposes	No impacts identified under this general authorisation. A landholder may take water for stock or domestic purposes from an overland flow dam, or from a watercourse adjoining their land. Stock and domestic dams are self-assessable development.
S.97 Environmental authorities to take or interfere with overland flow	<p>No identified change in water taken under this general authorisation.</p> <p>Notification for the construction of overland flow storages to satisfy an environmental authority or a development permit for carrying out an environmentally relevant activity is required under the Planning Regulation 2017 and Water Regulation 2016. No overland flow dams constructed for these purposes have been notified and recorded in the department's database.</p>
S.98 Resource activities that interfere with the flow of water by diversion of a watercourse	<p>No identified change in interference with watercourses under this general authorisation.</p> <p>The impacts of interference by diversion are assessed through requirements of the Environmental Protection Act 1994.</p>
S.99 Constructing authorities and water service providers	Limited volumes of water are required for road and rail construction and maintenance and public amenities. No significant increase in infrastructure or and amenities has been identified.
Authorisation that may be limited by water planning instrument or regulation	
S.101 Authorisation that may be altered or limited by water planning instrument or regulation.	<p>No impacts identified for water taken under these authorities.</p> <p>s101(1)(a) Prescribed activities: Prescribed activities that would be most utilised are washing down equipment, plant or vehicles, filling spray units to apply herbicides or pesticides. The water plan has set a limit of 5ML for prescribed activities.</p> <p>s101(1)(b) Take of overland flow: Only permitted if the water is taken under a water licence; or the water is taken for stock purposes or domestic purposes; or the water is taken using existing works in the plan area and the take of overland flow water is authorised under the water management protocol; or the water is taken using works, other than existing works,</p> <p>if— (i) the chief executive received a notice about the construction of the works before 31 July 2018; and (ii) if a development approval is required for the works—the development approval is granted on or before 31 December 2021; and (iii) the take of water is authorised under the water management protocol.</p>

Form of take	Catchment information sources
	<p>s101(1)(c) Take of underground water: Only permitted under a water licence or water permit within a groundwater management area, for stock or domestic purposes or for a prescribed activity. Additional water licences may only be granted from UAW.</p> <p>s101(1)(d) Take of water from a dam not on a watercourse: Refer to notes under s101(1)(b) above.</p> <p>s101(3) Take of contaminated agricultural run-off: No development permits have been granted for contaminated agriculture runoff dams in the plan area.</p>
S.102 Authorisations under water plans or regulation	No identified change in water taken under these authorities. The Water Plan has set a limit of 5ML for taking or interfering with water for activities prescribed under a regulation.
S.103 Authorisations to take water for stock or domestic purposes may be limited	No identified change in water taken under these authorities. In the Endeavour, Jeannie, and Normanby catchments water for stock or domestic purposes can only be taken from a location stated on a water licence and in a way authorised under a water licence. For another catchment in the plan area, an owner of land may take water, in any way, from a watercourse, lake or spring in the plan area for stock or domestic purposes.

Appendix D Water plan amendments and milestones

Table 15: Summary of water planning milestones

Effective date	Milestone
7 June 2019	<p>The plan commenced in June 2019 and provides for the allocation and sustainable management of water by:</p> <ul style="list-style-type: none"> • defining the availability of water in the plan area • providing a framework for sustainably managing water and the taking of water • identifying priorities and mechanisms or dealing with future water requirements • providing a framework for establishing water allocations • providing a framework for reversing, where practical, degradation in natural ecosystems • regulating the taking of underground water.
1 September 2019	Amendments made to bring the water plan in line with the Environmental Protection Regulation 2019.
1 September 2029	The water plan is due to expire.

Appendix E Overview of non-compliance by entitlement holders

Table 16: Summary of non-compliance incidents in the water plan area in 2018/19 - 2022/23 water years

Type of alleged non-compliances	Number of alleged non-compliances	Outcome
Contravene licence conditions	5	<ul style="list-style-type: none"> • Two advisory letters were sent. • Two formal warnings were issued. • One incident was referred to Water Licensing for a potential licence amendment.
Take through an unapproved meter	2	<ul style="list-style-type: none"> • One formal warning was issued. • One incident was resolved through receipt of a meter validation certificate.
Non-supply of meter readings	15	<ul style="list-style-type: none"> • One formal warning was issued. • Two penalty infringement notices were issued. • Twelve incidents achieved compliance without taking any formal administrative action.
Excess take under entitlement	4	<ul style="list-style-type: none"> • One advisory letter was sent. • Two penalty infringement notices were issued. • In one incident, prior to resolution, the limitation period expired.
Unauthorised take	4	<ul style="list-style-type: none"> • One advisory letter was sent. • Two formal warnings were issued. • One incident was addressed with verbal education.

Appendix F RDMW gauging stations in the water plan area

Table 17: List of current RDMW gauging stations in the water plan area.

Catchment	Gauging Station Number	Gauging Station
Endeavour	107003A	Annan River at Beesbike
Endeavour	107001B	Endeavour River at Flaggy
Normanby	105001B	Hann River at Sandy Creek
Normanby	105101A	Normanby River at Battle Camp
Normanby	105102A	Laura River at Coal Seam Creek
Normanby	105105A	East Normanby River at Mulligan Highway
Normanby	105107A	Normanby River at Kalpowar Crossing
Stewart	104001A	Stewart River at Telegraph Road
Archer	922001A	Archer River at Telegraph Crossing
Archer	922101B	Coen River at Racecourse
Watson	923001A	Watson River at Jackin Creek
Wenlock	925001A	Wenlock River at Moreton
Olive-Pascoe	102101A	Pascoe River at Fall Creek
Olive-Pascoe	102102A	Pascoe River at Garraway Creek
Ducie	926002A	Dulhunty River at Dougs Pad
Jardine	927001B	Jardine River at Monument

Table 18: List of current RDMW water monitoring bores in the water plan area.

Catchment	Bore Number	Location	Measurable (m)
Endeavour	10700002	Poison Creek Road Bore	Bore Level Ground Water Elevation
Endeavour	10700006	Hopevale Bore	Bore Level Ground Water Elevation
Normanby	10510001	Dawson Road Bore	Bore Level Ground Water Elevation
Normanby	10510002	Hurse Road Bore	Bore Level Ground Water Elevation
Normanby	10510003	Laura Road Bore	Bore Level Ground Water Elevation
Normanby	10510007A	One Mile Creek 7 Bore	Bore Level Ground Water Elevation
Normanby	10510009A	Red Valley 9 Bore	Bore Level Ground Water Elevation
Holroyd Basin	92100001A	Holroyd	Bore Level Ground Water Elevation
Archer	92210001	Oyala Thumotang Bore	Bore Level Ground Water Elevation
Wenlock	92500009	Batavia Downs Bore	Bore Level Ground Water Elevation
Ducie	92600002	Heathlands Bore	Bore Water Level Ground Water Elevation
Ducie	92600003	Bramwell_PDR Bore	Bore Water Level Ground Water Elevation

Appendix G Summary of ecological monitoring

Table 19: Summary of Ecological Monitoring and Research completed across the water plan area from 2019 - 2023

20 (1) Each of the following is an environmental outcome for water in the plan area—	
Ecological Outcomes	Summary of Monitoring and Research
<p>(a) to minimise changes to flows of water, including natural variability of flows, in the plan area that support -</p> <p>(i) waterholes as refugia; and</p>	<p>The intent of this outcome is to maintain the habitat values of refugial waterholes in the plan area. Refugial waterholes are important in intermittent rivers that periodically cease to flow. This outcome relates to no and low flows, which maintain connectivity between waterholes and “top-up” waterhole volume. Following the cessation of flow, waterhole volume falls from evaporation, which can be high in the tropics.</p> <p>Pollard (2021) identified refugial waterholes in the plan area using geographic information systems (GIS) and remote sensing. Thirteen waterholes were prioritised for monitoring, based on persistence values, ease of access, risk from water take and location (i.e. within water licence and water allocation zones). The department (NRAE 2022) completed bathymetric surveys and installed pressure (depth) loggers in four waterholes to determine persistence times. The waterhole with the highest persistence value, Crocodile Waterhole on the West Normanby River, could not be accessed at the time of the bathymetric surveys but would be a critical waterhole for future investigations. DESI will use this data to model waterhole persistence for plan review. Bathymetry will be completed every 10 years, to determine whether waterhole volume changes have occurred, as recommended in the Cape York implementation MERS.</p> <p>The department completed the bathymetry on a second Crocodile Waterhole, a culturally significant waterhole on the Laura River downstream of the Laura water licence zone (NRAE 2022). Depth loggers were installed over two years to obtain a time series of waterhole water level recession. Crocodile Waterhole has a volume of 43.8ML. Traditional owners believe water levels in Crocodile Waterhole had decreased over time due to upstream water use, sedimentation and that water quality had also deteriorated.</p> <p>The department has compared the trigger values for water sharing rules in the Endeavour Water Management (WM) Area with available discharge data (Mackay and Sternberg in prep). The WM area has five zones, three of which have flow triggers for cease to take. Revised flow triggers have been recommended to better protect low flow assets, maintain hydrologic connectivity, and ensure freshwater inflows to the Endeavour River estuary.</p> <p>Implications for flow management</p> <ul style="list-style-type: none"> • At present the refugial value of persistent waterholes is not adversely impacted within the plan area. Risk to this outcome is limited to nodes on Endeavour and Annan River (however, risk may be underestimated in the Normanby catchment). • Cape York water plan has implemented “significant reaches” to protect ecological values of key reaches. For plan review, a significant reach should be considered for the Cape York Water Plan to protect Crocodile Waterhole (Laura River), in addition to waterholes on the Normanby River. • The plan provides some protection to waterholes. For example, the plan allows for restrictions to be placed on licences in unsupplemented reaches regarding take of water from waterholes or lakes. However, there are several knowledge gaps that should be addressed to enhance management of these features to ensure their persistence. • Identification of permanent waterholes is often achieved with satellite imagery, which has limits on the minimum size of waterhole that can be detected. There may be critical permanent waterholes in the plan area in locations where satellite imagery cannot be used to determine permanency, such as in narrow braided channels.

20 (1) Each of the following is an environmental outcome for water in the plan area—

Ecological Outcomes	Summary of Monitoring and Research
	<ul style="list-style-type: none"> Risk to low flow regimes in the Normanby Basin may have been underestimated. In the Lakeland district (the headwaters of the Laura River) many small headwater dams have been constructed, prior to establishment of gauging stations. The threat to low flows regimes may therefore be greater than indicated by DES (2018).
(ii) fish spawning, fish movement and fish recruitment; and	<p>The intent of this outcome is to maintain natural flow regimes that support life cycle processes of native fish in the plan area, including access to spawning and feeding habitats. This outcome relates to multiple aspects of riverine flow regimes, depending on the life history traits and requirements of the species present. The fish fauna of the plan area includes several species that require connectivity over small or large spatial scales, including jungle perch, gudgeons, sawfish, spear-tooth shark, grunTERS, and catfish (e.g. Burrows et al 2009; Ebner and Donaldson 2015; Ebner and Vallance 2016; Dwyer et al 2019).</p> <p>The department has surveyed fish populations at nodes in the plan area where threats to no and low flow regimes have been identified, as part of the implementation strategy for the Cape York MERS. Sites that have been monitored include Endeavour River at Jensens Crossing, Endeavour River (right branch), Normanby River at Battle Camp, McIvor River at Elderslie, and Gap Creek. Information on fish populations will be used at plan review to determine whether connectivity is being maintained to support populations of migratory fish species where flow-related risks occur.</p> <p>There are relatively few large barriers to fish movement in the plan area. Larger barriers include the Annan River Weir at Mt Simon (capacity 400ML) and several dams that support mining operations on the western Cape. The Annan River Weir would be a barrier to fish movement but falls upstream of the weir would also limit movement of fish in the upstream catchment (Hortle and Pearson 1990). It is unknown whether Annan Weir drowns out. Water restrictions commence when the weir stops spilling but the weir has rarely ceased to spill (Bligh Tanner 2022), ensuring that connectivity downstream of the weir is maintained. Other storages in the plan area have been constructed to support bauxite mining on the western Cape (e.g. Tait 2016). For example, Dam C on a tributary of Norman Creek (Watson basin, capacity 10.9GL) was proposed by Rio Tinto to support bauxite mining operations and will alter connectivity regimes with the estuary. A fishway and associated monitoring plan was proposed (Tait 2016). Further dams are possible in the future, further altering connectivity regimes and habitat availability (e.g. Tapplebang Dam to support the Aurukun Bauxite project, Berghuis 2023).</p> <p>Dwyer et al (2019) tracked movement of juvenile speartooth sharks (<i>Glyphis glyphis</i>) in the Wenlock-Ducie system. Movement patterns were used to develop a conservation strategy, based on habitat use and connectivity between habitats. Connectivity throughout estuarine areas is important for this species.</p> <p>Sharks and Rays Australia (SARA) have commenced a sawfish tracking program in Lakefield National Park (https://www.sharksandraysaustralia.com/research/). Information from this program will provide information on flows associated with movement of sawfish in the Normanby River.</p> <p>Numerous small dams have been constructed in the Lakeland district to capture spring flows (NRAE 2020). Several larger dams have been constructed, including Honey Dam on Bullhead Creek (capacity ~ 6,000ML). These dams are not likely to have fishways and are potential barriers to movement for migratory fish species (NRAE 2020). Spring-fed waterways are utilised by migratory fish - a spring at Mt Butcher, to the east of Lakeland, was found to have an eel (<i>Anguilla</i> sp) and several rainbowfish. Eels require connectivity to the Coral Sea for spawning and the location where the eel was observed was approximately 250km from the mouth of the Normanby River. Similarly, the department captured a 700mm barramundi in a waterhole on Ninda Creek, a tributary of the Laura River downstream of Lakeland. The location was approximately 240km from the mouth of the Normanby River.</p>

20 (1) Each of the following is an environmental outcome for water in the plan area—	
Ecological Outcomes	Summary of Monitoring and Research
	<p>Implications for flow management</p> <ul style="list-style-type: none"> At present connectivity is not adversely impacted within the plan area by the presence of large flow-regulating structures. Water sharing rules in the Endeavour WM Zone will ensure dry season connectivity for migratory fish species.
(iii) floodplain ecosystems; and	<p>The intent of this outcome is to maintain overbank flows that support floodplain ecosystems that rely on seasonal or periodic inundation. No monitoring has been undertaken in the plan area to assess this outcome since the plan commenced. At present, risk to high flows is limited to the 1-year ARI (average recurrence interval) flow for Norman Creek end of system (Watson basin) and the Coleman River at King Junction (DES 2018). The 1-year ARI is an in-channel flow for the Coleman River at King Junction and would not impact floodplain inundation, based on data in HYDSTRA. The risk associated with the Coleman River is due to an unallocated water volume of 55,000ML assigned to the Coleman River. The threat to Norman Creek is associated with the proposed Dam C on a tributary of Norman Creek to support bauxite mining (Tait 2016).</p> <p>Implications for flow management</p> <ul style="list-style-type: none"> At present floodplain ecosystems are not at risk from changes from water resource use in the plan area. Future UAW releases will require robust information to support licence conditions. Risk to plan outcomes and assets will depend on the location and volume of any UAW released.
(iv) wetlands; and	<p>The intent of this outcome is to maintain the hydrologic regime of floodplain wetlands, including periods of inundation and connectivity with other habitats. Floodplain wetlands provide habitat for many species within the plan area. This outcome relates to high flows (DES 2018). No monitoring to assess this outcome has been undertaken since plan commencement. At present, risk to high flows is limited to the 1-year ARI (average recurrence interval) at Norman Creek end of system (Watson basin) and at closed gauging station 920002A Coleman River at King Junction (DES 2018). While this flow is unlikely to inundate floodplain wetlands, it could be critical for inundation of wetlands in anabranches. The proposed Dam C on a tributary of Norman Creek may reduce freshwater flows to intertidal wetlands at the mouth of Norman Creek (WetlandInfo).</p> <p>Many of the rivers of the plan area have DIWA-listed wetlands at end of system (DES 2018). The plan area contains 24 DIWA-listed wetlands (DES 2018). The Normanby River has extensive areas of DIWA-listed wetlands, extending almost as far upstream as Battle Camp (WetlandInfo). Freshwater inflows to end of system DIWAs may be critical for maintaining salinity gradients and supporting primary and secondary productivity (e.g. Burford and Faggotter 2021).</p> <p>Implications for flow management</p> <ul style="list-style-type: none"> The plan includes many wetlands listed in the DIWA. Future UAW releases may impact these wetlands, depending on the location of take and the volumes allocated to individual tenderers. UAW releases will require robust information to support licence conditions. Risk to plan outcomes and assets will depend on the location and volume of any UAW released.
(v) river-forming processes; and	<p>The intent of this outcome is to ensure the continuation of flows that maintain channel morphology and geomorphological processes. River-forming processes are associated with medium and high flows.</p>

20 (1) Each of the following is an environmental outcome for water in the plan area—

Ecological Outcomes	Summary of Monitoring and Research
	<p>There has been little work on sediment dynamics since plan commencement. Work prior to plan commencement has investigated gully erosion and sediment loads in the Normanby and other Cape rivers, with the Normanby identified as an erosion hot spot (Brooks et al 2013, 2016).</p> <p>Research on gully erosion has continued since plan commencement (Doriean et al 2020, 2021). Work by Brooks et al (2013) on sediment sources to the GBR identified that previous sediment models had over-estimated sediment contributions from hillslope erosion (which were relatively small), and that the contribution of gully erosion to sediment loads was higher than expected.</p> <p>Howley et al (2021) monitored sediments and nutrients during baseflows and flood events in the Normanby catchment. Suspended sediment concentrations were highest in the upper catchment, whereas mid and lower catchment areas were sinks for sediments. Annual variations in sediment loads were related to total discharge and peak discharge. At Kalpowar (lower Normanby River), sediment concentrations peaked early in the rising stage of a flood event, whereas at most upper catchment sites maximum suspended solids concentrations occurred during the rising flood stage (except for the Laura River where maximum suspended solids concentrations occurred during peak flow - Howley et al 2021).</p> <p>There has been little work on sediment movement in western Cape rivers during the life of the plan.</p> <p>Implications for flow management</p> <ul style="list-style-type: none"> • Absence of large storages means that sediment processes are not impacted by water resource development – river forming processes largely unimpacted within the plan area. • Release of UAW will require information to set licencing conditions to maintain river forming processes within the plan area.
(vi) riffle habitats; and	<p>The intent of this outcome is to maintain an appropriate depth regime in riffles. Riffles are shallow areas with flowing water and their habitats characteristics may vary considerably with small changes in flow. This outcome relates to no flow and low flows (DES 2018).</p> <p>The department has surveyed riffle cross sections at sites in the Endeavour Water Management Area to determine whether flow thresholds for cease to take support environmental outcomes of the plan. Sites have been surveyed in the Endeavour River, Endeavour River right branch, Annan River, Normanby River, Mungumby Creek, Wallaby Creek, Waterfall Creek, Gap Creek, and Carroll Creek. Further surveys will be conducted at the Annan River at Beesbike, McIvor River at Elderslie, and Laura River at Coal Seam Creek. This information will be used by DESI to inform plan review.</p> <p>There is little information on the environmental values supported by riffles in the plan area. Implementation of the Cape York MERS has included fish surveys at several sites in the Endeavour WM Zones. However, the environmental values of riffles in the plan area need further investigation.</p> <p>Implications for flow management</p> <ul style="list-style-type: none"> • Risk to low flow regimes in the Normanby Basin may have been underestimated. In the Lakeland district (the headwaters of the Laura River) many small headwater dams have been constructed, prior to establishment of gauging stations. The threat to low flows regimes may therefore be greater than indicated from modelled water use scenarios (DES 2018). • The environmental values supported by riffles in the plan area are unknown and require further investigation.
(vii) environmental values and	<p>The intent of this outcome is to meet obligations established under the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP (Water and Wetland Biodiversity)). This policy is administered by DESI.</p>

20 (1) Each of the following is an environmental outcome for water in the plan area—

Ecological Outcomes	Summary of Monitoring and Research
<p>water quality objectives under the Environmental Protection (Water) Policy 2019 for water in a catchment in the plan area, and water that flows from that catchment to the Great Barrier Reef and the Gulf of Carpentaria; and</p>	<p>Environmental values for water are qualities that make it suitable for supporting aquatic ecosystems and human water uses (DESI 2024). Environmental values have been established for Basins 101-107 on the eastern Cape (DES 2020a,b,c), but rivers on the western Cape have not been evaluated.</p> <p>All tidal and non-tidal waters, including wetlands, lakes, and underground water, have environmental values (DESI 2024). Aquatic ecosystem health is an environmental value for Queensland waters. Water quality objectives are stated for various flow bands, which typically include “baseflow” and “event”, with flow triggers established for each category.</p> <p>The Reef 2050 Long-Term Sustainability Plan 2021-25 describes a long-term strategy to protect and manage the health and resilience of the Great Barrier Reef (Commonwealth of Australia 2023). Several programs support implementation of the strategy, including the Reef 2050 Water Quality Improvement Plan 2017-2022 and the Paddock to Reef program. The Great Barrier Reef Marine Monitoring Program (MMP) supports the Paddock to Reef program. The MMP has three components – inshore water quality, coral and seagrass (https://www2.gbrmpa.gov.au/our-work/programs-and-projects/marine-monitoring-program). The water quality program assesses annual condition and long-term trends. There are currently insufficient data for the Cape to assess long term water quality data collected under the MMP. Water quality monitoring within the plan area includes the Pascoe, Stewart, Normanby-Kennedy, and Endeavour-Annan Rivers (Moran et al 2023). The annual index is a combination of scores for three indicators – water clarity, productivity (chlorophyll-a and oxides of nitrogen) and particulate nutrients (combined scores of particulate nitrogen and phosphorus). The long term water quality score also includes a combination of scores for water clarity, chlorophyll-a, oxides of nitrogen, particulate N and particulate P (https://app.powerbi.com/view?r=eyJrljoiMWNiZjc2NWUtZDdmYi00ZTNkLTk1ZjQtM2Y5Njg0N2EyY2ZhlwidCI6ImViMTFIZjE2LTMyMjQNGY4Ni04MDgxLTRIMWRkMTc2YjgzNiJ9).</p> <p>The most recent water quality reporting available is for 2021-2022 (Moran et al 2023). The Cape York region was scored “Good”, which was an improvement from the previous reporting period. The Normanby, Pascoe and Stewart Rivers were scored as “Moderate” and Endeavour-Annan as “Very Good”. Although water quality has been recorded in the Cape since January 2017, changes to the monitoring program in 2020 has made assessment of long-term trends difficult (Moran et al 2023).</p> <p>The seagrass monitoring program records abundance and resilience (resistance and recovery potential, see https://www2.gbrmpa.gov.au/our-work/programs-and-projects/marine-monitoring-program/inshore-seagrass-health). These parameters are combined into a seagrass score. Over the life of the plan, seagrasses have been monitored at eight sites for varying periods of time (Mackenzie et al 2023). The 2021-22 seagrass condition index was scored as “Moderate” but increased from the 2020-21 water year (also scored as “Moderate”). The condition index for 2019-2020 (scored as “Poor”) was the lowest score since monitoring commenced in 2005-2006 (Figure 24 of Mackenzie et al 2023). Summary scores for water quality, seagrasses and coral can be found at https://app.powerbi.com/view?r=eyJrljoiMWNiZjc2NWUtZDdmYi00ZTNkLTk1ZjQtM2Y5Njg0N2EyY2ZhlwidCI6ImViMTFIZjE2LTMyMjQNGY4Ni04MDgxLTRIMWRkMTc2YjgzNiJ9.</p> <p>Liu et al (2021) investigated the catchment-scale factors that influence event-based water quality in catchments draining into the Great Barrier Reef lagoon. Catchment-scale factors included rainfall, runoff, and vegetation cover. Of the 32 sites included, only one (Normanby River at Kalpowar Crossing) occurred within the plan area. Rainfall and runoff affected in-stream particulate water quality parameters (total suspended solids, particulate Nitrogen and Phosphorus), whereas catchment wetness and vegetation cover influenced dissolved nutrient concentration and salinity. Antecedent catchment soil moisture and vegetation influenced dissolved nutrients, indicating the importance of catchment hydrological connectivity on pollutant mobilisation and delivery (Liu et al 2021).</p>

20 (1) Each of the following is an environmental outcome for water in the plan area—	
Ecological Outcomes	Summary of Monitoring and Research
	<p>End of basin load water quality objectives covering all basins draining into the Great Barrier Reef lagoon have been established for anthropogenic dissolved inorganic nitrogen and anthropogenic fine sediments under the EPP (Water and Wetland Biodiversity) (DES 2019). These objectives are to be attained by 2025.</p> <p>Implications for flow management</p> <ul style="list-style-type: none"> • The plan has outcomes representative of the key environmental values of the plan area. • Monitoring under the MMP has documented water quality and seagrass condition for selected rivers of the eastern Cape. • Gully erosion and subsequent delivery of fine sediments to the Great Barrier Reef is an issue in some catchments of the plan area.
(b) to maintain an underground water regime in the plan area that supports ecosystems dependent on the underground water to which this plan applies; and	<p>The intent of this outcome is to maintain a groundwater regime that supports Groundwater-Dependent Ecosystems (GDEs) in the plan area. The seasonal nature of rainfall in the plan area means that groundwater is often a more reliable water source (Horn et al 1995). For example, spring flows in the Lakeland area have been widely exploited due to the lack of surface water. Groundwater resources of the plan area have been described by Horn et al (1995) and GDEs of the western Cape by DSITIA (2014).</p> <p>The plan area includes surface expression, terrestrial vegetation, and sub-surface expression GDEs (DES 2018). Surface expression GDEs include baseflow streams and rivers where groundwater contributes to perennial flows. Baseflow GDEs include the Jardine River, Annan River, Wenlock River, Hann River, Isabella Creek (Normanby basin) and Mclvor River.</p> <p>There has been limited monitoring to support this outcome since plan commencement. The department produced a MERS for springs in the Lakeland area. Implementation of the Lakeland MERS was limited by the extensive damming of springs and difficulties in accessing springs on private property (NRAE 2022). Implementation of the MERS has included spot gauging of discharge at Lemon Springs and the upper Laura River and fish surveys. A spring at Mt Butcher, to the east of Lakeland, was found to have an eel (<i>Anguilla</i> sp) and several rainbowfish (<i>Melanotaenia splendida splendida</i>), despite impacts to the spring from cattle and weeds. Eels require connectivity to the Coral Sea and the location where the eel was observed was approximately 250 km from the mouth of the Normanby River.</p> <p>The department (2022) made several recommendations to improve management of GDEs in the Lakeland district. These include improved hydrologic models to account for baseflows upstream of the current Laura River gauging station, amending licence conditions to promote flow passing rules at spring-fed impoundments, and improved understanding of the water requirements of terrestrial and surface expression GDEs.</p> <p>Groundwater assessments have been conducted within the life of the plan as part of Initial Advice Statements for mining projects near Aurukun and Cape Flattery (Groundwater Assessment and Solutions 2022; AGE 2023; BMT 2023). AGE (2023) characterised groundwater in the vicinity of the proposed Aurukun Bauxite project. A feature of the groundwater table or relevance to vegetation is that the groundwater surface may vary seasonally by up to 10 m, with rate of recharge related to rainfall intensity (AGE 2023).</p> <p>The Cape Flattery dunefields are located on the coast north of Hope Vale. The dunes include permanent and seasonal lakes and springs (Groundwater Assessment and Solutions 2022). A variety of freshwater habitats occur in the dunefields, including perched wetlands, and palustrine wetlands in depressions between dunes (Hydrobiology 2022). The connectivity of these waterbodies to groundwater is yet to be confirmed (Hydrobiology 2022). Uncommon species, and species with disjunct population distributions, are a feature of these systems (see also Pusey et al 2000).</p>

20 (1) Each of the following is an environmental outcome for water in the plan area—	
Ecological Outcomes	Summary of Monitoring and Research
	<p>The Queensland Herbarium undertakes mapping of GDEs across Queensland. Limited GDE mapping has occurred for the plan area (DSITIA 2014).</p> <p>Implications for flow management</p> <ul style="list-style-type: none"> • The plan area includes a variety of GDEs, including surface expression (baseflow streams), subsurface expression and terrestrial vegetation GDEs. The water requirements of biota associated with groundwater-dependent ecosystems is poorly understood. • Flows from springs in the Lakeland area are likely to have contributed to surface flows in the Laura River, prior to construction of small dams to capture spring flows. It is likely that risk to no and low flow regimes in the Laura River have been underestimated (DES 2018). Environmental values supported by springs in this area are unknown but work by the department as part of the MERS is compiling information on fish species present. • GDE mapping is required to better determine risk to GDEs in the plan area.
<p>(c) to provide a flow regime that –</p> <p>(i) maintains the flow of fresh water from estuaries in the plan area to the marine waters of the Great Barrier Reef and the Gulf of Carpentaria; and</p>	<p>The intent of this outcome is to ensure that freshwater inflows to estuaries and near-shore areas are maintained to support salinity gradients, connectivity between freshwater and estuarine habitats, and delivery of nutrients and sediments to the Great Barrier Reef and coastal areas. This outcome relates to high flows and end of system flows (DES 2018). The plan area includes a diverse range of fish species that require connectivity between freshwater and estuarine habitats (Burrows et al 2009; Ebner and Donaldson 2015; Ebner and Vallance 2016; Dwyer et al 2019). Freshwater discharge to estuaries is critical for maintaining salinity gradients, which in turn influence species' distributions, such as the endangered saw-tooth shark (Dwyer et al 2019), and habitat availability.</p> <p>The plan includes end of system nodes which can be used to assess freshwater inflows to estuaries. Annual discharge to the Great Barrier Reef lagoon is reported in the Marine Monitoring Program (MMP, Moran et al 2023). For the 2021-22 water year, discharge from the Cape York rivers was 1.2 times the long-term median discharge (Moran et al 2023). Discharge in water years 2018-19 and 2020-21 were 2-3 and 1.5 – 2 times the long-term median, respectively. Discharge was below the long-term median for the 2019-2020 water year.</p> <p>Implications for flow management</p> <ul style="list-style-type: none"> • Given the absence of large storages and limited water take it is likely that freshwater inflows to the Great Barrier Reef and Gulf of Carpentaria are being maintained and influenced by natural rainfall and runoff patterns.
<p>(ii) supports productive ecosystems in the receiving waters of the Great Barrier Reef and the Gulf of Carpentaria</p>	<p>The intent of this outcome is to maintain and protect the ecology of the Great Barrier Reef and Gulf of Carpentaria and maintain the productivity of fisheries. This outcome relates to high flows and end of system flows (DES 2018).</p> <p>Little work relevant to this outcome has been published during the life of the plan. However, work in the southern Gulf of Carpentaria has shown that freshwater discharge to estuaries and near shore areas are critical for stimulating primary and secondary productivity (e.g. Burford and Faggotter 2021; Burford et al 2021a, b). While first flush flows flood waters can provide a temporary boost in nutrient availability and ecological productivity, the long-term impacts can be detrimental if excessive nutrient inputs and sedimentation occur (Howley et al 2018). It is likely that similar patterns occur for waterways draining into the eastern Gulf. Flood flows are important for supporting the life history requirements of commercially important species such as barramundi and banana prawns. Recent work in the Mitchell River and other Gulf rivers confirmed these links and provided estimates of financial losses that could be expected from reduced flood flows that may arise from UAW releases (e.g. Broadley et al 2020).</p>

20 (1) Each of the following is an environmental outcome for water in the plan area—

Ecological Outcomes

Summary of Monitoring and Research

Gully erosion contributes nutrients as well as sediments to the Great Barrier Reef (GBR) lagoon (Brooks et al 2016; Doriean et al 2021).
Gully erosion contributes significant fine sediment loads to the GBR lagoon (Doriean et al 2021).

Implications for flow management

- Freshwater inputs to estuaries and adjacent coastal areas are critical to productivity in these areas. Productivity has been shown to be linked to flow magnitude.

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Department of Regional Development,
Manufacturing and Water
GPO Box 2247, Brisbane, Queensland 4001
13 QGOV (13 74 68)
info@rdmw.qld.gov.au
rdmw.qld.gov.au



Queensland
Government