Midterm Review: Ti Tree Water Allocation Plan 2020-2030

NORTHERN TERRITORY GOVERNMENT

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0.1	10 November 2024	Water Resources	First draft
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0.3	5 February 2025	Water Management	Draft for Executive Director Review

Acronyms	Full form
ESY	estimated sustainable yield
GDE	groundwater dependent ecosystems

Acknowledgement of Country

The Northern Territory Government respectfully and proudly acknowledges the Northern Territory's Aboriginal people and their rich cultures. We pay respect to Elders past and present. We acknowledge Aboriginal peoples as the traditional owners and custodians of the lands and waters that we rely on for our livelihoods. 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, now and into the future.

Further information

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1. Purpose

The primary objective of a water allocation plan midterm review is to determine:

- if the scientific assumptions on which a plan is based, have changed
- whether there is a new or increased risk to the water resource
- whether the plan is achieving its objectives.

A midterm review also provides opportunity to:

- assess the progress of any implementation actions identified in the plan
- ensure the plan remains compliant with the *Water Act 1992*
- prioritise the future engagement and water management activities for the region.

2. Summary of findings

The Ti Tree midterm review found the Ti Tree water allocation plan 2020-2030 (the plan) is suitable to remain in force until 18 February 2030. The key findings for each of the review components are summarised in Table 1.

Table 1: Key findings over the last five years

Review component	Status	Comment
Scientific assumptions	✓	The scientific assumptions on which the plan is based remain appropriate for the remainder of the plan period. New water resource data, obtained over the last 5 years, confirms the understanding of the resource and aligns with the results of the groundwater model.
Risk assessment and management	✓	Most of the residual risk ratings are moderate to very low. The highest risk relates to realising the economic benefit for Aboriginal people. Further work is being done across the Territory to enhance Aboriginal economic development in relation to access to water.
Delivery against plan objectives	✓	The plan is largely delivering against the objectives. The highest priority is to improve understanding, and protection, of water-related Aboriginal cultural values within the plan area.
Compliant with *Water Act 1992*	✓	The Act introduced Aboriginal water reserves in 2019, after most of the water had been licenced in this area. There has been limited opportunity to recover unused water, and this will be an ongoing regulatory focus for the region.
Delivery of actions	✓	There are 31 implementation actions in the plan: 14 are complete, 12 are in progress and 5 have not yet started.

The review has identified the three priority activities to improve future management decisions:

1. Improve understanding, and protection, of water related Aboriginal cultural values of the resource.
2. Improve the understanding of the groundwater recharge and basin stratigraphy.
3. Undertake a one off water quality audit across the plan area to confirm baseline conditions and detect change over time.

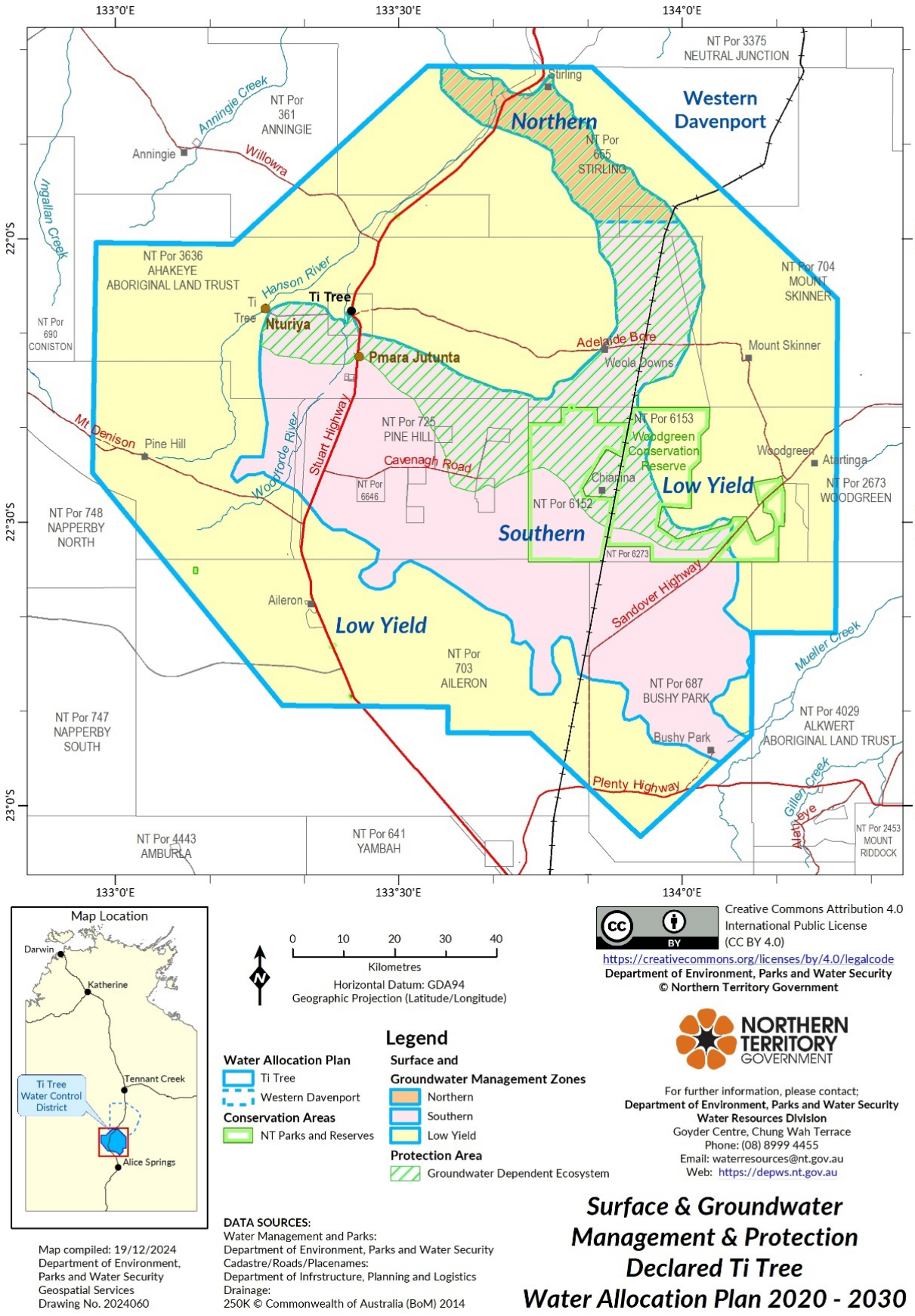

Figure 1: Map of Ti Tree water control district and plan area showing water management zones and the groundwater dependent ecosystems protection area.

3. Introduction

3.1. Statutory requirements

The completion of this review fulfils the statutory requirement of section 22B(3) of the *Water Act 1992* (the Act), which requires that water allocation plans are reviewed at a period of no longer than five years.

3.2. Plan area

Figure 1 shows the location and extent of the Ti Tree water control district in the Northern Territory, with the plan area covering the district in its entirety. The plan area is over 14,000 km², situated approximately 200 km north of Alice Springs. The plan manages groundwater in the Ti Tree Palaeovalley Aquifer (the Ti Tree aquifer) which is covered by the southern and northern groundwater management zones of the plan.

The purpose of the plan is to ensure water resources are managed in a way that recognises and maintains the water related environmental, social, and cultural values of the region, while enabling water to be sustainably extracted for people and communities, and for economically productive beneficial uses.

3.3. Climate and rainfall in the region

The plan area is characterised by highly variable climate with rainfall typically occurring between November and April. The long term average annual rainfall from 1990 to 2024 is 300.6 mm whereas the average annual rainfall over the past five years was 375 mm. This includes the lowest rainfall on record since 1900 where 43 mm of rainfall was recorded in 2019.

3.4. Water resources in the plan area

The Ti Tree aquifer is classified as a 'paleovalley aquifer,' an ancient valley which has filled with sediments over time. Many of these buried valleys contain active groundwater systems.

The aquifer is typical of an Arid Zone resource. Low annual rainfall averages and relatively high rates of evapotranspiration contribute to long periods of little to no groundwater recharge.

The water in the aquifer is replenished when surface water flows off the nearby ranges and into the basin, forming floodouts. Water remains for days to weeks at a time in floodouts allowing water to slowly seep into the ground and down to the aquifer. Significant rainfall events resulting in recharge occur approximately every seven to ten years.

There are no persistent surface water features within the plan area, although there are semi permanent rockholes within the hilly country at Native Gap and Anna's Reservoir. With the exception of Anna's Reservoir, most surface water bodies in the plan area are relatively short lasting, weeks to months, after rains. Allungra Creek and the Woodforde River are significant surface water features which contribute to groundwater recharge, with both of these sites being monitored as part of the water plan's implementation activities.

3.4.1. Groundwater management zones

The plan area is divided into three groundwater management zones. The northern and southern management zones cover the Ti Tree aquifer. The low yield zone covers areas of a different rock type, bedrock, and has much lower water storage potential (Figure 1).

3.4.2. Groundwater dependent ecosystem protection area

The plan assumes that groundwater dependent ecosystems (GDE) are likely to occur where depth to groundwater is 15 m or less (Figure 1). The plan sets a GDE protection area linked to the depth to groundwater. Plan implementation actions and recommended limits to change are included in the plan to manage water in this area more closely.

4. Review

4.1. Management activities

Since declaration of the plan, significant management activities undertaken include:

- **Aboriginal reference group**: an Aboriginal reference group was established in August 2024 to advise on the inclusion of Aboriginal cultural values into the plan.
- **Cultural mapping**: commencement of an anthropological report to improve understanding of water dependent cultural values in the plan area, expected to be complete in 2025.
- **High resolution survey**: collection of high resolution survey data through the National Water Grid fund science project: *Lidar survey and digital elevation model development for key Northern Territory Rivers*[1].
- **Water resources assessment report**: preparation of a detailed technical report to support the plan review and future work in the area: *Water Resources Assessment: Ti Tree Palaeovalley Aquifer* (Water Resources Technical Report TR25/2024)[2] (the Assessment).
- **Monitoring program**: groundwater and surface water monitoring, including annual reviews of the monitoring program.
- **State of the water resource**: release of the first annual state of the water resource for 2023-2024[3].

Activities underway for the remainder of the plan include:

- **Model recalibration**: recalibration of the Ti Tree groundwater model in 2026 through the National Water Grid Fund science project *Recalibration of models in high demand water systems*[4].
- **Aboriginal Water Science Project**: development of a methodology for describing Aboriginal water science features through the National Water Grid Fund Science Program project - *Aboriginal Water Science – Arid zone: Ti Tree Basin Palaeovalley*[5].

A detailed assessment of the plan implementation actions is provided in Schedule A. Additional Priority activities for ongoing management identified through the review are discussed in section 5.

[1] https://www.nationalwatergrid.gov.au/projects/lidar-survey-digital-elevation-model-development-key-nt-rivers

[2] https://territorystories.nt.gov.au/10070/986725

[3] https://nt.gov.au/environment/water/management-security/water-control-districts/ti-tree/ti-tree-water-allocation-plan-multi

[4] https://www.nationalwatergrid.gov.au/projects/recalibration-models-high-demand-water-systems-nt

[5] https://www.nationalwatergrid.gov.au/projects/aboriginal-water-science-ti-tree-basin

4.2. Monitoring

4.2.1. Surface water

Two surface water monitoring sites in the plan area continuously record measurements, on Allungra Creek, monitored since 2010, and the Woodforde River, monitored since 1974 (Figure 2). The sites are visited twice annually after the wet season June to July.

Rainfalls of around 100 mm are understood to be a threshold for regional rivers flowing in the plan. There were five instances where monthly rainfall exceeded 100 mm, the highest, 300 mm occurring in December 2020.

Substantial flows were observed in the Woodforde River in 2020 as well as 2023 and 2024. Below average flows were recorded in in the Woodforde River in 2021 and 2022 whereas no significant flows were observed in 2019 an unusually dry year. In the Allungra Creek, no flow was observed in 2020. From these results at both surface water monitoring locations, the Assessment found that rainfall levels and the rainfall patterns may be a better predictor of flow at Allungra Creek than rainfall levels alone.

4.2.2. Groundwater

A network of 40 groundwater bores is maintained in the Ti Tree water plan area, with continuous time series (logger) measurements currently recorded at nine of these sites (Figure 2). Most monitoring bores are clustered around Pmara Jutunta and the Ti Tree community along the Stuart Highway.

Groundwater levels across the Ti Tree basin over the past five years have shown high variability, with low spatial consistency. For example, monitoring bores in the central basin have seen one bore rise by over 7 m over five years, while others nearby fell by 2 to 3 m over the same period. Despite this, generally groundwater levels have fallen across the western, central, and northern parts, at a rate of 0.1 to 0.2 m per year.

Two additional bores were added to the monitoring program in June 2024 to improve understanding of potential mountain-front recharge, RN018900 and RN0189012.

At the start of the review period bore levels dropped in water levels, particularly shallow bores, due to very low rainfall, 43 mm in 2019. Many bores have shown a recovery in water levels in response to the subsequent above average wet seasons in 2020 to 2024 and are returning to pre 2019 levels.

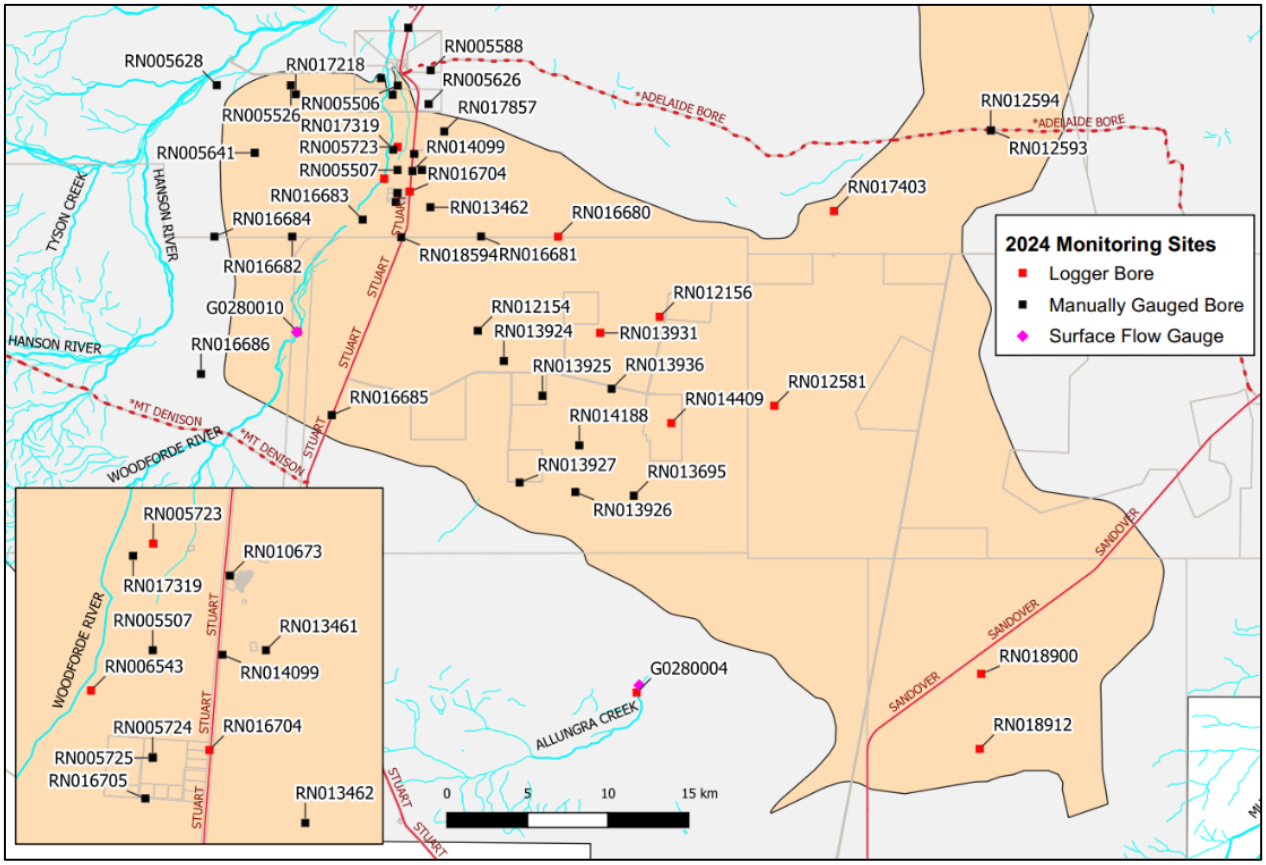

Figure 2: Map of monitoring sites, for both groundwater and surface water across Ti Tree water control district

4.3. Water use

Water taken for economic development and public water supply are subject to regulation under the Act.

Licences must be issued to take water for commercial activities and public water supply. The plan provides for trading between water licences in the area.

There are 14 groundwater licences authorised to extract a total of 7,529 ML per year in the plan area. The majority of licences are for agricultural purposes (Table 2). At the time of the review there were four active trades in the plan area totalling 1,795 ML per year. Despite changes in number of licences and their volumes, overall, the number of licences has dropped over the plan period (Table 2). The total licence entitlement has dropped by 1,000 ML, and the volume of water used has increased by approximately 500 ML (Table 2).

Table 2: Groundwater licences of the Ti tree water control district

Licences / licensed volume for Ti Tree Aquifer	2019-2020	2020-2021	2021-2022	2022-2023	2023-2024
Number of licences	18	17	13	14	14
Total volume groundwater licences (licenced entitlement) (ML)	8,704	8,604	7,219	7,529	7,529
Water use (ML)	3,265	2,906	2,571	3,044	3,625
% of water being used	26	34	36	42	50

To ensure licence holders comply with the Act and regulations, every year, a compliance plan is prepared to highlight to licence holders the Controller of Water Resources compliance and enforcement priorities. Over the past five years there have been a total of 12 licence inspections conducted and two warning letters issued.

More information, including compliance report cards is available online:
https://nt.gov.au/environment/water/licensing/rules

4.4. Scientific assumptions of the plan

A detailed technical report to support the plan review and future work in the area - *Water Resources Assessment: Ti Tree Palaeovalley Aquifer* (Water Resources Technical Report TR25/2024) (the Assessment) has been prepared.

The Assessment provides up to date analysis of long term climatic and hydrological data sets for surface water and groundwater resources, as well as a wide range of environmental, geological, and hydrogeological data for the Ti Tree basin.

With respect to the key scientific assumptions of the plan, the Assessment found:

- **Climate and rainfall** characteristics of the resource are consistent with assumptions in the plan. The assessment identified that a combination of both rainfall levels and the rainfall patterns may be a better predictor of flow at Allungra Creek than rainfall levels alone.
- **Geology and hydrogeology** of the system was generally confirmed, with new information from a 2021 Geoscience Australia study improving understanding of deep aquifers and the basement geology.
- **Recharge** mechanisms are known to be complex. The assessment documents a refined understanding of the relationship between rainfall and recharge, however further work is recommended. Model recalibration, due in 2026, will contribute to an improved understanding, as will the addition of two bores to the monitoring program in 2024.
- **Water quality** trends have not been monitored over the review period. Risks around water quality were found to be moderate with current controls in place, however additional water quality monitoring is recommended.
- **Groundwater modelling** shows consensus with measured water levels in the plan area, however there are notable deviations around the 'neck' of the basin and irrigated areas. Model recalibration is planned for 2026.
  - **Limits of change** were not directly assessed however modelling indicates drawdown from extraction is likely to occur in the central basin if full water entitlements are utilised, whilst rising water levels due to recharge occurring at the basin margins. Drawdown rates are predicted within natural conditions at the basin scale.
  - **The natural water balance** was updated with data from 1970 to 2024 and refined to include the low yield zone. Overall recharge estimates, which were important to determine the estimated sustainable yield (ESY), remain the same for the Northern groundwater management zone and increased slightly for the Southern groundwater management zone.
- **Groundwater dependent ecosystems (GDE) occurrence** was considered using updated vegetation mapping from satellite imagery and analysis of Actual Evapotranspiration. GDE outside of the groundwater protection area were identified at Woodforde River and Allungra Creek, however both are understood to be accessing perched water sources separate from the Ti Tree aquifer.

Key findings of the Assessment relevant to this review are outlined in greater detail in *Summary: Assessment of the Ti Tree Water Resource 2024* (Technical Summary).

4.5. Progress against the objectives of the plan

The plan identified a range of implementation actions[6] for an overarching monitoring and public reporting program, and each of the plan's objectives. Management activities referred to in section 4.1 have significantly contributed to the plan's implementation actions.

Territory wide initiatives have resulted in all implementation actions being completed for objective 1.

Delays to the mapping and establishment of key reference sites for both GDE and water dependent cultural values have resulted in slower progress against implementation actions for objectives 2, 3 and 5. The Aboriginal Water Science Program and cultural mapping will assist in progressing these objectives.

Implementation actions for objective 4 related to declaration of the plan and further work on salinity. Salinity work has not significantly progressed, however salinity risks were identified in the Assessment to remain moderate.

A detailed review of the status of each implementation action is provided in Schedule A.

Table 3: Snapshot of progress against objectives

	Objective 1. Ensure fair access to water for economic activities for today's users and future generations		Objective 2. Avoid significant detrimental impacts to water dependent ecosystems as a consequence of consumptive water use
	Objective 3. Avoid negative impacts to cultural values reliant upon surface or groundwater as a consequence of consumptive water use		Objective 4. Secure domestic and public water supplies for current and future populations
	Objective 5. Enhance opportunities for Aboriginal people from the region to benefit from consumptive use and management of water		Overarching monitoring and public reporting program

Icons represent the proportion of implementation ▪ completed, ▪ in progress and ▪ not started.

4.6. Ensure legislative updates are compliant with the Act

The plan was declared on 19 February 2020 in Gazette No. G7. During the intervening period there have been a number of legislative changes to the Act. The primary change to the legislation, in terms of water plans, has been the Water Further Amendment Bill 2019 that provided for a new beneficial use category related to Aboriginal economic development, and the establishment of an Aboriginal water reserve. This amendment commenced on the 8 July 2020 as per Gazette No. G27.

[6] The plan uses the terms 'management arrangements' and 'activities'. To align with other water allocation plans in the NT these are referred to in this review as 'implementation actions'.

Key considerations for compliance with this amendment are:

- a requirement to allocate water to an Aboriginal water reserve if there is eligible land within the water allocation plan area, section 22B(7) of the Act
- a requirement to consult with the relevant land council on the land proposed to be designated in a water allocation plan as land to which an Aboriginal water reserve applied, section 22C(2) of the Act.

A new independent Controller of Water Resources was appointed in May 2023 pursuant to section 18 of the Act, taking over from the incumbent Controller who was previously the Chief Executive Officer of the department. The Controller of Water Resources has the right to exercise a range of powers and functions in the Act, including the approval or rejection of water extraction licence applications following consideration of the factors under section 90(1) of the Act. The powers between the Minister and the Controller have also been separated.

4.7. Risk assessment and treatments

The risk assessment process identifies risks that may influence the plan's ability to achieve its objectives, and the development of controls or actions to mitigate these risks. The primary risks to the plan's objectives are associated with changes to groundwater availability, water quality and the economic benefits of water use not being realised. Key findings of the risk assessment are shown in Table 4.

The severity of risks was assessed based on existing controls in place, implementation actions that are complete or ongoing. The residual risk was then assessed based on the remaining relevant implementation actions being completed, implementation actions that are in progress or not started. The risk assessment and its methodology are shown in Schedule B.

Table 4: Key finding of the risk assessment

Findings	Implementation actions
Actions that relate to the greatest number of risks	2.1 GDE and water dependent cultural site research project: remote sensing and field study. 2.4 Commission study into potential for groundwater use by vegetation at Ti Tree. Establish parameters based on study recommendations. 0.4 Develop water monitoring plan[7]. 0.5 Implement water monitoring; rapid reporting against licence condition triggers.
Actions that relate to risks that are 'high' with current controls	0.4 Develop water monitoring plan[5]. 0.5 Implement water monitoring; rapid reporting against licence condition triggers. 3.1-3.3, 3.7-3.8 & 5.2-5.3 Involve Aboriginal people in water management through the following ways: • Aboriginal reference group • Cultural mapping • Aboriginal Water Science Project.
New actions to address high risks with no existing further controls identified in the plan	Ensure legislative settings are in place to facilitate use of Aboriginal water reserve. Consult with Aboriginal reference group to understand economic support needs, including by developing links to existing cross government development initiatives.

[7] An ongoing water monitoring program has been undertaken since plan commencement. As identified under implementation actions 2.7, 3.2 and 3.7, further refinement of the monitoring program is proposed to improve integration of groundwater dependent ecosystems and cultural values.

5. Priority activities for ongoing management

In consideration of the status of the water resource, the risks to the plan in achieving its objectives and implementation activities originally set in the plan, the priority activities are identified below. These activities are considered the most important for the ongoing management of the water resource over the next five years of the plan.

Improve understanding, and protection, of water related Aboriginal cultural values of the resource: increased awareness of economic water opportunities for Aboriginal communities and incorporation of elements of Aboriginal values into future water monitoring and water management. This priority will be supported by the new Aboriginal Water Science Project[8] (funded through National Water Grid), the completion of the cultural mapping project and the continuing the collaboration with the Aboriginal reference group.

Improve the understanding of the groundwater recharge and basin stratigraphy: complete recalibration of the Ti Tree groundwater model in 2026[9] (funded through National Water Grid). The model will be ground truthed through field observations to better understanding the water levels and recharge movements within the basin. In addition to this, further refinement of the monitoring program is proposed to improve integration of GDE, once mapping is completed and cultural values, as described above.

Undertake a one off water quality audit across the plan area to confirm baseline conditions and detect change over time: this would inform water managers of the in the future of any changes in water quality and may identify any potential point sources of pollution in the future.

6. References

National Water Grid - https://www.nationalwatergrid.gov.au/projects

Ti Tree water allocation plan webpage which includes: water allocation plan. plan area map, state of the water resource, mid term review, technical summary - https://nt.gov.au/environment/water/management-security/water-control-districts/ti-tree/ti-tree-water-allocation-plan-multi

Water Act 1992 - https://legislation.nt.gov.au/Legislation/WATER-ACT-1992

Water licensing portal - https://nt.gov.au/environment/water/licensing/licensing-portal

Water licensing rules, including compliance report cards - https://nt.gov.au/environment/water/licensing/rules

Water policies and guidelines - https://nt.gov.au/environment/water/management-security/water-policies-and-guidelines

Water Resources Assessment: Ti Tree Palaeovalley Aquifer (Water Resources Technical Report TR25/2024 - https://territorystories.nt.gov.au/10070/986725

[8] https://www.nationalwatergrid.gov.au/projects/aboriginal-water-science-ti-tree-basin

[9] https://www.nationalwatergrid.gov.au/projects/recalibration-models-high-demand-water-systems-nt

Schedule A: Review and prioritisation of plan implementation actions

Table 5: Review and prioritisation of plan implementation actions

Implementation action	KPI	Current status	Due
Objective 1: Ensure fair access to water for economic activities for today's users and future generations.			
1.1 Licence information published on the internet.	Ti Tree licence information available publicly.	**Complete**: the water licensing portal provides information about licence decisions to the public, refer: https://nt.gov.au/environment/water/licensing/licensing-portal	2024
1.2 Implement trading guidelines and other improvements to facilitate trading.	(a) Number of successful trades that have occurred. (b) Increase in the average use of water entitlements.	**Complete**: the *Trading Water Entitlements Policy* was approved in July 2020. A trade register and online information for applicants has also been published. At the time of the review there were four active trades in the plan area for 1,795 ML per year.	2024
1.3 Implement Managing unused licensed water entitlements policy.	Increase in the average use of water entitlements each year.	**Complete (ongoing)**: recovery of unused licensed water entitlements is one of Water Resource Division's 2021-2026 Compliance and enforcement priorities. While recovery has not occurred in Ti Tree, annual Territory wide recovery targets are set through compliance plans and are reported on through compliance report cards, refer: https://nt.gov.au/environment/water/licensing/rules Use of licenced water entitlements has increased from 34% in 2020-2021 to 50% in 2023-2024.	2024
Objective 2: Avoid significant detrimental impacts to water dependent ecosystems as a consequence of consumptive water use.			
2.1 GDE and water dependent cultural site research project: remote sensing and field study.	Map produced and interim reference sites identified in 6 months.	**In progress**: as documented in the Water Resources assessment report, improved groundwater dependent vegetation mapping has been undertaken for the plan area. Key reference sites are yet to be established, refer: https://nt.gov.au/environment/water/management-security/water-control-districts/ti-tree/ti-tree-water-allocation-plan-multi	ongoing

Implementation action	KPI	Current status	Due
2.2 Field work (1-2 weeks) & water modelling for accurate water table depth.	Map produced in 12 months.	**Complete (ongoing)**: high resolution survey data has been obtained through the National Water Grid fund Science Program: *Lidar survey and digital elevation model development for key Northern Territory Rivers*. LiDAR and annual water level monitoring data will be used to inform model recalibration in 2026, refer: https://www.nationalwatergrid.gov.au/projects/lidar-survey-digital-elevation-model-development-key-nt-rivers	ongoing
2.3 See section 4.1.1 of the plan (environmental water requirements).	Technical report published in 12 months.	**In progress**: refer to implementation action 2.1.	ongoing
2.4 Commission study into potential for groundwater use by vegetation at Ti Tree. Establish parameters based on study recommendations.	Parameters, limits to change in groundwater availability to GDE, established under Ti Tree water allocation plan (reviewed in five years).	**In progress**: limits to change were established with declaration of the plan. Through the Water Resource assessment report, potential for use of both depth to groundwater and salinity as predictive of groundwater dependent ecosystems has been identified. Further research would be required to characterise this relationship, refer: https://nt.gov.au/environment/water/management-security/water-control-districts/ti-tree/ti-tree-water-allocation-plan-multi	ongoing
2.5 Model groundwater drawdown and provide assessment report for assessment of relevant licence applications.	Modelling undertaken to assess all applications potentially affecting areas where water table is.	**Complete (ongoing)**: only one new water extraction licence application has been processed for the plan area since declaration of the plan. The application related a local aquifer, not the Ti Tree aquifer and as a result the regional model was not used. Modelling was undertaken to support a decision on a water trade in 2024. Information requirements for applications have been clarified, this includes requirement for more complex applications to prepare modelling reports, refer: https://nt.gov.au/environment/water/licensing/water-extraction-licence/tiers	

Implementation action	KPI	Current status	Due
2.6 Develop recommended conditions for water extraction licences related to GDE and surface water ecosystem protection.	From plan commencement, special conditions related to GDE protection recommended and considered by the Controller of Water Resources for all relevant licences.	**In progress**: examples of cultural value protection conditions have not been developed for the plan area, however special conditions have become increasingly common on water licences across the Northern Territory since declaration of the plan, particularly with respect to GDE.	
2.7 Develop and implement water monitoring plan, see P4 & P5.	GDE related monitoring included in water monitoring plan. From plan commencement, monitoring undertaken at GDE relevant reference sites.	**In progress**: the Ti Tree water monitoring program has been reviewed annually. Monitoring measures specifically for GDE have not been identified, findings from GDE mapping under implementation action 2.1 will contribute to this this implementation action.	
Objective 3: Avoid negative impacts to cultural values reliant upon surface or groundwater as a consequence of consumptive water use.			
3.1 Cultural site research / field work and Traditional Owner consultation, development of data sharing agreement.	Map produced and interim reference sites identified in 6 months; data sharing agreement in 12 months.	**In progress**: Water Resources Division commissioned an anthropological report to progress this implementation action, expected to be complete in 2025. The National Water Grid Fund Science Program project - *Aboriginal Water Science – Arid zone: Ti Tree Basin Palaeovalley* will also contribute to this implementation action, refer: https://www.nationalwatergrid.gov.au/projects/aboriginal-water-science-ti-tree-basin	2021
3.2 Development of monitoring and access protocol for culturally significant sites.	Protocol approved by the department and Central Land Council in 18 months.	**In progress**: in line with implementation action 3.1, monitoring and access protocols will be considered following the anthropological report and Aboriginal Water Science Project.	
3.3 Consultation with Central Land Council and Traditional Owners to design assessment process for assessing change to water dependent cultural sites.	Process established and approved by Central Land Council and the department by August 2020. Includes assigning limits to drawdown depth and rate for relevant cultural sites.	**In progress**: Water Resources Division is undertaking a National Water Grid Fund Science Program project - *Aboriginal Water Science – Arid zone: Ti Tree Basin Palaeovalley* which will contribute to this implementation action, refer: https://www.nationalwatergrid.gov.au/projects/aboriginal-water-science-ti-tree-basin	

Implementation action	KPI	Current status	Due
3.4 Email copy of water extraction licence Notice of intention advertisement to Central Land Council.	Central Land Council informed of all Notice of intentions, at the same time as others are informed.	**Complete (ongoing)**: Water Resources Division notifies the Central Land Council when advertising applications. This practice is guided by an internal operating procedure.	
3.5 Apply system for assessing impact on cultural values; including modelling groundwater drawdown and report for relevant licence applications.	From 2020, assess all applications potentially affecting areas where water dependent cultural values are identified.	**Complete (ongoing)**: assessment of water extraction licence applications, and applications for trade are guided by the Act, the plan and Territory wide policy. Information requirements for applications have been clarified, this includes requirement for more complex applications to assess GDE, prepare modelling reports and undertake stakeholder engagement, refer: https://nt.gov.au/environment/water/licensing/water-extraction-licence/tiers	
3.6 Develop recommended conditions for licences related to water dependent cultural value protection.	From plan commencement, conditions related to water dependent cultural values protection recommended and considered by the Controller of Water Resources for all relevant licences.	**In progress**: example cultural value protection conditions have not been developed for the plan area, however special conditions have become increasingly common on water licences across the Northern Territory since declaration of the plan.	
3.7 Develop and implement water monitoring plan for water dependent cultural values.	Water dependent cultural values related monitoring included in water monitoring plan; monitoring undertaken at relevant reference sites.	**In progress**: the Ti Tree water monitoring program has been reviewed annually. Monitoring measures specifically for water dependent cultural values have not been identified, findings from the anthropological report and Aboriginal Water Science Project will contribute to this implementation action.	
3.8 Develop guidelines for minimal impact unlicenced water use and promote to land holders.	All Ti Tree land holders are aware of guidelines within two years of their development.	**Not started**	
Objective 4: Secure domestic and public water supplies for current and future populations.			
4.1 4.1 Ti Tree water allocation plan development process.	Allocations prioritising domestic and public water supply established in Ti Tree water allocation plan.	**Complete**: with declaration of the plan.	
4.2 Consultation with Power and Water and stakeholders.	Forecast demand reported in Ti Tree water allocation plan.	**Complete**: with declaration of the plan.	2024

Implementation action	KPI	Current status	Due
4.3 Field work and Geoscience Australia mapping.	Completion of technical report on salinity in the soil profile within three years.	**Not started**	
4.4 Develop and implement solute transport model. May require additional water quality monitoring, see Activity P4 & P5.	Report completed within two years.	**Not started**	
Objective 5. Enhance opportunities for Aboriginal people from the region to benefit from consumptive use and management of water.			
5.1(a) Ti Tree water allocation plan development process. 5.1(b) Establish Strategic Aboriginal water reserve notional allocation.	Ti Tree water allocation plan includes notional Strategic Aboriginal water reserve.	**Complete**: consistent with the Strategic Aboriginal Water Reserve Policy Framework (October 2017), the plan identified a notional amount of water available for the Strategic Aboriginal water reserve in the southern zone of 1,505 ML. Water may become available in the future e.g. through surrendered, amended, or cancelled licences. Refer to implementation action 1.3 for details of recovery.	ongoing
5.2 Collaborate with Central Land Council to coordinate Anmatyerre Kwatye Committee meetings.	Target: from plan commencement, equivalent number of Anmatyerre Kwatye Committee meetings to Ti Tree water advisory committee meetings or similar consultation process.	**In progress**: in August 2024 the Ti Tree Aboriginal reference group was established. Consultation with the group and the Central Land Council is ongoing to understand how roles of a water advisory committee, the Aboriginal reference group and the Anmatyerre Kwatye Committee should relate to each other.	ongoing
5.3 (a) Develop Ranger monitoring plan, see activity P4 & P5. (b) Implementing monitoring and reporting activities, include capacity-building.	Quality assured monitoring data collected by Anmatyerr Rangers integrated into the department data management and reporting systems.	**Not started**	2024
Overarching monitoring and public reporting program - To ensure water resources in the Ti Tree water control district are managed in a manner that protects and maintains environmental and cultural values while providing a sustainable volume of water for consumptive beneficial use.			
0.1 P1. Water modelling and Ti Tree water allocation plan development process.	Productive base of the resource maintained; ESY established under Ti Tree water allocation plan (reviewed in five years).	**Complete**: an ESY was established with declaration of the plan, with recharge as a key parameter. Through the Water Assessment Report, the natural water balance and recharge have been re-estimated based on an updated data set, no reduction in overall recharge was identified,	2024

Implementation action	KPI	Current status	Due
		refer: https://nt.gov.au/environment/water/management-security/water-control-districts/ti-tree/ti-tree-water-allocation-plan-multi	
0.2 (a) Implement management of unused water policy, see 6.4.3. (b) Observe ESY limits to allocations and entitlements (c). Implement trade policy.	(a) Volume of water recouped. (b) Sum of licensed entitlements (should be equal to or less than the ESY). (c) Number of completed trades.	**Complete (ongoing)**: refer to implementation actions 1.2 and 1.3.	ongoing
0.3 Licensee visits and inspections, data collection, extension activities.	Target 100% compliance with licence conditions.	**Ongoing**: licence compliance is prioritised and planned at a Territory wide scale in accordance with Water Resource Division's 2021-2026 Compliance and enforcement priorities and annual compliance plans, refer: https://nt.gov.au/environment/water/licensing/rules 28 regulatory inspections have been undertaken since declaration of the Plan. Annual compliance statistics are published though the status of the water resource report (starting in 2023-2024), refer: https://nt.gov.au/environment/water/management-security/water-control-districts/ti-tree/ti-tree-water-allocation-plan-multi	ongoing
0.4 Develop water monitoring plan.	Water monitoring plan is strategic; monitoring activities are sufficient to support Ti Tree water allocation plan objectives; include licence condition triggers; completed and resourced in 12 months.	**In progress**: an ongoing water monitoring program, including groundwater and surface water has been undertaken since plan commencement. Annual reviews have occurred. As identified under implementation actions 2.7, 3.2 and 3.7, further refinement of the monitoring program is proposed to improve integration of GDE and cultural values.	biannual plus occasional programs
0.5 Implement water monitoring; rapid reporting against licence condition triggers.	Monitoring implemented in accordance the monitoring plan; exceedance of licence condition parameters reported to Water Licensing and Regulation as identified.	**Not started**	annual

Implementation action	KPI	Current status	Due
0.6 Analyse monitoring data and interpret results.	Monitoring 'report card' incorporated into five-yearly assessment report (for plan review and new plan).	**Complete (ongoing)**: commencing in 2023-2024 annual status of the water resource reports are being prepared for the plan area. The annual report captures key results of water monitoring. Also refer to the technical summary. Refer: https://nt.gov.au/environment/water/management-security/water-control-districts/ti-tree/ti-tree-water-allocation-plan-multi	annual

Schedule B: Risk assessment

The risk to plan objectives has been assessed to prioritise ongoing management activities for next five year period. Impacts on objectives that were not identified in the plan are identified as “new”.

This risk assessment complements that presented in *Water Resources Assessment: Ti Tree Palaeovalley Aquifer* (Water Resources Technical Report TR25/2024) which focusses on risks to groundwater and surface water resources.

The methodology for risk assessment has been determined by considering the likelihood of a threat occurring (Table 6) and the consequence associated with that threat (Table 7) on a scale of 1 to 5 and using a matrix to determine the risk level (Table 8). The risk level will indicate the type of response that may be required to mitigate or avoid the risk (Table 9).

Likelihood

Table 6: Likelihood of a threat occurring.

Category	Qualitative descriptor	Frequency	Probability of occurring in life of plan
1	Rare	Event occurs 1 in every 100 years	< 1%
2	Unlikely	Event occurs 1 in every 20–50 years	1 – 20%
3	Possible	Event occurs 1 in every 5–10 years	21 – 80%
4	Likely	Event occurs annually	81 – 95%
5	Almost certain	Event occurs many times per year	> 95%

Consequence

Table 7: Consequence associated with a threat.

Category	Qualitative descriptor	Ecological/water quality impacts	Socio-economic impacts
1	Insignificant	No noticeable impact to ecosystem.	Short period of low level water restrictions causing minor inconvenience to households, no material impact on irrigation allocations, minimal financial impact on industry and little to no loss of amenity.
2	Minor	Some impact on marginal ecosystems, for example, edges of riparian zones or small mixed dependency ecosystems.	Extended period of low level water restrictions causing some inconvenience to households, reduction in irrigation allocations with minimal material impact, potential financial impact for some industries and minor loss of amenity. First signs of impact on public morale.
3	Moderate	Water availability is so low, such that only the highest value environmental sites receive or retain water, putting vulnerable species at risk.	Medium level of water restrictions directly impacting on households, reduction in irrigation allocations resulting in some loss of productivity, some industries severely impacted or forced to close tourism, prioritisation of watering for amenities, increased impact on morale.
4	Major	Water availability is at critically low levels and groundwater systems become depleted beyond recharge rate. Extensive damage to ecosystems occurs with potential irreparable damage in some areas.	High level water restrictions directly limiting household water use, limited irrigation allocations resulting in low levels of productivity, some industries forced to close which may impact on national economy, severe loss of amenity and morale, some people leave.

Category	Qualitative descriptor	Ecological/water quality impacts	Socio-economic impacts
5	Catastrophic	Irreparable damage to ecosystem; severe adverse impacts to environment.	Water supply to major town becomes insufficient to ever again sustain community or nationally significant activity; no irrigation allocations, collapse of industry, total loss of amenity, dislocation of people, and significant impact to the national economy.

Risk level

Table 8: Risk level matrix

Risk level		Consequence				
		Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood	Rare	very low	very low	low	moderate	moderate
	Unlikely	very low	low	low	moderate	high
	Possible	low	low	moderate	high	high
	Likely	low	moderate	moderate	high	very high
	Almost certain	moderate	moderate	high	very high	very high

Risk response

Table 9: The risk level response that may be required to mitigate or avoid the risk.

Risk level	Action	Timing
Very low – low	Continue routine approach to management – no specific actions required	Ongoing
Moderate – high	Manage by specific monitoring or response procedures	Within water plan period
Very high	Develop management or investigation plan, cease activities for which high risks may arise	Immediate

Table 10: Risk assessment

Event scenario - risk			Existing controls in place	Current residual risk			Further controls	Target risk		
Hazard identification	Why can it happen	Impact on plan objectives		Likelihood	Consequence	Risk level	Actions	Likelihood	Consequence	Risk level
Groundwater levels reduce below minimum thresholds	Climate (low rainfall years, high rates of evapotranspiration). Excessive water use. Recharge zones not protected.	Significant detrimental impacts to water dependent ecosystems (GDE) (plan objective 2).	Estimated sustainable yield (ESY) set in plan (overarching action 0.1). Groundwater model developed and used (overarching action 0.1, implementation action 2.2). Monitoring program in place (overarching action 0.6). Regulatory compliance and enforcement of licence conditions (overarching action 0.3).	**Unlikely** Assessment report found that GDE overlying the basin are likely reliant upon a perched aquifer (separate water resource).	**Moderate** Species adapted to high variability Arid climate, five year plan review cycle.	**Low**	Update monitoring program to improve integration of GDE (overarching action 0.4, implementation action 2.7). Implement rapid reporting against licence condition triggers (overarching action 0.5). Further drilling and field investigations to cover data deficient areas to improve model (implementation actions 2.1, 2.3, 2.4). Further mapping of GDE to increase understanding and map published (implementation actions 2.1-2.4).	**Unlikely**	**Moderate**	**Low**
		Negative impacts to or loss of cultural values/sites reliant upon surface or groundwater (plan objective 3).	Model groundwater drawdown for new water extraction licences and provide report for assessment of licence applications (implementation actions 2.5 & 3.5). Notify CLC of licence applications (implementation action 3.4)	**Possible** Cultural sites have not been identified so management tools may not be in the appropriate areas.	**Major** Cultural practices can no longer be completed where previously done so. Cultural sites can no longer be visited.	**High**	Update monitoring program to improve integration cultural values (overarching action 0.4). Implement rapid reporting against licence condition triggers (overarching action 0.5). Aboriginal people involved in water management through the following ways: • Aboriginal reference group • Cultural mapping • Aboriginal Water Science Project. This will aim to identify areas of cultural importance to safeguard water resource to work towards implementation actions 3.1-3.3, 3.7-3.8 & 5.2-5.3.	**Unlikely**	**Major**	**Moderate**
		Reduced availability or access to water for rural stock and domestic purposes (plan objective 4).	Regulatory compliance and enforcement of licence conditions (overarching action 0.3). Model groundwater drawdown for new water extraction licences and provide report for assessment of licence applications (implementation action 2.5). Recovery of unused licenced water entitlements policy in place (implementation action 1.3). Ongoing analysis of future monitoring data to produce annual state of the water resource reports (overarching action 0.6).	**Unlikely** Stock and domestic use in aquifer is low. Stock and domestic in the low yielding aquifers are not affected by water extraction in other parts of the basin.	**Minor** Department monitoring continues to enable early action if triggered. Regulation and compliance measures in place to report water take.	**Low**	Implement rapid reporting against licence condition triggers (overarching action 0.5).	**Rare**	**Minor**	**Very low**
		Lack of water security for public water supply (plan objective 4).	Water supply to Pmara Jutunta and Ti Tree secured through licences (overarching action 0.1, implementation action 4.1). Prioritisation of public water supply in allocation (implementation action 4.1). Consultation with Power and Water Corporation (PWC) and other stakeholders to forecast water use demand in area (implementation action 4.1 & 4.2). Model groundwater drawdown for new water extraction licences and provide report for assessment of licence applications (implementation action 2.5).	**Rare** Power and Water Corporation licences has substantial buffer.	**Minor** Power and Water Corporation will need to extend the depth of their production bores.	**Very low**		**Rare**	**Minor**	**Very low**

Event scenario - risk			Existing controls in place	Current residual risk			Further controls	Target risk		
Hazard identification	Why can it happen	Impact on plan objectives		Likelihood	Consequence	Risk level	Actions	Likelihood	Consequence	Risk level
		Reduced availability or access to water for development including Aboriginal economic development (plan objective 5).	Recovery of unused licenced water entitlements policy in place (implementation action 1.3). Strategic Aboriginal water reserve notional amount available, consistent with published policy (implementation action 5.1b).	**Unlikely** High climate variability.	**Moderate**	**Low**	**Model recalibration scheduled for 2026 and will include ESY review (new action).**	**Possible**	**Minor**	**Low**
Water quality declines to unacceptable levels	Land use. Overuse of water resource. Upstream pollution (PFAS) flows downstream affecting lower catchment. Agrichemicals leach into surface and groundwater. Irrigation return flow from horticulture can increase salinity.	Significant detrimental impacts to water dependent ecosystems (GDE) (plan objective 2).	Estimated sustainable yield (ESY) set in plan (overarching action 0.1). Groundwater model developed and used (overarching action 0.1, implementation action 2.2). Monitoring program in place throughout plan areas (overarching actions 0.6). Regulatory compliance and enforcement of licence conditions (overarching action 0.3). Some GDE mapping complete in key development area/s (implementation actions 2.1 & 2.2). Power and Water Corporation water quality monitoring and treatment program (implementation action 4.1). Ongoing analysis of future monitoring data to produce annual state of the water resource reports (overarching action 0.6).	**Unlikely** GDE preliminary mapping shows unlikely presence GDE in the basin. GDE along the Woodforde River are likely reliant upon a perched aquifer (separate water resource).	**Moderate**	**Low**	Further mapping of GDE to increase understanding and map published (implementation actions 2.1-2.4). Develop GDE health and monitoring guidelines for future management in area (implementation actions 2.6 & 2.7). Update monitoring program to improve integration of GDE (overarching action 0.4, implementation action 2.7).	**Unlikely**	**Moderate**	**Low**
		Negative impacts to or loss of cultural values/sites reliant upon surface or groundwater (plan objective 3).		**Possible** Cultural sites have not been identified so management tools may not be in the appropriate areas.	**Moderate** Cultural practices can no longer be completed where previously done so. Cultural sites can no longer be visited.	**Moderate**	Aboriginal people involved in water management through the following ways: • Aboriginal reference group • Cultural mapping • Aboriginal Water Science Project. This will aim to identify areas of cultural importance to safeguard water resource to work towards implementation actions 3.1-3.3, 3.7-3.8 & 5.2-5.3.	**Unlikely**	**Moderate**	**Low**
		Reduced water quality for rural stock and domestic (plan objective 4).		**Possible** Naturally occurring water quality issues in region e.g. Nitrate levels are naturally high in the Arid Zone, some boreholes have high Uranium levels.	**Moderate** Generally, water is suitable for drinking but could be impacted.	**Moderate**	Work with on technical report on salinity in soil profile (implementation action 4.3). Develop solute transport model with additional water quality monitoring data (implementation action 4.4). Work with Power and Water Corporation and other stakeholders to implement water quality monitoring program (overarching actions 0.4 & 0.5, implementation action 5.3b).	**Possible**	**Moderate**	**Low**
		Insufficient quality for public water supplies (plan objective 4).		**Possible** Naturally occurring water quality issues in region e.g. Nitrate levels are naturally high in the Arid Zone, some boreholes have high Uranium levels.	**Minor** Power and Water Corporation may need to pretreat drinking water	**Low**	Work with Power and Water Corporation and other stakeholders to implement water quality monitoring program (overarching action 0.4 & 0.5). One off water quality audit across the plan area to confirm baseline condition and detect change over time (overarching objective 0.4, implementation actions 2.7 & 3.7).	**Possible**	**Minor**	**Low**
		Water not safe for agricultural (or other declared beneficial) use (plan objective 1).		**Possible** Naturally occurring water quality issues in region e.g. Nitrate levels are naturally high in the Arid Zone, some boreholes have high Uranium levels.	**Moderate**	**Moderate**	Develop and implement water quality monitoring program (overarching actions 0.4 & 0.5).	**Unlikely**	**Moderate**	**Low**

Event scenario - risk			Existing controls in place	Current residual risk			Further controls	Target risk		
Hazard identification	Why can it happen	Impact on plan objectives		Likelihood	Consequence	Risk level	Actions	Likelihood	Consequence	Risk level
Economic benefit of water use not realised	Business uncertainty of water policy impacts on investment. Water availability limits business viability.	Water isn't used to provide benefits to eligible Aboriginal people through Aboriginal water reserve (plan objective 5).	Aboriginal water reserve supports Aboriginal economic development (implementation actions 5.1a & 5.1b).	**Almost certain**	**Moderate** Economic status of the region remains the same.	**High**	**Ensure legislative settings are in place to facilitate use of Aboriginal water reserve (new action).** **Consult with Aboriginal reference group to understand economic support needs, including by developing links to existing cross government development initiatives (new action).**	**Almost certain**	**Moderate**	**High**
		Water isn't used to provide benefits to the region (plan objective 1).	Regulatory compliance and enforcement of licence conditions (overarching action 0.3). Licence information published on the internet (implementation action 1.1). Trading guidelines in place and online information available to facilitate trading (implementation action 1.2). Recovery of unused licenced water entitlements policy in place (overarching action 0.2a, implementation action 1.3). Produce annual state of the water resource reports, increasing visibility of water availability (overarching action 0.6).	**Likely**	**Moderate** Economic status of the region remains the same.	**Moderate**	**Consult with Aboriginal reference group to understand economic support needs, including by developing links to existing cross government development initiatives (new action).**	**Possible**	**Moderate**	**Moderate**