Katherine background report 2026-2036

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Acknowledgement of Country

The Department of Lands, Planning and Environment respectfully acknowledges the Northern Territory's Aboriginal people and their rich culture and pays respect to the Elders past and present.

We acknowledge the Traditional Owners and custodians of the lands and waters of the Katherine water allocation plan area, and Aboriginal peoples with connections to the waterways of the Katherine River.

We recognise the intrinsic connection of Traditional Owners to Country and value their ongoing contribution to managing the lands and waters. We support the need for genuine and lasting partnerships with Traditional Owners to better understand cultural connections, and we will work to establish lasting partnerships to manage water together.

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1. Executive summary

This document provides background information to support the Katherine water allocation plan 2026–2036 (the plan). This is the fifth iteration of the plan, which has changed substantially, building on past experience, updated scientific understanding and input from the water advisory committee. Major updates include refining the plan area based on hydrogeology, clarifying the ESY, addressing risks from unlicensed water extraction and introducing collaborative mechanisms to manage dry-year allocations.

The plan manages interconnected groundwater and surface water resources of the Tindall Limestone Aquifer (TLA) and the Katherine River, which together are referred to in the plan as the Katherine water resource. The TLA forms part of the Cambrian Limestone Aquifer, a significant groundwater resource covering 15% of the Northern Territory (NT) and extending into western Queensland. This aquifer sustains dry season flows in the Katherine and Daly rivers, underpinning regional ecological integrity, economic prosperity, and supporting the social and cultural values reliant on the resource. The plan relates to the portion of the TLA within the Katherine River catchment (Katherine - TLA), and surface water of the Katherine River that is directly influenced by groundwater discharges from the Katherine - TLA between the department's Ironwood and Wilden surface water gauging stations.

Over 70 years of regional groundwater and surface water monitoring has informed the department's understanding of the resource. The monitoring data shows that aquifer storage remains healthy, with groundwater levels currently exceeding those recorded in the 1970s, before much of the development in the Katherine area began. The Katherine River is in good condition, with no evidence of impacts from climate change or water extraction visible in the department's monitoring data (Rooke, 2024).

This background report provides an overview of the evidence available to support the updates and improvements to the water allocation plan and ongoing sustainable management of the Katherine water resource; allocate water to beneficial uses; and maximise the economic and social benefits of water use within ecological constraints.

Plan updates and management improvements

There are four significant updates in the plan:

1. Refinement of plan area

   The plan area has been revised to better reflect the geology and major water use areas. The new plan area includes only those parts of the TLA that are easily accessible for use and where water take directly affects groundwater discharge to the Katherine River. Surface water downstream of the plan boundary to the Wilden gauging station is managed under the plan.

2. Clarification of the estimated sustainable yield (ESY)

   The ESY reflects the improved understanding of aquifer behaviour and climate impacts. Long-term analyses suggest no immediate need to change the ESY. Future increased extraction may be feasible if conducted at an appropriate distance from the Katherine River and other identified sensitive areas.

3. Management of announced allocations in dry years

   The plan establishes a new collaborative approach for applying announced allocations. Announced allocations are an adaptive management tool that enables the Controller of Water Resources to temporarily reduce licence entitlements in dry years to minimise the impact of extraction on flows in the Katherine River. The plan recommends the department facilitates a collaborative approach with licence holders to meet the specified reduction in extraction.

4. Protecting groundwater discharge

   Water use in close proximity to groundwater discharge areas in the Katherine River could pose a greater risk to dry season flows. A discharge protection zone has been implemented to more tightly control licensed water use within 5 km of the Katherine River, while still enabling water to be traded. Implementation actions have been established to better characterise water use that is not subject to licensing, including consideration of powers to declare a ‘restricted water extraction area’ at the plan’s mid-term review.

Katherine water plan in context of the Daly basin

The Katherine plan area is situated within the Daly River basin, the largest river basin in the Northern Territory, covering an area of over 52,000 km^2. Flows in the Daly River basin are fed by three major groundwater resources (the Tindall Limestone, Oolloo and Jinduckin aquifers) and 16 surface water catchments, including the Katherine River catchment. Surface water in the Daly River basin is a mix of perennial and ephemeral systems, all of which connect to the Daly River and flow to the mouth at the Timor Sea.

Although the Katherine River contributes approximately 28% of the total annual flow of the Daly River, this proportion varies significantly between wet and dry seasons. The Katherine River contributes approximately 48% of the Daly River wet season flows, but only 8% of its dry season flows. As the Katherine plan focuses on integrated groundwater and surface water management to maintain dry-season flows in the Katherine River, it safeguards a small but important portion of the water resource within the broader Daly basin.

In light of this, and in considering the continued interest in further regional and economic development across the broader Daly basin, the NT Government has committed to developing a Daly River water allocation plan (Daly River water plan), to ensure effective management of this large, iconic Territory water resource in an integrated and holistic manner.

While the Daly River water plan is under development, the Katherine and Oolloo water plans will continue to be implemented, including ongoing data collection through the plan’s monitoring programs and delivery of priority implementation activities. It is anticipated that the Katherine water plan will become a chapter in the future Daly River water plan.

Revised plan area

The plan introduces a revised plan area to better align with hydrogeological characteristics, surface water management needs and groundwater extraction trends. The groundwater component focuses on the Tindall Limestone Aquifer (TLA) which directly contributes to baseflow in the Katherine River. The Jinduckin Formation is no longer included within the plan boundary due to its lower yields, water quality and limited influence on river flows. Surface water of the Katherine River is managed both within the plan boundary and along the Katherine River for 10 km west to the Wilden gauging station. The plan therefore encompasses all major areas of groundwater discharge and surface water flows to the upstream boundary of the Oolloo water plan.

The Katherine water plan will continue to manage all existing surface water extraction, 98% of metered TLA bores, 81% of unmetered bores, and 92% of licensed entitlements from the previous plan area. Water take outside the plan area will continue to be regulated under the *Water Act 1992*, including the remaining 2% of licensed TLA extraction.

Estimated sustainable yield

The ESY for the Katherine water resource is set at 39,000 ML per year, a slight increase from previous estimates to account for inherent uncertainties in unmetered and unlicensed domestic water use, and to avoid false precision. No additional water has been made available for extraction.

The ESY is informed by ongoing scientific research, historical and projected climate variability, ecological constraints, and community values. Management priorities emphasise maintaining ecological integrity, supporting Aboriginal cultural and social values, safeguarding long-term water security, and enabling regional and Aboriginal economic opportunities. Key strategies employed by the plan include adaptive management tools to address climatic variability; targeted management within a discharge protection zone; and prioritisation of essential water uses.

Current water use and management implications

Water extraction managed by the plan predominantly supports agricultural, residential and commercial uses. The current licensed volume totals approximately 28,200 ML per year, however, actual water use since 2020 has ranged from approximately 8,000 to 15,000 ML per year, or 30 to 55% of entitlements. Agriculture has the largest proportion of licensed entitlements accounting for 81% of all licensed volumes.

Unlicensed bores account for around 81% of total bores in the area, introducing uncertainty into the accounting of water use. Department estimates put unlicensed use at around 4,200 ML per year, however, there is low confidence in this estimate, and the level of uncertainty cannot be easily quantified. This uncertainty poses management challenges, particularly near sensitive environmental receptors and areas close to the Katherine River. Residential bores for unlicensed domestic use represent the largest portion of unmetered extraction near these sensitive areas.

While licensed use is expected to dominate moving forward, increases to domestic use may occur with population growth. Land for rural residential development has primarily been identified within 5 km of the river under the Katherine Land Use Plan 2014. Implementation actions have been established to better characterise unlicensed use, and to implement additional controls to balance sustainable residential development and protection of river flows.

Sustainability and climate influences

Department research and analyses included in this report demonstrate:

- Sustainability: despite increased water extraction since the 1970s, aquifer storage remains robust. Groundwater levels are higher now compared to the 1970s, even when modelled using full licensed extraction, indicating substantial resilience and buffer capacity in the TLA. Analyses show the Katherine River is in good condition, with no evidence of impacts from climate change or water extraction in the department's monitoring data (Rooke, 2024).

- Climate dominance: regional hydrological trends remain predominantly driven by climate variability, encompassing intra-annual, inter-annual, and interdecadal rainfall patterns. Aquifer volume and groundwater level trends are predominantly influenced by natural climatic variations, particularly recharge events. Historical records indicate rising average rainfall and minimal measurable extraction impacts on dry season river flows or aquifer storage levels. Although climate change projections suggest increased rainfall under some scenarios, the risk of occasional missed monsoons leading to short sequences of two consecutive dry years persists. Effective water management is essential to mitigate ecological risks during low-flow years and to protect aquifer recharge in wetter periods.

Landscape and environmental changes

The Katherine region has undergone significant landscape modifications since European settlement, notably through pastoral grazing and agricultural land clearing, which have permanently altered runoff patterns and influenced river flows and water quality. The region supports extensive agricultural activity, including horticulture, irrigated pastures, recent expansions into cotton production, and pastoral holdings.

Current ecosystem assessments indicate:

- There is no evidence of regional-scale impacts from water extraction from the TLA. Natural variability in rainfall appears to be the dominant influence on long-term aquifer storage trajectories in the Katherine Tindall Limestone Aquifer.
- The plan manages risks from groundwater extraction. Groundwater dependent ecosystems (GDE), such as rainforest, riparian vegetation, wetlands, and sinkholes, rely on stable groundwater levels for biodiversity and ecological processes. Excessive groundwater extraction poses a potential risk to these ecosystems. These risks are managed by setting extraction limits using the ESY, the announced allocations process in dry years, and targeted water licensing to reduce local impacts on GDEs.
- There is no evidence that water extraction from the TLA poses a risk to dry season flows in the Katherine River or to flows into the Daly River. The Daly River catchment, including the Katherine River, supports a rich diversity of fish, with over 50 species dependent on flow regimes and groundwater discharge, particularly during the dry season. Key species like barramundi and sooty grunter rely on these conditions for spawning and recruitment. Riparian vegetation, such as weeping paperbark and river red gum, contributes to biodiversity and ecosystem stability. However, the Katherine River provides only a relatively small proportion of dry season flows into the Daly River and there is no evidence that water extraction (at current or full entitlement) under current water management systems, or those proposed by the 2026–2036 plan, pose a risk to dry season flows in the Katherine or Daly river systems. The primary driver of changes to dry season flows is climate variability.

Regional water quality

Water quality in the Katherine region varies seasonally. Wet season runoff results in lower conductivity and higher turbidity due to sediment-laden overland flows. Conversely, groundwater-fed dry season flows exhibit higher conductivity from calcium, magnesium, and bicarbonate. Recent studies indicate stable water quality conditions across years, although impacts from land clearing, agriculture, grazing and late dry-season fires present ongoing risks through increased sediment and nutrient loads. Periodic monitoring for per- and poly-fluoroalkyl substances (PFAS) associated with historical defence activities, confirms they are present in the region in stable concentrations within safe guidelines, thus ensuring the safety of recreational water users and aquatic life.

Economic development

Water from the Katherine water resource is integral to Katherine’s economic vitality, underpinning key local industries and economic activity including agriculture, food processing, tourism, defence, light industry and related businesses. As the third largest town in the Northern Territory and a major regional economic hub, Katherine’s economy is dependent on reliable and sustainable water supplies. Effective water management enhances confidence in water resource sustainability, enabling regional economic growth, and attracting investment. The Aboriginal water reserve, now fully provisioned at 3,220ML, ensures access to water specifically for the economic benefit of Aboriginal people within the plan area, promoting equitable economic opportunities and long-term socio-economic benefits.

Social and cultural values

Water from the TLA and the Katherine River upstream of the plan area provides essential public water supplies necessary for everyday domestic use and sanitation. It also supports recreational facilities such as sporting fields and swimming pools, which are central to community health and social activities. Parks and residential gardens which enhance local liveability, aesthetics and biodiversity, rely heavily on water extraction. Collectively, these water-dependent amenities enhance the quality of life and social cohesion in the Katherine region. Maintaining the ESY at its current level allows for water extraction to continue to support these values.

The plan area encompasses significant Aboriginal cultural water sites, including rivers, creeks, gorges, waterfalls, plunge pools, waterholes, billabongs and springs. Seasonally inundated swamps and isolated rockholes also hold cultural importance. The plan identifies the consideration of Aboriginal cultural values in water management decisions as a key objective, and the implementation plan sets out activities to improve identification and protection of these important sites associated with water. Native Title proceedings in the area which are expected to be finalised within the term of the plan, will provide more certainty for the department’s engagement on cultural values in the future.

Securing Katherine’s water future

The plan integrates improved scientific knowledge and adaptive management strategies to ensure sustainable water resource use, ecological integrity, economic viability, and respect for Aboriginal cultural values. Ongoing monitoring, advanced mapping, and proactive management will safeguard environmental and community assets against future risks.

2. Introduction

Overview

This is the fifth water allocation plan for the Katherine area.

Water planning in the NT is guided by the National Water Initiative, which sets the framework and principles for water management around Australia.

The Minister appointed the 12-member Daly River water advisory committee in November 2024. This committee actively shaped the plan by advising on plan objectives, announced allocations, water recovery and priority implementation actions. The department consulted the public on the plan in 2025 and used the submissions received to refine the plan documents—addressing key themes like water security, environmental protection, Aboriginal rights and governance.

Natural resource management has inherent uncertainties. Risk management and adaptive management tools, such as those articulated in the Katherine water plan and implementation actions, are aimed at improving scientific understanding and confidence in decision-making, while correspondingly reducing risks to the water resource.

2.1 Overview of water planning in Katherine

This background report supports the Katherine water allocation plan 2026–2036 (the plan), providing an overview of the evidence that informed the plan's development and long-term sustainable water management. This is the fifth iteration of the plan, which has changed substantially, building on past experience, updated scientific understanding and input from the Daly River water advisory committee. Major updates include refining the management area based on hydrogeology, clarifying the ESY, implementing protection measures to address risks in more sensitive areas near the Katherine River, and introducing collaborative mechanisms to manage dry-year allocations.

A water control district, declared under section 22 of the *Water Act 1992* (the Act), was first placed over the Daly River basin on 8 December 2008 for the purposes of improving understanding of water use in the area and to guide surface water and groundwater regulation. The most recent declaration was on 19 October 2022 with a larger geographic area that includes the Roper River basin and parts of the Barkly district. A map of the Daly Roper Beetaloo water control district area and plan area is provided in Schedule C.

The plan area substantially overlaps the Katherine Local Government Area which has an estimated resident population of 10,836, equating to a population density of 1.5 persons per square kilometre. Aboriginal and Torres Strait Islander peoples make up 22.8% of the population. The total proportion of people born overseas is recorded as 13.6%. 34.5% of the population speaks a language other than English at home (data from Australian Bureau of Statistics, 2021).

Schedule D. Map of land tenure in the Katherine plan areaMost of the land in the water plan area is private freehold (~55%), perpetual Crown leasehold (~20%), or perpetual pastoral leasehold (~17%), with Aboriginal freehold title accountings for less than 1% (Schedule D). Three active Native Title claims within the Katherine municipality are currently under application or determination (National Native Title Tribunal, n.d). National Parks, pastoral leases, RAAF Base Tindal, and vacant Crown land are also located within the plan area (Northern Territory Planning Commission, 2014). Freehold land supports residential, irrigated agriculture, horticulture, dryland farming, and stock grazing land uses, with irrigated agriculture generating the greatest demand for water.

2.2 Water allocation planning in the Northern Territory

Water allocation is the process of determining how much water must be retained within the environment to protect ecological functions and meet environmental requirements, and how much water can be made available to support social, cultural and economic uses. Water planning is governed by the *Water Act 1992*. The following policies also inform water management in the Territory:

- Water allocation planning framework policy
- Strategic Aboriginal water reserve policy
- Processing water extraction licence applications policy
- Surface water take – Wet season flows policy
- Compliance and enforcement policy
- Trading licensed water entitlement policy
- Recovery of unused water licence entitlements policy.

These policies are supported by a range of procedures, guidelines and management statements, many of which are publicly available on the department's website[1].

The NT Government develops all water policies and supporting documents with reference to the National Water Initiative (NWI) (2004), which is a national agreement that identifies frameworks and principles for sustainable water management and in particular water planning, within Australia.

The application of the NWI in the NT differs in context relative to south-eastern Australia, where the experience of water allocation, land tenure and economic development has been very different. Some points of difference include managing for groundwater, not surface water, as the dominant supply; the large proportion of Aboriginal land tenure in the NT; a lack of historical over allocation of water resources; a largely intact environment with functional ecosystem services; and the targeting of regional scale water resources for development and economic growth.

In practice, this means that the NT has placed a higher priority on NWI implementation activities associated with outcomes such as ensuring Aboriginal access to water use and that water plans provide certainty for investment and the environment, with less emphasis on activities that have dominated water reforms in south-eastern Australia, such as addressing historical over-allocation and the implementation of water markets.

In 2022, the Commonwealth government committed to renewing the National Water Initiative. The NT Government actively contributed to the new National Water Agreement, seeking an agreement to build on the strengths of the NWI and flexible management approaches that are fit-for-purpose in addressing future water challenges in the NT. The final National Water Agreement is now under consideration by the NT Government.

2.3 Daly River water advisory committee

Under section 23 of the Act, the Daly River water advisory committee (the committee) was appointed by the Minister for Water Resources in November 2024[2]. The committee is comprised of 12 members representing different water-related interests, including horticulture, tourism, recreation, Aboriginal, pastoral, commercial and the local community. The committee's role is to provide advice on the development of the plan, with particular focus on maximizing the economic and social benefits of water use within ecological restraints.

The committee met five times during the development of the plan, providing input on a broad range of topics. The committee advised the department on social and community values, which influenced the objectives of water sharing in this iteration of the plan. The committee provided feedback that helped

[1] https://nt.gov.au/environment/water/management-security/water-policies-and-guidelines

[2] https://environment.nt.gov.au/boards-committees/water-advisory-committees/daly-river-water-advisory-committee

improve the design of announced allocations and water recovery processes, drawing on the local experience and lessons learnt from these policies being applied in Katherine in recent years. The committee also helped identify and prioritize implementation actions.

Records of each meeting were made available online and advertised through the department's frequent newsletter and social media channels.

2.4 Community feedback on the plan

The draft Katherine water allocation plan 2026–2036 was released for public consultation from 13 October to 10 November 2025. A total of 44 engagement activities were undertaken during and after the consultation period, including in-person meetings in Katherine, virtual briefings, phone discussions, and targeted emails. During this period, feedback was sought from the public, stakeholders and interested parties on the proposed plan.

Submissions received demonstrated engagement with and understanding of the plan materials, and key themes included water security, environmental protection, Aboriginal rights and water governance. While the number of submissions was relatively small at 12, the breadth and technical nature of the feedback reflected consideration of plan documents and the local context by respondents. Submissions were received from a range of stakeholder groups including Aboriginal community members, Katherine residents, industry and environment groups.

In response to feedback the three plan documents have been updated including:

- a clearer description of changes to the plan boundary
- expanding on the future proposals for a Daly River water plan
- more detail about water management outside of the plan boundary, including how people can access water for Aboriginal economic development outside of the plan
- explanations of the announced allocations process

In response to concerns about the impact and effectiveness of the proposed 'Restricted Water Extraction Area', analysis of water use trends has been refined to consider a range of unlicensed uses and future projections. Unlicensed use will be further investigated as part of the plan's implementation actions, with consideration of a 'Restricted Water Extraction Area' proposed for the mid-term review.

A consultation report has been prepared to document the outcomes of engagement processes. It provides a clear record of the feedback received during the consultation period, identifies the key themes raised by stakeholders, and outlines how these matters have been considered in refining and finalising the plan. The report ensures transparency in decision-making and demonstrates how community and stakeholder input has informed the development of the final Katherine water allocation plan 2026-2036.

2.5 About this document

This report is one of three core documents prepared as part of the water allocation process for the Katherine plan area. The three core documents are:

Katherine water allocation plan 2026–2036 (the plan) declared by the Minister under section 22B(1) of the Act. The plan establishes the area within which it operates, outlines a set of objectives and outcomes, sets the volume of water that can be taken from the water resource (the estimated sustainable yield), and allocates water available under the ESY among a set of declared beneficial uses. The plan takes effect from the date in the Government Gazette and will remain in force for a period of 10 years.

Katherine background report 2026–2036 (this document, the background report) provides details on the evidence and other information that informed the plan. It describes the environmental, social and cultural values of the plan area, and the social and developmental context of the region, including existing water use and projections of future water demand. The report collates the information and knowledge relevant to the plan at the time of its preparation.

Katherine implementation actions 2026–2036 (the implementation actions) details how the requirements in section 34 of the Act, with respect to the water resource within the plan area, will be fulfilled. It defines a continuous program of water resource assessment, including the investigation, collection and analysis of data concerning the occurrence, volume, flow, characteristics, quality and use of water resources. The program is presented as a series of implementation actions essential for the long-term management of the plan. The department's approach to risk and adaptive management for the Katherine water plan are also part of the implementation actions.

Information on the department's approach to water allocation planning[3] is available on the department's website.

Schedule A defines particular words used in this report. Abbreviations and acronyms are provided in Schedule B. Unless otherwise stated, terms defined in the Act have the same meaning when used in this report.

2.6 Adaptive management and knowledge-based planning

Uncertainty is inherent in natural resource management, including water management. The Act recognises this, particularly regarding the determination of an ESY. The Act does not prescribe a specific method for determining ESY; the sustainable yield must be estimated from the available evidence, considering the plan's objectives and the associated confidence in this evidence. The department employs risk and adaptive management approaches to address uncertainty, reducing the likelihood that errors in ESY estimates will compromise the resource, environment, or water users. These approaches include ongoing data collection and analyses, scientific investigation to improve confidence and reduce uncertainty over time, and adjustments to ensure settings remain appropriate and in line with articulated objectives, risk appetite and the latest information and conditions.

[3] https://nt.gov.au/environment/water/management-security/water-allocation/water-allocation-plans

3. Katherine water plan in context of the Daly basin

Overview

This section describes how the Katherine water allocation plan 2026-2036 will complement a proposed future Daly River water allocation plan (the Daly River water plan).

This Katherine water plan and the Oolloo Dolostone Aquifer water allocation plan 2019-2029 (the Oolloo water plan) will remain in place until a Daly River water plan is declared. It is anticipated that each plan will be retained as standalone chapters in the broader Daly River water plan to ensure that the unique needs and challenges in these plan areas remain a focus.

The Katherine plan area is situated within the Daly River basin (Figure 2), the largest river basin in the Northern Territory, covering an area of over 52,000 km^2. Thirteen river systems contribute to the Daly basin, including the Dry River, King River, Katherine River, Flora River and Fergusson River. Groundwater resources including the Tindall Limestone Aquifer, Oolloo Dolostone Formation, the Florina Formation and to a limited extent the Jinduckin Formation, contribute to baseflows in the system at various locations.

Two water allocation plans are in place in the Daly basin: the Katherine water allocation plan 2026-2036 and the Oolloo Dolostone water allocation plan 2019-2029.

The Katherine Plan manages the interconnected groundwater and surface water resources of the Tindall Limestone Aquifer (TLA) and the Katherine River. It applies to the portion of the TLA within the Katherine River catchment (Katherine–TLA), as well as surface water in the section of the Katherine River that is directly influenced by groundwater discharge from the Katherine–TLA, between the department's Ironwood and Wilden surface water gauging stations. Together, this system is referred to as the Katherine water resource.

The Plan focuses on maintaining dry season flows in the Katherine River up to the Wilden gauging station. Downstream of this point, where the Oolloo Dolostone Aquifer begins approximately 10 km west of the plan boundary, water resource management is guided under the Oolloo plan. The plan does not manage wet season flows in the Katherine River catchment which are predominantly influenced by rainfall and surface water runoff rather than groundwater discharge.

Although the Katherine River contributes approximately 28% of the total annual flow of the Daly River, this proportion changes significantly between the wet and dry seasons (Figure 1). The Katherine River's highly seasonal flows are estimated to contribute only 8% (Figure 1) of the Daly River dry season flows, but nearly half (approximately 48%) of the Daly River's wet season flows. The Katherine plan therefore manages a relatively small, albeit important, proportion of water in the whole Daly basin.

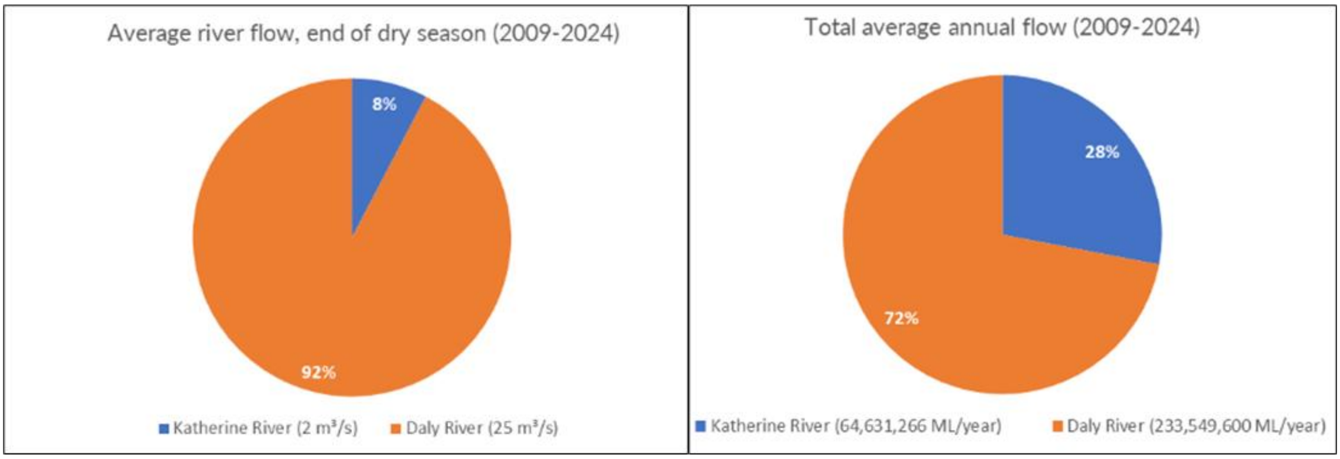

Figure 1. Contribution of the Katherine River to the Daly River flows comparing dry season instantaneous flow and total annual flow through the system (ML per year)

Considering the continued interest in development across the broader Katherine region, the NT Government has committed to developing a water plan for the Daly basin. The Daly River water plan will guide management for the Oolloo, Jinduckin and Tindall Aquifers to maintain dry season baseflows. It will also consider management arrangements for surface water take during the wet season.

The Katherine water plan 2026-2036 and the Oolloo Dolostone Aquifer water allocation plan 2019-2029 have been developed in consultation with local communities and are well-tailored to the local context. It is anticipated that content from existing plans will be retained as standalone chapters in the Daly River water plan. This will ensure that the unique needs and challenges in these plan areas remains a focus.

In the interim, the Katherine and Oolloo water plans will continue to be implemented until a Daly River water plan is declared. This will include ongoing data collection through the monitoring program and delivery of priority actions.

Developing a water plan for the Daly basin will provide certainty:

- for communities, by prioritising water for drinking and for homes
- for businesses and industry, by providing clear guidance and certainty around water availability, and rules or conditions of water access
- through establishing Aboriginal water reserves, which will provide for eligible Aboriginal people in the Daly region to access water for their economic benefit into the future as water entitlements to other beneficial uses are taken up
- to our Territory lifestyle for generations to come. Water plans ensure that water remains available to support the activities that Territorians love, such as camping, fishing, hunting and generally being out and about in nature.

The Daly River water plan will ensure effective management of one the largest and most iconic water resources of the Territory in an integrated, holistic manner. The Daly River water plan will prioritise:

- integrating surface water and groundwater management flowing into and through the basin
- using best available science
- being informed by the community
- retaining minimum baseflows important to the free-flowing Daly River.

DALY RIVER BASIN

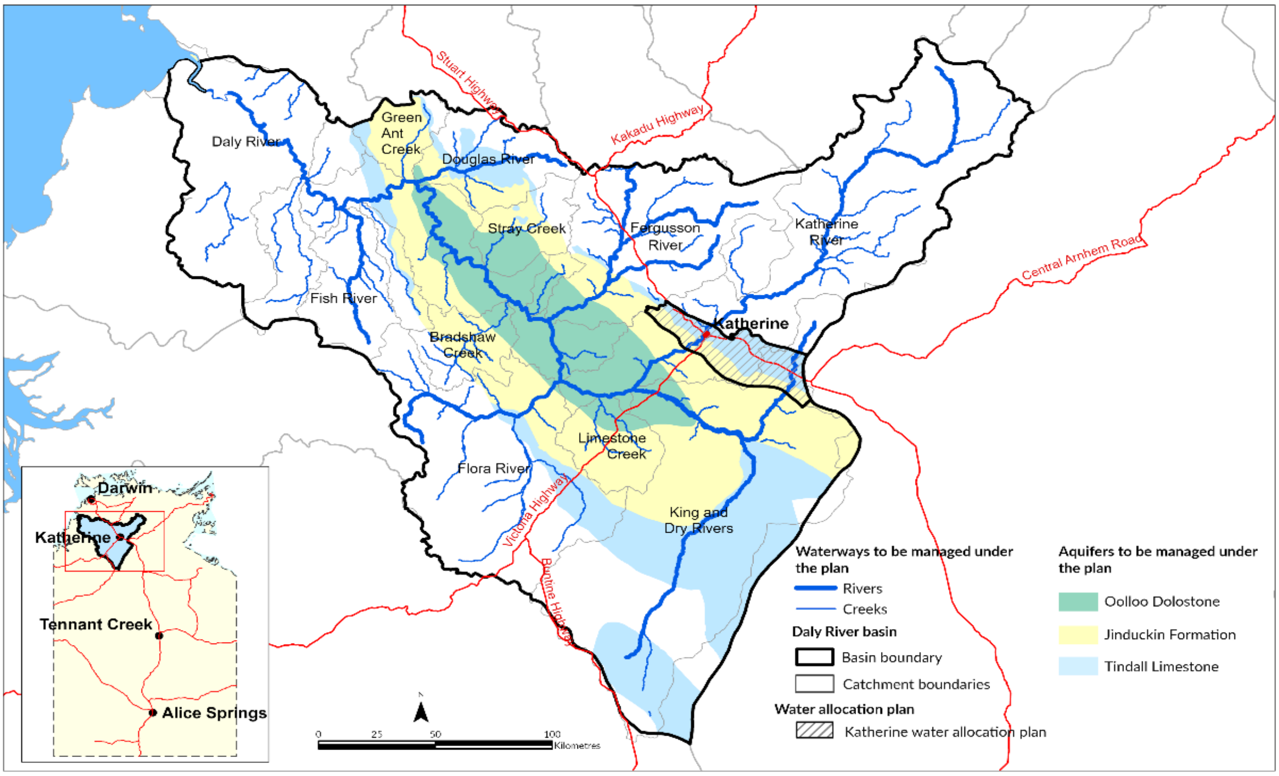

Figure 2. Map of the Daly River basin including water features and the Katherine water allocation plan boundary

4. Revised plan area and estimated sustainable yield

Overview

This section summarises the changes to the plan area and revision of the estimated sustainable yield (ESY).

The plan refines the plan area to better align with hydrogeology and groundwater extraction trends, focusing on parts of the Tindall Limestone Aquifer (TLA) that are easily accessible for use, and where take directly affects baseflow contributions to the Katherine River.

The plan area is around one-fifth of the previous plan area. The reduction in size means around 98% of licensed TLA bores, 81% of unlicensed bores, and 92% of licensed entitlements remain within the plan area. The 2% of licensed extraction taking water from the TLA outside of the plan area will continue to be regulated under the *Water Act 1992*. The water plan, including this background report, can provide guidance to inform water decisions outside of the plan area where it is relevant, and particularly regarding water trading and the discharge protection zone. The revised plan area improves management clarity, monitoring efficiency and stakeholder engagement.

The ESY is set at 39,000 ML per year. This is a slight increase from previous plans, adopted to avoid false precision and to account for improved and increased estimates of stock and domestic water use. The ESY accounts for aquifer resilience, historical and projected climate variability and ecological constraints, while delivering water to beneficial uses to meet the plan's overall objectives.

Objectives for water sharing prioritise maintaining ecological health, supporting Aboriginal culture and broader social values, safeguarding long-term water security, and reserving water for regional and Aboriginal economic development.

Critical management strategies in the plan include adaptive measures for climatic variability, targeted groundwater management areas and explicit prioritisation of essential water uses.

4.1 Revised plan area

The plan area has been reduced in size from previous plans to better align with the underlying hydrogeology and water use patterns. Setting plan boundaries involves some trade-offs, as groundwater systems do not always correlate with features on the surface. Additionally, the Tindall Limestone Aquifer is part of a regionally extensive groundwater system (Cambrian Limestone Aquifer) which has variable levels of extraction, water levels, water quality, flow, and responses to rainfall and extraction.

Previous plan boundaries for Katherine were based on aquifer boundaries to the north-west and the Katherine River catchment boundary to the south-east.

Regarding groundwater, the previous plan area encompassed a buffer zone, as well as multiple groundwater resources:

- Tindall Limestone Aquifer in areas where it is unconfined and has strong connection to the Katherine River
- Tindall Limestone Aquifer in areas where it is overlain by the Jinduckin Formation, and has less direct connection to the Katherine River
- Jinduckin Formation which is lower-yielding and has generally lower water quality
- Oolloo Dolostone Aquifer which is now managed separately under the Oolloo Dolostone water allocation plan 2019-2029.

The revised plan area adopts an approach that is proportional to the nature and scale of opportunities for using the water and the impact this may have on the environment. The revised plan area includes only the TLA in areas where it is unconfined, plus a buffer area where the overlying Jinduckin Formation is relatively shallow (150 metres below ground level) and the TLA is relatively accessible (Figure 3). This allows the new plan to focus on parts of the TLA that are easily accessible for use and where take directly affects baseflow contributions to the Katherine River. The plan will also manage surface water of the Katherine River between the Ironwood gauging station at the north-western plan boundary, and the Wilden gauging station approximately 10 km south-east of the plan boundary.

In the future an integrated Daly basin plan will consider water management for the Jinduckin Formation and other water resources outside the revised Katherine plan area. It will also retain both the Katherine and Oolloo water allocation plans as standalone chapters.

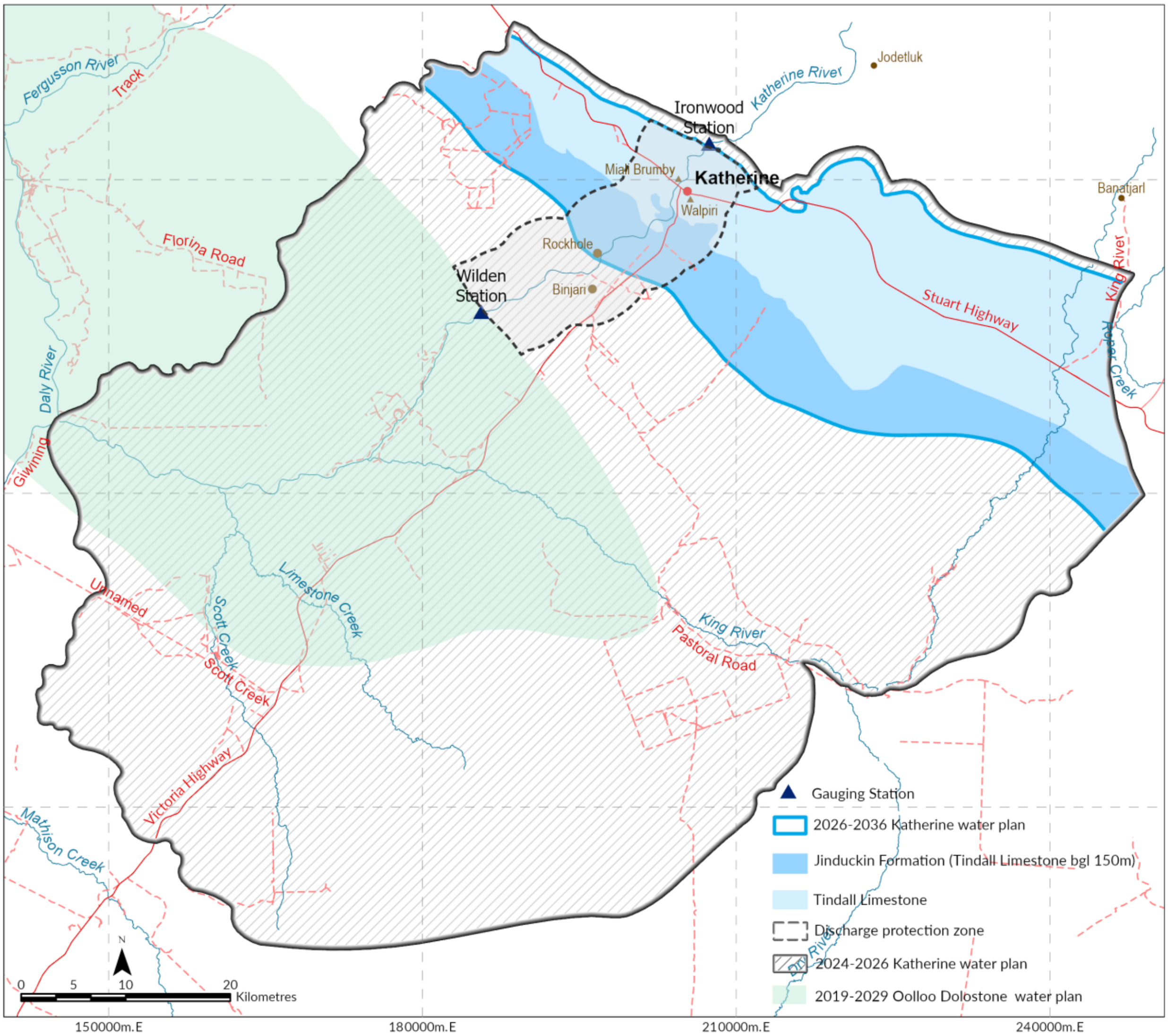

Figure 3. Blue shaded area represents the 2026-2036 plan area and boundary; the dashed line indicates 5 km discharge protection zone from the Katherine River; the grey-lined area represents the2024-2026 plan area and boundary.

The revised Katherine plan area is approximately one-fifth of the previous plan area, but it still captures the areas of highest groundwater (Figure 4). The revised plan area includes 98% of licensed TLA bores, 81% of unlicensed bores and 92% of the licensed entitlement volume associated with the TLA. Almost all licensed extraction within 5 km of the Katherine River remains within the revised boundary. The majority of bores excluded from the revised plan area extract groundwater from the Jinduckin Formation (see Figure 4). All surface water licensing between Ironwood and Wilden gauging stations will be managed in accordance with Katherine water allocation plan 2026-2036, recognising the connectivity between groundwater discharges and surface water flows.

Table 1. Proportion of TLA bores and extraction in the 2026-2036 plan area compared to the Katherine plan 2024-2026

Groundwater bores	Licensed (TLA bores)		Unlicensed	
Plan area	Inside	Outside	Inside	Outside
Proportion of bores	98%	2%	81%	19%
Proportion of licensed entitlements taking from the Katherine-TLA	92%	8%	NA	NA

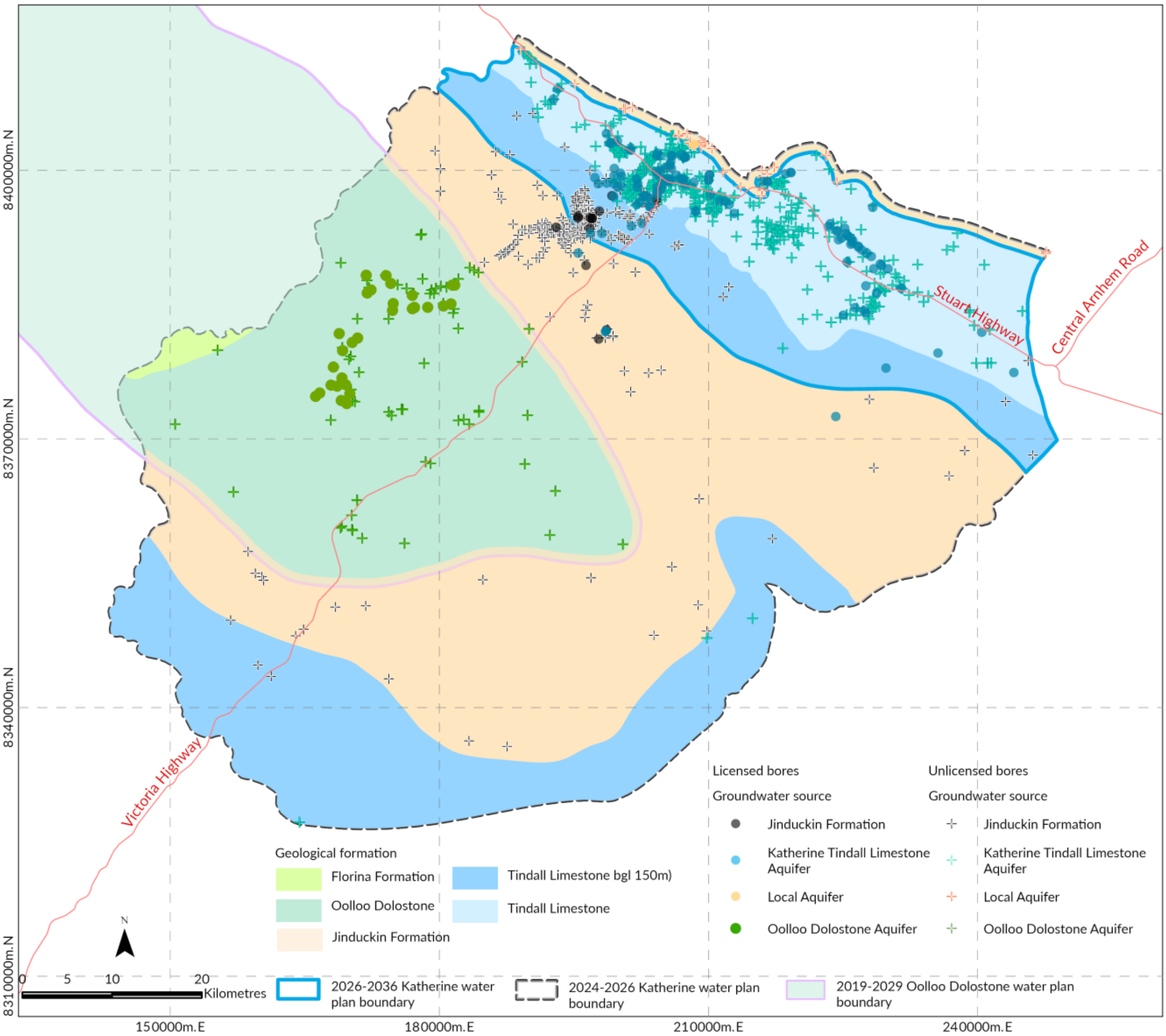

Figure 4. Distribution of licensed and unlicensed bores by groundwater source within the 2024-2026 Katherine water allocation plan, the 2026-2036 Katherine water allocation plan and the 2019-2029 Oolloo Dolostone water allocation plan boundaries

Reducing the plan area improves clarity and efficiency of the water plan, by focussing efforts on the highest-value and highest-risk zones for the Katherine water resource. The previous plan boundary caused some confusion where significant areas of the Jinduckin and Oolloo Dolostone formations were included within it (Table 2). The previous Katherine plan provided limited guidance on the management of these formations. Revising the plan boundary sets clear expectations about where and how water use will be managed through this plan.

Water take outside of the plan area will continue to be regulated under the Act. The 2% of licensed extraction from the TLA outside the plan area will continue to be licensed. Commercial take of water in the Daly Roper Beetaloo water control district will continue to require water extraction licences.

Based on the lower level of demand outside the plan area and the lesser degree of groundwater-surface water connection, the department is confident that assessment of applications guided by the Act and NT wide policies, including the NT Water Allocation Planning Framework and the Processing Water Extraction Licence Applications policy, will adequately manage risk outside of the plan area. Each water extraction licence application in the NT undergoes a site-specific assessment to understand impacts on other users and the environment. Water extraction licences are publicly advertised, allowing the public to provide submissions. The department routinely assesses licence applications using its groundwater-surface water model, and for significant applications the department requests detailed studies from applicants to support the assessment. The water plan and this background report can provide guidance to inform water decisions and assessments outside of the plan area where it is relevant.

Table 2. Surface area of aquifers within the previous and revised Katherine water allocation plan boundaries

Aquifer type	Surface area in previous Katherine water plan boundary (km²)	Surface area in new Katherine water plan boundary (km²)
Florina Formation	27	0
Jinduckin Formation	2,307	0
Oolloo Dolostone	1,451	0
Tindall Limestone (150m bgl)	1,361	450
Tindall Limestone	726	726
Local aquifer	78	0

4.2 Estimated sustainable yield

Water resource management involves sharing water for the benefit of the Territory. In the Territory, water for the environment is prioritised first and foremost. The majority of water stays in the environment for ecological and cultural needs (Figure 5). While the actual proportion will vary year to year, in very dry years the plan maintains 87% of flows in the Katherine River. Only a relatively small amount of water is available for use under the estimated sustainable yield, which for the Katherine water resource is 39,000 ML per year. (smaller, dark blue portion of the water bucket in Figure 5).

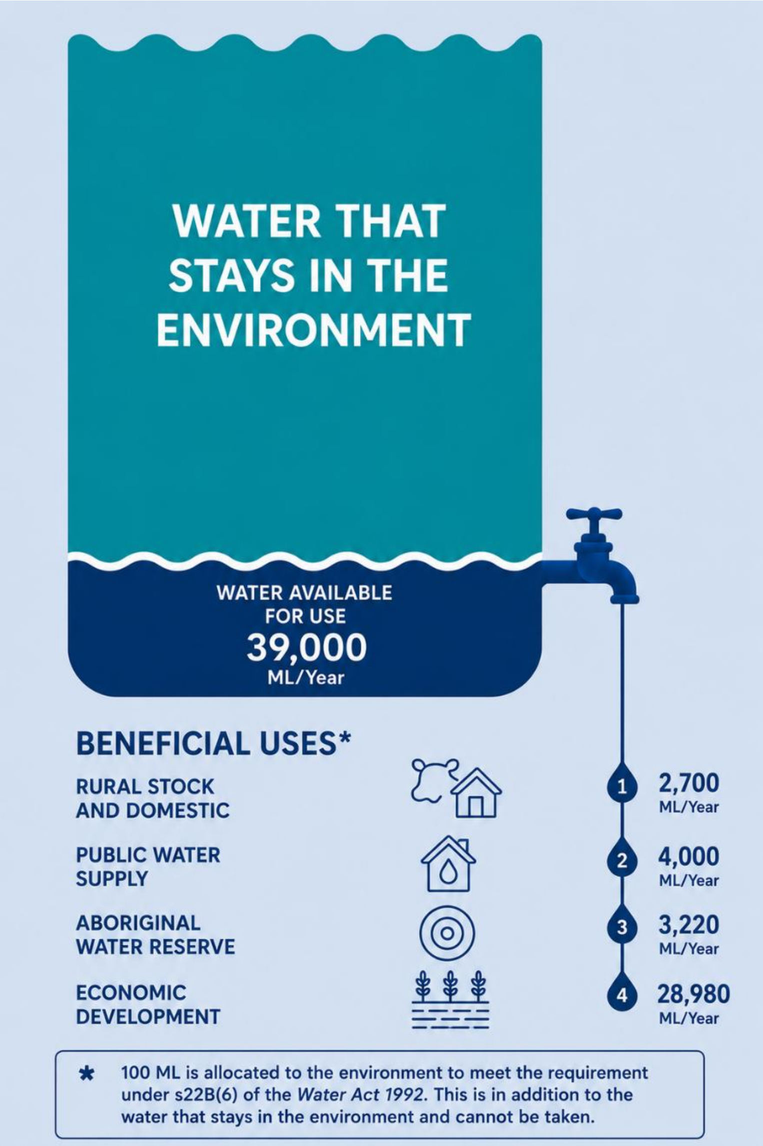

Figure 5: Conceptual water bucket indicating the relative balance of water for the environment, set aside first, and water for beneficial uses allocated in priority order within the ESY.

The ESY is the volume of water that can be allocated from the water resource to beneficial uses, within ecological constraints. The ESY prioritises water to stay in the system to support environmental and cultural values. Setting the ESY supports the plan's objectives of water sharing by balancing ecological sustainability, cultural values, social wellbeing, and economic development. The context of Katherine as the Territory's third largest town, and one of the most significant agricultural production areas in the Territory has been considered. The ESY is estimated in the context of uncertainties surrounding some evidence (as described in section 4.3), and is guided by clearly defined management priorities, ecological constraints, and community values.

The ESY is informed by:

- water availability (discussed further in section 7.6)
- ecological considerations, particularly maintaining the health of aquatic and groundwater-dependent ecosystems (discussed further in section 10)
- balancing economic and social benefits within ecological limits.

Water availability in the Katherine-TLA comprises inflows and outflows, including rainfall recharge and evapotranspiration, estimated using scientific studies, real-world data and computer models. As a Top End system, water availability is typically categorised as a percentage of average annual recharge, with the Katherine plan enabling extraction of 64% of this recharge. New and updated water and climate data has been incorporated, resulting in a slight decrease in average recharge estimates from 71,000 ML per year in the 2024-2026 plan, to 61,000 ML per year in this iteration of the plan (described further in section 7.6).

However, evaluating the ESY only in terms of recharge does not take into account other important contextual information and the detailed scientific understanding of the Katherine-TLA. For example, annual recharge excludes the substantial volume of rainfall that becomes ‘rejected recharge’ (refer to section 7.3), which is estimated to be in the order of tens of thousands of megalitres during intense rainfall events. When considered as part of the water balance, the ESY is approximately 3% of the total rainfall over the Katherine plan area, or 0.6% of total annual flows in the Katherine River in an average year.

The plan maintains and slightly increases the ESY from 38,391 ML per year to 39,000 ML per year. This adjustment avoids false precision and better aligns with current hydrogeological understanding and climatic variability.

Critical considerations supporting the ESY adjustment include:

- Water resource status and recharge dynamics: continuous monitoring demonstrates robust aquifer storage, with groundwater levels higher than pre-extraction (1970) levels due to a wetter climate regime. Modelling scenarios based on the ESY (full use entitlements) shows higher aquifer storage compared to storage in 1970, suggesting a high likelihood of aquifer resilience and buffer capacity under the climate regime of the last 50 years (see section 6).

- Ecological constraints: there is no evidence that current levels of extraction have had regional ecological impacts or impacts on dry season flows to the Katherine River. Modelling full use entitlements over the last 50 years shows that climate variability, not extraction, is the dominant driver of river flows. Biodiversity assessments in much of the plan area (Ruykys et al., 2024) identified that nearly half of the area has been significantly altered, and that risks to biodiversity in highly modified areas, including areas of irrigated agriculture, are lower (Ruykys et al., 2024). However, the impact of water take on discharge is known to be sensitive to the location of take (see sections 5, 7.4 and 7.5), and local risks to aquifer discharge from extraction close to the Katherine River are poorly understood. Additional management measures will more closely manage water take in and around the river (section 5).

- Climatic variability and management focus: the Katherine region experiences significant rainfall variability, driven by monsoonal patterns and phenomena like El Niño-Southern Oscillation. Climate change will continue to cause increases in average temperature in all seasons. However, natural climate variability is projected to remain the major driver of rainfall changes in the next few decades (Australian Climate Service, 2025). Despite an increasing rainfall trend, short dry periods of up to two years remain a key risk. Management strategies such as announced allocations, as well as additional characterisation and management of unlicensed use, will safeguard environmental flows during dry periods.

- Environmental water: The ESY of Katherine water plan is capped at 39,000 ML per year, prioritising water retention within the system to support environmental and cultural values. To further manage risk, an announced allocations framework will be applied to temporarily reduce water extraction during periods of heightened climatic stress, helping to maintain dry-season river flows, with additional restrictions on new licencing and trade applying within a discharge protection zone. Environmental water stays in the environment and is set aside prior to the calculation of the ESY. However, section 22B (6) of the *Water Act 1992* requires that the plan include an allocation to the environment from the ESY. The majority of the water balance remains unallocated to maintain environmental water requirements to ensure the plan is compliant with the Act, a small allocation to the environment is provided from the ESY.

- Plan area refinement: the reduced plan area better aligns with hydrogeology and extraction patterns. Recharge to the aquifer only occurs where the TLA is unconfined, while other formations including the Jinduckin prevent rainfall infiltration into the TLA in confined areas. As the new plan boundary retains the unconfined areas but excludes confined areas, recharge estimates that affect water availability are not affected by the change in plan boundary. The plan will continue to manage surface water extraction from the Katherine River, both within the plan boundary and downstream approximately 10 km to the Wilden gauging station.

Given these scientific and policy considerations, maintaining and slightly increasing the ESY to 39,000 ML per year supports the objectives of the plan and sustainable water management outcomes for the Katherine region.

4.3 Confidence level assessment of available evidence

Confidence level	Data and knowledge issues
High confidence	Licensed bore extraction and licensed entitlements: precise data exists for metered extraction within the revised plan area. Licensed entitlements are well-documented, and extraction patterns are supported by monitoring records. Refined plan area alignment with hydrogeology: hydrogeological data underpinning the revised boundary, particularly the distinction between the TLA and the lower-yielding Jinduckin Formation, are well established by prior scientific studies and monitoring data (summarised in Rooke, 2024).
Moderate confidence	Future climatic variability: while historical records and contemporary modelling provide reasonable confidence in the aquifer response to climate variability, uncertainties remain, particularly regarding future climatic extremes and their hydrological impacts. Biodiversity in much of the plan area has been assessed and groundwater dependent ecosystems identified and mapped through a process of expert elicitation and assigned a confidence level (see Ruykys et al., 2024 and section 10.3).
Low confidence and knowledge gaps	Unlicensed bore extraction: estimates regarding unlicensed bore extraction are inferred indirectly through property and bore registration data, leading to inherent uncertainty and difficulty quantifying confidence levels. Local risks to aquifer discharge from unlicensed bore extraction close to the Katherine River requires further investigation. The groundwater dependent ecosystem assessment was developed for a separate process and does not encompass the full extent of the 2026-2036 plan area. More recent groundwater dependent vegetation probability mapping (Box & Brim Box, 2024) should be considered in future.

5. Water use trends

Overview

This section focuses on water extraction, risks and potential impacts in the plan area.

Water extraction in the plan area supports agricultural, residential and commercial uses, with licensed volumes totalling approximately 28,200 ML per year. The department has increasing confidence in the accounting of water used by licence holders, with high compliance rates for metering and reporting in Katherine. Actual water use remains well below licensed entitlements, varying from approximately 8,000 to 15,000 ML per year since 2020. Licensed use in sensitive areas near the Katherine River has remained well within the overall volume granted to existing licences.

Unlicensed use in the plan area is less certain as it is unmetered. Unlicensed groundwater use has been estimated to be near 4,200 ML per year. Domestic use represents the largest portion of unlicensed extraction.

Overall, the level of water take is well within the ESY. This iteration of the plan applies a coordinated set of management measures — including a discharge protection zone with capped levels of take and targeted actions to better quantify unlicensed use.

5.1 Importance of water use trends

Understanding water use and potential future water use trends is important to establish water allocations within the ESY, and to identify if additional management measures are needed to support the plan's water sharing objectives.

Section 4 outlined evidence suggesting that full use of entitlements is unlikely to result in over-extraction from the TLA or cause unacceptable regional-scale environmental impacts. Much of the Katherine plan area has been substantially modified for urban and agricultural development (Ruykys, et al., 2024). Biodiversity risks from groundwater extraction are relatively low in these modified landscapes.

Taking water from bores further away from the river allows time for groundwater recharge to buffer the impact of take on surface water flows (see section 7). In contrast, taking water from bores close to the river has greater potential to impact aquifer discharges and river flows. Areas of high biodiversity value are known to exist near groundwater discharge areas along the Katherine River (Ruykys, et al., 2024), and this will require closer management.

5.2 Overview of licensed entitlements

Commercial water use requires a water extraction licence in most cases. Total maximum licensed entitlements for the Katherine water resource were 28,200 ML per year, across 66 groundwater and nine surface water licences at the time of declaration of the plan. Table 3 shows the distribution of the licensed entitlements by beneficial uses. Agriculture has the largest licensed entitlements accounting for 79% of groundwater licenses and 98% of surface water licences.

At the time of declaration, there were no water licences for the beneficial uses of Aboriginal economic development, aquaculture or petroleum activity in the Katherine plan area.

Table 3. Licensed entitlements by beneficial use

Beneficial use	Licensed entitlement (ML per year)	Proportion of volume (%)
Groundwater	***25,489***	
Agriculture	20,094	79%
Industry, mining activity and cultural	1,319	5%
Public water supply	4,076	16%
Surface water	***2709***	
Agriculture	2660	98%
Industry	49	2%
Total all licensed entitlements	***28,198***	

The department's understanding of actual licensed use has significantly improved over time as compliance rates for metering and reporting use have increased. Katherine compliance rates are high[4],with 97% of extraction points metered in Katherine, compared with 82% Territory-wide and 77% to 100% in other jurisdictions (Productivity Commission, 2024). More than 97% of licence holders in Katherine have reported their usage to the department since 2022. Water compliance rates have been reviewed and reported in annual 'State of the Resource' reports since 2022.

Prior to declaration of the first water allocation plan for Katherine, water use for agriculture was conservatively estimated using a desktop assessment to be 12,500 ML per year in 2006 (including of the former plan area) (DENR, 2008). Based on actual metered use, we know that demand from 2020 to 2024 has not significantly exceeded this in the two decades since the first plan, although it is trending up in some locations (section 5.4). Since 2020 actual water use has ranged from 8,000 to 15,000 ML per year (30-55% of entitlements).

Similar to the rest of the Territory, only a small proportion of water licences in the Katherine plan area use their full entitlements each year. However, actual use varies significantly between different beneficial uses (Table 4). Around half of agricultural entitlements are being used, while the use of water for public water supply is around 7% of its annual licensed entitlement.

The department periodically applies the recovery of unused licensed water entitlements policy[5] to recover water from licence holders who are not using or have no long-term plan to use their entitlement. During 2023-24 almost 6,000 ML was recovered in the Katherine region with a further 100 ML recovered in 2024-25. This recovery action enabled full provisioning of the Aboriginal water reserve and access to water for new and expanding developments. The policy was updated in 2025 in response to licence holder feedback (section 11.4).

[4] Historical compliance rates reported for the former plan area

[5] https://nt.gov.au/environment/water/management-security/water-policies-and-guidelines

Table 4. Proportion of full entitlements used by beneficial use (2020-2024)

Beneficial use	Total maximum entitlements ML per year	Average use ML per year	Average proportion of use (%)
Groundwater	*25,489*	*11,075*	*43%*
Agriculture	20,094	8,889	44%
Industry, mining activity and cultural	1,319	1891	143%[6]
Public water supply	4,076	296	7%
Surface water	*2709*	*453*	*17%*
Agriculture	2660	445	17%
Industry, mining activity and cultural	49	8	16%

5.3 Overview of unlicensed water extraction

Water can also be taken without a licence for limited purposes. Owners and occupiers of land have rights under sections 11 and 14 of the Act to take water from a bore or waterway for domestic purposes, drinking water for grazing stock and to irrigate a garden not exceeding 0.5 hectare. Land holders can also take small volumes of groundwater, up to 5 ML, per land parcel for other uses without a licences under a longstanding exemption to water licence requirements (refer to Gazette G13 of 20 June 2024). The Department of Defence also takes water from the TLA without a water extraction licence; estimates of take have been provided to the department to support water planning.

Across the plan area unlicensed water take is estimated to be around 4,200 ML per year, the majority of this is associated with domestic use (Table 5). The department has low confidence in this figure as use is unmetered and unreported. Estimated domestic and rural stock use exceeds current allocations within the ESY, however there is uncertainty as use is not metered. Given low rates of licensed take, this is not anticipated to result in overall take in excess of the ESY in this term of the plan. As discussed further in section 5.6, implementation actions (action 3.4.3) have been set to better characterise unlicensed use and additional actions, including a restricted water extraction area will be considered at the mid-term review of the plan.

Table 5. Estimated water use without water extraction licences within plan area

Land-use category	Estimated use (ML per year) [7]	Proportion of volume (%) [8]
Domestic (inc. gardens)	2,629	63%
Rural stock	684	16%
Other beneficial use - exempt	429	10%
Other beneficial use - defence	430	10%
Total	**4,172**	**100%**

[6] Proportion of full entitlement used exceeds 100% due to limitations of the DLPE database with respect to dual purpose licences (i.e. licences for both agriculture and industry, or agriculture and cultural). Licence holders for industry, mining activity and cultural uses in Katherine have remained within their maximum entitlements. Excess water use is attributable to agriculture.

[7] As unlicenced use is not subject to reporting and metering requirements, all unlicenced use is estimated. Domestic use (including gardens) has been estimated based on 3.5 ML per land parcel for properties greater than 0.5 ha, excluding vacant crown land. Rural stock use has been estimated based on stocking levels held by Department of Agriculture and Fisheries and estimates water use requirements per-head for the region. Exempt use has been estimated based on analysis of unlicensed irrigated land identified through the Land Use Mapping Project of the Northern Territory 2016-2024, applying a 2 ML per hectare rate. This estimated irrigation rate is comparable to metered water use rates for licenced agricultural properties.

[8] Will not total 100% due to rounding

5.4 Overall trends in water use over time

Patterns of licensed commercial water use, at a range of distances from the Katherine River, show significant growth since 2000. Although annual use fluctuates, a step change in water demand began in the early to mid-2000s, driven by the expansion of irrigated agriculture and the transition of new areas into production. Large-scale perennial horticulture plantings, particularly mangoes established in the early 2000s, began reaching maturity by the mid-2000s, alongside increased production of irrigated annual and broadacre crops. This period also included several relatively dry years, increasing reliance on groundwater extraction from the TLA.

An escalation in water use and growing competition between agricultural, industrial and public water supply demands were key factors leading to the development of the first Katherine water allocation plan in 2009, which sought to manage extraction and protect late dry-season flows in the Katherine River (Figure 4).

By the 2010s, the Katherine and Daly region was producing over 20,000 tonnes of mangoes annually, worth tens of millions of dollars (Ash & Watson, 2018). There has also been growth in irrigated hay production to supply the live cattle export trade and local feedlots. Cotton was first trialled in the 1800s and again in the 1960s with little success but is being revitalised with the construction of a cotton processing facility in the region. Several dozen farmers in the region have begun planting cotton commercially, taking advantage of the ample wet season rain and some irrigating in the dry season. According to land-use surveys, by the 2010s the Daly basin had one of the NT's largest concentrations of agricultural land, although still small when compared to the vastness of surrounding pastoral lands.

In preparation for this iteration of the plan, trends in unlicensed water use have been reviewed using the Northern Territory's bore construction database, which includes drilling records dating back to the 1970s[9]. While estimates for growth in extraction from unmetered bores are uncertain and should be treated with caution, it appears that unlicensed use has steadily increased since 1980, particularly in close proximity to the Katherine River (<5 km) (Figure 6).

[9] The same estimation method was used to estimate annual extraction from unmetered bores as that described in Ash & Watson, 2018. Bores were assumed to extract the same annual volume each year from the bore completion date on record. These estimates should be understood as indicative only and used with caution. Unlicenced use estimates vary from those in section 5.3, as section 5.3 relied on multiple data sets which did not include temporal data.

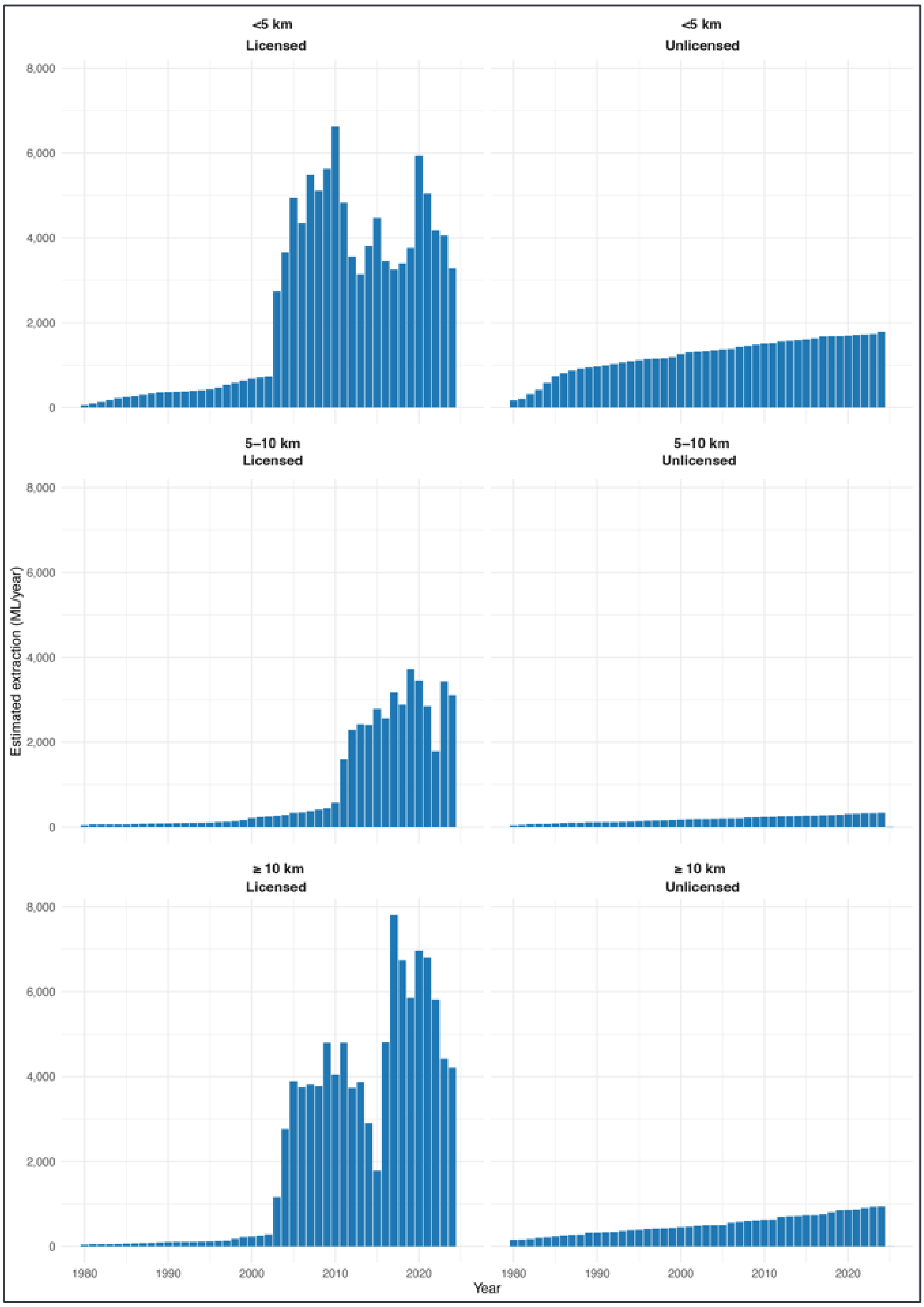

Figure 6. Estimated licensed and unlicensed extraction (ML per year) from unmetered bores in the plan area split by distance from the Katherine River

5.5 Trends near groundwater discharge areas

Water use in close proximity to groundwater discharge areas at the Katherine River has been considered in greater detail as extraction in this area could pose a greater risk to dry season flows. Previous iterations of the Katherine plan placed restrictions on trade and the granting of new licences in close proximity to the Katherine River, applying a groundwater discharge protection area that extended approximately 3 km from the river.

At the time of plan declaration, overall licensed water take within 5 km of the river was well within entitlement limits, and within extraction volumes that were assessed and modelled when determining the

ESY. This contrasts with licences operating 5 to 10 km from the river which are approaching 90% use of full entitlements (Table 6).

Table 6. Licensed water extraction trends in proximity to the Katherine River

Distance	Full entitlements	Average use	Proportion of full entitlements used (%)
<5 km	13,815	4,762	34%
5 to 10 km	1,455	1,289	89%
>=10 km	12,880	5,477	43%
Unclassified[10]	50		
Total	28,200	11,528	41%

To inform management arrangements, future growth has been considered based on beneficial use (Table 7). Overall, licensed use within 5 km of the Katherine River is considered unlikely to substantially increase beyond existing entitlements in the term of the plan, given the relatively low rates of current use.

Increases to domestic use may occur with population growth, and land for rural residential development has primarily been identified within 5 km of the river under the Katherine Land Use Plan 2014. Use within the 5 ML exemption remains uncertain but has been estimated in this iteration of the plan. Conservatively, future exempt use has been estimated to double in the term of the plan, however current uptake appears to be low with only 29 large (>1 hectare) properties irrigating without a water licence.

While licensed use is anticipated to continue to dominate moving forward, increasing pressure from domestic and exempt use has been identified.

Table 7. Future use projections within 5 km for the Katherine River

Land-use category	Estimated use ML per year	% of total estimated use [11]	Potential growth ML per year	Projection method
Licensed use	4,762	67%	13,815 (+9,053)	Based on total maximum water entitlements for the area being fully used. Does not account for future increases or trades into the area
Domestic (including gardens)	1,841	26%	2,156 (+315)	Based on subdivision of 180 ha land to create an additional 90 rural lifestyle lots, consistent with housing demand identified in Katherine Land Use Plan 2014
Rural stock	341	5%	341	Growth not assessed
Exempt use	116	2%	232 (+116)	Assumes exempt use rates will double over the term of the plan
Total	**7060**	**100%**	**16544**	

[10] Licences that have reported zero water use over the analysis period.
[11] Will not total 100% due to rounding

The department has considered the location of existing bores compared to known groundwater dependent ecosystems (GDEs) and discharge sites. Features of the TLA, including sinkholes and caves, can lead to large variances in localised aquifer response in these areas (Rooke, 2024), and smaller volumes of take may be relevant to environmental impact. Additionally, GDEs are understood to be of higher biodiversity value compared to the modified landscapes which cover the majority of the plan area.

The most recent biodiversity assessment of the Katherine area identified and mapped GDEs in part of the plan area (Ruykys, et al., 2024). As evidenced in Figure 7, the majority of bores within 1 km of moderate to high confidence GDE sites are unlicensed. While the overall volume of unlicensed take in proximity to GDEs is understood to be low, additional investigation is warranted to support the plan's water sharing objective 1: Maintain water quality and availability to support environmental values and beneficial uses, particularly given restrictions on licensing have been lifted in this iteration of the plan (refer implementation action 3.1.3).

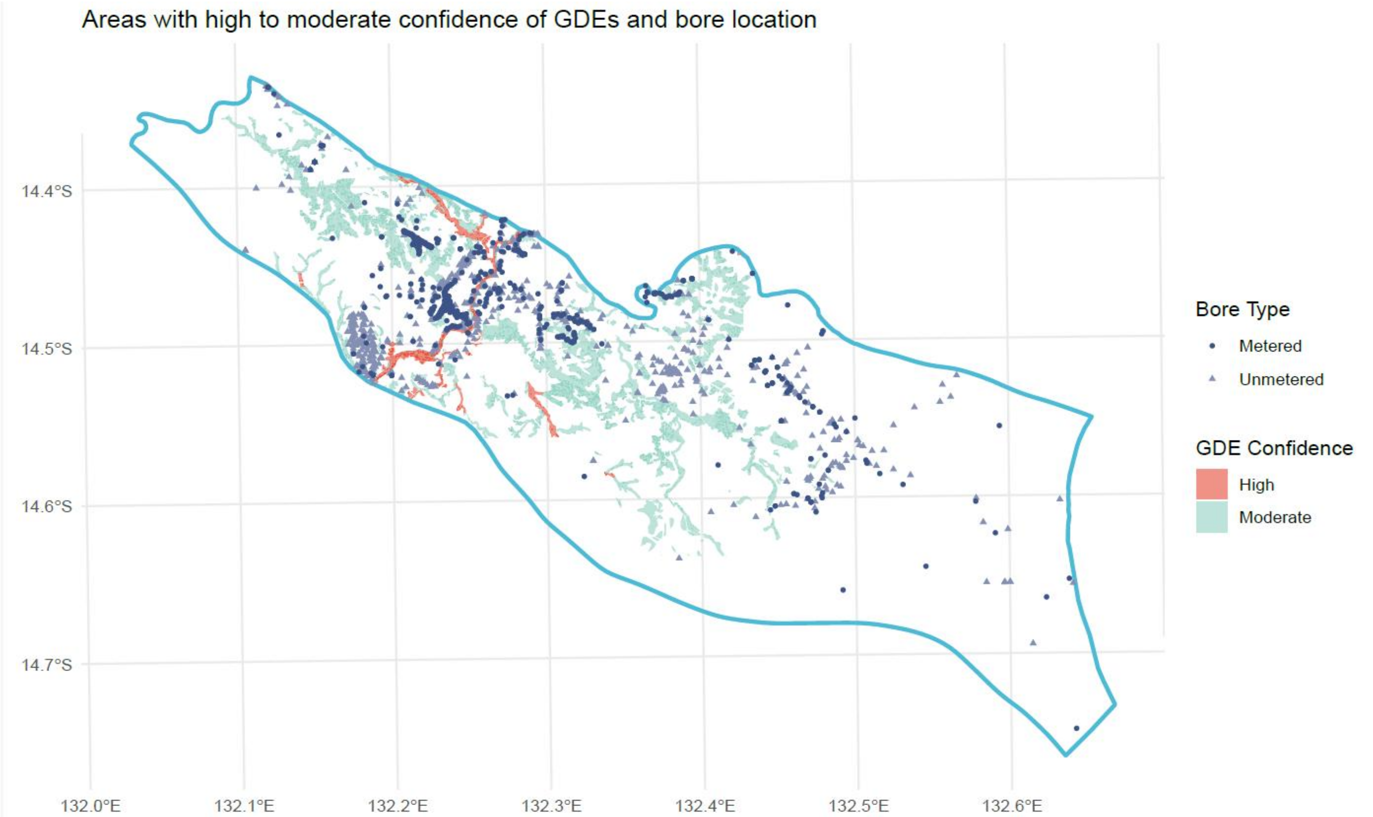

Figure 7: Areas with high to moderate confidence of GDEs and bore location (metered is licensed and unmetered is unlicensed bores)

5.6 Management implications

Overall water use trends observed since water planning commenced for Katherine include:

- Close proximity to the river (<5 km): actual licensed use appears to have fluctuated but has remained below 7,000 ML per year since declaration of the first plan in 2009 (Figure 6). Take remains well within full entitlements indicating there is not significant demand for additional licensed water. Unlicensed use has steadily increased, and this trend may continue in line with future residential development earmarked for this area.
- Intermediate distance (5 to 10 km): licensed use has steadily increased, and take is approaching full entitlement (average use 89%), indicating there may be demand for additional water through trade or increases to water licences in this area. Only marginal increases in unlicensed use have occurred.

- Licensed use is likely to continue to dominate in close proximity to the Katherine River and GDEs during the term of the plan, however there is uncertainty in estimates of unlicensed use and in water resource behaviour near GDEs.
- Estimation methods for unlicenced use give a range of indicative estimates, they are uncertain unlicenced use in not metered. However, rural stock and domestic use is understood to have increased since the previous plan.

Management arrangements in this iteration of the Plan apply a range of complementary tools to both encourage water use within sustainable levels and protect river baseflow, including:

- Allocations to rural stock and domestic use have been significantly increased to accommodate a growth in unlicenced extraction since the previous plan. While the allocation remains below current indicative estimates, the department's understanding will be improved over the term of the plan through an independent, targeted research program. Overall take from the water resource is unlikely to exceed the ESY in the term of the plan when low rates of licenced use are considered.
- Discharge protection zone will apply within 5 km of the Katherine River:
    - The rigid moratorium on new licences and trade, previously applied within the groundwater protection zone have been removed to encourage entitlements to be fully utilised for the benefit of the licence holder, the community and the Territory, while maintaining protection outcomes.
    - Total water entitlements will be capped at 13,816ML/yr i.e. the sum of the total maximum licence entitlement of all licences in the discharge protection zone at the time of declaration.
    - Temporary trades into the zone will be supported where total actual use is expected to remain below 13,816ML/yr for the duration of the trade.
    - Recovery of unused licensed water entitlements policy will be prioritised in the discharge protection zone to increase the volume of water available within the cap, under implementation action 3.5.4.
- Characterisation of unlicensed water take will be improved through independent research (implementation action 3.4.1) and public reporting (implementation action 3.4.3).
- Announced allocations will be used to manage licensed entitlements in dry years. Reductions in licenced entitlements will be complemented by education campaigns that target unlicensed water users.

Consideration was given to new powers that allow restrictions to be placed on domestic use where a risk to users or the environment had been identified. This 'restricted water extraction area' (RWEA) power would cap domestic use at current levels while allowing subdivisions to proceed where alternative water sources (e.g. tanks) can be identified. However, declaration of a RWEA would also place restrictions on new commercial licensing in the area. At the plan's mandatory five-year review, the department will consider if a RWEA is necessary based on new research and data on water use trends.

5.7 Confidence level assessment of available evidence

Confidence level	Data and knowledge issues
High confidence	Metered water extraction data from licence holders since 2020. Rates of metering and reporting are now high in Katherine, improved compliance coincides with release of Water Resources Division Compliance and Enforcement Policy (2020), the launch of an online portal for reporting (2021), and implementing regular reminders and auditing through compliance plans (2022 onwards).
Moderate confidence	Classification of groundwater dependent ecosystems in the biodiversity assessment area is based largely on expert elicitation with limited ecological and hydrological site-specific data. Future assessments could incorporate groundwater-dependent vegetation probability of occurrence mapping which has since been completed implementation of the plan (Box & Brim Box, 2024) Unlicensed water extraction estimates are calculated from limited information; they are intended to be indicative for precautionary management and not precise quantitative assessments.
Low confidence and knowledge gaps	Modelled groundwater travel times and flow paths (affected by karstic aquifer characteristics such as fractures and caves, creating substantial uncertainty). Projected future water use estimates are uncertain but considered to be conservative for the period of the plan.

6. Climate variability

Overview

Rainfall in the Katherine region is highly variable, with seasonal, annual and decadal fluctuations driven by monsoonal patterns and global climate systems.

Despite a long-term increase in average annual rainfall, very dry sequences still occur but are typically short (one to two years), with no evidence of sustained multi-year meteorological drought.

Modelled Katherine River flow data at Wilden shows similar variability, with dry-year sequences clustering in the early 1900s and limited persistence of low-flow periods.

Aquifer levels and river flows are also highly responsive to rainfall variability. There is no clear long-term trend in groundwater levels or river flows attributable to pumping.

In the next few decades, natural variability is expected to outweigh any climate change signal and water management in Katherine should focus on managing variability and extremes rather than assuming any single directional trend.

The plan is designed to manage the impacts of interannual variability and short dry sequences, aligning with the observed hydrological regime and current best available climate advice.

6.1 Rainfall patterns in the Daly River basin

The Daly River basin is in Australia's Monsoonal North region with rainfall falling over half of the year. There is a moderate variation observed within years (intra-annual variation of the wet-dry monsoonal climate), between years (interannual variation driven by changes between three major global weather systems: Indian Ocean Dipole, Maddon- Julian Oscillation, and El Niño - Southern Oscillation), and between decades.

Rainfall is characterised by a pronounced wet-dry tropical pattern (Figure 8). Rainfall averages around 980 mm annually, with approximately 97% of rainfall concentrated in the wet season (November to April), driven by intense monsoonal events and occasionally augmented by degraded cyclones. Dry season rainfall is minimal, necessitating groundwater-dependent baseflows such as from the TLA for sustained river flows.

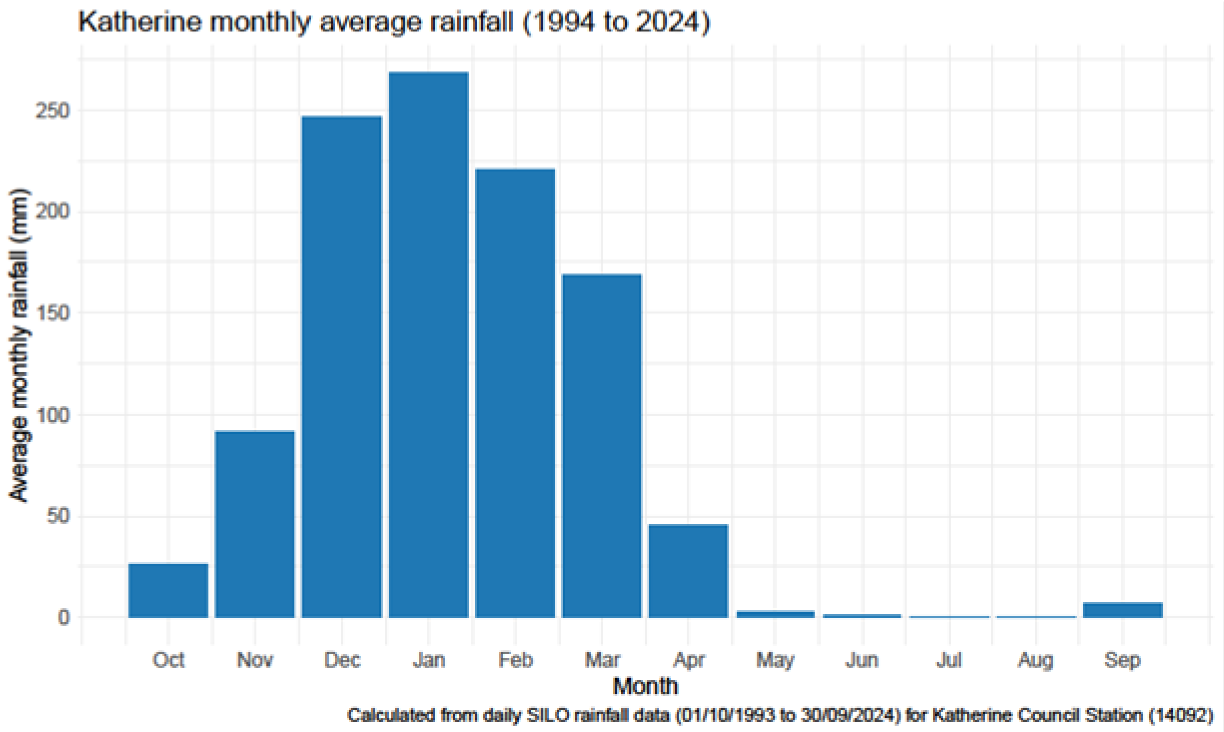

Figure 8. Monthly average rainfall in Katherine from 1994 to 2024, based on daily data from the SILO dataset for the Katherine Council Station (14092). Rainfall is strongly seasonal, with a clear wet-dry pattern and most precipitation occurring between December and March.

Climate variability across the Monsoonal North is significantly influenced by large-scale climatic phenomena, notably El Nino-Southern Oscillation and Southern Oscillation Index and Indian Ocean Dipole, causing interannual and interdecadal variations in rainfall intensity and duration. The last century of rainfall records shows an overall increase in annual rainfall with the most recent 30-year period wetter than much of the preceding century. Substantial variation remains within these periods, highlighting the need for robust and adaptive management to mitigate impacts during periods of drought arising from missed monsoons, which continued even during the most recent wetter period (Figure 9).

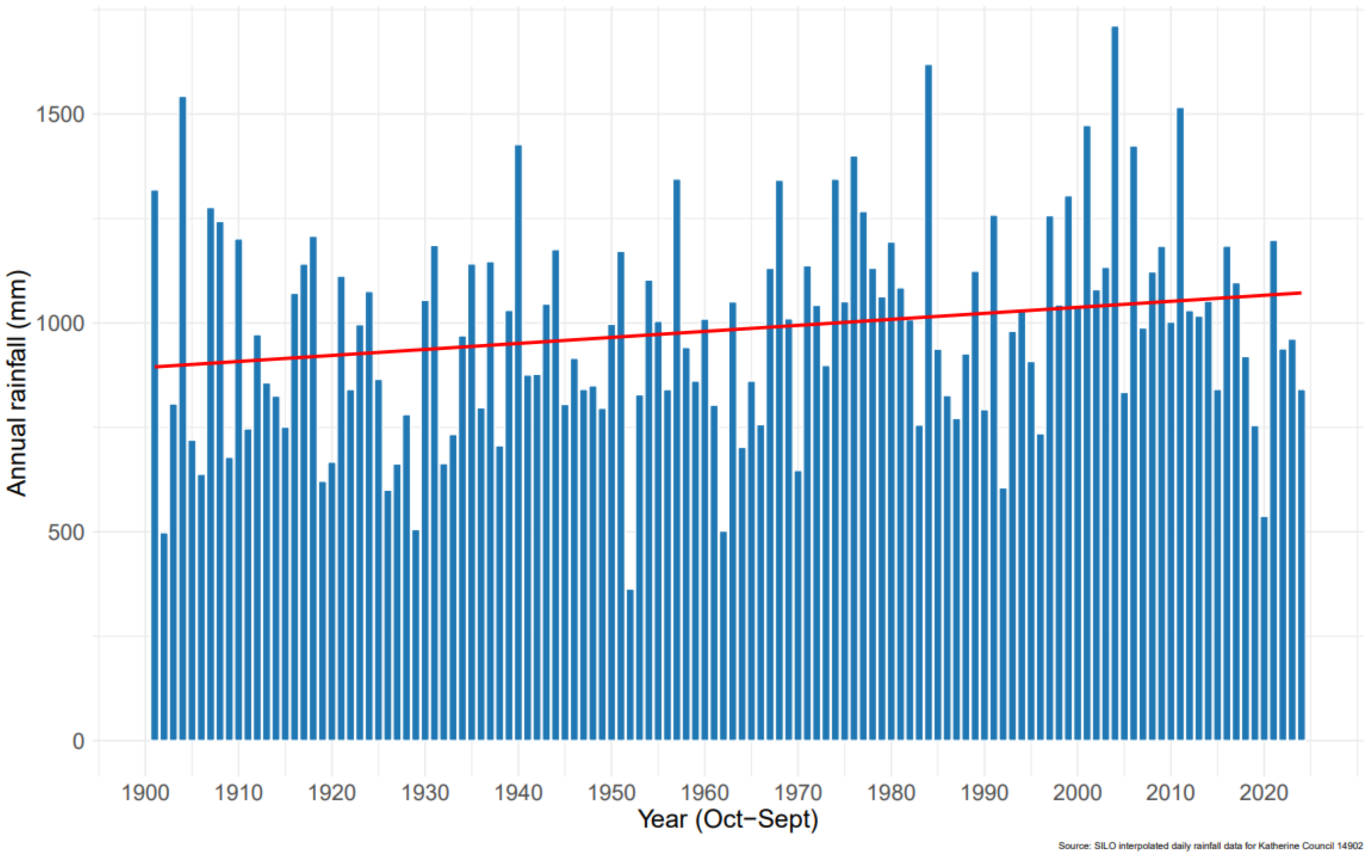

Figure 9. Distribution of annual rainfall in Katherine from 1901 to 2020 with a linear regression fitted by ordinary least square showing an increase in rainfall over time. Based on daily SILO rainfall data from Katherine Council Station (14092)

Sequences of dry years are relatively short compared to some other parts of Australia. Sequences with two years from among the driest 10% only occur twice across the historical rainfall record since 1900, and sequences of two years in the lowest 20% only occur three times. There are no sequences longer than two years with annual rainfall in the lowest 20% of years and, consistent with an overall increase in rainfall in recent decades, the dry periods cluster in the first half of the 1900s (Figure 10). There are also very few multi-year sequences of very wet years.

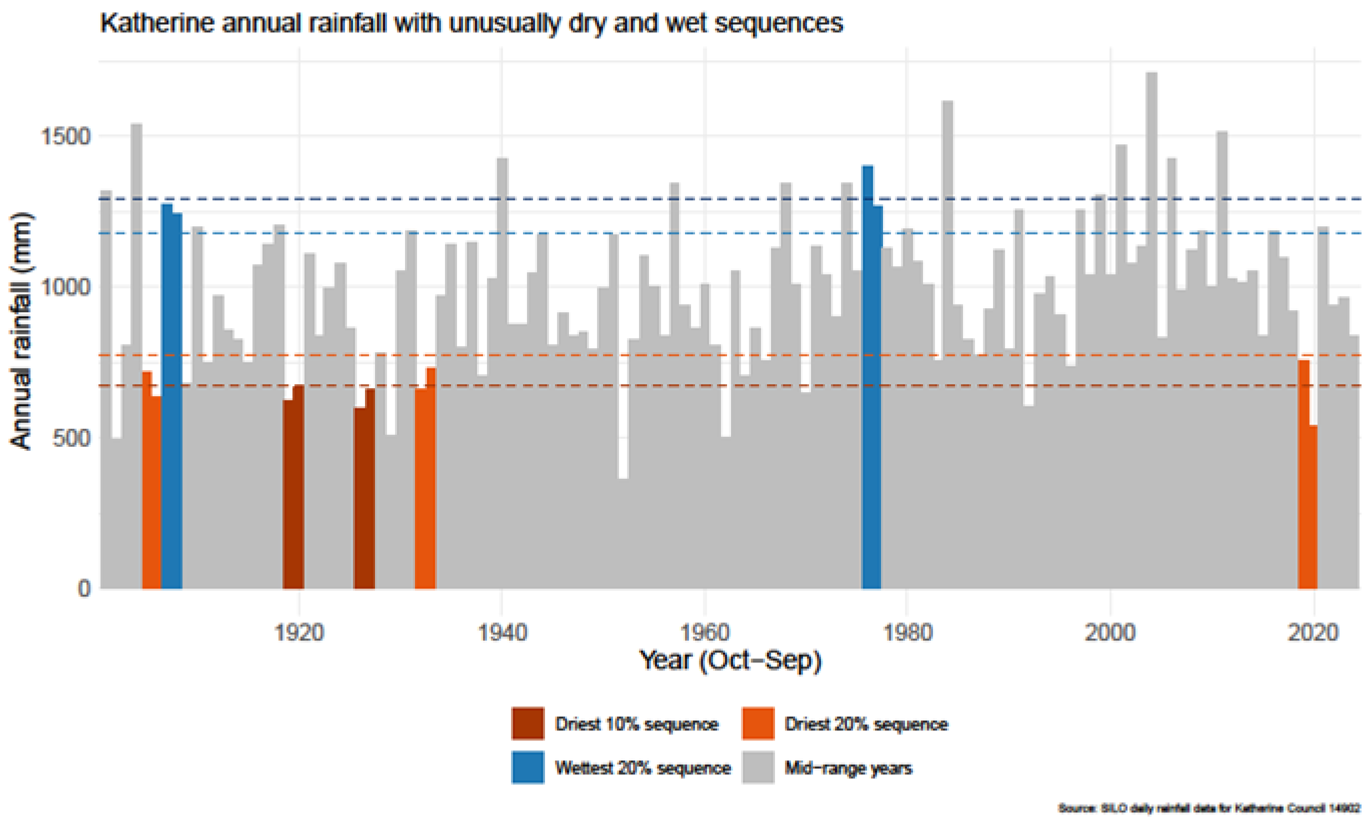

Figure 10. Annual rainfall in Katherine from 1900 to 2024, highlighting sequences of more than one consecutive unusually dry and wet years. Data derived from daily SILO rainfall records for Katherine Council Station (14902). Dashed horizontal lines mark decile and quintile thresholds

Water managers and users can typically expect dry periods to be short-lived, limiting the risk of prolonged meteorological drought. However, even short dry sequences can impact aquifer recharge and reduce dry season river flows. Modelled flows at Wilden on the Katherine River, where aquifer discharge makes an important contribution to dry season flows, show a similar pattern to rainfall with high variability between years, increasing flows in recent decades, and a small number of low annual flow sequences (Figure 11). Management strategies should therefore focus less on long-term rainfall deficits and more on protecting low flows during missed monsoon years, recognising that wetter recharge periods provide long-term buffering for aquifer storage and river discharge.

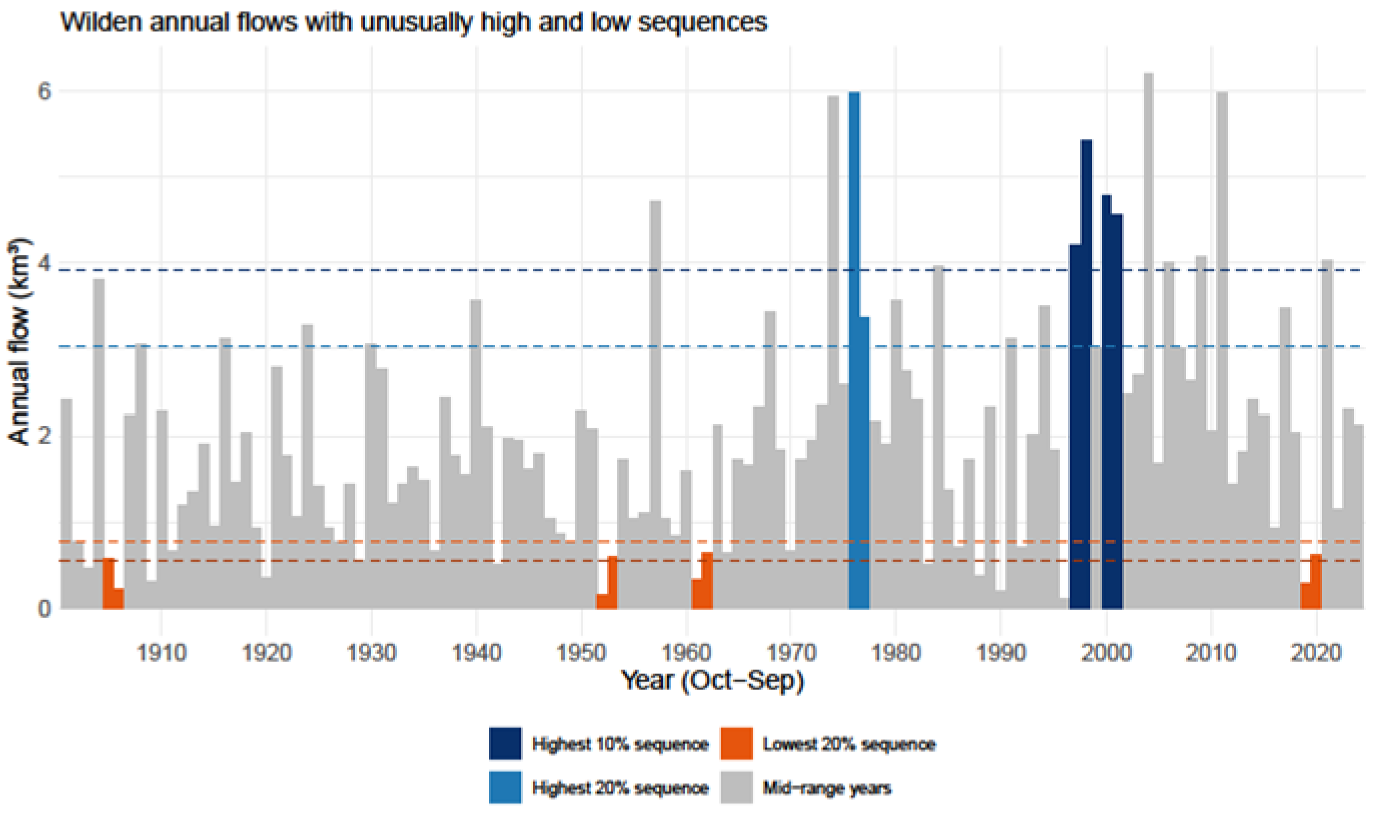

Figure 11. Annual modelled flow at the Wilden gauge from 1900 to 2024, showing sequences of more than one consecutive unusually high and low flow years. Dashed horizontal lines mark the threshold values for quintile and decile categories.

6.2 Water resource response to climate

From a groundwater perspective, natural variability in rainfall is the dominant influence on long-term aquifer storage trajectories in the Katherine Tindall Limestone Aquifer. Periods of above-average monsoon rainfall led to greater recharge, higher groundwater levels and increased spring and river discharge, whereas extended low-rainfall periods result in minimal recharge, declining water tables, and reduced dry season flows (Rooke, 2024).

Aquifer storage has followed a broadly cyclical pattern over the past 5 decades, with periods of decline and recovery closely tied to broader climatic trends (Figure 13). Storage increased significantly from the early 1970s through the late 1970s, declined through the 1980s and 1990s, and peaked again around 2011, which is consistent with high rainfall years. Consecutive poor wet seasons in 2018 to 2020 prevented the usual wet season groundwater rise, leaving groundwater levels in the Tindall Limestone Aquifer at their lowest in more than 20 years in mid-2020 (Bureau of Meteorology (BOM) 2020a). Conversely, an exceptionally wet La Niña period in 2010–2012 produced a large increase in aquifer storage in 2011-2012 (Bureau of Meteorology (BOM) 2020b). These observations underscore the aquifer's strong dependence on rainfall-driven recharge.

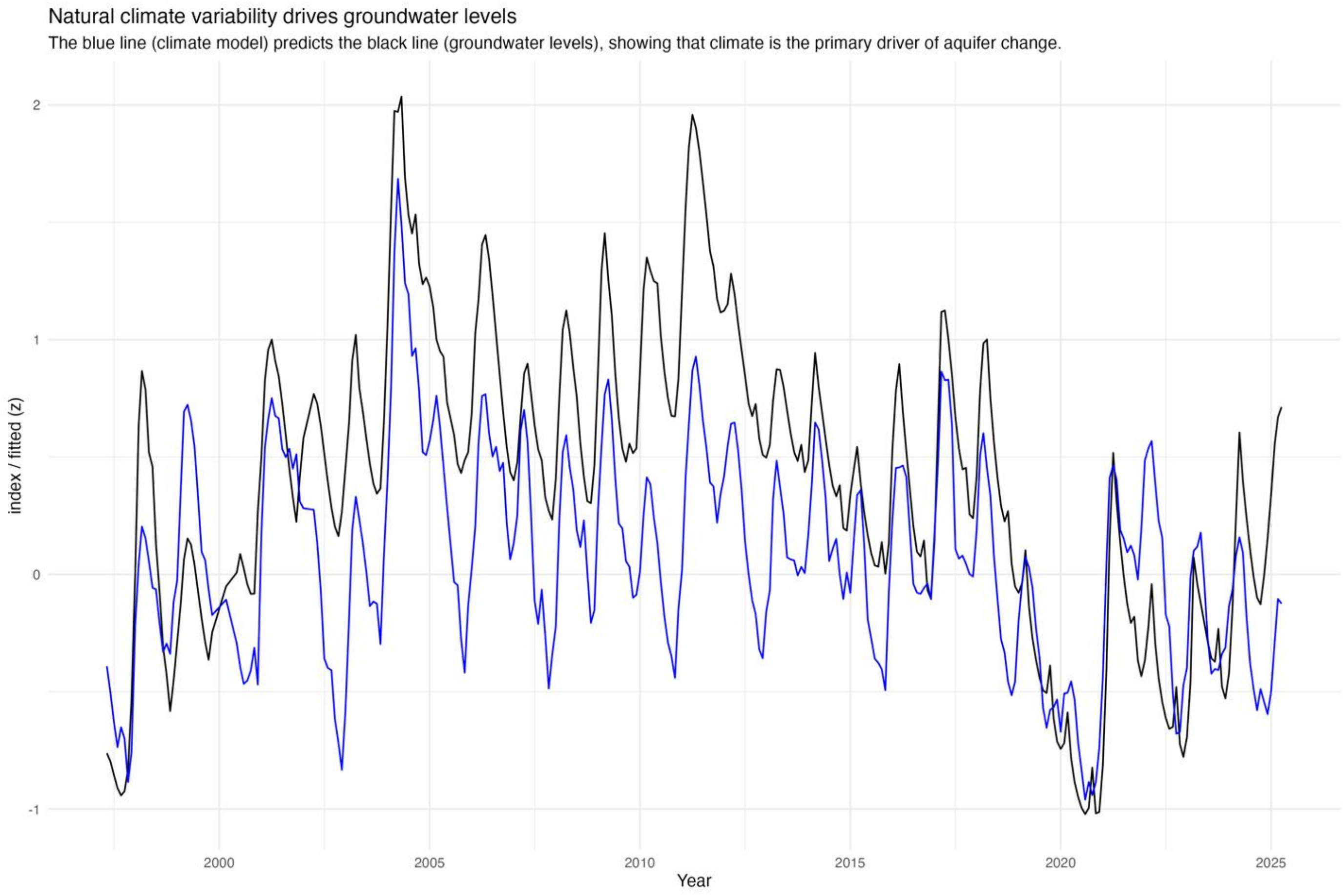

Figure 12. Natural climate variability drives TLA groundwater levels. The black line shows the actual groundwater level index. The blue line is a climate model that predicts water levels based on rainfall and evaporation. This analysis accounts for the natural lag in the system—it looks at rainfall over the previous 18 months to reflect the time it takes for water to recharge the aquifer. The fact that the blue line (climate prediction) tracks the black line (actual water) so tightly confirms that natural rainfall patterns, and the delayed response to them, are the dominant driver of change in aquifer levels.

The potential impact of extraction was tested using a regression model that included both the climate-fitted series and total extraction. Under this time-series-robust inference (n = 339 months since 1996), the climate term is large while the extraction term is small and statistically indistinguishable from zero (Table 8). In practical terms: after accounting for climate, the remaining fluctuations in the plan area groundwater index do not correspond to the volume of water extracted. This is also supported by considering that data series decomposed into seasonal, long-term trend, and residual components, groundwater and climate move together: both share the same seasonal cycles and the same gradual shifts between wetter and drier periods. Extraction, by contrast, has increased steadily (see Figure 6), yet there is no associated, independent downward trend in the groundwater series.

Table 8. Regression of groundwater index on climate-fitted series and total extraction (1996 to 2025)

Predictor	β (estimate)	SE (newey-west)	95% CI	p-value
Climate-fitted series	1.28	0.26	0.77 – 1.79	<0.001
Total extraction	0.13	0.12	−0.11 – 0.37	0.27

Note: Coefficients are estimated using time-series-robust newey–west standard errors (n = 339 months). The climate-fitted series has a strong and statistically significant positive effect on groundwater levels, while the extraction term is small and statistically indistinguishable from zero

Overall, the evidence points to a climate-sensitive aquifer whose basin-scale behaviour since the mid-1990s was driven by rainfall and evapotranspiration variability rather than by water extraction. This does not exclude the possibility of localised drawdown from high use bores but any such local perturbations are either mitigated by natural recharge or do not accumulate into a clear, basin-wide trend.

These findings align with broader hydrological studies in the Northern Territory, which highlight the Tindall Limestone Aquifer's sensitivity to climatic influences while noting that effects of extraction rates are not yet visible at a regional scale. Implications for management include prioritising climate-adaptive strategies, such as announced allocations during dry years, and scenario-based planning for future extraction under varying rainfall projections.

Analysis of long-term streamflow records from the Katherine River indicates that surface water flows are strongly climate-driven and closely linked to groundwater storage and discharge from the Tindall Limestone Aquifer. Despite the limited length of the gauging record at some stations, observed changes in discharge are subtle and cyclical, reflecting natural climate oscillations and antecedent catchment conditions rather than external drivers such as groundwater pumping or long-term climate change. In most years, the Katherine River functions as a gaining stream during the dry season, with low flows sustained by groundwater discharge via springs and diffuse riverbed seepage, typically contributing total gains of around 1.5 to 2 m^3/s by the end of the dry season. Low flows gradually recede through the dry season in response to declining groundwater discharge and increasing evapotranspiration. Overall, dry-season surface water behaviour mirrors underlying groundwater storage dynamics, reinforcing the role of groundwater in maintaining baseflows in the Top End dry season.

6.3 Climate change

Under recent climate change projections, the Northern Territory is expected to get warmer (NESP Earth Systems and Climate Change Hub 2020). Potential impacts of climate change in the tropical north of Australia include:

- the hottest days will be hotter and more frequent, and warm spells will be longer
- heavy rainfall events will become more intense
- droughts could increase, with changes in drought frequency and intensity
- tropical cyclones are projected to become less frequent but more intense
- potential evaporation will increase.

Moise et al. (2015) presents climate change projections with confidence ratings for the Katherine region to the year 2090. Substantial warming in the Katherine region is projected with 'very high confidence'. There is 'high confidence' that the intensity of heavy rainfall events will increase. Conversely, there is 'low confidence' in projecting changes in the frequency and duration of extreme meteorological drought. Projections for evapotranspiration indicate increases in all seasons with 'high confidence', although there is only 'medium confidence' about the magnitude of these increases (Moise, et al., 2015).

The projections presented by Moise et al. (2015) are supported by observed trends in the Katherine region (Rooke, 2024). Average maximum temperatures over the period 1960 to 2023 show a significant warming trend in the dry season. Average minimum temperatures across this same period show a slight wet season warming trend. Rising temperatures and associated increases in evapotranspiration are likely to impact vegetation water demand. This could affect deep recharge through increased water loss prior to infiltration.

Overall, observed rainfall across the Monsoonal North has shown a slight long-term increase over the twentieth century, marked by alternating periods of drying and above average rainfall. Year-to-year variability remains high and is strongly influenced by the El Niño-Southern Oscillation. Projecting future rainfall trends under a changing climate remains challenging. In the near term, natural variability is expected to outweigh any climate change signal, and global climate models continue to diverge in their representation of tropical rainfall dynamics. These uncertainties reduce confidence in medium-term rainfall projections.

By the late twenty first century, projected changes in summer rainfall range from a potential decline of 15% to an increase of 10% under an intermediate emissions scenario (RCP4.5), and from –25% to +20% under a high emissions scenario (RCP8.5). Some models show larger changes in winter rainfall, but these are less reliable due to the region's low baseline winter rainfall. Given the uncertainty, risk assessments for water management should consider the plausibility of both wetter and drier futures and focus on managing variability and extremes rather than relying on any single directional trend (Australian Climate Service 2025).

The plan's focus on managing dry years using announced allocations, maintaining the ESY at its current level, reducing the plan area to simplify aquifer management, and protecting aquifer discharge into the Katherine River is consistent with this advice.

6.4 Confidence level assessment of available evidence

Confidence level	Data and knowledge issues
High confidence	There is high confidence in the rainfall record for the Katherine region, with over a century of daily observations at the Katherine Council Station (14092), supported by interpolations for any missing days in the SILO gridded dataset. Confidence in projections of future temperature increases is high, and high confidence exists for increased intensity of extreme rainfall events. In the near to medium term, natural climate variability is projected to remain the dominant influence on rainfall and flow patterns in the region.
Moderate confidence	Modelled flows at the Wilden gauge on the Katherine River represent aquifer discharge contribution to river flow. There is moderate confidence in these modelled patterns as they are strongly correlated with observed rainfall trends, groundwater response dynamics and measured flows at Wilden. Measured flow exceeds modelled predicted flow, meaning that the model is conservative and tends to underestimate minimum flows (NTG, 2024).
Low confidence and knowledge gaps	There is low confidence in the direction and magnitude of any projected changes in average rainfall or the frequency of extreme meteorological drought, due to divergence across climate models and the challenge of resolving tropical systems.

7. Understanding the water resource

Overview

The Katherine water resource encompasses the Tindall Limestone Aquifer and the Katherine River.

The Tindall Limestone Aquifer (TLA) is a fractured, cavernous karst aquifer critical for water supply in the Katherine region. The TLA covers a large area (approximately 5,855 km²), with approximately 700 km² directly exposed as unconfined aquifer; significant parts of the plan area include this unconfined aquifer.

The TLA exhibits significant seasonal and long-term variability in storage, levels and discharge, driven by rainfall and climatic conditions

The Katherine River is a highly seasonal, groundwater-supported river system and one of the few perennial rivers in northern Australia. During the dry season, in the reach of Katherine River managed under the plan, river flows are sustained primarily by baseflow contributions from the TLA via springs and diffuse seepage, with the river functioning as a gaining stream throughout much of its length in the plan area. Peak wet-season flows are driven by monsoonal rainfall and tropical systems.

Despite increased extraction over the past 50 years, current TLA storage and levels remain above 1970 levels, suggesting current extraction levels are not impacting the long-term sustainability of the aquifer. The current ESY therefore remains appropriate.

High-volume recharge events can trigger a ‘fill and spill’ aquifer response, with rejected recharge exacerbating surface flooding when the aquifer is fully saturated. Rejected recharge during such events caps average annual recharge and means that greater recharge potential remains available to protect aquifer storage and groundwater-dependent ecosystems over the long term.

The time it takes for groundwater to travel through the plan area ranges from days to decades depending on proximity to the river and the presence of cave systems, underscoring the need for targeted management measures such as the discharge protection zone.

7.1 Overview of the Tindall Limestone Aquifer

The TLA is a distinct aquifer within the Cambrian Limestone Aquifer system. The Cambrian Limestone Aquifer is a large, connected groundwater system, in total covering about 570,000 km². The system contains 3 geological basins: the Daly, Georgina and Wiso basins.

The TLA is primarily a fractured rock and cavernous karst aquifer within the Daly basin. It is composed of Cambrian-age limestone and dolomitised limestone, with minor interbedded siltstone layers. Within the plan area the aquifer extends across 1,176 km². Around 726 km² of the TLA in the plan area is unconfined, directly intersecting the surface. The Jinduckin Formation overlies the TLA in 450 km² of the plan area (Figure 13).

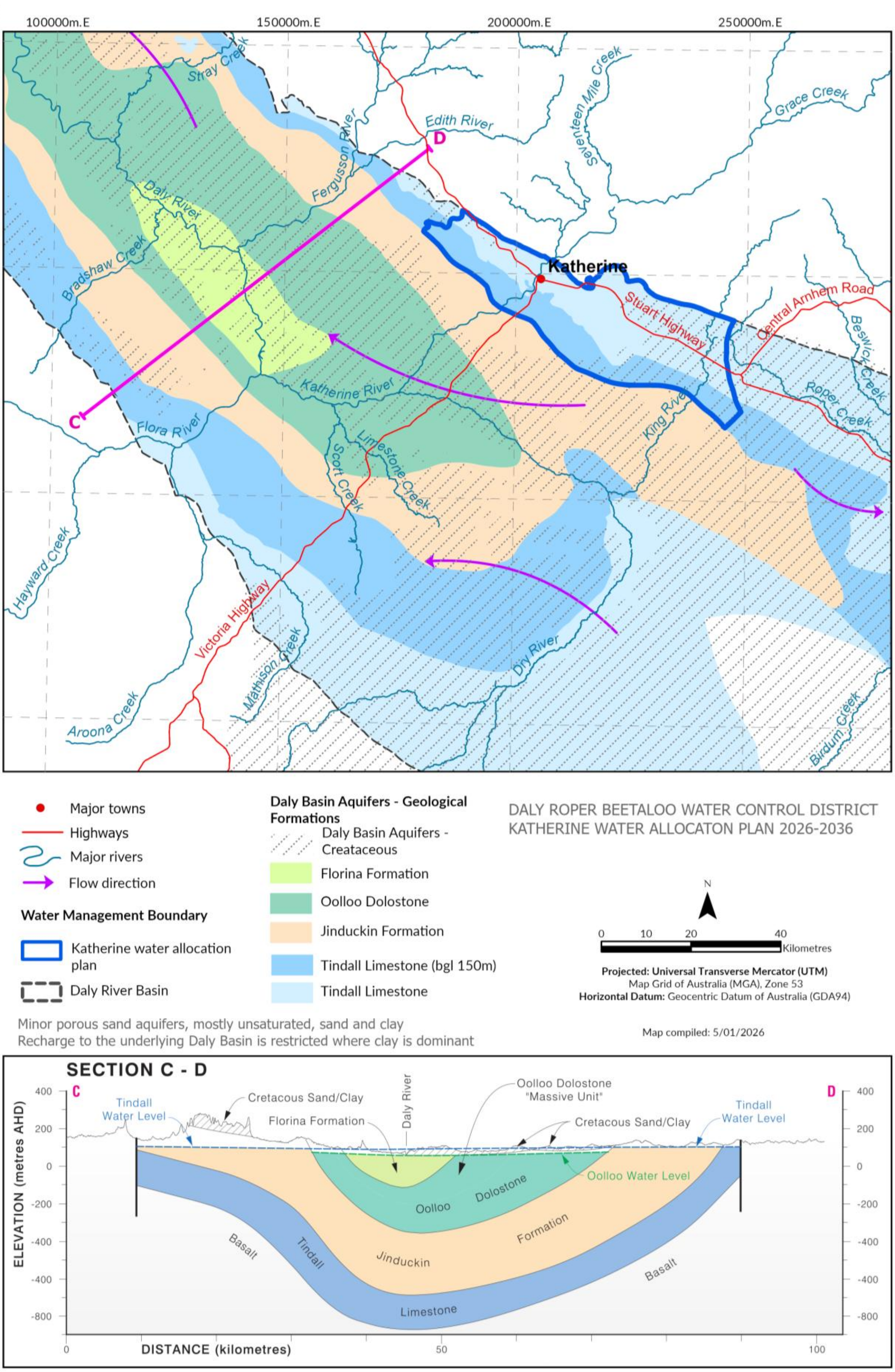

Figure 13. Geological/hydrogeological map and cross-section of aquifers within the previous Katherine TLA plan area and surrounding regions

Karstic processes, including weathering and solution, significantly enhance secondary porosity and permeability, especially in unconfined regions around Katherine. Other geological formations like the Jinduckin Formation confine the aquifer across much of its extent and restrict vertical water movement.

The Jinduckin Formation is present in the south-western portion of the plan area. While the Jinduckin Formation is not well characterised, it is unlikely to be suitable to support significant groundwater development beyond small scale stock and domestic use (IGS, 2022). Further, the Jinduckin is understood to act as an aquitard with limited vertical water movement between the Jinduckin and the TLA.

7.2 Groundwater recharge

Recharge mechanisms are heavily influenced by geological features:

- delayed diffuse recharge through semi-confining layers such as the Mullaman Beds
- indirect (macropore) recharge through karst structures including sinkholes and fractures, is dominant in unconfined areas
- localised discrete recharge through riparian depressions
- immediate diffuse recharge via exposed rock and thin soil cover in unconfined regions.

Recharge rates vary notably, from 50 mm per year beneath confining sediments to 100 to 200 mm per year in unconfined areas (Jolly 2002). Crosbie and Rachakonda (2021) estimate average recharge at 101 mm per year (95% CI [61 mm per year to 192 mm per year]) for the Daly River catchment (Table 9).

Table 9. A summary of recharge estimates in the Daly River catchment/Katherine (adapted from Crosbie & Rachakonda, 2021)

Region	Reference	Summary
Daly catchment	Jolly, 1984	Baseflow analysis of Douglas River (northern Daly catchment), yielded a regional average recharge of 100 mm per year. Bore hydrograph analysis gave a recharge of 190 mm per year. where there is no Cretaceous cover.
Daly River catchment	Jolly, 2002	Bore hydrographs analysis in Katherine area, recharge of 50 mm per year. under Cretaceous cover, 100 mm per year. without. Using differential gauging found an area average of 90 mm per year.
Daly River catchment	Wilson et al. (2006)	Land use change study using a water balance and chloride – native vegetation: 50 to 200 mm per year. recharge using water balance and 60 mm year using chloride mass balance (CMB). Annual pasture recharge of 300 to 540 mm per year. was found using water balance and 40 to 200 mm per year using CMB.
Daly River catchment	Crosbie et al. (2009)	CMB analysis over entire catchment (not just Cambrian Limestone Aquifer system): Daly 65 mm per year. with a range of 14 to 276 mm per year. (numerically modelled recharge using WAVES by Zhang & Dawes (1998): 153 mm per year).
Groundwater to the Daly River	Knapton (2009 & 2010)	Recharge estimated for all the sub-catchments (surface and groundwaters) of the Daly (and Roper) River using a surface water balance model that fed into a FEFLOW groundwater model.
Entire Cambrian Limestone Aquifer	Crosbie & Rachakonda, (2021)	Used probabilistic estimates of recharge from CMB up-scaled to the entire Cabrina Limestone Aquifer system on a 2,500 m grid. The uncertainty in the recharge estimates was constrained using observations of baseflow and remotely sensed ET. First study to estimate recharge over the entirety of the Cabrina Limestone Aquifer system and to discuss the uncertainty in the recharge estimates. Daly River catchment average recharge of 101 mm per year; 5th percentile 61 mm per year and 95th percentile 192 mm per year.

7.3 'Fill and spill' rejected recharge

The aquifer demonstrates notable 'fill and spill' behaviour during periods of exceptionally high recharge. For example, intense rainfall events in the Tindall Creek catchment in December 2003 and February to March 2004 fully saturated the TLA, causing groundwater flooding and surface flooding, illustrating the critical importance of this phenomenon for flood risk management (Rajaratnam et al. 2004). Similar events notably affected Katherine town during the historic 1998 flood.

From a policy and management perspective, the occurrence of 'rejected recharge' where additional recharge is effectively rejected due to full saturation of the aquifer, indicates that average annual recharge rates represent a natural cap. This highlights that the aquifer possesses additional recharge potential beyond current recharge rates, offering an inherent protective buffer for maintaining groundwater storage and safeguarding groundwater-dependent ecosystems. Understanding and accounting for this buffer in planning decisions is important for sustainable aquifer management, particularly in the context of anticipated climate variability and increased rainfall intensity.

7.4 Groundwater surface water connectivity

The primary connectivity between surface water and groundwater occurs in the unconfined regions of the TLA within the plan area. In these areas, groundwater discharge provides dry season baseflow to the Katherine River. Gauging data from 2011 indicated significant groundwater contributions of 259 ML per day, with the largest inflows occurring near the contact between the TLA and the overlying Jinduckin Formation (Tickell 2012). River flows progressively increase downstream due to additional groundwater inputs via springs, riverbed seepage, and inflowing tributaries.

As surface runoff diminishes after the wet season, groundwater discharge from the TLA, primarily via springs, increasingly dominates river flow, typically becoming the sole contributor by July. These groundwater-derived baseflows gradually decrease through the dry season due to declining groundwater levels and increased evapotranspiration, typically ranging between 1.5 and 2 m^3 per second by the end of the dry season. During exceptionally wet conditions, such as at the conclusion of the record-breaking 2011 wet season, groundwater discharge can be significantly higher, reaching approximately 5 m^3 per second.

Analysis of long-term rainfall and streamflow records indicates subtle, cyclical variability in dry season flows driven primarily by natural climatic fluctuations rather than groundwater extraction or climate change. Given the recent dominance of wetter conditions and the limited temporal extent of current monitoring records (e.g. the Wilden gauge, initiated in 2008), long-term water resource planning must consider historical climatic variability (see section 6).

The importance of groundwater discharge for dry season flows in the Katherine River highlights the value of the plan's minimum flow requirements, which activate announced allocations to limit ground water extraction in dry years. The plan has minimum flow requirement of - <155 ML per day (<1.8 m^3 per second, or cumecs). This is consistent with the previous plan arrangements and are based on the department's modelled natural flow at Wilden gauging station (G8140536) annually on 1 November for the announced allocations process (see section 11.3 for further information). The minimum flow requirement of <155 ML per day (<1.8 m^3 per second) represents a very dry year in the model and is based on flows since the 1900s, in which the more recent flows are higher (Rooke, 2024).

The minimum flow target established in the plan is higher than flows for most days in dry years during the twentieth century. This is evidenced in Figure 14, which shows the number of days the Katherine River has fallen below the plan's identified minimum flow since 1900, using modelled streamflow data. The majority of years in the early twentieth century had at least one month with flows below this threshold. Consistent with climate and rainfall trends discussed in section 6.3 above, the most recent 30-year period has been wetter, with only three years with instances of flows below the very dry threshold.

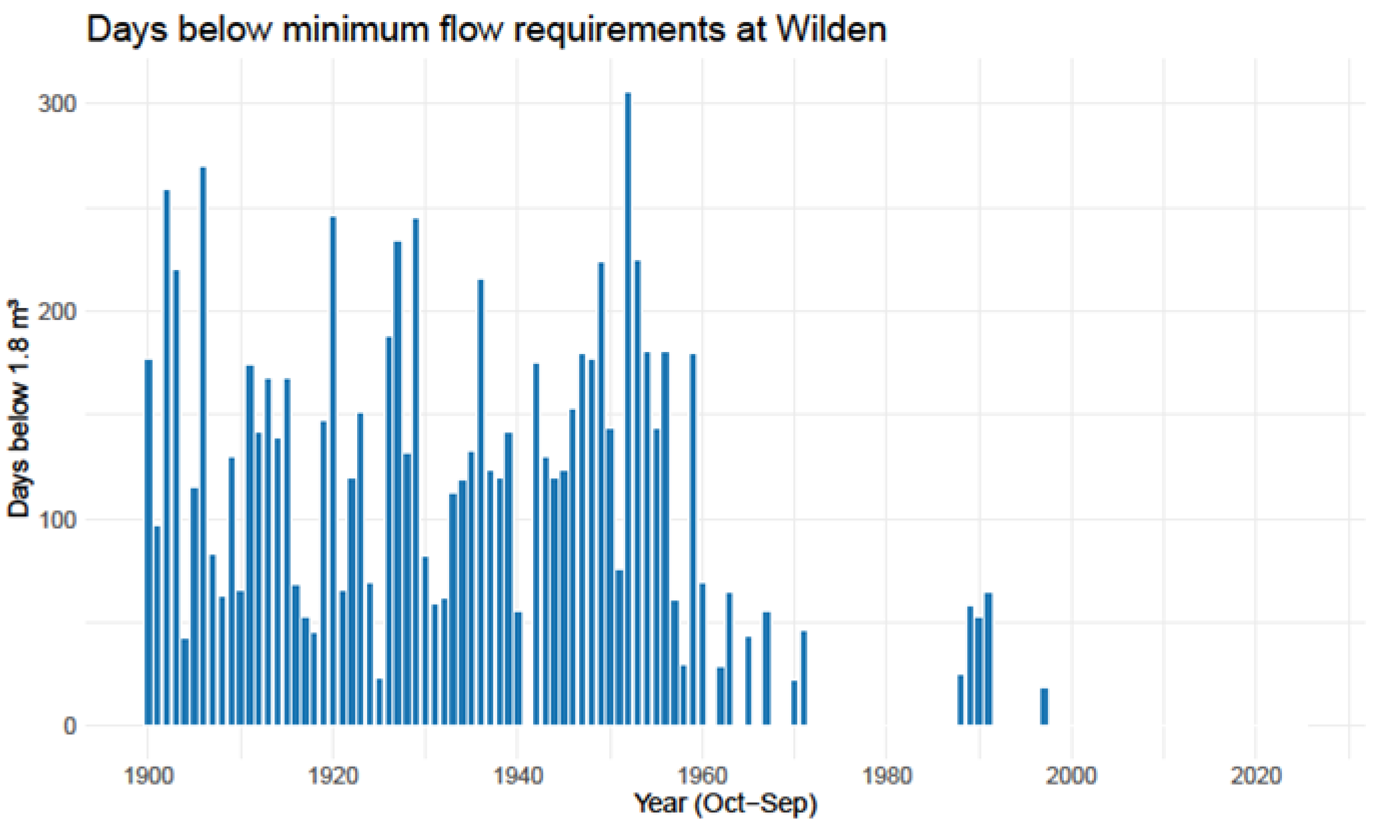

Figure 14. Number of days below minimum below

7.5 Lag effects and local flow paths

Groundwater flow within the plan area is largely localised, with flow-path scales typically measured in years to decades. This localised character means that groundwater management in the Katherine region can be effectively addressed without significant consideration of inter-basin groundwater throughflow.

In the Daly basin, regional groundwater discharge to rivers and creeks primarily reflects total aquifer recharge, with seasonal fluctuations mainly influenced by recharge distribution near discharge zones. Within the plan area, and where the TLA is unconfined, groundwater flow-paths are toward the Katherine River and groundwater moves through the networks of fine fractures and cavities. The latter can vary from sub-millimetre scale to large (tens of metres) caves. Groundwater moves relatively slowly through the regional fracture network but, on reaching a cave system, it is rapidly transported to the river; the major springs on the river are the discharge points for these cave systems (Rooke, 2024).

Travel times for areas close to the river can be measured in days when there are cave systems. For example, a dye tracing test conducted just north of the river showed that water movement through cave systems can be rapid (Karp, 2005). Dye released into a sinkhole took two and seven days respectively to reach springs on the river, located at distances of 2.5 km and 4 km from the sinkhole. In contrast, where there are no cave systems, travel times to the Katherine River from parts of the plan area distant from the river can be measured in decades.

There are significant knowledge gaps concerning local groundwater flow paths and the time lags between groundwater extraction and impacts on the Katherine River. However, extraction near the river (less than 5 km) is understood to pose a greater risk to dry season flows compared to extraction further away (more than 20 km), as distant extraction impacts are likely buffered by recharge events, except in areas with extensive cave systems. Management arrangements relevant to this are considered in section 5.

7.6 Water availability

The natural water balance is a core concept of water resource management, enabling an assessment of water availability within a region. For the Katherine plan area, the natural water balance was calculated using the department's integrated surface water-groundwater model. To reduce the uncertainty of modelled outputs, the model is regularly recalibrated with observed data gathered through the Department's monitoring programs. The most recent re-calibration was undertaken in 2024, as part of a Commonwealth-funded research project[12].

The water balance quantifies water inflows (recharge, inflow), outflows (runoff, discharge, evapotranspiration), and changes in water storage over time, represented by the simple flux equation:

Inflow = Outflow ± Change in Storage

The flux equation represents a general water balance; noting that fluxes, by definition, vary. Variation can occur both spatially and temporally, meaning the equation might not precisely balance at all locations, or at all times. Furthermore, individual data components can carry uncertainties due to spatial aggregation, parameter estimation, and assumptions inherent in the calculations (Knapton, 2020).

Figure 15 is based on historic climate data sourced from the Bureau of Meteorology, incorporating reliable evaporation data since the 1970s and actual river flow measurements since the 1960s. To simplify reporting, daily values have been averaged to produce long-term annual figures. Consequently, inflows may not precisely match outflows combined with storage changes at any specific time or location.

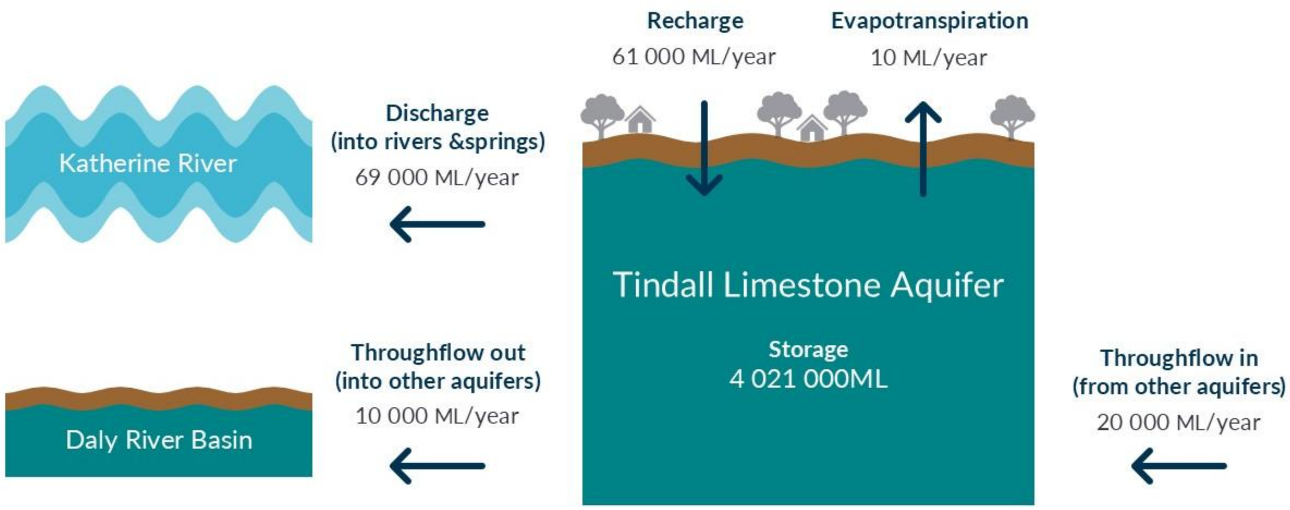

Figure 15. Modelled water balance for the Katherine plan area. All parameters are long-term averages (1970-2024)

The volume of water held in storage is estimated to be 4,021,000 ML. Recharge is highest in the unconfined areas and intermediate in value where Cretaceous rocks overlie the aquifers. Discharge zones from the aquifers are located along the Katherine River and include karst-type springs and more diffuse stream bed discharge (Rooke, 2024).

[12] This modelled water balance was generated using the most recent re-calibration of the department's integrated surface water-groundwater model ("DR3"). It varies from the water balance presented in Rooke (2024) which accounted for the previous plan area and was generated using an older calibration ("DR2").

8. Water quality

Overview

Generally high-quality and stable groundwater within the water resource meets Australian Drinking Water Guidelines, and is characterised by calcium, magnesium and bicarbonate dominance, with a slightly alkaline pH within safe limits.

However, elevated radium-226 levels, potentially sourced from uranium-rich minerals in confined areas, and PFAS contamination near RAAF Base Tindal are significant concerns for the Katherine community.

Groundwater and surface water quality are closely linked due to the strong hydraulic connectivity between the Tindall Limestone Aquifer (TLA) and the Katherine River, particularly during the dry season when river flows are sustained by groundwater discharge.

Most groundwater from the TLA is suitable for drinking water consumption as the quality is within acceptable limits in the Australian Drinking Water Guidelines 2011 (Rooke, 2024). The groundwater of the TLA is slightly alkaline with calcium, magnesium and bicarbonate being the dominant ions, which is typical of dolomite aquifers (Tickell, Report 34/2005). Total dissolved solids mostly range between 250 and 1,500 mg/L, pH ranges from 6.4 to 8 and it has high hardness. Spring water temperatures are about 32°C.

Elevated levels of the naturally occurring radioactive isotope radium-226 have been measured in many water bores in the Katherine area (Quereshi & Martin, 1996), including Springvale Spring (Tickell, 2018). Some of these exceed the guidelines for drinking water (screening level for radium-226 is 0.5 Bq/L; ADWG 2011).

Surface water quality in the Katherine River exhibits strong seasonal variation driven by climate and hydrological processes. During the wet season, high flows generated by monsoonal rainfall and cyclonic events are typically associated with increased turbidity, sediment transport and nutrient inputs from catchment runoff. In contrast, dry-season flows are dominated by groundwater discharge from the TLA and are characterised by clearer water, higher baseflow stability and water chemistry that closely reflects that of the aquifer.

8.1 PFAS and land use contamination risks

Surface water quality across the region is largely influenced by the season, with surface water runoff dominating during the wet season and groundwater discharge dominating the dry season (Townsend 2019). Wet season water quality is predominately characterised by low conductivity and higher turbidity due to overland runoff with high sediment loads. Dry season water quality is primarily characterised by higher conductivity and low turbidity consistent with the groundwater quality in the TLA.

Surface water quality in the Katherine region is impacted by land clearing, grazing, agriculture and late dry season fires, which increase sediment loads, and nutrient pollution from agricultural and pastoral land use (Cobban et al. 2024). In addition, the presence of per-and poly-fluoroalkyl substances (PFAS) has been detected in Katherine region and is monitored by the Department of Defence (Department of Defence, 2025). PFAS have been causally linked to the fire control substances used at RAAF Base Tindal near Katherine town. Rooke (2024) reports that PFAS in surface water is stable and all off-base locations are below recreational guidelines, including public swimming areas. PFAS concentrations in fish, shellfish and crustaceans are likewise stable (Rooke, 2024).

Power and Water Corporation commissioned an independent consultant (AGT, 2007) to undertake several groundwater contamination risk assessments for various towns in the northern part of the NT, including Katherine. This resulted in the development of an aquifer vulnerability map across the Katherine area and the establishment of wellfield protection zones based on 100-day and 500-day groundwater (particle) travel times to maintain protection of the public water supply. Sinkholes and inadequately or inappropriately constructed bores were highlighted as possible pathways for rapid point-contamination sources direct to the water table.

As part of an ongoing mitigation program, the Commonwealth Department of Defence operates 2 groundwater treatment plants on RAAF Base Tindal to remove PFAS from groundwater and to reduce the amount of PFAS moving off base. These plants have treated over 3 billion litres of PFAS-contaminated groundwater to date (Department of Defence, 2025) and more information on the management plans for the RAAF Base can be found on their website Power and Water Corporation also have a public water supply treatment plant that has been operational since May 2024 (Department of Defence, 2025).

To control water quality risks in the plan area water quality objectives under section 73(1) of the Act have been declared to guide decision making. The Northern Territory also has minimum requirements for constructing, maintaining, rehabilitating, and decommissioning water bores in line with national standards. Bore work permits are required in the plan area, allowing site specific conditions to be set for bore work in addition to national standards. As part of the plan's implementation actions, the department maintains and regularly reviews a surface water and water quality monitoring program in the plan area.

8.2 Confidence level assessment of available evidence

Confidence level	Data and knowledge issues
High confidence	Broad aquifer characteristics: the geological composition, physical extent and karstic nature of the Tindall Limestone Aquifer (TLA) are well established through extensive exploratory drilling, satellite data, historical monitoring, geological mapping, and scientific research. Long-term aquifer storage and level trends: historical groundwater levels and aquifer storage data span several decades, supported by rigorous scientific monitoring and modelling. There is high confidence that current extraction rates have not significantly diminished long-term aquifer storage below 1970 levels. Groundwater–surface water connectivity (general scale): Empirical gauging and observation data from key locations along the Katherine River reliably demonstrate that groundwater contributes to end of dry season flows with well-documented seasonal and interannual variability patterns.

Confidence level	Data and knowledge issues
Moderate confidence	Recharge rates and mechanisms: estimates of recharge rates and mechanisms carry inherent uncertainty due to spatial variability and modelling assumptions. While the dominant recharge mechanisms (diffuse recharge, macropore flow via karst structures, riparian depressions) are well understood qualitatively, quantification remains challenging. Catchment water balance: the natural water balance estimates for the Katherine plan area are derived from robust historical rainfall and temperature and shorter and less robust streamflow and aquifer-level datasets. The integrated surface water–groundwater model used for calculating the water balance is well-established, supported by decades of observational data, and considered reliable for general resource planning purposes. However, uncertainties remain due to spatial and temporal variability in key parameters such as evapotranspiration, recharge, and localised inflows/outflows; model simplifications and assumptions made to aggregate complex localised hydrological processes into a regional-scale balance; potential variations in groundwater storage dynamics and recharge events, particularly given the karstic nature of the TLA. ‘Fill and spill’ rejected recharge events: the occurrence and general characteristics of these events are reliably documented, supported by historical flood events. However, predicting their frequency, spatial distribution, and magnitude remains moderately uncertain due to limited direct observation of subsurface processes during extreme recharge events. Groundwater flow paths and lag effects: broad understanding of groundwater flow dynamics and travel times (ranging from days in karst caves to decades through diffuse fractured networks) is moderately robust, supported by limited empirical tests (dye tracing experiments) and modelled estimates. However, comprehensive mapping of flow paths, particularly in complex karst environments, remains incomplete (see below).
Low confidence and knowledge gaps	Localised groundwater flow-path specifics and time lags: precise flow paths and travel times within karst features remain highly uncertain, especially regarding exact impacts of localised extraction near sensitive ecosystems or river discharge zones. The unpredictable nature of karst structures, cave systems, and fracture connectivity creates significant uncertainty and limits precision. Groundwater quality issues (Radium-226 and PFAS): general groundwater quality parameters (e.g., pH, TDS, ionic composition) are well-understood. However, detailed spatial variability and long-term trends of contaminants like radium-226 and PFAS remain uncertain due to limited spatial sampling and ongoing variability in contaminant sources and mitigation effectiveness.

Management implications:

- High-confidence areas support reliable resource-wide planning and aquifer-scale decisions.
- Moderate-confidence areas necessitate precautionary and adaptive management strategies, including targeted monitoring and conservative assumptions.
- Low-confidence areas emphasise the need for increased scientific investigation; targeted groundwater quality monitoring; enhanced local-scale groundwater flow-path studies; and risk-based management interventions to protect groundwater-dependent ecosystems and water quality.

9. Regional socio-economic context

Overview

The plan area has a diverse economy that reflects the town's rural and remote context. The major industries of the region include agriculture (horticulture and pastoral), tourism and defence.

Katherine has one of the NT's highest concentrations of agricultural land and the Katherine community values their identity as an important agricultural area, evidenced by the large community attendance at agricultural events in the region, including the Katherine Campdraft, Katherine game fishing club annual competition: the Big Horse Barra Classic, and the Katherine and District show, the third largest event in the Territory.

The Katherine region's social, cultural, and economic vitality relies on sustainable water management with most of the water needed to sustain the region coming from the TLA.

9.1 Socio-economic context

The plan area is in the Big Rivers region which supports several major industries that are significant contributors to the NT economy, including agriculture (horticulture and pastoral), tourism, mining, transport and logistics sectors, and defence.

The Katherine area is a leading agricultural production region of northern Australia, with three times as many people employed by the agricultural sector in the region relative to the rest of the Territory. The total value of agricultural output from the Big Rivers region was approximately $325 million in 2020-2021. The Katherine community values the contribution their region makes to food and fibre production. The farming identity of the area is evident through the large attendance at community events such as the Katherine Campdraft, and the annual Katherine and District Show and Rodeo, which is now the third largest such event in the Territory and celebrated its 60th year in 2025.

Tourism is another important industry in the region reflecting the financial value of an accessible and intact environment. The significance of nature-based tourism also provides an indication of the cultural and social value placed on the environment and nature by the community. During 2023, the Big Rivers region welcomed a total of 307,000 visitors who spent an estimated $264 million. Reflecting community aspirations to further develop the tourism sector, there are a number of projects underway to build additional hotels and short-stay accommodation in Katherine, as well as $169.8 million allocated to major road upgrades in the area in the 2024 NT budget to improve regional accessibility.

The region also has a significant defence presence, including the RAAF Base Tindal (and $1.2 billion RAAF Base Tindal civil and construction project), Bradshaw field training area and Delamere air weapons range, which are supported by Commonwealth investment. Other projects underway (government and private) include the Katherine Logistics and Agribusiness Hub, Katherine East Neighbourhood Centre, onshore gas exploration, Roper Valley Iron Ore project, McArthur River Mine, the cotton gin and a $1.1 billion Remote Housing Investment Package.

One of the identified constraints to regional development has been the reported PFAS contamination, which has led to negative associations with agriculture businesses in the Katherine region.

9.2 Land tenure

There is a mix of land tenures in the Katherine region, with the large majority (over 85%) being private land (Table 10). The second largest proportion of land in the area is held by the Commonwealth Government and is used for defence purposes. At present the volume of water used by the Commonwealth to maintain the defence facility, including housing and other administrative and auxiliary support, is unknown. This adds an additionally layer of uncertainty and complexity to water management in the region. To manage this in the future, the plan implementation actions (action 3.4.3) recommend the NT Government works with the Commonwealth to understand the existing level of water use and likely future demand of the facility.

Table 10. Land tenure ownership by area (hectares) and proportions based on cadastre area (%)

Ownership category	Area (ha)	Proportions based on cadastre area (%)
Aboriginal Land (NT enhanced freehold)	**30**	**0.02**
Aboriginal Land (Scheduled under ALRA)	40	0.04
Commonwealth Government	12,510	10.8
Local Government Council	520	0.4
Northern Territory Government	3,530	3.04
Private	99,420	85.6
Others (owner not specified)	30	0.03
Total	**116,080**	**100.00**

9.3 Importance of the water resource to the Katherine region

The Katherine water resource is critical to Katherine's agricultural productivity, public water supply and overall regional development. Irrigated agriculture, horticulture and pastoral activities are key economic drivers that support employment in the region, all of which depend on reliable access to groundwater.

Additionally, secure water supplies enhance community liveability by maintaining recreational spaces, public amenities and essential services, which contribute significantly to the social fabric and attractiveness of the Katherine area as a regional hub. Katherine township's population is approximately 10,000 people, but the town services over 20,000 people across the Big Rivers region, including for essential and non-essential services.

9.4 Eligible Land for the Aboriginal water reserve

In 2017, the NT Government approved the Strategic Aboriginal Water Reserve Policy Framework (Aboriginal water reserve policy) to provide Aboriginal people with increased opportunities to access water resources for economic benefit. The amount of water allocated to that reserve was to be proportionate to the amount of eligible Aboriginal land in the plan area. In 2020 the Act was amended to give legislative effect to the Aboriginal water reserve policy, and further amendments in 2025 streamlined the requirements for Aboriginal access to the reserve.

In broad terms, a water allocation plan must allocate water to an 'Aboriginal water reserve' if any of the land in the water control district to which the plan relates is 'eligible land'.

Geographical Information Systems have been used to systematically review land data for the plan area, including the Digital Cadastre Database of the Northern Territory and the National Native Title Tribunal's Native Title determinations. Engagement was also undertaken during consultation on the draft plan to identify if any parcels may have been inadvertently missed, including publishing a specific survey on Have

Your Say alongside the draft plan. Additional parcels associated with one identified group were reviewed; however, they did not meet statutory criteria for eligibility.

Parcels that meet both eligibility criteria i.e. under section 4B and section 22C of the Act, have been identified for designation. Land parcels held by four Aboriginal entities are identified in Schedules F and G of the plan.

The amount of water allocated for Aboriginal economic development through the Aboriginal water reserve was determined based on the proportion of eligible land in the plan area and guidance in the Aboriginal water reserve policy. This process identified 64 ha of eligible land and an allocation of 3,220 ML/yr for Aboriginal economic development.

9.5 Confidence level assessment of available evidence

Confidence level	Data and knowledge issues
High confidence	Economic information is recent, accurate and appropriate to use in this context. Parcels of land for designation for the Aboriginal water reserve have been identified by systematically analysing land data, as well as through consultation.
Moderate confidence	Information about social context, such as the Katherine communities' attitude to particular community events, relied heavily on the committee's advice. Additional supporting data to confirm these descriptors would improve reliability. Land tenure data was manually sorted using the detailed descriptors of the data set. While the grouping is logical and systematic, it is not automated and relies on manual interpretation.
Low confidence and knowledge gaps	There are native title applications for the plan area currently under assessment. Determinations may have an impact on the Aboriginal water reserve in the future.

10. Water-related values

Overview

Aboriginal representation in water governance is essential to the success of regional water plans. Aboriginal members of the Daly River water advisory committee (committee) discussed cultural values, in the context of their representation from across the Daly River basin.

While specific Aboriginal cultural values that relate to the Katherine plan area are not able to be included in this iteration of the plan, the department is continuing to work with Aboriginal groups and other partner agencies to describe and document these important values to include in a future integrated Daly River water plan.

Water plays an important role in ensuring liveability in Katherine, including through the amenity of the river and the surrounding hot springs, recreational parks, picnic areas and walking tracks. The committee identified a strong alignment between water-related Aboriginal values and the social and environmental values of the broader community.

The Katherine water resource is managed in recognition of the important environmental values of the region, including the downstream reaches of the Katherine River and the larger Daly River basin.

Water related environmental values in the area include groundwater-dependent ecosystems, barramundi, sooty grunter and the pig-nosed turtle.

10.1 Aboriginal cultural values and Aboriginal representation in water governance

While the plan area encompasses significant Aboriginal cultural water sites, including rivers, creeks, gorges, waterfalls, plunge pools, waterholes, billabongs, and springs, understanding and accounting for these values can be a challenge.

The department acknowledges that Aboriginal representation in water planning is essential to achieving the desired community ownership of water plans in the NT. The department is actively working with the Aboriginal membership of the committee and other partners, such as the University of Wollongong, CSIRO and the National Water Grid Authority, to steadily improve understanding, documentation, trust and transparency in water management with Aboriginal Territorians. It is anticipated that some of the cultural values that are identified through existing projects may be included in the future Daly River water plan.

The committee comprises 40% Aboriginal representation from geographically diverse areas across the Daly River basin. During the development of the plan the committee discussed Aboriginal cultural water values in the context of the broader Daly River basin, with relevant members emphasising the importance of Aboriginal people being involved in water management, and that decision-makers account for and consider these values in the future. In addition, the Aboriginal membership is advising the department on how to better listen, engage, inform and consult with Aboriginal people in high priority water management areas of the broader Daly basin.

The plan identifies the consideration of Aboriginal cultural values in water management decisions as a key objective, and the implementation plan sets out activities to improve identification and protection of these important sites (actions 3.1.3, 3.2.1, 3.2.2 and 3.2.3). Native title proceedings in the area are expected to be finalised in the term of the plan which will provide more certainty for engaging on cultural values in the future.

10.2 Community and social water values

The community's water values were largely informed by advice from the committee, as well as feedback received through public consultation on the draft plan.

Advice from the committee has indicated that the community feels a strong alignment between water-related Aboriginal values and the social and environmental values of the broader community.

Committee members identified the important role that water plays in ensuring liveability in Katherine. This includes through the amenity of the river and surrounding hot springs, recreational parks, picnic areas and walking tracks. In addition, there are four sporting ovals that are used for various competitions throughout the year, including AFL. There is also a local swimming pool, currently being upgraded, that supports competitions, activities and amenity for all levels of accessibility in the hot build-up and summer months.

Water is used in the town for recreational and amenity purposes, including under a water licence held by the Country Club, which manages the golf course and the town bowling greens. Primary and secondary schools hold licences for maintaining ovals, playgrounds and growing edible gardens in science and food technology. Water is also used by the Charles Darwin University campus as part of their community agricultural courses.

The committee also confirmed the aspirations of the community regarding the future development of Katherine as an agricultural precinct that supports a blend of farming types, ownership and management models. This includes maintaining spaces and supporting the viability of family-owned farms that the committee see as essential to supporting and investing in the broader community, including in sectors such as education, training, medical, retail and service industries.

The Committee expressed a strong preference for a precautionary approach to water extraction in close proximity to the Katherine River. It recommended the use of multiple, complementary mechanisms to mitigate potential reductions in river flows, acknowledging that the effectiveness of individual measures may be hard to ascertain.

10.3 Environmental values

10.3.1 Water-dependent ecosystems

The NT Government uses the definition of groundwater-dependent ecosystems (GDEs) described in Schedule A. Eamus et al. (2006) classified GDEs into three major categories:

1. Terrestrial GDEs that rely on the presence of groundwater within rooting depth, especially during drought.
2. Subterranean GDEs such as caves, aquifers and the hyporheic zones of rivers (areas where stygofauna may exist).
3. Aquatic GDEs such as springs, baseflow rivers, streams and wetlands that rely on an influx of groundwater to maintain water levels and functionality.

The definition of GDEs includes ecosystems that depend on permanent or seasonal access to groundwater.

A technical report on biodiversity in the Katherine region was prepared as part of the NT Government's Mapping the Future program. In this report, Ruykys et al. (2024) describes the significant biodiversity values of the region, including GDEs. Riparian vegetation communities within the region are considered to have a permanent groundwater dependence, whereas the wetlands and dry monsoon vine forest communities have seasonal dependence on groundwater.

Sinkholes are also a type of GDE and are widespread throughout the region. Aside from contributing to the hydrogeological system, sinkholes provide critical habitat for some biota. Subsurface groundwater environments provide habitat for stygofauna and troglofauna.

The department has a GDE mapping program that uses a mix of satellite imagery, probability models and ground-truthing to identify GDEs over broad spatial areas. A report for the Katherine plan area was published in 2024 (Box & Brim Box, 2024) which can be considered for assessments and licence decisions during the term of the plan and at its mid-term review.

10.3.2 River baseflows and seasonal reliance

The characteristics of the river can vary significantly between seasons. *Dry season flows* are one of four distinct hydrological groupings used to classify surface water flows in the Top End (Figure 16). This term describes flows that are sourced entirely from groundwater (baseflows) without direct contribution from rainfall or overland flows.

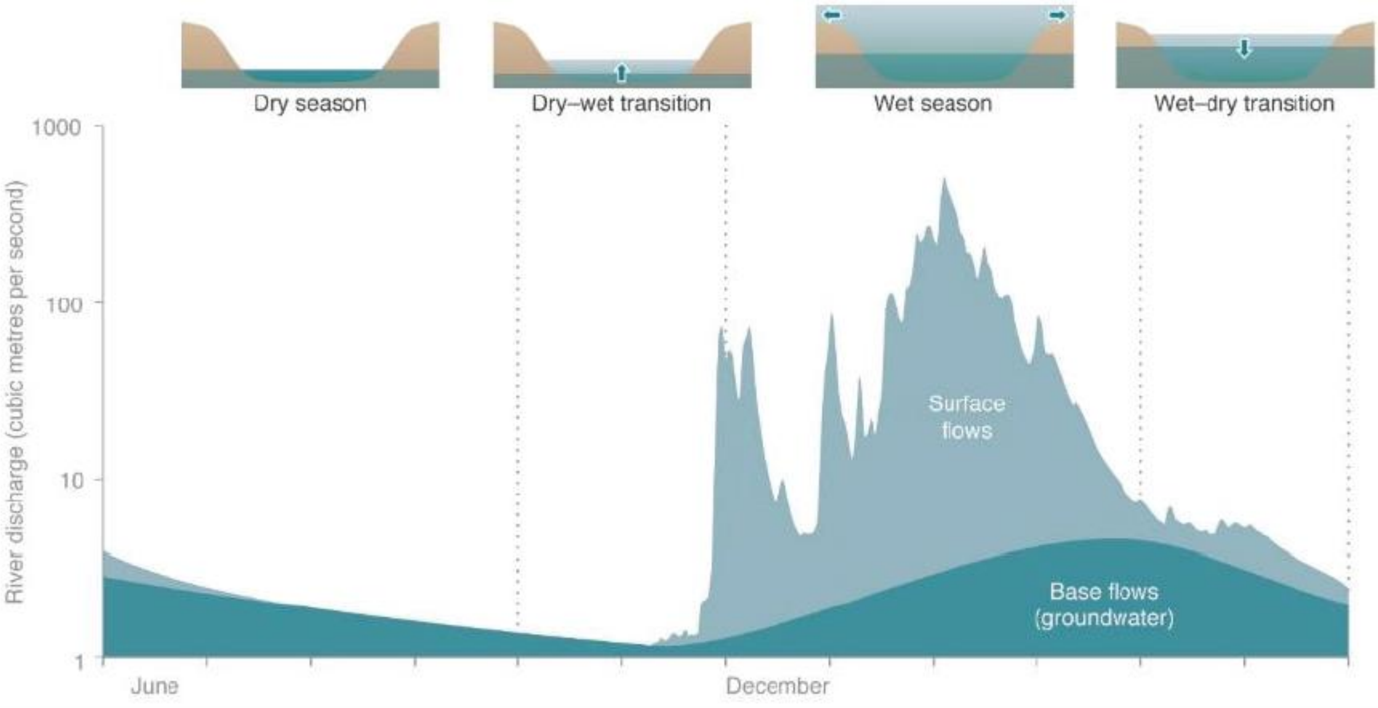

Figure 16. Schematic hydrological cycle of the Daly and Katherine Rivers, showing conceptualised contribution of groundwater and surface waters to the total river flow. Upper panel shows a cross-section of the river channel at various flow stages (from King et al. 2021)

In most years, the TLA is the sole source of late dry season flows in the Katherine River. As the dry season begins, river flow is dominated by surface runoff. As this runoff depletes, groundwater becomes the main component of river flow. Typically, by July nearly all flow in the Katherine River is sourced from groundwater. Accordingly, the Katherine River can be characterised as a 'gaining stream' for much of the year, driven by these inputs of groundwater via springs. Baseflows gradually decline as the dry season progresses due to decreasing groundwater discharge and increased evapotranspiration. At the end of the dry season the river flow typically gains between 1.5 and 2 m^3 per second from groundwater inputs. Dry season flows occasionally extend into December and January (Rooke, 2024), depending on the timing of the onset of the wet season.

10.3.3 Species of cultural and ecological concern

The Daly River catchment supports a diversity of aquatic ecosystems and riparian vegetation communities within and downstream of the plan area.

The Daly River catchment contains a highly diverse fish assemblage, with over 50 fish species regularly encountered. The fish community is structured by location, habitat type and time of year. Populations of barramundi (*Lates calcarifer*) in the catchment are affected by flow regime dynamics and abundance of prey (Turschwell, et al., 2019), highlighting the importance of holistic ecosystem management. Changes to flows, including groundwater discharge from springs, can affect water quality, physical habitat and aquatic biota. Some fish, including barramundi and sooty grunter (*Hephaestus fuliginosus*), are especially susceptible to low flow conditions (Schult & Townsend, 2012).

Riparian vegetation in the Katherine region constitutes a distinct ecological community and may provide refuge for a range of plants and animals. Riparian areas support woodland, shrubland and grassland vegetation communities on seasonally saturated areas and likewise play an important role as refugia. They also assist with the maintenance of ecological processes, for instance maintaining the physical stability of stream systems and acting as filters for runoff.

The banks of the Katherine River south of Katherine Gorge are dominated by weeping paperbark (*Melaleuca leucadendra*). Other species common in the overstorey of the extensive riparian communities include river oak (*Casuarina cunninghamiana*), river red gum (*Eucalyptus camaldulensis*), leichhardt tree (*Nauclea orientalis*) and *Xanthostemon eucalyptoides*. Riparian areas are mostly dominated by broad-leaved paperbark (*M. quinquenervia*) and *Lophostemon grandifloras*, although a diverse range of other trees and shrubs may be present.

A significant, permanent palustrine (fresh water) wetland is located on Manbulloo Station, adjacent to the RAAF Base Tindal. Numerous smaller ephemeral wetlands are also situated within the plan area.

Two plant species of conservation significance are associated with heavy clay wetland habitat found in the Katherine region: *Sorghum grande* and *Fimbristylis blakei* (Ruykys, et al., 2024). Threatened fauna species associated with the riparian vegetation, riparian areas and wetlands of the Katherine region include the red goshawk (*Erythrotriorchis radiatus*), masked owl (*Tyto novaehollandiae*), Mertens' water monitor (*Varanus mertensi*), Mitchell's water monitor (*V. mitchelli*) and yellow-spotted monitor (*V. panoptes*). The threatened freshwater sawfish (*Pristis pristis*) occurs in the Daly River downstream of the plan area.

King et al. (2021) reviewed existing and new knowledge on critical flow-ecology relationships within the Daly River catchment. The report described research on the spawning and recruitment of freshwater fish, sooty grunter, barramundi and pig-nosed turtle *(Carettochelys insculpta)*, which is summarised below. Additional research is required to better define the environmental water requirements of key aquatic species to inform the protection of the significant biodiversity and cultural values of the catchment.

10.3.4 Spawning and recruitment of freshwater fish

Tropical northern Australia has over 110 freshwater fish species from a variety of taxonomic and life history strategy groups. In the Daly River catchment, the spawning behaviour and larval assemblages of freshwater fish vary across seasons and hydrological regime. Increased river discharge during the wet season is often implicated as an important cue to initiate spawning and support successful recruitment. These conditions are assumed to facilitate rapid growth, development and dispersal of fish during their early life stages by providing the opportunity for increased food uptake and habitat availability.

Other species utilise low discharge periods in the dry season for spawning. In a study reported in King et al. (2021), larval abundances of blackmast (*Craterocephalus stramineus*) and rainbowfish (*Melanotaenia* spp.) were observed to be highest during periods of low or no flow. Low flow periods allow some species to take advantage of shallow, slack water habitats which provide conditions that enhance concentrations of suitable prey. These conditions may also provide refuge from predators and optimal water physiochemistry, all of which are conducive to rapid development and maximal survival. By comparison, King et al. (2021) noted that larval fish diversity was highest during periods of high flow and in complex habitats where food was abundant and flow velocity was slow. Groundwater discharge was also observed to support primary and secondary productivity, such as fish growth (King et al. 2021).

As with spawning, the hydrological regime is also considered a major driver of freshwater fish recruitment. In the Daly River catchment, wet season flow conditions are a strong predictor of both early and late dry season juvenile abundance for many species (King et al. 2021). Wetter wet seasons resulted in greater abundance of barramundi, freshwater longtom (*Strongylura krefftii*) and black finned eel catfish (*Neosilurus ater*). In contrast, greater abundances of juvenile blackmast, sooty grunter and common archerfish (*Toxotes chatareus*) occurred in years with drier wet seasons. Variability in flows, the number and the timing of wet season onset also influenced juvenile abundance for some species (King et al. 2021).

10.3.5 Sooty grunter

Sooty grunter, locally referred to as black bream, are one of the most common and widespread fish in the Daly River catchment. This species occurs in permanent river reaches, large intermittent streams and floodplain wetlands across the wet-dry tropics of Australia. They are culturally significant as a food source for Aboriginal people (Finn and Jackson 2011) and are a popular catch for recreational fishers (Pusey et al. 2004).

Sooty grunter in the Daly River catchment seek out a range of habitats according to life stage. Juveniles typically utilise shallow, high velocity riffle habitats while adults prefer deep and slow-flowing habitats (Keller, et al., 2019). Tyler et al. (2022) described the wet season spawning preference of this species, with particularly high recruitment in drier wet seasons. Once sooty grunter reach maturity, they exhibit long periods of restricted movement and a tendency to return to previous sites. However, ecologically important, large-scale movements do occur, especially during the wet seasons (King, et al., 2021). Reduced flows, particularly in the dry season, could place strain on the recruitment of juvenile sooty grunter through the loss of their preferred habitat (Crook, et al., 2021; King, et al., 2021).

10.3.6 Barramundi

Barramundi are iconic in northern Australia and are the most economically, socially and culturally significant fish in the Katherine region. Barramundi life cycles are complex, with most spawning as males prior to transitioning to females. Spawning occurs in the saline lower reaches of estuaries and associated coastal areas during the monsoonal wet season. Highest recruitment tends to occur in wetter years (Roberts, et al., 2019; King, et al., 2021). Following spawning, an unknown but significant proportion of young-of-year juveniles migrate upstream to the freshwater reaches of rivers and floodplain billabongs. Freshwater residency can span up to 11 years before return migration to the saline spawning grounds (Crook, et al., 2017; King, et al., 2021). Barramundi therefore rely heavily on waterway connection that allow for these migrations (King, et al., 2021).

The study reported in King et al. (2021) observed that migration to freshwater results in a growth advantage in barramundi. It is likely that wet season flooding events provide barramundi with access to a seasonal abundance of food in freshwater. Keller, et al. (2019) identified a consistent deep pool habitat preference for both juvenile and adult barramundi. These findings underscore the importance of preserving highly productive and hydrologically variable tropical freshwater habitats (King, et al., 2021), including protecting dry season refugia fed by spring flow.

10.3.7 Pig-nosed turtles

In Australia, pig-nosed turtle occurs only in 4 river systems in the Northern Territory, including the Daly. They are listed as endangered on the IUCN Red List (Eisemberg, van Dijk, Georges, & Amepou, 2018) and they have high cultural importance (Jackson, Finn, & Featherston, 2012; Jackson, et al., 2014).

The species occupies specific home ranges within the Daly River catchment (Doody, Young & Georges 2002). The study by Doody et al. (2002) showed females had significantly larger home ranges than males. Male turtles exhibited a consistent pattern of movement with intense activity during the dry season and relatively low activity in the wet season. The cessation of intense activity corresponds to an increase in mean daily water temperature and coincides with the commencement of nesting.

Most large-scale movements by females occurred in the late dry season and wet season. Pig-nosed turtles may also occupy flooded riparian habitats during the wet season to access food resources (King, et al., 2021).

Within its home range pig-nosed turtle activity is focused on activity hotspots, including foraging areas (for instance, ribbonweed (*Vallisneria nana*) meadows), thermal springs and nesting beaches. Nesting beaches are located adjacent to the river channel. Hatching is triggered by the flooding of nests in the early wet season, and the high turbidity of these flows may offer protection from visual predators such as barramundi.

The species most likely has periodic recruitment allied to major flood and resource pulses, driven by large wet season events. Moreover, there is evidence that reproductive parameters such as egg and clutch size and the timing of laying are related to the magnitude of the previous wet season (King, et al., 2021).

Groundwater inputs to the Daly River catchment play a key role in the ecology of pig-nosed turtles as core habitat encompasses zones with high spring inflows and warmer river temperature. Thermal springs are used for basking during the dry season when there is a temperature differential between the groundwater and upstream-derived river water (King, et al., 2021).

Reduced dry season flows could negatively impact pig-nosed turtles by restricting their movement between nesting, feeding and basking areas. Other impacts could include a decline in ribbonweed, and a loss or decline in the number of thermal springs (King, et al., 2021).

11. Water security in Katherine

Overview

Approximately 7 % of the water allocated to public water supply has been used each year. The remaining 93 % acts as a buffer for meeting future projected population demand to 2040 and beyond.

Supporting Aboriginal people to access water for economic development is a government priority. As a result of the department's regulatory activities, including the implementation of the recovery of unused water licence entitlements policy in the Katherine plan area, the Aboriginal water reserve is fully provisioned for this iteration of the plan.

Implementation actions developed with advice from the committee will help Aboriginal people access the reserve.

The annual allocations process will trial a collaborative model. It will facilitate water licence holders in the plan area to collaborate and advise the department on the application of reductions to licence allocations, to meet the identified environmental flow thresholds specified in the plan.

Climate change has been actively considered in the development of the plan, including modelling median and worst-case scenarios for the region.

11.1 Public water supply and security

The NT Government recognises the importance of water security for all Territorians, including rural and remote communities. Roles and responsibilities for water are spread across a number of government agencies and entities, each with their own legislation and remit. A suite of policy reforms and coordination initiatives were processed in the term of the previous plan to improve safety, supply, sustainability and trust and confidence in water across the NT. Relevant to Katherine, this has included[13]:

- release of annual status of the water resource reports for water plan areas to improve transparency
- 'know your bore' information products to help rural property owners and pastoralists to keep their bores safe and working
- amendments to the *Water Act 1992* to streamline approvals processes and encourage businesses to grow
- launch of a free 1800 number and materials for new tenant packs for remote customers to report water leaks
- science projects to investigate the feasibility of recharging the Tindall Limestone Aquifer using wet season flows from the King River, and collection of high-resolution LiDAR survey data across the Katherine River catchment to improve water resource management and modelling capability
- increased Aboriginal participation in water management, through increased Aboriginal membership on water advisory committees (including the Daly River water advisory committee).

Under the Act, water allocation plans deliver water security by providing a long-term plan for the management of a resource, and a clear articulation of impacts and trade-offs. In addition, the prioritisation of water allocation under the Act directly aligns to water security objectives. Water for rural stock and domestic purposes (enshrined in legislation as a statutory right) is the highest priority for extraction, followed by licensed public water supply as the second priority, with these licences having a higher level of security relative to other water extraction licences.

[13] Across government progress on water security was reported in 2024 and 2025 through Territory water plan annual progress reports: https://watersecurity.nt.gov.au/territory-water-plan

Water extraction licences for public water supply in the Katherine area are held by Power and Water Corporation, who have legislative responsibilities for water supply and delivery in the Territory under the *Power and Water Corporation Act 1987*. From a resource management perspective, the related licences in Katherine enable the extraction of approximately 4,000 ML per year, with only around 7% of the licence entitlement being used annually. This allows a very generous 93% buffer to manage for extended dry periods and population growth. Population growth of 0.6% annually to 2040 has been projected by (NT Government Department of Treasury and Finance 2024).

11.2 Aboriginal economic development

Aboriginal water reserves provide Aboriginal people with increased opportunity to access water resources for economic development on a long-term basis, particularly in areas of high competition for water. The *Strategic Aboriginal water reserves policy framework* was introduced in 2017, with corresponding legislative amendments made to the Act in 2019 and 2025. This policy established Aboriginal economic development as a category of water use and the Aboriginal water reserve (AWR) in water allocation plans. The Act requires that water is set aside for Aboriginal people to access for economic development. The reserve ensures that Aboriginal people are not excluded from water licences as full allocations are realised for other commercial uses.

The AWR in the Katherine plan is now fully provisioned. In 2023, as part of the implementation of the Katherine water plan, the *Recovery of unused licensed water entitlements policy* was implemented across the region, with approximately 6,000 ML of water returned to the consumptive pool. The recovered water was reallocated, in order of priority, to the environment and to other public benefits. This action reduced the volume of licensed water entitlements below the ESY; enabled the AWR to be provisioned; and returned water to the general consumptive pool for future licence applications. Additionally, to encourage uptake by eligible Aboriginal people, legislative changes to the Act in May 2025 have made the AWR easier to access.

With advice from the Aboriginal members, the committee supported implementation actions that help Aboriginal people use the AWR (actions 3.5.2 and 3.5.3). This includes publishing a detailed case study from the first AWR licence for other Aboriginal people to clearly understand how the process works in practice, as well as lessons learned from the first AWR licence decisions.

The AWR is not the only avenue to access water for Aboriginal economic development. Within plan areas, allocations to other economic beneficial uses can also be used. Outside of water allocation plan areas, water availability for Aboriginal economic development would be assessed based on the *NT Water Allocation Planning Framework*. The *Processing water extraction licence applications policy* requires that the availability of water for potential future AWR is considered in all water licence decisions. This ensures that water will be available for the AWR as water plans are developed for new areas.

11.3 Announced allocations

As identified in section 6, consecutive very dry years present a risk to maintaining end-of-dry-season flows in the Katherine River. Groundwater discharge from the TLA is a critical contributor to dry season river flows, particularly during extended dry periods. Maintaining these aquifer-fed flows at the end of each dry season is essential for sustaining the ecological communities of the Katherine River and protecting groundwater-dependent ecosystems.

To manage this risk, an announced allocations framework has been applied across multiple iterations of the Katherine water allocation plan. This framework provides a mechanism to temporarily reduce water extraction during periods of heightened climatic stress, while remaining within the ESY set by the water plan.

Announced allocations, described in section 4.3 of the plan, allow the actual volume of water available for extraction to be reduced on an annual basis. Announced allocation conditions apply to all Top End water extraction licences and enable the Controller of Water Resources to temporarily reduce the total maximum water entitlement of a licence where climate conditions indicate that continued extraction may compromise environmental flow objectives. The department's integrated surface water-groundwater model is used to inform announced allocation decisions.

Reductions are triggered where modelled predictions indicate that end-of-dry-season flows in the Katherine River are likely to fall below the minimum environmental flow threshold identified in section 4 of the plan. This approach ensures that environmental and cultural values, ecosystem function, and water quality objectives are prioritised during periods of water scarcity. In order to determine the announced allocation in any given year, a modelling and assessment exercise is undertaken. The process for determining annual announced allocations is shown in Figure 17.

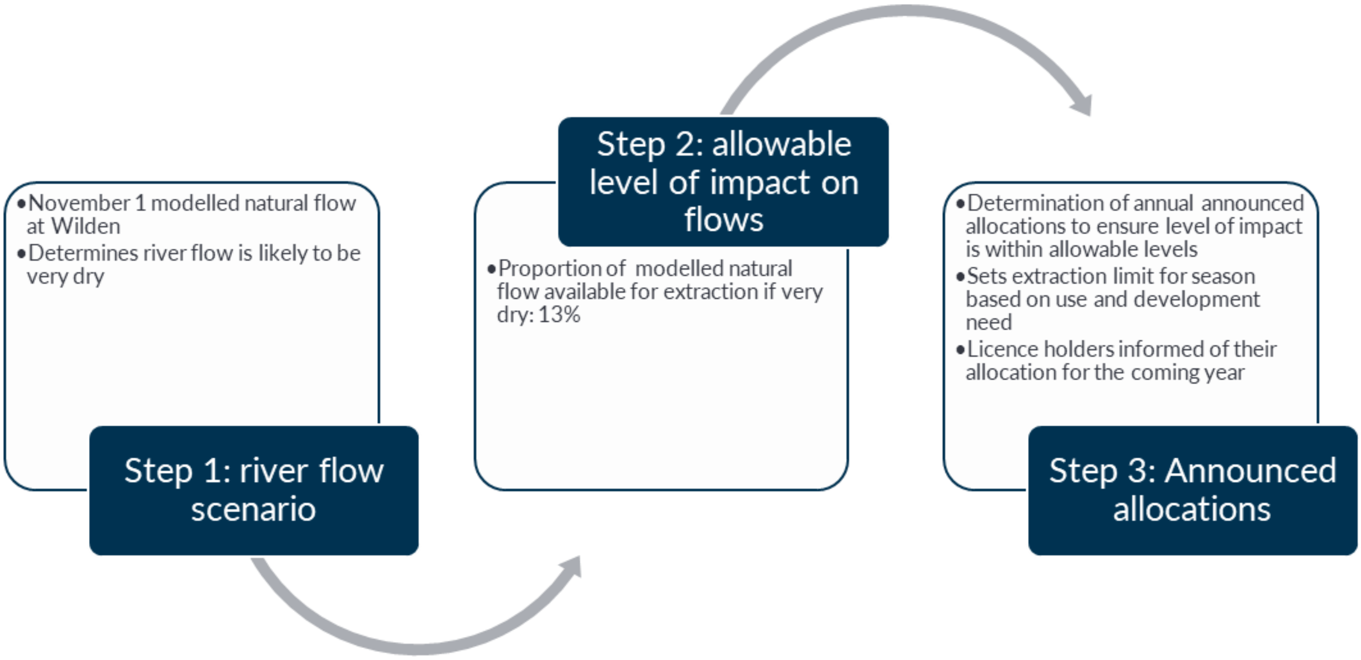

Figure 17. Overview of the announced allocation process

Previous iterations of the Katherine water allocation plan defined a suite of river-flow scenarios (very dry, dry, average, wet and very wet), each associated with different allowable levels of extraction. However, over the 16-year history of the plan, announced allocations have only ever been applied under the very dry scenario.

Consistent with this experience and recognising the current level of scientific certainty regarding the Katherine River system, this plan retains the existing very dry trigger and removes the higher-flow thresholds. Very dry conditions are defined as modelled natural flows at Wilden falling below 1.8 m^3 per second (cumecs) in November. Analysis of the most recent climate period (1990-2020) indicates that this threshold has been reached in three out of the 30 years. Examination of the longer-term record shows that flows during the twentieth century, when climate was notably drier, frequently fell below 1.8 cumecs for extended periods. This demonstrates that flows below the trigger level are a natural feature of the system under dry climatic conditions, rather than an indicator of extraction-related stress. The trigger is therefore set at a level that reflects natural system behaviour, while allowing water management to respond in critical periods of low flow (see section 7.4).

This change reflects the level of scientific understanding and certainty associated with the Katherine River system, as well as acknowledging the natural variation within the system that occurs regardless of extraction, where many consecutive days would have fallen below the minimum flow identified in the other scenarios.

Previous iterations of the plan have provided insufficient guidance to the Controller of Water Resources about the magnitude of reductions that could be applied. This resulted in a high degree of uncertainty for licence holders and did not reflect that a level of certainty is required for businesses. Additionally, there is ongoing unlicensed water use occurring in close proximity to the Katherine River (less than 5 km) and other sensitive receptors (such as GDEs), which can't be managed by the announced allocations process (as described in section 5).

To address these issues, this iteration of the s plan recommends that water licences for economic use are not reduced by more than 30%, and that any temporary reduction in licensed entitlements be accompanied by an education and awareness campaign about water efficiency for unlicensed household use, particularly targeting households within the discharge protection zone.

Based on advice from the committee, implementation of the announced allocation in the Katherine plan area will trial a different method to that used in previous years. Rather than the department recommending reductions to individual licence holders, the department will instead identify an overall percentage or volume reduction to the Katherine region, based on climate conditions and targeted river flows. An independent facilitator will then assist licence holders to identify, trade and volunteer the application of the necessary reductions in a collaborative manner.

11.4 Interaction of the plan with other water policies

The committee identified the difficulty water licence holders have in navigating the conflicting objectives of water policies and guidelines, specifically the *Trading licensed water entitlements policy*, the *Recovery of unused licensed water entitlements policy* and the announced allocations process. Following this advice, amendments have been made to these policies, including to review the percentage minimum use trigger for application of the unused water recovery policy, recognising trades as water use and providing further information on the recovery process to licence holders.

The recovery of unused water policy was applied around Katherine in 2023-2024 and 2024-2025. Recovery actions resulted in approximately 6,000 ML of unused water being made available for new and expanding development, including to fully provision the Aboriginal water reserve.

This integrated and improved approach to water policy in the Katherine plan area seeks to protect end-of-dry-season river flows, while minimising social and economic impacts and promoting long-term water stewardship across the Katherine region.

11.5 Planning for dry years and future population and economic growth

As identified in section 6, consecutive very dry years present a risk to end-of-dry-season flows in the Katherine River. An analysis of the historical rainfall record since 1900 identified that dry sequences of two years or more from among the driest 10% of all years occurred only twice, and dry sequences of two years or more from the driest 20% of all years occurred only three times. These sequences mostly occurred during the first half of the twentieth century, with only one such sequence occurring since 1970. Future climate scenarios do not suggest any change to this likelihood, with current patterns of interannual variation likely to dominate the next few decades.

However, maintaining aquifer fed flows during dry periods and at the end of every dry season remains a key priority for maintaining the ecological communities of the Katherine River.

While licensed take is the largest component of use in this area, it can be closely managed with metering, reporting, annual extraction limits, and the announced allocations process to reduce entitlements in dry years (see section 11.3). Unlicensed use, the majority of which is understood to be domestic use, poses a particular management challenge given is the significant uncertainty in rates of use, and the limited controls available to manage this use.

To address this risk, further investigation into unlicensed use is proposed, particularly in sensitive areas around the Katherine River. Based on the outcome, actions to improve water management could include the redistribution of water allocations within the ESY (refer to implementation actions).

Restricted water extraction areas can be declared under section 14A of the Act to cap both unlicensed and licensed use in an area. The need for a restricted water extraction area will be considered at the mid-term review of the plan based on the outcomes of further investigations. These measures are included in the plan's implementation actions (3.4.1 and 3.4.4) to improve confidence in the monitoring and management of unlicensed use in the plan area.

12. Conclusion

This background report provides an overview of the evidence available to support decisions about the plan. The report synthesises scientific analyses, stakeholder and community input, and detailed hydrological assessments that underscore the sustainability and resilience of the Katherine water resource.

Key findings include confirmation that aquifer levels and storage volumes remain robust despite increased extraction since the 1970s; that climate variability is the primary driver of aquifer recharge and river flows; and that current management practices have not resulted in any detectable regional ecological impacts.

The report also documents the varying confidence levels associated with some critical evidence. While data related to metered extraction, aquifer extent, and regional-scale groundwater trends have high confidence, notable uncertainties persist around unmetered extraction, localised groundwater flow paths in karst formations, mapping of groundwater-dependent ecosystems across the whole plan area and climate change impacts. To address these uncertainties, the plan emphasises precautionary and adaptive management strategies, such as maintaining the current ESY, considering the creation of a restricted water extraction area, targeted monitoring, and greater collaboration with major licence holders to manage extraction levels during dry periods. This balanced approach will help safeguard water-related ecological, cultural, social and economic values of the Katherine region over the next decade.

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Schedule A. Dictionary

Term	Definition or reference
Aboriginal water reserve	see *Water Act 1992*, section 4(1)
Act	the *Water Act 1992*
consumptive pool	the amount of a water that is available to take from a water resource in accordance with relevant state or territory legislation
beneficial uses	the beneficial uses for the Daly Roper Beetaloo water control district declared by *Gazette* no. G41, 19 October 2022. A copy of the declaration is included in Schedule E of the plan
Cambrian Limestone Aquifer	collective term for an extensive groundwater system covering 570,000 km² straddling the Northern Territory and Queensland border. The aquifer comprises the geological basins of the Daly, Georgina and Wiso. The aquifer consists primarily of limestone
Controller	the Controller of Water Resources appointed under the *Water Act 1992*, section 18
cumec	a cubic metre per second, a unit of measurement used to describe the flow rate in surface water systems; one cumec is equal to one thousand litres per second
department	the department with the responsibility for administering the *Water Act 1992*, according to the Northern Territory of Australia Administrative Arrangements Order
department's integrated surface water-groundwater model	The coupled surface-groundwater Daly-Roper (DR) model is a predictive tool designed to simulate hydrological flows through the Cambrian limestone Aquifer system and overlying units by incorporating surface-water/groundwater interactions at a regional scale. The model mesh has been refined in sensitive areas such as springs and discharge zones along drainage lines within the catchment, to provide greater predictive capability in areas that are managed by environmental controls. As best practise recommended in the Australian Groundwater Modelling Guidelines (Barnett, 2012) the model is recalibrated at key periods, generally not exceeding 5 years, once significant new data from monitoring and field studies have been collected and new research findings are available. The most recent re-calibration was undertaken in 2024, as part of a Commonwealth-funded research project: Knapton, A. (2024). Daly-Roper River Model (DR3) Recalibration. TR02/2025. Report by CloudGMS for Department of Lands, Planning and Environment, Northern Territory Government, Darwin, Australia
dry season	the period from 1 May to 30 September
eligible Aboriginal people	see *Water Act 1992*, section 4(1)
eligible land	see *Water Act 1992*, section 4B

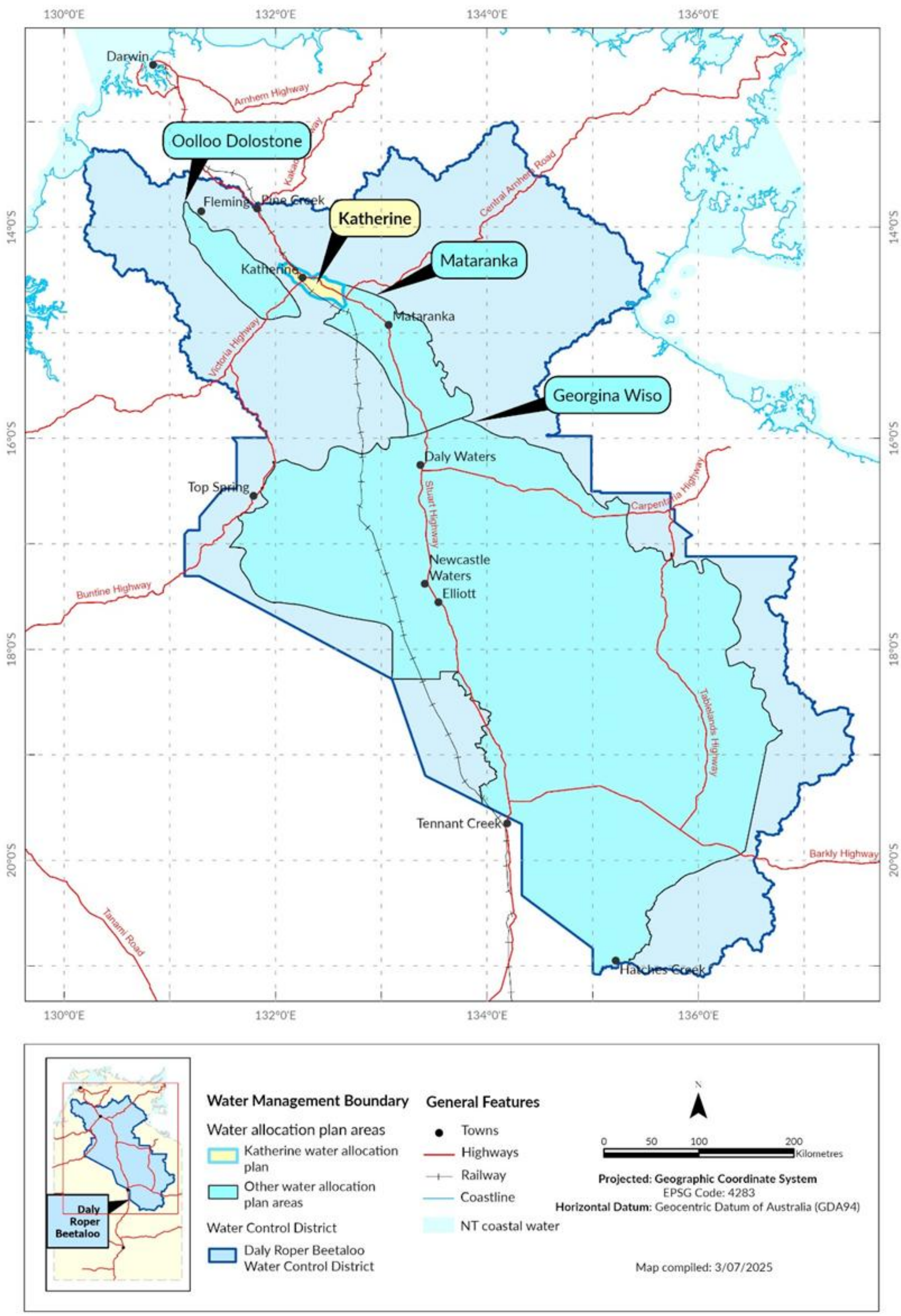
Term	Definition or reference
estimated sustainable yield	the amount of water that can be allocated from the water resource to support declared beneficial uses that is sustainable, section 4.2 of this document refers
gauging station	Station that collects water level, flow and rainfall data; they can also be equipped to collect discrete water quality data
groundwater	see *Water Act 1992*, section 4(1)
groundwater-dependent ecosystem	an ecosystem that requires access to groundwater to meet all or some of their water requirements
Katherine water resource	refer section 2.5 of the Katherine water allocation plan 2026-2036
licence holder	the person granted a licence to take water under section 45 or section 60 of the *Water Act 1992*
metered bores	licensed bores fitted with water meter
Minister	the Minister[14] responsible for the *Water Act 1992* under the Administrative Arrangements Order
plan area	the area to which this water allocation plan applies as shown in Schedule C
Tindall Limestone Aquifer	a regional limestone aquifer that extends from north of Katherine to south-east of Tennant Creek. Locally referred to as the Katherine and Mataranka Tindall Limestone aquifers in the Daly basin, Gum Ridge formation in the Georgina basin and Montejinni limestone in the Wiso basin
total maximum water entitlement	the maximum volume of water entitled to be taken in a year that is set by the water extraction licence
unmetered bores	bores that do not hold a water extraction licence and are not metered, typically used for exempt purposes such as stock and domestic supply
water control district	the Daly Roper Beetaloo water control district, declared by *Gazette* no. G41, 19 October 2022 under section 22 of the *Water Act 1992* A copy of the declaration is included in Schedule E of the plan
water licence/water extraction licence	see *Water Act 1992*, section 4(1)
waterway	see *Water Act 1992*, section 4(1)
wet season	the period from 1 October to 30 April

[14] Currently the Minister for Water Resources

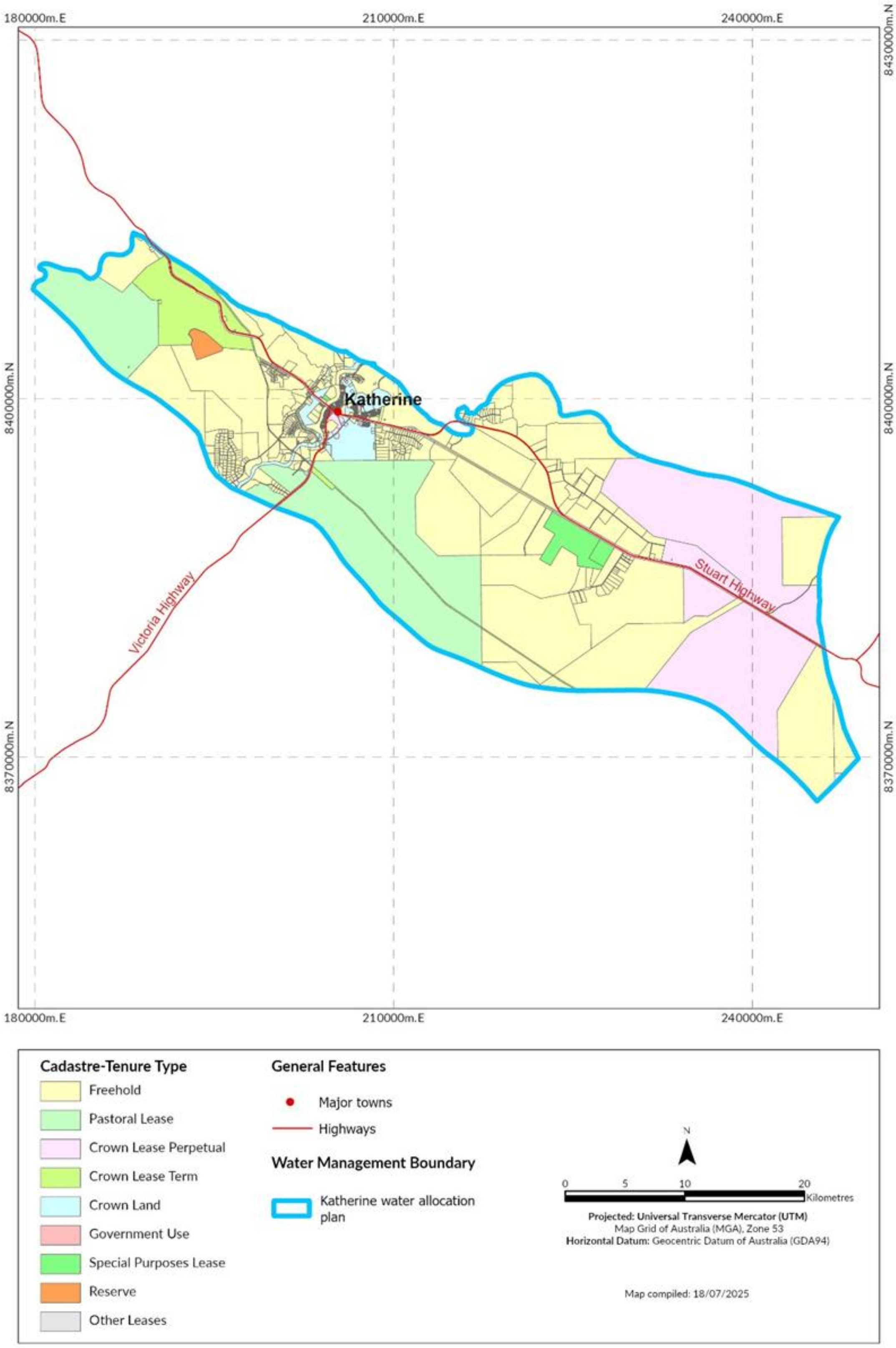
Schedule B. List of abbreviations and acronyms

Term	Full form
AWR	Aboriginal water reserve
°C	celsius
CMB	chloride mass balance
CSIRO	Commonwealth Scientific and Industrial Research Organisation
ESY	estimated sustainable yield
GDE	groundwater-dependent ecosystem
km	kilometre
km^2	square kilometre
L	litres
m	metre
m^3	cubic metre
mAHD	metres above Australian height datum
mm	millimetres
mg/L	milligrams per litre
ML	megalitre
NT	Northern Territory
NWI	National Water Initiative
PFAS	per- and poly-fluoroalkyl substances
RAAF	Royal Australian Air Force
RWEA	Restricted water extraction area
SILO	database of Australian climate data
TLA	Tindall Limestone Aquifer
95% CI	95% Confidence Interval

Schedule C. Map of the Daly Roper Beetaloo water control district and plan areas



Schedule D. Map of land tenure in the Katherine plan area



Schedule E. Katherine discharge protection zone