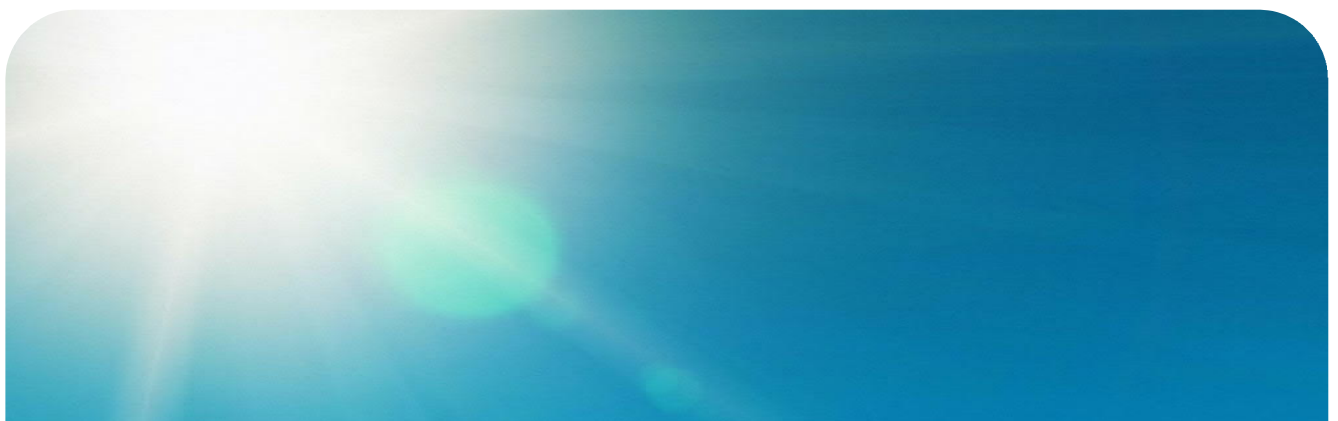


Appendix 6.1 – Groundwater Assessment - Solar Precinct



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GROUNDWATER ENTERPRISES

SOLAR PRECINCT GROUNDWATER STUDY

NOVEMBER 2022

PREPARED FOR AUSTRALIA-ASIA POWERLINK

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Contents

1	Introduction	- 1 -
1.1	Background	- 1 -
1.2	Objectives	- 1 -
1.3	Scope	- 1 -
1.4	Geology.....	- 3 -
2	Hydrogeology.....	- 6 -
2.1	Groundwater Occurrence	- 6 -
2.1.1	Montejinni Limestone	- 7 -
2.1.2	Helen Springs Volcanics	- 7 -
2.1.3	Proterozoic Basement Aquifers.....	- 8 -
2.2	Recharge	- 10 -
2.3	Groundwater Storage and Resource Capacity	- 11 -
2.4	Groundwater Quality.....	- 11 -
3	Groundwater Receptors	- 13 -
3.1	Existing Groundwater Users	- 13 -
3.2	Environmental Receptors	- 15 -
4	Project Water Requirement.....	- 16 -
4.1	Recommended Groundwater Targets.....	- 18 -
4.2	Evaporative Losses from Surface Water Storages	- 18 -
5	Drawdown and Impact Modelling.....	- 20 -
5.1	Methodology	- 20 -
5.2	Estimated Drawdown at Existing Bores.....	- 22 -
5.3	Parameter Sensitivity	- 25 -
6	Conclusions and Recommendations	- 26 -
7	References	- 27 -
	Appendix A Reported Transmissivity for the Montejinni Limestone.....	- 30 -
	Appendix B Construction Water Requirement Data.....	- 31 -

List of Tables

Table 1 Stratigraphic table of geology in the vicinity of the Solar Precinct (<i>after Kruse and Munson, 2013; Hussey et al, 2001; Kennewell, 1977</i>)	- 4 -
Table 2 Hydrostratigraphy of the Project area.....	- 6 -
Table 3 Groundwater quality and associated guideline values for various uses	- 12 -
Table 4 Summary of constructed and registered bores within 10 km of Project infrastructure	- 13 -
Table 5 Preliminary construction water requirements.....	- 16 -
Table 6 Source aquifer at consumption points and recommended target aquifer for water supply	- 18 -
Table 7 Existing bore construction, available drawdown and modelled impact.....	- 23 -
Table 8 Transmissivity estimates from pumping tests for the Montejinni Limestone aquifer	- 30 -
Table 9 Construction Water Profiles.....	- 31 -

List of Figures

Figure 1 Project Location and Site Layout.....	- 1 -
Figure 2 Surface Geology	- 5 -
Figure 3 Aquifer Map	- 9 -
Figure 4 Groundwater receptors	- 14 -
Figure 5 Preliminary demand profiles for consumption points	- 16 -
Figure 6 Water Consumption Points.....	- 17 -
Figure 7 Proposed pumping schedule to meet construction water requirements	- 21 -
Figure 8 Modelled drawdown curves at existing bores near the Solar Precinct.....	- 22 -
Figure 9 Modelled Drawdown Extent.....	- 24 -
Figure 10 Modelled Drawdown in RN041413 under A) varying transmissivity and B) varying storage	- 25 -

Glossary

Aquifer - a geologic formation(s) that is water bearing. The term is usually restricted to those water-bearing formations capable of yielding water in sufficient quantity to constitute a usable supply.

Aquitard - groundwater-filled body of poorly permeable formations, through which still significant volumes of groundwater may move, although at low flow rates.

Confined aquifer - an aquifer below the land surface that is saturated with water. Layers of impermeable material are both above and below the aquifer, causing it to be under pressure so that when the aquifer is penetrated by a well, the water will rise above the top of the aquifer.

Drawdown - Lowering of the groundwater level or piezometric surface caused by abstraction of groundwater.

Evaporation - the process of liquid water becoming water vapor, including vaporization from water surfaces, land surfaces, and snow fields, but not from leaf surfaces.

Evapotranspiration (ET) - the quantity of water transpired (given off), retained in plant tissues, and evaporated from plant tissues and surrounding soil surfaces.

Groundwater - water that occurs beneath the land surface and fills the pore spaces of the alluvium, soil, or rock formation in which it is situated. It excludes soil moisture, which refers to water held by capillary action in the upper unsaturated zones of soil or rock.

Groundwater discharge - Movement of groundwater from the subsurface to the surface. Natural discharge occurs into lakes, streams and springs as well as human discharge, generally referred to as pumping.

Hydraulic conductivity - capacity of a porous medium to transmit water. Units - m/day.

Potentiometric surface - surface defined by the piezometric levels corresponding to a predefined layer or topographic level inside an aquifer.

Recharge - water added to an aquifer or the process of adding water to an aquifer. Ground water recharge occurs either naturally as the net gain from precipitation, or artificially as the result of human influence.

Semi-confined aquifer - confined aquifer, where either the confining bed on top of the aquifer or the poorly permeable basal formation underneath the aquifer have sufficient permeability (aquitards) to allow the exchange of water between the aquifer and the domains above or below it.

Specific yield - the ratio indicating the volumetric fraction of the bulk aquifer volume that a given aquifer will yield when all the water is allowed to drain out of it under the forces of gravity.

Storativity (also storage coefficient) - the volume of water released from storage per unit decline in hydraulic head in the aquifer, per unit area of the aquifer. Storativity is a dimensionless quantity.

Transmissivity - the ability of the aquifer to transmit groundwater throughout its entire saturated thickness. Transmissivity is measured as the rate at which groundwater can flow through an aquifer section of unit width under a unit hydraulic gradient. Unit m^2/day .

Unconfined aquifer - a groundwater aquifer is said to be unconfined when its upper surface (water table) is open to the atmosphere through permeable material.

1 Introduction

1.1 Background

Sun Cable is building one of the world's largest renewable energy infrastructure projects, Australia-Asia PowerLink (AAPowerLink), which will supply renewable electricity to Darwin and Singapore. AAPowerLink features a high-capacity solar generation, storage and transmission system that will transmit renewable electricity from the Barkly region of the Northern Territory to Darwin and Singapore markets.

The solar generation component of the Project will take place at the "Solar Precinct". Located approximately 70 km south-west of Elliott, the Solar Precinct will capture the sun's energy through multiple large-scale solar and storage fields, located on approximately 12,000 ha of land. The Solar Precinct will also house various energy storage systems, converters, transmission lines, workforce accommodation, offices, carparks, access roads, an airfield, rail siding, fencing and other supporting infrastructure.

The "Project area" defined for this assessment covers the footprint of the Solar Precinct and associated infrastructure at the Powell Creek Solar Precinct. It extends from the Stuart Highway in the east through to the Alice Springs-to-Darwin railway line, which forms the western boundary to the Solar Precinct (Figure 1).

1.2 Objectives

The AAPowerLink Project Team has engaged Groundwater Enterprises Pty Ltd (GE) to undertake a desktop groundwater assessment of the Solar Precinct and surrounding area. The study has the following objectives:

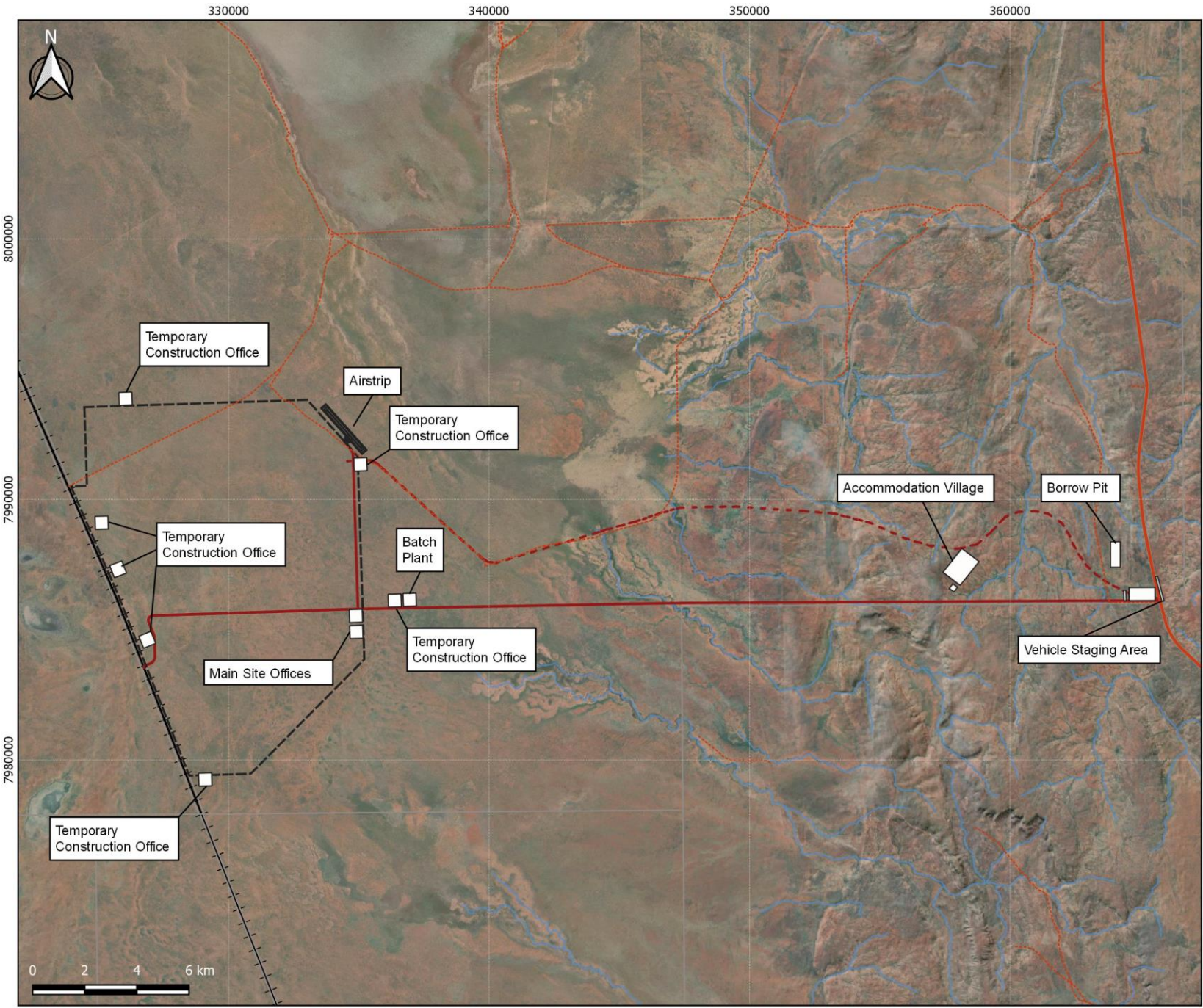
- ▼ Assess the availability of groundwater to supply construction activities around the Solar Precinct
- ▼ Assess the potential impacts of sourcing water for construction and maintenance activities in and around the Solar Precinct from groundwater sources
- ▼ Determine the reported water quality attributes of groundwater beneath the Solar Precinct and nearby areas so that an assessment of treatment requirements can be undertaken.

1.3 Scope

The Solar Precinct groundwater study has the following scope:

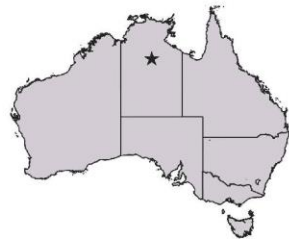
- ▼ Undertake a literature review and data compilation to characterise the groundwater conditions and hydrogeology of the Solar Precinct and its surrounding area, including:
 - ▽ Assessing the groundwater values and receptors including any existing groundwater users and groundwater dependent ecosystems (GDEs)
 - ▽ Recommending suitable bore locations for the Solar Precinct and associated infrastructure (e.g. construction village, access roads, airfield, etc)
 - ▽ Subject to the availability of existing data, assessing the chemical properties of the groundwater found from each bore/proposed new bore location and
 - ▽ Recommending additional work required to better characterise the groundwater system and investigate potential risks/impacts
- ▼ Assessing the capacity of local aquifers to supply the water requirement of the Project.
- ▼ Assessing the potential drawdown impacts of groundwater extraction on existing users/environmental receptors using analytical modelling methods based on conventional pumping test solutions (i.e. Theis Solution or similar).

Figure 1 Project Location and Site Layout



Project Location and Site Layout*

- AAPL Infrastructure
- Solar Farm Precinct
- AAPL Gravel Road
- AAPL Sealed Road
- ASP-DWN Railway
- Station Track
- Stuart Highway
- Property Boundaries
- Water Courses



* The infrastructure represents the 'initial Site Layout' - it may change as the project progresses through the design phases.

MAP INFORMATION - Scale 1:180 000 @A4, Projection GDA94 MGA Zone 53

DATA SOURCES - AAPL Infrastructure, roads, solar precinct (Supplied by AAPL), Roads (DIPL), Property Boundaries (DIPL), Water Courses (DEPWS)

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1.4 Geology

The eastern half of the Project area overlies Proterozoic basement rocks of the Tomkinson Province that outcrop in gentle north trending strike ridges in the Ashburton Ranges. The Solar Precinct is located to the west of the Ashburton Ranges and overlies the Cambrian Wiso Basin, which is obscured by a thin cover of Quaternary alluvial and aeolian sand deposits.

In the vicinity of the Project area, the Tomkinson Province consists of the Namerinni Group and the younger Renner Group. The Namerinni Group comprises a succession of marine sandstone, siltstone and carbonate rocks with a maximum thickness of 2,800 m (Donnellan, 2013). The Namerinni Group outcrops on Helen Springs Station to the south of the main access road (Figure 2). The Renner Group consists of shallow marine and fluvial sedimentary rocks with a maximum thickness of 3,500 m (Donnellan, 2013). The Renner Group outcrops on the flanks of a faulted anticline that plunges gently to the north and is bisected by the main access road. The structure of the Proterozoic basement is characterised by a series of north to north-easterly trending faults and minor north-westerly faults (Figure 2). The deformation events that led to these structures largely pre-date the Cambrian period when the Wiso Basin was deposited (Hussey et al, 2001).

To the west of the Proterozoic outcrop and along the southern flanks of the Ashburton Ranges the Tomkinson Province is unconformably overlaid by the Helen Springs Volcanics, which are correlated with the Kalkarindji province volcanics that extend over a large area of central and western NT (Glass et al, 2013). The Helen Springs Volcanics comprise of a massive basalt unit and a basal sandstone referred to as the Muckaty Sandstone Member (Hussey et al, 2001). The Muckaty Sandstone Member is a cross-bedded grey-brown quartz sandstone considered to be of aeolian origin (Hussey et al, 2001). The Helen Springs Volcanics do not outcrop in the Project area, being obscured by the overlying Wiso basin and more recent sedimentary cover.

The Wiso Basin is a regional scale sedimentary basin that extends over 160,000 km² in central-western Northern Territory (Kruse and Munson, 2013) and is present beneath the western half of the Project area. The Wiso Basin has an analogous stratigraphy to the Georgina Basin to the west and the Daly Basin to the north being separated from these systems by a Proterozoic basement high and by basement ridges in the Kalkarindji Province (Kruse and Munson, 2013). In the Project area, the Wiso Basin largely consists of the basal Montejinni Limestone, a sequence of grey-brown dolostone and limestone. A thin section (< 50 m) of Port Wakefield Beds/Hooker Creek Formation/Lothari Sandstone potentially overlie the Montejinni Limestone in the west of the Project area. Due to the absence of outcrop and stratigraphic holes the upper Cambrian sequence is not well characterised in the Project area. The Wiso Basin sediments are flat lying and thicken gradually to the west away from the basin margin.

Undifferentiated Cretaceous sediments, consisting of sandstone, siltstone and claystone, occur as isolated outcrops amongst the Ashburton Ranges. More extensive Cretaceous sediments are mapped subsurface 2 km north of the Solar Precinct. In this area they represent the southern extent of the Carpentaria Basin.

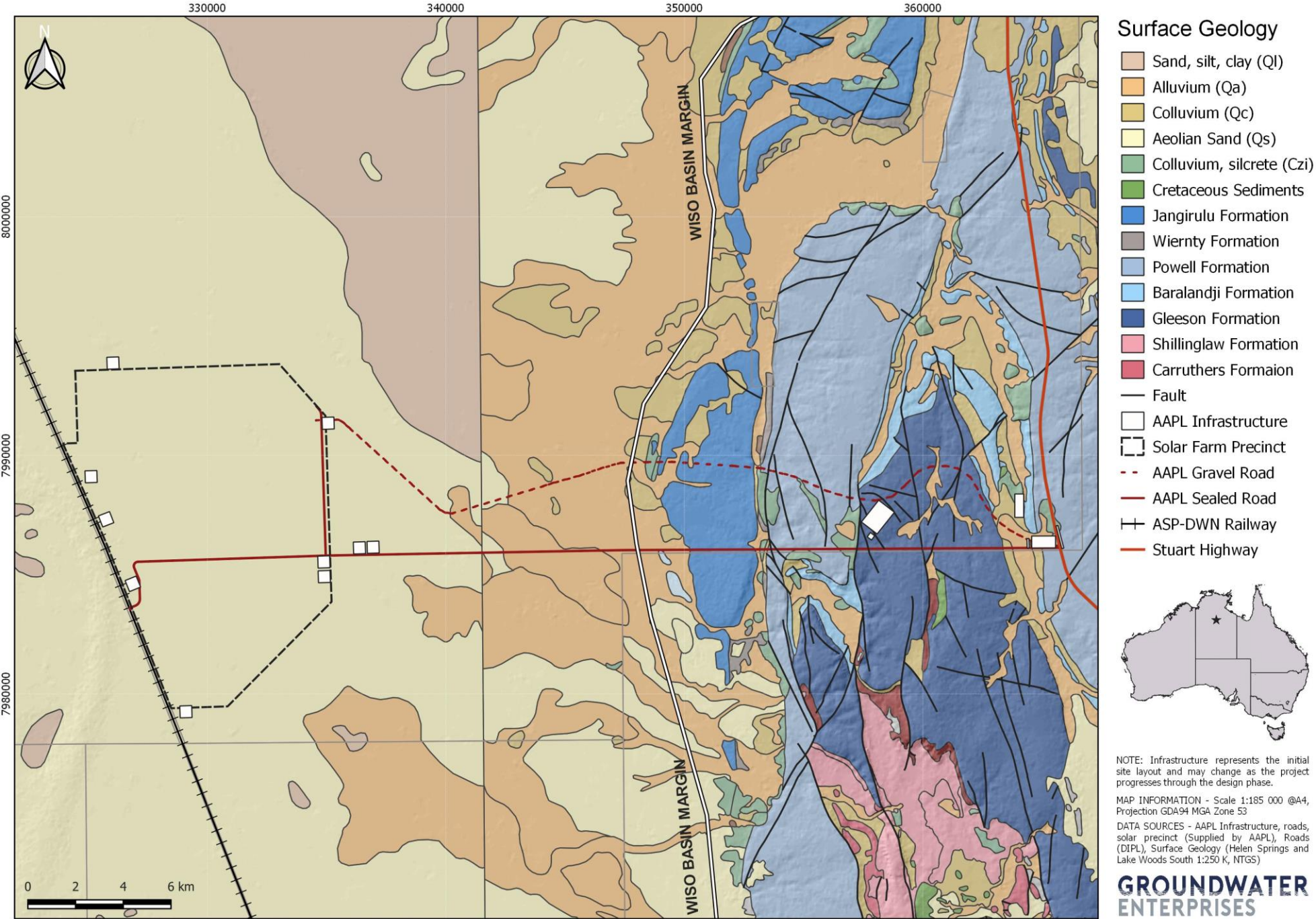
Cainozoic aged sediments outcrop in the western half of the study area and also along drainage lines within the Ashburton Ranges. These deposits are relatively thin (<10 m) and variously comprise of alluvial sands and clays, aeolian sand, colluvial sediments, clays and silts associated with Lake Woods, and products of in-situ chemical weathering: silcrete, laterite and ferricrete.

A summary of the stratigraphic sequence around the Project area is provided in Table 1. The mapped surface geology based on the Helen Springs and Lake Wood South 1:250 000 scale geology maps is presented in Figure 2.

Table 1 Stratigraphic table of geology in the vicinity of the Solar Precinct (after Kruse and Munson, 2013; Hussey et al, 2001; Kennewell, 1977)

AGE	GEOLOGICAL REGION	FORMATION	THICKNESS (m)	LITHOLOGY
Cainozoic		Czi, Czk,	-	Silcrete, calcrete
		Czc – Colluvium	-	Conglomerate, sandstone, siltstone
		Ql – Lake deposits	<10	Claypans, sand, silt, clay
		Qa – Alluvium	<10	Sand, silt, clay and gravel
		Qc – Colluvium	<10	Cobbles, sand, silt and clay
		Qs - Aeolian sand	<8	Quartz sand, minor silt and clay
Cretaceous	Carpentaria Basin	Undifferentiated sediments	<52	Claystone, siltstone, basal quartz sandstone
Cambrian	Wiso Basin	Point Wakefield Beds	40	White to brown calcareous claystone, interbedded claystone and sandstone
		Lothari Hill Sandstone	90	Pale to red-brown quartz sandstone, minor claystone and dolostone
		Hooker Creek Formation	160	Maroon-green siltstone, minor limestone and sandstone
		Montejinni Limestone	151	Grey brown limestone and dolostone, siltstone, minor quartz sandstone.
	Kalkarindji Province	Helen Springs Volcanics	<37	Basalt
		Muckaty Sandstone Member	15	Grey-brown quartz sandstone
Proterozoic	Tomkinson Province (Namerinni Group)	Willeray Formation	70 – 400	Sandstone and siltstone
		Shillinglaw Formation	500 – 650	Dolostone and dolomitic mudstone
		Carruthers Formation	800 – 1100	Sandstone, siltstone, dolostone, chert
		Jeromah Formation	350 – 700	Sandstone, siltstone, mudstone
	Tomkinson Province (Renner Group)	Lake Wood Beds	200	Sandstone, siltstone, shale, dolostone
		Janglrulu Formation	400 - 700	Sandstone, pebble conglomerate
		Wiernty Formation	400 – 500	Micaceous sandstone, conglomerate, siltstone, shale, dolostone
		Powell Formation	300 – 820	Quartz sandstone, conglomerate, minor siltstone and mudstone
		Baralandji Formation	100 – 700	Micaceous siltstone and sandstone, glauconitic, conglomerate, shale
		Gleeson Formation	50 – 650	Sandstone, pebble conglomerate

Figure 2 Surface Geology



2 Hydrogeology

2.1 Groundwater Occurrence

The western half of the Project area, including the Solar Precinct, overlies the Wiso Basin which hosts a regional scale aquifer in the Montejinni Limestone. Water resources are limited in the east of the Project area where groundwater occurs in local scale aquifers within fractured and weathered Proterozoic basement rocks and fractured basalt of the Helen Springs Volcanics. More prospective aquifers in the Proterozoic basement are associated with dolostones in the Shillinglaw Formation and are mapped to the south of the main access road (Figure 3). Quaternary and Cretaceous sedimentary deposits are not considered to contain significant water resources due to limited saturated thickness and the discontinuous nature of the deposits.

A summary of the main aquifer units in the vicinity of the Solar Precinct is provided in Table 2.

Table 2 Hydrostratigraphy of the Project area

Aquifer	Host Unit/s	Aquifer Scale and Type	Indicative Bore Yield (L/s)^	Occurrence
Wiso Basin	Montejinni Limestone	REGIONAL Fractured and karstic	5 – 15	Western half of the Project area becomes more productive away from the basin margin where there is greater saturated thickness.
Helen Springs Volcanics	Helen Springs Volcanics Muckaty Sandstone Member	LOCAL Fractured and Weathered	0 – 2.5	Western half of the study area beneath alluvial cover and Wiso Basin sediments. Presence of basal Muckaty Sandstone Member is not known.
Fractured Basement Aquifers	Shillinglaw Formation	INTERMEDIATE Fractured and karstic	0.5 – 5	Discrete aquifer on Helen Springs Station, mapped to the south of the proposed accommodation village.
Fractured Basement Aquifers	- Willeray Formation - Carruthers Formation - Jeromah Formation - Lake Wood Beds - Janglrulu Formation - Wiernty Formation - Powell Formation - Baralandji Formation - Gleeson Formation	LOCAL Fractured and weathered	0.05 – 0.5	Principal aquifer type in the eastern half of the Project area. Also occurs at depth in the west of the site beneath the Wiso Basin sequence and the Helen Springs Volcanics.

[^]Source: Modified using local data after NT Aquifer Map (Tickell, 2013) and Helen Springs 1:250 Hydrogeology Map (Verma and Jolly, 2002)

2.1.1 Montejinni Limestone

Groundwater in the Wiso Basin is primarily hosted in the Montejinni Limestone aquifer within the Project area. Along with correlative units in the Georgina Basin (Gum Ridge Formation) and the Daly Basin (Tindall Limestone), the Montejinni Limestone forms a regional scale aquifer system, the Cambrian Limestone Aquifer (CLA), which hosts a major groundwater resource in the Northern Territory.

The Montejinni Limestone comprises a sequence of grey-brown dolomite, limestone and calcareous siltstone with a maximum recorded thickness of 151 m (Kruse and Munson, 2013). Mineral drilling to the north of the Project area suggests a local formation thickness ranging from 18 to 132 m (Vale, 2010; Vale, 2011). Bore yields in the Montejinni Limestone aquifer are variable as they depend on drill holes intersecting fracture zones and solution cavities within the limestone/dolostone. Regional aquifer mapping (Tickell, 2013; Jolly and Verma, 2002) report an indicative bore yield range for the Montejinni Limestone of between 5 and 15 L/s. However, larger yields are feasible if large cavities are intersected. An example of this occurs at the historic Warrego mine north-west of Tennant Creek where a borefield established in the Montejinni Limestone reported individual pumping rates of up to 39 L/s (Ride, 1972). At a local scale, 16 bores have been drilled into the Montejinni Limestone within a 20 km radius of the Solar Precinct with reported bore yields of 0 - 6 L/s (average 3 L/s). The observed bore yields are notably lower than the mapped range in Tickell, 2013 and Jolly and Verma, 2002. This is a function of the limited number of bores drilled in the area and also the low water requirement for existing bores which are largely used for stock watering. Higher yields within the observed bores are more consistently recorded away from the Wiso Basin margin to the west of the Solar Precinct where the saturated thickness of the aquifer is greater (Figure 3).

Aquifer transmissivity (T) in the Montejinni Limestone ranges from 8 – 8,230 m²/day based on 19 pumping tests completed throughout the Wiso Basin (see Appendix A for further detail). The closest test to the Project area is from bore RN030505, located 15 km north-north-west of the Solar Precinct, which has an estimated T of 4,340 m²/day. Existing pumping test data are largely single bore tests and consequently estimates of storativity are not available for the Montejinni Limestone. The specific yield of the formation is likely to vary from 0.01 to 0.06, the reported range for the CLA in the Daly Basin and Georgina Basin where more hydraulic data is available (Knapton, 2020). A regional scale numerical model of the CLA (Knapton, 2020) that covers the Project area adopts an average specific yield of 0.04.

The depth to groundwater in the Montejinni Limestone ranges from 34 - 44 m below ground level (mBGL) in the vicinity of the Solar Precinct. Locally, there is limited information to constrain groundwater flow directions. Groundwater is assumed to flow to the west and north-west in line the regional flow direction in the CLA (Knapton, 2020; Randal, 1969).

2.1.2 Helen Springs Volcanics

The Helen Springs Volcanics form a continuous base to the Wiso Basin across the Project area. Thicker sequences of the massive basalt flows have negligible primary porosity and the Helen Springs Volcanics, with their analogue the Antrim Plateau Volcanics, form a regional basement to the overlying Wiso groundwater basin (Tickell, 2005, Yin Foo and Matthews, 2001).

At a local scale the Helen Springs can form a viable aquifer and the basalt provides a water supply for stock bores and domestic use on Helen Springs Station and Banka Banka Station south-east of the Project area. Aquifer development is commonly dependent on enhanced secondary porosity derived from fault related fracturing (Yin Foo and Matthews, 2001). Groundwater intersections have also been recorded in the Muckaty Sandstone unit at the base of volcanic sequence (Randal, 1969).

The Helen Springs Volcanics have a mapped yield range of 0.5 - 5 L/ (Tickell, 2013; Jolly and Verma, 2002). More productive aquifers in the volcanics occur south-east of the Project area where the formation overlies the Proterozoic basement. The Helen Springs Volcanics are not considered to host major aquifers along the eastern margin of the Wiso Basin where they overlie Montejinni Limestone (Verma and Jolly, 1992). In light of this and on the basis of local drilling results the mapped yield range for the Helen Springs Volcanics has been revised down to 0 - 2.5 L/ (Figure 3).

In the vicinity of the Project area 12 groundwater bores have been drilled into the Helen Springs Volcanics with a yield range of 0 - 1.8 L/s (average of 0.6 L/s). Five bores intersected groundwater seepage or were dry and only 25% of bores produced yields greater than 1 L/s. The reported water level in bores constructed in the Helen Springs Volcanics ranges from 42 - 80 mBGL.

2.1.3 Proterozoic Basement Aquifers

LOCAL SCALE FRACTURED ROCK AQUIFERS

Local scale aquifers occur in the east of the Project area within fractured and weathered rocks of the Renner Group and siliciclastic units of the Namerinni Group. Aquifers consist of consolidated quartz sandstone, calcareous siltstone, siliceous siltstone, chert, conglomerate and dolerite sills. Typically, these formations have a very low permeability with poor groundwater potential (Sanders, 1989). Verma and Jolly (1992) report low yields of 0.1 – 0.5 l/s within the basement aquifers unless fracture zones, coarse sandstone or carbonaceous lithologies are encountered.

Within a 20 km radius of the Project area 21 bores have been drilled into the Proterozoic basement with a yield range of 0 – 5.3 L/s (average yield of 1.3 L/s). Drilling in the basement has a low success rate with only 50% of bores reporting yields over 1 L/s and 33% of bores failing to intersect groundwater. Pumping test results report a T range of 1.7 – 32 m²/day for the fractured basement aquifers (Sanders, 1989; Sanders, 1991). No storativity or specific yield estimates are available for the basement aquifers.

Groundwater levels show a large variation ranging from 1.5 – 69 mBGL. Shallow groundwater levels of less than 5 m are reported at Gleeson Springs, 5 km north of the Project access road, and the Powell Creek Telegraph Station, 10 km north of the access road. Shallow groundwater levels are consistent with inferred springs mapped along drainage lines at these locations (Suncable, 2022).

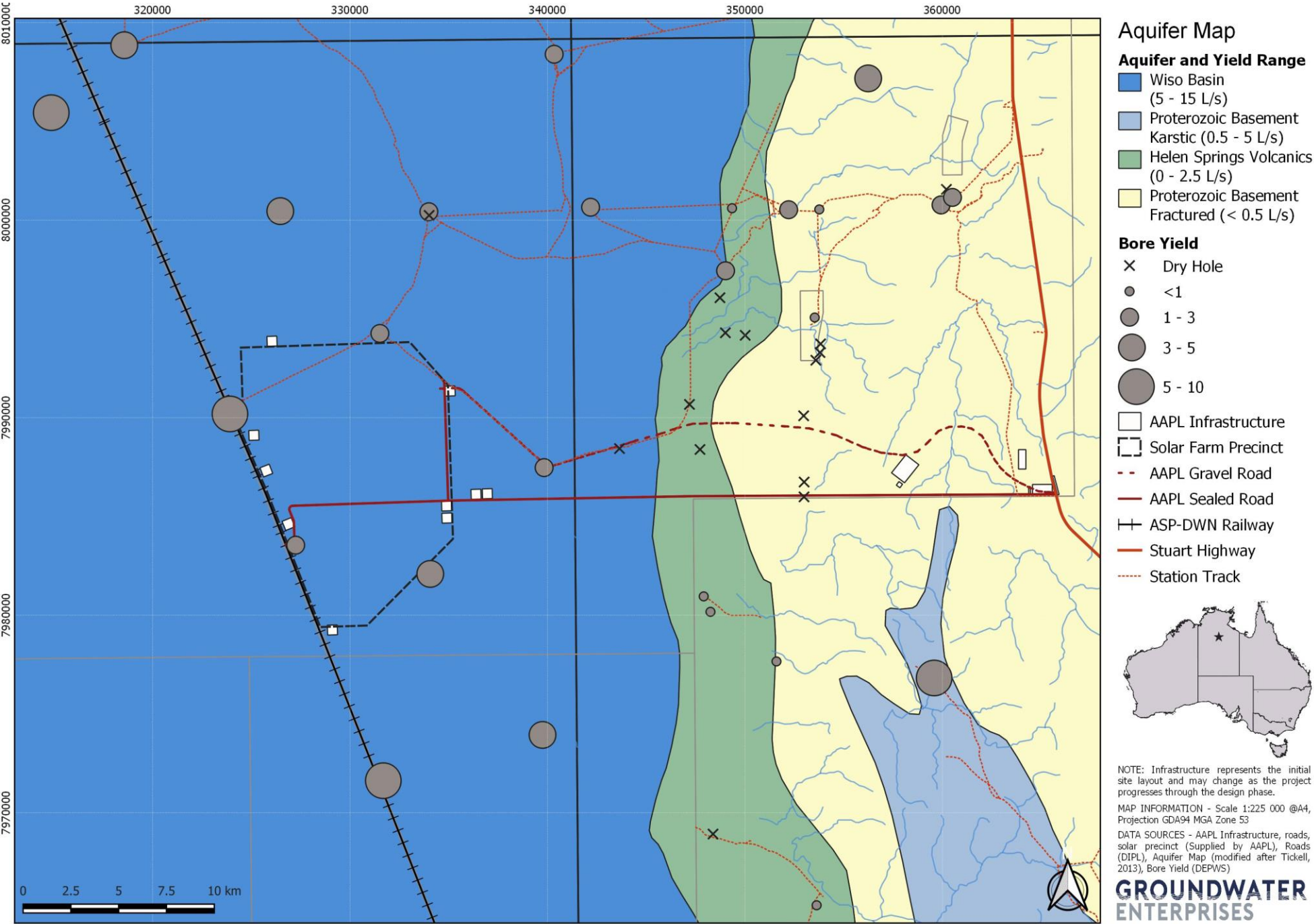
INTERMEDIATE SCALE KARSTIC AQUIFER

An intermediate scale aquifer in dolostone is mapped south of the Solar Precinct access road in the east of the Project area. Based on the surface geology (Hussey et al, 2001) the aquifer appears to be hosted by Carbonate dominated formations in the Namerinni Group, primarily the Shillinglaw Formation.

The closest bore constructed in the aquifer, RN025357, is located 9 km south of the main access road. RN025357 was drilled as a mineral investigation hole that intersected approximately 8 L/s in cavernous dolomite at a depth of 24 m. The depth to groundwater is reported at 11 mBGL.

There is very limited information available on the dolostone aquifer beyond the regional classification (Tickell, 2013) and the areal extent, hydraulic characteristics and groundwater flow dynamics of the aquifer are unknown.

Figure 3 Aquifer Map



2.2 Recharge

Regional groundwater studies (Verma and Jolly, 1992; Knapton, 2020) describe major recharge mechanisms to the CLA. These include direct recharge from the infiltration of rainfall to the watertable where the CLA outcrops or subcrops beneath porous surface cover, and indirect recharge where aquifers underly ephemeral drainage lines or surface water bodies/lakes. In the semi-arid climate indirect recharge mechanisms are generally considered the most significant processes, though these are both poorly understood and quantified in the south of the CLA (Knapton, 2020). The infiltration of surface water from Lake Woods, particularly during the monsoon season, likely represents the major recharge mechanism to the Wiso Basin on Powell Creek and Newcastle Waters Stations (Verma and Jolly, 1992; de Caritat et al; 2019).

PREVIOUS ESTIMATES

Verma and Jolly (1992) calculated recharge to the Wiso Basin in the north-west of the Helen Springs area at approximately 6 mm/year. This first order approximation is based on the hydrograph fluctuation method using long term groundwater level monitoring data from Barrow Creek and Tennant Creek. Tickell and Brewer (2017) estimated recharge rates to the Gum Ridge Formation on the eastern flank of the Ashburton ranges adjacent to the Project area as between 1.9 - 8.0 mm/year using a Chloride Mass Balance (CMB) method. Crosbie and Rachakonda (2021) applied the CMB method constrained by surface water baseflow and remotely sensed evapotranspiration to provide catchment wide estimates of recharge for the CLA. Constrained mean recharge rates for the Wiso region were reported at 10 mm/year with 5th/95th percentile ranging from 6 - 19 mm/year respectively.

CHLORIDE MASS BALANCE

In order to better constrain recharge rates around the Solar Precinct, estimates have been made using the groundwater CMB method (see Healy, 2010 for further detail). The CMB method uses the chloride concentration in groundwater and an atmospheric chloride deposition rate to estimate recharge rates to the groundwater system. The CMB method calculates recharge according to the following equation:

$$Recharge = \frac{100D}{[Cl]_{gw}}$$

Where:

Recharge = recharge (mm/year)

D = the chloride deposition rate from rainfall (kg/ha/year)

[Cl]_{gw} = the chloride concentration of groundwater (mg/L)

The average chloride deposition rate around the Solar Precinct was assumed to be 2.05 kg/ha/year based on national mapping of chloride deposition (Davies and Crosbie, 2018). The groundwater chloride concentration in the Montejinni Limestone within a 10 km radius of the Solar Precinct ranges 17 – 74 mg/L based on bore records (DEPWS, 2022). The CMB method estimates a recharge rate of 2.8 – 12 mm/year to the Montejinni Limestone aquifer around the Solar Precinct, which is consistent with more regional estimates from previous studies (1.9 – 10 mm/year). This corresponds to an annualised recharge volume of between 420 – 1,440 ML over the Solar Precinct and between 11,600 – 39,800 ML across Powell Creek Station. It is noted that the CMB method does not quantify indirect recharge mechanisms, such as infiltration from Lake Woods, which is considered to be a significant process to the aquifer. There is also uncertainty in the CMB estimates due to assumptions about the accuracy of the chloride deposition rate.

2.3 Groundwater Storage and Resource Capacity

A preliminary estimate of the groundwater storage in the Montejinni Limestone beneath the Solar Precinct has been made by multiplying an assumed specific yield by the saturated aquifer thickness and the area of the Solar Precinct. This estimate assumes an average specific yield of 4% for the Montejinni Limestone, which is consistent with the value adopted by Department of Environment, Parks and Water Security (DEPWS) for licence assessments in the CLA aquifer (Short, 2020) and regional numerical models (Knapton, 2020). The Montejinni Limestone is assumed to have an aquifer thickness of 50 m based on local water bore data and mineral drilling logs (Vale, 2011). The footprint of the Solar Precinct is 120 km². The total aquifer storage in the Montejinni Limestone beneath the Solar Precinct is estimated to be in the order of 240 GL.

The Project area is located in the Daly Roper Beetaloo Water Control District but outside of a Water Allocation Plan (WAP) area. Under this scenario the regulator, DEPWS, assesses groundwater extraction applications on the basis of contingent allocation rules documented in the Northern Territory Water Allocation Planning Framework (NTWAP). The Arid Zone allocation rules apply to the Project area, whereby groundwater extraction must not result in any deleterious change in groundwater discharges to dependent ecosystems, and total extraction over a period of at least 100 years must not exceed 80% of the total aquifer storage at start of extraction.

The construction phase of the Solar Precinct is estimated to require 8.04 GL, which equates to 3.4% of the estimated groundwater storage (240 GL) in the Montejinni Limestone beneath the Solar Precinct.

2.4 Groundwater Quality

Selected groundwater quality data is available from 16 bores within a 10 km radius of the proposed Project infrastructure with reported data on physical chemistry, major ions, nitrate, fluoride and silica content. There is some uncertainty around this data as most samples were collected during airlift, however, they provide a general indication of groundwater quality beneath the Project area. The water quality data has been categorised into the source aquifer and is summarised in Table 3 along with guideline values, where applicable, for drinking water (NHMRC, NRMCC (2011)) and livestock water (ANZECC, ARMCANZ, (2000)). Domestic and stock watering represent the main beneficial uses of groundwater on Powell Creek and Helen Springs Stations.

Groundwater quality data is available for the Montejinni Limestone (Wiso Basin), the Helen Springs Volcanics and the fractured basement aquifers. The Project plans to target groundwater resources in the Montejinni Limestone to meet the construction water requirement. Groundwater from this aquifer has a neutral pH with a Ca-Mg-Na/HCO₃ type water and a relatively low Total Dissolved Solids (TDS). On the basis of TDS and Electrical conductivity (EC) groundwater is suitable for a range of uses including potable use and livestock watering. Concentrations are at or below guideline levels for all reported analytes with the exception of fluoride, iron and hardness. There is no information available on concentrations of dissolved metals and other trace elements in groundwater around the Project area.

Table 3 Groundwater quality and associated guideline values for various uses

Parameter	Unit	Guideline Values		Aquifer		
		Drinking Water ¹	Livestock ²	Montejinni Limestone	Helen Springs Volcanics	Fractured Basement Aquifers
pH	pH	6.5 - 8.5 [^]	-	7.8 – 8.2	7.4 – 8.4	6.1 – 8.1
EC	µs/cm	-	-	560 – 987	860 – 1370	118 – 2,320
TDS	mg/L	600 [^]	4,000	402 – 600	510 – 732	54 – 1,410
Sodium	mg/L	180 [^]	1,000	24 – 72	166 – 201	11 – 376
Potassium	mg/L	-	-	22 – 68	6 – 62	4 – 32
Calcium	mg/L	-	-	26 – 66	16 – 43	3 – 78
Magnesium	mg/L	-	-	37 – 52	2 – 26	4 – 62
Iron	mg/L	0.3 [^]	-	0.1 – 1.0	0.1 – 1.0	0.1 – 95
Hardness	mg/L	60 - 200 [^]	-	255 – 350	48 – 214	24 – 216
Alkalinity	mg/L	-	-	322 – 421	124 – 490	49 – 400
Silica	mg/L	80 [^]	-	32 – 67	13 – 40	1 – 28
Chloride	mg/L	250 [^]	-	17 – 74	30 – 287	7 – 427
Sulphate	mg/L	250 [^]	1,000	7 – 49	1 – 89	1 – 325
Nitrate	mg/L	50	400	1 – 14	1 – 4	1 – 10
Bicarbonate	mg/L	-	-	393 – 513	150 – 598	60 – 488
Fluoride	mg/L	1.5	2	0.5 – 1.9	0.2 – 1.7	0.1 – 1.2

1. NHMRC, NRMCC (2011)

2. ANZECC, ARMCANZ, (2000)

3. Aesthetic guideline value

3 Groundwater Receptors

3.1 Existing Groundwater Users

Registered groundwater bores within 10 km of the proposed Project infrastructure were identified using NRMaps (DEPWS, 2022), results are summarised in Table 4. There are 13 constructed bores identified within the Project area. Five bores are located within 500 m of Project infrastructure with the remaining bores located at a distance of over 5,000 m. The majority of bores are used to supply water for cattle grazing on Powell Creek Station and Helen Springs Station. Bore RN026497 is used for domestic water supply to the Jangirulu Outstation at Gleeson Springs and two bores (RN033264, RN033248) were drilled to supply water for the construction of the Alice Springs to Darwin railway line. The locations of the constructed bores are shown in Figure 4.

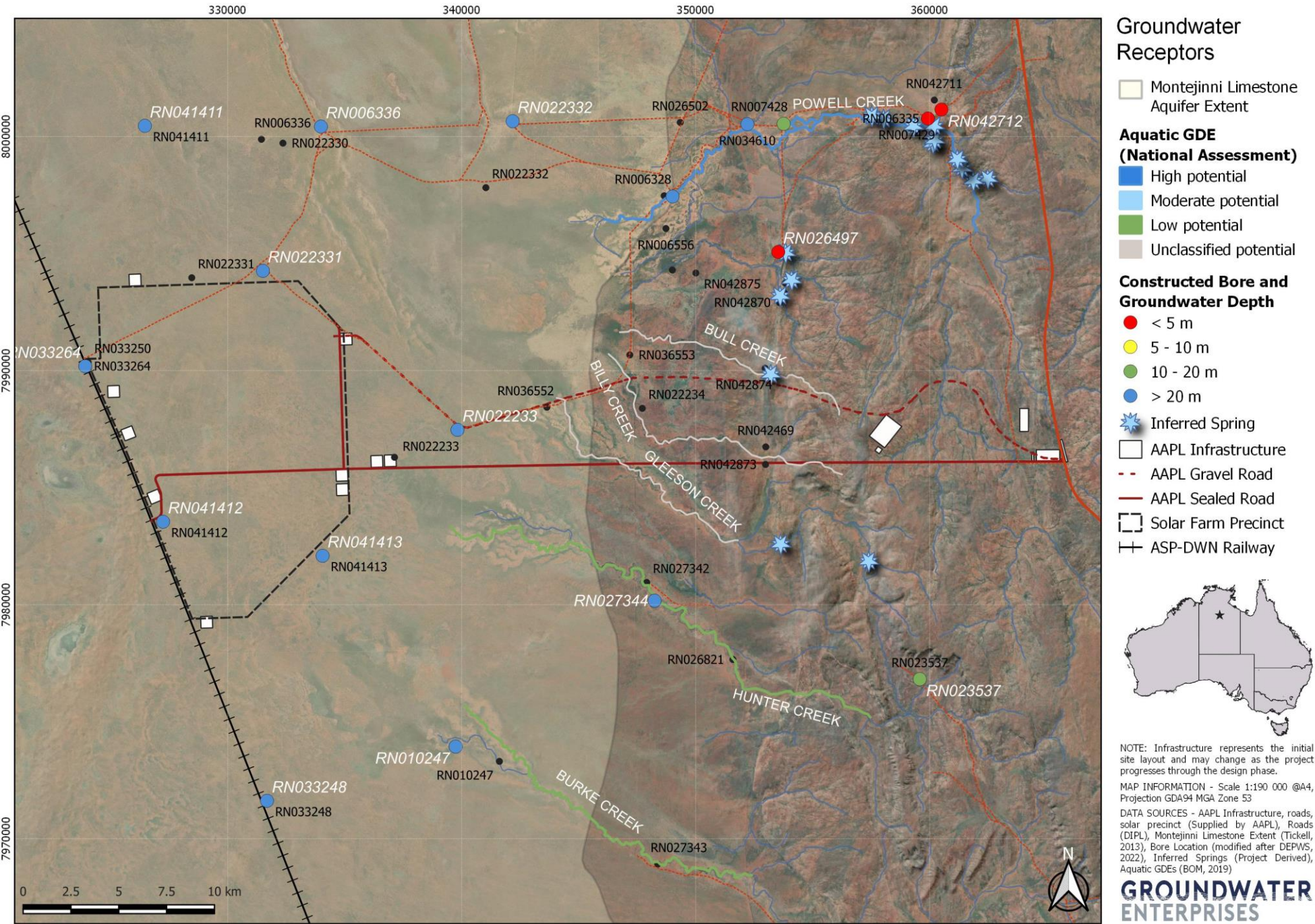
There is no licensed groundwater extraction in the vicinity of the Solar Precinct. The nearest groundwater extraction licence taking water from the Wiso Basin is located 85 km north of the Solar Precinct at Newcastle Waters where Power and Water Corporation (PWC) hold a licence of 100 ML/year for public water supply. PWC also hold a groundwater extraction licence for 300 ML/year in the Georgina Basin at Elliott, 50 km north-east of the Solar Precinct.

Table 4 Summary of constructed and registered bores within 10 km of Project infrastructure

Bore ID	Easting GDA94 Z53	Northing GDA94 Z53	Distance from Project Infrastructure (m)	Use	Comment
RN041412	327238	7983542	0	Stock watering	Powell Creek stock bore within Solar Precinct
RN033264	323910	7990185	150	Construction water supply	Bore drilled for ASP-DWN railway line construction
RN022233	339821^	7987467^	180	Stock watering	Powell Creek "Len Pascoe" stock bore
RN041413	334055	7982087	430	Stock watering	Powell Creek stock bore
RN022331	331503^	7994261^	500	Stock watering	Powell Creek "Thommo" stock bore
RN026497	353527	7995068	5,600	Water Supply	Supply bore for Jangirulu Outstation
RN027344	348247	7980168	5,850	Stock watering	Helen Springs "Hunter Creek" stock bore
RN041411	326458	8000454	6,350	Stock watering	Powell Creek stock bore
RN006336	333984^	8000423^	6,600	Stock watering	Powell Creek "Wally Grout" stock bore
RN022330	333984^	8000423^	6,600	Stock watering	Powell Creek "Wally Grout duplicate" stock bore
RN006328	349012	7997435	7,700	Stock watering	Powell Creek "Gleeson Springs Site L" stock bore
RN033248	331677	7971618	7,900	Construction water supply	Bore drilled for ASP-DWN railway line construction
RN023537	359576	7976818	9,200	Stock watering	Helen Springs stock bore

^Bore coordinates have been corrected using satellite imagery and topographic maps as the registered coordinates are incorrect.

Figure 4 Groundwater receptors



3.2 Environmental Receptors

Potential GDEs in the Project area have been identified using the GDE Atlas and field reconnaissance mapping with reference to depth to groundwater from existing bores.

The GDE Atlas is a national dataset developed by the Bureau of Meteorology (BOM, 2019) to assist groundwater management and planning. The GDE Atlas contains information about three types of ecosystems: aquatic, terrestrial and subterranean. Aquatic ecosystems rely on the surface expression of groundwater – this includes surface water ecosystems which may have a groundwater component, such as rivers, wetlands and springs. Terrestrial ecosystems rely on the subsurface presence of groundwater and include vegetation ecosystems such as forests and riparian vegetation. Subterranean ecosystems include cave and aquifer ecosystems. Information on terrestrial and subterranean ecosystems is not available in the GDE Atlas for the Project area.

Figure 4 maps the GDE potential from the GDE Atlas based on national scale assessment. A high potential for aquatic GDEs is mapped along Powell Creek, north of the Project area and a low potential along Hunter Creek and Burke Creek to the south. Billy Creek, Gleeson Creek and Bull Creek, located around the proposed access roads, are identified in the aquatic GDE layer but are unclassified. The presence of aquatic GDEs along the eastern extents of these drainage lines is consistent with the location of inferred springs identified during ecological surveys (see Sun Cable, 2022 for further detail). All springs identified in the field mapping occur in the Proterozoic basement rocks. Groundwater levels in the spring areas are shallow (<5 m) which supports the presence of potential terrestrial and aquatic GDEs in these areas. Permanent waterholes along Gleeson Creek, Powell Creek and nearby drainage lines are recorded by Randal (1969) who concludes they are sustained by groundwater discharge from jointed sandstone of the Tomkinson Beds (Proterozoic basement).

The GDE Atlas maps potential for aquatic GDEs where the drainage lines overlie the eastern margin of the Wiso Basin. However, the depth to groundwater in the Montejinni Limestone aquifer ranges from 34 - 44 mBGL in the Project area, which indicates it is unlikely the aquifer is supporting any GDEs.¹ Ecological surveys did not identify any springs in the western half of the Project area where the watertable aquifer occurs in the Montejinni Limestone.

Stygofauna (small aquatic invertebrate animals) are found in cave and aquifer ecosystems. Stygofauna are predominantly found in aquifers with large pore spaces, including alluvial, karstic and some fractured rock aquifers, generally at depths of less than 100 m (Hose et al, 2015). There are no published surveys of stygofauna in the Wiso Basin aquifers, however, the karst nature of the Montejinni Limestone suggests that their presence cannot be discounted in aquifers around the Solar Precinct.

¹ Aquatic GDEs require very shallow groundwater levels to support inflow into surface water features. Terrestrial GDEs, where groundwater supports vegetation, can be present where the watertable is deeper. Cook and Eamus (2018) found evidence of significant groundwater use in air zone areas with a watertable depth of 8-12 m and some evidence of groundwater use in vegetation at depths of 15 – 20 m. Groundwater is considered unlikely to support terrestrial GDEs at watertable depths exceeding 20 mBGL.

4 Project Water Requirement

The water requirement for the construction of the Solar Precinct is spread across nine consumption points, each with an individual demand profile for the projected six-year timeline (Figure 5). The peak daily demand (in kL) for each consumption point is summarised in Table 5 alongside the total requirement across the Project (in ML). The locations of the consumption points are shown in Figure 6.

The cumulative demand across all consumption points peaks at 5,585 kL/day toward the end of the first year of construction. The total water requirement for the construction phase is estimated at 8,040 ML. The annual water requirement peaks in the second year of construction at 1,860 ML.

In addition to the construction water requirement, the Solar Precinct will have an ongoing operational water requirement estimated at 11.4 ML/year. The ongoing demand meets a number of water requirements including the accommodation village for operations personnel, road maintenance, vehicle washdown and fire protection.

Figure 5 Preliminary demand profiles for consumption points

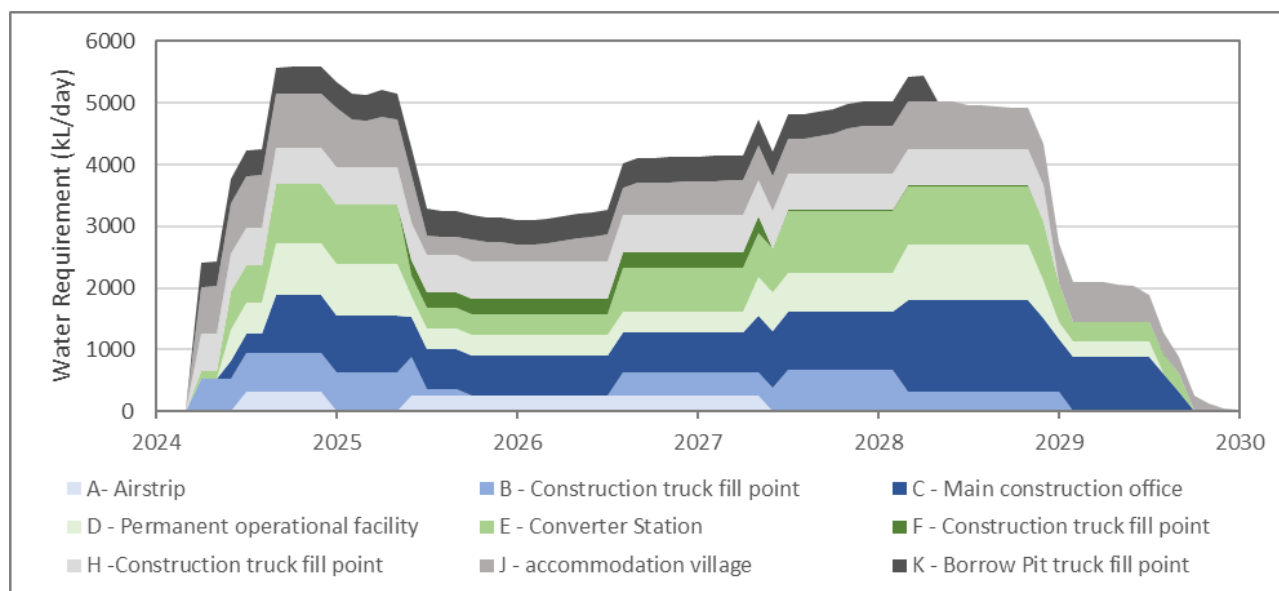
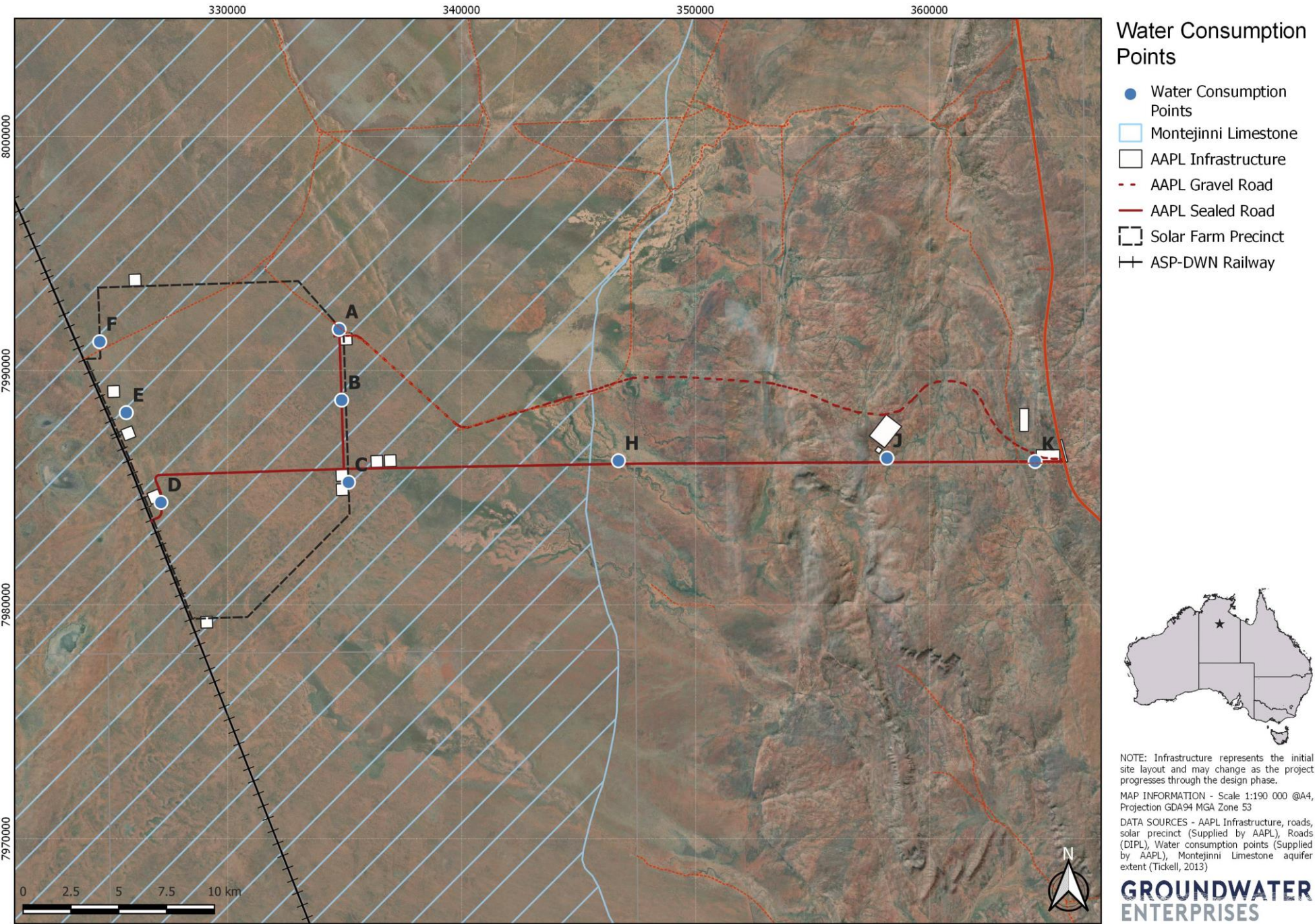


Table 5 Preliminary construction water requirements

Consumption Point	Description	Maximum Daily Demand Over Construction Period (kL/day)	Total Demand over Construction Period (ML)
A	Airstrip	325	252
B	Construction truck fill point	682	684
C	Main construction office	1,499	1,672
D	Permanent operational facility	888	1,018
E	Converter Station	1,016	1,341
F	Construction truck fill point	260	192
H	Access Rd construction truck fill point	600	1,040
J	Construction accommodation village	965	1,231
K	Borrow Pit truck fill point	425	608
Total water demand over construction period (ML)			8,038

Figure 6 Water Consumption Points



4.1 Recommended Groundwater Targets

The peak demand and the underlying aquifer at each consumption point is summarised in Table 6. Consumption points A - F are located in the Solar Precinct and overlie the Wiso Basin. Existing data suggests that bore yields in the Montejinni Limestone should be adequate to meet the construction water requirement at these locations. Consumption points H - K are located over fractured Proterozoic basement aquifers. These systems have limited supply potential and are unlikely to meet the projected demand at points H-K. It is recommended that water for these consumption points is piped from a borefield constructed in the Montejinni Limestone aquifer within the Solar Precinct.

The stated yield range for the Montejinni Limestone is based on regional information (Tickell, 2013, Verma and Jolly, 2002). Site investigation will be required to confirm the groundwater resources in this aquifer around the Solar Precinct, particularly at the consumption points with higher demand. Existing data suggests that groundwater availability is greater to the west of the Solar Precinct where there is greater saturated thickness in the Montejinni Limestone.

Table 6 Source aquifer at consumption points and recommended target aquifer for water supply

Consumption Point	Peak Water Requirement (L/s)	Aquifer at Consumption Point	Indicative Bore Yield (L/s)	Recommended Target Aquifer	Comment
A	3.8	Montejinni Limestone	5 – 15	Montejinni Limestone	
B	7.9	Montejinni Limestone	5 – 15	Montejinni Limestone	
C	17.3	Montejinni Limestone	5 – 15	Montejinni Limestone	Likely to require supply from multiple bores
D	10.3	Montejinni Limestone	5 – 15	Montejinni Limestone	
E	11.8	Montejinni Limestone	5 – 15	Montejinni Limestone	
F	3.0	Montejinni Limestone	5 – 15	Montejinni Limestone	
H	6.9	Fractured Basement	0.05 - 0.5	Montejinni Limestone	Supply recommended to be piped from a borefield in the Montejinni Limestone located near consumption point C.
J	11.2	Fractured Basement	0.05 - 0.5	Montejinni Limestone	
K	4.9	Fractured Basement	0.05 - 0.5	Montejinni Limestone	

4.2 Evaporative Losses from Surface Water Storages

The proposed infrastructure for the Solar Precinct accommodation village includes a 3 ML raw water pond required to ensure water supply security. The pond has nominal surface dimensions of 41 m x 41 m, a depth of 3 m and a base dimension of 23 m x 23 m. The surface area of the pond is calculated at 1,681 m².

Potential evaporative losses from the pond have been estimated using average daily pan evaporation rates sourced from SILO data drill (<https://www.longpaddock.qld.gov.au/silo>), a national scale database of climate records for Australia. The SILO data set has been used in preference to individual weather stations

because it provides a continuous rainfall and evaporation record. The SILO evaporation data has been sourced for the gridded coordinate -18.20 (Lat), 133.65 (Long), which approximates the proposed location of the accommodation village. Daily evaporation rates for this area range from 5 – 11.1 mm/day with an annual evaporation rate of 2,942 mm.

The evaporative loss from the surface water storage is estimated at 4.95 ML/year and 29.7 ML for the construction phase of the accommodation village, which runs for approximately six years. These estimates assume the storage is continually supplied with water to maintain a surface area of 1,681 m².

5 Drawdown and Impact Modelling

An analytical borefield model has been developed to investigate groundwater level drawdown resulting from groundwater extraction for the construction of the Solar Precinct. The model results are used to assess potential impacts on groundwater receptors around the Solar Precinct. As no environmental receptors have been identified in the Montejinni Limestone (Section 3.2) the assessment focuses on potential impacts to existing supply bores around the Solar Precinct.

5.1 Methodology

The drawdown modelling was undertaken using an analytical method based on conventional pumping test solutions (i.e. the Theis solution) using the pumping test analysis software Aqtesolv Pro (Hydrosolv, 2007). The Theis equation (Theis, 1935) is a solution for a confined aquifer that is applicable to unconfined aquifers by using the Jacobs correction. The solution estimates the water level drawdown around a pumping well/s using the pumping rate Q , transmissivity T and the storage coefficient S of the aquifer.

$$s = \frac{Q}{4\pi KD} \int_u^{\infty} \frac{e^{-y} dy}{y} = \frac{Q}{4\pi KD} W(u)$$
$$u = \frac{r^2 S}{4KDt}$$

Where:

s = the drawdown in m measured in a piezometer

r = the distance of a piezometer from the well in metres

Q = the constant well discharge in m^3/d

KD = the transmissivity (T) of the aquifer in m^2/d

S = the dimensionless storage coefficient of the aquifer

t = the time in days since pumping started

$W(u)$ = is the Theis well function and is approximated by:

$$W(u) = -0.5772 - \ln u + u - \frac{u^2}{2 \cdot 2!} + \frac{u^3}{3 \cdot 3!} - \frac{u^4}{4 \cdot 4!} + \dots$$

ASSUMPTIONS AND LIMITATIONS

Key inputs into the modelling include hydraulic parameters (T , S), pumping bore locations and pumping schedules/rates (involving Q and t). The modelling assumes a uniform value for T and S , which due to the absence of site-specific data is based on regional estimates for the Montejinni Limestone aquifer. The modelling assumes a variable pumping rate based on the monthly extraction totals provided for each water consumption point. The drawdown analysis does not consider the cumulative drawdown resulting from the operation of landholder bores because pumping rates and use profiles are unknown for these bores.

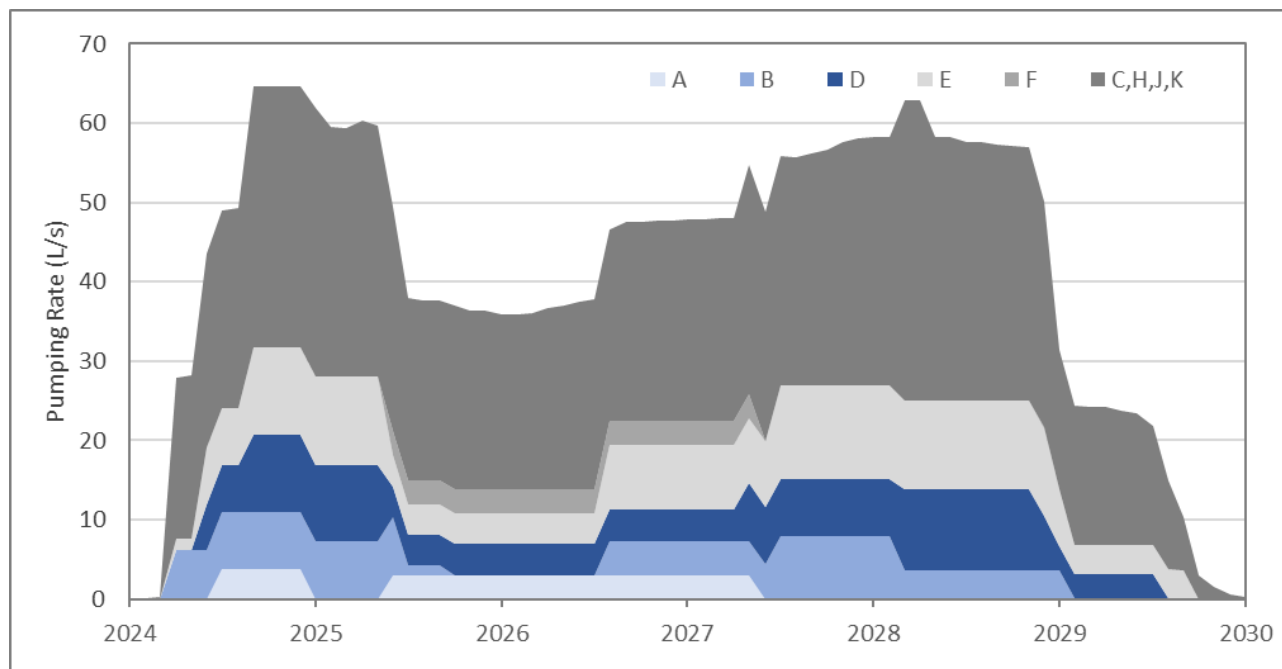
A key assumption in the Theis (1935) equation is that the aquifer has an infinite, areal extent. The Montejinni Limestone is a regional scale aquifer that is extensive to the south, west and north. The edge of the basin is located approximately 10 km to the east of the Solar Precinct (Figure 3). This boundary has been incorporated into the borefield modelling as a no-flow boundary with a simplified north-south geometry. Aqtesolv simulates no-flow boundaries using image well theory.

The available data and the modelling approach used to develop the borefield model is consistent with a Class 1 model using the classification presented by Barnett et al (2012). A Class 1 model is suitable for understanding groundwater flow processes under various hypothetical conditions and developing coarse relationships between groundwater extraction locations, pumping rates and associated impacts.

WATER REQUIREMENT AND PUMPING SCHEDULES

AA PowerLink provided a projected construction water requirement with a monthly time step for nine water consumption points around the Solar Precinct (see Section 4 for further detail). Groundwater resources in the Proterozoic basement aquifers around the eastern consumption points (H, J, K) are unlikely to support the demand at these locations. The modelling assumes that the demand for points H, J and K will be met by a borefield in the Montejinni Limestone located at consumption point C with water supplied to eastern consumption points via a pipeline. The modelled pumping schedule for consumption points A, B, D, E, F and the combined C, H, J, K points is shown in Figure 7. The full pumping schedules for each consumption point are tabulated in Appendix B.

Figure 7 Proposed pumping schedule to meet construction water requirements



HYDRAULIC PARAMETERS

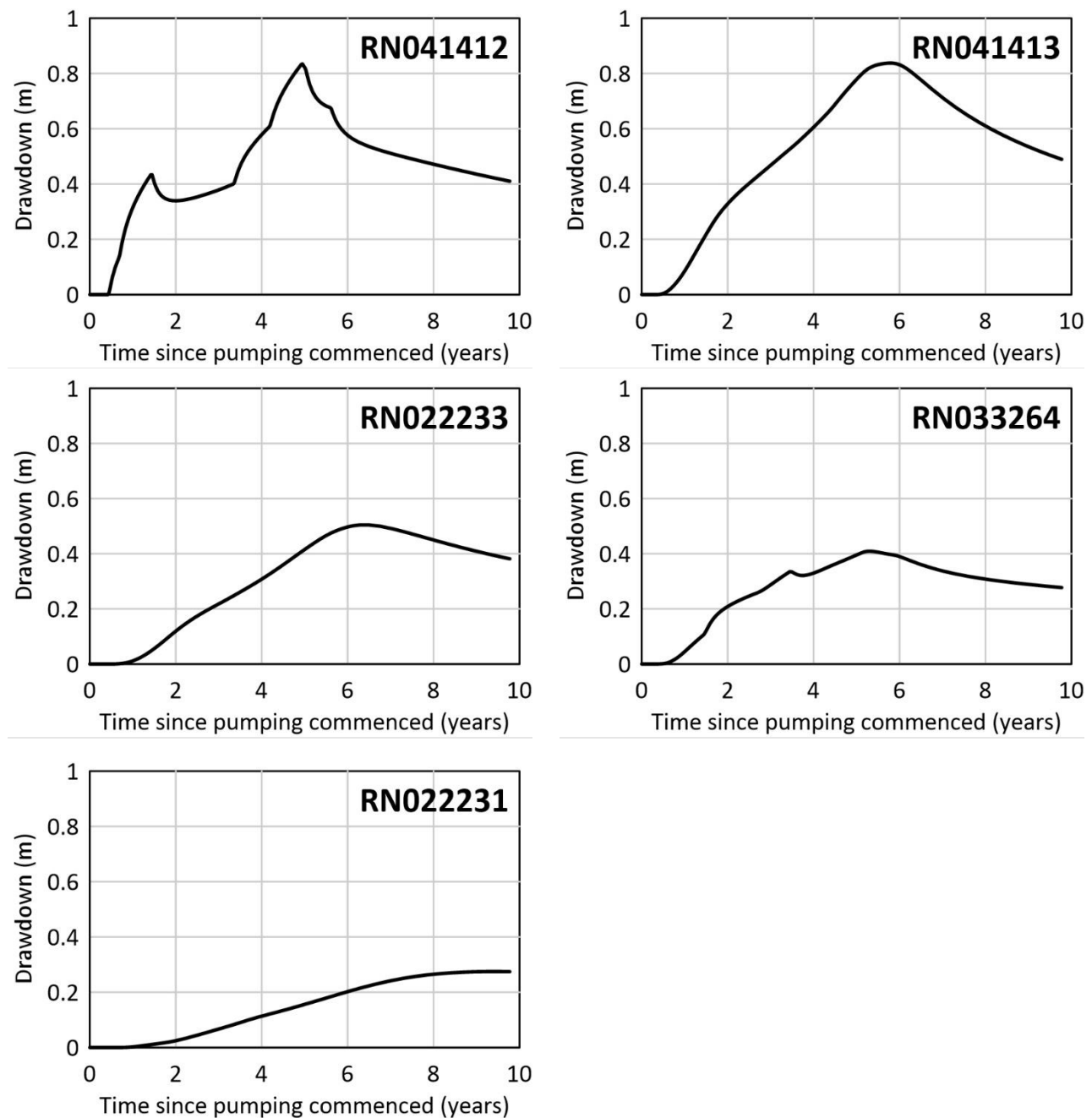
Transmissivity shows a large range in the Montejinni limestone from 8 – 8,230 m²/day across 21 pumping tests from the Wiso Basin (see Appendix A). The borefield modelling adopts the geometric mean of the data set, which has a value of 373 m²/day. The geometric mean provides a better mid-point of the range where there are outliers or the data set has log-normal distribution, which is the case for hydraulic conductivity and transmissivity (Neuman, 1982). The geometric mean is likely to represent a conservative estimate of transmissivity as the nearest estimate of T is 4,340 m²/day (RN030505) located 15 km north-west of the Solar Precinct. The borefield modelling adopts a specific yield of 0.04, which is consistent with the specific yield used the CLA in regional numerical models (Knapton, 2020) and groundwater licence assessments by DEPWS (Short, 2020).

5.2 Estimated Drawdown at Existing Bores

In assessing the extent of the drawdown and potential impacts from groundwater extraction at the Solar Precinct, this assessment adopts a drawdown of 0.25 m as the limit of influence. A drawdown of 0.25 m approximates the extent to which a water level response can be reliably quantified while allowing for standard errors in measurement methods and variations in atmospheric pressure.

Modelled drawdown curves show the predicted water level impact from pumping at the five closest bores to the Solar Precinct (Figure 8). Under the modelled scenario, the peak drawdown at these bore ranges from 0.27 m in RN022331 to 0.84 m in RN041413 (Table 7) with the maximum drawdown in most bores occurring between years four and six of construction.

Figure 8 Modelled drawdown curves at existing bores near the Solar Precinct



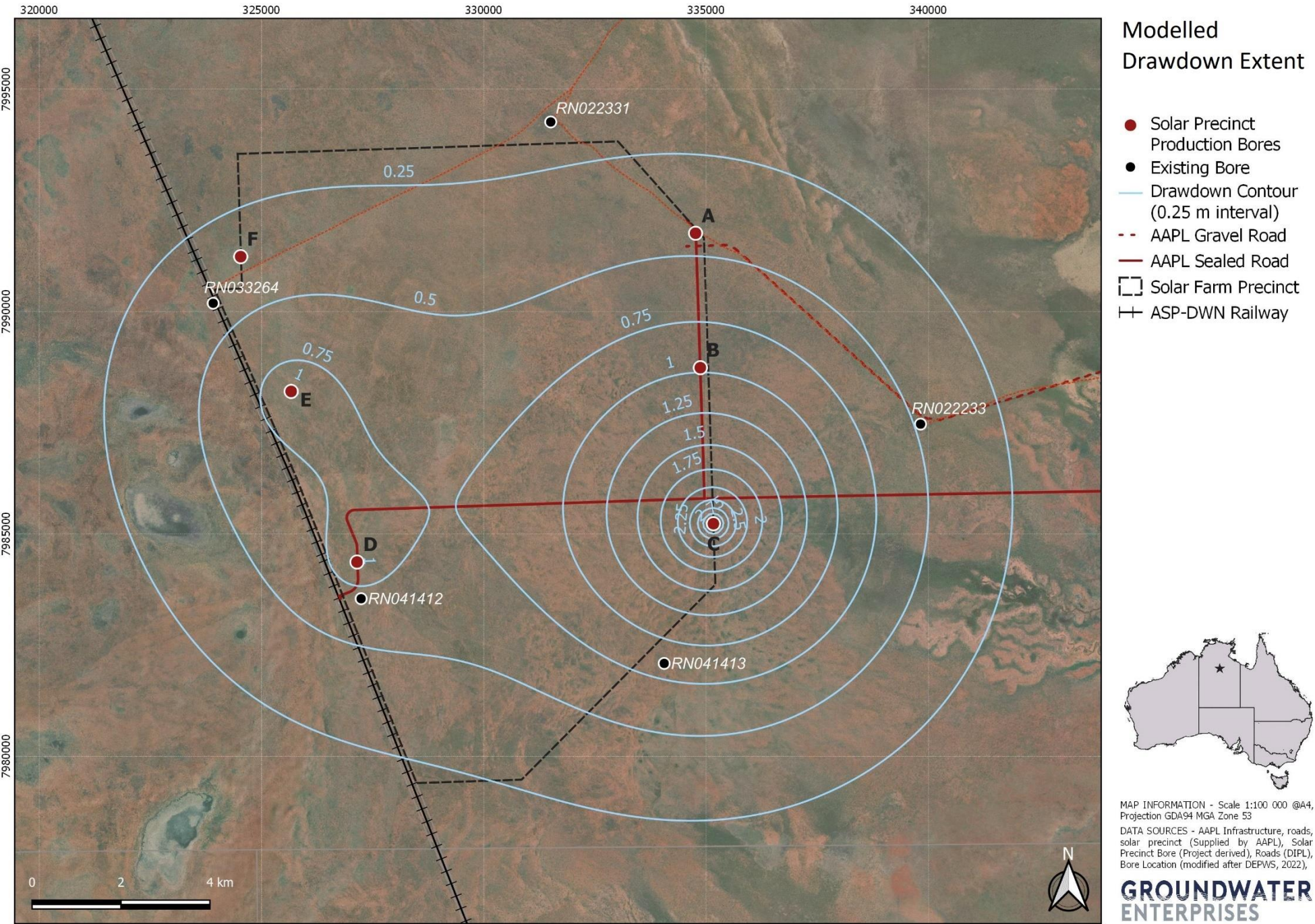
Assuming pumps are set immediately above the screened interval, the available drawdown in the existing bores ranges from 6 – 51 m. The estimated water level decline from the Solar Precinct pumping (0.27 – 0.84 m) represents between 0.5 – 14% of the available drawdown in the existing bores (Table 7). This suggests pumping for the Solar Precinct is unlikely to have a material effect on bore performance and groundwater availability in the existing production bores. Of the five existing bores located within 500 m of the Solar Precinct infrastructure stock bore RN041412 is the most vulnerable to drawdown impacts from the Project pumping. This is due RN041412 being in close proximity to the proposed pumping bore at consumption point D and the limited drawdown available.

Table 7 Existing bore construction, available drawdown and modelled impact

Bore ID	Top of Screened Interval (mBGL)	Water Level Depth (mBGL)	Available Drawdown (m)	Modelled Water Level Impacts from Solar Precinct (m)	Modelled Impact as % of Available Drawdown
RN022233	78	42	36	0.5	1.4%
RN022331	99	48	51	0.27	0.5%
RN033264	57.8	43	14	0.41	2.9%
RN041412	48	42	6	0.83	14%
RN041413	48	34	14	0.84	6%

The spatial extent of the modelled drawdown towards the end of 2029 or year five of construction is shown in Figure 9. This time approximates the peak drawdown around the closest bores to the Solar Precinct production bores. Figure 9 shows that the drawdown is predicted to be less than 1 m at the existing bores with drawdown concentrated around the production bore at point C,H,J,K, which has the highest extraction.

Figure 9 Modelled Drawdown Extent



5.3 Parameter Sensitivity

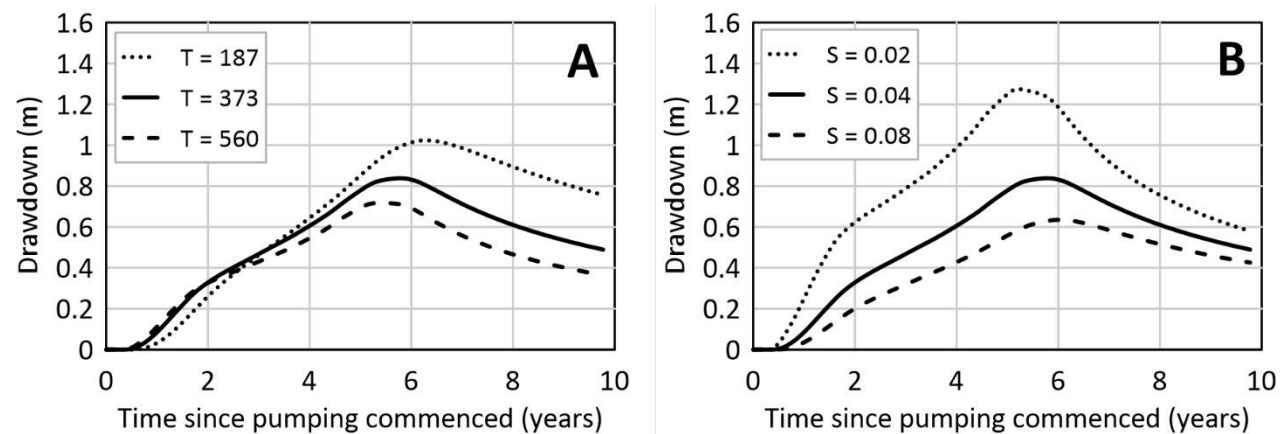
The hydraulic parameters represent a significant source of uncertainty to the drawdown predictions. To provide an assessment of this uncertainty additional model runs have been completed varying the transmissivity and storage parameters accordingly:

- ▼ Doubling the transmissivity ($T = 560 \text{ m}^2/\text{day}$);
- ▼ Halving the transmissivity ($T = 187 \text{ m}^2/\text{day}$);
- ▼ Doubling the specific yield ($S = 0.08$); and
- ▼ Halving the specific yield ($S = 0.02$).

The results for these runs are presented in Figure 10, using the drawdown at RN041413, which recorded the largest modelled drawdown, as the point of comparison.

The doubling/halving of the transmissivity results in approximately a 14 – 22% decrease/increase in the modelled drawdown at RN041413. The doubling/halving of the specific yield results in a 24 – 52% decrease/increase in the modelled drawdown at RN041413.

Figure 10 Modelled Drawdown in RN041413 under A) varying transmissivity and B) varying storage



6 Conclusions and Recommendations

This assessment makes the following conclusions on the availability of groundwater to support the Solar Precinct construction and the likelihood of impacts to groundwater receptors:

- ▼ The Solar Precinct and the western half of the Project area overlie the Wiso Basin, a regional scale aquifer system with an indicative bore yield range of 5 – 15 L/s. Groundwater resources hosted in the Montejinni Limestone aquifer have the potential to meet the construction water requirement of the Solar Precinct. Local data is limited and site investigations will be required to confirm groundwater availability within the Montejinni Limestone.
- ▼ The eastern half of the Project area overlies local scale aquifers in the Helen Springs Volcanics and the Proterozoic Basement. These aquifers have limited groundwater supply potential and are unlikely to support the construction water requirement in the east of the Project area. Demand at the eastern water consumption points should be met by piping water from the Montejinni Limestone in the vicinity of the Solar Precinct.
- ▼ There are 13 constructed bores identified within a 10 km radius of the proposed Project infrastructure with the majority of bores used to supply stock water on Helen Springs and Powell Creek Stations. Five constructed bores are located within 500 m of the Solar Precinct infrastructure with the remaining bores located at distances over 5 km. The location of existing bores requires field verification as the registered coordinates of some bores appear incorrect.
- ▼ Environmental receptors in the form of springs and permanent waterholes are mapped along several water courses in the east of the Project area. These GDEs are associated with groundwater discharge from the fractured basement aquifers. The depth to groundwater in the Montejinni Limestone aquifer ranges from 34 – 44 m below ground level (mBGL). No GDEs have been identified in the Montejinni Limestone and the aquifer is unlikely to support GDEs because the watertable depth exceeds 20 mBGL.
- ▼ Analytical borefield modelling estimates the drawdown impact on existing bores from the proposed Solar Precinct groundwater extraction will range from 0.27 to 0.84 m. This represents 0.5 – 14% of the available drawdown and suggests the Solar Precinct pumping will not have an appreciable impact on groundwater availability in the existing bores. Drawdown impacts on existing bores are subject to uncertainty from the assumed aquifer parameters and should be revised when site specific data has been collected. Drawdown impacts on environmental receptors are not expected as these occur in a separate aquifer system.

This assessment makes the following recommendations to better characterise the groundwater system and to improve the assessment and mitigation of potential impacts:

- ▼ Complete a bore audit to ground truth the location of existing bores around the Solar Precinct and to collect baseline groundwater data (groundwater levels, quality data).
- ▼ Undertake an investigation drilling program to confirm the availability of groundwater in the Montejinni Limestone aquifer. This should include completing pumping tests on selected test production bores to allow for the collection of site-specific aquifer parameters and reduce uncertainty in the drawdown impact modelling.
- ▼ Develop a groundwater management plan to monitor impacts from the proposed Solar Precinct production bore on neighbouring bores and the broader aquifer system.

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Appendix A Reported Transmissivity for the Montejinni Limestone

Table 8 Transmissivity estimates from pumping tests for the Montejinni Limestone aquifer

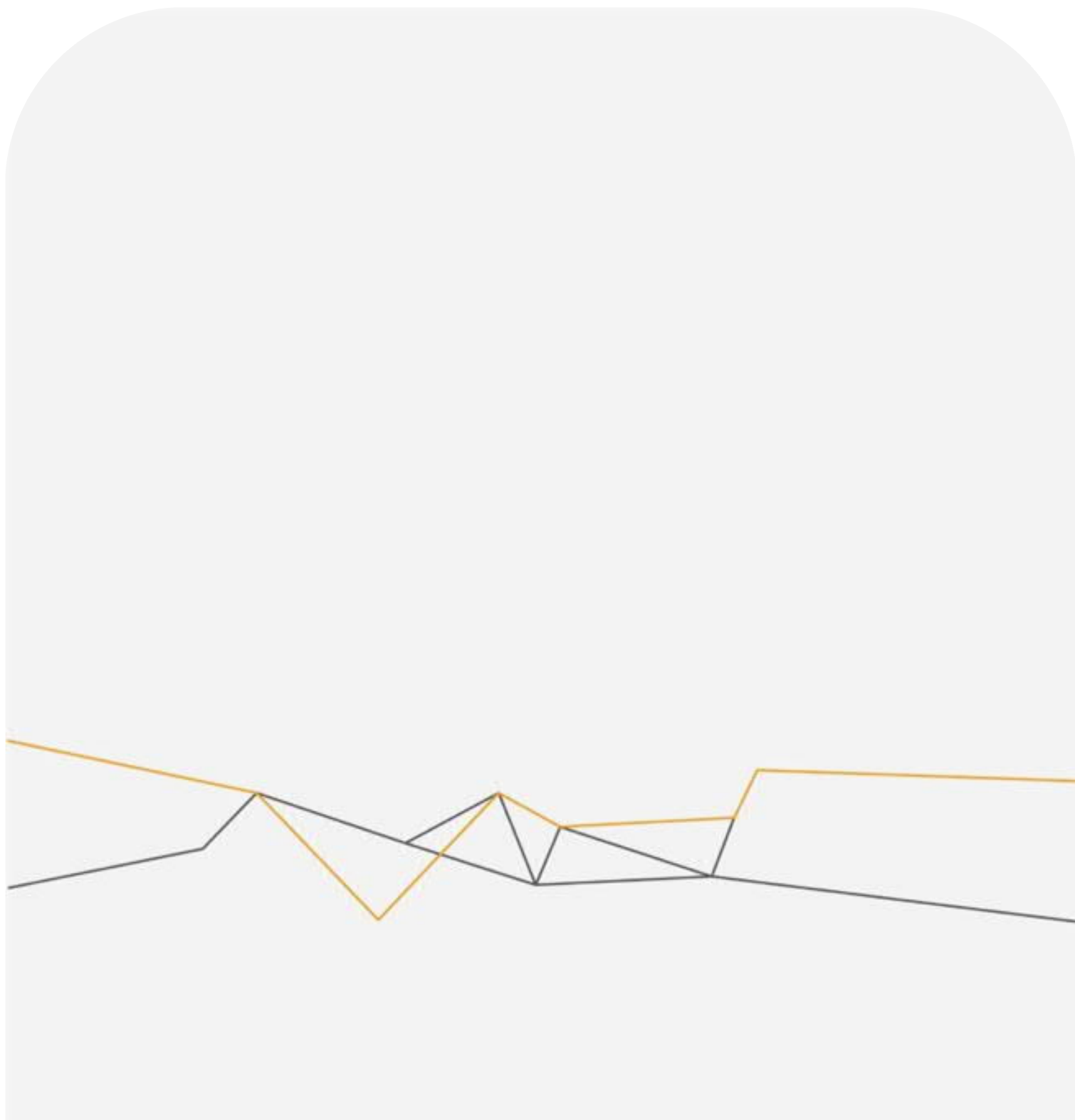
Test Bore	Test Rates (L/s)	Estimated Transmissivity (m ² /day)	Source
RN022232	4, 5, 6	7,900	Statement of Bore
RN024445	0.6, 1.5, 3, 6	27.8	Statement of Bore
RN024815	2.2, 2.8, 3.3, 3.7	25	Statement of Bore
RN024816	3.2, 4.8, 6.8, 8	70	Statement of Bore
RN024817	3.7, 4.7, 6, 8	209	Statement of Bore
RN030656	2, 4, 6, 12, 14	2,942	Statement of Bore
RN030656	14	7,393	Statement of Bore
RN030856	0.2, 0.4	7.9	Statement of Bore
RN030871	1.4	92	Statement of Bore
RN030986	0.5, 1.5, 3	271	Statement of Bore
RN030987		2,370	Statement of Bore
RN030988	0.3, 0.6, 1.0, 2.0	13.5	Statement of Bore
RN030989	0.4, 0.8, 1.6	414	Statement of Bore
RN031108	5, 10, 15	2,728	Statement of Bore
RN031963	0.5, 1.1, 1.7, 2.3	250	Statement of Bore
RN032464	0.1, 0.25, 0.5	56.4	Statement of Bore
RN030505	1.5 - 2.8	4,344	Re-analysed using data from Mathews, 2001
RN007136	38.9	8,230	Re-analysed using data from Ride, 1970
RN007136	38.9	2,500	Re-analysed using data from Ride, 1970
RN006859	7.58	890	Re-analysed using data from Ride, 1970
RN007135	7.58	3,870	Re-analysed using data from Ride, 1970

Appendix B Construction Water Requirement Data

Table 9 Construction Water Profiles

ELAPSED TIME (Days)	CONSUMPTION POINT WATER REQUIREMENT (L/s)					
	A	B	D	E	F	Combined D-H-J-K
0	0.0	0.0	0.0	0.0	0.0	0.1
31	0.0	0.0	0.0	0.0	0.0	0.2
62	0.0	0.0	0.0	0.0	0.0	0.3
92	0.0	6.1	0.0	1.4	0.0	20.4
123	0.0	6.1	0.0	1.4	0.0	20.6
153	0.0	6.1	5.8	7.2	0.0	24.4
184	3.8	7.3	5.8	7.2	0.0	25.0
215	3.8	7.3	5.8	7.2	0.0	25.2
243	3.8	7.3	9.7	11.1	0.0	32.8
274	3.8	7.3	9.7	11.1	0.0	32.8
304	3.8	7.3	9.7	11.1	0.0	32.8
335	3.8	7.3	9.7	11.1	0.0	32.9
365	0.0	7.3	9.7	11.1	0.0	33.8
396	0.0	7.3	9.7	11.1	0.0	31.6
427	0.0	7.3	9.7	11.1	0.0	31.4
457	0.0	7.3	9.7	11.1	0.0	32.3
488	0.0	7.3	9.7	11.1	0.0	31.7
518	3.0	7.3	3.9	3.9	3.0	28.3
549	3.0	1.2	3.9	3.9	3.0	23.0
580	3.0	1.2	3.9	3.9	3.0	22.6
608	3.0	1.2	3.9	3.9	3.0	22.6
639	3.0	0.0	3.9	3.9	3.0	23.1
669	3.0	0.0	3.9	3.9	3.0	22.5
700	3.0	0.0	3.9	3.9	3.0	22.6
730	3.0	0.0	3.9	3.9	3.0	22.0
761	3.0	0.0	3.9	3.9	3.0	22.1
792	3.0	0.0	3.9	3.9	3.0	22.3
822	3.0	0.0	3.9	3.9	3.0	22.8
853	3.0	0.0	3.9	3.9	3.0	23.2
914	3.0	0.0	3.9	3.9	3.0	24.0
945	3.0	4.3	3.9	8.2	3.0	24.2
973	3.0	4.3	3.9	8.2	3.0	25.0
1004	3.0	4.3	3.9	8.2	3.0	25.0
1034	3.0	4.3	3.9	8.2	3.0	25.2
1065	3.0	4.3	3.9	8.2	3.0	25.3
1095	3.0	4.3	3.9	8.2	3.0	25.3
1126	3.0	4.3	3.9	8.2	3.0	25.4
1157	3.0	4.3	3.9	8.2	3.0	25.5
1187	3.0	4.3	3.9	8.2	3.0	25.6
1218	3.0	4.3	7.3	8.2	3.0	28.9
1248	0.0	4.3	7.3	8.2	0.0	28.9
1279	0.0	7.9	7.3	11.8	0.0	28.8

ELAPSED TIME (Days)	CONSUMPTION POINT WATER REQUIREMENT (L/s)					
	A	B	D	E	F	Combined D-H-J-K
1310	0.0	7.9	7.3	11.8	0.0	28.7
1339	0.0	7.9	7.3	11.8	0.0	29.2
1370	0.0	7.9	7.3	11.8	0.0	29.7
1400	0.0	7.9	7.3	11.8	0.0	30.7
1431	0.0	7.9	7.3	11.8	0.0	31.1
1461	0.0	7.9	7.3	11.8	0.0	31.2
1492	0.0	7.9	7.3	11.8	0.0	31.3
1523	0.0	3.6	10.3	11.1	0.0	37.9
1553	0.0	3.6	10.3	11.1	0.0	37.9
1584	0.0	3.6	10.3	11.1	0.0	33.3
1614	0.0	3.6	10.3	11.1	0.0	33.2
1645	0.0	3.6	10.3	11.1	0.0	32.6
1676	0.0	3.6	10.3	11.1	0.0	32.6
1704	0.0	3.6	10.3	11.1	0.0	32.2
1735	0.0	3.6	10.3	11.1	0.0	32.1
1765	0.0	3.6	10.3	11.1	0.0	32.0
1796	0.0	3.6	6.9	11.1	0.0	28.5
1826	0.0	3.6	3.0	7.2	0.0	17.5
1857	0.0	0.0	3.0	3.6	0.0	17.5
1888	0.0	0.0	3.0	3.6	0.0	17.4
1918	0.0	0.0	3.0	3.6	0.0	17.4
1949	0.0	0.0	3.0	3.6	0.0	17.0
1979	0.0	0.0	3.0	3.6	0.0	16.7
2010	0.0	0.0	3.0	3.6	0.0	15.0
2041	0.0	0.0	0.0	3.6	0.0	11.1
2069	0.0	0.0	0.0	3.6	0.0	6.7
2100	0.0	0.0	0.0	0.0	0.0	3.0
2130	0.0	0.0	0.0	0.0	0.0	1.5
2161	0.0	0.0	0.0	0.0	0.0	0.5
2191	0.0	0.0	0.0	0.0	0.0	0.2
2222	0.0	0.0	0.0	0.0	0.0	0.0



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