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Executive Summary

The Northern Territory Government is committed to the long term sustainable management of its water resources. The current Western Davenport Water Allocation Plan was declared in 2011 and was required to be reviewed after five years, in accordance with the Water Act 1992. Review of the 2011 plan formally commenced in 2016, which resulted in the development of the draft Western Davenport Water Allocation Plan (the Plan).

The draft Plan applies to the Western Davenport Water Control District (the District), which covers an area of almost 24,500km$^2$ located approximately 150km south of Tennant Creek in the Northern Territory (NT). The purpose of the draft Plan is to ensure that water is allocated within the estimated sustainable yield for consumptive use, while protecting environmental and cultural needs in the District. The objectives of the draft Plan are to:

- Maintain public water supply
- Support equitable access to water for sustainable regional economic development
- Protect water dependent ecosystems
- Support Indigenous culture and communities

Landowners, including Traditional Owners, pastoral lessees and business owners have been consulted during the development of this draft Plan. The identification of areas of cultural significance has been informed by consultation with Traditional Owners and assisted by the Central Land Council (CLC).

The Department of Environment and Natural Resources (DENR) is now seeking stakeholders' views on a range of issues outlined in this draft Plan (see page 8 for details on how to provide feedback). All feedback received from stakeholders will contribute to the finalisation of the Plan.

As part of the development of this draft Plan, knowledge gaps have been identified and a risk assessment undertaken. This risk assessment has informed the approach to assessing licence applications outlined in the draft Plan; the performance evaluation framework; and the development of actions that Government and stakeholders commit to undertake to fill identified knowledge gaps.

The draft Plan proposes an adaptive management approach to achieve the Plan's objectives. This means that as new scientific knowledge about the water resources and the water dependent ecosystems of the District is developed through monitoring and assessment activities, this knowledge will be applied to the assessment of licence applications and to the monitoring and compliance of licence conditions. Each licence assessment will therefore be based on knowledge current at the time of assessment.

In keeping with this adaptive management approach, the draft Plan is based on a review of all the available knowledge for the groundwater system in the District. A new groundwater model was developed to better understand the groundwater system in terms of recharge, storage and discharge characteristics. A new approach to assessing the potential impact of groundwater extraction on groundwater dependent ecosystems (GDEs) and areas of cultural significance reliant on groundwater has also informed the draft Plan.

The draft Plan proposes that all licence applications will be considered with regard to the consumptive use allocations agreed in the declared Plan, and be tested by the groundwater model to assess the level of risk of impact on potential GDEs. Investigations will be undertaken during the term of the Plan to improve understanding of the groundwater needs of vegetation in the District. This may lead to reassessments of the volume of water that can be sustainably extracted. Any re-assessment will be published and discussed with stakeholders. This could pose some risk to
developers who may be forming property development plans based on the allocations available under this draft Plan.

The draft Plan outlines the further work that will be carried out within the next five years to improve knowledge of groundwater resources and vegetation in the District. This work will include further groundwater investigations to:

- Provide confirmation of the vertical thickness and continuity across the region of the aquifer,
- Assess spatial variation in terms of its hydraulic characteristics and water quality;
- Improve knowledge of arid zone recharge processes and recharge modelling;
- Develop a targeted water resource monitoring programme; and
- Contribute to addressing the knowledge gaps about GDEs.

The draft Plan allocates water to beneficial uses, consistent with the Water Act and the Northern Territory Water Allocation Planning Framework (the Framework), which requires that there will be no deleterious change to groundwater dependant ecosystems in the arid region of the NT, and total extraction over a period of at least 100 years will not exceed 80% of the total aquifer storage at the start of extraction. It is likely that some vegetation in the District has roots that access groundwater and therefore is a type of GDE.

Surface water in the District is ephemeral and is not a practical source of reliable water for consumptive use. Additionally, a number of surface water sites with cultural significance are identified in the region. Under this Plan, surface water extraction licences will not be issued. Surface water extraction is only permissible for stock and domestic use.

When evaluating the effects of pumping on potential GDEs, modelling reveals that localised and site-specific draw-down within the aquifer may be associated with individual bores/borefields, even if the sustainable yield for the aquifer as a whole has not been exceeded. While the volume of water extracted is a factor contributing to impact on potential GDEs, the location of the bore/borefield is critical.

Given the adaptive management approach of this plan, and because this is the first time a water allocation plan considers the impact on GDEs for this District, two options for the determination and allocation of indicative sustainable yields are provided (pages 28-30). Option A provides a smaller sustainable yield and incorporates modelled impacts on possible GDEs. Option B provides a potentially larger sustainable yield and will rely on individual licence assessment and licence conditions, including monitoring, to protect potential GDEs. Option B also incorporates a staged approach to allocation.

Stakeholders are asked to provide feedback on these options to contribute to finalisation of the plan.
This draft Plan has been prepared for public comment and the Department of Environment and Natural Resources welcomes feedback during the public comment period, which closes on 16 June 2017.

For a response to questions during the consultation period, please telephone 8999 4455.

Submissions on the draft Plan can be lodged by:

Email: waterresources@nt.gov.au

Post: PO Box 1120, ALICE SPRINGS NT 0871

A consultation report will be prepared to inform stakeholders and interested parties of the issues raised during consultation on the draft Plan, and how these issues were considered in finalising the Plan.
1 Overview

1.1. Western Davenport Water Allocation Plan

This plan is the draft ‘Western Davenport Water Allocation Plan’ (the Plan), to be cited as DENR (2017) Draft Western Davenport Water Allocation Plan, Department of Environment and Natural Resources, Alice Springs, Northern Territory.

1.2. The Western Davenport Plan area

The draft Plan applies to the Western Davenport Water Control District (the District), as declared as a water control district on 15 July 2009 under section 22 of the Water Act (1992). The location and land tenure of the District are shown in Map 1.

The District covers an area of almost 24,500km² located approximately 150km south of Tennant Creek in the Northern Territory (NT).

Approximately 1000 people live in the District, including around 500 people in the major community of Ali Curung. The District also includes three smaller communities (Imangara, Mungkarta and Tara) and nine homelands/family outstations (Ankweleyelengkwe, Annerre, Greenwood, Illeuwurru, Imperrenth, Indaringinya, Kalinjarri, Tjuperle and Wakurlpu).

The pastoral industry has a long history in the District and is a major land use. Five pastoral leases overlap the District (these being Stirling, Murray Downs, Elkedra, Neutral Junction and Singleton Stations). The District also supports a number of tourism enterprises as well as an established horticultural industry. There is strong interest in increased horticultural development in the District and some mining exploration is occurring in the general area.

The District is centred on Kaytetye country and also incorporates Alyawarr country in the southwest, Warramungu country to the far north and Warlpiri country to the far west. People from all these groups reside at Ali Curung. Approximately 41% of land in the District is recognised as Aboriginal Land (refer to map at Schedule A).

While the District is an area of predominantly flat terrain, the north-east boundary straddles the Davenport Ranges and the south-east boundary includes the Forster and Spring Ranges. Between these ranges, the area mainly consists of lightly wooded red Aeolian sand plain (sand transported and deposited by wind) covered with spinifex, or by dense mulga shrubland, with intermittent low sand dunes, large patches of alluvial floodout country, ephemeral swamps and clay pans, and some small areas of colluvial foot slopes adjacent to the ranges.
Map 1: Western Davenport Water Control District boundary and land tenure
1.3. **Date the Plan comes into effect**

The Plan comes into effect on the day it is declared by the Minister of Environment and Natural Resources as a water allocation plan, by notice in the Gazette (section 22B (1) of the *Water Act*).

1.4. **Period the Plan is to remain in force**

Once declared this revised Plan will be in place for five years.

The previous plan was declared by the Minister for Natural Resources, Environment and Heritage in 2011. In accordance with section 22B (3) of the *Water Act*, this revised draft Plan has been prepared, and once declared will remain in force until 2021, when a new Plan will be required.
2 Introduction

2.1 Plan context

The Northern Territory Government (NTG) is committed to the long term sustainable management of the Territory's water resources.

Under section 22B of the Water Act (the Act), the Minister may declare a water allocation plan for a period of up to ten years, with provision for reviews at no longer than 5 yearly intervals. Plans take their legal force from the Act, which remains the main source of legal rights and obligations affecting the use of water resources in the Northern Territory. Although this Plan contains summaries of the effect of certain provisions of the Act, those summaries are provided for information only. The Plan should be read in conjunction with the Act, and will be subject to any amendments which may be made to the Act after declaration of the Plan.

Water allocation plans establish a framework to share water between human and environmental needs. Water resource management and use in a water allocation planning area is to be in accordance with such a plan. A plan is declared to ensure that water is allocated within the estimated sustainable yield to beneficial uses, as defined in s4(3) of the Water Act. The beneficial uses of water defined in the Act include agriculture, public water supply, the environment, cultural needs, industrial needs, aquaculture and to provide water for rural stock and domestic purposes.

The Western Davenport Water Allocation Plan was first declared in 2011. Review of that plan formally commenced in 2016. The rules for the allocation of the water resources in the District over the next five years are outlined in this revised draft Plan and are consistent with the NT Water Allocation Planning Framework.

The NT Water Allocation Planning Framework (the Framework) requires that there will be no deleterious change in groundwater discharges to dependant ecosystems in the arid region of the NT, and total extraction over a period of at least 100 years will not exceed 80% of the total aquifer storage at the start of extraction (see Schedule B).

The current 2011 declared plan does not align with this Framework. Estimates of the sustainable yield at the time of developing the 2011 plan were based on recharge. This approach was recommended by an independent technical assessment of the groundwater resources commissioned at the time of the initial 2011 plan's development (Rooke 2009).

The draft Plan is based on all the available knowledge for the groundwater system in the District. A new groundwater model water has been developed to better understand the groundwater systems in terms of their recharge, storage and discharge characteristics. A new approach to assessing the potential impact of groundwater extraction on areas of cultural significance reliant on groundwater and on any groundwater dependent ecosystems (GDEs) that may be present has also been applied to the development of the draft Plan.

The draft Plan establishes an adaptive management framework to allocate water to consumptive beneficial uses within the estimated sustainable yield, while protecting environmental and cultural needs.

There is increasing interest in agricultural and horticultural development in the District and current mineral exploration, which has potential to contribute to regional economic development and may be water dependant. The draft Plan is intended to ensure the fair and equitable sharing of the water resources of the plan area and the sustainable management of the resource for the future.
The National Water Initiative and the NT Planning Scheme were taken into consideration when developing the draft Plan.

2.1.1 National Water Initiative

The National Water Initiative 2004 (NWI) is the major policy document of the federal, territory and state governments in relation to water allocation and planning. Its basic premise is that governments have a responsibility to ensure water is allocated and used to achieve socially and economically beneficial outcomes in a manner that is environmentally sustainable. The Northern Territory Government agreed to an NWI Implementation Plan in 2006.

2.1.2 NT Planning Scheme

The NT Planning Scheme (the Scheme) generally applies to the whole of the Northern Territory, and includes a number of 'planning principles', which are broad expressions of the Northern Territory Government's commitment to outcomes of land use planning and development control. These principles as listed in Clause 4.1 (b) state that the administration of the Scheme will:

- "contribute to the sustainable use and development of land and water resources so that the use and development of land is consistent with the principles of sustainable development and avoids pollution and minimises degradation of the environment or over commitment of water resources".
2.2 Process to develop the Plan

Water allocation plans establish a framework to share water between various human and environmental needs. They are developed through detailed technical and scientific assessment, and community consultation to determine an appropriate balance between competing requirements for water.

The following steps are taken when developing a Plan:

**Figure 1 Plan development process**

Schedule C outlines the stakeholder engagement and community consultation that has occurred as part of the development of the draft Plan.
3 Purpose and draft Plan Objectives

3.2 Purpose and objectives

The purpose of the draft Plan is to:

Ensure water is allocated within the estimated sustainable yield for consumptive use, while protecting environmental and cultural needs in the Western Davenport Water Control District.

The objectives of the Plan are to:

- Maintain public water supply
  
  To ensure a safe water supply, sufficient in volume and quality for essential services to communities as well as for rural stock and domestic water requirements.

- Support equitable access to water for sustainable regional economic development
  
  Development of sustainable water consumptive industries supporting regional economic development that benefits current and future generations and is conducted within an environmentally sustainable framework.

- Protect water dependent ecosystems
  
  Detrimental impacts to water dependent ecosystems as a consequence of consumptive water use will be avoided.

- Support Indigenous culture and communities
  
  Maintain and support traditional cultural values on Aboriginal owned land through the protection of culturally significant water dependent sites, as well as providing access to water for commercial development.

- Ensure the best available knowledge and science is transparently applied to management of water resources
  
  Best available knowledge and science is available to the community, underpins any allocations made under this draft Plan, and improvement in understanding gained through research and monitoring is considered during review of the draft Plan.

Section 7.1 provides further detail regarding the objectives, strategies and performance indicators for this plan.

As part of the development of this draft Plan, knowledge gaps have been identified and a risk assessment undertaken of these gaps. This risk assessment has informed the approach to assessing licence applications outlined in the draft Plan; the performance evaluation framework; and the development of actions that Government commits to undertake to fill identified knowledge gaps.

In this context, the achievement of the draft Plan’s objectives will be supported by an adaptive management approach. As new scientific knowledge about the water resources and the water dependent ecosystems of the District is developed through monitoring and assessment activities, this knowledge will be applied to the assessment of licence applications and to the monitoring and compliance of use through licence conditions. This means that each licence assessment will be based on knowledge current at the time of assessment.
4 Water resources (supply and condition)

4.1 Climate and rainfall

The District has an arid climate with highly variable and episodic rainfall. The climate of the Western Davenport Region is hot in the summer months between October and March, and relatively mild and dry for the remainder of the year. The average monthly maximum temperature in summer is approximately 38°C and 24°C in the dry season months. Temperatures of up to 43°C are common in summer, but the mild winter rarely produces frosts.

Rainfall over the district is predominantly from thunderstorms between November and March, and is largely influenced by the dissipation of tropical rainfall depressions and monsoonal activity. The average rainfall of the District, based on more than 120 years of records, varies from 322mm per year at Barrow Creek to 392mm per year at Tennant Creek to the north of the District.

Figure 2 Total annual rainfall at Barrow Creek 1900-2010

![Graph showing total annual rainfall at Barrow Creek 1900-2010](https://www.longpaddock.qld.gov.au/silo/about.html)
Although rainfall is more reliable than in Alice Springs, there is significant variability from year to year with the maximum annual total at Barrow Creek, for example, being 975 mm in 1904 and the minimum annual total being 70mm in 1963 (refer to Figure 2). Similarly, in Tennant Creek the lowest annual rainfall, recorded in 1935, was 95mm while in the year 2000, the annual total was 1003mm (refer to Figure 3).

Large intense rain events are important for groundwater recharge, filling wetlands and supplying pulses of water and nutrients to floodouts. Groundwater recharge in the region does not occur annually and is predominantly from these episodic high rainfall events. An assessment of the rainfall record for the District since 1900 indicates that significant recharge has occurred during three periods since 1975 and little recharge occurred between 1900 and 1975. Following the high rainfall events, groundwater levels rise in major recharge areas over a period of years then fall to base levels over decades.

4.2 Surface water resources

The surface water catchment of the Western Davenports Plains, its sub-catchments, and some of the ephemeral watercourses and floodouts of the District are shown in Schedule D.

Surface water in the District is ephemeral and is not a practical source of reliable water for consumptive use. The District includes a surface water catchment of nearly 15 000 km², and is mostly underlain by the Wiso Surface Water Management Area – also referred to the ‘Wiso Drainage Basin’.

The District includes:

- Two major ephemeral rivers (Hanson River and Taylor Creek) flow north, into or towards the Tanami Desert,
• Ephemeral rivers and creeks (including the McClaren, Wauchope, Wycliffe, Skinner, Amelia and Murray Creeks) that flow off the Davenport Ranges in a south-westerly direction and meet with a south-east to north-west flood path, which continues beyond the Western Davenport Plains for a further 200 km.

• Significant ephemeral swamps, claypans, and floodouts, including the Thring Swamp (a floodout of Wycliffe Creek), Warrabri Swamp and Skinner Creek Floodout, and the Bonney Creek, McClaren Creek and Gilbert Creek floodouts.

The wetlands of the District are associated with, and include, the rivers and creeks which emanate from rocky ranges. The deeper waterholes in major channels are the places that hold water the longest in the district, although few, if any, are permanent. Most of the larger wetlands are associated with the river floodouts, being places where water spreads out from a defined channel. These wetlands can be filled from rain that has fallen many kilometres away and travelled down the river channels before flooding out. They can also be filled from more localised rainfall and flooding events (Duguid, 2009).

The floodouts and associated vegetation are culturally important to the Traditional Owners, particularly in relation to large trees they support (such as *Eucalyptus* sp. and *Cormbia* sp.) and the high importance of these areas to Aboriginal cultural practices and land use. Floodouts are generally important hunting areas and often have ceremonial importance.

Most of the natural recharge likely occurs in the coarse deposits along the normally dry floodouts, where precipitation runoff from the surrounding bedrock areas infiltrates as mountain front recharge. Mountain front recharge is an important, if not, predominant, source of recharge to basins in arid and semi-arid regions (Knapton, 2016).

### 4.3 Groundwater resources

There are three hydrogeologically distinct environments occurring within the Plan area. This provides the basis for establishment of the management zones: Davenport Ranges, Southern Ranges and Central Plains. These management zones serve to delineate between the higher yielding and better quality aquifers in the plains, versus the poorer quality, and poorer yielding, aquifers in the ranges. A map of the management zones is at Schedule E. A regional aquifer cross section is at Schedule F. Details about each of the management zones are summarised in Table 1.

The most significant groundwater resources within the district are the Lake Surprise Sandstone, Arrinthunga Formation, Chabalowie Formation, and Dulcie Sandstone aquifers underlying the Central Plains zone. Water stored in these aquifers is very old, having been in long-term storage. Modelling has indicated that within the 120 years of recorded climate history, only three periods of significant recharge have occurred. These were associated with periods of major rainfall.

The Central Plains area has the largest volume and best quality of water within the district. Recent modelling indicates there is a high degree of connectivity between the aquifers within this zone, and extraction from one resource is expected to impact the neighbouring aquifers. For this reason, the boundaries of the management zones have been revised from the current 2011 Plan zones: the revised Central Plains management zone boundary incorporates the 2011 Plains North-West; Plains South-East; and Plains Central management zones, and its boundary have been slightly amended to align with the improved knowledge of underlying water resources.

Water in the Southern Ranges and Davenport Ranges is lower yielding and poorer quality. Consequently, the water resources in these management zones are expected to be primarily used for stock purposes.
**Table 1 Management zone - hydrogeological attributes**

<table>
<thead>
<tr>
<th>Aquifer rock types</th>
<th>Davenport Ranges</th>
<th>Central Plains</th>
<th>Southern Ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proterozoic Sandstone</td>
<td>Arrinthunga Formation</td>
<td>Proterozoic Sandstone</td>
</tr>
<tr>
<td></td>
<td>Cenozoic</td>
<td>Chabalowie Formation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lake Surprise Sandstone</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dulcie Sandstone</td>
<td></td>
</tr>
<tr>
<td>Underlying basin(s)</td>
<td>Davenport Geosyncline</td>
<td>Wiso (north)</td>
<td>Arunta Block (north)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Georgina (south)</td>
<td>Georgina (south)</td>
</tr>
<tr>
<td>Salinity (TDS ) (water quality)</td>
<td>Highly variable</td>
<td>600 - &gt;3000</td>
<td>Highly variable</td>
</tr>
<tr>
<td>Potential bore yields</td>
<td>&lt; 5</td>
<td>&lt; 30</td>
<td>&lt; 2.5</td>
</tr>
<tr>
<td>(Litres/sec)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage (ML)</td>
<td>503,117</td>
<td>138,314,200</td>
<td>702,280</td>
</tr>
</tbody>
</table>

The volumes presented in Table 1 above are largely theoretical and based on the modelled thickness of the aquifers and best knowledge values for specific yield. The geological information and basis for projecting aquifer depth to approximately 800m is provided in Knapton (2016). However, it is unlikely that extraction of the full storage volume could occur due to uneconomic pumping costs and possible adverse impact on GDEs. Refer to Schedule E for a regional aquifer cross section and Figures 3-10 in Knapton (2016). For further information about the groundwater resources in the District, refer to Rooke et al (2003; 2011) and Knapton (2016).

**4.3.1 Groundwater recharge**

Rainfall in the District is variable and recharge is generally from intermittent and high rainfall events. The average annual rainfall for the period 1970 to 2016 was approximately 300mm, with significant rainfall events occurring during three periods since 1975. It is the peak rainfall years that contribute most significantly to recharge entering the aquifer. During a dry year, minimal, if any, recharge into the groundwater system may occur.

There are two recharge mechanisms assumed to operate within the District: direct (diffuse), and indirect (local). Direct recharge is where water percolates down from the surface where it has fallen as rain. Indirect recharge is when water is shed horizontally from rocks, on sloping soil or along drainage lines, before percolating down.

Direct infiltration is thought to be limited or absent, due to small rainfall volumes, deep vadose zones, and the effective water harvesting vegetation found in dry climates. Indirect recharge results from water percolating to the water table following flooding events – this occurs by ponding in low-lying areas or through the beds of surface watercourses. Mountain front recharge (a form of indirect recharge) along the margin of basins can also be an important mechanism in arid and semi-arid environments such as those found in the District (Knapton 2016).

Because recharge events are intermittent and there are continuous groundwater losses to evapotranspiration, the volume of the resource will continue to gradually decrease year by year until a significant rainfall event partially recharges the system. Significant recharge has occurred during three periods since 1975. Modelled data indicates that little recharge occurred between 1900 and 1975.

As shown in Table 2 (page 21), for the Central Plains management zone, modelling outputs show that, despite these recharge events and without taking into account any groundwater extraction, the
volume of water in the aquifer is gradually diminishing (the estimated natural discharge from the system equates to 11,800 ML/year).

4.4 Hydrologic modelling

In response to stakeholder feedback in 2016, the Department of Environment and Natural Resources (DENR) commissioned the development of a computer-based hydrological model to underpin the decision-making and allocation of water for the District.

The development of this groundwater model has improved understanding of the groundwater system in terms of recharge, storage and discharge characteristics. Most importantly, the model gives better understanding of the limits that should apply to groundwater extraction to avoid potential impacts to possible GDEs and culturally significant areas.

The groundwater model represents the current conceptualisation of the hydrogeological processes active in the system. It provides a dynamic water budget between the five layers which are used to represent the aquifers in the District and it incorporates the processes associated with episodic recharge (i.e. overland flow, unsaturated zone flow and evapotranspiration); three-dimensional groundwater flow; regional groundwater throughflow; and aquifer storage. The groundwater model also has the capacity to accommodate the potential effects to estimate recharge under various climate change scenarios. For a detailed description of the groundwater model, refer to Development of a Groundwater Model for the Western Davenport Plains (Knapton 2016).

The groundwater model provides water balance estimates for the main aquifers and assists in identifying the water resources potentially available for allocation. The model will be used to inform the positioning of new bores and borefields by predicting the effects of different extraction rates within the modelled aquifer area.

Different scenarios for current and potential future use of the resource can be investigated with the groundwater model. These scenarios are termed ‘pumping regimes’ and enable cumulative impact on the water resources to be assessed. This assessment forms part of the overall assessment of applications for groundwater extraction licences.

Under this draft Plan, for each licence application, the maximum rate and volume of water extraction for consumptive use will be determined by groundwater drawdown at reference sites, which are based on the best information currently available regarding potential GDEs.
4.4.1 Natural water balance

The natural water balance (Table 2) is based on modelling the past 100 years of climate data. Estimates beyond 100 years have not been undertaken due to the difficulty in predicting future climate beyond the next 100 years.

The natural water balances for the groundwater resources in each water management zone includes the volumes of water in storage, combined with the inputs (recharge; throughflow) and outputs (discharge; throughflow).

**Table 2 Natural water balance (predicted after 100 years (without pumped extraction))**

<table>
<thead>
<tr>
<th>Water Management Zones</th>
<th>Davenport Ranges</th>
<th>Central Plains</th>
<th>Southern Ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting Total Aquifer Storage</td>
<td>503,117 ML</td>
<td>138,314,200 ML</td>
<td>702,280 ML</td>
</tr>
<tr>
<td>Average Annual Aquifer Inflow</td>
<td>10,430 ML/year</td>
<td>45,190 ML/year</td>
<td>32,570 ML/year</td>
</tr>
<tr>
<td>Average Annual Aquifer Outflow</td>
<td>10,066 ML/year</td>
<td>57,082 ML/year</td>
<td>29,206 ML</td>
</tr>
<tr>
<td>Final Total Aquifer Storage</td>
<td>529,502 ML</td>
<td>137,129,400 ML</td>
<td>765,300 ML</td>
</tr>
<tr>
<td>Change in Aquifer Storage after 100 years</td>
<td>26,385 ML Increase</td>
<td>1,184,800 ML Reduction</td>
<td>63,020 ML Increase</td>
</tr>
</tbody>
</table>
5  Water use

5.1  Water use overview

Water uses are described in terms of beneficial use categories under the Water Act, including consumptive and non-consumptive uses:

- Public Water Supply: provide source water for drinking purposes delivered through community water supply systems;
- Rural Stock and Domestic: public rights and ownership rights to take water for domestic and/or stock purposes;
- Agriculture: provide irrigation water for primary production including related research;
- Industry: provide water for industry, including secondary industry and a mining or petroleum activity, and other industry uses;
- Aquaculture: provide water for commercial production of aquatic animals including related research (not relevant to the Western Davenport Region);
- Environment: to provide water to maintain the health of aquatic ecosystems; and
- Cultural: to provide water to meet aesthetic, recreational and cultural needs.

5.2  Non-consumptive use

5.2.1  Environmental water requirements

Environmental water requirements concern the water needs of the natural environment. This draft Plan primarily allocates groundwater and not surface water, so the focus here is a consideration of ecosystem requirements for groundwater.

Ecosystems that require groundwater are called groundwater dependent ecosystems (GDEs).

These are defined by Kuginis et al (2016) as 'ecosystems that require access to groundwater to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystems services'. The NT Water Planning Framework specifies that GDEs be protected from impacts when considering water extraction licence applications in the arid zone. Several types of GDE may occur in the District, some of which may be impacted by groundwater extraction.

A small number of springs are known in the District, as well as waterholes sustained by groundwater discharge. These are not well documented but are thought to mainly occur in and near the rocky ranges. It is considered unlikely that GDEs of these types would be impacted by licenced groundwater extraction. In some parts of central Australia, small aquatic invertebrate animals called 'stygofauna' have been found in water that has just been pumped from aquifers. The presence of these subterranean aquatic animals means that an aquifer is a GDE. As stygofauna have not been found in the District, for the purposes of this draft Plan, it is assumed that they are not present.

Based on current knowledge, the GDEs most likely to be affected by groundwater extraction in the District are terrestrial plants that use groundwater for some or all of their water needs - referred to as Terrestrial Vegetation GDEs. In the District, these are likely to be large trees.

The presence of terrestrial vegetation GDEs is inferred from research in similar vegetation in the neighbouring Ti Tree district (Eamus & Cook, 2016). That research has shown that large trees can use groundwater when the water table is shallow enough, and that in the arid zone GDEs can access groundwater to a depth of 15 metres, and possibly up to 20 metres, below the surface.
If any vegetation in the District is using shallow groundwater then there is potential for an adverse impact to result from groundwater extraction for consumptive use. Long-term pumping may lower water tables and potentially reduce groundwater availability for some vegetation. Reduced access to groundwater could limit key physiological processes, particularly transpiration and photosynthesis.

The relevant areas of the District are the lowlands (i.e. not rocky hills). There are substantial parts of the ‘lowlands’ or ‘plains’ of the District with groundwater shallower than 15m (with at least one area with groundwater shallower than 5m). Large trees within those areas are the most likely to be accessing groundwater. However, it is also possible that some other plants such as shrubs and small trees may be using groundwater.

Calculations have been made of the volume of water held within the sediments that is available above a level of 15 metres. This provides a measure of potential water availability to GDEs across the Plan area. Table 3 presents estimates of the water available to GDEs if modelled over a period of 300 years for each management zone. However, it is important to note that the location of bores/borefields is critical to the modelled impact on GDEs (see below for further discussion). Further research is needed to measure the use of groundwater by vegetation in the District, and to document the biodiversity values of any confirmed GDEs.

<table>
<thead>
<tr>
<th>Water Management Zones</th>
<th>Total Aquifer Storage</th>
<th>Water Availability above 15m (over 300 years)</th>
<th>Equivalent % of Total Aquifer Storage Extracted over 300 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davenport Ranges</td>
<td>503,117 ML</td>
<td>200 ML/year</td>
<td>11.9 %</td>
</tr>
<tr>
<td>Central Plains</td>
<td>138,314,200 ML</td>
<td>4,220 ML/year</td>
<td>0.9 %</td>
</tr>
<tr>
<td>Southern Ranges</td>
<td>702,280 ML</td>
<td>1,200 ML/year</td>
<td>51.2%</td>
</tr>
</tbody>
</table>

To avoid deleterious impact on identified GDEs by groundwater extraction, the effects of drawdown will be monitored under this draft Plan to ensure that any GDEs are able to access groundwater, and be sustained, between the intermittent recharge events. There are, however, key knowledge gaps in this area.

Initial work to address knowledge gaps has trialled using satellite imagery to identify possible GDEs in the District. The trial method uses analysis of satellite imagery to identify areas that were ‘persistently green’ across the driest years within the period of available data.

Locations identified from the remote sensing trial have been used in an analysis of possible future groundwater extraction. This allows the groundwater model (section 4.4) to be used to investigate various ‘pumping regimes’ to assess the possible impact of future extraction on these potential GDEs.

In general, modelling shows that pumping within the aquifer will have the effect of reducing water levels across the aquifer over the long term if the rate of pumping should exceed inflows due to recharge.

When evaluating the effects of pumping on potential GDEs, modelling reveals that localised and site-specific adverse draw-down within the aquifer may be associated with individual bores/borefields, even if the sustainable yield for the aquifer as a whole has not been exceeded. While the volume of water extracted is a factor contributing to impact on potential GDEs, the location and proximity to GDEs of the bore/borefield is critical. This is why it will be necessary to evaluate each proposed allocation, which may then be restricted due to its impacts on any confirmed GDEs. All licence
applications will be considered with regard to the consumptive pool allocations specified in the Plan, and will also be input into the groundwater model (section 4.4) to assess the level of risk of cumulative impact on GDEs.

It is important to note that there are limitations associated with applying the current scientific knowledge on GDEs. Under the adaptive management approach, a re-calculation of the sustainable yield may be required as new knowledge about GDEs is obtained. Following publication and consultation with stakeholders, a revised sustainable yield may be incorporated into the assessment of licence applications so that each assessment is based on the most current publically available knowledge.

Further work is underway to refine knowledge of possible GDEs in the District. Research into GDEs will include ground truthing the remote sensing trail. Sections 6.1.3 and 9.2 of the Plan set out the commitments to further work to address the knowledge gaps about GDEs in the District. This work will also include examination of the interplay between surface water and groundwater in the District and whether groundwater is being transpired by any vegetation.

Relatedly, a policy on ‘high value’ GDEs will be developed. This policy will support the NT Water Allocation Framework by further defining ‘deleterious impact’ on GDEs and acknowledging that it is the cultural and biodiversity values of GDEs that should be the focus of consideration.

### 5.2.2 Cultural water use

Indigenous people within the District have a strong connection to country. Water is important to local Indigenous people as dreaming trails very often relate to surface water ecosystems. All water sources such as soaks, rock holes, springs and rivers play a major role in the social, spiritual and customary values of the Traditional Owners in the District. The continuing importance of these water-related sites and their cultural associations is emphasised by activities such as the “Walking and Sharing Stories from Bonney Creek to Barrow Creek” in June 2008 where about 65 Kaytetye, Warramungu, Warlpiri and Alyawarra people took 15 days to walk 140km between some 30 soakages near the central north-south axis of the District, with Traditional Owners working to maintain the health of the soaks along the way (Land Rights News, Sept 2008).

Water availability also affects many traditional and culturally important activities such as hunting and harvesting. Soaks are considered one of the most important sources of water in the desert. Knowledge of where to find water, and how to source it, is vital information, passed down from generation to generation. Traditional hunting and gathering is regularly conducted in these environments and habitats. Significant drying or lowering of the water table could adversely affect both the availability of water in soaks as well as important GDEs.

### 5.2.3 Cultural water requirements

The draft Plan recognises that cultural and environmental water requirements are not the same. However, the draft Plan assumes that the provisions for environmental water requirements will maintain the condition of places that are valued by both Indigenous and non-Indigenous people for cultural purposes. The approach explained in section 5.2.1 is intended to protect potential GDEs and groundwater dependent cultural sites.

Surface water extraction is only allowed for the purpose of stock and domestic use. Surface water licences will not be issued under this draft Plan. This will contribute to the protection of culturally significant sites associated with surface water.

It is recognised that environmental water requirements may not always align with Indigenous cultural requirements. Stakeholders have indicated that further work is required to ensure that cultural sites are protected. As part of the public comment period, stakeholders may want to provide feedback as to how cultural water requirements should be protected.
5.3 Consumptive Use

5.3.1 Consumptive uses

Consumptive water use refers to water used for the following beneficial uses, as listed in section 4(3) of the Water Act:
- public water supply;
- agriculture;
- aquaculture;
- industry; and
- rural stock and domestic.

A policy for a Strategic Indigenous Reserve (SIR) is under development by the Northern Territory Government. The draft Plan provides a provisional allocation for a SIR within the consumptive allocation (refer to section 7.2.3.2 for further detail).

5.3.2 Current surface water use

There is currently no licenced surface water extraction within the District.

5.3.3 Current licensed groundwater use

Current licensed groundwater is used for the following beneficial uses:
- ‘public water supply’ includes Ali Curung, Tara and Imangara communities;
- ‘agriculture’ includes horticulture and is used for a range of crops, including irrigated pasture and melons; and
- ‘industry’ is licensed to Barrow Creek Hotel; Wycliffe Well Holiday Park; and Devils Marbles Hotel.

Table 4 provides a summary of current licensed entitlement and actual use for the 2015/2016 financial year, based on the monthly pumpage records provided to DENR by licence holders.

<table>
<thead>
<tr>
<th>Table 4 Licensed entitlement and actual use for 2015 / 2016 (ML/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Public supply</strong></td>
</tr>
<tr>
<td>Central Plains</td>
</tr>
<tr>
<td>Licensed Entitlement</td>
</tr>
<tr>
<td>Actual Use</td>
</tr>
<tr>
<td>% of entitlement extracted</td>
</tr>
<tr>
<td>Davenport Ranges</td>
</tr>
<tr>
<td>Licensed Entitlement</td>
</tr>
<tr>
<td>Actual Use</td>
</tr>
<tr>
<td>% of entitlement extracted</td>
</tr>
<tr>
<td>Southern Ranges</td>
</tr>
<tr>
<td>Licensed Entitlement</td>
</tr>
<tr>
<td>Actual Use</td>
</tr>
<tr>
<td>% of entitlement extracted</td>
</tr>
<tr>
<td>Summary for overall Western Davenport Water Control District</td>
</tr>
<tr>
<td>Licensed Entitlement</td>
</tr>
<tr>
<td>Actual Use</td>
</tr>
<tr>
<td>% of entitlement extracted</td>
</tr>
</tbody>
</table>
5.3.4 Current unlicensed groundwater use

Current unlicensed groundwater use is for stock and domestic use, which is unlicensed and unmetered. Use is estimated at 433ML/year, as shown in Table 5. The total volume is assumed to be evenly distributed, by land area in each management zone.

Table 5 Current unlicensed groundwater use

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Extraction ML/year</th>
<th>Estimate methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>342</td>
<td>Maximum carrying capacity is calculated at 18,750 head of cattle x 50 litres per day (based on carrying capacity figures from the Australian Valuation Office (2000)).</td>
</tr>
<tr>
<td>Domestic</td>
<td>91</td>
<td>Estimate is based on 250 people x 1000L/day, for people living on stations, homelands/family outstations and other community residents not using licensed public water supplies. Water design criteria for remote communities recommends 1200 litres per person per day (Indigenous Community Engineering Guidelines: 2008), however this figure has been reduced to accommodate estimated fluctuations in population.</td>
</tr>
</tbody>
</table>

5.3.5 Future consumptive requirements

Based on stakeholder feedback, this Plan specifies that any surface water extraction must only be used for the purpose of stock and domestic use and surface water licences will not be issued.

There is growing interest in the commercial utilisation of groundwater, particularly within the Central Plains management zone. Traditional Owners have identified water for drinking (i.e. 'public water supply' and 'domestic' beneficial uses) as their first priority for water within the District. These interests and priorities have been considered in the Plan’s development. As summarised in Table 6, future demand, by each beneficial use, is projected as follows:

- **Stock numbers are not anticipated to increase while human population is projected to increase by 1%**, which is anticipated to have minimal (<1ML/year) increase in water demand. Water for people living on stations, homelands/family outstations and other community residents not using licensed public water supplies is included in beneficial use 'stock and domestic', not 'public water supply'.

- **Public water requirements are expected to increase.** Anticipated population growth in Ali Curung, Tara and Imangara communities is 1% (DLGCS, 2014). An application for a 100ML/year increase for Ali Curung town water supply has been received.

- **Increased demand for agriculture.** There is strong interest in increased agricultural and horticultural development in the District. DENR has licence extraction applications for additional extraction of 76,500ML/year for this Beneficial Use.

- **Allocation to the Strategic Indigenous Reserve (SIR).** The demand for SIR has not been defined; however, this draft Plan provides a provisional allocation for this purpose. Refer section 7.2.3.2.

- There is currently no aquaculture within the District, nor is any new aquaculture anticipated.

- **Increase in industry demand.** The Department has received an increase application for 200ML/year. The Beneficial Use 'industry' includes allocations to roadhouses and associated tourism activities, as well as mining - although there is currently no mining, this may change during the life of this Plan (see below dot point).
Further to the volumes listed in Table 6, the Hanson River paleochannel has been cited as a potential water source for the proposed Mount Peake mine. This Plan does not allocate water for extraction from the paleochannel. Water extraction from the Hanson River paleochannel, and all other water sources not included in this Plan, must also be in accordance with the Northern Territory Water Allocation Planning Framework (Schedule E), which requires that extraction must not have a deleterious impact on GDEs.

**Table 6** Projected future consumptive water requirements – including licence applications (ML/year)

<table>
<thead>
<tr>
<th></th>
<th>Public supply</th>
<th>SIR</th>
<th>Agriculture</th>
<th>Industry</th>
<th>Stock and domestic</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Plains</td>
<td>400</td>
<td>Not yet defined - refer to section 7.2.3.2</td>
<td>81,850</td>
<td>400</td>
<td>193</td>
<td>83,010</td>
</tr>
<tr>
<td>Davenport Ranges</td>
<td>30</td>
<td></td>
<td>0</td>
<td>10</td>
<td>90</td>
<td>40</td>
</tr>
<tr>
<td>Southern Ranges</td>
<td>35</td>
<td></td>
<td>0</td>
<td>1</td>
<td>150</td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>465</td>
<td>TBC</td>
<td>81,850</td>
<td>411</td>
<td>433</td>
<td>83,086</td>
</tr>
</tbody>
</table>

The licence applications for increased extraction referred to above will be assessed after the declaration of this Plan. The total licensed entitlements will not exceed the volume allocated to the consumptive use allocations for each management zone as stated in section 7.2.3.
6 Sustainable yield

Under section 22B(5)(a) of the Water Act, water is allocated within the estimated sustainable yield to beneficial uses. For the purpose of this Plan, **sustainable yield** is defined as the volume of water that can be extracted from an aquifer on a sustainable basis without impairing water quality or causing environmental damage (Fetter, 2000). The sustainable yield provides the basis for decisions on the amount of water available for allocation to beneficial uses (section 7.2).

Under the NT Water Allocation Planning Framework (the Framework), for the arid zone the sustainable yield of an aquifer is equivalent to the groundwater extraction over 100 years that will not exceed 80% of the total aquifer storage at the beginning of extraction and will not impact on GDEs. In accordance with the Framework, the upper limits for sustainable yields in this revised plan will depend on the location and magnitude of extraction of proposed borefields, and the impact on verified GDE sites (the location of GDEs have not been verified, although they are considered likely to be present in the District).

It should be noted that currently, the groundwater model includes water which is very deep (up to 800 metres). The costs of extracting water from these depths may be prohibitive.

Table 2 (page 22) provides natural water balances (aquifer storage) figures for each of the three management zones. Two options for calculating the sustainable yield from the aquifer are presented in this draft plan.

As part of the finalisation of this draft plan, feedback from stakeholders is sought on these options. Note that the consumptive pool allocations (section 7.2.3) in the draft Plan are based on Option A.

**Option A**

This option provides indicative sustainable yields for each management zone based on an assumed development scenario described as ‘moderate’ and based on modelling the impact of this scenario on sites identified as potential GDEs. The details of this scenario are provided in Table 7. Note this scenario represents pumping from the Central Plains management zone.

<table>
<thead>
<tr>
<th>Extraction Regime</th>
<th>Volume (ML/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock and Domestic Use</td>
<td>433</td>
</tr>
<tr>
<td>Existing Licences</td>
<td>5,926</td>
</tr>
<tr>
<td>SIR</td>
<td>21,000</td>
</tr>
<tr>
<td>New Licences</td>
<td>23,860</td>
</tr>
</tbody>
</table>

Further work is underway to verify the location of potential GDEs. Option A includes modelling of sites identified as possible GDEs in the remote sensing trial. These sites are undergoing verification and this option assumes that some of these sites will be found not to be GDEs. Given these assumptions, the indicative sustainable yields for each management zones are provided in Table 8. Option A results in an increase of 7,647 ML/year for the sustainable yield in this draft plan, as compared with the 2011 plan.
Table 8: Option A: Indicative Sustainable Yields

<table>
<thead>
<tr>
<th>Water Management Zone</th>
<th>Total Aquifer Storage</th>
<th>Assessed 'Sustainable Yield' over 300 years negating GDE impacts</th>
<th>Total Volume Extracted over 300 years negating GDE impacts</th>
<th>Percentage of Total Aquifer Storage Extracted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davenport Ranges</td>
<td>503,117 ML</td>
<td>188 ML/year</td>
<td>56,400 ML</td>
<td>11.2%</td>
</tr>
<tr>
<td>Central Plains</td>
<td>138,314,200 ML</td>
<td>51,219 ML/year</td>
<td>15,365,700 ML</td>
<td>11.1%</td>
</tr>
<tr>
<td>Southern Ranges</td>
<td>702,280 ML</td>
<td>390 ML/year</td>
<td>117,000 ML</td>
<td>16.7%</td>
</tr>
</tbody>
</table>

Option B

Feedback from stakeholders during consultation on this draft plan has included suggestions for a staged approach to allocations and a clearer application of the adaptive management approach in the calculation of the sustainable yield. Option B provides for a sustainable yield based extraction of 80% total aquifer storage over 100, 200 or 300 years, with the protection of GDEs to be achieved through staged allocations with conditions for licence assessment and monitoring. The three timeframes are presented in line with approaches in previous NT water allocation plans.

Under Option B, it is proposed that the licence assessment process considers detailed pre-feasibility studies, including planning for bore/borefield location based on the latest available data on potential GDE locations and water requirements for GDEs. The assessment process would apply the groundwater model to each actual licence application to assess the likely cumulative impact on confirmed GDEs. Developers may be required to amend their proposed bore location/borefield designs and additional investment in scientific studies may be required in order for risks to be properly investigated prior to final assessment of licence applications.

Furthermore, licence conditions would include clear requirements to monitor impact on potential GDEs and the staged allocation of water within the conditional total licenced volume. Licence holders would need to demonstrate that they have met development milestones and are efficiently and sustainably using their initial allocation, with clear monitoring results indicating impacts on GDEs are mitigated, prior to receiving a further allocation. Some stakeholders have suggested that potential allocations of 5000ML/year at a time should be sufficient to allow for efficient development.

Licence conditions would include ongoing monitoring of the impacts of extraction to ensure that GDEs and cultural sites are protected, and adjustments to an extraction regime would be required where impacts are demonstrated.

This option provides for a significantly higher sustainable yield under the Plan contingent on a staged approach to allocations, and monitoring and reporting requirements in licence conditions to progressively add to the knowledge base of the water resources in the District. In turn, this additional knowledge would be used to confirm protections for important GDEs and subsequent allocations under the Plan.

Table 9 provides the figures which could form the basis for assessing the sustainable yield under this option. These figures are volumes based on a calculation of extraction of 80% of the total aquifer storage over 100, 200 and 300 years. This option would likely include the allocation to the consumptive pool of a smaller proportion of these total volumes.
Table 9 Option B: Extraction of 80% total aquifer storage over 100, 200 or 300 years

<table>
<thead>
<tr>
<th>Water Management Zones</th>
<th>Total Aquifer Storage</th>
<th>'Indicative Sustainable Yield' excluding GDE consideration over 300 years</th>
<th>'Indicative Sustainable Yield' excluding GDE consideration over 200 years</th>
<th>'Indicative Sustainable Yield' excluding GDE consideration over 100 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davenport Ranges</td>
<td>503,117 ML</td>
<td>1,340 ML/year</td>
<td>2,010 ML/year</td>
<td>4020 ML/year</td>
</tr>
<tr>
<td>Central Plains</td>
<td>138,314,200 ML</td>
<td>368,800 ML/year</td>
<td>553,250 ML/year</td>
<td>1,106,500 ML/year</td>
</tr>
<tr>
<td>Southern Ranges</td>
<td>702,280 ML</td>
<td>1,870 ML/year</td>
<td>2,810 ML/year</td>
<td>5,620 ML/year</td>
</tr>
</tbody>
</table>

It is important to reiterate that when evaluating the effects of pumping on potential GDEs, the modelling reveals that localised and site-specific draw-down within the aquifer may be associated with individual bores/borefields, even if the sustainable yield for the aquifer as a whole has not been exceeded. While the volume of water extracted is a factor contributing to impact on potential GDEs, the location of the bore/borefield is critical.

Under Option B, DENR will need to work with individual licence applicants to assess proposed bore layouts by modelling the impact of proposed individual licenced extraction over time, as well as the cumulative impact of all licences, on GDEs and culturally important sites.

6.1 Risk and uncertainty

This section outlines risks to the sustainable yield within the district, consistent with the National Water Initiative.

6.1.1 Climate variability and change

Allocation and licence limits in this plan have been determined based on historic climatic data only and do not consider the possible effect of climate change on the long term availability of water from this water source. Although it is anticipated that temperature and therefore evaporation will increase in the District, an increase in intensity of storm events projected under current climate change modelling may also increase recharge to the groundwater resource. When this plan is reviewed, the latest climatic data will be used to take account of information on projected future climate change.

There is no industry standard for projecting future climate patterns. Different climate scenarios invariably result in different rainfall and recharge estimates and predict differing impacts on the estimated sustainable yield and GDEs.

For the purpose of this draft Plan, the past 100 years has been assumed to represent the next 100 years, and has been selected for modelling purposes. Figure 4 shows the modelled correlation between rainfall and recharge for the next 100 years, based on rainfall data from the past 100 years. The option that has been used is more conservative than alternatives A and B. Alternative A is a 'mirroring' of the past 100 years, whereby the first 40 years are wetter than the latter 60. Meanwhile, alternative B assumes that the past 40 years are indicative of the next 100 years. Refer to Figure 5 for a depiction of the considered options.

The CSIRO’s Sustainable Yields projects consider a range of options for projecting future climate – this information should be considered during preparation of the next plan (to be finalised by 2021). However, the time required to develop these alternatives has precluded them from consideration for the purpose of developing this draft Plan.
6.1.2 Proposed development and land use change

The majority of land within the district is under pastoral lease or held by Aboriginal Land Trusts. It is anticipated that there may be applications for non-pastoral use – for the purpose of irrigated agriculture – on some properties within the district.

6.1.3 Caveats or limitations on the underpinning science

6.1.3.1 Resource Estimates: Southern Ranges and Davenport Range Management Zones

The Assessment of Groundwater Resources in the Western Davenport Water Control District (Rooke, 2009) states that the available information which underpins the District’s water resource estimates is limited, and recommends more scientific work be undertaken to improve scientific knowledge about the water resources and estimation of their characteristics. The recommended work has been considered in the development of the implementation actions for this Plan (section 9).
6.1.3.2 Groundwater Model limitations and assumptions

The Western Davenport groundwater model was developed to characterise the aquifers underlying the Central Plains management zone (see section 4.4). The groundwater model is the primary tool used to assess the projected impact from extraction, and to allow for informed decision-making about allocation and licence decisions. Modelling will be incorporated into the assessment process for all future water extraction licence applications.

Further model development will be based on:

- The outcomes of future groundwater investigations of the aquifer underlying the Central Plains Management Zone - this work will provide confirmation of the aquifer’s existence at depth and continuity across the region, as well as spatial variation in terms of its hydraulic characteristics and water quality (including variation associated with different geological units);
- Improved knowledge of arid zone recharge processes and recharge modelling; and
- A targeted water resource monitoring programme which will provide:
  - data for improved resource assessment; and
  - resource performance data as a basis for assessment of water allocation plan performance in relation to stakeholder objectives.

Further work will be undertaken to improve knowledge of the natural processes in the region and of the groundwater resources:

- Study possible vegetation use of groundwater, map the location of verified GDEs, and map vegetation characteristics to enable future monitoring programs to be developed.
- Mapping of soil profile distribution across the region and the study of infiltration through the unsaturated zone;
- Further examination of the interplay between surface water and groundwater in the District
- Groundwater investigations; and
- Implement a targeted groundwater and surface water monitoring network.

Further scenario modelling will be based on:

- The realistic representation of proposed production bores in terms of location and pumping rates in the assessment of the impact of pumping on any identified GDE sites that may be confirmed in the future;
- The confirmed Strategic Indigenous Reserve (SIR) allocation; and
- An appropriate climate sequence will need to be developed, which will provide a basis for projecting recharge into the future. A number of possible approaches to synthesising this sequence will be investigated.

6.1.3.3 Estimated water use

Existing water use figures are based on a combination of reported actual water use and estimates. Licensed use is required to be metered, and readings are to be provided to DENR Water Resources Division. In addition, annual compliance inspections are undertaken by departmental staff. There is a moderate degree of metering compliance within the District, which will continue to be enforced to improve the availability of usage data for future plans.

Stock and domestic use is unlicensed, and estimated at 433 ML/year. Refer to section 5.3.4 for further details about this estimate.
7 Water management arrangements

Section 7.1 outlines the objectives, desired outcomes, management strategies, and performance indicators for this draft Plan.
### 7.1 Plan objectives, management strategies and performance indicators

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Strategies</th>
<th>Key Performance Indicators</th>
</tr>
</thead>
</table>
| 1. Maintain public water supply                                           | • Regional groundwater quality and water levels will be monitored for long and short term changes.  
| To ensure a safe water supply, sufficient in volume and quality for essential services to communities as well as for rural stock and domestic water requirements. | • Public water supply not affected by lack of access to water that meets water quality standards.  
| • There will be compliance monitoring of conditions on water extraction licences and bore construction permits.  
| Legal action may be used to effect compliance of these conditions at the discretion of DENR. Conditions on public water supply licences will require water quality standards to be met.  
| • Conditions will be attached to licences to place buffer zones around potential sources of pollution and for the siting of production bores.  
| • Any reports of bore field interference or contamination of aquifers will be investigated.  
| • Backflow devices will be recommended for production bores as a means of minimising risk of pollution to aquifers. | • Level of compliance (target >80%) with licence conditions (including those relating to water quality for drinking water).  
| • Number of reported pollution events or degradation to water dependent ecosystems or public water supplies arising from groundwater extraction within the district that are investigated. | • Allocations and licensed entitlements are based upon re-assessed sustainable yield.  
| • Water is used efficiently.  
| • Level of compliance (target >80%) with licence conditions.  
| • Up-to-date water data and information is readily available to the public.  
| • % of licenced entitlement volume utilised (target >60%).  
| • Whether sustainable development projects have been impeded by lack of access to water. | • Allocations and licensed entitlements are based upon re-assessed sustainable yield.  
| • Depth and rate of groundwater drawdown at reference areas measured, recorded and maintained.  
| • Improved understanding and changes in distribution/condition of potential GDEs has been documented and included in the plan.  
| • Change in condition of culturally significant places associated with water.  
| • Level of compliance (target >80%) with licence conditions.  
| • Number of reported pollution events or degradation to water dependent ecosystems or public water supplies arising from groundwater extraction within the district that are investigated. |
| 2. Equitable access to water for sustainable regional economic development  | • Water extraction licences will be available for amounts within the estimated sustainable yield of the relevant management zone.  
| Development of sustainable water consumptive industries supporting regional economic development that benefits current and future generations and is conducted within an environmentally sustainable framework. | • Allocations and licensed entitlements are based upon re-assessed sustainable yield.  
| • Water trading will be permitted (subject to modelling assessment).  
| • Water efficient practices will be encouraged.  
| • Underutilised water entitlements will be returned to the consumptive pool.  
| • Annual monitoring of licenced use in relation to property development plans. | • Water is used efficiently.  
| • Level of compliance (target >80%) with licence conditions.  
| • Up-to-date water data and information is readily available to the public.  
| • % of licenced entitlement volume utilised (target >60%).  
| • Whether sustainable development projects have been impeded by lack of access to water. | • Allocations and licensed entitlements are based upon re-assessed sustainable yield.  
| • Depth and rate of groundwater drawdown at reference areas measured, recorded and maintained.  
| • Improved understanding and changes in distribution/condition of potential GDEs has been documented and included in the plan.  
| • Change in condition of culturally significant places associated with water.  
| • Level of compliance (target >80%) with licence conditions.  
| • Number of reported pollution events or degradation to water dependent ecosystems or public water supplies arising from groundwater extraction within the district that are investigated. |
| 3. Protect water dependent ecosystems                                      | • 95% of surface water flows are preserved for the environment.  
| Detrimental impacts to water dependent ecosystems as a consequence of consumptive water use will be avoided. | • Allocations and licensed entitlements are based upon re-assessed sustainable yield.  
| • Continued documentation and assessment of environmental values of water dependent ecosystems within the District, and applying this knowledge to the management of the resource under the adaptive management approach.  
| • Impact of increased agricultural development on water quality in the District is assessed.  
| • Groundwater allocations within the Southern Ranges and Davenport Ranges Management Zones apply to the water contained in the underlying local-scale aquifers. Water from all other groundwater resources (including the Hanson River paleochannel) will be assessed on a case-by-case basis, in accordance with the NT Water Allocation Planning Framework (Schedule E). | • Water is used efficiently.  
| • Level of compliance (target >80%) with licence conditions.  
| • Up-to-date water data and information is readily available to the public.  
| • % of licenced entitlement volume utilised (target >60%).  
| • Whether sustainable development projects have been impeded by lack of access to water. | • Allocations and licensed entitlements are based upon re-assessed sustainable yield.  
| • Depth and rate of groundwater drawdown at reference areas measured, recorded and maintained.  
| • Improved understanding and changes in distribution/condition of potential GDEs has been documented and included in the plan.  
| • Change in condition of culturally significant places associated with water.  
| • Level of compliance (target >80%) with licence conditions.  
| • Number of reported pollution events or degradation to water dependent ecosystems or public water supplies arising from groundwater extraction within the district that are investigated. |
| 4. Support Indigenous culture and communities                              | • Introduce Strategic Indigenous Reserve(s) - a volume of water from the consumptive pool that is exclusively available for Aboriginal landowners to use or trade.  
| Maintain and support traditional cultural values on Aboriginal owned land through the protection of culturally significant water dependent sites, as well as providing access to water for commercial development. | • Allocations and licensed entitlements are based upon re-assessed sustainable yield.  
| • Work with Centrefarm Aboriginal Horticulture Ltd and other organisations that have the support of the Traditional Owners, in order to provide water for projects on Indigenous owned land, within the estimated sustainable yield of the relevant aquifer.  
| • Undertake the documentation, identification and assessment of cultural values to Traditional Owners of culturally significant water dependent sites.  
| • Preserve a minimum of 95% of surface water flows for the environment. To achieve this, only stock and domestic extraction of surface water is allowed under this Plan and no surface water extraction licences will be granted. | • Water is used efficiently.  
| • Level of compliance (target >80%) with licence conditions.  
| • Up-to-date water data and information is readily available to the public.  
| • % of licenced entitlement volume utilised (target >60%).  
| • Whether sustainable development projects have been impeded by lack of access to water. | • Allocations and licensed entitlements are based upon re-assessed sustainable yield.  
| • Depth and rate of groundwater drawdown at reference areas measured, recorded and maintained.  
| • Improved understanding and changes in distribution/condition of potential GDEs has been documented and included in the Plan.  
| • Change in condition of culturally significant places associated with water.  
| • Level of satisfaction with consistency, clarity and transparency of licencing/permitting process.  
| • Management activities, and management of culturally significant places associated with water is documented.  
| • Change in condition of culturally significant places associated with water.  
| • Level of compliance (target >80%) with licence conditions.  
| • Number of reported pollution events or degradation to water dependent ecosystems or public water supplies arising from groundwater extraction within the district that are investigated. |
| 5. Ensure the best available knowledge & science is available to the community, and underpins water management.  | • Under an adaptive management approach, use the best available knowledge and science for management of water resources.  
| Best available knowledge and science is available to the community, underpins any allocations made under this Plan, and improvement in understanding gained through research and monitoring is considered during review of the Plan. | • Allocations and licensed entitlements are based upon re-assessed sustainable yield.  
| • Ensure the best available knowledge and science underpins the allocations and policies specified in the Plan, and will be given full consideration during the review of the Plan.  
| • Provide the community, stakeholders, and licence holders with up-to-date and relevant information. | • Depth and rate of groundwater drawdown at reference areas measured, recorded and maintained.  
| • Improved understanding and changes in distribution/condition of potential GDEs has been documented and included in the Plan.  
| • Change in condition of culturally significant places associated with water.  
| • Level of satisfaction with consistency, clarity and transparency of licencing/permitting process.  
| • Management activities, and management of culturally significant places associated with water is documented.  
| • Change in condition of culturally significant places associated with water.  
| • Level of compliance (target >80%) with licence conditions.  
| • Number of reported pollution events or degradation to water dependent ecosystems or public water supplies arising from groundwater extraction within the district that are investigated.  
| • Methodology for projecting future climate is based on up-to-date science and industry standards. |
7.2 Allocation of water to Beneficial Uses under the Plan

7.2.1 Environmental water

For the Southern and Davenport Ranges, 20% of the pre-development aquifer storage volume is allocated to environment and culture. In the Central Plains management zone, potential GDEs will be protected by managing consumptive water use, to prevent drawdown of greater than 15 metres below ground level at the identified sites.

As part of the process of granting licences within the Central Plains management zone, allowable drawdown limits and associated monitoring programs will be developed based on proximity to cultural sites and GDEs, and commensurate with the predicted potential impact of extraction, in line with the best scientific knowledge available at the time.

A bore construction permit is required for the construction of all bores within the district. Applications will be assessed through modelling, and will only be granted if the Controller is satisfied with the level of risk of potential impact on GDEs.

7.2.2 Water for Indigenous and cultural use

This draft Plan recognises that cultural water requirements may not align entirely with environmental requirements. The provision for protection of environmental values included in section 7.2.1 will contribute to the maintenance of places valued by Indigenous people for cultural purposes. New research on specific environmental water requirements and cultural water requirements will be considered when preparing a new Plan by 2021.
7.2.3 Water for consumptive use

7.2.3.1 Consumptive pool

Under this draft Plan, water for consumptive use is allocated by management zone to consumptive Beneficial uses and to the Strategic Indigenous Reserve, as per Table 10. This draft Plan bases these figures on Option A for assessing the sustainable yield (see section 6).

| Table 10 Consumptive use allocations for each management zone (ML/year) |
|--------------------------------------------------|------------------|------------------|------------------|
| Management Zone                               | Davenport Ranges | Central Plains   | Southern Ranges |
| Sustainable yield                             |                  |                  |                  |
| Strategic Indigenous Reserve                  | 38               | 21,000           | 4               |
| Agriculture                                   | 0 (currently licenced: 5350) | 28,969           | 151             |
| Industry                                      | 10 (currently licenced: 10) | 500 (currently licenced: 200) | 10 (currently licenced: 1) |
| Public water supply                           | 50 (currently licenced: 30) | 500 (currently licenced: 300) | 60 (currently licenced: 30) |
| Rural stock & domestic                        | 90               | 250              | 150             |
| Total allocation for licensed / unlicensed use | 169              | 51,219           | 351             |

The total volume of water in the consumptive pool is 51,797ML/year. The volumes listed in Table 10 represent the maximum amount of water that is available for extraction. All applications for groundwater extraction will be assessed, under the draft Plan's adaptive management approach, against the best available knowledge and science. Each application will be input into the groundwater model, and its cumulative impact on the resource assessed.

There are a number of pending licence applications which will be assessed following the declaration of the new Plan. Under the current ‘first in first served’ policy, these applications would be assessed, and approved licenced allocations would be granted, in the order the applications were received by DENR.

Some stakeholders have raised the option of an Expression of Interest process rather than the ‘first in first served’ approach to allocations as a way to manage competition for the water resource and to ensure the resource are allocated to the most viable developments or projects in terms of contributing to the region.

All stakeholders are invited to comment on whether this option should be considered in the finalisation of the Plan.

7.2.3.2 Strategic Indigenous Reserve

The Government is committed to the introduction of a Strategic Indigenous Reserve (SIR) in water allocation plans. The SIR policy is under development. The final SIR policy will be incorporated into this Plan. This may result in a change to the volume of water allocated to the SIR in the final declared Plan. In addition, further detailed modelling of the final SIR allocation will need to include the assessment of realistic licence scenarios. This may affect the results of modelling the cumulative effect on any verified GDEs which may affect the calculation of the sustainable yield in the future.
The provisional allocations to SIR in this draft Plan have been based on the percentage of land under Aboriginal tenure (land recognised as ‘Aboriginal Land (scheduled under ALRA)’ or ‘Aboriginal Land (NT Enhanced Freehold)’. Based on this, approach, the provisional allocations for each management zone are:

- **Southern Ranges**: 1% of the consumptive pool (4 ML/year)
- **Central Plains**: 41% of the consumptive pool (21 000 ML/year)
- **Davenport Ranges**: 39% of the consumptive pool (73 ML/year). Due to existing licensed and unlicensed use, the allocation is reduced to 38 ML/year.

7.2.3.3 Surface water licences

Based on stakeholder feedback, surface water will only be available for stock and domestic use. Surface water licences will not be issued under this draft Plan. This will contribute to the protection of culturally significant sites associated with surface water.

7.2.3.4 Groundwater licences

All licences must meet the requirement of the *Water Act* and its Regulations and associated approved forms. Groundwater extraction licences will carry conditions including appropriate metering and reporting of usage. Most licences are required to report usage on at least an annual basis. Reported usages are checked against licensed volumes and major variations investigated.

Based on feedback from Indigenous stakeholders, in addition to the existing circulation of the Notice of Intention and Notice of Decisions relating to water licence decisions, a copy will also be provided to the Central Land Council, for circulation to the relevant Traditional Owners.

All groundwater licences issued within the district will have equal levels of security.

Without limiting section 90 of the *Water Act*, the following matters are relevant to the Controller’s decision of whether to grant an application for a water extraction licence:

- Whether access to the resource and a capacity to undertake the proposed development can be demonstrated.
- Whether the required volume of water is available for the relevant beneficial use, as outlined in this draft Plan, and with consideration for existing licensed and unlicensed use.
- Whether the proposed production bore/s will negatively impact on:
  - existing production bores (for licensed or exempt unlicensed use);
  - groundwater dependent cultural sites or ecosystems;
  - current or future public water supply and unlicensed rural stock and domestic requirements; or
  - the environmental and/or cultural objectives of this draft Plan.
- Whether the applicant proposes to implement water efficiency and water protection principles in the use of water extracted under the licence.
- The capacity of proposed production bore/s and their location relative to existing bore/s, and the provision of evidence demonstrating minimum potential for impact. Construction of a bore expected to yield ≥ 20 litres per second should be located at least 400 metres from an existing licensed/exempt operative unlicensed bore (Rooke, 2011).
- The location of a proposed production bore relative to a potential pollution source, including without limitation, old and current landfill sites, septic tanks and/or unbunded fuel or chemical depots and the provision of evidence demonstrating minimum potential for water
quality impacts. A bore should not be constructed within 200m of such a source (Rooke, 2011).

- In the case of applications for licences for public water supply the projected demand for water supply, including population projections and per capita demand, and whether the extracted water will achieve water quality targets guided by the Australian Drinking Water Guidelines, 2004.
- Any other information or evidence considered as relevant by the Controller.

### 7.2.4 Underutilised water

An action within this draft Plan is to develop and implement an ‘underutilised water licence entitlement’ policy. If a licence holder cannot demonstrate the need to retain the entitlement, and the intent to use the water, then the entitlement should be returned to the consumptive pool. The overarching intent will be to reduce speculation and monopolies in water allocations.

Underutilised water entitlements will be reclaimed, and returned to the consumptive pool. The preference is for reclaimed water allocations to be available for the same beneficial use, as previously licensed for. For example, reclaimed water that was previously licensed for agriculture, would return to the consumptive pool for agriculture.

### 7.2.5 Transfer of licences as a result of sale of property

Where a NT Portion is sold, a new licence will be issued to reflect the change of ownership once the sale of a property, or a transfer of ownership, is confirmed with the Department’s Water Resources Division. In situations where an NT Portion is sold and the new owner’s water demands are greater than the volume specified on the existing licence, the new owner must apply for an increase in the volume specified on the licence in accordance with the Act.

### 7.2.6 Subdivision

A subdivision of land subject to a water extraction licence is likely to result in the need for the licence to be varied. There may also be the need for a replacement licence or licences to be issued. The need for variations, or replacement licences, will depend upon the details of the proposed subdivision and will therefore be assessed by the Controller on a case by case basis.

The types of steps that may be necessary following subdivision include variations of the existing licence and/or the issue of new licences to reflect the fact that bores may now be located on legally distinct properties; and re-evaluation and redistribution of the extraction entitlements under the original licence according to the intended use of the subdivided lots. New subdivisions will require the developer to demonstrate that a sustainable water supply is available.

### 7.2.7 Fees and charges

In accordance with section 22B(5)(d) of the Water Act – as far as possible – the full cost for water resources management is to be recovered through administrative charges to licence holders and operational contributions from licence holders. However, fees and charges have not been introduced within the Northern Territory, but may be considered in the future. Currently, the licence holder is expected to bear the monitoring and reporting costs associated with providing any necessary data or information required by conditions in the licence.

### 7.2.8 Bore construction permits

Without limiting section 90 of the Water Act, the following matters are relevant to the Controller’s decision of whether to grant a construction permit inside the district:
• It is the land owner’s responsibility to ensure all appropriate permits and approvals have been granted before any construction begins. This includes ensuring that the proposed works fit within the exemptions to the Water Act:
  o regardless of the exemptions specified in clause IV, construction of dams or water-intercepting/diverting works may require a permit under sacred sites, heritage conservation or other applicable legislation; and
  o granting of permits will not absolve the permit holder from any responsibilities they may have under sacred sites, heritage conservation or other applicable legislation.
• A bore construction permit is required for the construction of all water bores greater than 3 metres deep within the district, irrespective of their intended use or capacity
  o Permits are not required for bores deeper than 3 metres drilled in connection with the supply of utilities, public drains, or road and building construction (Gazette S35, 30 June 1992)
  o Bores must be constructed by a Northern Territory licensed driller.
  o Bore construction permits will require compliance with the Minimum construction requirements for water bores in Australia (L&WBC, Current Edition).
• A permit is required to construct a dam, with the exception of rural dams of less than 3m bank height and a catchment area of less than 5 km².
• The NT Water Allocation Planning Framework (Schedule C), will be considered by the Controller in respect of any decisions made regarding permits for construction of a bore, dam, or other water control structures
• Standard conditions will be imposed by the Controller on all construction permits.

7.2.9 Emergency powers to limit rights to take water

In times of actual or likely water shortage or otherwise under the emergency powers as set out in section 96 of the Water Act, the Minister may place water restrictions on licence holders in the district as well as on stock and/or domestic and any other groundwater users.

7.3 Water accounting period

The water accounting period for the plan area begins on 01 July of any year and concludes on 30 June in the following year. The water accounting period or ‘water accounting year’ is used for the purpose of water licensing, usage and trading.

7.4 Water trading

Section 22B (5)(c) of the Water Act, specifies that a water allocation plan provides for “the right to take or use water under a licence granted under section 45 or 60 is able to be traded (in part or in full)”. Water may be traded in accordance with the water trading rules specified in section 7.4.1 of this plan.

7.4.1 Water trading rules

Water trading rules are in place to facilitate water use within the sustainable yield. The trading rules directly relate to achieving Objective 2 of the draft Plan (section 7.1).
• The right to take and use water under a licence granted in accordance with this draft Plan is able to be traded in part or in full in accordance with the following provisions. The procedure to be followed when trading depends upon whether the trade is intended to be temporary or permanent.

• Temporary trades are trades on an annual basis and are only effective during the current year. In situations involving a temporary trade to a person who already holds a water extraction licence, the Controller will issue that person with an ‘own motion’ licence (for the traded allocation) under section 60 of the Act. If the person does not already hold a licence, they will need to apply for a water extraction licence and the process in Part 6A of the Act will apply.

• Under a permanent trade a licence holder’s entitlements for the remainder of their licence are traded to another person. The trade may relate to the entire licensed volume or a part of it. An applicant for a permanent trade will need to apply for a water extraction licence and the process in Part 6A of the Act will apply. It is not expected that permanent trades will occur until the consumptive pool is completely allocated.

• Trade in licensed entitlements to groundwater is permitted only within a single management zone and where extraction will continue to be from the same aquifer. This provision is intended to prevent licences for extraction from the large regional aquifers being traded and used to extract water from much smaller local fractured rock aquifers or vice versa.

• Trade in licensed entitlements between third parties will be subject to the provision to the Controller by the Purchaser of a feasible business development plan for efficient use of the water that is satisfactory to the Controller.

• Water used for stock and domestic purposes cannot be traded.
8 Risk identification and mitigation strategies

Table 11 outlines the draft Plan’s risks, the likelihood and consequences of the risk occurring, and an associated risk rating. It also specified the management strategies contained within the draft plan, and assigns a revised, risk rating based on the mitigating strategies. Schedule G provides a description of the qualitative measures of likelihood, consequence and risk rating categories, which was used to determine the risk ratings.

8.1 Risk assignment

It must be understood by all water users in the Northern Territory that:

- their rights to extract and use water, whether under the Water Act (for example for stock and domestic purposes) or under a licence, are not, and cannot be, guaranteed by the Northern Territory Government;

- they bear the risks of any reductions to water availability under their licence resulting from seasonal or long term changes in climate, and from periodic natural events such as drought or contamination; and

- they bear the risk of reduced water availability under a water licence arising as a result of bona fide improvements in the knowledge about the water sources capacity to sustain particular extraction levels.
### Table 11 Summary of risks associated with the draft Plan and proposed mitigation strategies

<table>
<thead>
<tr>
<th>Risk</th>
<th>Likelihood</th>
<th>Consequence</th>
<th>Risk Rating</th>
<th>Management Strategy in the Plan</th>
<th>Risk rating with mitigation</th>
</tr>
</thead>
</table>
| Allocations based on modelling that underestimate extraction impact on regional groundwater drawdown/water quality, and subsequent impact on groundwater dependent environmental and cultural assets. | Likely: Models use limited samples, approximations & historical data to make predictions; they are not exact and are only indicative of future ‘real world’ responses; there are knowledge gaps regarding GDEs | Moderate: (If drawdown under estimated): GDE impacts expected sooner (If drawdown over estimated): Consumptive allocations may be needlessly conservative | High        | • Monitor actual drawdown at reference sites  
• Link volumetric allocations to model drawdown rate & limits, relative to potential GDE sites  
• Review allocations every 5 years to account for improved knowledge of GDEs requirements, modelling, and observations  
• Implement monitoring and research program to improve modelling and knowledge of the aquifer | Moderate |
| Lack of knowledge about groundwater dependent ecosystems (GDEs) in the District leads to either over or under allocation of the resources | Likely: The method used to identify potential GDE sites for this Plan is a trial of a new method. Results are preliminary and field testing is underway. | Moderate: (if over allocated): Licenses face financial losses due to amendments in development plans (if under allocated): Opportunities for investment in regional development are lost; Unfavourable risk profile for business; Reduced confidence and investment in agricultural or industry development | High        | • Undertake extensive modelling based on best available knowledge  
• Provide certainty by applying precautionary principle when determining sustainable yield to reduce risks of it being reduced | Moderate |
| Extraction limits exceeded | Unlikely: Overall compliance with licensed | Minor: Long term non-compliance may mean | Low         | • Continue to monitor extraction & compliance with licence conditions  
• Independently and with other | Low |
<table>
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<tr>
<th>Possible: Sustainable yield based on modelling. Models use limited samples, approximations &amp; historical data to make predictions; they are not exact and are only indicative of future 'real world' responses.</th>
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<tr>
<td>Moderate: Unfavourable risk profile for business; Reduced confidence / investment in agricultural or industry development</td>
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<tr>
<td>High</td>
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<tr>
<td>• Ensure model inputs are conservative (e.g. assume highest scenario extraction, lowest scenario recharge)</td>
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<tr>
<td>• Apply trade-off between maximising sustainable yield volume with the need to increase certainty: apply precautionary principle when determining sustainable yield to reduce risks of it being reduced</td>
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<tr>
<th>Uncertainty about sustainable yield / consumptive pool impedes investment</th>
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<tr>
<th>Public water supply and domestic water sources are of poor water quality and unfit for drinking.</th>
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<tr>
<td>Rare: Allocations in the 2011 Western Davenport plan have been consistently underutilised. Extraction is significantly less than the estimated sustainable yield.</td>
</tr>
<tr>
<td>Major: High quality water is needed for human consumption. Lack of access to quality water means water would need to be trucked in and distributed.</td>
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<tr>
<td>High</td>
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<tr>
<td>• Implement monitoring and research program to improve modelling and knowledge of the aquifer</td>
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<tr>
<td>• Bore construction permits required for new bores</td>
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<tr>
<td>• Continue to monitor extraction &amp; compliance with licence conditions</td>
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<td>• High quality water ($\leq 500$TDS) is preserved for public water supply and domestic water use.</td>
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<th>Licence holders do not use, or under utilise their entitlement(s)</th>
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<td>Likely: Since declaration of the 2011 Western Davenport plan there has been a consistent pattern of underutilisation (approx. $1/3^{rd}$ of entitlements actually used)</td>
</tr>
<tr>
<td>Moderate: Failure to maximise development potential, loss of opportunities for new development if water is locked up in unutilised entitlements</td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>• DENR implement ‘underutilised water licence entitlement’ policy</td>
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<td>• DENR to encourage trade in water entitlements</td>
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<td>Topic</td>
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<td>----------------------------------------------------------------------</td>
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| Aboriginal cultural values threatened by inadequate Aboriginal participation in water planning and governance | Challenges in effectively facilitating Aboriginal participation within the planning timeframes.    | Cultural values and management strategies not well defined, therefore increased risk that they are not protected | • DENR commitment to TO engagement during planning process  
• An action of this plan is to identify, map, and develop management strategies to protect cultural values within the plan. | Moderate |
| Entitlements fully allocated before Aboriginal landowners have capacity to participate in development that requires water | Demand for water exceeds the maximum sustainable yield established in the 2011 Western Davenport plan. | Aboriginal land owners disadvantaged / unable to attain economic benefit from consumptive use of water | • Establish Strategic Indigenous Reserve (SIR)  
• Ensure an allocation is provided to the SIR before new licence applications are provisioned at the commencement of the planning period | Moderate |
| Mining within the district could affect water availability and water quality | There is potential for future extraction of water for mining purposes. | If extraction were to occur, poorer quality water would likely be used. | • Sustainable yield has been calculated, and will be reviewed every 5 years. This will be used to inform decisions regarding future mine operations. | High   |
9 Plan implementation, monitoring and review

9.1 Implementation of the Plan

This section will be finalised following stakeholder feedback on the draft Plan.

This section describes the roles and responsibilities of the various parties to implement, monitor, review and update the Plan.

Requirements under the Water Act:

- Consistent with Section 23 (1B) (a) of the Act, that the Minister may ask a water advisory committee to advise on the effectiveness of the water allocation plan in maximising economic and social benefits within ecological restraints.
- Consistent with Section 34 of the Act, that DENR must continue to investigate, collect, collate and analyse data concerning the occurrence, volume, flow, characteristics, quality, flood potential and use of water resources in the plan area.
- Consistent with Section 46 of the Act, licence holders must use water consistent with the terms specified on the licence and the management arrangements outlined in the Plan.

The Northern Territory Government maintains a network of monitoring bores and surface water gauging stations and is responsible for water resource investigation studies and water resource modelling. The monitoring program for the District will be further developed in line with the implementation targets below.

The implementation targets will be used to help tailor the monitoring program to ensure that it adequately assesses the performance of this Plan as well as identifying where further research is required to better inform the next plan. Performance evaluation of this Plan, will take into consideration the degree to which the actions listed in the implementation targets have been achieved. Implementation of the Plan will be guided by the management strategies identified in section 7.1.

9.2 Monitoring implementation of the plan

Performance evaluation of this Plan will take into consideration the degree to which the performance indicators listed under section 7.1 have been achieved.

The targets in section 9.2.1 will be met as part of the implementation of this Plan. In addition, if resourcing permits, the following activities could be undertaken to further enhance understanding of the hydrological system in the district:

- Investigative drilling in areas with minimal drilling, to improve knowledge of groundwater resources;
- 24-48 hour large discharge pump testing of DENR observation bores in order to determine bore and thus aquifer sustainable yields;
- Construct telemetered gauging stations on the Wycliffe, Taylor and Skinner creeks to monitor flood flows and baseflow recession;
- Expansion of the existing monitoring bores, with more evenly spread and deeper groundwater drilling investigations; and
- Investigate and report on surface and groundwater pollution vulnerability in each management zone and recommend appropriate actions.
## 9.2.1 Plan Implementation Actions

### A. Actions to monitor resource condition

<table>
<thead>
<tr>
<th>Action</th>
<th>Target</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Implement a targeted water resource monitoring programme that monitors regional rainfall, stream flow, groundwater levels and water quality.</td>
<td>Annual</td>
<td>DENR</td>
</tr>
<tr>
<td>2 Develop a monitoring program of groundwater drawdown at reference areas (including culturally important sites and areas confirmed as GDEs)</td>
<td>Within 2 years</td>
<td>DENR</td>
</tr>
<tr>
<td>3 Implement monitoring of groundwater drawdown at reference areas (including culturally important sites and areas confirmed as GDEs)</td>
<td>Within 3 years then 2 x annum</td>
<td>DENR</td>
</tr>
<tr>
<td>4 Develop and implement a monitoring program of groundwater dependent vegetation</td>
<td>Within 2 years</td>
<td>DENR</td>
</tr>
<tr>
<td>5 Conduct compliance inspections for permit and licence conditions (including water quality for public water supply and compliance with property development plans).</td>
<td>Minimum of once per year</td>
<td>DENR</td>
</tr>
<tr>
<td>6 Identification of and condition assessment of key culturally significant places associated with water and development of management strategies, including ‘buffer zones’ where appropriate.</td>
<td>Within 5 years</td>
<td>DENR with CLC</td>
</tr>
<tr>
<td>7 Investigate and document any reported pollution events or degradation to water dependent ecosystems arising from groundwater extraction within the district.</td>
<td>As required</td>
<td>EPA &amp; DENR</td>
</tr>
<tr>
<td>8 Review licensed entitlements based on reassessed sustainable yield.</td>
<td>Upon licence renewal</td>
<td>DENR</td>
</tr>
<tr>
<td>8 Maintain pumpage records.</td>
<td>Monthly</td>
<td>DENR</td>
</tr>
</tbody>
</table>
### B. Actions to improve knowledge of the resource

<table>
<thead>
<tr>
<th>Action</th>
<th>Target</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 Review groundwater model and reassess the sustainable yield for each management zone.</td>
<td>5 yearly</td>
<td>DENR</td>
</tr>
<tr>
<td>10 Re-assess and update understanding of potential GDE distribution and characteristics.</td>
<td>Within 2 years</td>
<td>DENR</td>
</tr>
<tr>
<td>11 Decide on the preferred methodology for climate projection (including consideration of CSIRO’s Sustainable Yields approaches), for modelling of the next plan.</td>
<td>Within 5 years</td>
<td>DENR</td>
</tr>
<tr>
<td>12 Support external water assessment/water dependent ecosystem research programs.</td>
<td>As required</td>
<td>DENR</td>
</tr>
<tr>
<td>13 Review maps of culturally significant places (at appropriate resolution).</td>
<td>5 yearly</td>
<td>DENR with CLC</td>
</tr>
<tr>
<td>14 Undertake groundwater investigations of the aquifer underlying the Central Plains Management Zone to provide confirmation of the aquifer’s existence at depth and continuity across the region, as well as spatial variation in terms of its hydraulic characteristics and water quality</td>
<td>Within 5 years</td>
<td>DENR</td>
</tr>
<tr>
<td>15 Improve knowledge of arid zone recharge processes and recharge modelling</td>
<td>Within 5 years</td>
<td>DENR</td>
</tr>
<tr>
<td>16 Develop a map of soil profile distribution across the region and study infiltration through the unsaturated zone</td>
<td>Within 5 years</td>
<td>DENR</td>
</tr>
<tr>
<td>17 Review applicability of current knowledge on impact of irrigated agriculture on water quality in the arid zone in relation to this resource and scope further work required to monitor this impact in the District</td>
<td>Within 5 years</td>
<td>DENR</td>
</tr>
</tbody>
</table>

### C. Actions to monitor implementation of the Plan

<table>
<thead>
<tr>
<th>Action</th>
<th>Target</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 Document Traditional Owner participation in water management activities, and management of culturally significant places associated with water.</td>
<td>Annually</td>
<td>DENR with CLC</td>
</tr>
<tr>
<td>19 Make all monitoring data available on the DENR website.</td>
<td>Ongoing</td>
<td>DENR</td>
</tr>
<tr>
<td>20 Include Strategic Indigenous Reserve (SIR) in this plan.</td>
<td>5 yearly</td>
<td>DENR</td>
</tr>
<tr>
<td>21 Maintain transparent public ‘Water Portal’ with information about allocations and licences.</td>
<td>Ongoing</td>
<td>DENR</td>
</tr>
<tr>
<td>22 Develop and adopt ‘underutilised water licence entitlement’ policy</td>
<td>Within 2 years</td>
<td>DENR</td>
</tr>
<tr>
<td>23 Provide capacity-building opportunities to improve understanding of water resource management issues (e.g. irrigation efficiency and backflow prevention).</td>
<td>Ongoing</td>
<td>DENR</td>
</tr>
<tr>
<td>24 Maintain ‘Water Portal’ (transparent, public, online portal with information about allocations and licences).</td>
<td>Ongoing</td>
<td></td>
</tr>
<tr>
<td>25 Survey the public about their satisfaction with the water licensing/permitting process</td>
<td>With licence/permit determination letter; and during review</td>
<td>DENR</td>
</tr>
<tr>
<td>26 Develop a policy on high value GDEs, taking account of cultural and biodiversity values, to support the NT Water Allocation Framework</td>
<td>Within 3 years</td>
<td>DENR</td>
</tr>
</tbody>
</table>
9.3 Reporting obligations

Extraction licences issued under the Plan will carry conditions including appropriate metering and reporting of usage. Most licences are required to report usage on at least an annual basis. Reported usages are checked against licensed volumes and significant variations investigated.

DENR will maintain an up to date, public and transparent record of all water allocations, entitlements and licences associated with the Western Davenport Water Control District, available through an online Water Portal, which is currently under development. Annual reporting against the implementation targets will also be undertaken.

9.4 Reviewing the plan

In accordance with 22B (4) of the Water Act, the Minister must ensure that a review of a water allocation plan is conducted at intervals not longer than 5 years. This plan is a revision of the plan that was declared in 2011, and a new plan will be required in 2022.

The new Plan will reflect improved knowledge and will be generally informed by the outcomes of the monitoring program, research findings, and community consultation. If appropriate, the allocations within the next Plan may also be adjusted to align with the improved understanding. All public submissions, as well as any Northern Territory or regional policies or agreements coming into force after the initial declaration and with relevance to this Plan, will be considered.

Under limited circumstances, such as those relating to level of development or risk to the resources, then a new plan may be declared prior to 2022.

Performance evaluation of this Plan will take into consideration the degree to which the actions listed in the implementation targets have been achieved.
Schedule A: Aboriginal Land Tenure

Legend:
- Aboriginal Land (scheduled under ALRA)
- Aboriginal Land (NT enhanced freehold)

LOCATION MAP
- Darwin
- Jabiru
- Katherine
- Nhulunbuy

NORTHERN TERRITORY
- Tennant Creek
- Alice Springs

WESTERN DAVENPORT WATER CONTROL DISTRICT

ABORIGINAL LAND
Schedule B: Northern Territory Water Allocation Planning Framework

All available scientific research directly related to environmental and other public benefit requirements for the water resource will be applied in setting water allocations for non-consumptive use as the first priority, with allocations for consumptive use made subsequently within the remaining available water resource.

In the absence of directly related research, contingent allocations are made for environmental and other public benefit water provisions and consumptive use. These are explained below.

Arid Zone (southern two thirds of the Northern Territory)

Rivers
At least 95 per cent of flow at any time in any part of a river is allocated as environmental and other public benefit water provision, and extraction for consumptive uses will not exceed the threshold level equivalent to five per cent of flow at any time in any part of a river.

In the event that current and/or projected consumptive use exceeds the threshold levels of five per cent for river flow, new surface water Licences will not be granted unless supported by directly related scientific research into environmental other public benefit requirements.

Aquifers
There will be no deleterious change in groundwater discharges to dependent ecosystems, and total extraction over a period of at least 100 years will not exceed 80 per cent of the total aquifer storage at start of extraction.

In the event that current and/or projected consumptive use exceeds the threshold levels of 80 per cent of the consumptive pool for aquifers, or groundwater discharges to groundwater dependent ecosystems are impacted, new groundwater Licences will not be granted unless supported by directly related scientific research into groundwater dependent ecosystem/cultural requirements.

Top End (northern one third of the Northern Territory)

Rivers
At least 80 per cent of flow at any time in any part of a river is allocated as water for environmental and other public benefit water provision, and extraction for consumptive uses will not exceed the threshold level equivalent to 20 per cent of flow at any time in any part of a river.

In the event that current and/or projected consumptive use exceeds the 20 per cent threshold level, new surface water Licences will not be granted unless supported by directly related scientific research into environmental other public benefit requirements.

Aquifers
At least 80 per cent of annual recharge is allocated as water for environmental and other public benefit water provision, and extraction for consumptive uses will not exceed the threshold level equivalent to 20 per cent of annual recharge.

In the event that current and/or projected consumptive use exceeds the 20 per cent threshold level, new groundwater Licences will not be granted unless supported by either directly related scientific research into groundwater dependent ecosystem/cultural requirements, or in the absence of such research, hydrological modelling confirming that total groundwater discharge will not be reduced by more than 20 per cent.
Schedule C: Stakeholder engagement and consultation

Community consultation is a key part of the water planning process and helps inform values to be protected by the Plan. The public and key stakeholders were invited to participate in the planning process by attending community and private meetings. They were kept informed of planning progress through the DENR website www.nt.gov.au/water and via email correspondence.

Stakeholders consulted as part of this review include:

- NT Cattlemen’s Association
- Central Land Council
- Traditional Owners
- Pastoral lessees from Neutral Junction, Singleton, Stirling, Mount Skinner, Elkedra and Murray Downs Stations
- Centrefarm
- Desert Melons
- Arid Lands Environment Centre
- NT Farmers Association
- Power & Water Corporation
- NT Farmers
- Barkly Regional Council
- Barkly Landcare
- Barrow Creek Roadhouse
- Devils Marbles Hotel
- Wycliffe Well Tourist Park
- Department of Primary Industry and Resources
- Department of Infrastructure, Planning and Logistics
- Parks and Wildlife Commission of the Northern Territory
- Department of the Chief Minister
Schedule D: Surface water catchment area

Figure 5
Western Davenport Water Control District
SURFACE WATER
SUBCATCHMENTS AND FLOW DIRECTION
Schedule E: Management Zones
Schedule F: Western Davenport WCD – regional aquifer cross section
### Schedule G: Risk definition & classification

1. **Likelihood of occurrence**

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Detailed description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almost certain</td>
<td>Is expected to happen in most situations</td>
</tr>
<tr>
<td>Likely</td>
<td>Will probably happen in most situations</td>
</tr>
<tr>
<td>Possible</td>
<td>May happen at some time</td>
</tr>
<tr>
<td>Unlikely</td>
<td>Could happen at some time</td>
</tr>
<tr>
<td>Rare</td>
<td>May happen only in exceptional situations</td>
</tr>
</tbody>
</table>

2. **Consequence (impact)**

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>Detailed description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insignificant</td>
<td>Immaterial impact to environmental and/or cultural values; and/or inconsequential financial impact and reputational damage</td>
</tr>
<tr>
<td>Minor</td>
<td>Material but low impact on environmental and/or cultural values; and/or low financial impact and reputational damage</td>
</tr>
<tr>
<td>Moderate</td>
<td>High impact on environmental and/or cultural values; and/or moderate financial impact and reputational damage</td>
</tr>
<tr>
<td>Major</td>
<td>Extensive impact to environmental and/or cultural values; and/or high financial impact and reputational damage</td>
</tr>
<tr>
<td>Catastrophic</td>
<td>Severe, irreversible impact to environmental and/or cultural values; and/or huge financial loss and reputational damage</td>
</tr>
</tbody>
</table>

3. **Risk rating (Matrix)**

<table>
<thead>
<tr>
<th>Likelihood of occurrence</th>
<th>Insignificant</th>
<th>Minor</th>
<th>Moderate</th>
<th>Major</th>
<th>Catastrophic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almost certain</td>
<td>M</td>
<td>H</td>
<td>E</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>Likely</td>
<td>M</td>
<td>H</td>
<td>H</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>Possible</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>E</td>
<td>E</td>
</tr>
<tr>
<td>Unlikely</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>E</td>
</tr>
<tr>
<td>Rare</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>H</td>
</tr>
</tbody>
</table>

**Legend:**

- Extreme (E): urgent intervention / correction required
- High (H): matter requiring ongoing / systematic action to manage
- Moderate (M): identify responsibility and actions to address
- Low (L): manage by routine policy and procedures
### Glossary and abbreviations

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>alluvial deposits</strong></td>
<td>Materials laid down by physical processes in river channels or on floodplains.</td>
</tr>
<tr>
<td><strong>allocation</strong></td>
<td>Ongoing access to a share of water from a specified consumptive pool. The total licensed entitlements for a particular beneficial use cannot exceed the specified allocation as defined in the water allocation plan.</td>
</tr>
<tr>
<td><strong>aquifer</strong></td>
<td>A water-bearing geological formation.</td>
</tr>
<tr>
<td><strong>Cainozoic</strong></td>
<td>An area of geological time from the present to 65 million years ago.</td>
</tr>
<tr>
<td><strong>Cambrian</strong></td>
<td>A period of geological time 500-600 million years ago.</td>
</tr>
<tr>
<td><strong>colluvial</strong></td>
<td>Formed from a loose accumulation of rock and soil debris at the foot of a slope.</td>
</tr>
<tr>
<td><strong>Controller of Water Resources</strong></td>
<td>Appointed under section 18 of the Act. Referred to within this plan as ‘Controller’.</td>
</tr>
<tr>
<td><strong>DENR</strong></td>
<td>The Department of Environment and Natural Resources.</td>
</tr>
<tr>
<td><strong>ephemeral</strong></td>
<td>Not permanent.</td>
</tr>
<tr>
<td><strong>environmental water requirements</strong></td>
<td>Descriptions of flow regimes (e.g. volume, timing, seasonality, duration) that are needed to sustain the ecological values of aquatic or floodout ecosystems, including their processes and biological diversity.</td>
</tr>
<tr>
<td><strong>fractured rock</strong></td>
<td>Rock with linear gaps of varying direction, length and width.</td>
</tr>
<tr>
<td><strong>groundwater</strong></td>
<td>The water contained in saturated rock or soil located below the water table.</td>
</tr>
<tr>
<td><strong>groundwater dependent ecosystem (GDE)</strong></td>
<td>Ecosystems that require access to groundwater to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystems services.</td>
</tr>
<tr>
<td><strong>hydrogeological</strong></td>
<td>Study of the interrelationship between geology and water, particularly groundwater.</td>
</tr>
<tr>
<td><strong>hydrographs</strong></td>
<td>A graph showing the properties of water.</td>
</tr>
<tr>
<td><strong>licence</strong></td>
<td>A licence to extract water granted to a person by the controller under the Act, subject to the terms and conditions as specified in the licence.</td>
</tr>
<tr>
<td><strong>licensed entitlement</strong></td>
<td>The specific volume of water licensed under the Act for extraction in a given period (typically annually), according to rules established in the relevant water allocation plan and offered within the sustainable yield. Subject to change if sustainable yield is altered during review periods (5 or 10 years).</td>
</tr>
<tr>
<td><strong>Mbgl</strong></td>
<td>Metres below ground level.</td>
</tr>
<tr>
<td><strong>ML</strong></td>
<td>Megalitre is 1,000,000 litres.</td>
</tr>
<tr>
<td><strong>porous rock</strong></td>
<td>Solid and typically sedimentary rock that contains holes, for example sandstone.</td>
</tr>
<tr>
<td><strong>potentiometric surface</strong></td>
<td>The level to which water will rise in a bore, for example a water table.</td>
</tr>
<tr>
<td><strong>quaternary</strong></td>
<td>A period of geological time from the present to 2 million years ago.</td>
</tr>
<tr>
<td><strong>stratigraphic</strong></td>
<td>systematic arrangement of geological strata according to age.</td>
</tr>
<tr>
<td><strong>surface water</strong></td>
<td>The water found in rock holes, rivers, creeks and floodouts sometimes called free water, to distinguish it from water in soil; springs are places where discharging groundwater becomes surface water; in the arid zone, nearly all surface water is the result of rainfall that has run off rather than infiltrating soils.</td>
</tr>
<tr>
<td><strong>sustainable yield</strong></td>
<td>The level of water extraction from a particular system which, if exceeded would compromise key environmental assets, or ecosystem functions and the productive base of the resource.</td>
</tr>
<tr>
<td><strong>throughflow</strong></td>
<td>Water that infiltrates the soil surface and then moves laterally through the upper soil horizon often as shallow perched saturated flow above the main groundwater table.</td>
</tr>
<tr>
<td><strong>transmissivity</strong></td>
<td>The rate at which water is transmitted horizontally through a unit width of an aquifer.</td>
</tr>
<tr>
<td><strong>vadose zone</strong></td>
<td>Also termed the unsaturated zone, that part of the profile that lies between the land surface and the water table.</td>
</tr>
</tbody>
</table>
References


Eamus, Cook (2016 unpublished) Groundwater Recharge and Discharge within the Ti Tree Basin Australia.

International Association for Public Participation Australasia (2014) IAP2 Public Participation Spectrum, Australia.


Further Reading
