Appendix 3 Water Resource Assessment – Water Resources of the North Eastern Southern Basins (Arafura and Ride Consulting, August 2017)

Water Resources of the North Eastern Southern Basins

Arafura Resources Limited; August 2017

ABSTRACT

This technical water resource assessment report describes the results of water investigations and baseline water monitoring completed by Arafura Resources Ltd seeking a water supply for their proposed Nolans Rare Earth Project near Aileron, Northern Territory.

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Photos showing cleanout and development of Reaphook Paleochannel production bore RC 22 (PB1) The six production bores intersected high yielding aquifers with thick sequences of sand, gravel and to the west boulders in the deep paleochannels. Note the gravel being airlifted during cleanout of RC 12 (bottom left) and gravel in the bore drain of bore RC 19 (bottom right).

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Key Nolans Project Water Components

Project Life

Construction period	2 years
Operational period	41 years

Mine Site

Pit	open pit to be excavated to a maximum depth of about 270 m for the life-of mine case with surface area up to 140 ha
Slurry transfer pipe	single stage pumping slurry pipeline between the concentrator near the pit 1.2 km south to the processing plant between Old Albs stockwatering bore and the gas pipeline
Borefields	up to 4 borefields with multiple water production bores extracting mainly brackish quality groundwater from Reaphook Paleochannel aquifers. Groundwater pumped to centrally located water storage within the borefields then to water storages at a reverse osmosis plant for use in the processing plant, mine infrastructure construction and mine operations. One borefield with multiple water production bores extracting better quality groundwater (near potable) from low yielding Arunta Basement aquifers and adjacent Reaphook alluvial aquifers.
Mine Water Demand	total site raw water demand projected to be 2.7 GL/an: processing plant water 2,342 mega litres per year (ML/yr), potable water 50 ML/yr and water for beneficiation, up to 387 ML/yr
Sources of Water	dewatering pit during mining operations; up to five borefields in the NE Southern Basins and adjacent weathered and colluvial basement aquifers. Reuse water and possibly storm water some years
Workforce	
Construction	peak of 500 housed in a purpose-built camp
Operations	peak of 300 mining village east of the gas pipeline and the main processing plant

Key Southern Basins Groundwater Monitoring Components

Borefields	**Production bores**: recording pumping rate (L/sec); start and finish (minutes); yield: m^3/hr or L/hr or /day; EC and pH and Temperature: hourly; drawdown and recovery (WL, SWL, m); chemical water quality suite: annual or reduced if significant changes occur) Production bore observation bores: SWL (time, minutes and hours) Borefield monitoring bores: SWL (time: hours; chemical quality)
Resource	Resource monitoring bores: SWL and groundwater quality changes

1 Introduction

Arafura Resources Limited *(Arafura)* is planning to extract 2.7 GL/yr of mainly brackish groundwater from the NE Southern Basins (Eastern Whitcherry Basin) and associated aquifers for their proposed rare earth mine at Nolans, 10 km west of Aileron.

This report describes the water investigations which have been completed by *Arafura* in seeking a reliable supply of water for the planned 43 year life of this mine.

Arafura has completed extensive groundwater and surface water investigations and other studies in the region which are described in this report and form part of the Nolans Project 2016 Environmental Impact Statement assessments.

This report provides:

- detailed supplementary information on the results of the water investigations *Arafura* has completed in the region,
- an outline of the planned future development and management of the *Arafura* NE Southern Basins borefields,
- an outline of the planned expansion of the *Arafura* water monitoring programs in the region and
- an outline of planned *Arafura* future water investigations in the area.

Arafura originally planned to complete groundwater investigations in the south western Ti Tree Basin, seeking to obtain their brackish and potable water requirements from this source. They completed preliminary investigations of this area prior to completing an exploratory water drilling program 30 km south of their planned major ore treatment plant in a region where no previous successful water bores had been drilled i.e. within the NE Southern Basins, 40 km south of Nolans.

Nolans Bore

The *Arafura* mine site is located at the abandoned Nolans Stock Bore on Aileron Station, 12 km west of Aileron. Nolans Bore (RC # 62, RN 11769) obtained its water supply from the Rare Earth orebody aquifer. *Arafura* have drilled over 600 mineral exploration bores into and adjacent to this orebody.

Nolans Bore is located within the Ti Tree Basin Water Control District as declared under the NTG Water Act. It is located within the basement rock outcrop catchment area near Kerosene Camp Creek which is a tributary of the Woodforde River, both ephemeral arid zone creeks within the Wiso River Basin. The top of the catchment of Kerosene Camp Creek is 7.5 km to the south of Nolans, at a surface and groundwater catchment divide between the Wiso and Burt River Basins (Figures 8 & 13; Appendix K).

Nolans Bore failed due to corrosion of its casing and collapse of the bore. *Arafura* completed a minor groundwater investigation in basement rock to the southwest of Nolans Bore and constructed a replacement stock watering in a fracture zone aquifer on the banks of Kerosene Camp Creek (New Nolans Bore (RC # 63, RN18761)). It also constructed 2 monitoring bores in this area to monitor SWL changes and recharge characteristics of the fracture aquifer and a nearby calcrete aquifer from adjacent creek flows (RC # 64 and 65; RN 18760 and 18762).

Southern Basins

The Southern Basins, as described by *Arafura,* are a series of Cenozoic Basins and the structural Ngalia Basin (a Palaeozoic - Neoproterozoic Basin) between Aileron Roadhouse and Alice Springs.

These basins occur mainly west of the Stuart Highway and commence about the junction with the Tanami Road, 17 km north of Alice Springs.

The Cenozoic Southern Basins cover 35,350 km^2 north and north-west of Alice Springs and include the Whitcherry, Mount Wedge, Burt, Sixteen Mile and Lake Lewis Basins, see location maps, Figures 1 and 2. The eastern Whitcherry Basin overlies part of the eastern Ngalia Basin which in this area consists of a narrow synclinal structure of the basal Neoproterozoic Vaughan Springs Quartzite Formation.

NE Southern Basins

Arafura located a previously unknown major groundwater resource in the NE Southern Basins within and adjacent to a deep paleochannel overlying the Ngalia Basin syncline and Aileron Province basement rock. This paleochannel forms part of the eastern Whitcherry Basin and in this region occurs between the Reaphook Hills and the Yalyirimbi Range. *Arafura* completed groundwater investigations to assess the availability of groundwater from this paleochannel and its associated aquifers over a length of 40 km between Day Creek and the Hann Range. The Reaphook Paleochannel and its associated aquifers have a maximum width of around 20 km, though the main Paleochannel aquifer generally occurs over a width of less than 10 km (Figures 4, 5, 7 & 14; Appendix K).

The Whitcherry Basin is connected with the Northern Burt Basin on Aileron Station over a basement high at *Arafura* Investigation/Monitoring Bore (RC # 30; RN 18880). Shallow alluvial aquifers continue south of this basement high, some joining with the Burt Basin 15 km to the south on Amburla Station.

Basement rock outcrop north and south of the Hann Range (west of the Stuart Highway) provides a groundwater barrier between the Reaphook Paleochannel/Northern Burt Basin and the Ti Tree Basin to the east.

Arafura has constructed five (5) high-yielding investigation production bores in this mainly brackish groundwater aquifer system and one production bore in basement rock for near-potable groundwater (Figure 11; Appendix L). *Arafura* is planning to use up to six (6) of these production bores for construction of the mine infrastructure and initial operations. *Arafura* has also constructed fourteen (14) water level and groundwater quality monitoring bores in the Reaphook Paleochannel and associated aquifers. *Arafura* also monitors fifteen (15) bores owned by others within the NE Southern Basins extended study area. It commenced groundwater monitoring programs in the region in 2012.

The Margins

The NE Southern Basins join with the Ti Tree Basin south of the Hann Range east of the Stuart Highway at a groundwater and surface water divide described by *Arafura* as the Margins area.

The Margins area is generally an area of shallow basement rock; however there are narrow paleochannels linking the NE Burt Basin to the Southern Ti Tree Basin (Figure 2; Appendix K).

GHD has shown the Margins as a much larger area on the draft EIS maps. The Margin area on these maps cover the shallow bedrock areas of the southern Ti Tree Basin on Aileron Station and include that section of the Margins area adjacent to the groundwater divide where Arafura completed a substantial water drilling investigation.

There is also an extensive calcrete sheet over parts of the Margins area providing groundwater supplies to Aileron Station Stockwatering Bores.

There is a similar discontinuous sheet on the boundary of Aileron with Yambah Station which continues to the east on Amburla and Narwietooma Stations, south of basement rock outcrop at Injulkama Outstation and other basement rock outcrop to the west, prior to the ephemeral Lake Lewis playa.

Arafura completed an extensive groundwater investigation either side of the groundwater divide within the Margins Area and constructed 27 groundwater level monitoring bores along 6 transects. *Arafura* also monitors 6 other water bores in this area owned by others.

Northern & North Eastern Burt Basin

The NE Burt Basin includes the narrow paleochannels in the Margins area that continue through Arunta Basement rock into the southern Ti Tree Basin. The NE Burt Basin commences on the western side of the groundwater and surface water groundwater divides.

The groundwater divide between the two basins approximately coincides with the surface water catchment divide. The surface water and groundwater moves in opposite directions either side of the catchment divides. On the Ti Tree Basin side of the divide, water is generally moving to the north-east; on the Burt Basin side of the divide, it is moving to the south-west and south-south-west.

Aileron Station stockwatering bores, New Connors Bore, Old Fred's Bore and the Abandoned Max's Bore are within these paleochannels. Bardia Bore on the eastside of the Stuart Highway obtains its water from shallow calcrete aquifers within the NE Burt Basin. In addition to its Arafura Margins standing water level monitoring bores *Arafura* has been monitoring 5 bores in this area owned by others.

The Northern Burt Basin joins with the Whitcherry Basin at an east-west trending basement high on Aileron Station. This basement high occurs at *Arafur*a Monitoring bore RN 18880, 20 km north of the Amburla/Aileron Station Boundary. The western boundary of this alluvial basin is near the Napperby/Aileron Station boundary and runs north-south parallel to this station boundary. Its eastern boundary is the basement rock outcrop and shallow outcrop south of the Hann Range which separates the Northern Burt Basin from the NE Burt Basin.

AEM interpretation of the northern Burt basin indicates that its profile is quite rugged with areas of shallow basement "hills". There is a paleochannel outlet to the Burt Basin south of the Aileron/Amburla Station boundary. *Arafura* has a monitoring bore in this paleochannel on the Aileron/Amburla Station boundary (*Arafura* Bore RC # 10, bore site G4).

This small shallow paleochannel is located between Injulkama and the Yambah/Amburla Station Boundary, a distance of 17 km. At the Injulkama Aboriginal outstation, Arunta basement rock outcrops at the surface.

Burt Basin

The Burt Basin covers approximately 1,750 square kilometres and is a Cenozoic-aged basin directly connected to the Lake Lewis Basin. The Burt Basin is mainly filled with sandy clay which is predominantly clay. Aquifers tend to be low yielding, discontinuous and difficult to locate. Stock watering bores are spread across most of this basin at about 15 kilometre intervals but the success rates of these generally low yielding bores is about 1 out of 3. The best success rate is where there are solution cavities in shallow calcrete and the calcrete occurs below the water table.

Arunta Basement Rock

The basement rock of Central Australia underlies the structural basins (including the Amadeus and Ngalia Basins) and also the Cenozoic Basins (which include the Southern Basins and Ti Tree Basin). Large areas of Arunta Basement rock outcrop in Ranges, ridges and hills in the Alice Springs and Aileron Regions. This approximate 200 000 km^2 area of basement outcrop is called the Arunta Region.

The Arunta Basement Rock is a complex assembly of Proterozoic and Precambrian igneous and metasediments which, within the Arunta Region, is divided into three provinces. The Aileron Province Arunta basement rock underlies the NE Southern Basins, Ti Tree Basin and outcrop in the Yalyirimbi/Reynolds Ranges, the hills and valleys west of Aileron and at the Nolans mine site.

The 60 km Paleoproterozoic Yalyirimbi and Reynolds Ranges trend north-west and merge north of Old Albs Bore (RN 13647). *Arafura's* rare earth orebody at Nolans Bore is 7 km NNE of Old Albs Bore. The orebody occurs in the meta-igneous and metasedimentary rocks of the Aileron Province.

The Yalyirimbi Range is north of the northern shoulder of the east-west trending Ngalia Basin syncline and consists mainly of schist, gneiss, quartzite, granite and calc-silica rock.

The hills east of the Yalyirimbi/Reynolds Range to the Stuart Highway are usually called the Aileron Hills whereas the basement rock hills to the North East of Nolans are the Yundurbungu Hills and north west of Nolans (and north of the Reynolds Range) the Yaningidjara Hills. These hills of basement outcrop and shallow subcrop separate the Ti Tree Basin from the NE Southern Basins by more than 30 km in this location.

***Arafura* Nolans Mine Pit**

The Nolans pit is planned to a maximum depth of about 270 m in the life of the mine and at cessation of mining is expected to cover an area of about 140 ha.

A high-yielding aquifer with limited storage and recharge is associated with the orebody. The adjacent gneiss is expected to have a few localised fracture and weathered zone aquifers with very poor storage and recharge characteristics.

Arafura has completed a dewatering study of the orebody aquifer, drilling a series of investigation monitoring bores, completing a 7-day hydraulic pump test on a 250 mm cased production bore and slug tests on the monitoring bores. The constant rate test at 10 L/sec had to be reduced to 6 L/sec due to boundary conditions.

The main recharge to the orebody aquifer is from rare periodic short duration flows in the ephemeral Kerosene Camp Creek which currently flows over orebody aquifer intake beds on the western side of the planned pit. This creek is to be diverted south of the planned open pit, in a north westerly direction with the creek flowing into a major western tributary of this same creek system.

The pit will be bunded by *Arafura* to exclude stormwater flow from surface runoff around the pit. As mining proceeds, the pit and the adjacent basement rock aquifers will be dewatered and the water used for dust suppression and as process water. Rainwater will provide some occasional recharge to the pit; however evaporation rates in this area exceed rainfall by a 9 to 1 factor.

Alyuen ALT, Aileron Roadhouse and Aileron Station Homestead

At Aileron Roadhouse, Aileron Station Homestead and the northern half of the Alyuen Aboriginal Land Trust (ALT) property, only a few successful bores have historically been drilled in the Arunta Province basement rocks and all these bores are unreliable over dry and drought years. None of these bores intersect aquifers with water of a quality that meets Australian Drinking water guidelines.

A large number of unsuccessful bores has been drilled in this area. In the case of Alyuen community water supply, 13 unsuccessful bores were drilled at sites selected by a NTG geologist before successfully completing one production bore (Solar Bore) and this bore proved to be unreliable. Over many years the community was supplied with water trucked by tankers. Aileron Roadhouse and homestead obtained their water supply from a dam, unreliable bores, rainwater tanks and water tankers.

***Arafura* Water Resource Study Areas**

Arafura completed a series of desktop and field groundwater investigations in the Nolans Region and commenced groundwater monitoring programs in 2012.

They have also established 33 hydrographic stations in and around the Nolans site (4 in the Burt River Basin catchment near Old Albs Bore (RC # 78; RN 13647) and 29 in the Wiso River Basin Catchment. Other hydro stations are planned for Day Creek and on short creeks and sheet flow areas running off the Yalyirimbi Range and Aileron Hills.

There are many different *Arafura* Study Areas established for different water investigations and *Arafura* water assessment/development projects. Care is required when comparing results or reports to ensure that datasets are comparable or applicable.

The *Arafura* NE Southern Basins water study areas coved in this report are detailed in Appendix A which also lists a number of the detailed *Arafura* water study areas within the NE Southern Basins and adjacent region.

The *Arafura* Nolans Region, *GHD* numerical model covers a much larger area than the *Ride Consulting* and *Centreprise Resources Group* NE Southern Basins Study areas. There are excellent reasons why GHD are using the larger area for the numerical model. *Ride Consulting* have completed many water studies in the Nolans region, including those within the NE Southern Basins, with different levels of detail and assessment for the different areas studied. These study areas are defined in this report.

Another area of care when comparing datasets is the use of different names for the same area. This is partly a result of completing work in the area over many years with incremental knowledge being acquired in each area and partly the different objectives of the various studies.

For example, *GHD* identified quite different spatial areas in the Nolans EIS to those used by *Ride Consulting* in this report and other reports for The Margins Area. They also used different names e.g. Lake Lewis Basin for areas described by *Ride Consulting* as the Northern Burt Basin and the NE Burt Basin. Whilst this can be confusing, the major study areas are very large, the hydrogeology and hydrology complex when examined in detail at particular locations and many publications refer or map these areas from the data and interpretations that were available at the time of publication. *Arafura* has completed extensive desktop and field water investigations in this region over the past 5 years so it can be expected that they have more detailed knowledge of different locations within their study areas.

In completing the assessment of the Reaphook Paleochannel and associated aquifers, datasets from Ti Tree Basin assessments have been used since the NTG and GA have completed many major field investigations and water resource assessments over this basin over a 50-year period. There have been significant volumes of groundwater extracted from this basin over the past 30 years and the AG and NTG have completed extensive groundwater monitoring programs on the effect of extraction and recharge over this period.

In respect to the NE Southern Basins aquifers, *Arafura* has only limited steady state data over a limited period. There has yet to be any significant extraction from the *Arafura* NE Southern Basin's Borefields; the only groundwater extracted from the major aquifers in this area to date has been drilling and short-term pump testing.

The main aquifers in the Reaphook Paleochannel are deep, massive colluvial sand, gravel and small boulder beds which were sourced from nearby quartzite, granite and other hard rock. Similarly, some of the associated deep sand and sand and gravel aquifers which are connected to the Reaphook Paleochannel aquifers are also interpreted as colluvial in origin. The alluvial aquifers overlying the deep, high-yielding NE Southern Basin aquifers are not as thick as the "Ti Tree Aquifer" and have been extensively reworked.

Despite these differences, there are similarities which include that they are adjacent Cenozoic Basins with similar recharge modes.

The main differences appear to have been the presence of the Ngalia Basin syncline and its early topographic, geomorphological and structural history in this region, providing the fluvial mechanisms for massive movement of sand, gravel and boulders from weathered hard rock from adjacent weathering of mountains and ranges of quartzite and hard sandstone.

2 Hydrogeology

Arafura constructed eighteen (18) groundwater investigation bores into the NE Southern Basins on Aileron and Napperby Stations, mainly between the Reaphook Hills and Yalyirmbi Range, east of Day Creek and west of the Hann Range. These bores were mainly drilled into alluvial and colluvial sediments overlying the eastern sector of the Ngalia Sedimentary Basin, (Figures 3, 4, 6 & 14, Appendix K).

2.1 Previous Work

No Water Bores had previously been drilled within the main study area except for

- a stock bore east of Day Creek on Napperby Station (Supplejack Bores RN 1554, 16177)
- stock bores within the NE Burt Basin near the Stuart Highway: Old Fred's Bore RN 17893, New Connors Bore RN 17892
- unsuccessful Community Water Supply Bores and NTG Roads Maintenance Bores near the Stuart Highway, south of Connors Well Picnic Area
- Government groundwater investigation bores west of Day Creek, seeking a water supply for Laramba Community. Two Laramba Production bores were constructed in a silcrete calcrete aquifer located near Patty Well adjacent to a gap in the Reaphook Hills on Napperby Station.

Many uranium exploration bores were drilled on the western and southern fringes of the main study area. Within the shallow basement rock areas on Napperby and Aileron Stations, immediately south of the Yalyirimbi Range and the Aileron Hills, a few successful stock bores and many unsuccessful bores have been drilled into basement rock.

On Yambah, Amburla and Narwietooma Stations, to the south of Aileron, a series of successful stock bores was drilled into calcrete aquifers e.g. Mt Eclipse Bore RC # 192 (RN 12567).

Since 1966, the AG and NTG have completed a series of groundwater investigations in the Ti Tree Basin (see appendix D). Groundwater from the Ti Tree Basin is used for community water supplies, irrigation of crops and for stock water. Ti Tree Basin has a declared Water Control District (WCD) and is managed by the NTG according to policies set out in a Water Management Plan. The proposed *Arafura* Nolans mine is sited within the Ti Tree WCD within a small section of the basement rock Ti Tree Basin upper catchment area (Figure 15; Appendix K).

Arafura completed a major mineral exploration drilling program over the Nolans area and drilled over 1,600 mineral exploration bores into the basement rock of the area to define the Rare Earth orebody and its composition and grades. The orebody includes a good aquifer recharged mainly from a local ephemeral creek.

Arafura completed a hydrogeological investigation of this aquifer, including construction of a production bore, monitoring bores and pump testing. A description of this water investigation are provided in Appendix D; Arafura Nolan Region Groundwater Investigations Summary.

2.1.2 Government Laramba Water Supply Investigations Napperby Station

The AG's Water Resources Branch and later the NTG completed a series of groundwater investigations on Napperby Station between 1971 and 1981 to locate a water supply for Laramba Community (population now approx. 300).

In 1970 Water Resources Branch hydrogeologist Geologist Keith Knott successfully located the Laramba Aquifer and constructed and tested Laramba Production Bore # 1 (RC # 236 RN 13212). A standby Production bore was constructed nearby (Laramba Production Bore # 2 (RC # 297 RN 15890)). The bores are too close to be pumped simultaneously. The borefield is managed by the Power & Water Corporation. Water is pumped through a small diameter pipeline to the storage tanks in the Laramba Community, 34 km to the north. The community water demand has increased since the pipeline was constructed and it cannot now meet the peak water demand.

Laramba Aquifer

The Laramba Aquifer is a shallow, multiple-aquifer system overlying the northern shoulder of the Ngalia Basin basal formation which forms the adjacent Reaphook Hills, an eastern extension of the Stuart Bluff Range on Napperby Station.

The aquifer consists of colluvial sediments from weathering of the Reaphook Hills quartzite, alluvial sand and gravel beds from flows in Day Creek and associated drainage lines, calcrete and silcrete aquifers. It covers an estimated area of 36 square kilometres astride Day Creek and abutting the Reaphook Hills. There is a gap in the Reaphook Hills, 1 km west of Patty Well (RC # 110, RN 1555), through which Day Creek flows to occasionally discharge floodwater onto a floodout overlying shallow Arunta basement, 5 km to the south. During rare major floods, some of the floodwaters are likely to flow through the floodouts and disgorge into Aeolian sand south of the flood out. The ephemeral Lake Lewis, 30 km SW of Patty Well, is not in the direct drainage line of Day Creek (unlike Napperby Creek, the next Ephemeral River, 15 km to the west of Day Creek).

Day Creek is a substantial ephemeral arid zone river whose catchment rises in the Yalyirmbi Range, 25 to 30 km north of the Laramba Aquifer. This creek trends north-south and flows across an alluvial flood plain up to 10 km wide. East of this alluvial plain are the Aeolian spinifex-covered sand plains and occasional sand dunes between the Yalyirimbi Range and the Reaphook Hills. Thirty-five (35) km east of Day Creek, this 25 km wide sand plain reduces to less than 15 km wide including about 7.5 km of alluvial plains in part underlain by shallow bedrock.

The east-west trending Ngalia Basin synclinal structure underlies the sand plain and hosts the Reaphook Paleochannel. There is a significant increase in the width of this paleochannel to Day Creek which also divides into multiple channels to the west. At Day Creek, the paleochannel is more than 260 m deep with a cover of 105 m of alluvial sandy clays at *Arafura* investigation bore P7 (RC 26, RN 19038).

Flows in the current alignment of Day Creek are impeded by the Reaphook Hills which acts as a recharge dam providing recharge to the shallow porous aquifers along the northern side of the hills. The presence of shallow calcrete in the Patty Well area improves the efficiency of recharge to the deeper colluvial aquifers. These aquifers are believed to be a colluvial fan. At Patty Well, there is 6-9 m of calcrete covered with 6 m of unconsolidated sands and clays.

The recharge and nature of the sandstone silcrete aquifers results in good quality groundwater in storage in the Patty's Well area. Knott estimated the safe yield of the Laramba aquifer at 405 000 m^3 per year based on throughflow estimates.

The high yielding aquifer in the Reaphook Paleochannel *Arafura* Investigation Bore RN 19038 on the western bank of Day Creek, 8 km north of Patty Well, commences at 105 m bGL and is separated from the shallow Laramba Aquifer by a thick sequence of clay.

2.2 Geology

The Yalyirmbi Range and associated hills to the east and south are formed from Arunta Basement rock of the Aileron Province, mainly gneiss, schist, granites and other igneous and metamorphosed Proterozoic basement rock.

The Reaphook Hills are the southern shoulder of the Ngalia Basin syncline and are composed of basal Proterozoic Vaughan Springs Quartzite, the equivalent of the Heavitree Quartzite in the Amadeus Basin, 130 km to the south.

The northern shoulder of this Ngalia Basin synclinal structure is only exposed at the surface within the study area as hills and ridges in the west on Napperby Station north east of Day Creek and structurally complex hills in the east on Aileron Station, south of the floodout of Pridmore Creek. The width of the east-west trending syncline is about 20 km. The syncline plunges down to the west; at Investigation bore P1, the Vaughan Springs Quartzite is 100 m below the ground surface whilst at Day Creek it is around 260 m below the surface. The associated trough is filled with sediments which within the study area is called the Reaphook Paleochannel. In the Day and Napperby Creek zone, the Reaphook Paleochannel is multichannel; it has a series of herringbone-type paleochannels eroded into basement rock to the north (Figures 2, 8, 9, 10, 11, 12, 13 &14; Appendix K).

The lower section of the paleochannels is filled with layers of sand, boulders and sandy clay; the upper section is filled with reworked alluvial sediments.

Aeolian sand provides most of the surface cover, with low to high sand dunes in places across the plains and alluvial sediments in occasional shallow broad drainage lines and flood outs from runoff of hills and ranges.

East of Day Creek, short ephemeral creeks flow off the hard rock basements and valleys within the hills and ranges of the Yalyirimbi Ranges onto the sandplains. They disgorge their runoff into the sandy beds of the creek floodouts and sheet flow areas (Figures 7 & 13; Cross sections 2, 3 &4; Appendix K).

During rare major flood events, some water will travel beyond the floodouts, onto the adjacent sand plains and rapidly infiltrate into the sand and soil cover with some water percolating slowly into aquifers below.

Day and Napperby Creeks are large ephemeral rivers with extensive hard rock catchment areas and are much wider and more deeply incised than the other creeks running off the Yalyirimbi Range and Hann Range to the east.

Day Creek has wide flood channels and a floodout area immediately north of the Reaphook Hills where these hills impede stream flow south until it reaches a gap west of Patty Well. Seven (7) km south of this Gap there is a floodout, then 15 km of sand plains between this floodout and basement rock outcrop east of Lake Lewis.

Napperby Creek, west of the *Arafura* NE Southern Basins main study area, passes through a Gap in the Stuart Bluff Range, 24 kilometres west of Patty Well Gap. The Reaphook Hills are an extension of the Stuart Bluff Range.

Shallow basement and occasional basement outcrop in hills, including Mount Harris, occur south of the Reaphook Hills to near Lake Lewis. Mount Harris is on Napperby Station, 6 km west of the Aileron/Napperby Station boundary and rises 140 m above the surrounding plains.

2.3 Aquifers

Arafura intersected major colluvial and alluvial aquifers (airlift yields to 50 L/sec) at moderate depth (65 m bGL) in the eastern sector of the Reaphook Paleochannel and deeper to the west at Day Creek (105 to 260 m bGL).

Low to moderate yielding shallow aquifers (40 m bGL) occurred within the upper strata of the Reaphook Paleochannel and associated paleochannels to the south of Dozer Gate on Aileron Station. These aquifers are within often heavily reworked alluvial systems and are equivalent to the Ti Tree Basin Aquifer as defined by Read and Tickell (see Ti Tree Aquifer Map in reference section).

Only one aquifer (Bore RC 19 bore site 6B – 20 L/sec) intersected in the Reaphook Paleochannel had a similar yield to the best of the Ti Tree Basin Aquifer but this aquifer was sand and gravel beds, a different aquifer type to the Ti Tree Aquifer.

The Ti Tree Aquifer occurs within 100 m of ground level and its hydraulic characteristics, thickness and bore yields are variable across the basin with the highest yielding aquifer airlifting up to 40 L/sec. The sustainable continuous bore yield of the best production bores drilled to date is around 20 L/sec.

Over 300 water investigation bores have been drilled into the Ti Tree Basin and there are currently 30 production bores, most of which have been pump tested. In comparison, only 30 groundwater investigation bores have been drilled by *Arafura* into the Reaphook Paleochannel, and no permanent production bores have been constructed. Six (6) investigation production bores were constructed to evaluate some of the major aquifers intersected and pump tested to provide initial hydraulic characteristics of these aquifers, to facilitate design and construction of the operational mine production bores and to provide mine development construction water.

A very high yielding (30 L/sec airlift) fractured rock, Vaughan Springs Quartzite aquifer with saline (6,000 mg/L TDS) groundwater, was intersected between 218 and 219 m in *Arafura* water investigation bore RC 18 (bore site 6A). Whether this fracture zone is extensive is not known. The quartzite could be fractured along axes of the syncline or it could be some other structural feature; to the north-east, along the northern shoulder of the syncline and in other locations along this shoulder, some of the outcrop is overturned. There are also wide gaps between the hills of quartzite, along both the southern and northern shoulders of the syncline, indicating considerable tectonic movements in Ngalia Basin Formations during past eons.

There are also likely to be zones of colluvial deposits of this quartzite adjacent to hills, ridges and ranges, forming local aquifers of fallen and weathered quartzite. One of these deposits is the Laramba Aquifer at Patty Well, immediately north of the Reaphook Hills. This shallow aquifer is interpreted as covering an area of 36 square kilometres with its primary recharge from flows in Day Creek and runoff from the adjacent hard rocky hills and ridges.

The Reaphook Paleochannel aquifers are a multi-layered colluvial aquifer system overlain by reworked alluvial aquifers with variable yields. The main aquifers in *Arafura* production bores RC # 22 (bore site PB1) and RC # 21 (bore site PB6) are overlain by alluvial sandy clay sediments. Based on interpretation of the hydraulic pump tests, these sediments provide a leaky seal i.e. they are semi confined. Further to the west at RC # 25 (bore site PB 7) and RC # 26 (bore site PB 4), the Reaphook Aquifers are confined by the overlying sandy clay sediments. RC # 25 is 5.5 km west of RC # 21 and RC # 26 is about a further 10 km west of RC # 25.

Recharge to the Reaphook Paleochannel aquifers occurs from overlying alluvial aquifers and throughflow from deep and shallow “herringbone aquifers” which are directly connected to the Reaphook Paleochannel along its northern side. In addition there are deep high yielding colluvial and weathered sandstone aquifers east of the Reaphook Paleochannel on Aileron Station.

High airlift yields (20 L/sec and up to 40 L/sec) were obtained from Arafura explorations bores RC # 12 & 8. RC # 12 is adjacent to Dozer Gate which is immediately south of an outcrop of quartzite. This hill of quartzite are the remnants at this location of the southern shoulder of the Ngalia Basin Syncline.

Dozer Gate is a gate in the Aileron Paddock Fence which runs between the western end of the Hann Range and a location on the Aileron/Napperby Boundary in line with the Reaphook Hills and approximately follows the southern shoulder of the Ngalia Basin syncline.

2.4 Aquifer Parameters

Controlled pump tests were completed on the *Arafura* NE Southern Basins investigation production bores RC # 21, 22, 25, 26, 27 & 28 in 2014 and 2015 by the Diverse Resources Group pump testing rig to:

- determine the indicative hydraulic characteristics of selected aquifers in the Reaphook Paleochannel
- assist in determining design criteria of future high-quality mine water supply production bores
- identify appropriate short-term and continuous pumping rates for each of these *Arafura* investigation bores (RC # 21, 22, 25, & 28)

Summaries of these *Arafura* pump tests are provided in Appendix G. A detailed description of these and other pump testing which has been completed on production bores in the *Arafura* Study Region is provided in *Attachment 7, "Regional Production Bore Pump Testing" and not included in this report.*

Reaphook Paleochannel Aquifers

The estimated aquifer parameters of the NE Southern Basins based on the pump test results are provided in Table 1.

The transmissitivity analysis from the pumping results of bores in the Reaphook Paleochannel indicate a value between 95 at RN 18714 (PB2) on Aileron Station east of the gas pipeline increasing to 775 m^2/day at RN 19038 (PB4), 60 km to the west on Napperby Station adjacent to Day Creek.

The aquifer tested at bore P6 (RN 19033) is the same aquifer that occurs just below the potentiometric surface in bore P1 (RN 19027). As the aquifer was close to the potentiometric surface in P1 it was not able to be screened and tested. P6 (RN 19033) has more permeable aquifers at depth. This is based on the airlift tests, the strata intersected and sieve analysis of samples of the aquifers. It is expected that the main aquifers in P6 will have much higher values of transmissitivity, refer *Attachment 7*.

Bore RN 19027 (PB1) screened multiple aquifers between 51 m and 130 m with a complex casing screen string of different lengths and apertures opposite the different aquifer particle sizes, varying from fine sand to fine gravel. A 5 mm aggregate stabiliser was placed in the 40 mm annulus between the outside of the casing and the drilled 249 mm hole. It took 12 hours to stabilise the bore with careful air surging development.

Table 1 Aquifer Parameters Reaphook Paleochannel*

Pumped Bore	Date	Observation Bore	Obs Bore Radius (m)	Transmissivity (m^2/day)	Storativity	Permeability (m/day)	Comments
PB2 RN 18714	25/ 8/14	2A RN 18876		95	$1.50E^{-01}$	6.7	Leaky Confined
PB1 RN 19034	25/ 8/14	1A RN 19207		250	$4.50E^{-03}$	3.6	Leaky Confined
PB6 RN 19033	25/ 8/14	6C RN 19032		225		4.4	Confined
PB7 RN 19037	25/ 8/14	7A RN 19036		375	$7.00E^{-04}$	3.9	Confined
PB4 RN 19038	25/ 8/14			775		27.8	Confined

Note: Analysis by GHD: Pump test interpretation*

The storage coefficient values in water level observation bores adjacent to the pumped bores varied between 0.15 and 0.0007 i.e. between about 1 and 15%. We would expect values of 1 to 2% in sandy clays and up to 10% in the clean uniform sands RC # 26 & 12 (bore sites PB4 & A0), a little less in the sand and gravel beds RC # 22 (bore site PB 1) and less in the sand, gravel and boulder beds RC # 21, 18 25 & 26 (PB6 deep, 6A, PB7, PB4).

The drawdown response in PB 1 and 2 indicated a leaky confined aquifer and PB 6, 7 and 4 a confined aquifer. This response also reflected the observed drilling results and stratigraphic logging.

Values for specific yield are not able to be determined until the aquifers have been stressed with significant extraction over an extended period and data is available on the monitored water level response data compared to volume of groundwater extracted over this period. Lee Evans (GHD) used a value of 1% for the NE Southern Basins area in the 2016 *Arafura* numerical groundwater model.

NE Southern Basins Adjacent Basement Rock Aquifer

Arafura investigation production bore RN 19039 (P8) is a production bore north of the Reaphook Paleochannel and northern shoulder of the Ngalia Basin. It is sited over basement rock aquifers between Herringbone Reaphook feeder paleochannels. It was drilled into a weathered basement rock aquifer south of the Wickstead Creek floodout. The aquifer parameters from the short pumping test completed on this bore are provided in Table 2.

The bore is sited within the potable water supply borefield which is expected to supply the mining camp from a series of low yielding bores in basement rock aquifer, sandy clay aquifers and possibly some colluvial aquifers that may be present in this area.

Pumped Bore	Date	Observation Bore	Obs Bore Radius (m)	Transmissivity (m^2/day)	Storativity	Permeability (m/day)	Comments
PB8 RN 19039				11.5		0.3	Leaky Confined

*Table 2 Aquifer Parameters Basement Aquifer**

Note: Analysis by GHD: Pump test interpretation*

As can be expected, the indicated transmissitivity and permeability of this low-yielding aquifer are quite low at 11.5 m^2/day and 0.3 m/day. These aquifers are often anisotropic, limited in extent with limited storage and variable water quality e.g. New Nolans (RC # 63 RN 18761), Old Albs, Alyuen and Aileron Roadhouse Bores.

***Arafura* Rare Earth Orebody Aquifer**

The estimated aquifer parameters of the *Arafura* Nolans Rare Earth Orebody Aquifer based on pump test results are provided in Table 3.

Arafura completed a 7-day controlled pump test on the Dewatering Bore within the proposed mining pit to determine the indicative hydraulic characteristics of the orebody aquifer.

Pumped Bore	Date	Observation Bore	Obs Bore Radius (m)	Transmissivity (m^2/day)	Storativity	Permeability (m/day)	Comments
NBGW819	13/3/10	NBGW818 NBGW813		322.6 340	$1.5E^{-3}$ $2.0E^{-3}$		Confined Confined

*Table 3 Aquifer Parameters: Nolans Mine Pit Aquifer**

Note: Analysis by Environmental Earth Sciences: Pump test interpretation*[1]

The constant rate pump test of 10 L/sec was determined from a step test. This rate was reduced to 6 L/sec when unexpected higher drawdowns occurred after 5 days of continuous pumping (due to boundary conditions). The orebody aquifer has micro solution cavities in the orebody within altered basement gneiss surrounded by gneiss with no or very limited storage localised aquifers i.e. it behaves like a large tank.

The recharge source is mainly from very periodic flows in the ephemeral Kerosene Camp Creek which flows across the western end of the orebody, two shallow localised paleochannels and infiltration of rainfall and runoff at the surface. As surface water puddles over the orebody often only lie for days to weeks until dewatered from evaporation, evapotranspiration and stock use, infiltration volumes are likely to be very small.

The pump test exhibited boundary conditions along three (3) boundaries N, S and E. The fourth boundary was not evident but was probably obscured by recharge effects of a flow in Kerosene Camp Creek during the pump test. Substantial rains occurred just prior to and during the test.

Table 4 Aquifer Parameters Laramba Aquifer*

Pumped Bore	Date	Observation Bore	Obs Bore Radius (m)	Transmissivity (m^2/day)	Storativity	Permeability (m/day)	Comments
RN 13208		 RN 13206 RN 13207 RN 6867		2.2 1.1 2.0 3.8	 $2.3E^{-04}$ $2.6E^{-04}$ $1.6E^{-04}$		Gimcrack Bores, sandy lenses within clay
RN 13209		 RN 13210		101 158	 $3.4E^{-04}$		Patty Well Area fact. quartzite & ssd
RN 13213		 RN 13214		92 255	 1.0×1.0^{-3}		Day Creek; coarse sands
				72	4.3×10^{-2}		Laramba Prod Bore

[1] Hydrogeological Open Pit Dewatering Investigation, Nolans Bore, via Aileron, NT Environmental Earth Sciences

RN 13219		RN 13220		396			silcrete

Note: Analysis by WRB NTG: Pump test interpretation by Geoff Knott 1981*

The NTG completed hydraulic pump tests on several investigation production bores in the Laramba Aquifer and constructed a production bores and a standby production bore. Recently a duplicate production bore has been constructed to replace the # 1 production bore which was constructed in 1972.

The NTG completed hydraulic pump testing on the Alyuen Community Production Bores within the Alyuen ALT and on a few bores within the Southern Basins Study Area. The Alyuen Community production bores within the Alyuen ALT are typical Arunta Complex production bores i.e. low yielding, unreliable with varying yields and chemical quality, often dry and the water quality does not meet Australian drinking water standards.

The Central Desert Council completed a basic pump test on one of the new Alyuen Production Bores they constructed in the NE Southern Basins north of the Hann Range and west of the Stuart Highway.

The AG, NTG and various properties within the Ti Tree Basin have completed extensive pump testing of aquifers within this basin to determine aquifer parameters and sustainable bore yields. The results of this pump testing and their assessment are included in a series of technical reports. Selected results from these reports have been used in the preparation of the NTG Ti Tree Basin water resource management plans and development of NTG numerical groundwater models.

The NTG completed an assessment of aquifer parameters for Territory Table Grapes (now Southern Cross Farms) to identify separation distances of borefields and new farms in the Central Ti Tree Basin using monitored water level impacts (borefield cone of depression) as a result of reported extraction.

2.5 Groundwater Monitoring

Arafura commenced a groundwater monitoring program in 2012 which has been expanded during and following field groundwater investigations in the Nolans Region. The program has been both scheduled and opportunistic as identified in Appendix B and consists of:

- standing water level monitoring
- collection of water samples for field and laboratory analysis, standard ADWG chemical, 32 and 64 trace metals, strontium
- bore gas sampling during pump testing southern basins

The standing water levels were measured and water sampled during drilling and pump testing in 78 *Arafura* bores during field drilling investigations in the NE Southern Basins, Ti Tree Basin and its southern Arunta Basement surface water catchment.

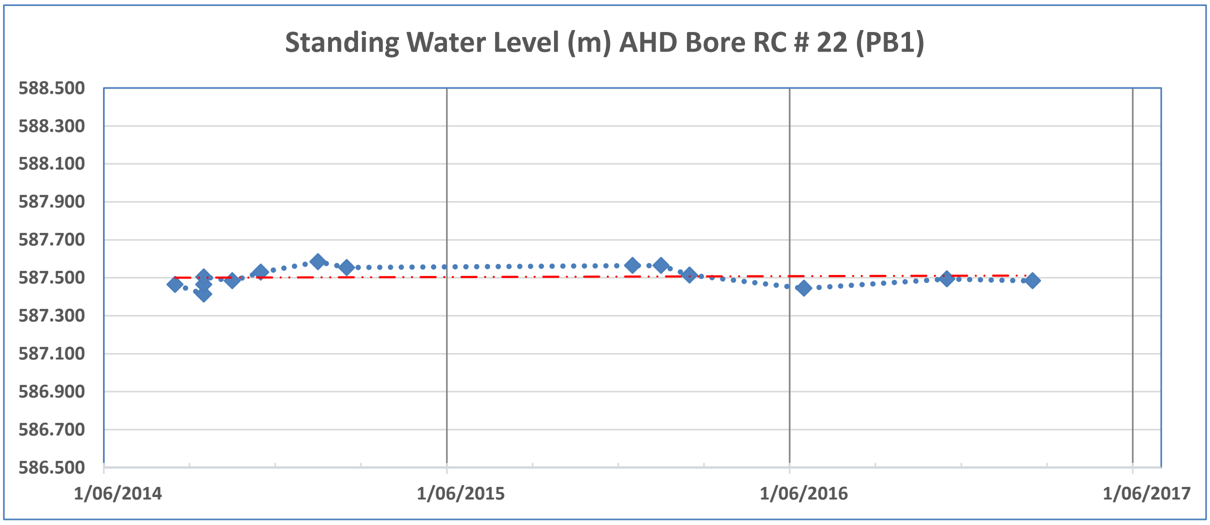
A total of 150 bores in the Nolans Region have been sampled or water level measurements taken as part of scheduled and opportunistic monitoring programs since 2012. The *Arafura* Nolans Region bore groundwater quality and standing water record is extensive and is available in digital format.

Graphs of the results of bore standing water level monitoring are available for those bores with multiple measurements. A selection of these graphs is provided in Appendix B.

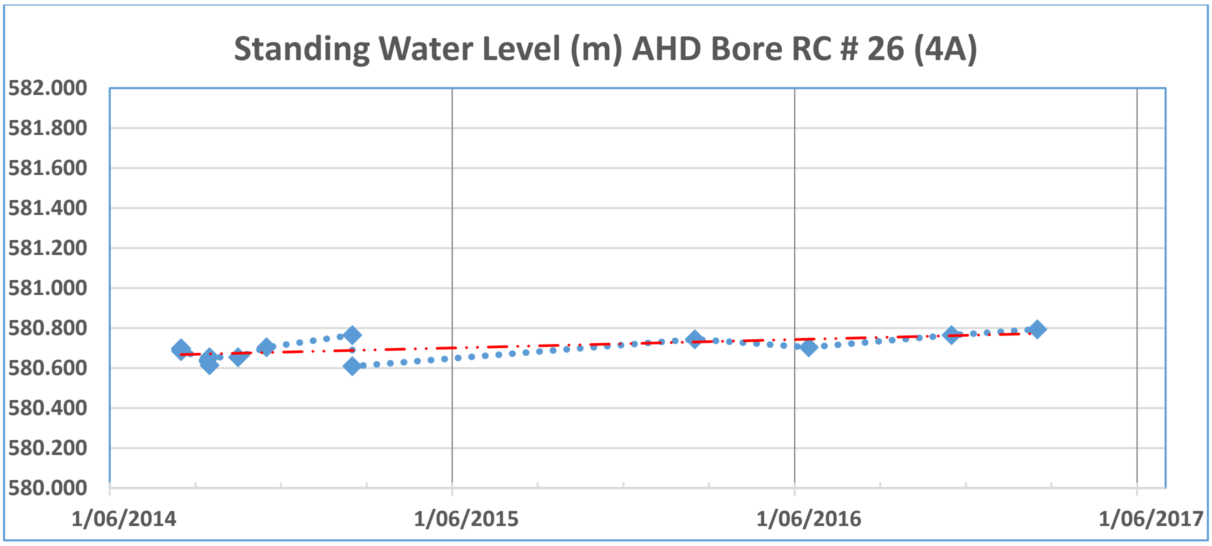
With the exception of Arafura Monitoring Bore RC 26, the standing water levels in monitoring bores in the Reaphook Paleochannel appear to have remained constant over the past 3 years except for diurnal variations. There appear to be discrete changes of minimal amplitude which are most likely diurnal and tidal variations but could be minor rises and falls. We have identified these trends with the bore standing water hydrographs graphs, Appendix B.

This lack of change to date is consistent with the observed high permeability and transmissivity values of the major extensive aquifers within the Reaphook aquifer system indicating very high groundwater storage volumes, recharge from throughflow and direct infiltration, lack of change over the monitoring period of throughflow gradients and other factors.

Despite high rainfall over January-February 2017, no evidence was present during the March 2017 standing water survey of changes in water levels in the Reaphook aquifers being monitored, unlike the Laramba aquifer monitoring bores which rose up to 1 m and the Nolans orebody aquifer which rose up to 2 metres. The Laramba aquifer is a shallow aquifer with excellent intake beds at the surface and across the adjacent Day Creek Floodout and can be expected to respond quickly to high rainfall runoff events.



Graph # 1 Bore SWL Hydrograph Production Bore RC # 22 (PB 1) Reaphook Paleochannel



Graph # 2 Bore SWL Hydrograph Production Bore RC # 26 (PB 4) Reaphook Paleochannel

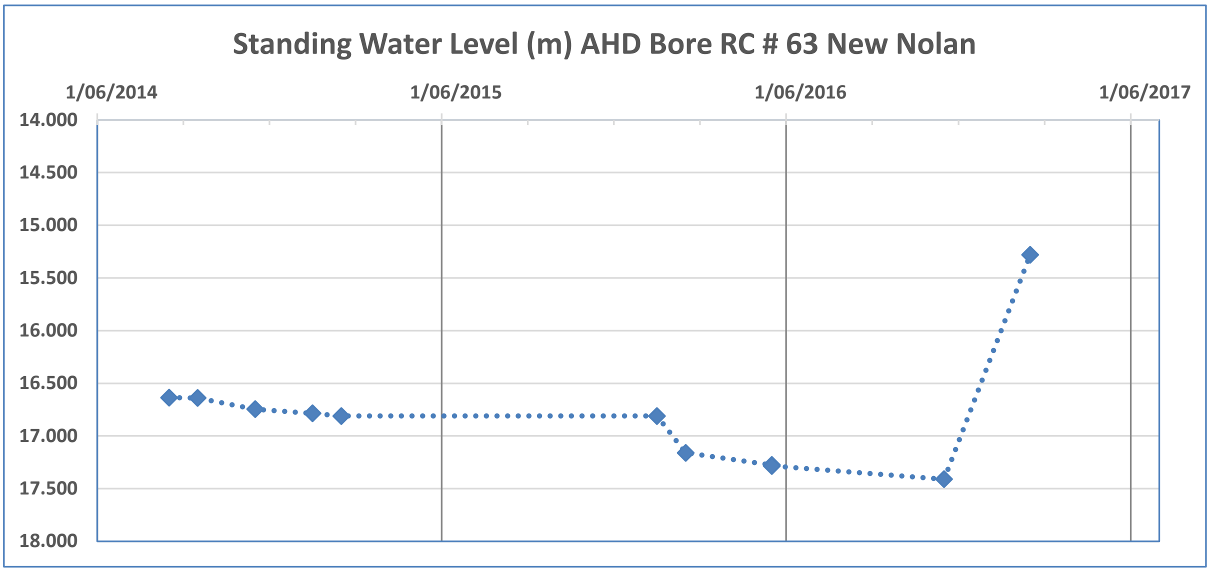
Arafura Production Bore 4A (RC # 26) is also a baseline water level monitoring bore. The current SWL record is displayed on graph # 2 which may be showing minor recharge since 2014/15. The imminent installation of a datalogger in this bore should resolve this issue.

Assessment of Ti Tree Basin monitoring records by the NTG indicates that more than 100 mm of rainfall over a month results in significant recharge to the Basin from both surface flows and direct infiltration of rainfall over recharge zones. The NTG estimates that average annual recharge averages 2 mm over the basin area.

The bore standing water levels in monitoring bores across the Margins Area show different responses to rainfall and recharge with different lag times depending on the aquifer and location. The aquifers in this area are generally low yielding; some are shallow, others are deep and there are many locations with no aquifers or no useful aquifers.

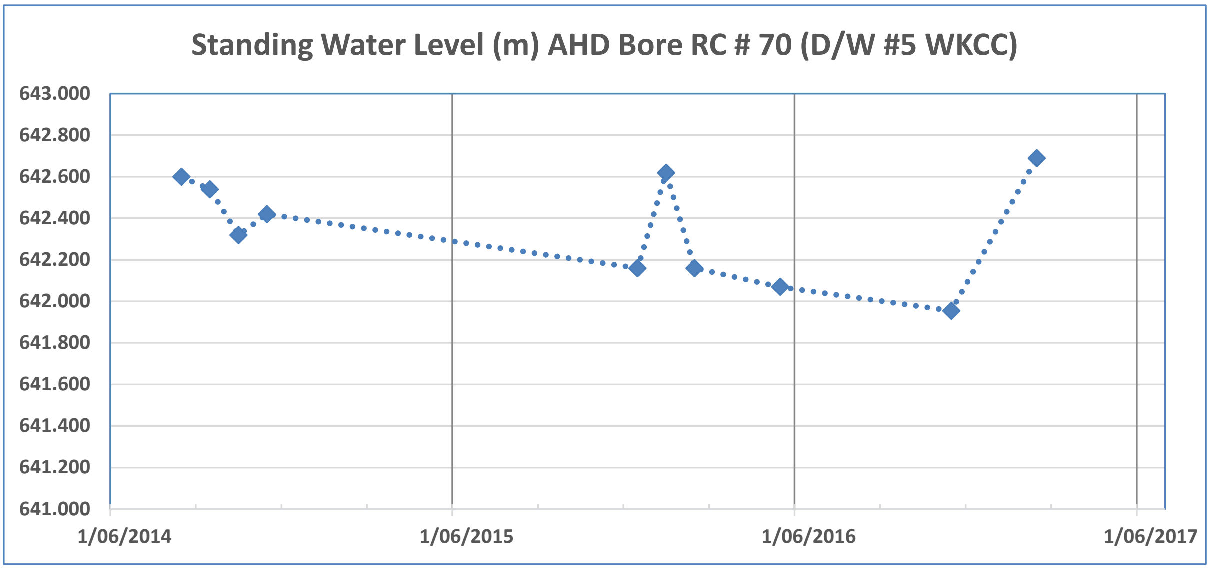
As can be expected, the water level in stock watering bores in basement rock aquifers beyond the boundaries of the NE Southern Basins have fluctuated over this period from extraction and lack of regular recharge. These aquifers are mainly small natural groundwater storage tanks usually associated with fracture zones but there are also calcrete aquifers where calcrete solution cavities occur below the water table. New Nolan's stockwatering bore was drilled on the bank of Kerosene Camp Creek approximately 2 km southwest of the proposed Arafura mine pit. It was drilled into a fracture zone.

This bore has yet to be equipped for stockwatering and Graph # 3 below displays a decline followed by a rapid rise from recharge from flood flows in the adjacent ephemeral Kerosene Camp Creek over the summer of 2016/17.



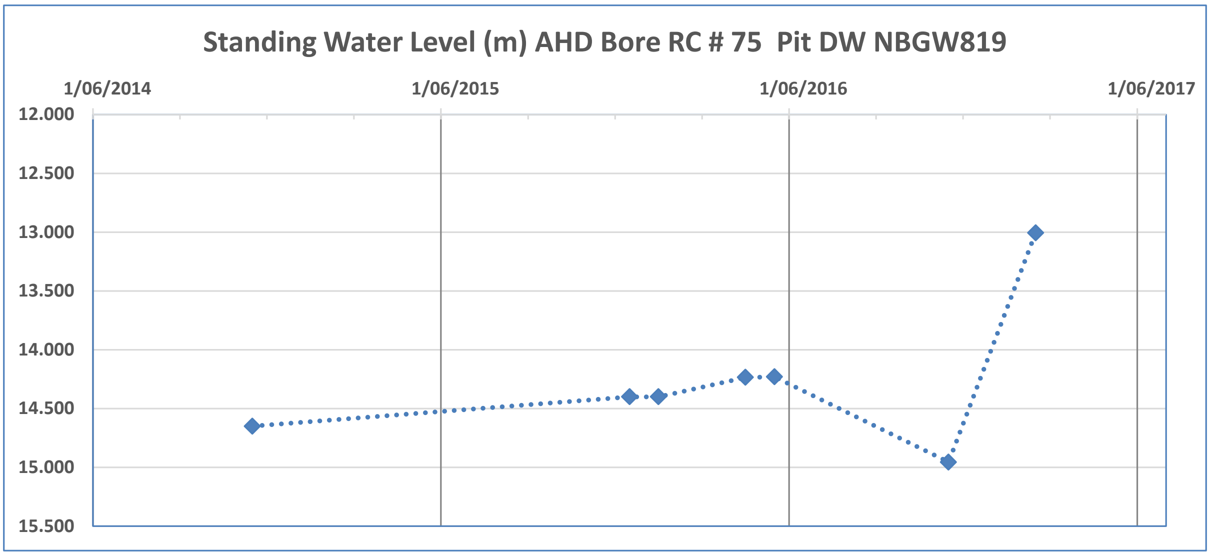
Graph # 3 Bore SWL Hydrograph New Nolans Production Bore RC # 63 Ti Tree Basin Arunta Catchment approx. 1 km up gradient of mine pit

An Arafura monitoring bore within the planned pit area drilled on the banks of Kerosene Camp Creek shows 3 recharge events from flows in Kerosene Camp Creek with a gradual fall from groundwater discharge into the pit aquifers and from transpiration by trees within the riparian zone. The recent summer recharge event resulted in a rise of more than 1 m.



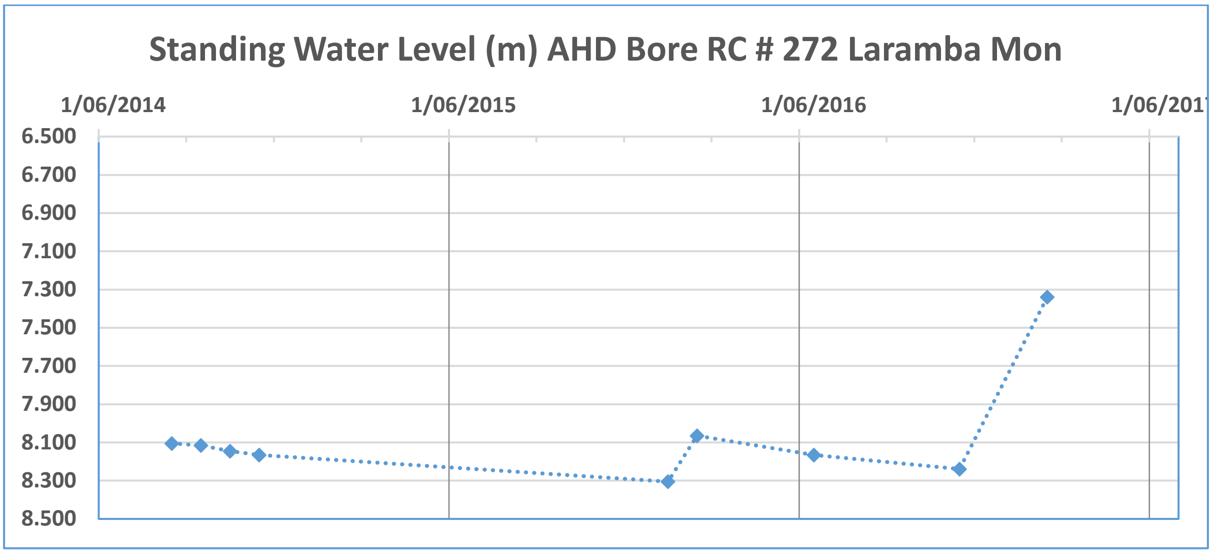
Graph # 4 Bore SWL Hydrograph Arafura Nolans monitoring bore RC # 70 Ti Tree Basin Arunta Catchment within proposed mine pit

There may also be some ground through flow through weathered rock below the creek bed but with shallow granite and granite outcrop at the Pine Hill Aileron boundary to the north any significant throughflow is unlikely.



Graph # 5 Bore SWL Hydrograph Arafura Nolans Dewatering Bore RC # 75 Ti Tree Basin Arunta Catchment within proposed mine pit

The Nolans Dewatering bore is being used periodically by Aileron Station for stockwatering. It is showing a rise in bore water levels of >2m as a result of the major recharge event during the 1016/17 summer.



Graph # 6 Bore SWL Hydrograph NTG Laramba Aquifer Monitoring Bore RC # 272 near Patty Well & adjacent Day Creek, RN 13210

There are a large number of graphs of NE Southern Basins and other bores in the Nolans Region that *Arafura* have been monitoring over the past 5 years. These graphs and their interpretation are included in a separate report on the Water Resources of the *Arafura* Nolans Region and in the *Arafura* Water Database.

2.6 Groundwater Movement

The primary groundwater systems of interest to *Arafura* are

- the Reaphook Paleochannel from which *Arafura* plans to obtain most of its mine processing plant water and near potable water supply
- the orebody aquifer
- the Nolans region bedrock aquifers
- the mine pit down gradient Ti Tree Basin aquifers

In respect to groundwater movement, *Arafura* is interested in the macro systems, the main localised movement of groundwater and specific micro systems. This interest is in respect to assessment, utilisation, management and extraction of the water resource, and minimising impacts on existing users, including the environment.

Regional Movement of Groundwater

Within the Southern Basins, between the Yalyirmbi Ranges and the MacDonnell Range groundwater divides, groundwater is moving to the west on a regional basis. Lake Lewis, a playa south of Tilmouth Well and the Tanami Road, is a groundwater discharge zone for the south western sector of the Southern Basins. West of Lake Lewis there are other groundwater discharge areas. Groundwater in the Reaphook Paleochannel in the north eastern sector of the Southern Basins is moving to the west.

Groundwater north of the regional east-west trending groundwater divide in Arunta Basement rock within the Yalyirimbi Range trends to the north then to the north west into the Wiso Basin, as illustrated by the groundwater flow in the Ti Tree Basin to the north of Nolans.

From a localised perspective, the direction of groundwater movement is much more complex due to topography, geology and variable hydrogeological characteristics of the aquifers and strata.

Reaphook Paleochannel

Groundwater in the Reaphook Paleochannel aquifers is moving to the west. The deep paleochannel aquifers are covered by an increasing thickness of alluvial sediments to the west increasing from 65 m at bore RC # 22 (P1) to 105 m at bore RC #26 (P4 or site 4A), a distance of 22 km. Over this distance the potentiometric surface (bore water level) drops about 7 m, i.e. at an average gradient of about 1:3,100. The apparent gradient is steeper between bore RC # 22 (P1) and bore RC # 21 (P6) 1:4,000 and shallower between bore RC # 21 (P6) and bore RC # 26 (P4) 1:2,300.

Whilst groundwater moves very slowly through the Reaphook Paleochannel, the deep aquifer is an excellent aquifer whereas the alluvial aquifers and other feeder aquifers examined to date have much lower permeability and much slower rate of groundwater movement.

ESE Reaphook Feeder aquifer (PB1, PB 6, PB 7, PB 4 and other nearby deep Arafura Investigation bores)

The deep aquifer at bore RC # 28 (P2) and RC # 12 (A0), a feeder aquifer from the ESE (on Aileron Station south of the Hann Range and its ancient hidden linkage to the Reaphook Hills), is a very good aquifer with high permeability but the SWL gradient to the west between these bores is only around 1: 1,000 . It increases slightly to 1: 1,100 between P2 and P1.

Additional information on gradients and groundwater movement in this feeder aquifer is provided in Appendix B and the attachment identified above.

Isotope sampling is to be completed during the project development phase to determine the age of the groundwater at key locations within the NE Southern Basins study area.

Alluvial Aquifers Eastern Sector of the NE Southern Basins (Alyuen Production Bores RC # 84 and # 85 , Arafura Monitoring Bores RC # 7 (J1), RC #1 (A3) , RC # 60 (9(2)))

The groundwater in these aquifers is moving in a southerly direction providing vertical recharge to deep aquifers and over the basement high intersected in bore RC # (N1). The deep aquifers include those intersected in A0 and those identified in the Arafura AEM model, south of the Hann Range.

The ESE aquifers are linked to the Reaphook Paleochannel (see conductivity map slices in the Arafura digital water database).

Between RC # 7 (J1) and RC # 1 (A3) the average gradient is high at 1:800 which is consistent with the low yielding alluvial aquifers intersect and interpreted low permeability, particularly average permeability, due to the extensive reworking of these alluvial sediment over the millennia. Between RC # 1 A3 and RC # 60 (9(2)) the gradient reduces to 1:700 which is consistent with the clays intersected in 9(2).

Additional information on gradients and groundwater movement in these eastern alluvial aquifers and the Reaphook herringbone feeder aquifers is provided in Appendix B and the attachment identified above.

Northern Burt Basin *Arafura* monitoring bore RC # G4

The groundwater is nominally moving from the north to south 23 km south of the basement high at a gradient between 1:1,200 and 1:1,700 based on the current sparsity of bores and SWL records in this region. This groundwater changes direction on Yambah Station and moves towards Lake Lewis, south of the Aboriginal Outstation Injulkama.

RC # G4 was drilled in a narrow shallow paleochannel, the southern outlet from the northern Burt Basin to the Burt Basin defined by drilling and the Arafura AEM model.

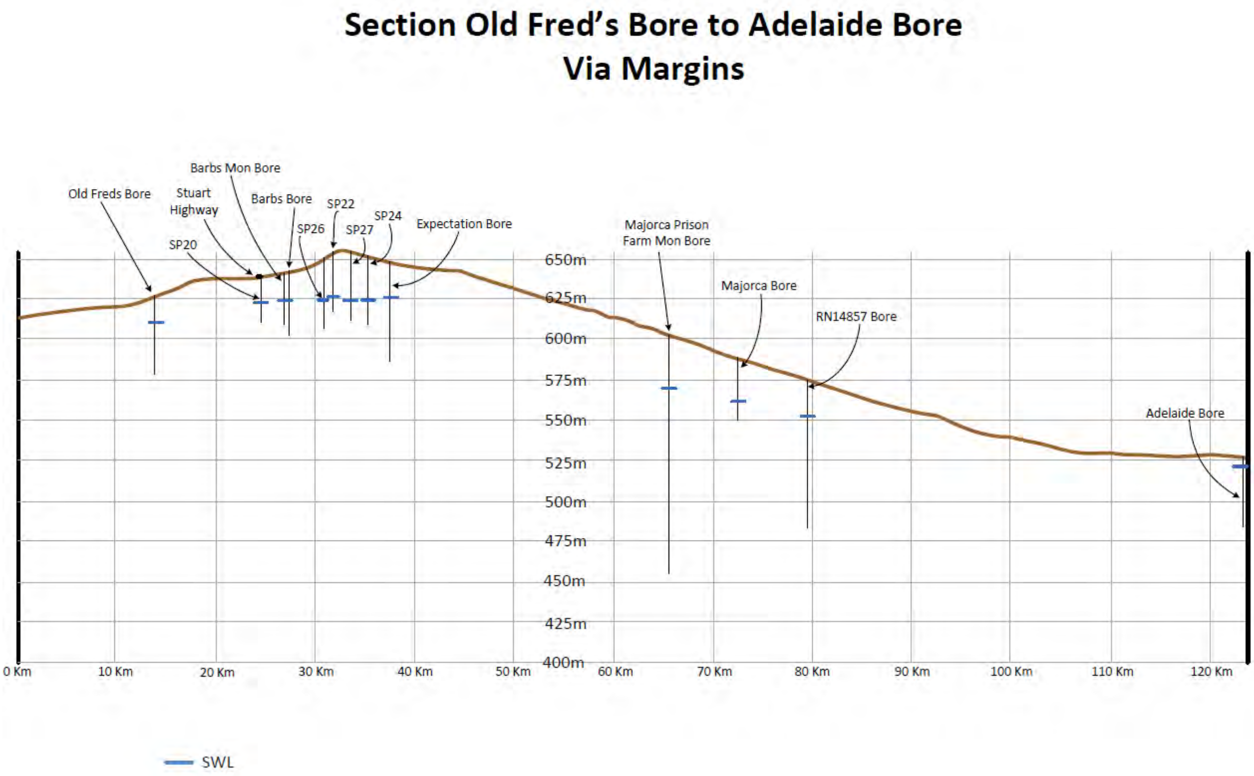
The AEM datasets indicate that there is a paleochannel cutting across this area in the south which is directing some groundwater to the SW. This paleochannel was identified in previous studies over the Burt Basin further to the south (Hussey personal communication).

NE Burt Basin - Bores, RC # 109 (Old Fred's), RC # 189 (Abd Max, RC # 106 (New Connors), RC # 103 (Bardia) stockwatering bores and Arafura Margins Monitoring Bores

Within the NE Burt Basin, groundwater is moving SSW from the groundwater divide between the Ti Tree Basin and the NE Burt Basin in the Margins area in relatively shallow paleochannels and in a large discontinuous shallow calcrete sheet. It joins with the Burt Basin on Yambah, south of the Yambah/Aileron Boundary, and changes direction, moving west towards Lake Lewis.

The estimated gradients are provided in the attachment identified above.

Section 1 below displays the surface water and groundwater catchment divide between the Ti Tree Basin and the NE Southern Basins.



Section 1 Surface Water Divide, Margins Area, between the Wiso River Basin and Burt River Basin

Nolans Bore and Proposed Mine Pit

Kerosene Camp Creek crosses the western sector of the proposed Arafura Mine Pit and is to be diverted over a saddle into West Kerosene Camp Creek. West Kerosene Camp Creek is a tributary of Kerosene Camp Creek with its junction 5 km north of Nolans Bore.

The orebody aquifer is a mixture of the surrounding Arunta Basement Rock Aileron Province rocks (gneiss, pegmatite and schist) and includes the mineralised body itself which forms a micro solution cavity aquifer amongst other aquifer types. These aquifers provided the supply to the abandoned Nolans Stockwatering Bore which collapsed at the water table following corrosion of the steel casing.

The orebody is surrounded by gneiss and, further to the south and east, granite which outcrop in hills and rise 13 km N and 47 km ESE to the Ti Tree Basin. This outcrop and shallow subcrop in the valley floors form the Aileron Hills which are the eastern extension of the Yalyirimbi, Reynolds and Anmatjira Ranges. There are several major east-west trending faults and other minor faults in this outcrop with the associated fracture zones generally filled with clay. Gneiss and schist in these fracture zones decomposes to sandy clay and is mainly clay. There can be thin localised aquifers below the water table adjacent to the surface of weathered granite but aquifers in the Arunta Basement rock are rare and difficult to locate. Where they are present, they tend to be in fracture zones often associated with intrusive rock such as felsic gneiss, pegmatite or quartz veins. They are localised with limited groundwater storage and the better quality water associated with recharge zones as a plume, surrounded by poor quality or saline groundwater that is static.

Our interpretation of aquifers in the gneiss surrounding the orebody, based on the mineral exploration drilling completed in the area and regional water bore drilling in the Arunta Basement Rock, is that there will be limited localised aquifers in the gneiss and other rock surrounding the pit and those immediately adjacent to the pit wall will be dewatered during mining and the majority will not receive significant recharge following rainfall events in the area.

The pit is overlain in part by two small shallow localised paleochannels. There may be a few localised basement rock aquifers underlying the shallow paleochannels in the area but these are unlikely to provide significant volumes of groundwater to the pit due to the limited extent of these paleochannels.

New Nolans Bore

This bore is located on the western bank of Kerosene Camp Creek, 2 km south of the Abandoned Nolans Bore. It was drilled by Arafura as a replacement for Nolans Bore which will be within the mine pit. The fracture zone is evident on satellite imagery and crosses the creek. The bore is about 3 m above the bed of the creek. The adjacent observation bore is higher up the bank on the margin of a calcrete rise.

An investigation bore was drilled about 200 m to the west of New Nolans Bore on the other side of the hill which is gneiss with a thin cap of calcrete. This bore was drilled into basement rock through the solution cavities but as there was insufficient water supply for a stock watering bore it was completed as a monitoring bore up gradient of the mine site. It is adjacent to a broad shallow creek, a tributary of Kerosene Camp Creek.

Anna's Reservoir

Anna's Reservoir Conservation Reserve is a small NTG Conservation Reserve within the Yalyirimbi Range and includes 2 rock holes which periodically store runoff until evaporated. These rock holes are within a small ephemeral creek which flows off the range onto shallow bedrock areas south of the range within the catchment area of the NE Southern Basins, 100 m below the rock holes. These rock holes are about 50 m above ground level at Nolans Bore (Cross section 5, Appendix K)

Groundwater Movement in Other areas of the Nolans Region

Arafura has completed bore standing water monitoring at New Nolans, Nolans (proposed mine pit area), the Margins Area, Ti Tree Basin, Southern Ti Tree Basin and the main sector of the Ti Tree Basin. Additional information on gradients and groundwater movement in these aquifers is in the attachment identified above and in the *Arafura* water database.

2.7 Groundwater Dependent Ecosystems

No known studies of GDEs have been completed within the *Arafura* Southern Basins Study area. GDE studies have been completed in the northern Ti Tree Basin by the NTG in partnership with other organisations. These studies focussed on flora over the Ti Tree spinifex-covered *(Trioda spp)* sand plains and identified that desert bloodwoods *(Corymbia opaca)* may draw groundwater from up to 30 m. The roots of spinifex grow both horizontally and downwards. The NTG Desert Park states that the roots grow to a depth of about 3 m and if this is the case they are not a GDE within the NE Southern Basins west of Day Creek where the SWL is deeper than 10 m bGL.

Along the boundary of the Central and Western Ti Tree Basin management zones, the groundwater levels rise to near the surface following rare major rainfall recharge events and some wells flow at the surface. It has been speculated that water levels in some locations may rise to above the surface in some of the northern zones but wet, boggy conditions along access tracks persist for long periods following these rainfall events and sophisticated research has not been completed in these areas.

The water table is shallow in some areas of the *Arafura* Southern Basins Study area and there could be some flora GDE's in these areas which have not been identified to date by *Arafura's* specialist consultants or others; the vegetation in these shallow water table areas is not strikingly different to areas with deeper water tables.

Ephemeral creeks and rivers flow off the hills and ranges within the *Arafura* Study area. The majority of these creeks flow for a short distance as distinct sandy creek beds then onto alluvial flood outs. Rare extreme rainfall runoff events result in some surface water reaching the sand plains but the gradients are shallow and the infiltration rates high so the flow distances on these sand plains is normally short.

There are alluvial sheet flow areas off the hills dominated by mulga groves and woodland. Frequent wildfires in recent decades have reduced the area covered by this tall shrub woodland.

No perennial or annual springs have been located within the *Arafura* Southern Basins Study area though temporary soakages occur in river banks and beds in some locations and occasional short-lived temporary springs occur in rare favourable locations at the foot of basement hills and ranges and occasionally high up hillsides and rock faces. These low-yielding Arunta Basement Rock temporary springs occur at various locations across the 100 000 square kilometre area of this rock outcrop in Central Australia. Due to the frequency and duration of dry periods and drought of duration up to 10 years these temporary springs are unlikely to support GDE's.

Riparian GDEs may exist at some favourable locations within the beds of the ephemeral creeks and rivers in the area where there are thick sequences of sandy clays, sand and gravel forming small alluvial basins. They are more likely to be present below the larger river beds such as in Day Creek at the western edge of the *Arafura* study area or in Napperby Creek, a further 10 km to the west. These two creeks are heavily wooded with Red River Gums (*Eucalyptus camaldulensis*) and other smaller creeks within the study area also have varying densities of river gums along their banks and creek beds.

Creek flows are rare, usually only once or twice a year; the small creeks running off hard rock hills flow more frequently but flows do not necessarily occur each year. They normally occur as flash floods and the flow duration may be only a few hours; however, over high rainfall years there can be baseflow or intermittent trickle flow (associated with underflow below the bed) in some of the larger creeks.

This means that when there is underflow or shallow groundwater seepage, partial GDEs may be present in that they are using groundwater when it is available then revert to use of phreatic water.

No detailed studies for GDE's have been completed along these riparian zones. The basement rock is generally shallow below the smaller creeks and in the large creeks, such as Day Creek, is deep within and adjacent to the Reaphook Paleochannel. At PB 4, drilled on the western bank of Day Creek, the basement is estimated at 260 m bGL. PB4 was drilled to a total depth of 160 m where drilling ceased due to the large volumes of groundwater encountered to this depth. A seepage aquifer was intersected 33 m bGL and a low-yielding aquifer intersected at 84 m bGL (2.5 L/sec). The top of the Reaphook Paleochannel aquifer was intersected at 105 m. The Reaphook Paleochannel aquifer is confined based on interpretation of the hydraulic pump tests and the stratigraphy in the above 105 m being mainly clay with layer of sandy clay and gravel and clay.

2.7.1 Stygofauna

No known stygofauna studies have been completed over the Southern Basins.

Arafura (GHD) completed a stygofauna pilot survey on groundwater from 5 monitoring bores within the proposed Nolans Pit and on groundwater and 2 bores in the Ti Tree Basin (believed to be stock watering bores Sandy Bore and Tinarkie Bore based on the map included in their report) but no stygofauna or other aquatic invertebrates were present in the samples obtained from these bores.

Calcrete aquifers within the NT and WA are favourable habitat for endemic species of stygofauna. Stygofauna were also identified in shallow groundwater from sandy clays, sand and gravel water table aquifers within the Alice Springs Town Basin, a small shallow Quaternary alluvial basin.

It is highly likely that stygofauna, possibly endemic species, are present in calcrete aquifers in the Margins Area, NE Burt Basin on Aileron and Yambah Stations, Northern Burt Basin on Aileron and Amburla Stations. It is possible that stygofauna are present in the Laramba Aquifer.

Arafura has located its Nolans water supply borefields in locations not directly connected to these aquifers e.g. the Margins and the NE Burt Basin aquifers are distant (tens of km) from these calcrete aquifers. It has also established multiple borefields to manage borefield cone of depressions to minimise impacts on superficial aquifers which may be connected to the aquifers from which it is planning to extract groundwater.

Arafura will also be complying with the NTG 80/20 rule whereby 80% of the water resources' beneficial use is the environment with 20% available for mining and other uses. The mine has a limited life which will enable the aquifers used to meet the mine demand to eventually fully recover providing the Government does not allow other major use of the groundwater from these borefields once *Arafura's* mining has ceased.

Arafura has committed to completing a stygofauna study within its borefield area and locations that are likely to be affected from measurable (significant) impacts from extraction of groundwater for the mining operation within the NE Southern Basins in the future.

2.8 Climate

Nolans is over 300 km north of the geographical centre of Australia within the arid zone where the climate is dry and hot and is dominated by its location within the interior of the continent and the southern oscillation. The climate of the region is described in Appendix J; BOM and DNER regional climate datasets are included in the *Arafura* digital water database and are readily available on government web pages.

The climate of the area has major ramifications for the availability of water, the environment, surface water and recharge to groundwater systems. There is a lack of permanent surface water due to minimal rainfall, extended dry and drought periods and high evaporation rates.

Arafura installed an AWS near Nolans Bore in 2008. The closest BOM AWS is at Territory Grape Farm, 43 km to the ENE. The most comprehensive and longest climate data set is available at Alice Springs, 135 km to the south.

The mean average annual rainfall at Nolans is 314 mm which predominantly falls over summer (November to March) and up to 50% of the annual rainfall occurs over a 4-week period and sometimes over a few days. This average is based on about 8 years of data which includes an anomalously wet period in 2010-2012. In comparison, tropical Darwin has a mean annual rainfall of 1722 mm, Adelaide 443 mm and Perth 776 mm.

The average annual rainfall figure is misleading, in respect to an expectation that this order of rainfall will occur most years, as the annual total is highly variable. At Barrow Creek, which has a similar climate, the annual rainfall has been as low as 83 mm (1897 and1928) and as high as 986 mm (1904).

High rainfall events can be expected to occur in the Nolans region about every 11 years, with major rainfall events about every 33 years. These cycles are not precise and vary considerably. There are occasional years of extremely high rainfall (in comparison with average rainfall years); there can be 2 or 3 good rainfall years followed by dry and drought years. This large annual rainfall variability has important positive ramifications for surface runoff and groundwater recharge.

Extended periods of drought (years) occur over some of the recorded 33 year cycles. The last extended drought in this region was between 1955 and 1966.

Rainfall intensity is usually low but high intensity rainfall can occur over short periods (minutes) during thunderstorms and occasionally over longer periods. River and creek flooding events (over bank and flood channel flows) are often linked to high intensity rain. Groundcover density is another factor which is also linked to dry/drought periods, high temperatures and wind. Many of the desert vegetation drought and temperature evading mechanisms result in reduced transpiration. Reduced transpiration can enable more vadose zone water to reach the phreatic zone.

Summer maximum temperatures frequently exceed 38°C and winter minimum temperatures can be less than 5°C. In recent years, the lowest minimum temperature recorded at Nolans was -1.6 °C (6 years) though at Territory Table Grapes on a sand plain 43 km ESE, -6 °C was the minimum recorded temperature over the past 15 years.

The current record shows that frosts occur about twice a year, every three years between July and August. It is probable that over some years they are more frequent, particularly over the sand plains. Cold winter weather and frosts adversely affect plant growth, significantly reducing transpiration.

The mean monthly potential evaporation record is 2,396 mm/yr which is significantly more than the annual average rainfall. Mean monthly potential evaporation records at Nolans ranges between 89 mm in June and 286 mm in December. Mean monthly potential evaporation exceeds 235 mm over summer and averages 77 mm over winter.

The prevailing winds are from the south east over both winter and summer but are more frequent and are stronger over winter.

Implications of Nolans Climate on runoff and groundwater recharge

The climatic variation, particularly periodic high daily rainfall, high intensity rain, high temperatures and associated high evaporation rates and persistent wind and their impact on the desert vegetation have a strong influence on runoff, the type and duration of runoff and periods of groundwater recharge.

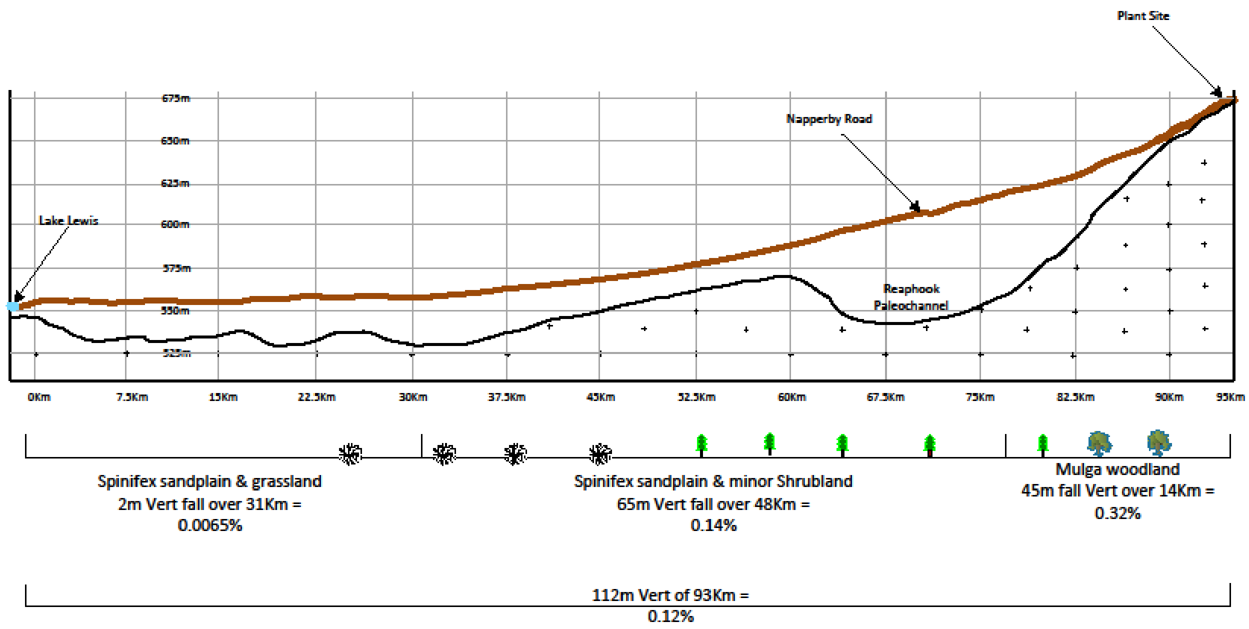
There are threshold minimum rainfall volumes before significant groundwater recharge occurs in small groundwater systems (e.g. basement fracture zones) and major groundwater systems (e.g. NE Southern Basins and the Ti Tree Basin). Similarly, there are variable threshold rainfall amounts for runoff to commence in rivers, creeks and sheet flow areas. In both cases there are many variables, some more important than others. Catchment ground cover is an example where, following good and high rainfall years, catchment yield may be reduced over Arunta basement rock catchments by 20% due to good (denser) vegetation ground cover (based on catchment studies completed over the Todd River catchment up-gradient of Alice Springs). Rainfall intensity is another key variable influencing rates of runoff.

There are insufficient climate and other records at Nolans (catchment condition and standing water level changes) and across the NE Southern Basins to determine the threshold rainfall required for runoff and significant recharge to groundwater systems to occur.

2.9 Surface Water

No permanent surface water, lakes or waterholes exist in the Nolans Region. There are many small temporary waterholes, rock holes and soakages and a few semi-permanent waterholes or soakages on some of the major creeks in the area including Napperby Creek, Day Creek, Allungra Creek and the Woodforde River. The largest surface water feature in the region is Lake Lewis, an extensive salt lake south of the Tanami Road, where significant areas of shallow surface water may persist for months following rare major rainfall events.

Section Lake Lewis to Proposed Plant Site



Cross section 2 ***Surface Gradient from Main Treatment Plant Site south of the Yalyirimbi Range (Aileron Hills) & Lake Lewis; Burt River Basin***

Lake Lewis is a regional groundwater discharge area 93 km south west of the proposed *Arafura* main Nolan treatment plant to be located south east of Old Albs Bore adjacent to the Mereenie Darwin Gas Pipeline on Aileron Station. Lake Lewis is a large ephemeral salt lake near Tilmouth Well south of the Tanami Road.

Napperby Creek whose catchment rises in the western Yalyirimbi Range flows over sand plains between this range and the Reaphook Hills, through a gap in the Reaphook Hills and then over sand plains to Lake Lewis (Section 3, Appendix K). Napperby Creek rarely flows over its full length, there is only anecdotal evidence from local residents and satellite imagery available since the 1960's which is too short a period to provide a reasonable estimation of frequency and the characteristics of these flood events. There is a large surface catchment to the south which rise in the MacDonnell Ranges and a series of creeks and other drainage systems which flow off these ranges and the adjacent plains into Lake Lewis.

Cross section 2 covering the main treatment plant site to the internal surface drainage system of Lake Lewis display the low surface gradients across the sand plains above the Reaphook Paleochannel of 0.14% and downgradient of 0.0065% over a distance of nearly 80 km. Over this distance there are also a series of high sand dunes rising up to 6 m above the sand plains at right angles to the direction of the surface gradient blocking surface flow.

Further to the west the east west trending Reaphook Hills and associated sand dunes also block the passage of surface water flow to the south though with the exception of Day Creek and Napperby Creek there is a lack of creek or river flow through the occasional gaps in these hills. The sand plain south of the Laramba Access Road appears to be a thick sequence of surface sand overlying deep sediments in the Reaphook Paleochannel and Ngalia Basin syncline. The general lack of apparent runoff over this plain indicated high infiltration rates. Shallow sand and gravel beds have been intersected in the few water investigation bores drilled by *Arafura* in this area.

Day Creek has a broad alluvial flood plain up to 10 km wide south of the public Laramba Access Road and nearly 15 km wide to the north. Its main channel north of the Reaphook Hills strikes these hills at right angles between 2 and 4 km east of Patty Well Gap though which it flows south into its floodout. This floodout commences about 4 km to the SW and continues south for another 6 km. The floodout appears to have a maximum width of about 2 km. The eastern tip of Lake Lewis is about 26 km SW of Patty Well Gap.

The calcareous Day Creek flood plain north of Patty Well has high levels of uranium compared to the surrounding sand plains. Geiger counters get quite excited over this flood plain and over drill cuttings from the top 100 m of sediments. Groundwater from *Arafura* bore RC # 26 on the banks of Day Creek had uranium levels above 92 ug/L (about 5 times above the Australian Standard for drinking water) with the deep aquifer reducing to 36 ug/L over the pump test. The water production bores at and adjacent Aileron Roadhouse have levels over 100 ug/L and bores drilled about 20 km NW of Nolan more than 3 times this level.

Day Creek flowed a banker this past summer up to about 1 m deep across the Laramba public access road crossing. There is no river gauging station on this river. It is probable that during very rare major floods that water from Day Creek flows into Lake Lewis.

Napperby Creek has a flood plain about 17 km wide north of the Reaphook Hills unlike Day Creek its current main channel flows directly through the hills and into a drainage system which is a flood channel which effectively is an extension of the Lake Lewis drainage and storage system (Cross section 4, Appendix L). The Reaphook Hills are the eastern extension of the Stuart Bluff Range which is the southern shoulder of the Ngalia Basin syncline and outcrop of the basal Vaughan Springs Quartzite Formation.

The western section of the Napperby Creek floodout north of the Stuart Bluff Range flows about 20 km to the west north of the range and through a gap and into Lake Lewis to the south.

There are waterholes and rock holes in Napperby Creek, Day Creek and the other ephemeral creeks in the region. *Arafura* prepared a simple cross section of the ground surface between 20 Mile Waterhole on Napperby Creek south of Napperby Homestead and Mt Boothby on Pine Hill Station NE of Nolan's Bore (Section 5, Appendix K). Mt Freeling is the highest peak in the Yalyirimbi Range and is immediately west of Anna's Reservoir Conservation Reserve. There are two rock holes on Wickstead Creek at Anna's Reservoir which periodically hold water due to the high evaporation rates prevalent in the region. They hold water for extended periods over rare wet years and over periods when there are frequent rainfall events in the catchment of this creek up gradient of these rock holes particularly over dry years when there is minimal groundcover.

There is a lack of stream or sheet flow records covering the Nolans Region particularly within the Burt River Basin. The Southern Groundwater Basins are located within the Burt River Basin. The NTG has river gauging stations (open and closed stations) in the adjacent Wiso River Catchment on the Hanson, Woodforde and Lander Rivers. There is also a river gauging station on Allungra Creek at Allungra Waterhole on Aileron Station.

The catchments, rivers and creeks in the Nolans Region are similar to other surface water systems in the Alice Springs region where good stream flow and rainfall distribution records exist e.g. Todd River.

Arafura has constructed 33 basic stream flow monitoring stations within and adjacent to the Nolans Mine Site and are planning to expand the number and sophistication of these stations during the mine development phase. These works include hydrographic stations on Day Creek.

The NTG River gauging station on the Woodforde River at Arden Soak is 21 km N of Nolans Bore. This station replaces a closed station on this river adjacent to the Ti Tree Farms.

The Nolans mine site is within the hilly basement rock outcrop catchment area of the Ti Tree Basin. Kerosene Camp Creek is a small ephemeral creek which occasionally flows over the *Arafura* Nolans orebody north to the Ti Tree Basin. This creek is one of the main tributaries of the ephemeral Woodforde River which flows across the full length of the Ti Tree Basin western water management zone past the Ti Tree Farms, 41 km north of Nolans Bore, and town of Ti Tree, 53 km away, and joins with the ephemeral Hanson River 73 km to the north. The Woodforde River rarely flows over its full length but is an important groundwater recharge source to the western management zone.

There are only a few creeks and drainage lines which flow off the southern basement hills and ranges south of the Ti Tree Basin. The catchment of Allungra Creek rises in the Aileron Hills, 15 km SE of Nolans, 13 km N of the Hann Range west of the Stuart Highway, trends east for 28 km to Allungra waterhole then north and dissipates over floodouts and occasionally on sand plains to the east of the Territory Grape Farm, BOM AWS 30 km to the N. This creek is another important recharge source for the Ti Tree Basin (central water management zone).

The small tributaries within the basement rocks hills and valleys of these creeks flow off the basement rock catchments over short distances following less than 20 mm of rainfall and when conditions are right with less than 10 mm. High rainfall over part of a day or a few days over large areas of the rocky basement catchments is normally required for these creeks to flow onto the Ti Tree Basin. Major rainfall is required for the creeks to flow over their full length off the rocky catchments, through alluvial fans over sand plains onto alluvial floodout areas. Occasionally they will flow across the floodouts over sand plains to the north of the alluvial floodouts.

The hydrology is quite complex with a range of key variables which control flows, their flow type, extent, volume, duration. These variables include rainfall intensity, total rain within spatial zones and catchment conditions, particularly groundcover biomass.

The river and creek flow hydrographs in this region can be identified as two types:

- flash floods with no trickle flow, these are flows of short duration normally rising to a peak in minutes and rapidly falling to no-flow in a few hours
- extended high flows, often multistage with multiple peak flows and a short or extended period of baseflow or trickle flow

The Arunta basement rock catchments produce large volumes of sand from weathering, steep rocky catchments and relatively bare soil and rock catchments have a high rainfall catchment yield. These basement rock catchments with steep gradients result in rapid runoff (and larger volumes of runoff when the catchment is bare or with reduced groundcover) resulting in flash floods from short duration rainfall events, generally turbulent flow, high bedloads and sediment load, increased number of water holes and the size of water holes. They are poor contributors to groundwater recharge. The irony is that over drought periods many of the Arunta, Aileron Province catchment types have many more flows than during high rainfall years (see records of flows in the Todd River up gradient of Alice Springs).

The extended high flow types provide the majority of river flow recharge to groundwater systems where they flow over groundwater intake zones (recharge zone).

Over this past summer, flood flows occurred in Kerosene Camp Creek, Woodforde River, Allungra Creek, Day Creek and other creeks in the region. Up gradient of Nolans Bore Kerosene Camp Creek, the maximum depth of flow was over 2 m, and the duration of flow resulted in significant recharge to the basement fracture aquifer at New Nolans Bore (0.5 m) and to the orebody aquifer at Nolans (2 m rise in SWL).

East Kerosene Camp Creek including Nolans Creek broke its banks 5 km south of Nolans. West Kerosene Camp Creek, a much larger creek than the other two creeks, flowed over 3 m at the Aileron/Pine Hill Station Boundary. Day Creek flowed a banker through the alluvial flood plain resulting in significant recharge to the Laramba aquifer (1 m rise at Patty's Well area).

Intermittent trickle flow and a series of small water holes persisted for weeks in the Kerosene Camp Creeks but the temporary basement hill aquifers (temporary springs) providing small flows in small creeks across station bore access roads did not recharge from this high rainfall yet recharged the previous summer from less rainfall. There are a number of possible explanations; however, until there are more rain gauges within the catchments and data loggers recording creek flow hydrographs at Nolans the data will not be available to definitively identify why the springs did not flow following a major rainfall event.

In January 2016, Kerosene Camp Creek up gradient of Nolans Bore flowed to a maximum depth of less than 1.5 m in comparison to > 2m in January 2017.

The Ti Tree Basin and its rocky basement catchment to the south are within the Wiso River Basin. The catchment divide between the Wiso and Burt River Basins marks the top of the catchment for Kerosene Camp Creek (5.5 km south of Nolans Bore), Allungra Creek (10 km SE of Nolans Bore) and the catchment divide at the Margins Area between the Ti Tree Basin and the NE Southern Basins (30 km SSE of Nolans Bore).

South and west of the catchment divide within the NE Southern Basins study area there is a series of creeks, drainage lines and sheet flow areas running off the basement hills and ranges (Yalyirimbi Range). The first major creek equivalent in size and area of its rocky catchment to the Woodforde River is Day Creek, about 50 km west of the Stuart Highway. A further 17 km west is Napperby Creek with a much larger rocky catchment area than Day Creek.

Between the Burt River Basin catchment divide near the Stuart Highway to the east and Day Creek is a series of small and more substantial creeks flowing off the Yalyirimbi Range and the Aileron Hill with occasional minor short creeks (with high catchment yields) flowing off the Hann Range and Reaphook Hills.

Regional

The Southern Ti Tree Basin (including the western, central and eastern water management zones) and the NE Southern Basins are recharged from runoff from the adjacent hard rock catchments, ponding of surface water in discrete locations across the sand plains and direct infiltration of rainwater across the sand plains and alluvial plains. There are also other important groundwater recharge mechanisms which are mainly related to geological, stratigraphic and/or ancient erosion features.

In the NE Southern Basins, these groundwater recharge mechanisms to the major aquifers in the Reaphook Paleochannel include the deep, wide Herringbone paleochannels eroded deeply into Arunta basement rock from the foot of the Yalyirimbi Range joining the Reaphook Paleochannel to the N. These deep Herringbone paleochannels are overlain by ephemeral creeks, drainage lines and sheet flow areas which recharge the shallow and deep aquifers present in these channels (as interpreted from the AEM geophysics model - conductivity slice maps and sections generated by Surpac are available from the digital water database).

These other recharge mechanisms also include infiltration and throughflow in shallow to deep fractured and weathered sandstone within the Ngalia Basin basal formation as evidenced from the weathering and fracturing from inspection of outcrop along the synclinal shoulders and very high yields encountered in a deep bore drilled into fractured and weathered quartzite within the axis of the syncline.

Over both groundwater basins there is a conspicuous lack of major rivers and creeks across the extensive areas of sand plains and alluvial plains. The Woodforde River is within the Ti Tree Basin western management zone and the majority of flows dissipate before reaching the town of Ti Tree, downgradient 40 km to the north. There is a series of short creeks flowing off the Yalyirimbi Range until Day Creek, the first major ephemeral river in the NE Southern Basins, 49 km west of the Wiso/Burt River Basin catchment boundary.

Both groundwater basins have large areas of alluvial plains and fans with Mulga Groves *(Acacia Aneura)* but the basin structure is generally different. In the case of the Ti Tree Basin, the alluvial and/or calcareous sediments are thick whereas in the NE Southern Basins the wide band of alluvial fans and alluvial plains (up to 12 km wide) south of the Yalyirimbi Range and in places north and south of the Hann Range is shallow Arunta bedrock.

The new Alyuen Community water supply bores are located in the NE Southern Basins in a narrow paleovalley north of the Hann Range within thick Mulga Woodland. The soils here are alluvial soils from decomposition of Arunta basement rock from the NE.

The thick mulga groves between and beyond the Hanson and Woodforde Rivers within the western water management zone of the Ti Tree Basin grow on thick sequences of sandy clay and in places calcareous mudstone. The thick mulga woodland west of Territory Grape Farm is mainly over calcrete and calcareous soils. There are high yielding aquifers in this location.

The Ti Tree Basin has long, low parallel discontinuous sand dunes (about 1 m in height, up to 20 km long with swales 200 to 800 m) across the sand plains parallel to the contours and, in some locations, irregular dunes and, in others, high irregular dunes e.g. at Territory Grape Farm. Within the NE Southern Basins there are also long, low parallel discontinuous sand dunes (up to 7 m in height, up to 25 km long with swales 400 to 800 m) across the sand plains parallel to the contours. In some locations, high short dunes occur e.g. north of *Arafura* production bore PB 7. There are also bands of Aeolian sand dunes parallel to the northern foot of the Reaphook Hills and between gaps in these hills.

The implication of the presence and location of these sand dunes across the sand plains parallel to the ground contours is that they block movement of surface water down gradient resulting in increased recharge to the vadose and phreatic zones. This is not uncommon in Central Australia.

Day Creek is a major ephemeral river in the region with a wide alluvial calcareous flood plain (with elevated levels of uranium) where river flows are blocked by a high range east of Paddy's Well and the river is impeded by the range and forced to change direction until there is a gap in the range (Patty Well Gap). This frequently occurs in the MacDonnell Ranges and other Ranges within Central Australia e.g. the Todd River at Heavitree Gap Alice Springs.

There are other similarities between the Todd River and Day Creek: on the sand plains south of the gaps in the ranges, a floodout formed due to the change in gradients and high sand and silt loads from the Arunta basement rock catchments. One difference is that the Todd floodout is over deep sediments of the Cenzoic Alice Springs Outer Farm Basin which also overlie Palaeozoic Amadeus Basin Formations, both with a number of excellent aquifers whereas the Day Creek Floodout is over relatively shallow Arunta Basement rock with no significant aquifers.

Due to the presence of excellent shallow colluvial aquifers at Paddy Well, north of the Reaphook Hills, and the ancient development of calcrete and silcrete aquifers in this location, Day Creek and associated drainage provides excellent recharge to the Laramba Aquifer.

The normally dry salt lake, "Lake Lewis", south of the Tanami Road and Stuart Bluff Range, other salt lakes and small swamps north of this range commence at Day creek and continue west beyond the project study area. There are also a few clay pans in some locations and other surface water features.

Lake Lewis is a groundwater discharge zone. Similarly other smaller salt lakes to the west of Lake Lewis and Napperby Creek are also believed to be groundwater discharge zones based on shallow water tables and saline ground.

There is no current evidence that surface flows in Day Creek reach Lake Lewis; however the bed of Napperby Creek runs into Lake Lewis and there is anecdotal and biological evidence that flood flows in this creek periodically flow into this salt lake (playa). Other major ephemeral creeks in the Burt River Basin from the south also periodically flow directly into this lake.

2.10 Surface Water Monitoring

Surface water monitoring is being completed in both the Nolans bore mine site area and in the NE Southern Basins and their catchment areas. This monitoring includes hydrostations currently consisting of:

- automatic creek flow water samplers,
- basic maximum flow height gauges,
- environmental cross sections including catchment condition monitoring points
- creek cross sections and longitudinal sections
- creek underflow sampling points and
- opportunistic sampling of:
    - waterholes
    - river flow
    - flow from temporary springs

It is planned to increase the number of hydrographic stations in the NE Southern Basins and its catchment area, upgrade the sophistication of key hydrostations (hydrograph data loggers, sampling water for chemical analysis) and commence sediment and bed load sampling.

2.11 Groundwater Recharge

Arafura has monitored groundwater recharge responses to rainfall and runoff in various aquifers in the region including in the Ti Tree Basin, the Margins area between the NE Burt Basin and Ti Tree Basin, the Nolans Orebody Aquifer, the Laramba Aquifer and Arunta Bedrock Aquifers.

No significant recharge response has been evident to date in the 15 widespread monitoring bores in the Reaphook Paleochannel Aquifer System over the past 2 years. Significant rainfall and runoff is a rarity in this arid region of Central Australia. The average annual rainfall is 300 mm and between July 2015, when the most of the Reaphook monitoring bores were drilled, and December 2016 a total of 400 mm of rain fell at the *Arafura* AWS and much less in the western zone of the study area near Day Creek (300 mm recorded at Napperby Homestead over this period).

This aquifer is a large Cenozoic Basin with many similarities to the adjacent Cenozoic Ti Tree Basin. Very extensive recharge and other hydrogeological studies have been completed by the NTG and other organisations over the Ti Tree Basin so, until more detailed knowledge is known on the Reaphook Paleochannel recharge, *Arafura* is using the Ti Basin assessment as a surrogate.

This adjacent basin has been studied in detail. SWL monitoring commenced in 1966. From the monitoring record and other assessed datasets, an average annual recharge of 2 mm/year over the basin is being used by the NTG in its numerical groundwater modelling and groundwater management plans. From the rainfall, runoff and observed Ti Tree Basin monitoring bore standing water level responses, significant recharge occurs following 100 mm of rainfall falling over a period of one month.

Reaphook Paleochannel Aquifers

We have no definitive data on the magnitude and frequency of recharge to the Reaphook Paleochannel Aquifers within the 4000 square kilometre study area which includes the borefields which are planned to be used to provide the main water supply for the *Arafura* Nolans mine.

Arafura has been monitoring the standing water levels in 25 bores and chemical water quality changes in 5 bores within this area for 3 years. The standing water level bore monitoring was increased to 30 monitoring bores two years ago. *Arafura* is also monitoring more than double this number of bores in the Margins Area, Northern Burt Basin, Ti Tree Basin and the Ti Tree Basin Arunta basement rock catchment (Nolans Mine site and Aileron).

Except for diurnal changes, the water levels in the Reaphook Paleochannel monitoring bores either have not shown any significant change in water level or do not appear to show any significant changes. Data loggers are on order and are due to be installed in selected Reaphook Paleochannel monitoring bores during August.

There was a significant response to this summer's rainfall and runoff at Patty Well area in the Laramba Aquifer.

No recharge response from rainfall runoff events is evident in the current record but clearly recharge is occurring as the water levels are not dropping despite significant groundwater flow through the system. Possible explanations include that:

- the changes are small and being masked by the diurnal changes (consistent with the large volumes of groundwater in storage and high aquifer permeability)
- response lag time
- monitoring bores need to be constructed closer to northern and eastern recharge zones and additional monitoring bores constructed within infiltration zones below the sand plains
- there could be tank type recharge zones with large fluctuating water levels

Significant recharge to the Reaphook paleochannel must be occurring as there is movement of groundwater through the aquifer systems indicated by the gradient on the standing water level.

A major rainfall and runoff event occurred over the region during the past summer (2016/17) with 500 mm of rain falling at the *Arafura* AWS over December and January. Higher amounts were recorded at station homesteads in the greater region. There had been no observable response to this event by the March 2017 SWL monitoring survey in the Reaphook Paleochannel Bores. Monitoring bores in the Southern Ti Tree Basin Majorca region were in a falling phase from natural throughflow whereas 3 months previously they were in a rising recharge phase, having increased in level by 100 mm over the previous 3 months.

Significant local recharge from infiltration of rainwater though the sand plains in discrete locations must occur as there are better quality water zones (and a change in water type) downgradient of poor quality water zones within the Reaphook Paleochannel.

NE Southern Basins Storage

Hussey[2] June 2014 calculated the total area of the central and eastern Cenozoic basin zones of NE Southern Basins as 955 km^2 and estimated the volume of total sediments as 111 km^3. Using average SWL of over his identified zones the total saturated sediments is 94.75 $km^{3.}$.

If we assume 1% as the available groundwater from the total saturated sediments then 947.5 GL is potentially available from these two (2) two zones of the NE Southern Basins.

If we use 4% (the same value as used by Knapton for the Ti Tree Basin numerical groundwater model) then 3,790 GL is available from Central and Eastern Sectors of the NE Southern Basins.

[2] Kelvin Hussey, Principal Geologist Arafura Resources Limited who created the AEM geophysical model over the NE Southern Basins, identified the extent of the saturated sediments, completed GIS mapping, area calculations using MapInfo and provided geological interpretation and assessments.

If we assign a value of 10% as used for the GHD Arafura Nolans groundwater numerical model (the same value used by Water Studies for their Ti Tree Basin numerical model) then 9,480 GL is available from these two zones of the NE Southern Basins.

Arafura requires 2.7 GL/yr over 43 years i.e. a total of 116.1 GL. NTG policy requires allocation of 80% to the environment and maximum use of the groundwater resources up to 20%.

1% specific Yield		**10% specific yield**		**4 % specific yield**	
94.75	km3	94.75	km3	94.75	km3
9.475E+10	m3	9.48E+10	m3	94750000000	m3
9.475E+13	L of volume	9.48E+13	L of volume	9.475E+13	L of volume
0.01	Sy	0.10	Sy	0.04	Sy
9.475E+11	L of water	9.48E+12	L of water	3.79E+12	L of water
2.7	GL/year	2.7	GL/year	2.7	GL/year
43	years	43	years	43	years
116.1	GL	116.1	GL	116.1	GL
116100	ML	116100	ML	116100	ML
116100000	m3	1.16E+08	m3	116100000	m3
1.161E+11	L	1.16E+11	L	1.161E+11	L
12%		1%		3%	
1.895E+11	20%	1.9E+12	20%	7.58E+11	20%
61%	of the 20% allocation	6%	of the 20% allocation	15%	of the 20% allocation

Table 5: volumes of groundwater available from the Central and Eastern Sector of the NE Southern Basins for different values of specific yield & percentage of the 20% maximum allowable water use

The calculations shown in table 5 exclude the volume of groundwater available in the Western sector of the NE Southern Basins and the Southern sector of the NE Southern Basins. They also exclude recharge from rainfall and runoff and deep weathered Ngalia Basin high yielding aquifers intersected in Bore RC # 18 (bore site 6A).

They show that based on the volume of saturated sediments calculated from the AEM geophysical model and standing water measurements and an ultra-conservative storage coefficient of 1% that over the 43 years planned life of the *Arafura* Nolans Mine that the mine will use up to 61% of the available allocation if the mine uses 2.7 GL/yr. *Arafura* is and will be seeking to reduce this demand to reduce pumping costs of obtaining their water supply from borefield 40 km downgradient of the main treatment plant.

These figures do not include the:

- the additional 160 km^2 Western Zone not included in Hussey's calculations, an estimated additional 100 GL
- groundwater in storage in the deep weathered beds of the Vaughan Springs Quartzite (sandstone) within the underlying Ngalia Basin syncline and
- ground water available in the Northern Burt Basin on Aileron station.

The above volumes do not include recharge from:

- the 331 km^2 hard rock catchment area (Yalyirimbi Range, Reaphook Hills, Hann Range and other rock outcrop in the area), recharge from the
- floodout areas including the alluvial fans 1,433 km^2,
- diffuse recharge from infiltration across the 936 km^2 sand plains[3],

More than 90% of the groundwater available NE Southern Basins has a total dissolved solids content greater than 1,500 mg/L, i.e. it is brackish water which does not meet Australian Standards for domestic water supplies but the quality is fine for Arafura's purposes.

The outputs of the initial Arafura GHD numerical groundwater model reflects the large volumes of groundwater in storage. This model covered the whole area of the NE Southern Basins, included estimated recharge, used a reasonable storage coefficient value of 10% and the previously identified mine water demand of 4.3 GL/yr.

NE Southern Basins Recharge (Recharge to the Reaphook Paleochannel and associated aquifers).

Currently there is a lack of data to assess recharge to the NE Southern Basins. As previously identified there is a large volume of groundwater in storage, there is a gradient to the west on the potentiometric surface in the Reaphook Paleochannel and associated aquifers which indicates the groundwater is moving slowly to the west but there is no evidence that there has been a significant drop in bore water levels across the system within the study area or near eastern extent of these aquifers.

There are no significant users of the resource within the study area though there may be some use in some locations by trees and shrubs, particularly in shallow groundwater feeder systems. It appears that steady state conditions currently prevail in the main aquifer systems within the study area which covers an area of approximately 4,000 km^2.

The NTG policy that only up to 20% of the water resources may be used for water supplies providing there are no adverse impacts on existing users including the environment and cultural users places a limit on how much groundwater water can be utilised from the NE Southern Basins borefield and ultimate borefield drawdown zone.

Rainfall events which could be expected to provide recharge to these aquifers occurred over the past two summers. You can expect a significant lag period with direct infiltration through the vadose zone

[3] These areas were provided by Rodney Dean, Arafura Exploration Geologist who used the Hussey extent of saturated sediments within the NE Southern Basins and surface water catchment boundaries determined from the shuttle radar DEM and from National Mapping 1:250 000 raster

and very long lag times through leaky aquifers and arrival by throughflow from intake beds tens of kilometres distant. Monitoring bores will be required in these potential distant recharge zones.

There was a significant response in the Laramba water table aquifer particularly following the January 2017 high rainfall event. Variable responses also occurred in shallow water table aquifers in the Margins area and a dramatically good response in the Nolans mine site monitoring bores. Monitoring bores in the SE Ti Tree Basin were in a falling phase in February 2017 despite the high summer rainfall where over 2016 they were in a recharge phase.

In the Ti Tree Basin there is a large number of monitoring bores in the southern water management zones with over 50 years of records in the north western zone and over 30 years in the central zone. For the initial Ti Tree Basin water management plans prepared by the NTG in 2002 a simple catchment model was used to estimate recharge. It was estimated that average recharge from direct infiltration across the central sectors of the basin was 2 mm/yr and that flood recharge from catchment runoff was estimated at less than 1.5% of annual rainfall based on runoff occurring after rainfall of more than 100 mm in a month.

Two numerical groundwater models were developed by the NTG over the Ti Tree Basin. The last model was prepared by Knapton in 2009, a more sophisticated approach covering a much larger area of the basin.

Arafura (GHD) has prepared a numerical groundwater model over the Nolans Region including the NE Southern Basins study areas, the Nolans mine area and the central Ti Tree Basin but it currently lacks both the long term water level record and, importantly, a history of major extraction of groundwater over an extended period with datasets showing the effect of this extraction on the water resources. At least 3 years of major extraction from the *Arafura* NE Southern Basins borefield will be required and possibly up to 5 years of groundwater extraction/water monitoring data will be required before the *Arafura* numerical groundwater model over the NE Southern Basin region can be fully calibrated.

As an interim initial approach, a simple catchment model method based on the NTG Ti Tree approach has been applied to the NE Southern Basins. The outputs from the current *Arafura* numerical model also provides useful information about the possible extent of borefield drawdown at 100 years and 1000 years and other time slices; these are provided in the draft Nolans EIS.

Laramba Aquifer Recharge

During March 2017, *Arafura* measured an increase in SWL of 0.9 m in NTG monitoring bores in the Laramba aquifer adjacent to Day Creek and Patty Well. Adjacent to the # 1 Laramba Production bore the SWL had risen 23 cm; however this monitoring bore is within the cone of depressions of the pumped bore. Day Creek had flowed a banker and was still trickling in some locations between the Laramba main road crossing and Patty Well.

Abstraction of groundwater occurs in this location from 2 Laramba water supply community production bores and a stock bore. One Laramba production bore pumps continuously and the stock bore is equipped with a windmill.

The shallow Laramba Aquifer is recharged from flows in Day Creek and infiltration of rainwater through the overlying calcrete, silcrete, sand and gravel. This 10 to 30 m thick aquifer overlies steeply dipping quartzite and covers a surface area of 36 km^2 immediately north of the southern shoulder of the Ngalia Basin (Reaphook Hills).

The SWL in Nolans Replacement Bore (RN 18761; RC # 63), adjacent to Kerosene Camp Creek, had risen 2.1 m and the ore body aquifer at Nolans had risen 1.4 m, immediately west of Kerosene Camp Creek within the area of the planned pit, a rise of 0.73 m depending on distance from the major recharge source, Kerosene Camp Creek. A major flash flood had occurred in Kerosene Camp Creek and it continued to trickle flow in places within the Nolans Region over the following 2 weeks.

2.12 Groundwater Quality

The groundwater in the Reaphook Paleochannel aquifers and feeder aquifers ranges in quality between fair to saline with median conductivity based on water analyses from Arafura Southern Basins water investigation bores is 2,130 uS/cm. The groundwater does not meet the Australian guidelines for drinking water and most of the water is not suitable for irrigation but is fine for the intended use i.e. ore treatment and mine use at Nolans.

As can be expected in such a large multi aquifer system with many different recharge sources the groundwater quality within the alluvial and colluvial sediments of the basins in the region is complex both spatially and vertically. The groundwater in the region can be characterised by aquifer type:

- alluvial
- alluvial / fluvial
- calcrete
- calcrete alluvial
- calcrete alluvial fluvial
- calcrete basement
- reaphook paleochannel
- Ti Tree Basin Aquifer
- weathered basement
- other

The groundwater chemistry by aquifer type is shown on a series of diagrams and tables in Appendix K: *Arafura* Nolans EIS May 2016. These include a piper diagram (figure 13), graph of electrical conductivity plotted by aquifer type (figure 14), electrical conductivity statistics by aquifer type (table 4), electrical conductivity (min) of groundwater samples (figures 15, 16). These drawings are included in Appendix F.

These figures and tables were prepared from the *Arafura* groundwater investigations in the region (mainly NE Southern Basins water investigation) and the Arafura baseline water quality sampling program. The sample set used consists of 158 chemical analysis from a total of 71 bores, these datasets are included in Appendix F. In addition there are extensive NTG bore groundwater chemical analyses on samples from bores in the region in the NTG DENR webpage water portal and Hydstra database. These include large chemical datasets on samples from bores in the Ti Tree Basin, NTG groundwater investigations for the Laramba Water Supply, Alyuen ALT community water supply, pastoral bores and bores constructed for road construction and maintenance.

A major influence on the groundwater quality in the NE Southern Basins is the high salt load in the adjacent weathered Arunta Basement Rock. This salt load is due to weathering and evaporation. Evaporation concentrates the constituents and results in distinctive high sodium chloride rich water.

There is significant Arunta Basement Rock outcrop in the Yalyirimbi Ranges / Aileron Hills north of the Reaphook paleochannel and isolated low basement rock outcrop in places between the east west trending Paleochannel and the Ranges to the north.

There is a broad area over the alluvial plains and sand plains 4 to 5 kilometres wide south of the Yalyirimbi Range and the Aileron Hills to the Reaphook Paleochannel where there is shallow sub crop of Arunta Basement rock. The Reaphook Herringbone feeder paleochannels were eroded into basement rock then filled with colluvium and alluvial sediments. The weathered basement rock will include limited localised aquifers and seepage water above the fresh basement rock.

The overall permeability of the weathered rock is very low as evidenced from the number of unsuccessful dry bores and inspection of the cuttings. Seepage of brackish and saline groundwater from this basement rock will provide a limited volume of poor quality water to the feeder paleochannels and main channels however it is believed that most of the sodium chloride rich water from the basement rocks and associated thin sediments and soils is transported by periodic runoff i.e. flows in the limited numbers of rivers, creeks, drainage lines, floodouts and sheet flow areas. Most of the flows in the creeks, floodouts and sheet flow area rarely reach the sand plains due to the topography. On those rare occasions when major flood flows occur (on average about every 30 years based on NTG records in similar catchments in the region) the flood flush provides good chemical quality water but periods of extended trickle flow (baseflow) tend to provide poor quality water off the basement rock catchments.

Significant recharge from infiltration of rainwater and runoff changes the water type particularly in locations distant from runoff from basement rocks. Here the water type is dependent on local geology/hydrogeology. Within the Patty Well area of the Laramba Aquifer the groundwater is calcium and magnesium rich from the excellent vertical recharge characteristics of the area.

3 Conceptual Groundwater Model

GHD developed a conceptual groundwater model prior to preparing their *Arafura* numerical groundwater model. It covers an area three times as large as the *Arafura* NE Southern Basins Study Area. This conceptual model is described by GHD in the Nolans project EIS.

A more detailed conceptual groundwater model over the *Arafura* groundwater and surface water study areas was prepared by *Ride Consultants*. These conceptual models covered the:

- NE Southern Basins
    - Reaphook Paleochannel and associated aquifers
    - Northern Burt Basin
    - NE Burt Basin
    - The Margins area
- Nolans Basement Rock Region
- South Western area of the Ti Tree Basin
- *Arafura* Allungra Borefield.

These conceptual models are described at different levels of detail in a report by *Ride Consultants* on the Water Resources of the Nolans Region and in attachments to this report.

4 Numerical Groundwater Model

Lee Evans, Senior Hydrogeologist GHD, prepared an initial *Arafura* numerical groundwater model covering an area much larger than the *Arafura* study areas. He included within the modelled area:

- *Arafura's* NE Southern Basins study area (4000 km^2) which includes their Nolans Mine Southern Basin's borefields
- An area west of the NE Southern Basins study area
- Lake Lewis
- The Southern Ti Tree Basin (6000 km^2)
- The Margins (1000 km^2): a much larger area within and adjacent to the Ti Tree Basin than used by *Arafura*; this area includes the Majorca sector of the Ti Tree Basin
- Lake Lewis (1000 km^2)
- The basement area between the Southern Basins and the Ti Tree Basin which includes the mine pit

The numerical model is currently being reviewed to assess the probable effect of the significantly reduced mine water demand.

Data loggers are being installed to provide standing water data to enable revision of the model. It is planned to periodically update and re-run the model once significant groundwater is extracted from the *Arafura* Borefield, following acquisition of significant additional datasets or as required to assist management of the borefields to minimise environmental impacts.

It is expected that the model will be re-run 3 years after commencement of full operation of the mine or 5 years after commencement of significant extraction of groundwater from the borefields and then every 5 years or as dictated by monitoring results, water resource and borefield management requirements.

The model and its initial output are described in detail by GHD in the EIS and supplementary EIS documents.

6 Nolans Mine Estimated Water Demand

Arafura have substantially reduced their Nolans Mine water demand from about 4.7GL to about 2.7GL per annum (pa) by changing the treatment process in the beneficial treatment plant and planned improved water management measures.

The mining camp and mine operations potable water supply demand remains similar.

Arafura is planning to use groundwater from pit dewatering for construction, dust suppression and in beneficiation within the mine site and ore treatment. Recharge to the pit from flows in Kerosene Camp Creek will be cut off during the early construction phase as this creek is to be diverted into one of its tributaries, "West Kerosene Camp Creek". Availability of water from the pit has been estimated from mine planning studies and the volume estimated based on the dewatering groundwater investigation and climatic factors.

Water from the pit and stormwater capture on the mine site will reduce the demand for brackish water from the Southern Basins. The actual volume of groundwater available from the pit will only be known with confidence once mining operations commence; it is expected that this source of water will significantly reduce the demand from the Southern Basins over the construction phase and initial operations.

7 Mine Groundwater Supply Planned Development

Up to five borefields in the NE Southern Basins are planned to be utilised to meet the demand and provide borefield management opportunities to minimise potential drawdown impacts on vegetation and the environment within and adjacent to the borefields.

One of these borefields targets the good to fair quality groundwater north of the main Reaphook Paleochannel borefields where mine process water is to be sourced. It is estimated that 0.05 GL pa is required for the mine potable water supply. One domestic water supply investigation production bore is currently sited in this borefield and will extract groundwater from low yielding weathered basement aquifer.

A small borefield groundwater investigation is planned to locate additional better quality groundwater within the designated borefield area (*Arafura* Borefield # 5), and to construct permanent production bores, borefield and water resource monitoring bores.

The total mine construction and treatment water demand could possibly be obtained from one borefield based on interpretation of the current short-term pump testing results and the output of the numerical groundwater model. Development of a series of borefields will provide flexibility in management of the resource to minimise impacts on existing users of the groundwater resources.

Multiple borefield development and associated borefield field groundwater investigations will facilitate collection of additional critical resource behaviour data on each of the *Arafura* NE Southern Basins borefields.

The current plan is to develop up to 4 process water borefields around the existing investigation production bores P1, P2, P6 and P7 which are to be used for construction water and the initial process water. The highest bore yield from the Reaphook Paleochannel (bores P1, P6 and P7) was obtained from P7 and the lowest from P6. This is a little misleading as P6 was designed to determine the hydraulic characteristics of the upper aquifer intersected too high in P1. A much higher yielding production bore can be constructed at P6 by drilling deeper and targeting the deeper high yielding aquifers in this location.

These 4 borefields were originally planned to deliver 4.7 GL pa with an additional 2 borefields identified to the west and south if required to meet environmental, regulatory or future borefield management requirements. The change to a different ore treatment process and reduced throughput resulted in a reduction in process water demand to 2.7 GL pa which will result in a reduced number of production bores and possibly a reduction in the number of borefields required. Until further borefield groundwater investigations are completed and behaviour of the aquifers in each borefield to significant extraction is known it is prudent to plan on use of the 4 process water borefields and one potable water borefield. The additional data will provide improved predictability of the numerical model.

The production bores were not designed as permanent high-quality production bores; they were sited and designed as part of the NE Southern Basins groundwater exploration program to facilitate the design and construction of permanent high-quality production bores.

These production bores and their associated stratigraphic and hydrogeological investigation bores were drilled to confirm the outputs of the AEM geophysical model and to assess the hydraulic characteristics of the aquifers, potential production bore and borefield yields. Due to the high yields encountered in these bores and the interpreted possible hydraulic characteristics of the aquifers intersected based on the drilling and airlift testing results, their separation was partly based on the "Gunter Seidel Ti Tree Basin borefield separation model".

The airlift yields of the NE Southern Basin bores in the nominal borefields 1 and 2 (PB 1 and 2) were similar to those encountered at Southern Cross Farm (previously Territory Grape Farm) in the Ti Tree Basin. PB 4 and 7 plus 6A had airlift yields about double the production bores at the Southern Cross Farm. The actual sustainable pumping rate of the Southern Cross production bores is about half the airlift yield on completion of drilling.

The NTG "Gunter Seidel Ti Tree Basin borefield model" was based on assessment of the hydraulic performance of the Ti Tree aquifer at the Southern Cross Farm. Extraction data was available from the borefields' 15 production bores and extensive SWL data was available from a wide network of monitoring bores.

Seidel used the output from this model and assessment of groundwater investigations in that sector of the Ti Tree Basin to recommended the location of 3 additional farms based on borefield separation calculations to avoid significant pumping interference between borefields. The proposed new farm borefields required extraction of up to 1 GL pa based on farm economic factors and Seidel calculated that these borefields should each cover a minimum area of 10 km^2.

Whilst the aquifers at this location are quite different to the aquifers in the Reaphook Paleochannel there are apparent similarities in recharge from distant streamflow and local infiltration. The Basins are both adjacent Cenozoic Basins with an upper aquifer and deep paleochannel aquifers.

Major differences in the Central Ti Tree Basin Water Management Zone include the Ti Tree Aquifer which includes a series of alluvial aquifers within the upper 100 metres of the basin and mainly consists of sand beds and sandy clays with silt layers whereas the equivalent strata in the NE Southern Basins is the reworked upper 70 metres of alluvium with relatively low-yielding aquifers. The main Reaphook aquifers are deep massive colluvial boulder beds, sand and gravel beds or semi consolidated sandstone; the sand is believed to have been originally sourced from colluvial deposits. The groundwater quality in the main NE Southern Basins aquifers is of much poorer quality than the groundwater quality of the main high yielding aquifers within the upper 100 m of the Ti Tree Basin development zones.

8 Conclusions

1. The interpreted storage, discharge (throughflow & extraction for main and other use) recharge to the NE Southern Basins Arafura Study Area is sufficient to supply the Arafura Nolans mine with 2.7 GL/yr for 43 years and complies with the NTG 80% (environment) 20% (maximum usage) water use policies.
2. The initial Arafura Nolans numerical groundwater model output indicates that there will be minimal impact if any on existing users of the groundwater resources in the NE Southern Basins, Ti Tree Basin Basement Catchment area and the Ti Tree Basin from extraction of the 2.7 GL/yr from the NE Southern Basins and progressive dewatering of the pit
3. The long term sustainable use of the groundwater resources in the NE Southern Basins is limited to recharge of the resource. The aquifers in this area are being recharged from runoff from adjacent hills and ranges, diffuse recharge across the overlying sand plains with higher rates of recharge occurring at particular preferential sand plain recharge locations.
4. There is natural flow of groundwater through the Reaphook Paleochannel aquifers which from the limited water level records near Laramba appears to have remained relatively constant for more than 30 years indicating long term recharge processes.
5. Whether based on an ultra-conservative specific yield of 1% or the more likely around 10% there is a very large volume of brackish groundwater in storage in the Reaphook Paleochannel and associated aquifers.
6. Up to 4 borefields extracting groundwater from the Reaphook Paleochannel, 1 borefield extracting groundwater from feeder aquifers to the E of the Reaphook Paleochannel and a domestic water supply borefield N and NE are proposed to provide the annual extraction of 2.7 GL/yr and manage potential borefield drawdown impacts.
7. Additional groundwater investigations are required within the designated borefield areas and feeder herringbone aquifers to select the best array, design and construction of permanent production bores and additional borefield and NE Southern Basin groundwater resource monitoring bores.
8. There has been no significant extraction of groundwater from the NE Southern Basins, 3 to 5 years of significant extraction will be required to stress the aquifers and provide the monitoring data for complete calibration of the numerical groundwater model.

9 Recommendations

1. Establish long term water resource management and monitoring program in the NE Southern Basins to determine drawdown and aquifer recharge rates to a high level of confidence. The program to include bores drilled to monitor varying levels i.e. shallow, moderate and deep aquifers within the palaeochannels.
2. Complete groundwater borefield investigations in the NE Southern Basins Eastern, South Eastern, Central and Domestic Borefields in the early development phase. These will include investigation bores, permanent production and monitoring bores within the designated borefields. Investigations to include down hole geophysical logging and interpretation, hydraulic pump testing, aquifer sieve analyses for selection of production bore screen aperture and gravel pack sizes, land surveying for levelling AHD of GL, bore MP, hydrographic stations MP and MPs of infiltrometers.
3. If required construct additional monitoring bores in the Reaphook Paleochannel to identify recharge responses to inform the assessment of throughflow and monitoring datasets for input and refinement of the numerical groundwater model.
4. If required establish investigation bores and permanent water level and water quality monitoring bores in the herringbone feeder channel aquifers of the NE Southern Basins.
5. Construct high quality production bores in the Eastern and Central *Arafura* Borefields to extract groundwater from Reaphook Paleochannel aquifers and one investigation production bore and associated observation bores in the deep fracture zone aquifer intersected in investigation bore RC # 18 (bore site 6A).
6. Construct high quality production bores in the South-Eastern *Arafura* Borefields to extract groundwater from Reaphook Paleochannel feeder aquifers.
7. Construct investigation production bores in the domestic water supply borefield to determine the sustainability and suitability of this borefield for its intended purpose.
8. All production bores on extracting significant volumes of groundwater should have water meters to record extraction rates, weekly extraction volumes, bore and borefield drawdown (and recovery).
9. Construct new water level and water quality monitoring bores with inert casing down groundwater gradient of the Nolans mine site.
10. Review and revise the groundwater monitoring programs following completion of the additional groundwater investigations. Commence monitoring extraction of groundwater from the NE Southern Basins and from the mine pit for construction and other uses
11. Install infiltrometers at selected sites in interpreted borefield recharge zones in the NE Southern Basins
12. Update the GHD numerical groundwater model following completion of the development phase groundwater investigations
13. Install rain gauges across the NE Southern Basins.
14. Construct new hydrographic stations on Day Creek, Pridmore Creek and on creeks if suitable within and adjacent to the main treatment plant area

9 Acknowledgements

This report has not referenced all the statements and extracts from various reports and documents used in this assessment and in particular the draft Nolans Environmental Impact Statement May 2016 prepared by GHD on behalf of *Arafura*.

We wish to acknowledge the excellent contributions by Dr Lee Evans, Principal Hydrogeologist GHD, Kelvin Hussey Principal Geologist *Arafura* and Brian Fowler General Manager Northern Territory & Sustainability *Arafura*.

A large digital water resource database has been prepared for Arafura from the various extensive groundwater and mineral investigations completed by Arafura in seeking a water supply for the proposed mine and establishing baseline surface water and groundwater monitoring programs in the region. The database includes large datasets prepared by Northern Territory Government Agencies downloaded from their webpages. This database includes large water bore datasets, surface water monitoring and technical water resource assessment reports.

The report and datasets prepared by Government hydrogeologist Geoff Knott in seeking a water supply for the Laramba Community were very useful in describing the Laramba Aquifer.

10 Disclaimer

The information contained in this document has been carefully compiled but *Ride Consulting* takes no responsibility for any loss or liability of any kind suffered by any party, not being the intended recipient of this document, in reliance upon its contents whether arising from any error or inaccuracy in the information or any default, negligence or lack of care in relation to the preparation of the information in this document.

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Abbreviations

AG	Australian Government
Arafura	Arafura Resources Limited
RC	Ride Consulting
NT	Northern Territory (of Australia)
NTG	Northern Territory Government
DENR	NTG Department Environment & Natural Resources
NRETAS	NTG Department Natural Resources Environment and the Arts and Sport, a predecessor of DENR
NTEPA	NT Environmental Protection Authority
Mine Site	Area comprising Mineral Lease Application ML 26659 lodged with NTG by *Arafura* February 2008. Includes the mine, concentrator and associated infrastructure.
Nolan	The collective term referring to the Nolans Project Site including all components – mine site, processing sites, borefields, accommodation village, access roads, utility corridors
Nolans Bore	Abandoned Aileron Station stockwatering bore drilled into the RE orebody within area of the proposed Nolans mine pit.
Nolans Region	Includes the Nolans project site; Southern Ti Tree Basin and SW basement catchment area; catchments of Kerosene Camp Creek; Western and Eastern Kerosene Camp Creek; NE Southern Basins between Yalpirakinu ALT to the west and the Stuart Highway to the east, Stuart Bluff Range and Reaphook Hills to the south, the basement rock catchment areas to the north; Margins Area; NE Burt Basin; Northern Burt Basin.
NNE	North of north east
NE	North east
NW	South west
SE	South east
SSE	South of south east
SW	South west

AHD	Australian height datum
PMF	Possible maximum flood
PMP	Possible maximum precipitation
an	annum, year

yr	year
km	kilometres
km^2	square kilometres
m^2	square metres
GL	gigalitres; 1 million litres
ML	megalitres; 100 000 litres
L	litres
L/sec	litres per second flow rate
m	metre
m^3	cubic metres (volume measurement)
mg	once thousandth of a gram (unit of measurement of mass)
mg/L	milligrams per litre; once thousandth of a gram per litre
ug	one millionth of a gram; one thousandth of a milligram
ug/L	micrograms per litre
ppm	parts per million equivalent to mg/L
GL	ground level
RL	reduced level
RLMP	reduced level of (bore) measuring point
SWL	standing water level (bore)
ssd	sandstone
lsd	limestone
slt	siltstone
pa	per annum
RC_ID	Ride Consulting unique bore identification number. All bores within *Arafura* Nolans study regions are assigned a number covers: water, mineral, stratigraphic and other bores included in the *Arafura* Water Database
Site	Ride Consulting bore site number
Depth	drilled depth, completed depth monitoring bores much less than drilled depth
Yield (AL)	airlift yield of open hole at the completion of drilling and clean out
SWL	standing water level at completion of drilling
bGL	below ground level
bMP	below measuring point

bTOC	below top of casing
Est Base	estimated basement rock (Arunta, Aileron Provence rock: granite, gneiss, schist etc.)
>	greater than
mm PVC	internal diameter class 12 PVC casing

Glossary

Southern Basins	A series of Cenozoic Basins south of the Surface Water and Groundwater Divide between Ti Tree Basin and Arunta Basement Rock outcrop which occurs in the Yalyirimbi Range and other hills and ranges in the Nolans area. These basins include the Cenozoic Whitcherry, Central Mount Stuart, Mt Lewis, Burt, Sixteen Mile, Northern and North Eastern Burt Basins. The Whitcherry Basin overlies in part the Palaeozoic Ngalia Basin
NE Southern Basins	Eastern Whitcherry, Northern Burt Basin, NE Burt Basin (including Margins Area which also includes the connection of the NE Burt Basin with the Ti Tree Basin)
Margins	The groundwater and surface water divide and adjacent areas between the north eastern Burt Basin and the Ti Tree Basin. This area on Aileron Station south of the Hann Range is the only location where Southern Basin sediments are directly connected to Ti Tree Basin sediments. The aquifers are connected but at the groundwater divide the groundwater moves in opposite directions i.e. either to the NE towards the central and eastern Ti Tree Basin or to the SW into the Burt Basin. Similarly within the Margins area at the surface water divide, surface drainage is either to the NE or SW. NE of the divide surface water is within the Wiso River Basin and SW within the Burt River Basin.
Borefield	One or more water production bores extracting groundwater from aquifers
Aquifer	Saturated sediments or rocks that yield useable volumes of groundwater
Aquifer Porosity	Within aquifers i.e. saturated sediments and rocks with useful supplies of groundwater, the water that fills the spaces between the individual grains in sediments or rock (the pores) is called aquifer porosity. Clay has a high porosity (40 to 60%) but has virtually zero permeability so is not an aquifer whereas sand and gravel such as occurs in the Reaphook Paleochannel aquifers will have a porosity between 10% and 35%. And the sandstone intersected in some of the Arafura NE Southern Basins investigation bores will have between 5% & 30 % and high permeability.
Permeability	Is a measure of the interconnection between cracks, pores and any solution cavities.

Appendices

Appendix A *Arafura* Nolans Water Study Areas

The study areas cover the different groundwater and surface water investigations and assessments as listed below:

- *Arafura* Nolans Mine Site
- Treatment Plant Old Albs Bore
- Southern Basins
- NE Southern Basins: note the different spatial areas used in different assessments
    - *Arafura* NE Southern Basins Borefields
    - NE Southern Basins field drilling and associated groundwater investigations
    - NE Southern Basins hydrogeological assessment
    - NE Southern Basins water allocation submissions
    - GHD numerical groundwater model
- NE Southern Basins catchment areas
- Reaphook Paleochannel
- Northern Burt Basin
- North Eastern Burt Basin
- Margins Area
- Pridmore Basin Investigation
- Lake Lewis
- Southern Ti Tree Basin
- *Arafura* Allungra Borefield
- Majorca Prison Farm Investigation (Ti Tree Basin)
- Laramba Investigations: Patty's Well, Napperby Creek, Napperby Homestead, Tilmouth Well
- Dann's Hidden Valley (Ti Tree Basin, Aileron Station)
- SW Ti Tree Basin Brackish Water Study
- SW Ti Tree Basin Catchment
- Nolans Region
- Nolans Bore includes the area and immediate surrounds of the proposed pit
- Nolans Replacement bore
- Aileron Roadhouse including Aileron Homestead, Racecourse, Alyuen ALT, and area covered by the NTG Alyuen Investigation
- Woodforde River
- Kerosene Camp Creek catchment, Aileron and Pine Hill Stations
- Western Kerosene Camp Creek
- Eastern Kerosene Camp Creek and Nolans Creek
- Day Creek
- Bore monitoring programs
- Surface water monitoring programs

Some of these study areas are for regional studies; others are where extensive field groundwater investigations were completed including drilling and testing programs; others are local areas within the regional areas where detailed field or desktop studies were completed or are ongoing e.g. baseline monitoring programs.

Appendix B *Arafura* Groundwater Monitoring Program Results

The groundwater monitoring program included bore standing water level and water sampling for field and laboratory analysis. Gas samples were taken from outflow of production bores during airlift testing and two selected samples were analysed in a laboratory.

Water samples were taken for isotope analysis but except for two strontium analyses were not analysed.

Scheduled standing water monitoring includes:

- 32 *Arafura* monitoring bores in the NE Southern Basins, plus 12 bores owned by others (NTG, Napperby and Aileron Stations) - NE Southern Basins
- 32 *Arafura* Monitoring bores in the Margins Area plus 5 bores owned by others (NTG, Aileron Station) - NE Burt Basin and S Ti Tree Basin
- 3 bores in the New Nolans area 1 km up-gradient of the proposed mine pit, 2 *Arafura* baseline monitoring bores plus one bore owned by others (Aileron Station) – SW Arunta Basement Catchment Area of the Ti Tree Basin
- 7 bores within the proposed pit - 6 *Arafura* bores and 1 bore owned by others (Aileron Station - SW Arunta Basement Catchment Area of the Ti Tree Basin
- 6 bores at Alyuen and Aileron Roadhouse, all owned by others
- 1 *Arafura* monitoring Bore Ti Tree Basin (Dann’s Hidden Valley)
- 3 *Arafura* monitoring Bores Allungra Borefield – Ti Tree Basin
- 20 monitoring bores Ti Tree Basin – Majorca, Railway Corridor, Woodgreen CR, Pine Hill, Aileron, Ahakeye ALT, TGF

Scheduled groundwater quality monitoring includes:

- 4 bores in the pit area (3 *Arafura* dewatering bores) and one bore owned by others (Aileron Station)
- 2 bores at New Nolans (one owned by *Arafura* and one by others) - SW Arunta Basement Catchment Area of the Ti Tree Basin 2 bores in the NE Southern Basins (1 *Arafura* monitoring bore and 1 production bore owned by CDSC) - NE Southern Basins
- 2 bores at Aileron Roadhouse owned by the Roadhouse
- 1 *Arafura* monitoring Bore Ti Tree Basin (Dann’s Hidden Valley)

Opportunistic Bore Standing Water Level and Groundwater Quality Monitoring

25 bores on Aileron, Napperby, Pine Hill, Yambah Stations; Ti Tree Farms, Pmara Jutunta, Alyuen, Laramba access road. Opportunistic is when bore pumping equipment has been pulled from a bore or bore is pumping water so a water sample can be taken.

Arafura Field Groundwater Investigations Sampling and Monitoring

Programs as identified in the appendices which also included pump testing of investigation production bores in the NE Southern Basin where gas samples were taken during each constant rate test.

Data Loggers:

Standing water level and temperature data loggers were installed in the production bore and nearby observation and monitoring bores whilst the NE Southern Basins pump testing program was completed.

Seven (7) In Situ Level Troll 400 bore water level and temperature data loggers are due to be installed in key NE Southern Basins baseline water level monitoring bores RC # 12, 16,17,18,23,26 & 60 (bore sites A0, 1C, 1B, 6A, 5A, 4A & 9(2)) early September 2017. A Baro Troll will be installed in one of these bores.

Standing water levels were measured in:

- *Arafura* investigation bores during field drilling investigations: NE Southern Basins and Margins Area using tape and sounders/ploppers
- *Arafura* investigation bores several times a year following completion of drilling: NE Southern Basins and Margins Area using tape and sounders/ploppers
- Investigation production bores, observation bores and selected monitoring bores during hydraulic pump testing using Troll data loggers.
- Other regional bores:
    - Selected bores in the Laramba Borefield, Alyuen Borefield, Aileron and Napperby Station Bores within and adjacent to the study area several times a year
    - Other stockwatering and roads maintenance bores in the region on an opportunistic basis
    - Bores in the Nolans Arunta Basement Rock, the area between the NE Southern Basins and Ti Tree Basin including the Dewatering Monitoring Bores and the New Nolans Replacement Bores
    - Bores in the Arunta Basement Rock between the Ti Tree Basin and Margins Area (Ti Tree Basin Catchment Area) at Aileron Roadhouse, Alyuen ALT and stockwatering bores east of the Stuart Highway
    - Ti Tree Basin Bores including bores on Aileron, Pine Hill and Bushy Park Stations and the Railway Reserve. The bores monitored in the Ti Tree Basin on Aileron Station included the previously proposed Majorca Prison Farm area, the *Arafura* Allungra Borefield and a small hammerhead paleochannel of the southern Ti Tree Basin.

The bore standing water level record is described and summarised in Attachment 1. The methodology and identification of measurement issues are also provided in this attachment. The complete record is available in Microsoft Excel digital format.

Where available, standing water level monitoring completed by others has been included in the complete record. This includes the NTG records on the Ti Tree Basin and Laramba Monitoring Bores.

All the standing water level monitoring records for each bore have been graphed.

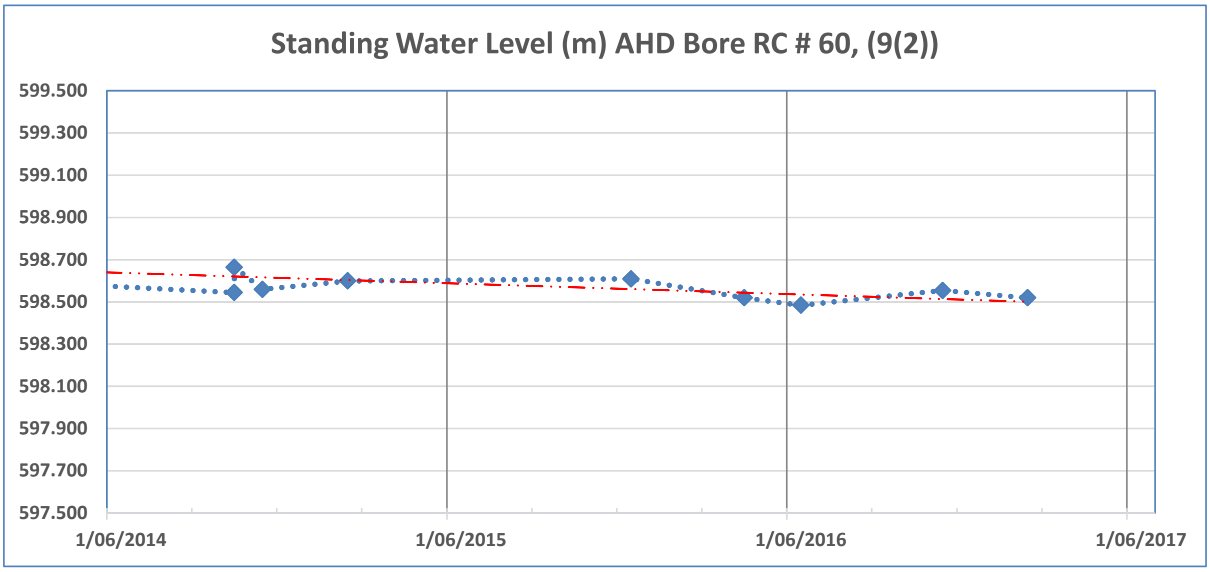
<u>Bores East to west Reaphook Paleochannel and extension to south of Hann Range</u>

RC # 60 Bore site 9(2) (*Arafura* baseline water level monitoring Bore)

Minimum depth SWL = 598.599 m AHD (22.130 m bGL)

Maximum depth bGL = 598.484 m AHD (22.425 m bGL)

Median depth bGL = 598.530 m AHD (trending a minor fall)

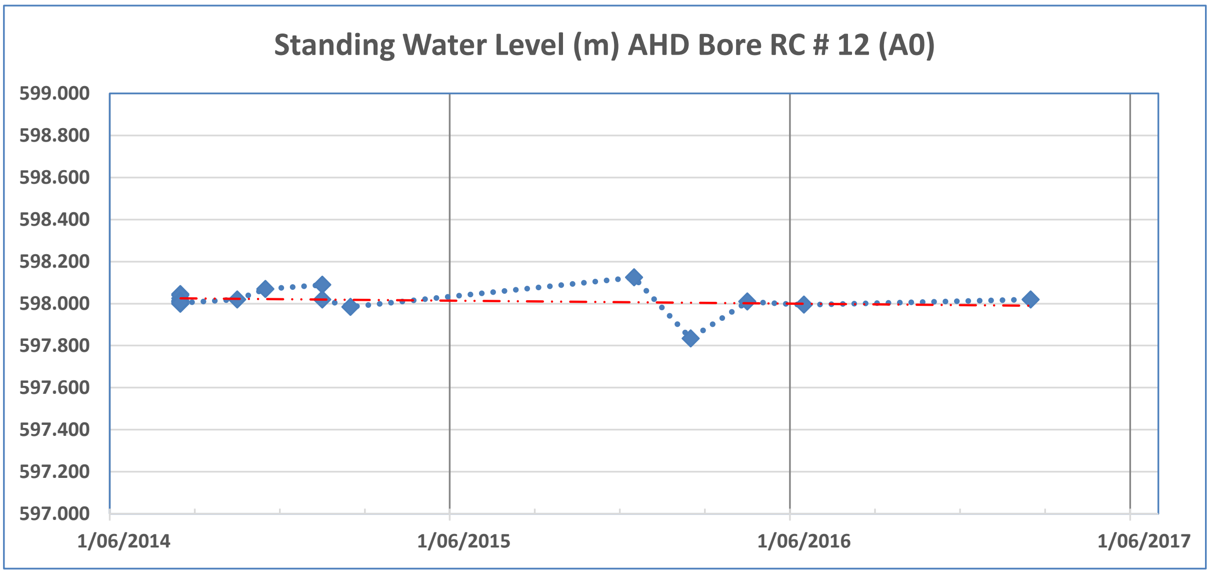


RC # 12 Bore site A0 (*Arafura* baseline water level monitoring Bore)

Minimum depth SWL = 598.069 m AHD (20.655 m bGL)

Maximum depth bGL = 598.019 m AHD (20.705 m bGL)

Median depth bGL = 598.035 m AHD (trending a very minor fall)

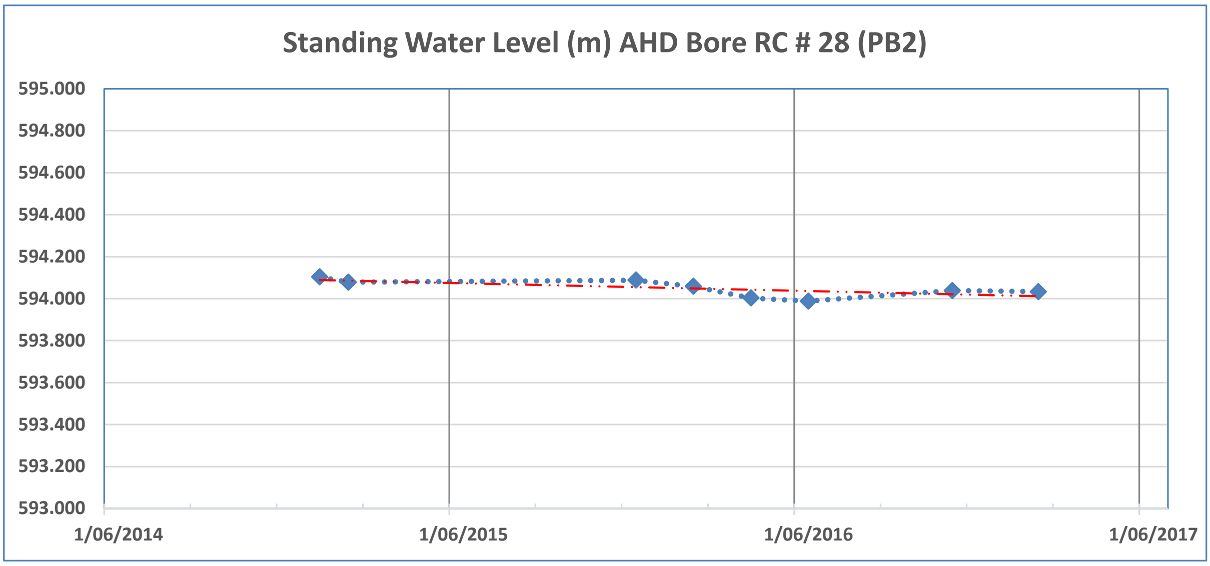


RC # 28 PB2 Bore site PB 2 (*Arafura* Production Bore)

Minimum depth SWL = 598.069 m AHD (19.910 m bGL)

Maximum depth bGL = 594.058 m AHD (19.965 m bGL)

Median depth bGL = 594.063 m AHD (trending a very minor fall: possibly for diurnal)

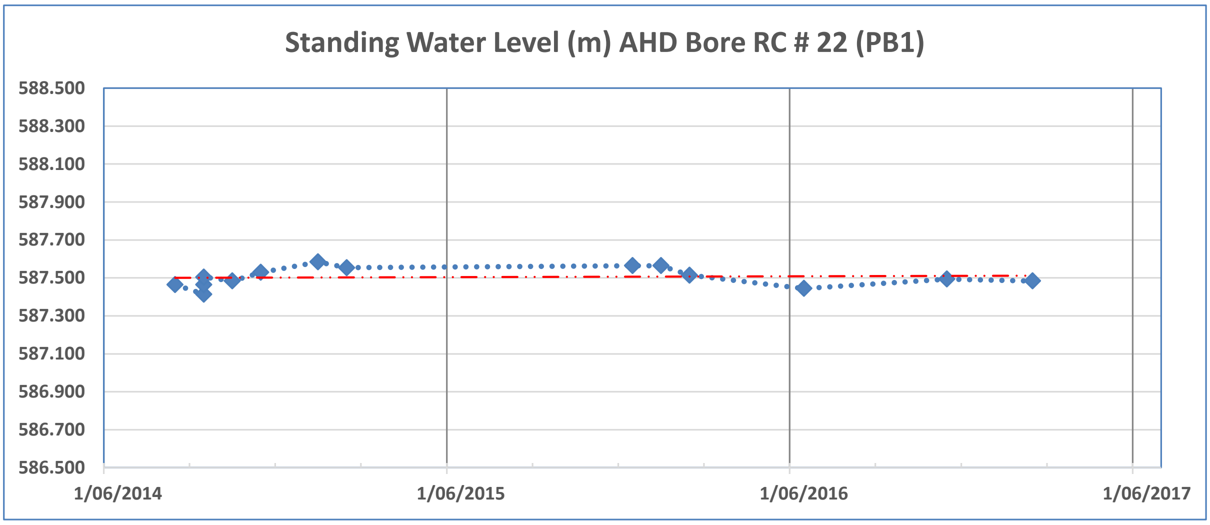


RC # 22 Bore site PB 1 (*Arafura* Production Bore)

Minimum depth SWL = 587.504 m AHD (18.890 m bGL)

Maximum depth bGL = 587.890 m AHD (18.940 m bGL)

Median depth bGL = 587.545 m AHD (trending a very minor rise: possibly diurnal)

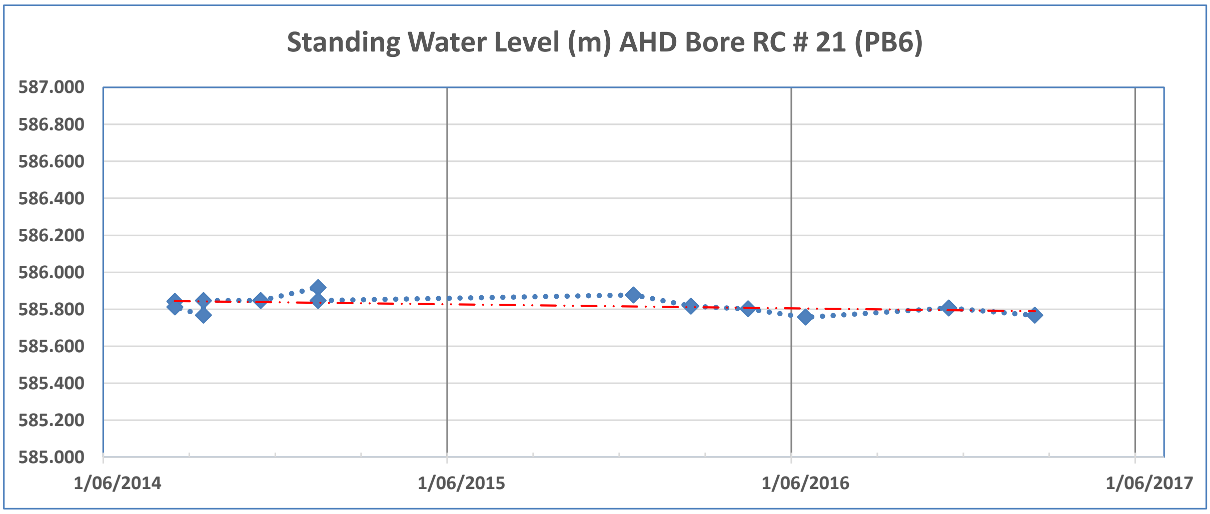


RC # 21 Bore site PB 6 (*Arafura* Production Bore)

Minimum depth SWL = 585.877 m AHD (16.060 m bGL)

Maximum depth bGL = 585.757 m AHD (16.180 m bGL)

Median depth bGL = 585.800 m AHD (trending a very minor fall: possibly diurnal)

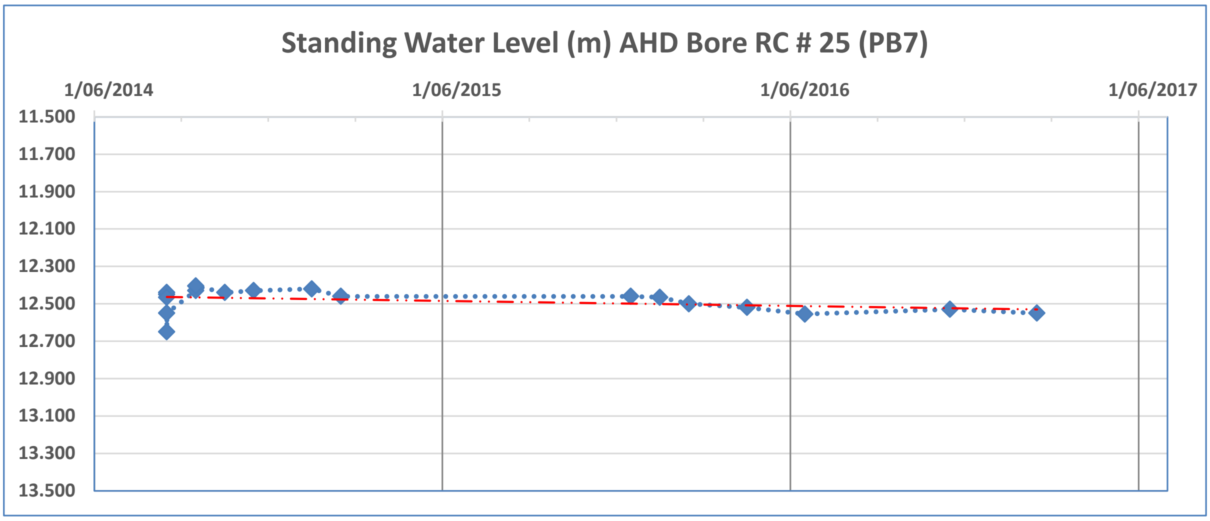


RC # 25 Bore site PB 7 (*Arafura* Production Bore)

Minimum depth SWL = 12.405 m bGL

Maximum depth bGL = 12.550 m bGL

Median depth bGL = trending a minor fall:

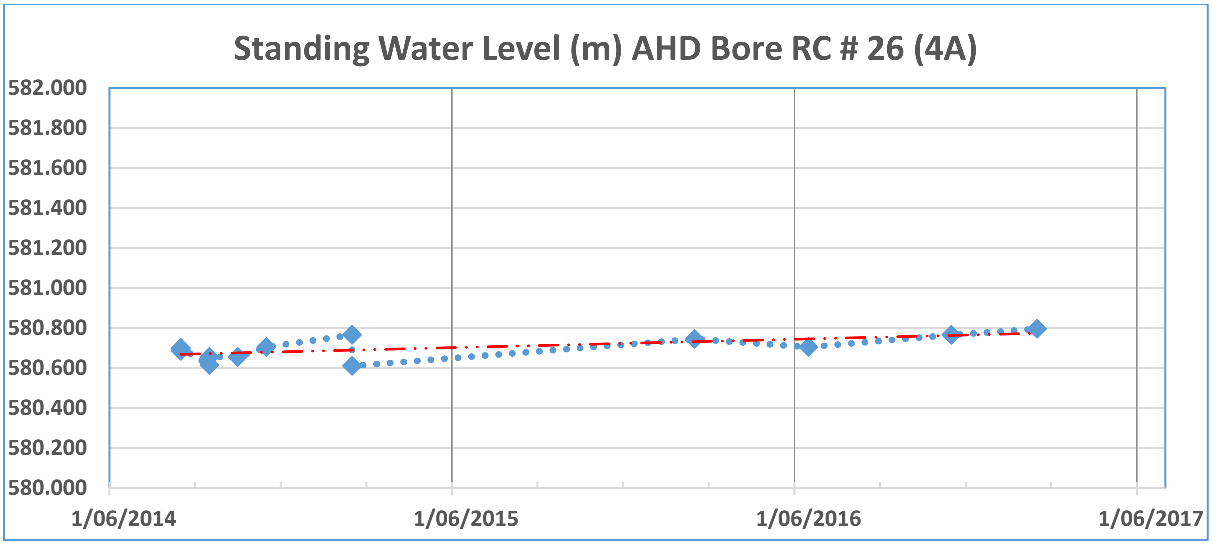


RC # 26 **Bore site PB 4** **(*Arafura* Production Bore & Baseline Monitoring Bore)**

Minimum depth SWL = 580.794 m AHD (27.890 m bGL)

Maximum depth bGL = 580.609 m AHD (28.075 m bGL)

Median depth bGL = 580.700 m AHD (trending a minor rise)

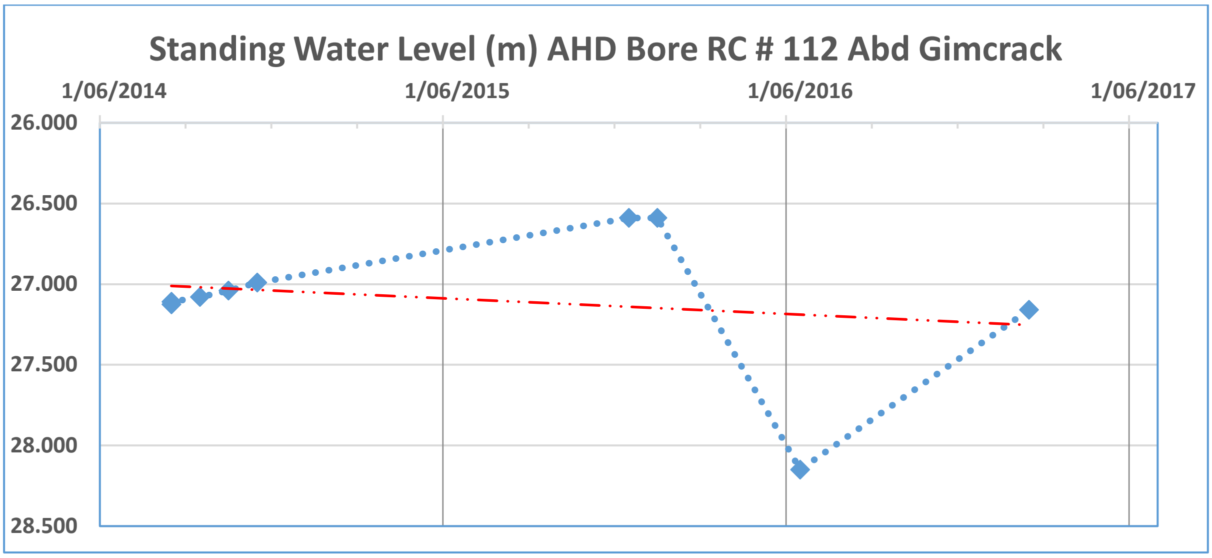


RC # 112 **Gimcrack Stock Watering Bore (*Arafura* Baseline Monitoring Bore)**

Minimum depth SWL = 26.590 m bGL

Maximum depth bGL = 28.150 m bGL

Median depth bGL = trending a falling phase (risen 1 m this year; previous fall possibly due to pumping nearby bores then a recovery following rainfall recharge event summer 2016/17)



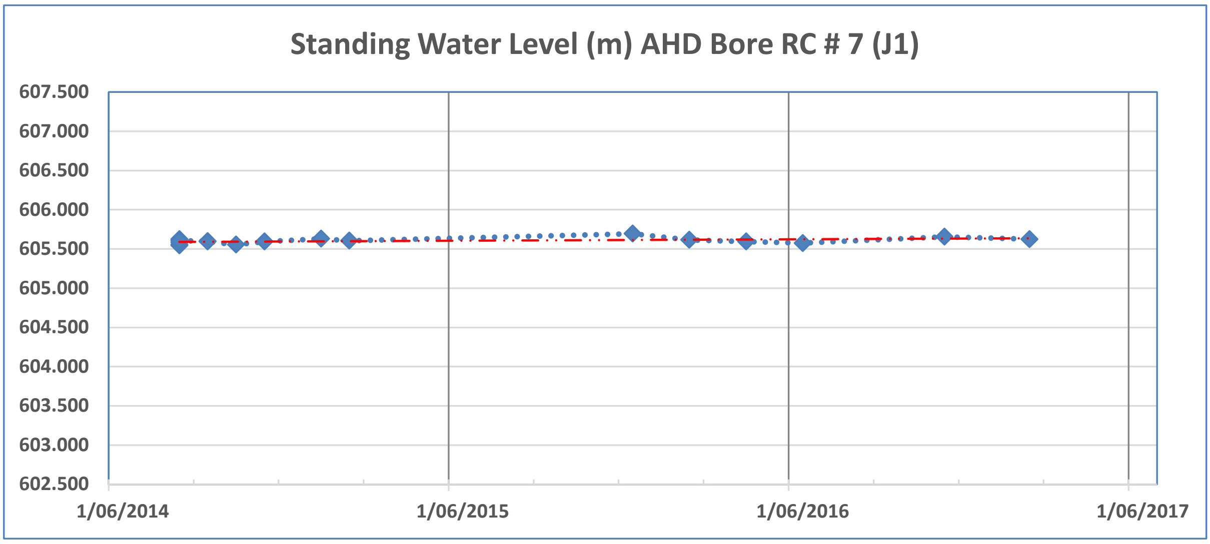
<u>**Eastern Zone north to south**</u>

RC # 7 Bore site J1 (*Arafura* baseline water level monitoring Bore)

Minimum depth SWL = 605.695 m AHD (26.812 m bGL)

Maximum depth bGL = 605.545 m AHD (26.952 m bGL)

Median depth bGL = 605.500 m AHD (trending a very minor rise)

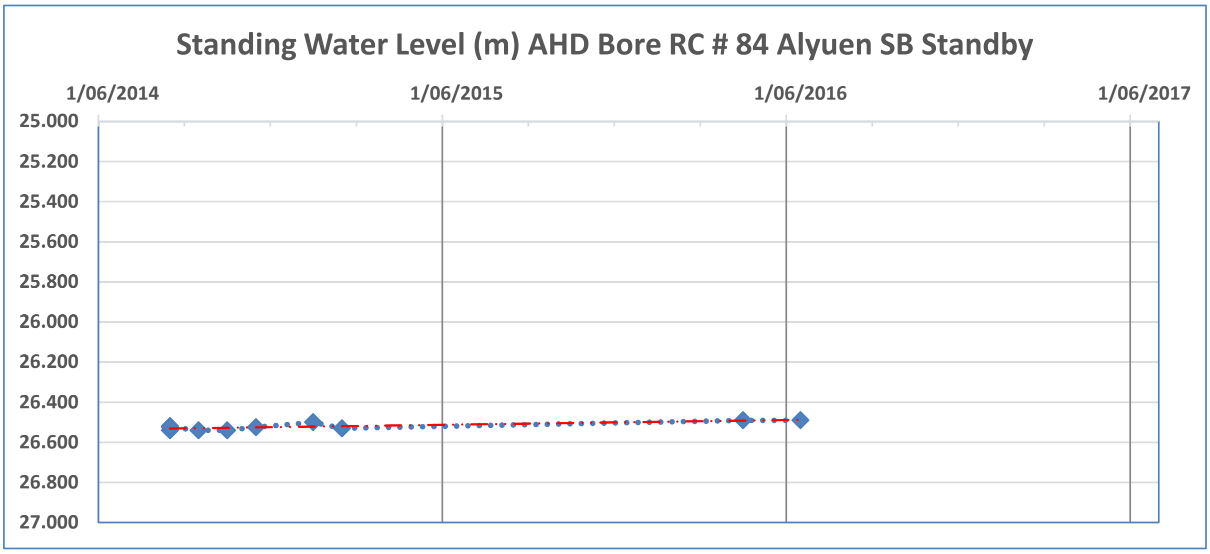


RC # 84 Alyuen Standby Production Bore (CDSC used by Aileron Station for stockwatering)

Minimum depth SWL = 26.490 m

Maximum depth bGL = 26.540 m

Median depth bGL = 26.510 m (trending a minor rise)

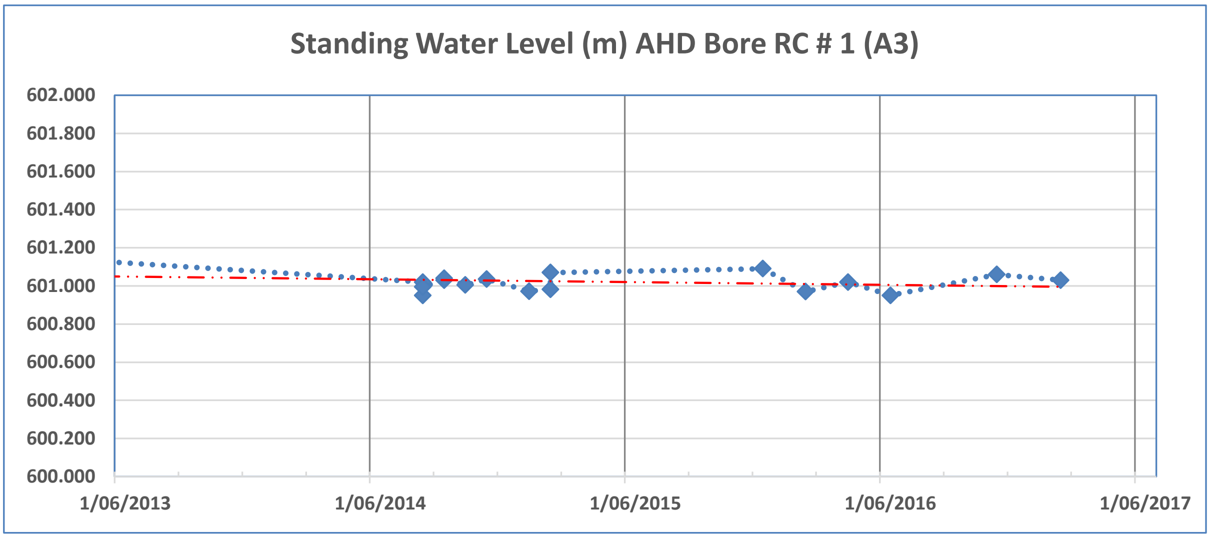


RC # 1 **Bore site A3** **(*Arafura* baseline water level monitoring Bore)**

Minimum depth SWL = 601.090 m AHD (23.310 m bGL)

Maximum depth bGL = 600.950 m AHD (23.450 m bGL)

Median depth bGL = 601.030 m AHD (trending a very minor fall)

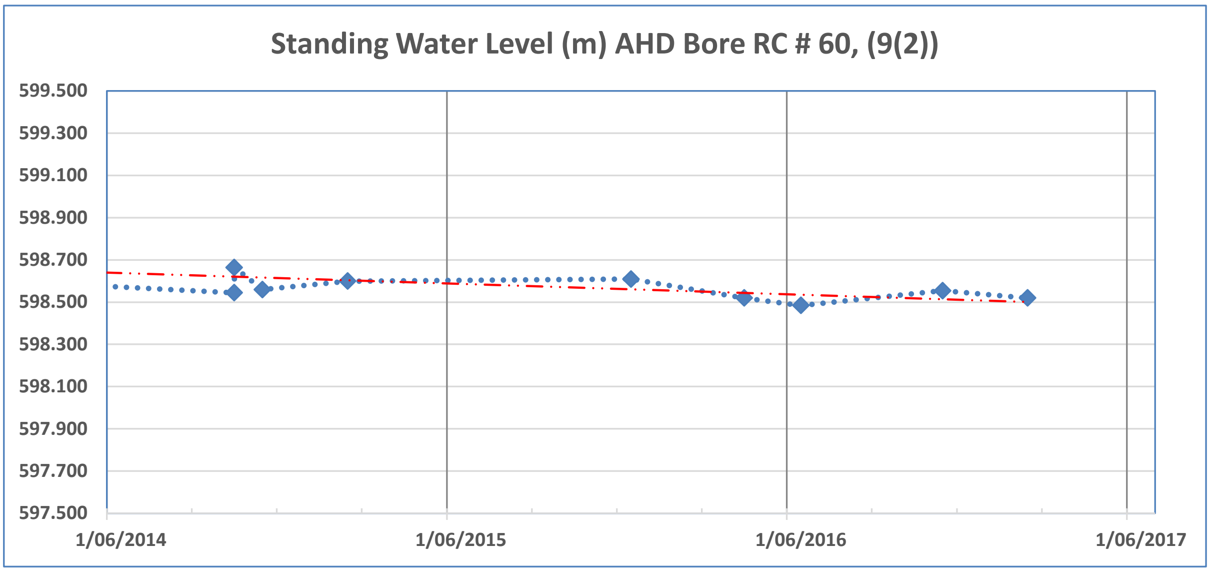


RC # 60 **Bore site 9(2)** **(*Arafura* baseline water level monitoring Bore)**

Minimum depth SWL = 598.599 m AHD (21.060 m bGL)

Maximum depth bGL = 598.484 m AHD (21.355 m bGL)

Median depth bGL = 598.530 m AHD (trending a minor fall)

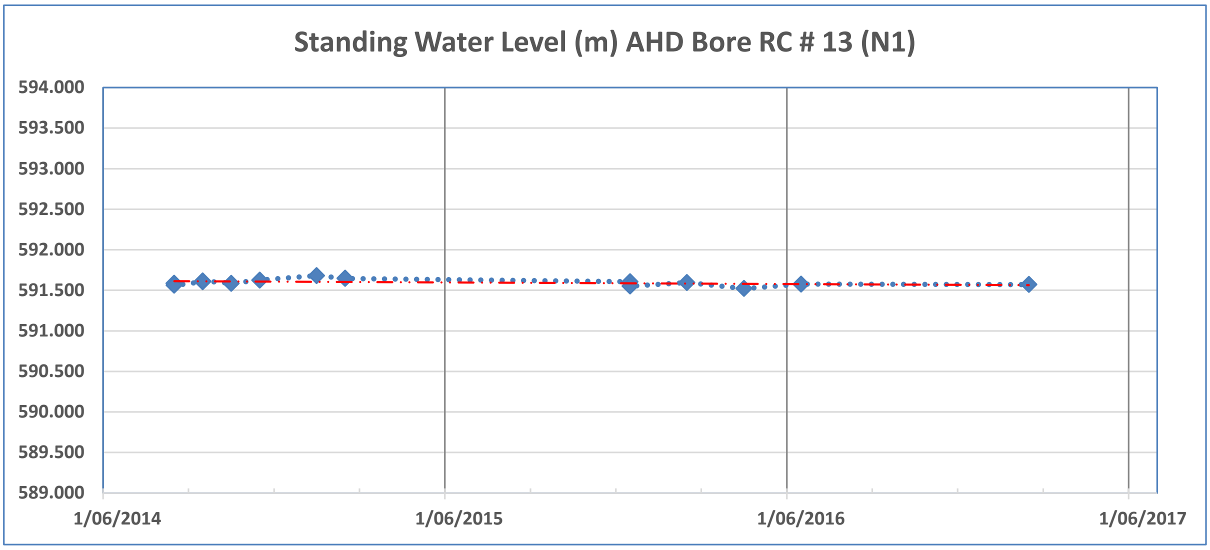


RC # 13 **Bore site N1** **(*Arafura* baseline water level monitoring Bore)**

Minimum depth SWL = 591.561 m AHD (15.875 m bGL)

Maximum depth bGL = 591.646 m AHD (15.790 m bGL)

Median depth bGL = 591.590 m AHD (trending a very minor fall)

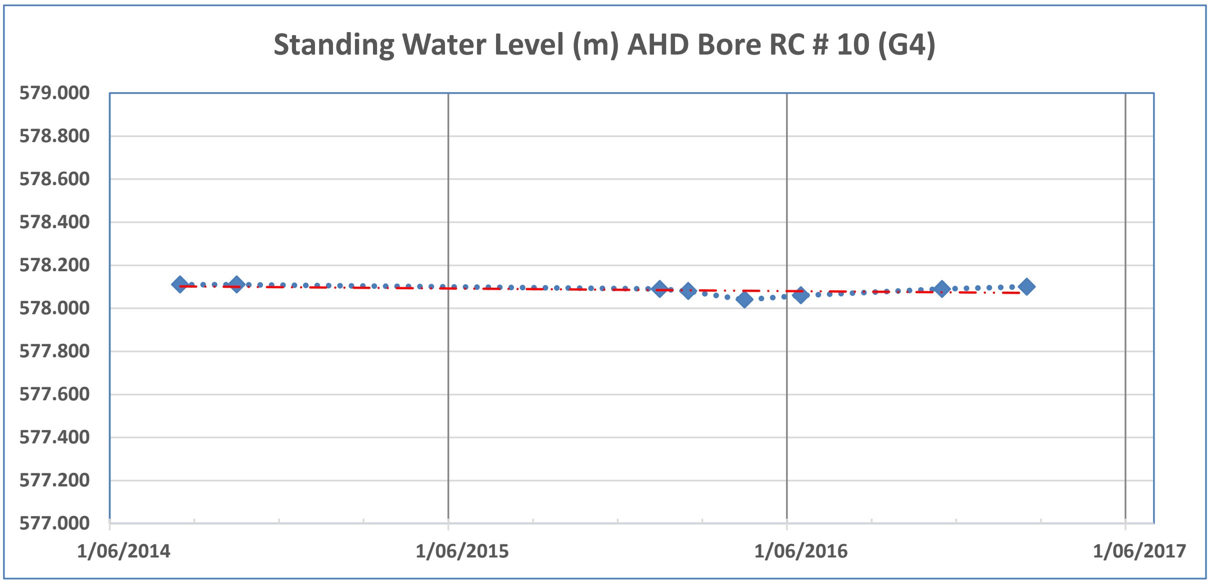


RC # 10 **Bore site G4** **(*Arafura* baseline water level monitoring Bore)**

Minimum depth SWL = 578.110 m AHD (22.000 m bGL)

Maximum depth bGL = 578.040 m AHD (22.070 m bGL)

Median depth bGL = 578.065 m AHD (trending a very minor fall) currently rising phase

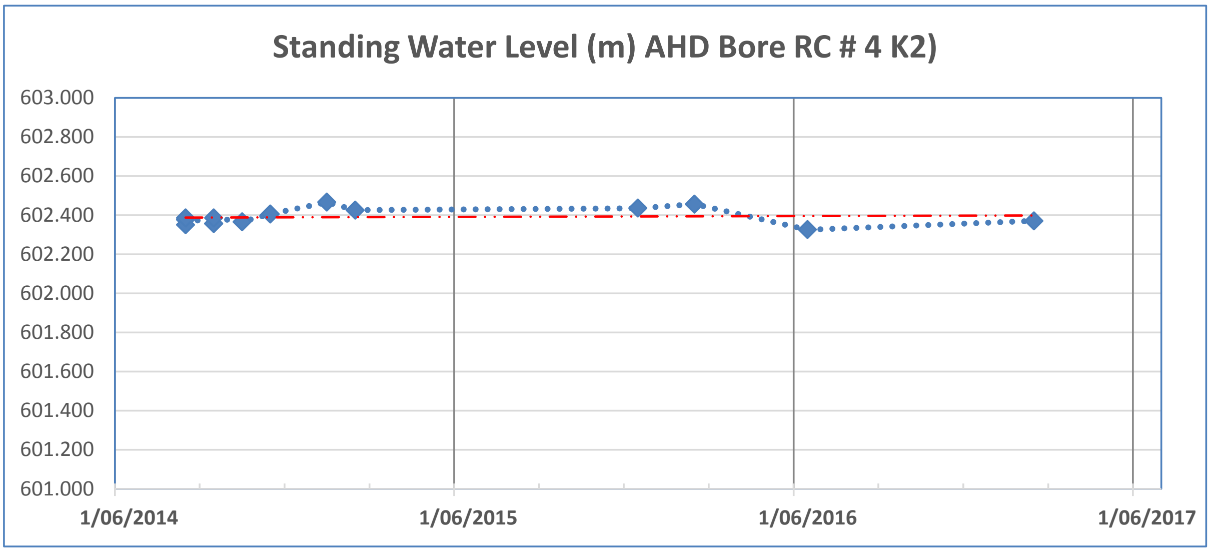


RC # 4 **Bore site K2** **(*Arafura* baseline water level mon. Bore used for stockwatering)**

Minimum depth SWL = 602.466 m AHD (27.867 m bGL)

Maximum depth bGL = 602.326 m AHD (28.007 m bGL)

Median depth bGL = 602.400 m AHD (trending static except for diurnal) currently possibly rising phase; pumping drawdown 6 L/sec 38.17 m bGL i.e. drawdown 10.2 m in partly backfilled monitoring bore.

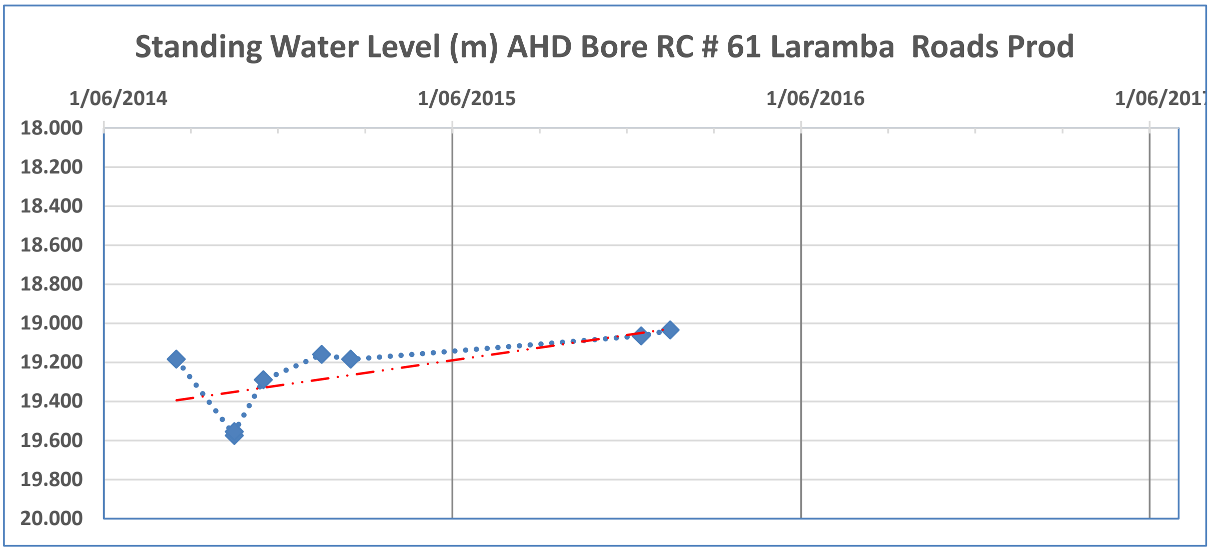


RC # 61 **Laramba Access Road Maintenance Production Bore (NTG)**

Minimum depth SWL = 19.04 m bGL)

Maximum depth bGL = 19.58 m bGL

Median depth bGL = 19. 89 m bGL (trending a minor rise); possibly recovery following pumping for road construction

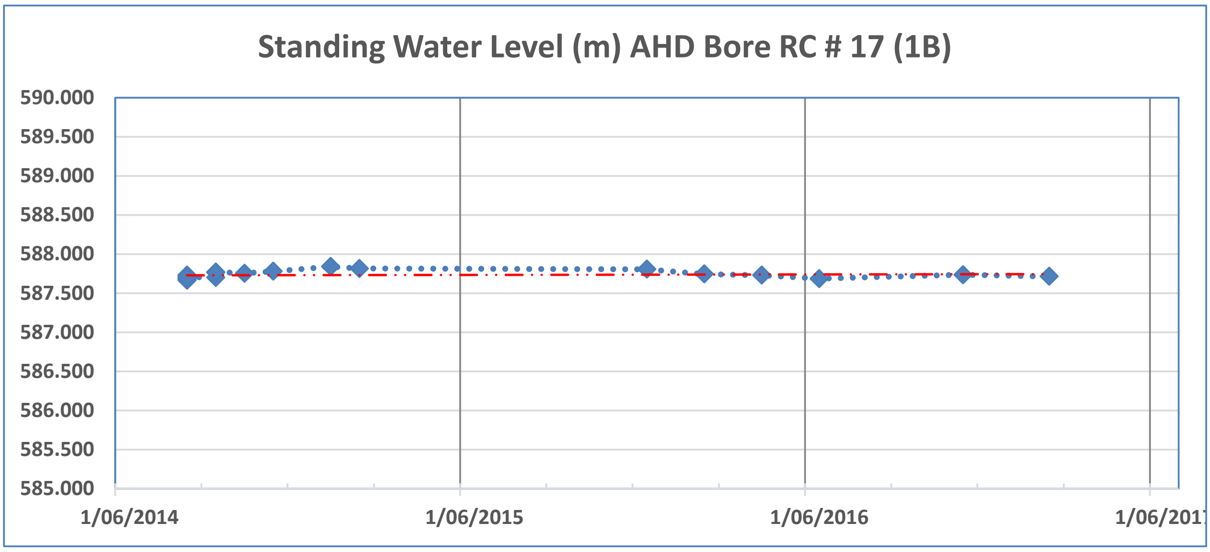


RC # 17 Bore site 1B (*Arafura* baseline water level monitoring bore)

Minimum depth SWL = 587.666 m AHD (16.405 m bGL)

Maximum depth bGL = 587.841 m AHD (16.290 m bGL)

Median depth bGL = 587.700 m AHD (trending static except for diurnal) currently possibly falling phase;

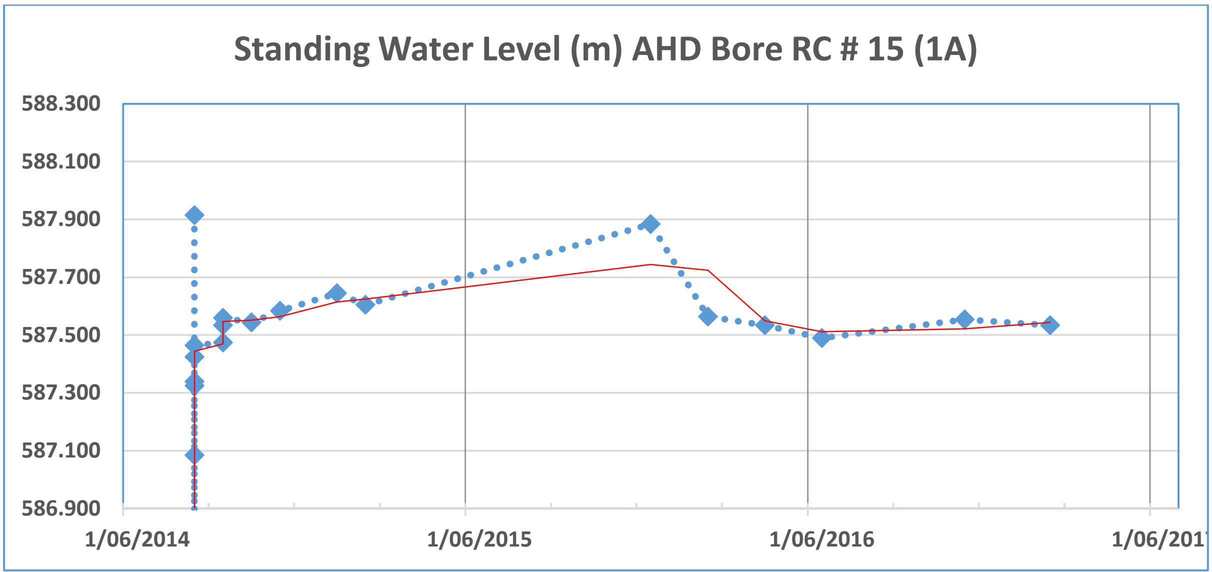


RC # 15 Bore site 1A (*Arafura* water level observation bore)

Minimum depth SWL = 587.599 m AHD (18.640 m bGL)

Maximum depth bGL = 587.644 m AHD (18.555 m bGL)

Median depth bGL = 587.666 m AHD (trending static except for diurnal)

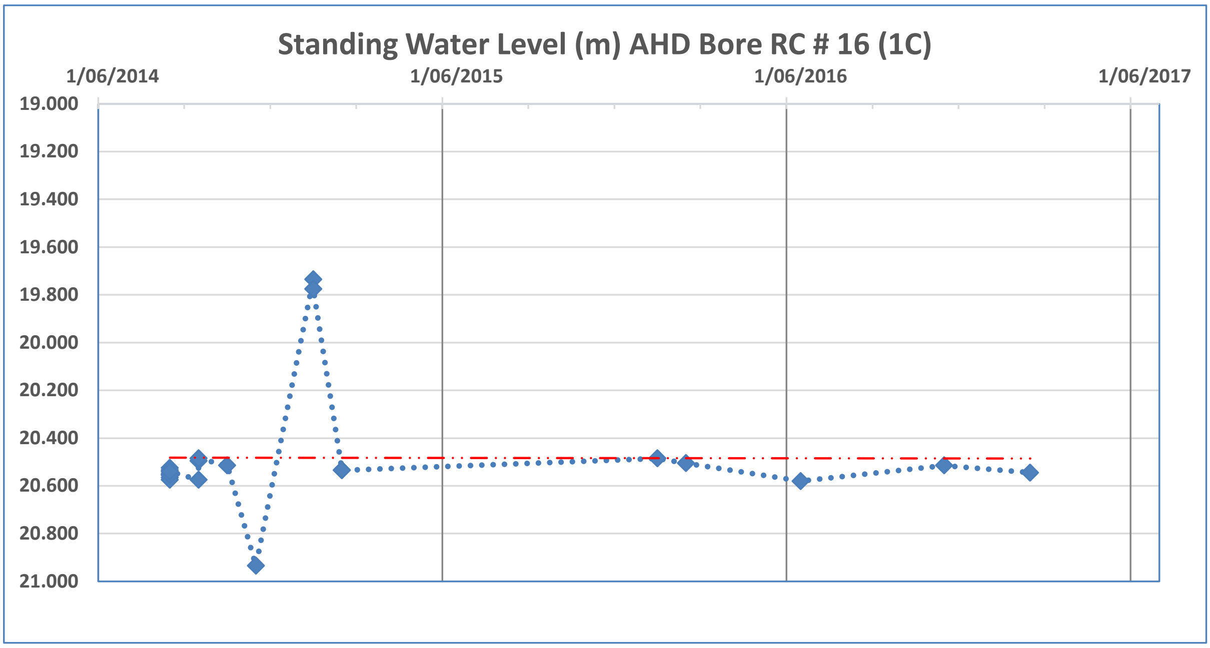


RC # 16 **Bore site 1C** **(*Arafura* baseline water level monitoring bore)**

Minimum depth SWL = 19.77 m bGL

Maximum depth bGL = 20.93 m bGL

Median depth bGL = 20.50 m bGL (probably trending static except for diurnal)

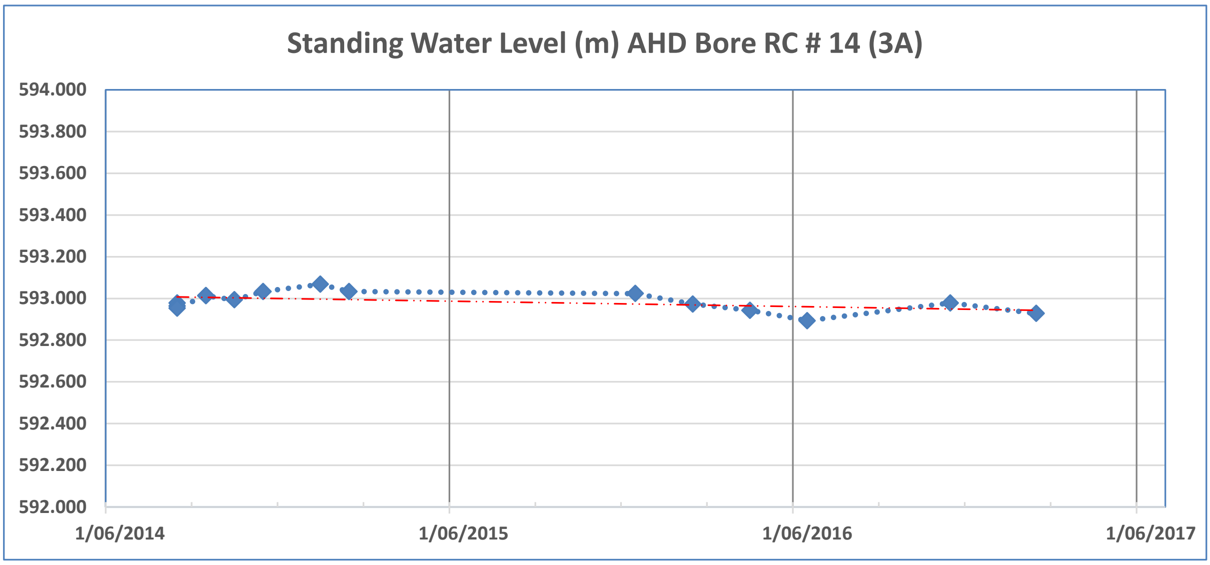


RC # 14 **Bore site 3A** **(*Arafura* baseline water level monitoring bore)**

Minimum depth SWL = 593.023 m AHD (18.060 m bGL)

Maximum depth bGL = 592.953 m AHD (18.130 m bGL)

Median depth bGL = 587.666 m AHD (trending static except for diurnal)



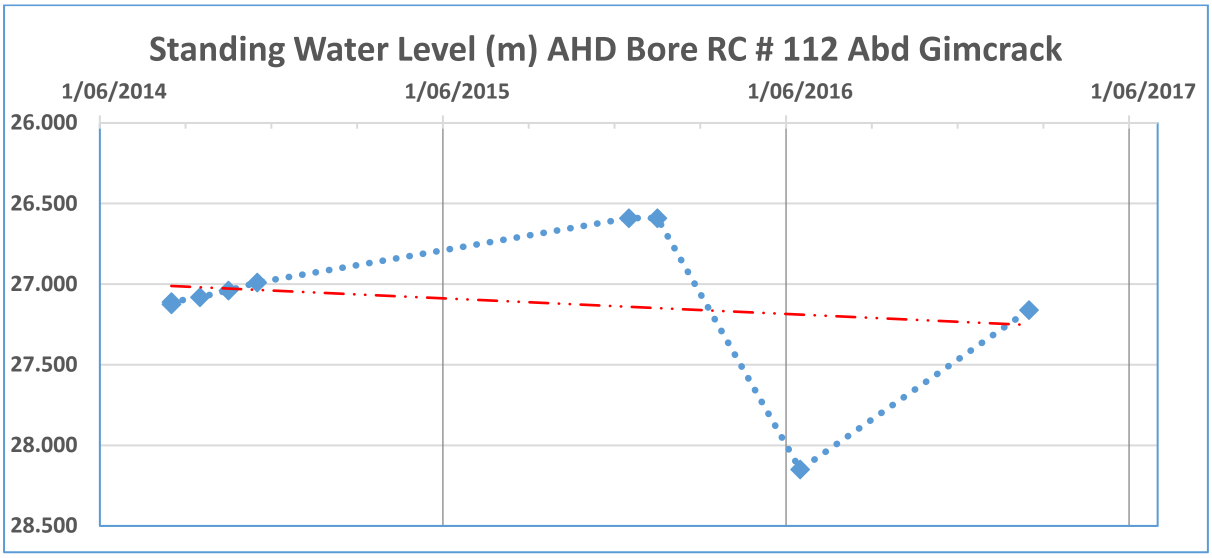
Laramba Borefield Laramba Aquifer

RC # 112 Abd Gimcrack Stock Watering Bore (*Arafura* Baseline Monitoring Bore) RN 6867

Minimum depth SWL = 26.590 m bGL

Maximum depth bGL = 28.150 m bGL

Median depth bGL = trending a falling phase (risen 1 m this year; previous fall possibly due to pumping nearby bores then a recovery following rainfall recharge event summer 2016/17)

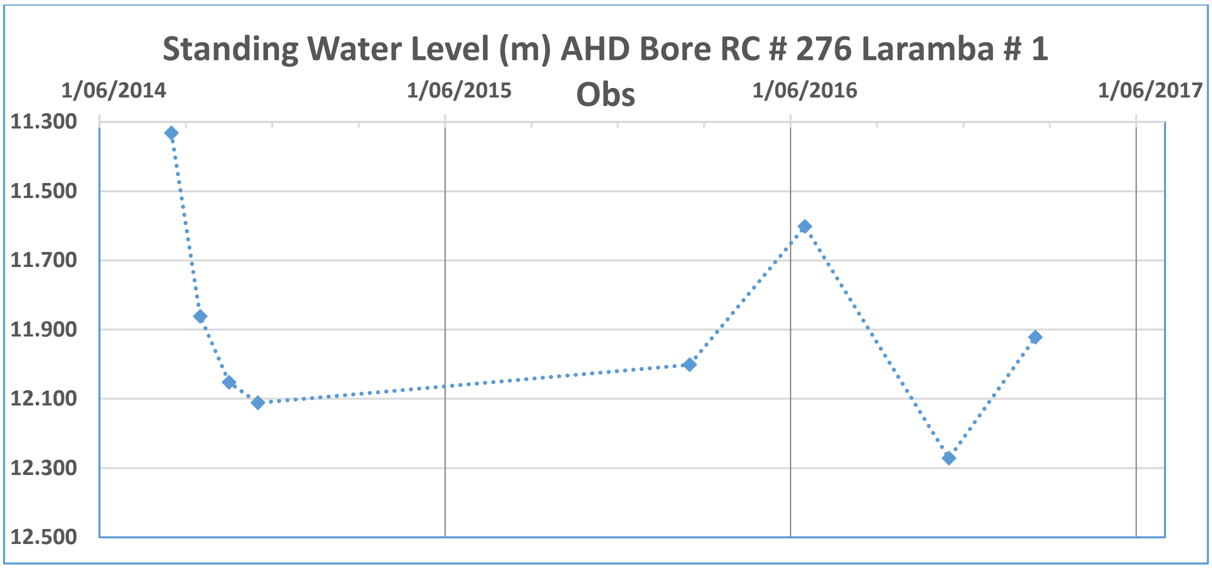


RC # 276 Laramba Production Bore # 1 Observation Bore RN 13214

Minimum depth SWL = 11.33 m bGL

Maximum depth bGL = 12.27 m bGL

Median depth bGL = 12.5 m (adjacent production bore and near standby both alternately pumped, currently raising phase

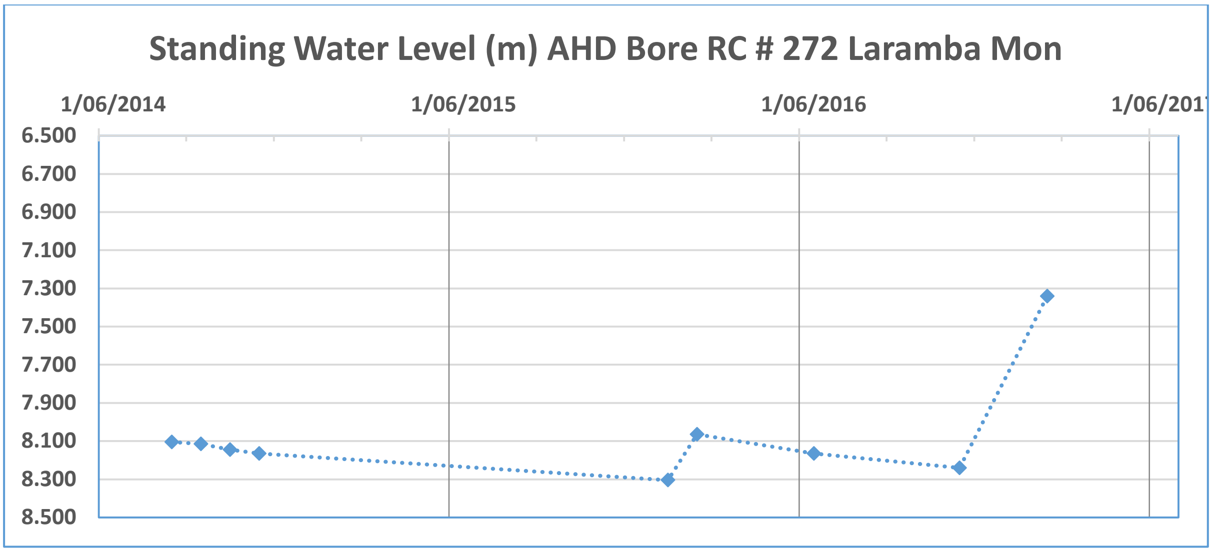


RC # 272 Laramba Monitoring Bore RN 13210 near Patty Well

Minimum depth SWL = 7.34 m bGL

Maximum depth bGL = 8.3 m bGL

Median depth bGL = 8.2 m Rising phase following summer 2016/17 recharge event > 1 m



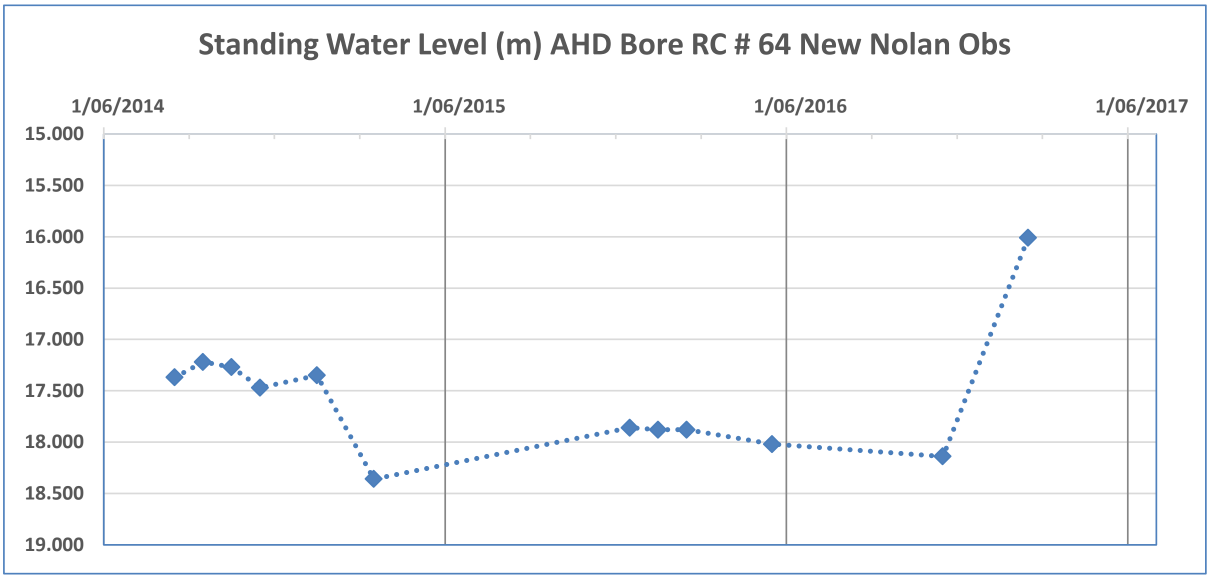
New Nolans Bore Group 1 km up gradient of Nolans Bore & adj Kerosene Camp Creek

RC # 64 New Nolans Monitoring Bore adjacent Kerosene Camp Creek

Minimum depth SWL = 16.10 m bGL

Maximum depth bGL = 18.36 m bGL

Median depth bGL = 18.7 m Rising phase following summer 2016/17 recharge event > 2 m

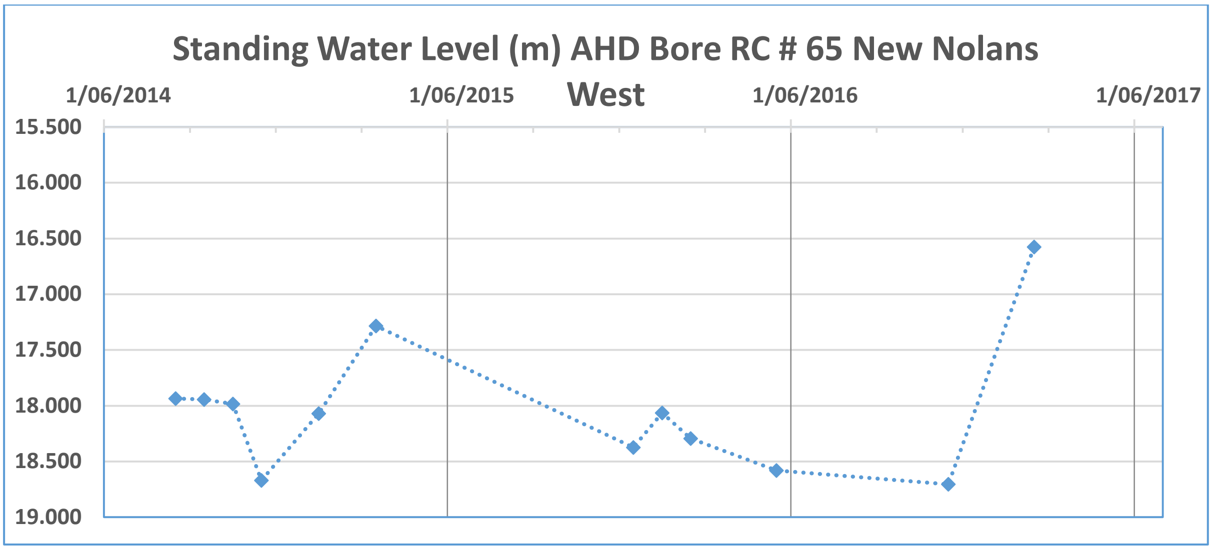


RC # 65 New Nolans West Monitoring Bore adj Tributary Kerosene Camp Creek

Minimum depth SWL = 16.58 m bGL

Maximum depth bGL = 18.70 m bGL

Median depth bGL = 18.0 m Rising phase following summer 2016/17 recharge event > 2 m



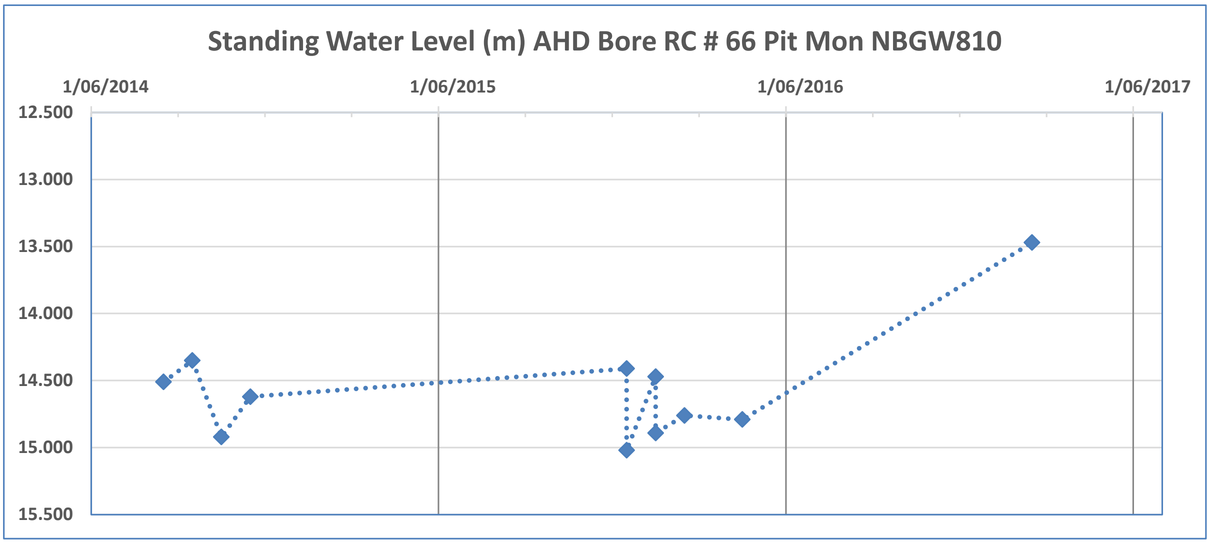
Nolans Bore Pit Area

RC # 66 Dewatering Monitoring Bore Pit Area NBGW810 NW

Minimum depth SWL = 13.471 m bGL

Maximum depth bGL = 14.921 m bGL

Median depth bGL = 14.5 m Rising phase following summer 2016/17 recharge event > 1 m

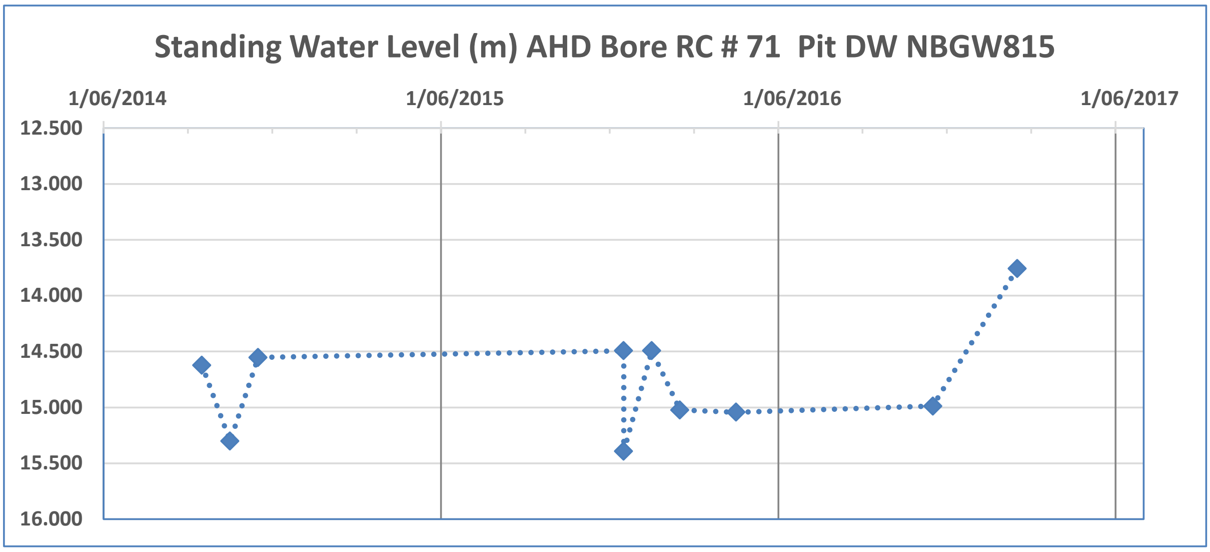


RC # 71 Dewatering Monitoring Bore Pit Area NBGW815 SW

Minimum depth SWL = 13.76 m bGL

Maximum depth bGL = 15.39 m bGL

Median depth bGL = 14.25 m Rising phase following summer 2016/17 recharge event > 1 m

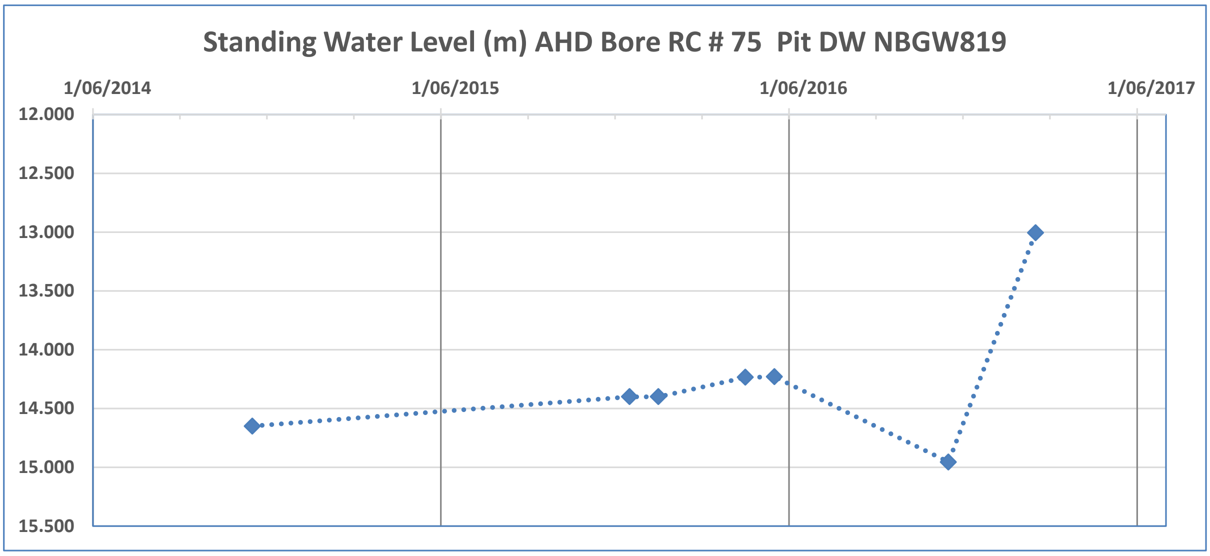


RC # 75 Dewatering Bore Pit Area NBGW819

Minimum depth SWL = 13.71 m bGL

Maximum depth bGL = 15.23 m bGL

Median depth bGL = 14.3 m Rising phase following summer 2016/17 recharge event > 2 m

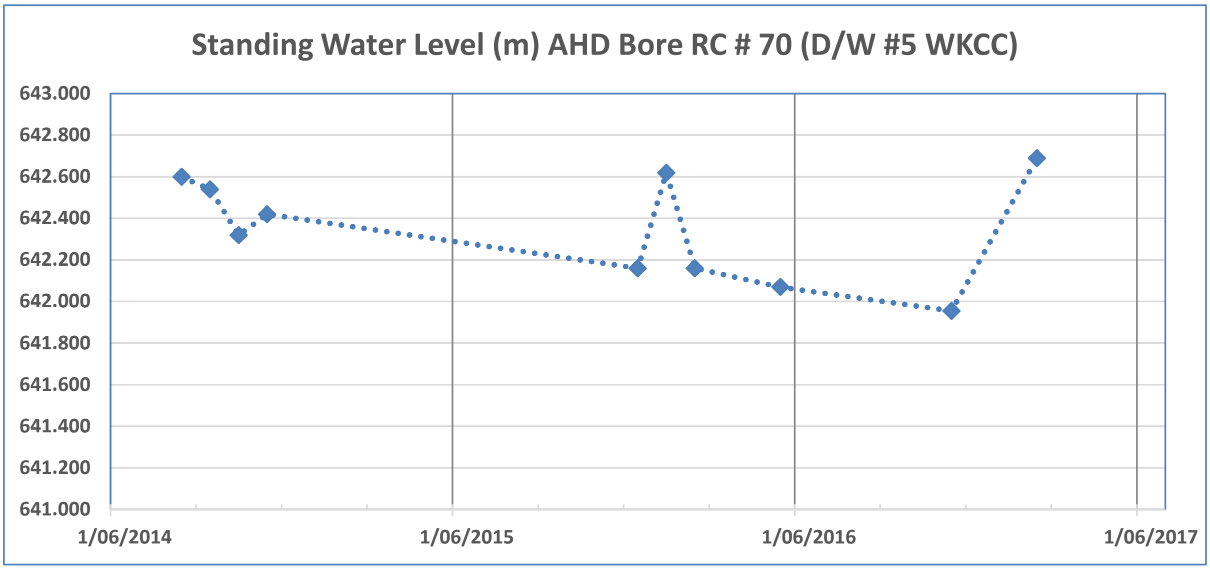


RC # 70 Dewatering Monitoring Bore Pit Area NBGW814 West KCC

Minimum depth SWL = 642.689 m AHD (14.56 m bGL)

Maximum depth bGL = 641.954 m AHD (15.30 m bGL)

Median depth bGL = 642.200 m AHD responds to flows in Kerosene Camp Creek (currently rising phase following summer 2016/17 recharge event > 6 m



Appendix C Surface Water & Monitoring Program Results

No permanent surface water, lakes or waterholes exist in the Nolans Region. There are many small temporary waterholes, rock holes and soakages and a few semi-permanent waterholes or soakages on some of the major creeks in the area including Napperby Creek, Day Creek, Allungra Creek and the Woodforde River. The largest surface water feature in the region is Lake Lewis, an extensive salt lake south of the Tanami Road where significant areas of shallow surface water may persist for months following rare major rainfall events.

There is a lack of stream or sheet flow records covering the Nolans Region particularly within the Burt River Basin. The Southern Groundwater Basins are located within the Burt River Basin. The NTG has river gauging stations (open and closed stations) in the adjacent Wiso River Catchment on the Hanson, Woodforde River and Lander Rivers. There is also a river gauging station on Allungra Creek at Allungra Waterhole on Aileron Station.

The catchments, rivers and creeks in the Nolans Region are similar to other surface water systems in the Alice Springs region where good stream flow and rainfall distribution records exist e.g. Todd River.

Arafura has constructed 33 basic stream flow monitoring stations within and adjacent to the Nolans Mine Site and are planning to expand the number and sophistication of these stations during the mine development phase. These works include hydrographic stations on Day Creek.

The NTG River gauging station on the Woodforde River at Arden Soak is 21 km S of Nolans Bore. This station replaces a closed station on this river adjacent to the Ti Tree Farms.

Flows in the Woodforde River rarely reached the station near the Ti Tree Farms due to groundwater recharge, recharge to the vadose zone and extensive alluvial deposits across the river bed adjacent to the Pine Hill Station/Ahakeye ALT boundary forming an in-bank floodout area. The Woodforde River at the Farms area is not incised and is an extension of the in-bank floodout with areas of sandy creek beds just below the adjacent alluvial banks and adjacent flood plains.

The Nolans mine site is within the hilly basement rock outcrop catchment area of the Ti Tree Basin. Kerosene Camp Creek is a small ephemeral creek which occasionally flows over the *Arafura* Nolans orebody north to the Ti Tree Basin. This creek is one of the main tributaries of the ephemeral Woodforde River which flows across the full length of the Ti Tree Basin western water management zone past the Ti Tree Farms, 41 km north of Nolans Bore, and town of Ti Tree, 53 km away, and joins with the ephemeral Hanson River 73 km to the north. The Woodforde River rarely flows over its full length but is an important groundwater recharge source to the western management zone.

There are only a few creeks and drainage lines which flow off the southern basement hills and ranges south of the Ti Tree Basin. The catchment of Allungra Creek rises in the Aileron Hills, 15 km SE of Nolans, 13 km N of the Hann Range west of the Stuart Highway, trends east for 28 km to Allungra waterhole then north and dissipates over floodouts and occasionally on sand plains to the east of the Territory Grape Farm (now Southern Cross Farm), BOM AWS 30 km to the N. This creek is another important recharge source for the Ti Tree Basin (central water management zone).

The small tributaries within the basement rocks, hills and valleys of these creeks flow off the basement rock catchments over short distances following less than 20 mm of rainfall and when condition are right with less than 10 mm. High rainfall over part of a day or a few days over large areas of the rocky basement catchments is normally required for these creeks to flow onto the Ti Tree Basin. Major rainfall is required for the creeks to flow over their full length off the rocky catchments, through alluvial fans over sand plains onto alluvial floodout areas. Occasionally they will flow across the floodouts over sand plains to the north of the alluvial floodouts.

The hydrology is quite complex with a range of key variables which control flows, their flow type, extent, volume, duration. These variables include rainfall intensity, total rain within spatial zones and catchment conditions, particularly groundcover biomass.

Over this past summer flood flows occurred in Kerosene Camp Creek, Woodforde River, Allungra Creek, Day Creek and other creeks in the region. Up gradient of Nolans Bore, the maximum depth of flow in Kerosene Camp Creek was over 2 m, and the duration of flow resulted in significant recharge to the basement fracture aquifer at New Nolans Bore (0.5 m) and to the orebody aquifer at Nolans (2 m rise in SWL).

East Kerosene Camp Creek including Nolans Creek broke its banks 5 km south of Nolans. West Kerosene Camp Creek, a much larger creek than the other two creeks, flowed over 3 m at the Aileron/Pine Hill Station Boundary. Day Creek flowed a banker through the alluvial flood plain resulting in significant recharge to the Laramba aquifer (1 m rise at Patty Well area).

Intermittent trickle flow and a series of small water holes persisted for weeks in the Kerosene Camp Creeks but the temporary basement hill aquifers providing small flows across station bore access in small creeks did not recharge from this high rainfall yet recharged the previous summer from less rainfall (Kerosene Camp Creek up gradient of Nolans Bore flowed to a maximum depth of less than 1.5 m).

The Ti Tree Basin and its rocky basement catchment to the south are within the Wiso River Basin. The catchment divide between the Wiso and Burt River Basins marks the top of the catchment for Kerosene Camp Creek (7.5 km south of Nolans Bore), Allungra Creek (10 km SE of Nolans Bore) and the catchment divide at the Margins Area between the Ti Tree Basin and the NE Southern Basins (30 km SSE of Nolans Bore).

South and west of the catchment divide within the NE Southern Basins study area, there is a series of creeks, drainage lines and sheet flow areas running off the basement hills and ranges (Yalyirimbi Range). The first major creek equivalent in size and area of its rocky catchment to the Woodforde River is Day Creek, 50 km west of the Stuart Highway. A further 20 km west is Napperby Creek with a much larger rocky catchment area than Day Creek.

Between the Burt River Basin catchment divide near the Stuart Highway to the east and Day Creek is a series of small and more substantial creeks flowing off the Yalyirimbi Range and the Aileron Hill with occasional minor short creeks (with high catchment yields) flowing of the Hann Range and Reaphook Hills.

Regional

The Southern Ti Tree Basin (including the western, central and eastern water management zones) and the NE Southern Basins are recharged from runoff from the adjacent hard rock catchments, ponding of surface water in discrete locations across the sand plains and direct infiltration of rainwater across the sand plains and alluvial plains. There are also other important groundwater recharge mechanisms which are mainly related to geological, stratigraphic and/or ancient erosion features.

In the NE Southern Basins these groundwater recharge mechanisms to the major aquifers in the Reaphook Paleochannel include the deep wide Herringbone paleochannels eroded deeply into

Arunta basement rock from the foot of the Yalyirimbi Range joining the Reaphook Paleochannel to the N. These deep Herringbone paleochannels are overlain by ephemeral creeks, drainage lines and sheet flow areas which recharge the shallow and deep aquifers present in these channels (as interpreted from the AEM geophysics model - conductivity slice maps and sections generated by Surpac are available from the digital water database).

These other recharge mechanisms also include infiltration and throughflow in shallow to deep fractured and weathered sandstone within the Ngalia Basin basal formation as evidenced from the weathering and fracturing from inspection of outcrop along the synclinal shoulders and very high yields encountered in a deep bore drilled into fractured and weathered quartzite within the axis of the syncline.

Over both groundwater basins, there is a conspicuous lack of major rivers and creeks across the extensive areas of sand plains and alluvial plains. The Woodforde River is within the Ti Tree Basin western management zone and the majority of flows dissipate before reaching the town of Ti Tree, downgradient 40 km to the north. There is a series of short creeks flowing off the Yalyirimbi Range until Day Creek, the first major ephemeral river in the NE Southern Basins, 49 km west of the Wiso/Burt River Basin catchment boundary.

Both groundwater basins have large areas of alluvial plains and fans with Mulga Groves *(Acacia Aneura)* but the basin structure is generally different. In the case of the Ti Tree Basin, the alluvial and/or calcareous sediments are thick whereas in the NE Southern Basins the wide band of alluvial fans and alluvial plains (up to 12 km wide) south of the Yalyirimbi Range and in places north and south of the Hann Range is shallow Arunta bedrock.

The new Alyuen Community water supply bores are located in a narrow paleovalley north of the Hann Range within thick Mulga Woodland. The soils here are alluvial soils from decomposition of Arunta basement rock from the NE.

The thick mulga groves between and beyond the Hanson and Woodforde Rivers within the western water management zone of the Ti Tree Basin grow on thick sequences of sandy clay and in places calcareous mudstone. The thick mulga woodland west of Territory Grape Farm is mainly over calcrete and calcareous soils. There are high yielding aquifers in this location.

The Ti Tree Basin has long, low parallel discontinuous sand dunes (about 1 m in height, up to 20 km long with swales 200 to 800 m) across the sand plains parallel to the contours and, in some locations, irregular dunes and, in others, high irregular dunes e.g. at Territory Grape Farm. Within the NE Southern Basins there are also long, low parallel discontinuous sand dunes (up to 7 m in height, up to 25 km long with swales 400 to 800 m) across the sand plains parallel to the contours. In some locations, high short dunes occur e.g. north of *Arafura* production bore PB 7. There are also bands of Aeolian sand dunes parallel to the northern foot of the Reaphook Hills and between gaps in these hills.

The implication of the presence and location of these sand dunes across the sand plains parallel to the ground contours is that they block movement of surface water down gradient resulting in increased recharge to the vadose and phreatic zones. This is not uncommon in Central Australia.

Day Creek is a major ephemeral river in the region with a wide alluvial calcareous flood plain (with elevated levels of uranium) where river flows are blocked by a high range east of Patty Well and the river is forced to change direction until there is a gap in the range (Patty Well Gap). This frequently occurs in the MacDonnell Ranges and other Ranges within Central Australia, e.g. the Todd River at Heavitree Gap, Alice Springs.

There are other similarities between the Todd and Day Creek: on the sand plains south of the gaps in the ranges, a floodout formed due to the change in gradients and high sand and silt loads from the Arunta basement rock catchments. One difference is that the Todd floodout is over deep sediments of the Cenzoic Alice Springs Outer Farm Basin which also overlie Palaeozoic Amadeus Basin Formations, both with a number of excellent aquifers whereas the Day Creek Floodout is over relatively shallow Arunta Basement rock with no significant aquifers.

Due to the presence of excellent shallow colluvial aquifers at Patty Well north of the Reaphook Hills and the ancient development of calcrete and silcrete aquifers in this location, Day Creek and associated drainage provides excellent recharge to the Laramba Aquifer.

The normally dry salt lake, “Lake Lewis”, south of the Tanami Road and Stuart Bluff Range, other salt lakes and small swamps north of this range commence at Day creek and continue west beyond the project study area. There are also a few clay pans in some locations and other surface water features.

Surface Water Monitoring

Surface water monitoring is being completed in both the Nolans bore mine site area and in the NE Southern Basins and their catchment areas.

The surface water monitoring consists of

1. collecting 250 mL water samples from automatic stream flow samplers for trace metal and EC laboratory analysis. There are 29 samplers (3 and 7 stage samplers) in Kerosene Camp Creek and its tributaries and 4, 3 stage samplers in small creeks near Old Albs Bore, the site of the main ore treatment plant. These 4 samplers are within the Burt River Basin over shallow Arunta basement rock
2. basic maximum height flow markers on the water sampler towers
3. environmental traverses through the automatic water samplers to the estimated extent of flooding based on interpretation of satellite images, these pegged traverses are to be surveyed periodically including more frequent surveying of the creek cross sections
4. underflow sampling points in Kerosene Camp Creek where opportunistic water samples are taken for standard chemical and trace metal analysis
5. opportunistic sampling of waterholes, river, creek and temporary spring flows for chemical and trace metal analysis

It is planned to increase the number of hydrographic stations in the NE Southern Basins and its catchment area plus commence sediment and bed load sampling.

Appendix D *Arafura* Nolans Region Groundwater Investigations Summary

Since 2012 *Arafura* have completed the following field water investigations:

1. **Southern Basins Stage 1 Groundwater Exploration Program** – SW Aileron Station: Northern Burt Basin, Eastern Whitcherry Basin and Eastern Ngalia Basin
2. **North Eastern Southern Basins Stage 2 Groundwater Investigation Program:** SW Aileron and Central Napperby Stations: Northern Burt Basin, Eastern Whitcherry Basin and Eastern Ngalia Basin
3. **Margins Groundwater Investigation Program**: NE Burt Basin and SW Ti Tree Basin
4. **New Nolans Bore Replacement Drilling Program**
5. **Nolans Pit Dewatering Investigation**
6. ***Arafura* Allungra Borefield Ti Tree Basin Groundwater Investigation**
7. **Ti Tree Brackish Water Desktop**

1. NE Southern Basins Groundwater Investigations 2012 to 2017
    a. 2012, Centreprise Resources Group (CRG): collection, collation and desktop assessment of existing groundwater and surface water datasets within the NE sector of the Southern Basins covering SW Aileron Station, central Napperby Station, Yalpirakinu ALT, northern Yambah, Amburla and Napperby Stations. Coarse AEM maps prepared by NuPower Ltd for uranium exploration and assessment; government datasets indicated that there may be paleochannels on SW Aileron Station which may have significant supplies of brackish groundwater.
        i. G Ride recommended *Arafura* complete exploratory groundwater investigations over the SW corner of Aileron Station to assess if groundwater resources were present which could possibly provide the proposed Nolans mine's water supply
        ii. *Arafura* approved a program and obtained AAPA clearances to enable field investigations to proceed.
    b. 2014 CRG (G Ride) completed reconnaissance surveys of the area including survey of existing bores, analysed the datasets then selected a series of potential bore sites, liaised with the pastoralist who constructed access tracks and drilling platforms, bore sites were pegged
    c. 2014 CRG, project managed a stage 1 field investigation program, Murranji Drillers were contracted to complete drilling water exploration bores (rapidly drilled investigation bores) as part of the stage 1 NE Southern Basins ground water investigations with G Ride as the site hydrogeologist. The NTG Registered water driller, D Smith, completed the drilling program. 14 exploration bores were drilled (12 in the NE Southern Basins) and sampled (1 m soil to 6 m, 3 m strata to TD, water samples at rod changes and TD). 11 investigation bores were drilled under the NTG Water Act and 2 exploration bores were drilled under the mining Act. A 360° down hole image camera and logging tools were run down the bores about 6 weeks after completion to obtain high quality strata images. SWL were taken regularly on all bores during the field program. 8 bores were completed as permanent monitoring bores and 4 bores were backfilled, sealed and plugged. The new monitoring bores were included on the scheduled *Arafura* water level monitoring program.
        i. CRG provided a detailed report and the collated datasets and on the results of the successful stage 1 investigation

ii. CRG recommended a stage 2 investigation

RC_ID	*Site #*	*NTG RN*	*Depth*	*Yield (AL)*	*SWL*	*Est Base*	*Comments*
			m	L/sec	m bGL	m	
RC0001	A3	18869	94	8.0	23.35	>94	Monitoring Bore 50 mm PVC
RC0002	I4	18870	75	3.3	25.12	>75	Backfilled & capped
RC0003	L1	18871	81	5.0	26.22	>81	Backfilled & capped
RC0004	K2	18872	120	8.0	27.92	>120	Monitoring Bore 125 mm PVC
RC0005	M2	18873	118	0.6	32.07	99	Backfilled & capped
RC0006	H1	18874	63	6.0	19.02	>63	Backfilled & capped
RC0007	J1	18875	111	3.0	26.92	105	Monitoring Bore 100 mm PVC
RC0008	B2	18876	118	20.0	19.19	>118.4	Monitoring Bore 125 mm PVC
RC0009	G5	18877	52	1.5	22.51	>52.5	Backfilled & capped
RC0010	G4	18878	65	5.0	22.00	>65	Monitoring Bore 100 mm PVC
RC0011	G0		6	0.0			Backfilled & capped
RC0012	A0	18879	118	30.0	20.06	>118.4	Monitoring Bore 100 mm PVC
RC0013	N1	18880	112	12.0	16.26	86	Monitoring Bore 100 mm PVC
RC0092	DHV1		63	3.3	39.18		Monitoring Bore 100 mm PVC

Table 1: *Arafura* Stage 1 Exploration Bore Summary

2. **North Eastern Southern Basins Stage 2 Groundwater Investigation Program**
    a. The field drilling and hydraulic pump testing was completed in two phases:
        i. Phase 1 drilling 16 investigation bores on Aileron and Napperby Stations
        ii. Phase 2 drilling 3 investigation bores on Aileron Station
    b. *Arafura* gained access to the NuPower AEM datasets covering SW Aileron and the Central Napperby region and arranged processing and preparation of conductivity maps and spreadsheets. They also provided high resolution satellite images of the study area. *Arafura* and CRG selected initial bore sites. CRG liaised with the Napperby and Aileron Pastoralists who cleared access tracks and drilling platforms
    c. CRG prepared stage 2 drilling specifications and tender documents then called tenders. From 7 drilling contractors who tendered, L2 Drilling Contractors was selected and entered into a contract with *Arafura*.
    d. Ride Consulting (RC) was engaged to project manage the stage 2 groundwater investigation of the NE Southern Basins with assistance from *Arafura*.
        i. L2 Drillers completed drilling, construction development and airlift testing
            1. 6 investigation production bores (3 bores 150 mm steel cased and slotted, 2 bores 260 mm steel cased with stainless steel screens)
            2. 3 production observation bores (50 mm PVC cased)
            3. 7 investigation/monitoring bores (50 mm & 100 mm PVC cased)
        ii. 1,340 strata samples were logged by a contract geologist and added to the *Arafura* strata library
        iii. 300 soil samples were taken and tested for pH and salinity
        iv. Borehole Wireline completed downhole imaging and geophysical logging of 13 bores including 12 Arafura NE Southern Basins Exploration Bores.

3. **Margins Groundwater Investigation Program**

RC_ID	Site ID	Depth	Current Depth	Yield	SWL	Comments
		m	m	L/sec		
RC0029	SP 1	27	24.150	Dry	Dry	Capped
RC0030	SP 2	36	36.467	0.3	27.030	Monitoring Bore 50mm PVC
RC0031	SP 3	42	42.080	0.1	28.130	Monitoring Bore 50mm PVC
RC0032	SP 4	36	35.025		29.225	Monitoring Bore 50mm PVC
RC0033	SP 5	42	40.152	Water	29.370	Monitoring Bore 50mm PVC
RC0034	SP 6	18	17.063	Dry	Dry	Capped
RC0035	SP 7	27	26.030	Water	20.380	Monitoring Bore 50mm PVC
RC0036	SP 8	30	30.200		20.651	Monitoring Bore 50mm PVC
RC0037	SP 9	42	41.810		22.248	Monitoring Bore 50mm PVC
RC0038	SP 10	18	11.420	Dry	Dry	Capped
RC0039	SP 11	32	26.200		22.980	Monitoring Bore 50mm PVC
RC0040	SP 12	30	30.512		21.380	Monitoring Bore 50mm PVC
RC0041	SP 13	24	24.540		20.923	Monitoring Bore 50mm PVC
RC0042	SP 14	42	33.650		19.380	Monitoring Bore 50mm PVC
RC0043	SP 15	42	40.510		18.442	Monitoring Bore 50mm PVC
RC0044	SP 16	24	26.550		17.172	Monitoring Bore 50mm PVC
RC0045	SP 17	27	23.000		17.183	Monitoring Bore 50mm PVC
RC0046	SP 18	42	41.930		37.710	Monitoring Bore 50mm PVC
RC0047	SP 19	42	42.376		35.870	Monitoring Bore 50mm PVC
RC0048	SP 20	27	27.430		17.805	Monitoring Bore 50mm PVC
RC0049	SP 21	30	30.032	Water	16.400	Monitoring Bore 50mm PVC
RC0050	SP 22	36	39.050		30.260	Monitoring Bore 50mm PVC
RC0051	SP 23	30	29.782	Dry	Dry	Capped
RC0052	SP 24	42	42.252		29.610	Monitoring Bore 50mm PVC
RC0053	SP 25	30	29.330		17.410	Monitoring Bore 50mm PVC
RC0054	SP 26	42	42.890		29.010	Monitoring Bore 50mm PVC
RC0055	SP 27	42	42.568		30.425	Monitoring Bore 50mm PVC
RC0056	SP 28	51	50.790		24.760	Monitoring Bore 50mm PVC
RC0057	SP 29	60	60.344		34.290	Monitoring Bore 50mm PVC
RC0058	SP 30	54	44.200		38.735	Monitoring Bore 50mm PVC

Table 3: Arafura Margins Groundwater Investigation Exploration Bore Summary

Appendix E Climate

The weather pattern in the region is controlled largely by its geographical location within the continent and the seasonal cyclical north-south movement of the atmospheric pressure systems. Over winter, Alice Springs and Nolans lie within the northern sector of a high pressure belt separated by low pressure troughs which move across the Great Australian Bight. Some of these troughs can be high enough to provide winter rains to local or widespread areas. These weather systems result in persistent south easterlies which are stronger over winter than over summer. Winter is generally characterised by clear skies and excellent visibility with higher humidity.

Over summer, low pressure troughs from the northern tropical low are often accompanied by cloud and may provide summer rain. Visibility is often reduced over summer due to high temperature and airborne dust (dust haze). Willy-willies are common and the humidity is normally very low. Tropical cyclones that cross the north Australian coastline between Broome WA and east of Darwin NT may result in occasional widespread rain or thunderstorms in the Nolans Region which may result in high intensity rainfall and most of the annual rainfall occurring over a few days or weeks.

Climate Records

Arafura installed an automatic weather station (AWS) at the Nolans mine site in 2008. The nearest BOM climate station to Nolans is at Territory Grape Farm, 43 km ENE, which was established in 1987. The longest and most extensive climate records available for the region are from BOM Alice Springs, 136 km SSW, which was established in 1873. The second longest set of climate records are the BOM Barrow Creek rainfall and temperature records, 133 km to the NNE (1874 to 2008).

The Barrow Creek records are more analogous to Nolans and Ti Tree than Alice Springs due to location with respect to the Central Australian oscillating pressure systems between winter and summer, topographic and other factors.

There are also other excellent continuous regional climatic records (mainly rainfall and temperature) available for Yuendumu, Papunya, Jervois and Tennant Creek. Continuous rainfall records with some gaps ranging from weeks to months are available for pastoral properties and towns surrounding the project area. These records are particularly useful in defining types of rainfall events, their spatial extent, rainfall variability, point total rainfall and comparisons to the *Arafura* and Territory Grape Farm AWS records.

Rainfall

Rainfall intensity records are available for Alice Springs, Territory Grape Farm, Nolans mine site and Jervois.

The Nolans Region is within the Australian Arid Zone with a mean annual rainfall of 314 mm since 2008 but this included a significant region-wide period of higher rainfall. The record at Territory Grape Farm over 15 years, 1987 to 2008, was a mean annual rainfall of 305mm and a median rainfall of 297 mm. There is a predominance of rainfall over summer (November to March).

Rainfall is highly variable from year to year and erratic from month to month, but significant rain can be expected to occur twice a year over summer and once every two years over winter. About 50% of the annual rainfall can fall over a single month.

Significant follow-up rainfall over the next month is less common but can be important for vegetation growth, runoff and groundwater recharge.

High rainfall events can be expected to occur about every 11 years with major rainfall years about every 33 years. This frequency is reflected in recharge shown in a limited number of regional monitoring bores (in Cenozoic aquifers) where there are records for more than 30 years.

The rainfall records for Alice Springs and Barrow Creek show that these cycles are not precise and the high and major rainfall years vary over different decades. Dry and extended drought years predominate and occur between high and good rainfall years.

The rainfall record at Alice Springs is too short to develop a definitive understanding of the rainfall cycles but assists in providing an indication of past regional groundwater recharge/discharge cycles.

Temperatures

At Nolans, summer maximum daily temperatures frequently exceed 38°C and in some years over periods of weeks. The mean monthly minimum and maximum temperatures are likely to range between 5°C in July or August and 37°C in January. The highest daily temperature recorded at Territory Table Grapes was 46°C.

The summer nights are generally cool with a reduction of up to 20°C by early morning. Winters are cold in comparison, partly due to the frequency and strength of the prevailing wind. Maximum temperatures are generally around 20°C with minimum daily temperatures generally down to 5°C but every few years there can be minimum early morning temperatures less than 5°C. The minimum recorded temperature at Territory Table Grapes was -6°C.

Frosts

Unlike at Alice Springs, 135 km to the south, where up to 18 frosts may occur most years, in the Nolans region frosts are rare but do occur some years as can be identified from the above temperatures. The current record over a few years show that 2 frosts have occurred in some years during July or August about every 3 years. However, the annual record is too short and it is suspected that there are more frequent frosts over some years particularly over the NE Southern Basin sand plains between early June and late August.

Evaporation

The annual potential evaporation rate at Alice Springs is 2196 mm/yr but can be expected to be slightly higher in the Nolans Region as the temperatures at Alice Springs are slightly lower than at Nolans. The current annual potential evaporation estimate for Nolans, based on a short term record, is 2396 mm/yr (range 2111 mm to 3162 mm).

Mean monthly potential evaporation record at Nolans ranges between 89 mm in June and 286 mm in December. Mean monthly potential evaporation exceeds 235 mm over summer and averages 77 mm over winter.

Prevailing winds

The prevailing winds are from the south-east over both summer and winter. Hot westerlies occur most years over about 10 days in spring and mark the change in the dominance of the winter low pressure troughs from the south to the dominance of the low pressure troughs from the tropical north.

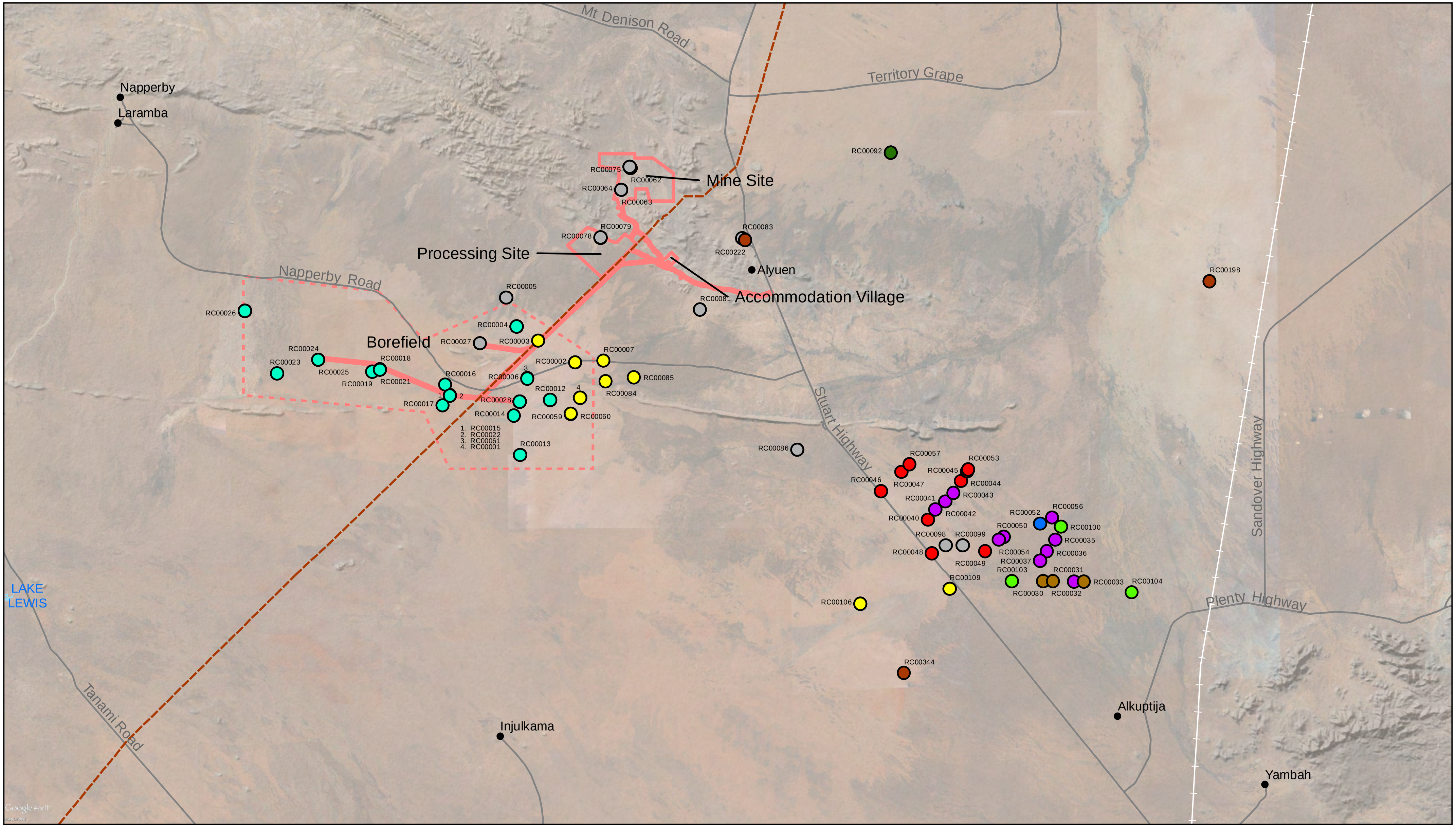
Climatic Effects on Runoff and Groundwater Recharge

Each of the above climatic factors has an effect on vegetation biomass and growth, wildfire, groundwater recharge and surface runoff.

Appendix F Water Quality Datasets, drawings and maps.

This appendix includes maps, graphs and tables of chemical water quality data prepared by GHD and included in the Arafura draft Nolan Project EIS May 2016.

- Figure F -1 is a map of the NE Southern Basins groundwater samples by aquifer type
- Figure F -2 is a Piper diagram of the groundwater chemistry by aquifer type
- Figure F -3 is a graph of the EC plotted by aquifer type
- Figure F -4 is a map of the EC (minimum) of groundwater samples from Arafura NE Southern Basins bores and adjacent Aileron Station Bores
- Figure F -5 is a map of the EC (maximum) of groundwater samples from Arafura NE Southern Basins bores and adjacent Aileron Station Bores
- Table F -1 is EC statistics by aquifer type
- Table F -2 is Appendix B: groundwater chemical analyses and guideline exceedances as provided by Ride Consultants. Note very difficult to read as original spreadsheet A3 landscape, recommend viewing original digital dataset, included with digital standing water level record.



1:500,000 @ A4

0 5 10 15 20

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53

N

LEGEND

Main Aquifer

- Alluvial
- Alluvial/Fluvial
- Calcrete
- Calcrete/Alluvial
- Calcrete/Alluvial/Fluvial
- Calcrete/Basement
- Reaphook Paleochannel
- Ti Tree Basin Aquifer
- Weathered Basement
- Unknown
- Gas Pipeline
- Major Roads
- Project Areas
- Borefield Area
- Waterbodies

Arafura Resources Limited
Nolans Project

Groundwater Samples by Aquifer Type

Job Number	4322301
Revision	0
Date	05 May 2016

Figure F- 1

G:\43\22301\GIS\Maps\4322301_601_GroundSamplesAquiferType.mxd

Level 5 66 Smith Street Darwin NT 0800 Australia T 61 8 8982 0100 F 61 8 8981 1075 E drwmail@ghd.com W www.ghd.com

Data source: Google Earth Pro - Imagery (Date extracted: 04/02/2015). Ride - Groundwater Data (2015). ARL - Project Areas (2015). GA - Placenames, Railways, Gas Pipeline, Major Roads, Waterbodies (2015). Created by: CM

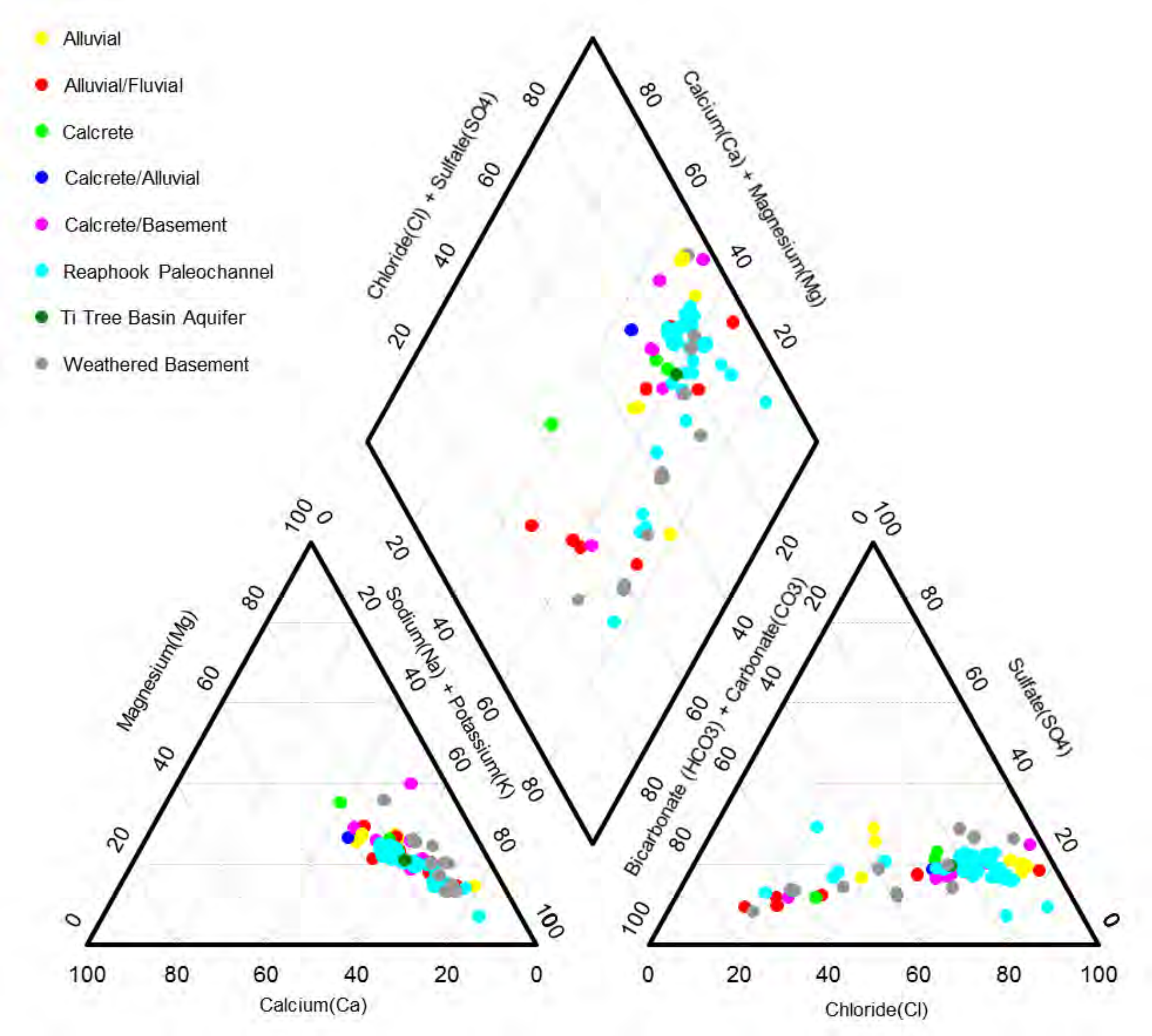


Figure **F-2** Groundwater chemistry by aquifer type

As a preliminary proxy for water quality, the electrical conductivity of groundwater samples are presented in Figure 14 by aquifer type, in Figure 15 and Figure 16 spatially and summarised in Table 4.

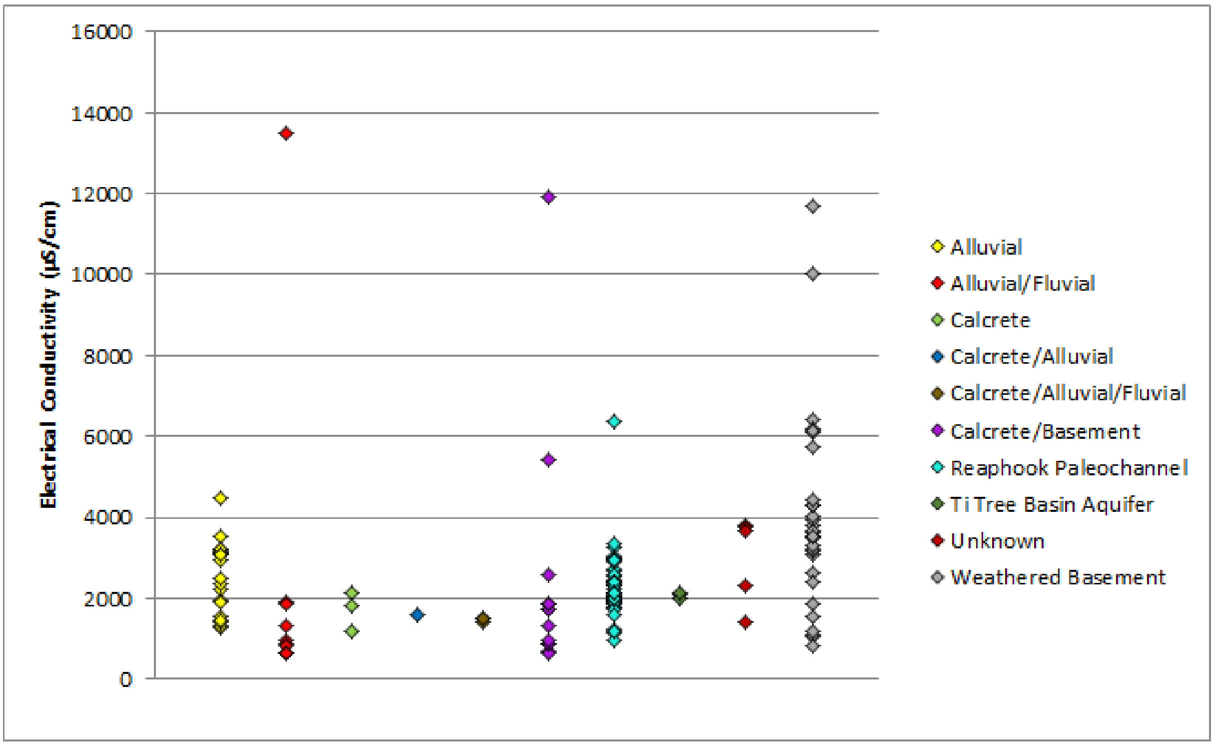
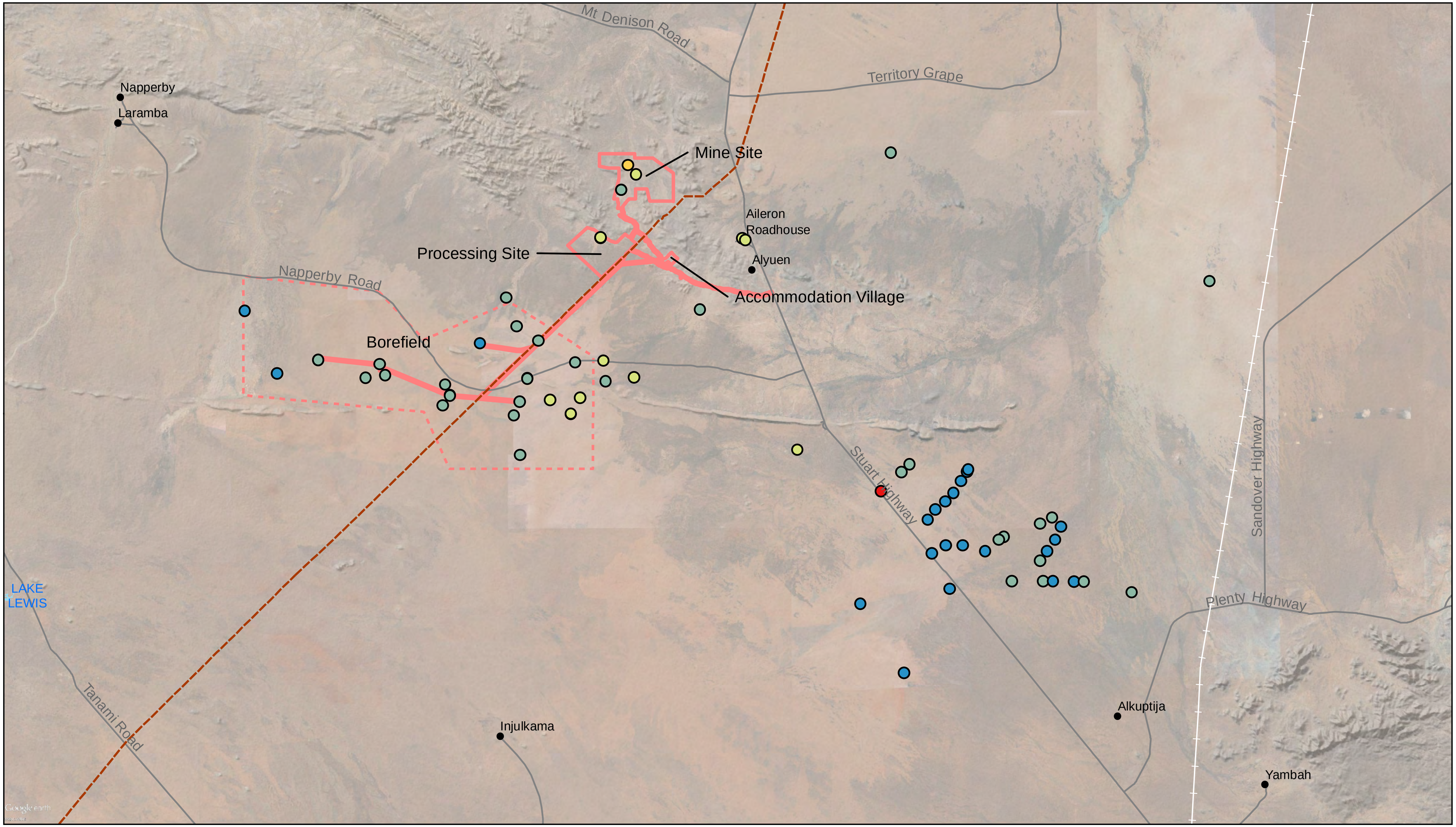


Figure **F-3** Electrical conductivity plotted by aquifer type

Table **F-1** Electrical conductivity statistics by aquifer type

Aquifer Type	n	Min EC (µS/cm)	Median EC (µS/cm)	Max EC (µS/cm)
Alluvial	21	1,280	2,950	4,480
Alluvial/Fluvial	10	654	917	13,500
Calcrete	3	1,200	1,820	2,140
Calcrete/Alluvial	1	1,570	1,570	1,570
Calcrete/Alluvial/Fluvial	3	1,430	1,520	1,520
Calcrete/Basement	13	636	1,710	11,900
Reaphook Palaeochannel	59	957	2,130	6,350
Ti Tree Basin Aquifer	3	2,000	2,090	2,120
Unknown	5	1,430	3,585	3,820
Weathered Basement	32	845	3,680	11,700



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Job Number	4322301
Revision	0
Date	05 May 2016

Electrical Conductivity (Min) of Groundwater Samples

Figure **F-4**

G:\43\22301\GIS\Maps\4322301_602_GroundSamplesElectricalConductivity.mxd

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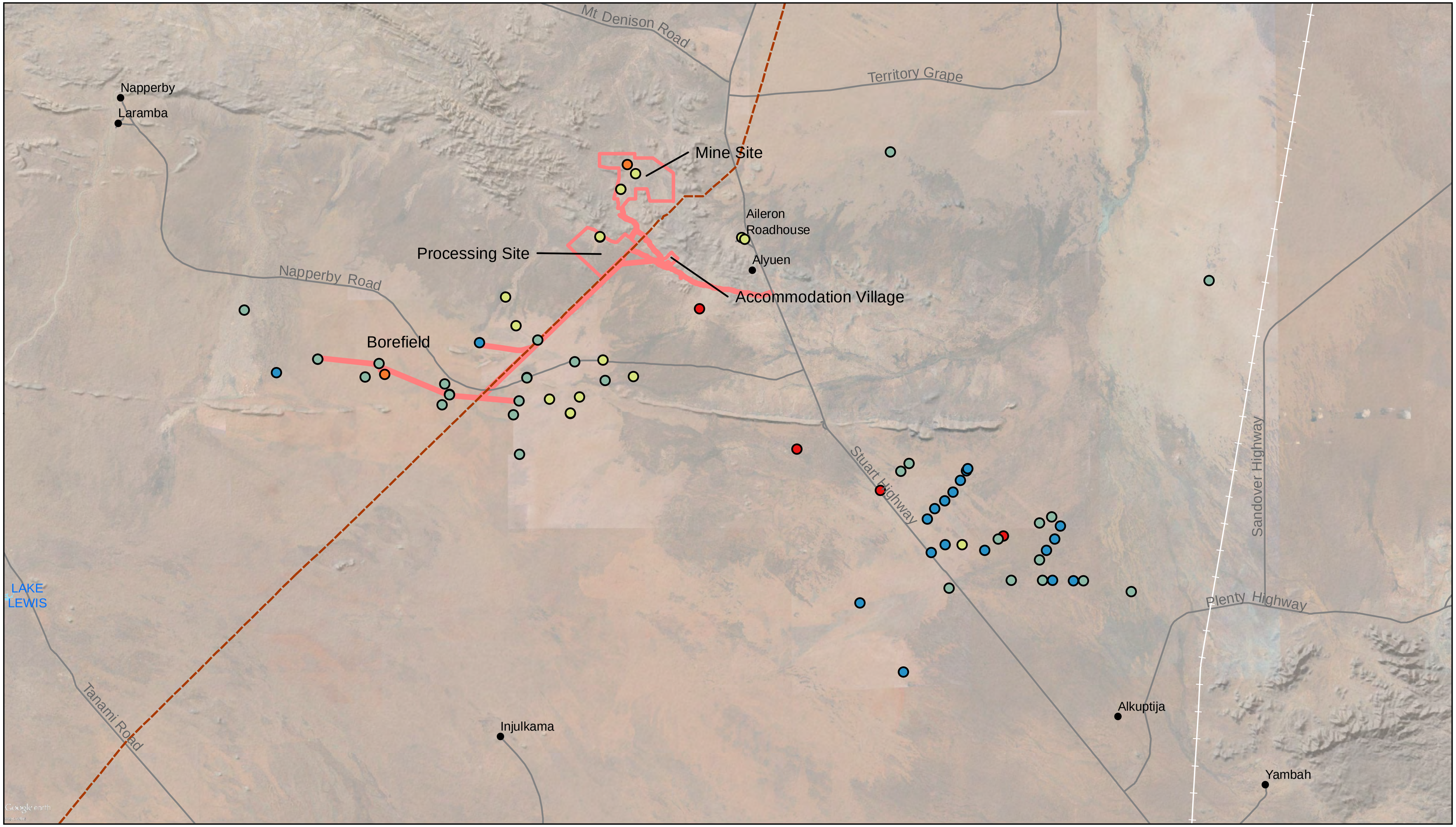

1:500,000 @ A4

0 5 10 15 20

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53

N

LEGEND

Electrical Conductivity (uS/cm)

- 0 - 1500
- 1501 - 3000
- 3001 - 4500
- 4501 - 6000
- 6001 - 7500
- 7501 - 13500
- Gas Pipeline
- Major Roads
- Project Areas
- Waterbodies

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Revision	0
Date	22 Mar 2016

Electrical Conductivity (Max) of Groundwater Samples

Figure **F-5**

G:\43\22301\GIS\Maps\4322301_603_GroundSamplesElectricalConductivityMax.mxd

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Data source: Google Earth Pro - Imagery (Date extracted: 04/02/2015). Ride - Groundwater Data (2015). ARL - Project Areas (2015). GA - Placenames, Railways, Gas Pipeline, Major Roads, Waterbodies (2015). Created by: CM

										Major Ions											Nutrients					
					Electrical conductivity (lab)	pH (Lab)	Total Dissolved Solids	Total Suspended Solids	Calcium	Magnesium	Sodium	Potassium	Chloride	Sulphate	Calcium Carbonate	Bicarbonate	Carbonate	Hydroxide	Fluoride	Bromide	Ammonia as N	Nitrate (as N)	Nitrate (as NO3-)	Nitrite (as N)	Nitrite (as NO2-)	Phosphate (as P)
					µS/cm	pH Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ADWG 2011 Aesthetic						**6.5-8.5**	**600**				**180**		**250**	**250**												
ADWG 2011 Health														500					1.5				50		3	
ANZECC 2000 FW 99%																					0.32	0.0038	0.017			
ANZECC 2000 Irrigation - Long-term Trigger Values																			1							
ANZECC 2000 Stock Watering							*4000*		*1000*					*1000*					*2*			*90*	*400*	*9.1*	*30*	
Monitoring_Zone	**Location Code**	**Grouping**	**GW Basin**	**Location Type**																						
Alluvial	RC00001	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	3230 - 4480	8.2 - 8.3	**2070 - 3580**	<10	164 - 281	102 - 139	-	43.4 - 45.4	-	**277 - 312**	829,000 - 1,280,000	128 - 149	<1	<1	0.8	5.02 - 5.23	0.02 - 0.3	12.4 - 22.5	55.1 - 99.6	<0.005	<0.02	0.01 - 0.015
Alluvial	RC00002	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	2240 - 2480	**8.4 - 8.5**	**1340 - 1510**	<10 - 50	90.7 - 98.7	55.4 - 59.6	-	34.9 - 38.8	-	174 - 210	455,000 - 492,000	188 - 201	5 - 7	<1	1.2	3.5 - 3.86	0.005 - 0.495	13.5 - 15.8	60 - 70.1	<0.005 - 0.06	<0.02 - 0.2	0.015
Alluvial	RC00003	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	1920 - 1950	**8.7**	**1170**	10 - 20	33.5 - 45.6	43.7 - 46.1	-	35.9 - 36.5	-	185 - 212	263,000 - 303,000	291 - 343	28 - 31	<1	1.2 - 1.7	5.14 - 5.5	0.1 - 0.105	8.79 - 9.19	38.9 - 40.7	0.02	0.06	0.01 - 0.015
Alluvial	RC00007	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	3100 - 3130	**8.4 - 8.5**	**1950 - 2030**	<10	127 - 134	109 - 112	-	59.5 - 64.8	-	**302 - 312**	767,000 - 795,000	190 - 193	7 - 10	<1	1 - 1.2	5.47 - 5.54	0.215 - 1.57	18.8 - 19.3	83.1 - 85.5	0.01 - 0.44	0.02 - 1.44	0.015 - 0.02
Alluvial	RC00059	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	3140 - 3510	7.9 - 8.3	**2090 - 2390**	<10 - 20	162 - 187	106 - 120	**326 - 372**	43.2 - 48.8	**815 - 928**	**297 - 333**	-	117 - 161	<1	<0.001	0.8 - 1.2	4.56 - 4.89	<0.005 - 0.025	19.6 - 23	86.7 - 102	<0.005 - 0.025	<0.02 - 0.08	0.01 - 0.03
Alluvial	RC00060	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	3060 - 3210	8.2	**2090 - 2240**	<10 - 10	171 - 177	97.7 - 114	**317 - 346**	39 - 45.4	**806 - 861**	**265 - 311**	-	140 - 149	<1	<0.001	0.9 - 1	4.08 - 4.69	<0.005 - 0.015	15.8 - 21.4	69.8 - 94.7	<0.005	<0.02	0.02
Alluvial	RC00084	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	2950	8.1	**1970**	40	122	82.4	**331**	45.5	**700**	**285**	-	154	<1	<0.001	0.9	4.3	1.27	16.8	74.4	0.455	1.48	0.025
Alluvial	RC00085	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	3080	8.4	**1870**	<10	141	98.7	**294**	48.6	0.015	**293**	-	174	6	<0.001	0.6	4.36	679	23.3	103	<0.005	<0.02	0.01
Alluvial	RC00106	Margins Area	NE Burt	Aileron Station	1280 - 1430	**8.1 - 8.8**	**770 - 890**	<10 - 40	25.8 - 52.6	21.6 - 48.5	158 - 178	25.9 - 28	157	81 - 174	154,000	258 - 283	<1 - 21	<0.001	1.4 - 1.5	1.14 - 1.35	<0.005 - 0.01	10.7 - 25	47.3 - 111	<0.005 - 0.005	<0.02	0.02 - 0.045
Alluvial	RC00109	Margins Area	NE Burt	Aileron Station	1450 - 1530	**8.1 - 8.6**	**890 - 1080**	<10 - 20	19.1 - 19.3	26.2 - 26.3	**244**	39.7 - 40.6	162	93.9 - 94	156,000	294 - 315	<1 - 14	<0.001	1.2 - 1.3	1.3 - 1.41	0.005 - 0.015	23.4 - 25.9	104 - 115	<0.005	<0.02	0.025 - 0.055
Alluvial/Fluvial	RC00040	Margins Area	NE Burt/Arunta	Aileron Station	972	8.4	**650**	<10	32.1	25	126	29.8	0.01	58.4	-	261	6	<0.001	1.5	0.693	82.2	13.1	58.1	0.03	0.1	<0.005
Alluvial/Fluvial	RC00044	Margins Area	NE Burt	Aileron Station	862	**8.5**	**630**	30	17.6	15	131	26	75.2	38.8	-	210	6	<0.001	1.7	0.793	0.01	19.5	86.5	0.13	0.4	<0.005
Alluvial/Fluvial	RC00045	Margins Area	NE Burt	Aileron Station	654	**8.5**	570	10	30.8	23.3	58	21	26.5	20.1	-	189	6	<0.001	0.9	0.37	0.01	23.9	106	0.02	0.04	<0.005
Alluvial/Fluvial	RC00046	Margins Area	NE Burt	Aileron Station	13,500	8.1	***9660***	20	406	381	**2240**	192	**4490**	***1450***	-	387	<1	<0.001	1.3	32.2	0.14	1.03	4.56	0.095	0.32	0.01
Alluvial/Fluvial	RC00047	Margins Area	NE Burt	Aileron Station	1900	8	**1240**	<10	98.8	49.8	**213**	35.4	**413**	181	-	211	<1	<0.001	0.8	3	0.135	0.605	2.68	0.13	0.42	0.01
Alluvial/Fluvial	RC00048	Margins Area	NE Burt	Aileron Station	845	**8.5**	500	10	25.8	22.5	109	26.9	0.005	32.7	-	261	6	<0.001	1.4	0.452	60.1	14.5	64.1	0.19	0.62	<0.005
Alluvial/Fluvial	RC00049	Margins Area	NE Burt	Aileron Station	1340	**8.5**	**880**	130	46.1	42.1	139	43.4	191	88.5	-	189	7	<0.001	0.9	2.12	0.025	19.8	87.8	0.01	0.04	<0.005
Alluvial/Fluvial	RC00053	Margins Area	NE Burt	Aileron Station	663	**8.3 - 8.6**	**340 - 630**	30 - 190	24 - 24.3	16 - 18.4	73.7 - 77.9	19 - 20.5	34.4 - 36.1	20.3 - 24.4	-	157 - 172	<1 - 9	<0.001	0.9	0.461 - 0.489	0.01 - 0.02	24 - 26	106 - 115	0.01	0.02 - 0.04	<0.005
Alluvial/Fluvial	RC00057	Margins Area	NE Burt	Aileron Station	1860	8.2	**1100**	20	54.6	40.4	**265**	32.9	**389**	154	-	215	<1	<0.001	0.9	2.61	0.15	0.04	0.16	0.025	0.08	0.015
Calcrete	RC00100	Margins Area	Arunta Basement	Aileron Station	1200	8	**800**	20	65.2	54.2	103	15.9	94.9	48.7	-	297	<1	<0.001	1.1	1.32	0.01	43.3	192	0.02	0.06	0.01
Calcrete	RC00103	Margins Area	NE Burt	Aileron Station	2140	7.8	**1230**	<10	84.3	68.1	**247**	32.1	**346**	187	-	287	<1	<0.001	1.2	3.4	0.01	26.7	118	0.06	0.18	0.01
Calcrete	RC00104	Margins Area	Ti Tree	Aileron Station	1820	7.9	**1140**	<10	70.7	53.1	**238**	17	**294**	176	-	233	<1	<0.001	0.8	2.67	0.01	15.3	67.7	<0.005	<0.02	0.01
Calcrete/Alluvial	RC00052	Margins Area	Ti Tree/Arunta	Aileron Station	1570	8	**1060**	<10	90.9	51.7	145	32.5	**274**	130	-	239	<1	<0.001	0.7	2.22	0.045	5	22.1	*12*	*39.5*	0.015
Calcrete/Alluvial/Fluvial	RC00030	Margins Area	NE Burt	Aileron Station	1520	8.2	**970**	<10	53	42	**181**	33.1	0.045	116	-	210	<1	<0.001	1	2.27	255	11.8	52.3	0.215	0.7	0.005
Calcrete/Alluvial/Fluvial	RC00031	Margins Area	Ti Tree	Aileron Station	1430	7.8	**870**	40	59.8	52.8	135	32.3	0.02	93.8	-	183	<1	<0.001	0.9	2.64	237	20.8	92	0.01	0.02	<0.005
Calcrete/Alluvial/Fluvial	RC00033	Margins Area	Ti Tree	Aileron Station	1520	8.3	**930**	20	65.9	48.5	156	29.6	0.005	107	-	163	<1	<0.001	1	2.74	249	30.9	137	0.05	0.18	<0.005
Calcrete/Basement	RC00032	Margins Area	Ti Tree/Arunta	Aileron Station	1340	8	**870**	200	67.8	47.3	123	25	0.01	84.5	-	205	<1	<0.001	0.9	2.3	192	28.6	127	0.035	0.12	0.005
Calcrete/Basement	RC00035	Margins Area	Ti Tree/Arunta	Aileron Station	680	8.3	450	<10	34.9	37.8	38.7	17.1	0.015	15.5	-	204	1	<0.001	0.8	0.458	26.6	25.3	112	0.015	0.04	<0.005
Calcrete/Basement	RC00036	Margins Area	Ti Tree/Arunta	Aileron Station	636	8.2	470	<10	43.3	30.7	29	16.5	0.01	11.4	-	174	<1	<0.001	1.2	0.459	33.3	27	119	<0.005	<0.02	<0.005
Calcrete/Basement	RC00037	Margins Area	Ti Tree/Arunta	Aileron Station	1710 - 1730	7.9 - 8.2	**1110 - 1140**	<10 - 60	79.2 - 81.4	54.8 - 56.2	**196**	25.7 - 26.5	**309 - 342**	137 - 142	-	243 - 255	<1	<0.001	1.1 - 1.2	2.22 - 2.5	<0.005 - 0.01	23.6 - 24.7	105 - 109	0.01 - 0.03	0.04 - 0.1	<0.005 - 0.02
Calcrete/Basement	RC00041	Margins Area	NE Burt/Arunta	Aileron Station	858	8.4	**600**	10	26.5	21	113	25.9	0.01	37	-	253	2	<0.001	0.7	0.596	62.9	15	66.4	0.01	0.02	<0.005
Calcrete/Basement	RC00042	Margins Area	NE Burt	Aileron Station	850	8.1	450	140	31.9	19.6	110	23.5	59.3	37.7	-	256	<1	<0.001	0.9	0.615	0.01	17.5	77.7	1.65	5.4	<0.005
Calcrete/Basement	RC00043	Margins Area	NE Burt	Aileron Station	978	8.2	**610**	50	28.2	28.2	116	31.7	0.015	51.5	-	216	<1	<0.001	1.5	1.03	88	21.8	96.7	0.775	2.54	0.005
Calcrete/Basement	RC00050	Margins Area	NE Burt/Arunta	Aileron Station	1880 - 11,900	7.8 - 8.4	***1110 - 8730***	<10 - 130	53.3 - 307	47.7 - 659	**234 - 1440**	59.1 - 302	**340 - 3340**	***139 - 1550***	-	220 - 545	<1 - 5	<0.001	0.5 - 0.9	3.46 - 33.1	0.005 - 0.175	3.51 - 17	15.5 - 75.5	0.02 - 0.38	0.04 - 1.24	<0.005 - 0.015
Calcrete/Basement	RC00054	Margins Area	NE Burt/Arunta	Aileron Station	1880	8.4	**1110**	80	53.3	47.7	**234**	59.1	**340**	139	-	231	5	<0.001	0.9	3.46	0.005	9.76	43.2	0.015	0.04	<0.005
Calcrete/Basement	RC00056	Margins Area	Ti Tree/Arunta	Aileron Station	2580	8.3	**1590**	10	81.1	84.1	**334**	48.9	**479**	192	-	410	<1	<0.001	1.2	4.11	0.215	15.5	68.6	*18.3*	*60.2*	0.01
Reaphook Paleochannel	RC00004	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	1790 - 3270	8.1 - 8.3	**1050 - 2430**	<10 - 30	53.9 - 211	45 - 93.2	**263 - 280**	30.9 - 48.4	**0.01 - 263**	174 - 238	544,000 - 912,000	159 - 396	<1	<0.001	0.8 - 1.2	1.78 - 2.92	<0.005 - 256	6.97 - 17.2	30.8 - 76	<0.005 - 0.01	<0.02 - 0.02	0.01 - 0.03
Reaphook Paleochannel	RC00006	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	2050	**8.5**	**1210 - 1300**	<10 - 20	60.8 - 65.3	48.6 - 49.8	-	34.2 - 34.4	-	173 - 175	357,000 - 363,000	249 - 259	12 - 13	<1	1.3 - 1.4	2.76 - 2.9	<0.005 - 0.04	16.6 - 16.8	73.3 - 74.2	0.01 - 0.065	0.04 - 0.22	0.015 - 0.02
Reaphook Paleochannel	RC00012	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	3010 - 3020	8.3 - 8.4	**1530 - 1830**	20 - 50	83 - 98.5	97.1 - 112	-	50.8 - 56.7	-	**229 - 355**	607,000 - 707,000	151 - 256	<1 - 5	<1	*2.5 - 2.8*	3.43 - 3.55	2.4 - 3.67	2.91 - 6.41	12.9 - 28.4	0.975 - 1.76	3.22 - 5.78	0.01
Reaphook Paleochannel	RC00013	Southern Basins - Reaphook	Eastern Mt Wedge	Aileron Station	2670 - 2710	8 - 8.2	**1720 - 1810**	20 - 30	128 - 143	83	-	48.3 - 56.1	-	210 - 216	662,000 - 698,000	138 - 144	<1	<1	0.5 - 0.6	3.7 - 3.89	0.04 - 0.36	17.1 - 17.6	75.8 - 78	<0.005 - 0.02	<0.02 - 0.06	0.025
Reaphook Paleochannel	RC00014	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	1940 - 2080	**8.5**	**1230 - 1280**	<10	71.1 - 79.9	53.2 - 59.3	**225 - 281**	35.3 - 47.5	**381 - 429**	166 - 171	-	157 - 183	9 - 10	<0.001	0.8 - 0.9	2.63 - 3.13	0.01 - 0.035	14.7 - 15.6	64.9 - 68.9	0.005	<0.02 - 0.02	0.02 - 0.025
Reaphook Paleochannel	RC00015	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	1940 - 1950	**8.5 - 8.6**	**1200 - 1230**	<10	79.9 - 90.8	54.7 - 59.3	**225 - 232**	45 - 47.5	**365 - 381**	171 - 181	-	157 - 188	9 - 14	<0.001	0.7 - 0.8	3.05 - 3.13	0.035 - 0.115	15.6 - 16.5	68.9 - 73.2	0.005 - 0.035	<0.02 - 0.12	0.02 - 0.025
Reaphook Paleochannel	RC00016	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	2240	**8.5**	**1390**	<10	92.8	68.4	**259**	46.2	**507**	182	-	156	8	<0.001	0.6	3.74	<0.005	13.6	60.2	<0.005	<0.02	0.02
Reaphook Paleochannel	RC00017	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	1780 - 1890	**8.6**	**1110 - 1160**	<10 - 20	65.8 - 71	45.6 - 48.3	**231 - 246**	43.1 - 47.2	**309 - 357**	140 - 145	-	185 - 202	13 - 17	<0.001	0.7	2.83 - 3.11	<0.005 - 0.04	17.3 - 17.6	76.6 - 77.8	<0.005 - 0.025	<0.02 - 0.08	0.02 - 0.06
Reaphook Paleochannel	RC00018	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0 - 6350	**0 - 8.6**	**0 - 3710**	<10 - 40	0 - 116	0 - 67.7	**0 - 1190**	0 - 44.3	**0 - 1860**	**0 - 282**	-	0 - 229	<1 - 12	<0.001 - 0	0 - 1.2	0 - 3.74	0 - 0.94	0 - 16.1	0 - 71.3	0 - 0.18	0 - 0.58	0 - 0.025
Reaphook Paleochannel	RC00019	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	2580	**8.6**	**1660**	<10	101	74.7	**305**	47.8	**552**	**255**	-	180	14	<0.001	0.7	3.22	<0.005	9.62	42.6	<0.005	<0.02	0.03
Reaphook Paleochannel	RC00021	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0 - 2390	**0 - 8.3**	**0 - 1560**	<10 - 420	0 - 88.2	0 - 66.7	**0 - 272**	0 - 43.4	**0 - 601**	0 - 226	-	0 - 190	<1 - 0	<0.001 - 0	0 - 0.8	0 - 3.83	0 - 0.085	0 - 6.19	0 - 27.4	<0.005 - 0.135	<0.02 - 0.44	0 - 0.035
Reaphook Paleochannel	RC00022	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	1850 - 1910	7.4 - 7.7	**1240 - 1310**	<10 - 10	81.7 - 84.3	52 - 56.9	**201 - 203**	40.8 - 43.6	**358 - 397**	158 - 162	-	202 - 207	<1	<0.001	0.6 - 0.8	2.78 - 3.05	0.01 - 0.02	14.3 - 14.8	63.3 - 65.4	0.005 - 0.015	<0.02 - 0.06	0.03
Reaphook Paleochannel	RC00023	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	1140	**8.5**	**770**	<10	35.4	19.8	168	25.7	79.8	139	-	268	10	<0.001	0.9	0.6300001	0.005	13.5	59.9	<0.005	<0.02	0.045
Reaphook Paleochannel	RC00024	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	1920 - 1960	8.2 - 8.3	**1330 - 1350**	<10 - 10	78.8 - 79.3	50.3 - 51.1	**212 - 219**	42.3 - 43.7	**369 - 381**	189 - 192	-	206 - 210	<1 - 2	<0.001	0.7	2.15 - 2.65	0.01 - 0.015	17.3 - 17.5	76.6 - 77.4	<0.005	<0.02	0.03 - 0.035
Reaphook Paleochannel	RC00025	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	1870 - 2130	8.1 - 8.4	**1260 - 1450**	<10 - 90	78.5 - 92.7	48.3 - 54.3	**207 - 235**	37.6 - 42.7	**367 - 448**	187 - 210	-	195 - 214	<1 - 3	<0.001	0.3 - 0.6	2.18 - 2.44	0.01 - 0.15	10.3 - 17.6	45.6 - 78.1	<0.005 - 0.055	<0.02 - 0.18	0.025 - 0.035
Reaphook Paleochannel	RC00026	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0 - 2960	**0 - 8.7**	**0 - 1860**	<10 - 1590	0 - 98.4	0 - 66.6	**0 - 386**	0 - 40	**0 - 786**	0 - 242	-	0 - 323	<1 - 19	<0.001 - 0	0 - 1.9	0 - 3.31	0 - 0.445	0 - 6.76	0 - 29.9	<0.005 - 0.01	<0.02 - 0.02	0 - 0.025
Reaphook Paleochannel	RC00028	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	1590 - 2420	7.4 - 8.4	**1020 - 1680**	<10 - 60	45 - 106	37.7 - 64.1	**246 - 297**	30 - 32	**283 - 638**	134 - 194	-	171 - 232	<1 - 3	<0.001	0.8 - 1.5	1.68 - 3.19	<0.005 - 0.03	12.8 - 18.5	56.6 - 82.1	<0.005 - 0.09	<0.02 - 0.28	<0.005 - 0.015
Reaphook Paleochannel	RC00061	Southern Basins - Reaphook	Eastern Whitcherry	Public Road	2140	**8.5**	**1350**	<10	73	54.4	**306**	34.9	**402**	185	-	258	14	<0.001	1.1	3.42	<0.005	16.6	73.3	<0.005	<0.02	0.04
Ti Tree Basin Aquifer	RC00092	Ti Tree Basins	Ti Tree	Aileron Station	2000 - 2120	7.5 - 8.2	**1230 - 1310**	20 - 90	75.8 - 76.5	51.7 - 52.2	**259 - 261**	37.1 - 41.6	**0.01 - 385**	177 - 210	405,000	236 - 264	<1	<0.001	0.6 - 1.2	3.38 - 3.6	0.01 - 368	16.1 - 16.5	16.1 - 73.2	<0.005 - 0.02	<0.02 - 0.01	0.01 - 0.04
Unknown	RC00198	N/A	Unknown	Aileron Station	2310	8.1	**1270**	<10	122	52.6	-	25.7	-	213	521,000	211	<1	<1	0.5	2.64	410	19.7	87.1	<0.005	<0.02	0.05
Unknown	RC00222	N/A	Unknown	Aileron Roadhouse	3680 - 3820	**7.7 - 8.6**	**2110 - 2140**	<10 - 10	97.4 - 107	57.9 - 63.2	**612**	18.7 - 23	<0.005	**238 - 264**	488,000 - 528,000	492 - 563	<1 - 42	<0.001	*3 - 3.5*	6.3 - 6.61	<0.005 - 748	2 - 2.39	8.9 - 10.6	<0.005 - 0.005	<0.02	0.005 - 0.025
Unknown	RC00344	Margins Area	Unknown	Yambah Station	1430	**8.7**	**920**	<10	49.1	45.6	-	26.8	-	148	311,000	240	17	<1	1.5	1.25	0.01	21.3	94.2	<0.005	<0.02	0.03
Weathered Basement	RC00005	Southen Basins - Basement	Eastern Whitcherry	Aileron Station	2620 - 3060	**8.4 - 8.5**	**1820 - 1860**	<10 - 20	154 - 158	107	-	58.3 - 59.3	-	**349 - 355**	826,000 - 838,000	150 - 237	5 - 13	<1	0.7	4.26 - 4.27	0.22 - 0.28	17.2 - 17.3	76.2 - 76.5	<0.005 - 0.005	<0.02	0.015
Weathered Basement	RC00027	Southern Basins - RC00027 - Basement	Eastern Whitcherry	Aileron Station	0 - 1080	**0 - 8.4**	**0 - 680**	<10 - 0	0 - 26.5	0 - 19	**0 - 187**	0 - 21.1	0 - 87.3	0 - 62.6	-	0 - 347	0 - 4	<0.001 - 0	0 - 1.3	0.5470001 - 0.761	0 - 0.015	0 - 6.26	0 - 27.7	<0.005 - 0	<0.02 - 0	0 - 0.22
Weathered Basement	RC00062	Mine Area - Basement	Arunta Basement	Aileron Station	4280 - 4310	**7.5 - 8.5**	**2530 - 2560**	<10	64.3 - 93.2	130 - 138	-	30 - 32.3	-	**331 - 347**	728,000 - 770,000	818 - 856	<1 - 14	<1	*4.2 - 4.5*	5.39 - 5.79	<0.005 - 0.065	21.8 - 28.8	96.4 - 128	<0.005 - 0.28	<0.02 - 0.92	0.02 - 0.03
Weathered Basement	RC00063	Mine Area - Basement	Arunta Basement	Aileron Station	3170 - 3800	**7.9 - 8.6**	**1860 - 2300**	<10 - 110	62.8 - 74	82.6 - 103	**552 - 579**	30.3 - 34.3	**<0.005 - 614**	199 - 245	497,000 - 604,000	676 - 796	<1 - 76	<0.001	*0.8 - 6.9*	4.74 - 5.39	<0.005 - 615	5.15 - 5.82	22.8 - 25.8	<0.005 - 0.035	<0.02 - 0.12	0.02 - 0.055
Weathered Basement	RC00064	Mine Area - Basement	Arunta Basement	Aileron Station	2410 - 3520	8.1 - 8.2	**1430 - 2230**	<10 - 390	41.3 - 59.4	57.1 - 97.8	-	26.6 - 34.2	-	136 - 239	338,000 - 551,000	627 - 752	<1	<1	*5.5 - 6.7*	2.66 - 5.29	<0.005	4.37 - 6.18	19.3 - 27.4	<0.005 - 0.045	<0.02 - 0.14	0.015 - 0.05
Weathered Basement	RC00075	Mine Area - Basement	Arunta Basement	Aileron Station	5730 - 6420	**7.8 - 8.5**	**3760 - 3840**	<10 - 30	140 - 155	193 - 203	**940 - 970**	34.2 - 36.6	**<0.005 - 1320**	**633 - 688**	1,180,000 - 1,220,000	731 - 875	<1 - 105	<0.001	*2.7 - 3.6*	10.2 - 10.9	<0.005 - 1270	7.75 - 9.4	34.3 - 41.6	0.01 - 0.03	0.02 - 0.1	0.02 - 0.045
Weathered Basement	RC00078	Southern Basins - Basement	Arunta Basement	Aileron Station	3930	8.1	**2210**	20	81.7	102	**651**	22.2	<0.005	**255**	-	865	<1	<0.001	*3.5*	5.95	671	3.29	14.6	<0.005	<0.02	0.03
Weathered Basement	RC00079	Southern Basins - Basement	Arunta Basement	Aileron Station	3650	**8.5**	**2360**	30	81.2	101	**633**	21.4	**698**	**253**	-	869	42	<0.001	*4.1*	6.02	<0.005	3.12	13.8	<0.005	<0.02	0.06
Weathered Basement	RC00081	Southern Basins - Basement	Arunta Basement	Aileron Station	1870 - 10,000	**7.8 - 8.6**	***1140 - 7420***	<10 - 70	62.6 - 367	51.8 - 505	**1260**	27.8 - 29.4	**2770**	***140 - 1450***	369,000	267 - 394	<1 - 14	<0.001	*0.7 - 2.5*	2.3 - 26.5	<0.005 - 0.005	4.51 - 21	20 - 93.1	<0.005	<0.02	0.025 - 0.035
Weathered Basement	RC00083	N/A	Arunta Basement	Aileron Roadhouse	3550	8.4	**2210**	30	101	59.5	**615**	19.9	**786**	**252**	-	534	15	<0.001	*4.3*	5.73	0.005	2.07	9.16	0.005	<0.02	0.03
Weathered Basement	RC00086	Margins Area	Arunta Basement	Aileron Station	4010 - 11,700	7.7 - 8.4	***2770 - 8180***	<10 - 30	121 - 456	134 - 613	**539 - 585**	32.6 - 64.8	**777 - 807**	***496 - 1690***	3,660,000	335 - 399	<1 - 13	<0.001	*2.3 - 3*	7.32 - 25.3	<0.005 - 0.01	6.49 - 56.8	28.8 - 252	<0.005 - 0.02	<0.02 - 0.04	0.015 - 0.025
Weathered Basement	RC00098	Margins Area	Arunta Basement	Aileron Station	845	7.7	560	<10	24	22.5	121	30.5	54.8	32.3	-	360	<1	<0.001	1.5	0.374	0.17	0.385	1.7	0.03	0.1	0.05
Weathered Basement	RC00099	Margins Area	Arunta Basement	Aileron Station	1170 - 4430	**7.9 - 8.5**	**710 - 2800**	<10 - 20	27.2 - 132	21.9 - 143	**189 - 234**	26.1 - 67.2	136 - 196	**73.2 - 554**	920,000	319 - 334	<1 - 16	<0.001	*1.4 - 3*	1.05 - 7.02	<0.005 - 0.01	11 - 55.4	48.8 - 245	<0.005 - 0.005	<0.02 - 0.02	0.02 - 0.05

Statistical Summary - all sample events	Electrical conductivity (lab)	pH (Lab)	Total Dissolved Solids	Total Suspended Solids	Calcium	Magnesium	Sodium	Potassium	Chloride	Sulphate	Calcium Carbonate	Bicarbonate	Carbonate	Hydroxide	Fluoride	Bromide	Ammonia as N	Nitrate (as N)	Nitrate (as NO3-)	Nitrite (as N)	Nitrite (as NO2-)	Phosphate (as P)
Number of Results	157	157	157	157	157	157	116	157	116	157	41	157	157	157	157	150	157	157	157	157	157	157
Number of Detects	157	157	157	88	157	157	116	157	112	157	41	157	73	7	157	150	128	157	157	97	88	136
Minimum Concentration	0	0	0	0	0	0	0	0	0	0	154000	0	0	0	0	0	0	0	0	0	0	0
Minimum Detect	636	7.4	340	10	17.3	15	29	15.9	0.005	11.4	154000	117	1	ND	0.3	0.37	0.005	0.04	0.16	0.005	0.01	0.005
Maximum Concentration	13500	8.8	9660	1590	456	659	2240	302	4490	1690	3660000	875	105	<1	6.9	33.1	1270	56.8	252	18.3	60.2	0.22
Maximum Detect	13500	8.8	9660	1590	456	659	2240	302	4490	1690	3660000	875	105	ND	6.9	33.1	1270	56.8	252	18.3	60.2	0.22
Average Concentration	2568	7.9	1653	43	88	77	301	38	442	233	694366	290	5.9	0.13	1.5	4	40	13	58	0.25	0.84	0.023
Median Concentration	2130	8.3	1350	10	81.4	55.4	234.5	35.2	368	191	557000	215	0.5	0.0005	0.9	3.05	0.015	13.5	58.7	0.005	0.02	0.02
Standard Deviation	1971	1.7	1375	142	67	87	298	28	612	250	550293	202	12	0.22	1.4	4.8	156	9.7	43	1.7	5.8	0.027
Number of Guideline Exceedances	0	50	142	0	0	0	87	0	73	35	0	0	0	0	77	0	30	150	150	2	5	0
Number of Guideline Exceedances(Detects Only)	0	50	142	0	0	0	87	0	73	35	0	0	0	0	77	0	30	150	150	2	5	0

					Metals															
					Aluminium	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Cerium	Cesium	Chromium (III+VI)	Cobalt	Copper	Dysprosium	Europium	Gadolinium
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ADWG 2011 Aesthetic					**0.2**												**1**			
ADWG 2011 Health						0.003	0.01	2	0.06		4	0.002					2			
ANZECC 2000 FW 99%					0.027		0.0008				0.09	0.00006			0.00001		0.001			
ANZECC 2000 Irrigation - Long-term Trigger Values					5		0.1		0.1		0.5	0.01			0.1	0.05	0.2			
ANZECC 2000 Stock Watering					*5*		*0.5*				*5*	*0.01*			*1*	*1*	*0.5*			
Monitoring_Zone	**Location Code**	**Grouping**	**GW Basin**	**Location Type**																
Alluvial	RC00001	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	**0.167 - 0.366**	<0.00025	0.00035 - 0.0006	0.0386 - 0.0566	<0.00025	<0.00005	0.588 - 0.595	<0.0001	0.00015 - 0.0054	0.00069 - 0.00101	<0.0005 - 0.0014	0.00013 - 0.00061	0.0004 - 0.0009	<0.00005 - 0.00016	<0.00005 - 0.00006	<0.00005 - 0.0003
Alluvial	RC00002	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	0.043 - 0.17	<0.00025 - 0.0002	0.00035 - 0.001	0.042 - 0.0454	<0.00025	<0.00005	0.603 - 0.611	<0.0001	<0.00005 - 0.00015	0.00023 - 0.00073	<0.0005	0.00014 - 0.00032	0.00014 - 0.00026	<0.00005	<0.00005	<0.00005
Alluvial	RC00003	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	**0.152 - 0.301**	<0.00025	0.0003 - 0.00035	0.035 - 0.0454	<0.00025	<0.00005	0.751 - 0.783	<0.0001	0.00014 - 0.00018	0.00017 - 0.00049	<0.0005	0.00018 - 0.00069	0.0002 - 0.00078	<0.00005	<0.00005	<0.00005
Alluvial	RC00007	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	0.073 - 0.087	<0.00025 - 0.0003	0.00045 - 0.00065	0.0416 - 0.0668	<0.00025	<0.00005	0.718 - 0.782	<0.0001	0.00002 - 0.00021	0.00051 - 0.00082	<0.0005	0.00016 - 0.00119	0.0003 - 0.00357	<0.00005	<0.00005	<0.00005
Alluvial	RC00059	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	-	<0.00025	0.0003 - 0.0005	0.049 - 0.0558	<0.00025	<0.00005	0.416 - 0.515	<0.0001	0.00012 - 0.00188	0.00029 - 0.0004	<0.0005 - 0.0006	0.00009 - 0.00131	0.0003 - 0.00102	<0.00005 - 0.00009	<0.00005	<0.00005 - 0.00008
Alluvial	RC00060	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	-	<0.00025	0.00025 - 0.0004	0.048 - 0.0538	<0.00025	<0.00005	0.487 - 0.494	<0.0001	0.00047 - 0.00143	0.00033 - 0.00036	<0.0005	0.0002 - 0.00301	0.00011 - 0.00013	<0.00005 - 0.00006	<0.00005	<0.00005 - 0.00013
Alluvial	RC00084	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	0	<0.00025	0.00065	0.0332	<0.00025	<0.00005	0.695	<0.0001	<0.00005	0.00152	0.0011	0.00015	0.00098	<0.00005	<0.00005	<0.00005
Alluvial	RC00085	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	0	<0.00025	0.00025	0.0336	<0.00025	<0.00005	0.676	<0.0001	<0.00005	0.00452	0.0021	<0.00005	0.00153	<0.00005	<0.00005	<0.00005
Alluvial	RC00106	Margins Area	NE Burt	Aileron Station	**0 - 0.62**	<0.00005	<0.0005 - 0.0005	0.0392 - 0.1	<0.00005	<0.00001	0.43 - 0.68	<0.00002	<0.00001 - 0.00002	0.00008 - 0.00009	<0.005 - 0.0024	<0.00001 - 0.00002	<0.01 - 0.00039	<0.00001	<0.00001	<0.00001
Alluvial	RC00109	Margins Area	NE Burt	Aileron Station	<0.02 - 0	<0.00005	<0.0005 - 0.0004	0.05 - 0.0628	<0.00005	<0.00001	0.757 - 0.92	<0.00002	<0.00001	0.00004	<0.005 - 0.0035	<0.00001	<0.01 - 0.00009	<0.00001	<0.00001	<0.00001
Alluvial/Fluvial	RC00040	Margins Area	NE Burt/Arunta	Aileron Station	0	0.0003	0.00115	0.0892	<0.00005	0.00003	0.612	<0.00002	0.00104	0.00013	0.0009	0.00038	0.00072	0.00006	0.00002	0.00008
Alluvial/Fluvial	RC00044	Margins Area	NE Burt	Aileron Station	0	0.0001	0.0005	0.122	<0.00005	<0.00001	0.64	0.00002	0.00002	0.00015	0.0001	0.00011	0.00029	<0.00001	<0.00001	<0.00001
Alluvial/Fluvial	RC00045	Margins Area	NE Burt	Aileron Station	0	0.0004	0.0006	0.143	<0.00005	0.00001	0.306	0.00004	0.00072	0.00011	0.0028	0.00023	0.00152	0.00005	0.00002	0.00006
Alluvial/Fluvial	RC00046	Margins Area	NE Burt	Aileron Station	-	<0.001	<0.001	0.231	<0.001	<0.0002	3.13	<0.0004	0.00303	<0.0002	<0.002	0.00675	0.0018	<0.0002	<0.0002	<0.0002
Alluvial/Fluvial	RC00047	Margins Area	NE Burt	Aileron Station	-	0.0001	0.00075	0.107	<0.00005	<0.00001	0.538	0.00002	0.00166	0.00009	0.0011	0.00175	0.0028	0.00003	0.00001	0.00005
Alluvial/Fluvial	RC00048	Margins Area	NE Burt	Aileron Station	0	0.00055	0.00115	0.16	<0.00005	0.00001	0.568	<0.00002	0.00012	0.00008	0.0002	0.00035	0.00022	<0.00001	<0.00001	0.00001
Alluvial/Fluvial	RC00049	Margins Area	NE Burt	Aileron Station	0	<0.00005	0.0003	0.0438	0.00005	0.00005	0.471	0.00004	0.00186	0.00011	0.0005	0.00075	0.00262	0.00013	0.00003	0.00011
Alluvial/Fluvial	RC00053	Margins Area	NE Burt	Aileron Station	0	<0.00005	0.0007	0.108 - 0.166	<0.00005	<0.00001 - 0.00001	0.291 - 0.307	<0.00002	0.00029 - 0.00054	0.00016 - 0.00017	0.0008 - 0.0011	0.00008 - 0.00011	0.00028 - 0.00091	0.00002 - 0.00005	<0.00001 - 0.00002	0.00003 - 0.00007
Alluvial/Fluvial	RC00057	Margins Area	NE Burt	Aileron Station	-	0.0001	0.0004	0.071	<0.00005	<0.00001	0.584	<0.00002	0.00066	0.00017	0.0015	0.00072	0.00075	0.00005	<0.00001	0.00005
Calcrete	RC00100	Margins Area	Arunta Basement	Aileron Station	0	0.0001	0.0003	0.14	<0.00005	<0.00001	0.345	<0.00002	0.00002	0.00004	0.0005	0.00003	0.00012	<0.00001	<0.00001	<0.00001
Calcrete	RC00103	Margins Area	NE Burt	Aileron Station	0	<0.00025	0.0006	0.0464	<0.00025	<0.00005	0.486	<0.0001	<0.00005	0.00011	0.0018	<0.00005	0.0109	<0.00005	<0.00005	<0.00005
Calcrete	RC00104	Margins Area	Ti Tree	Aileron Station	0	<0.00005	0.0003	0.0356	<0.00005	<0.00001	0.354	<0.00002	<0.00001	0.00007	0.0006	0.00002	0.00039	<0.00001	<0.00001	<0.00001
Calcrete/Alluvial	RC00052	Margins Area	Ti Tree/Arunta	Aileron Station	-	0.00005	0.00015	0.104	<0.00005	<0.00001	0.411	<0.00002	0.00066	0.00007	0.0006	0.00092	0.00037	0.00007	0.00002	0.00009
Calcrete/Alluvial/Fluvial	RC00030	Margins Area	NE Burt	Aileron Station	0	0.0001	0.0006	0.0536	<0.00005	<0.00001	0.427	<0.00002	0.00005	0.00012	0.0037	0.00039	0.0006	<0.00001	<0.00001	<0.00001
Calcrete/Alluvial/Fluvial	RC00031	Margins Area	Ti Tree	Aileron Station	**1.32**	0.0002	0.0004	0.0822	0.00005	0.00002	0.428	0.00004	0.00329	0.00018	0.0112	0.00059	0.00204	0.00018	0.00005	0.00023
Calcrete/Alluvial/Fluvial	RC00033	Margins Area	Ti Tree	Aileron Station	0	0.0002	0.00055	0.0976	<0.00005	0.00001	0.364	<0.00002	0.0182	0.00034	0.0008	0.00095	0.0009	0.00074	0.00048	0.00161
Calcrete/Basement	RC00032	Margins Area	Ti Tree/Arunta	Aileron Station	**3.12**	0.0002	0.00255	0.0952	0.0001	0.00003	0.387	0.00004	0.00849	0.00043	0.0095	0.00091	0.00359	0.00041	0.00015	0.00061
Calcrete/Basement	RC00035	Margins Area	Ti Tree/Arunta	Aileron Station	0	<0.00005	0.00055	0.228	<0.00005	<0.00001	0.233	<0.00002	0.00008	0.00004	0.0002	0.00025	0.00017	<0.00001	<0.00001	<0.00001
Calcrete/Basement	RC00036	Margins Area	Ti Tree/Arunta	Aileron Station	0	0.00005	0.0006	0.368	<0.00005	<0.00001	0.171	<0.00002	0.00011	0.00008	0.0012	0.00007	0.00019	<0.00001	<0.00001	0.00002
Calcrete/Basement	RC00037	Margins Area	Ti Tree/Arunta	Aileron Station	**1.4**	<0.00005 - 0.0001	0.0004 - 0.0005	0.157 - 0.16	<0.00005 - 0.00005	<0.00001	0.397 - 0.399	<0.00002	0.00043 - 0.00391	0.00011 - 0.00027	0.0044 - 0.0071	0.00017 - 0.00078	0.00208 - 0.00231	0.00003 - 0.0002	<0.00001 - 0.00007	0.00003 - 0.00028
Calcrete/Basement	RC00041	Margins Area	NE Burt/Arunta	Aileron Station	0	0.0001	0.0009	0.0726	<0.00005	<0.00001	0.602	<0.00002	0.00024	0.00009	0.0037	0.0014	0.00048	0.00002	0.00001	0.00002
Calcrete/Basement	RC00042	Margins Area	NE Burt	Aileron Station	**7**	0.0014	0.0022	0.0838	0.0002	0.0007	0.474	0.00014	0.0127	0.00063	0.016	0.00305	0.017	0.00135	0.00036	0.00152
Calcrete/Basement	RC00043	Margins Area	NE Burt	Aileron Station	0	0.00045	0.00035	0.0912	<0.00005	0.00001	0.545	<0.00002	0.00535	0.00005	0.0015	0.00067	0.0022	0.00024	0.00009	0.00035
Calcrete/Basement	RC00050	Margins Area	NE Burt/Arunta	Aileron Station	**0 - 2.2**	<0.0005 - 0.0003	<0.0005 - 0.0013	0.0804 - 0.214	<0.0005 - 0.00015	<0.0001 - 0.00002	0.558 - 3.17	<0.0002 - 0.00006	0.00518 - 0.0419	<0.0001 - 0.00096	0.0032 - 0.0156	0.00092 - 0.00777	0.00362 - 0.0105	<0.0001 - 0.00172	<0.0001 - 0.00045	0.00015 - 0.00179
Calcrete/Basement	RC00054	Margins Area	NE Burt/Arunta	Aileron Station	**2.24**	0.0003	0.0002	0.0804	0.00015	0.00002	0.558	0.00006	0.0232	0.00025	0.0061	0.00092	0.00362	0.00051	0.0002	0.00066
Calcrete/Basement	RC00056	Margins Area	Ti Tree/Arunta	Aileron Station	-	<0.00025	<0.00025	0.061	<0.00025	<0.00005	0.544	<0.0001	0.00111	0.00007	0.0012	0.00177	0.00007	0.00007	<0.00005	0.00012
Reaphook Paleochannel	RC00004	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	**0 - 0.917**	<0.00005	0.00025 - 0.00035	0.0374 - 0.0548	<0.00005	<0.00001	0.574 - 0.652	<0.00002	<0.00005 - 0.00102	0.0002 - 0.00065	<0.0005 - 0.001	0.00001 - 0.00031	0.00028 - 0.0009	<0.00001 - 0.00006	<0.00001	<0.00001 - 0.00007
Reaphook Paleochannel	RC00006	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	**0.326 - 0.396**	0.0002 - 0.0003	0.00115 - 0.00125	0.0584 - 0.0602	<0.00025	<0.00005	0.668 - 0.68	<0.0001	0.00082 - 0.00116	0.00012 - 0.00016	<0.0005	0.0008 - 0.00088	0.0006 - 0.00107	0.00006 - 0.00007	<0.00005	0.00006 - 0.00011
Reaphook Paleochannel	RC00012	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	**0.764 - 0.868**	<0.00025	0.00055 - 0.00065	0.0486 - 0.0504	<0.00025	<0.00005	0.573 - 0.578	<0.0001	0.00125 - 0.00146	0.00042 - 0.00046	0.0006	0.00089 - 0.00095	0.0124 - 0.0171	0.00008 - 0.00009	<0.00005	0.00009 - 0.00011
Reaphook Paleochannel	RC00013	Southern Basins - Reaphook	Eastern Mt Wedge	Aileron Station	0.081 - 0.175	<0.00025	0.0004	0.0812 - 0.0942	<0.00025	<0.00005	0.507 - 0.532	<0.0001	0.00022 - 0.00024	0.00016 - 0.00021	<0.0005 - 0.0025	0.00027 - 0.00086	0.00081 - 0.00188	<0.00005	<0.00005	<0.00005
Reaphook Paleochannel	RC00014	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0	<0.00025 - 0.0001	<0.00025 - 0.00055	0.0406 - 0.0484	<0.00005	<0.00001	0.513 - 0.648	<0.00002	0.00037 - 0.00056	0.00024 - 0.00028	<0.0005 - 0.0015	<0.00005 - 0.0001	<0.00005 - 0.00009	<0.00005 - 0.00002	<0.00001	<0.00005 - 0.00003
Reaphook Paleochannel	RC00015	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	**0 - 1.76**	0.0001 - 0.0011	0.00055 - 0.0006	0.0406 - 0.057	<0.00005 - 0.0001	<0.00001 - 0.00002	0.648 - 0.671	<0.00002 - 0.00008	0.00037 - 0.00417	0.00024 - 0.00119	0.0015 - 0.0018	0.0001 - 0.0013	0.00009 - 0.00218	0.00002 - 0.00025	<0.00001 - 0.00007	0.00003 - 0.00035
Reaphook Paleochannel	RC00016	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0	<0.00025	<0.00025	0.0424	<0.00025	<0.00005	0.618	<0.0001	0.00042	0.00029	<0.0005	0.0004	0.00034	<0.00005	<0.00005	<0.00005
Reaphook Paleochannel	RC00017	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	**0 - 1.78**	<0.00005	0.0002 - 0.0003	0.0418 - 0.0466	<0.00005 - 0.0001	<0.00001 - 0.00002	0.648 - 0.652	<0.00002	0.00039 - 0.00395	0.00007 - 0.00035	0.0001 - 0.0014	0.0006 - 0.0008	0.00019 - 0.00057	0.00002 - 0.00015	<0.00001 - 0.00005	0.00003 - 0.0002
Reaphook Paleochannel	RC00018	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0	<0.00025 - 0.0034	0 - 0.00585	0 - 0.0626	<0.00005 - 0	<0.00001 - 0.00002	0 - 0.622	<0.00002 - 0.00004	0 - 0.00461	0 - 0.00656	<0.001 - 0.0019	0 - 0.00634	0 - 0.00409	<0.00001 - 0.00018	<0.00001 - 0.00009	<0.0001 - 0.00038
Reaphook Paleochannel	RC00019	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	-	<0.00025	0.00045	0.0374	<0.00025	<0.00005	0.5	<0.0001	0.0007	0.00034	<0.0005	0.0005	0.00035	<0.00005	<0.00005	<0.00005
Reaphook Paleochannel	RC00021	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	-	<0.00025 - 0	0 - 0.00035	0 - 0.0398	<0.00025 - 0	<0.00005 - 0	0 - 0.54	<0.0001 - 0	0 - 0.00051	0 - 0.0005	<0.0005 - 0.0019	0 - 0.0007	0 - 0.00365	<0.00005 - 0	<0.00005 - 0	<0.00005 - 0
Reaphook Paleochannel	RC00022	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	-	<0.00005 - 0.00005	0.0003 - 0.0004	0.0432 - 0.0456	<0.00005	<0.00001	0.589 - 0.615	<0.00002	<0.00001 - 0.00009	0.00042 - 0.00087	0.0006 - 0.0008	0.00012 - 0.00042	0.00225 - 0.107	<0.00001	<0.00001	<0.00001
Reaphook Paleochannel	RC00023	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0	<0.00025	0.0007	0.0312	<0.00025	<0.00005	0.506	<0.0001	0.00029	0.00014	0.0005	0.00031	0.00019	<0.00005	<0.00005	<0.00005
Reaphook Paleochannel	RC00024	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0	<0.00025	0.0005 - 0.00065	0.0306 - 0.0376	<0.00025	<0.00005	0.473 - 0.548	<0.0001	0.0003 - 0.00057	0.00018 - 0.00021	<0.0005	0.00048 - 0.00115	0.00023 - 0.00027	<0.00005	<0.00005	<0.00005 - 0.00006
Reaphook Paleochannel	RC00025	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0	<0.00025	<0.00025 - 0.0006	0.0356 - 0.0654	<0.00025	<0.00005 - 0.00008	0.478 - 0.508	<0.0001	<0.00005 - 0.00971	0.00037 - 0.00181	0.0012 - 0.0023	0.00018 - 0.00073	0.00057 - 0.00393	<0.00005 - 0.00049	<0.00005 - 0.00013	<0.00005 - 0.00056
Reaphook Paleochannel	RC00026	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	***0 - 9.52***	<0.00005 - 0.00005	0 - 0.00195	0 - 0.147	<0.00005 - 0.0012	<0.00005 - 0.00033	0 - 0.599	<0.00002 - 0.00002	<0.00005 - 0.0976	0 - 0.00314	<0.0005 - 0.0173	0 - 0.00867	0 - 0.00908	<0.00005 - 0.00304	<0.00005 - 0.00106	<0.00005 - 0.00554
Reaphook Paleochannel	RC00028	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	-	<0.00025	0.00025 - 0.0008	0.0462 - 0.0604	<0.00025	<0.00005	0.433 - 0.465	<0.0001	<0.00005 - 0.00607	0.00022 - 0.0006	<0.0005 - 0.0019	0.00006 - 0.00091	0.00028 - 0.00582	<0.00005 - 0.0003	<0.00005 - 0.00008	<0.00005 - 0.00035
Reaphook Paleochannel	RC00061	Southern Basins - Reaphook	Eastern Whitcherry	Public Road	0	<0.00025	0.00105	0.0436	<0.00025	<0.00005	0.737	<0.0001	<0.00005	<0.00005	0.0006	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Ti Tree Basin Aquifer	RC00092	Ti Tree Basins	Ti Tree	Aileron Station	0	<0.00005	0.00075	0.0426 - 0.0436	<0.00005	<0.00001	0.589 - 0.636	<0.00002	<0.00005 - 0.00006	0.00517 - 0.0052	0.0019 - 0.002	<0.00005 - 0.00004	0.00042 - 0.00045	<0.00001	<0.00001	<0.00001
Unknown	RC00198	N/A	Unknown	Aileron Station	0.04	<0.0002	<0.0005	<0.05	<0.001	-	0.44	<0.0002	-	-	<0.005	-	<0.01	-	-	-
Unknown	RC00222	N/A	Unknown	Aileron Roadhouse	0 - 0.007	<0.00025	0.00085 - 0.00125	0.0444 - 0.0486	<0.00025	<0.00005	0.808 - 0.841	<0.0001	<0.00005	<0.00005	<0.0005	<0.00005	0.00031 - 0.00055	<0.00005	<0.00005	<0.00005
Unknown	RC00344	Margins Area	Unknown	Yambah Station	<0.02	<0.0002	0.0005	<0.05	<0.001	-	0.5	<0.0002	-	-	<0.005	-	<0.01	-	-	-
Weathered Basement	RC00005	Southen Basins - Basement	Eastern Whitcherry	Aileron Station	**0.194 - 0.344**	0.0018	0.0015 - 0.0017	0.15 - 0.152	<0.00025	<0.00005	0.656 - 0.685	<0.0001	0.00044 - 0.00072	0.00053 - 0.00055	<0.0005	0.00131 - 0.0014	0.00091 - 0.00182	<0.00005	<0.00005	<0.00005 - 0.00007
Weathered Basement	RC00027	Southern Basins - RC00027 - Basement	Eastern Whitcherry	Aileron Station	**1.2**	<0.00005	0.00075 - 0.0008	0.0296 - 0.0404	<0.00005 - 0.00005	<0.00001 - 0.00004	0.534 - 0.574	<0.00002	0.00002 - 0.0121	0.00014 - 0.00032	0.0043 - 0.0053	0.00007 - 0.00272	0.00017 - 0.00383	<0.00001 - 0.00041	<0.00001 - 0.00012	<0.00001 - 0.00049
Weathered Basement	RC00062	Mine Area - Basement	Arunta Basement	Aileron Station	<0.02	<0.0002	<0.0005 - 0.0005	<0.05	<0.001	-	1.48 - 1.58	<0.0002	-	-	<0.005	-	0.02	-	-	-
Weathered Basement	RC00063	Mine Area - Basement	Arunta Basement	Aileron Station	**0 - 2.14**	<0.00025 - 0.0006	0.0015 - 0.0037	0.05 - 0.0914	<0.00025 - 0.00035	<0.00005	0.847 - 0.983	<0.0001	<0.00005 - 0.00019	0.00008 - 0.00019	<0.0005 - 0.01	0.00008 - 0.00018	<0.01 - 0.00173	<0.00005	<0.00005	<0.00005
Weathered Basement	RC00064	Mine Area - Basement	Arunta Basement	Aileron Station	**<0.02 - 1.9**	<0.0005	0.001 - 0.003	<0.05 - 0.1	<0.001	-	0.62 - 0.9	<0.0002	-	-	<0.005	-	<0.01	-	-	-
Weathered Basement	RC00075	Mine Area - Basement	Arunta Basement	Aileron Station	0 - 0.012	<0.00025	0.00125 - 0.00195	0.0274 - 0.033	<0.00025	<0.00005 - 0.00044	1.62 - 1.77	<0.0001 - 0.0005	<0.00005	<0.0001 - 0.00054	<0.0005	0.00022 - 0.00074	0.00038 - 0.00621	<0.00005	<0.00005	<0.00005
Weathered Basement	RC00078	Southern Basins - Basement	Arunta Basement	Aileron Station	0	<0.00025	0.00275	0.0748	0.00055	<0.00005	1.18	<0.0001	<0.00005	0.0002	<0.0005	<0.00005	0.00046	<0.00005	<0.00005	<0.00005
Weathered Basement	RC00079	Southern Basins - Basement	Arunta Basement	Aileron Station	0	<0.00025	0.0032	0.0878	0.00065	<0.00005	1.37	<0.0001	<0.00005	0.00023	<0.0005	<0.00005	0.00013	<0.00005	<0.00005	<0.00005
Weathered Basement	RC00081	Southern Basins - Basement	Arunta Basement	Aileron Station	<0.02 - 0	<0.0002	<0.0005 - 0.00155	<0.05 - 0.0466	<0.001	<0.0002	0.62 - 3.07	<0.0002	<0.0002	0.00051	<0.002	<0.0002	0.00085 - 0.03	<0.0002	<0.0002	<0.0002
Weathered Basement	RC00083	N/A	Arunta Basement	Aileron Roadhouse	0	<0.00025	0.00085	0.047	<0.00025	<0.00005	0.789	<0.0001	0.00212	0.0001	0.0009	<0.00005	0.0137	<0.00005	<0.00005	0.00006
Weathered Basement	RC00086	Margins Area	Arunta Basement	Aileron Station	<0.02 - 0	<0.00025	<0.001 - 0.00045	<0.05 - 0.0552	<0.00025	<0.00005	1.7 - 3.34	<0.0001	<0.00005	<0.00005	<0.0005 - 0.0016	<0.00005	<0.00005 - 0.00082	<0.00005	<0.00005	<0.00005
Weathered Basement	RC00098	Margins Area	Arunta Basement	Aileron Station	-	<0.00005	0.00025	0.134	<0.00005	<0.00001	0.452	<0.00002	0.00064	0.00008	0.0005	0.00033	0.00017	0.00002	0.00001	0.00004
Weathered Basement	RC00099	Margins Area	Arunta Basement	Aileron Station	<0.02 - 0	<0.00005	<0.0005 - 0.0001	<0.05 - 0.0994	<0.00005	<0.00001	0.637 - 1.82	<0.00002	0.00005 - 0.00081	0.00006 - 0.00008	<0.005 - 0.0023	<0.00001 - 0.00002	<0.00001 - 0.00008	<0.00001 - 0.00003	<0.00001 - 0.00002	<0.00001 - 0.00005

Statistical Summary - all sample events	Aluminium	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Cerium	Cesium	Chromium (III+VI)	Cobalt	Copper	Dysprosium	Europium	Gadolinium
Number of Results	107	150	150	150	150	138	150	150	138	138	150	138	150	138	138	135
Number of Detects	99	42	137	142	23	30	150	19	106	129	92	121	137	55	37	62
Minimum Concentration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Detect	0.004	0.00005	0.0001	0.0274	0.00005	0.00001	0.171	0.00002	0.00001	0.00004	0.0001	0.00001	0.00007	0.00001	0.00001	0.00001
Maximum Concentration	9.52	0.0034	0.00585	0.368	0.0012	0.0007	3.34	0.0005	0.0976	0.00656	0.0173	0.00867	0.107	0.00304	0.00106	0.00554
Maximum Detect	9.52	0.0034	0.00585	0.368	0.0012	0.0007	3.34	0.0005	0.0976	0.00656	0.0173	0.00867	0.107	0.00304	0.00106	0.00554
Average Concentration	0.52	0.0002	0.00078	0.065	0.00015	0.000035	0.7	0.00005	0.003	0.00059	0.0018	0.00069	0.0031	0.00013	0.000052	0.00018
Median Concentration	0	0.000125	0.0005	0.0481	0.000125	0.000025	0.574	0.00005	0.000215	0.00023	0.0008	0.00027	0.00086	0.000025	0.000025	0.000025
Standard Deviation	1.5	0.00037	0.00083	0.049	0.00017	0.000078	0.53	0.000053	0.011	0.0011	0.003	0.0014	0.0095	0.00039	0.00012	0.0006
Number of Guideline Exceedances	36	1	44	0	0	0	144	97	0	0	144	0	66	0	0	0
Number of Guideline Exceedances(Detects Only)	36	1	42	0	0	0	144	5	0	0	86	0	57	0	0	0

					Metals																
					Gallium	Gold	Hafnium	Holmium	Indium	Iron	Lanthanum	Lead	Lithium	Manganese	Mercury	Molybdenum	Neodymium	Nickel	Niobium	Osmium	Palladium
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	ug/L	ug/L
ADWG 2011 Aesthetic										0.3				0.1							
ADWG 2011 Health												0.01		0.5	0.001	0.05		0.02			
ANZECC 2000 FW 99%												0.001		1.2	0.00006			0.008			
ANZECC 2000 Irrigation - Long-term Trigger Values										0.2		0.2	2.5	0.2	0.002	0.01		0.2			
ANZECC 2000 Stock Watering												0.1			0.002	0.15		1			
Monitoring_Zone	Location Code	Grouping	GW Basin	Location Type																	
Alluvial	RC00001	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.00005 - 0.00018	<0.00005	<0.00005	<0.00005	<0.00005	0.06 - 0.1	0.00008 - 0.00216	0.00016 - 0.00036	0.0015 - 0.0105	0.00482 - 0.0137	<0.0001	0.0011 - 0.00175	0.00005 - 0.0021	0.00068 - 0.00138	<0.1	<0.5	<0.25
Alluvial	RC00002	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.00005 - 0.00009	<0.00005	<0.00005	<0.00005	<0.00005	0.02 - 0.058	<0.00005 - 0.00012	0.00006 - 0.00011	0.002 - 0.0065	0.00851 - 0.0156	<0.0001	0.00305 - 0.00415	<0.00005 - 0.0001	0.00043 - 0.00079	<0.1	<0.5	<0.25
Alluvial	RC00003	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	0.00007 - 0.00008	<0.00005	<0.00005	<0.00005	<0.00005	0.074 - 0.194	0.00013 - 0.0002	0.00005 - 0.00018	0.002 - 0.0025	0.0152 - 0.0385	<0.0001	0.00175	0.00015 - 0.00019	0.00073 - 0.00115	<0.1	<0.5	<0.25
Alluvial	RC00007	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0.028 - 0.032	<0.00005 - 0.00021	0.00005 - 0.00019	0.001 - 0.0045	0.0138 - 0.0519	<0.0001	0.0024 - 0.00395	<0.00005 - 0.00019	0.00057 - 0.00102	<0.1	<0.5	<0.25
Alluvial	RC00059	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.00005 - 0.00028	0.00009 - 0.00015	<0.00005	<0.00005	<0.00005	-	0.00006 - 0.00118	<0.00005 - 0.00031	0.00065 - 0.0039	0.00979 - 0.103	<0.0001	0.00125 - 0.0105	<0.00005 - 0.00081	0.00079 - 0.00498	<0.1	<0.5	<0.25
Alluvial	RC00060	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.00005	0.00009 - 0.0001	<0.00005	<0.00005	<0.00005	-	0.00017 - 0.00056	0.00006 - 0.0001	0.00045 - 0.0076	0.0298 - 0.0413	<0.0001	0.00175 - 0.0043	0.00016 - 0.00089	0.00091 - 0.00155	<0.1	<0.5	<0.25
Alluvial	RC00084	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.00005	<0.00025	<0.00005	<0.00005	<0.00005	0	<0.00005	<0.00005	0.00075	0.159	<0.0001	0.0012	<0.00005	0.00039	<0.1	<0.5	<0.25
Alluvial	RC00085	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0	<0.00005	0.00014	0.00095	0.00342	<0.0001	0.00095	<0.00005	0.00251	<0.1	<0.5	<0.25
Alluvial	RC00106	Margins Area	NE Burt	Aileron Station	<0.00001	0.00003 - 0.00021	<0.00001	<0.00001	<0.00001 - 0.00001	0 - 0.6	<0.00001 - 0.00001	0.00002 - 0.002	0.0001	<0.005 - 0.00017	<0.00002	0.0016 - 0.005	<0.00001 - 0.00001	<0.002 - 0.00043	<0.02	<0.1	<0.05
Alluvial	RC00109	Margins Area	NE Burt	Aileron Station	<0.00001	0.00002	<0.00001	<0.00001	<0.00001	<0.02 - 0	<0.00001	<0.001 - 0.00001	0.00015	<0.005 - 0.00049	<0.00002	<0.005 - 0.00095	<0.00001	<0.002 - 0.00012	<0.02	<0.1	<0.05
Alluvial/Fluvial	RC00040	Margins Area	NE Burt/Arunta	Aileron Station	0.00015	<0.00001	0.00002	0.00001	<0.00001	0	0.0004	0.00032	0.0026	0.04	<0.00002	0.0105	0.00046	0.00107	<0.02	<0.1	<0.05
Alluvial/Fluvial	RC00044	Margins Area	NE Burt	Aileron Station	0.00003	0.00001	<0.00001	<0.00001	<0.00001	0	<0.00001	0.00002	0.0021	0.00719	<0.00002	0.0145	0.00001	0.00022	<0.02	<0.1	<0.05
Alluvial/Fluvial	RC00045	Margins Area	NE Burt	Aileron Station	0.00011	<0.00001	<0.00001	<0.00001	<0.00001	0	0.00031	0.00988	0.0009	0.0163	<0.00002	0.00095	0.00036	0.00143	0.1	<0.1	<0.05
Alluvial/Fluvial	RC00046	Margins Area	NE Burt	Aileron Station	0.00037	0.00083	<0.0002	<0.0002	<0.0002	680	0.00185	<0.0002	0.0385	0.464	<0.0004	0.0105	0.00203	0.0196	<0.4	<2	<1
Alluvial/Fluvial	RC00047	Margins Area	NE Burt	Aileron Station	0.00015	0.00013	<0.00001	<0.00001	<0.00001	352	0.00043	0.00172	0.0105	0.0977	<0.00002	0.00465	0.00042	0.00554	0.06	<0.1	<0.05
Alluvial/Fluvial	RC00048	Margins Area	NE Burt	Aileron Station	0.00002	<0.00001	0.00001	<0.00001	<0.00001	0	0.00005	0.00005	0.0063	0.0525	<0.00002	0.0071	0.00008	0.00093	<0.02	<0.1	<0.05
Alluvial/Fluvial	RC00049	Margins Area	NE Burt	Aileron Station	0.00014	0.00004	<0.00001	0.00003	0.00005	0	0.00055	0.00029	0.0052	0.0487	<0.00002	0.00325	0.00065	0.00298	0.04	<0.1	<0.05
Alluvial/Fluvial	RC00053	Margins Area	NE Burt	Aileron Station	0.00003 - 0.00013	<0.00001	<0.00001	<0.00001	<0.00001	0	0.00019 - 0.00078	0.00007 - 0.00016	0.0002	0.00299 - 0.00357	<0.00002	0.0023 - 0.00375	0.00021 - 0.0007	0.00013 - 0.00018	<0.02	<0.1	<0.05
Alluvial/Fluvial	RC00057	Margins Area	NE Burt	Aileron Station	0.00013	0.00016	<0.00001	<0.00001	<0.00001	288	0.00032	0.00254	0.012	0.0544	<0.00002	0.00485	0.00032	0.00159	0.06	<0.1	<0.05
Calcrete	RC00100	Margins Area	Arunta Basement	Aileron Station	<0.00001	0.00002	<0.00001	<0.00001	<0.00001	0	0.00002	0.00004	0.00175	0.00815	<0.00002	0.00105	0.00001	0.00011	<0.02	<0.1	<0.05
Calcrete	RC00103	Margins Area	NE Burt	Aileron Station	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0	<0.00005	0.0033	<0.00025	0.0204	<0.0001	0.0012	<0.00005	0.00021	<0.1	<0.5	<0.25
Calcrete	RC00104	Margins Area	Ti Tree	Aileron Station	<0.00001	0.00003	<0.00001	<0.00001	<0.00001	0	<0.00001	0.00002	0.0002	0.00816	<0.00002	0.0025	<0.00001	0.00007	<0.02	<0.1	<0.05
Calcrete/Alluvial	RC00052	Margins Area	Ti Tree/Arunta	Aileron Station	0.00008	0.00014	<0.00001	0.00001	<0.00001	186	0.00056	0.00036	0.00195	0.0748	<0.00002	0.00435	0.00058	0.00253	0.04	<0.1	<0.05
Calcrete/Alluvial/Fluvial	RC00030	Margins Area	NE Burt	Aileron Station	0.00001	<0.00001	0.00003	<0.00001	<0.00001	0	0.00002	0.00003	0.0016	0.0207	<0.00002	0.00725	0.00003	0.00119	0.04	<0.1	<0.05
Calcrete/Alluvial/Fluvial	RC00031	Margins Area	Ti Tree	Aileron Station	0.00035	<0.00001	0.00003	0.00003	0.00001	1.1	0.00146	0.00431	0.0007	0.0278	<0.00002	0.00285	0.00182	0.00353	0.1	<0.1	<0.05
Calcrete/Alluvial/Fluvial	RC00033	Margins Area	Ti Tree	Aileron Station	0.00004	<0.00001	0.00002	0.00011	<0.00001	0	0.0127	0.00284	0.00325	0.0383	<0.00002	0.0115	0.0146	0.00067	0.12	<0.1	<0.05
Calcrete/Basement	RC00032	Margins Area	Ti Tree/Arunta	Aileron Station	0.00096	<0.00001	0.00002	0.00007	0.00001	3.35	0.0042	0.0124	0.0015	0.0391	<0.00002	0.00305	0.00439	0.00353	0.12	<0.1	<0.05
Calcrete/Basement	RC00035	Margins Area	Ti Tree/Arunta	Aileron Station	0.00004	<0.00001	<0.00001	<0.00001	<0.00001	0	0.00003	0.00004	0.0006	0.04	<0.00002	0.0024	0.00006	0.00086	<0.02	<0.1	<0.05
Calcrete/Basement	RC00036	Margins Area	Ti Tree/Arunta	Aileron Station	0.00002	<0.00001	0.00001	<0.00001	<0.00001	0	0.00005	0.00003	0.0007	0.00211	<0.00002	0.0023	0.00008	0.00025	<0.02	<0.1	<0.05
Calcrete/Basement	RC00037	Margins Area	Ti Tree/Arunta	Aileron Station	0.00009 - 0.00051	0.00004 - 0.0001	<0.00001	<0.00001 - 0.00004	<0.00001	1.55 - 240	0.00022 - 0.002	0.00062 - 0.00311	0.00045 - 0.0009	0.00771 - 0.0124	<0.00002	0.0019 - 0.002	0.00021 - 0.00193	0.00083 - 0.00222	0.04 - 0.28	<0.1	<0.05
Calcrete/Basement	RC00041	Margins Area	NE Burt/Arunta	Aileron Station	0.00006	<0.00001	<0.00001	<0.00001	<0.00001	0	0.00014	0.00043	0.0006	0.00606	<0.00002	0.00185	0.00017	0.00054	<0.02	<0.1	<0.05
Calcrete/Basement	RC00042	Margins Area	NE Burt	Aileron Station	0.00166	<0.00001	0.00004	0.00027	0.00002	6.55	0.00549	0.0162	0.00495	0.115	<0.00002	0.00375	0.0067	0.00755	0.36	<0.1	<0.05
Calcrete/Basement	RC00043	Margins Area	NE Burt	Aileron Station	0.00005	<0.00001	0.00001	0.00004	<0.00001	0	0.0029	0.00072	0.0165	0.0538	<0.00002	0.02	0.00271	0.0018	0.04	<0.1	<0.05
Calcrete/Basement	RC00050	Margins Area	NE Burt/Arunta	Aileron Station	0.00044 - 0.0043	<0.0002 - 0.00038	<0.00001	<0.0001 - 0.00029	<0.00001	0 - 1220	0.00141 - 0.0129	0.00024 - 0.00802	0.00785 - 0.0505	0.0306 - 0.385	<0.00002	0.0019 - 0.0105	0.00094 - 0.0112	0.00441 - 0.0199	<0.2 - 0.54	<0.1	<0.05
Calcrete/Basement	RC00054	Margins Area	NE Burt/Arunta	Aileron Station	0.00053	0.00005	<0.00001	0.0001	<0.00001	2.05	0.00534	0.00802	0.00785	0.0306	<0.00002	0.0019	0.00535	0.00441	0.38	<0.1	<0.05
Calcrete/Basement	RC00056	Margins Area	Ti Tree/Arunta	Aileron Station	0.0002	0.0002	<0.00005	<0.00005	<0.00005	796	0.00064	0.00048	0.014	0.175	<0.0001	0.00905	0.00076	0.00207	0.12	<0.5	<0.25
Reaphook Paleochannel	RC00004	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	<0.00001 - 0.00032	<0.00005 - 0.00007	<0.00001	<0.00001	<0.00001	0 - 0.392	<0.00001 - 0.00055	<0.00001 - 0.0005	0.00035 - 0.0065	0.00033 - 0.0342	<0.00002	0.0094 - 0.015	<0.00005 - 0.0005	0.00039 - 0.00058	<0.02 - 0.16	<0.1	<0.05
Reaphook Paleochannel	RC00006	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.00009	<0.00005	<0.00005	<0.00005	<0.00005	0.264 - 0.322	0.00035 - 0.00091	0.00034 - 0.00059	0.0055 - 0.006	0.0523 - 0.0619	<0.0001	0.0025 - 0.0027	0.00041 - 0.00053	0.00144 - 0.00149	<0.1	<0.5	<0.25
Reaphook Paleochannel	RC00012	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.00016 - 0.00023	<0.00005	<0.00005	<0.00005	<0.00005	0.34 - 0.45	0.00068 - 0.00072	0.00037 - 0.00043	0.0015	0.061 - 0.0628	<0.0001	0.00305 - 0.0033	0.00064 - 0.00073	0.00181 - 0.00204	<0.1	<0.5	<0.25
Reaphook Paleochannel	RC00013	Southern Basins - Reaphook	Eastern Mt Wedge	Aileron Station	<0.00005 - 0.00008	<0.00005	<0.00005	<0.00005	<0.00005	0.046 - 0.08	0.00012 - 0.00013	0.00017 - 0.00021	0.0015 - 0.0025	0.00087 - 0.0731	<0.0001	0.00145 - 0.0026	0.00011 - 0.00014	0.00149 - 0.00251	<0.1	<0.5	<0.25
Reaphook Paleochannel	RC00014	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	<0.00005 - 0.00005	<0.00005 - 0.00007	<0.00001	<0.00001	<0.00001	0	0.00018 - 0.0002	<0.00005 - 0.00005	0.0004 - 0.00075	0.00486 - 0.00916	<0.00002	0.0022 - 0.0023	0.00012 - 0.00015	0.0001 - 0.00026	<0.02	<0.1	<0.05
Reaphook Paleochannel	RC00015	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.00005 - 0.00047	0.00007	<0.00001 - 0.00005	<0.00001 - 0.00005	<0.00001	0	0.0002 - 0.00196	0.00005 - 0.0018	0.00075 - 0.00735	0.00486 - 0.00917	<0.00002	0.0023 - 0.0025	0.00015 - 0.00308	0.0001 - 0.00182	<0.02 - 0.2	<0.1	<0.05
Reaphook Paleochannel	RC00016	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0	0.00022	<0.00005	0.001	0.0337	<0.0001	0.0022	0.00017	0.00184	<0.1	<0.5	<0.25
Reaphook Paleochannel	RC00017	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.00006 - 0.00043	0.00006 - 0.00007	<0.00001 - 0.00002	<0.00001 - 0.00003	<0.00001	0 - 1.4	0.00021 - 0.0015	0.00003 - 0.00041	0.0015 - 0.00185	0.0285 - 0.088	<0.00002	0.00845 - 0.022	0.00022 - 0.00132	0.00163 - 0.00229	<0.02 - 0.18	<0.1	<0.05
Reaphook Paleochannel	RC00018	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0 - 0.00046	0 - 0.00041	<0.00001 - 0	<0.00001 - 0	<0.00001 - 0	-	0 - 0.00246	0 - 0.00147	0 - 0.0365	0 - 0.0481	<0.00002 - 0	0 - 0.0185	0 - 0.0026	0 - 0.00994	<0.02 - 0	<0.1 - 0	<0.05 - 0
Reaphook Paleochannel	RC00019	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0.00015	0.00012	<0.00005	<0.00005	<0.00005	-	0.00025	0.00035	0.001	0.0223	<0.0001	0.00355	0.00022	0.00092	<0.1	<0.5	<0.25
Reaphook Paleochannel	RC00021	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	<0.00005 - 0	<0.00005 - 0	<0.00005 - 0	<0.00005 - 0	<0.00005 - 0	-	0 - 0.00031	0 - 0.00027	0 - 0.00045	0 - 0.0646	<0.0001 - 0	0 - 0.00195	0 - 0.00038	0 - 0.00094	<0.1 - 0	<0.5 - 0	<0.25 - 0
Reaphook Paleochannel	RC00022	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	<0.00001 - 0.00001	0.00001 - 0.00002	<0.00001	<0.00001	<0.00001	-	<0.00001 - 0.00004	0.00059 - 0.00235	0.00045 - 0.0015	0.00555 - 0.0316	<0.00002	0.00175 - 0.00215	<0.00001 - 0.00005	0.00149 - 0.00237	<0.02	<0.1	<0.05
Reaphook Paleochannel	RC00023	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0.00007	0.00006	<0.00005	<0.00005	<0.00005	-	0.00009	0.00007	0.00085	0.0203	<0.0001	0.00295	0.00015	0.00063	<0.1	<0.5	<0.25
Reaphook Paleochannel	RC00024	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	<0.00005 - 0.00014	0.00017 - 0.0002	<0.00005	<0.00005	<0.00005	-	0.00015 - 0.00026	0.00008 - 0.0001	0.00075 - 0.0017	0.0316 - 0.118	<0.0001	0.0017 - 0.0034	0.00015 - 0.00024	0.00088 - 0.00204	<0.1	<0.5	<0.25
Reaphook Paleochannel	RC00025	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	<0.00005 - 0.00093	<0.00005 - 0.00017	<0.00005	<0.00005 - 0.00008	<0.00005	-	<0.00005 - 0.00794	0.00017 - 0.00298	0.0006 - 0.00195	0.00557 - 0.0741	<0.0001	0.00165 - 0.00375	<0.00005 - 0.0037	0.00077 - 0.0017	<0.1 - 0.36	<0.5	<0.25
Reaphook Paleochannel	RC00026	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	<0.00005 - 0.00444	<0.00005 - 0.00035	<0.00005 - 0.00039	<0.00005 - 0.00055	<0.00001 - 0.00003	0 - 8	<0.00005 - 0.0551	0 - 0.034	0 - 0.016	0 - 0.0804	<0.00002 - 0.00026	0 - 0.019	<0.00005 - 0.0469	0 - 0.0161	<0.02 - 0.18	<0.1 - 0	<0.05 - 0
Reaphook Paleochannel	RC00028	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	<0.00005 - 0.00088	<0.00005	<0.00005	<0.00005 - 0.00006	<0.00005	12 - 2710	<0.00005 - 0.00291	<0.00005 - 0.00103	0.0007 - 0.00885	0.00454 - 0.0724	<0.0001	0.00195 - 0.00565	<0.00005 - 0.00249	0.00065 - 0.00204	<0.1 - 0.14	<0.5	<0.25
Reaphook Paleochannel	RC00061	Southern Basins - Reaphook	Eastern Whitcherry	Public Road	<0.00005	0.00007	<0.00005	<0.00005	<0.00005	0	<0.00005	<0.00005	0.0003	0.00275	<0.0001	0.00175	<0.00005	<0.00005	<0.1	<0.5	<0.25
Ti Tree Basin Aquifer	RC00092	Ti Tree Basins	Ti Tree	Aileron Station	<0.00001	<0.00005 - 0.00008	<0.00001	<0.00001	<0.00001	0	<0.00005 - 0.00004	<0.00001	0.0305 - 0.033	0.00013 - 0.00035	<0.00002	0.0015 - 0.0017	<0.00005 - 0.00003	0.00076 - 0.00123	<0.02	<0.1	<0.05
Unknown	RC00198	N/A	Unknown	Aileron Station	-	-	-	-	-	0.3	-	<0.001	-	<0.005	<0.0001	<0.005	-	<0.002	-	-	-
Unknown	RC00222	N/A	Unknown	Aileron Roadhouse	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.01 - 0	<0.00005	<0.0001 - 0.00012	0.0165 - 0.0175	<0.00005	<0.0001	0.014 - 0.0155	<0.00005	0.00015 - 0.00052	<0.1	<0.5	<0.25
Unknown	RC00344	Margins Area	Unknown	Yambah Station	-	-	-	-	-	<0.02	-	<0.001	-	<0.005	<0.0001	<0.005	-	<0.002	-	-	-
Weathered Basement	RC00005	Southen Basins - Basement	Eastern Whitcherry	Aileron Station	<0.00005 - 0.00012	<0.00005	<0.00005	<0.00005	<0.00005	0.122 - 0.226	0.00027 - 0.00034	0.00025 - 0.00046	0.0295 - 0.0305	0.0582 - 0.059	<0.0001	0.017 - 0.0175	0.00028	0.0018 - 0.00229	<0.1	<0.5	<0.25
Weathered Basement	RC00027	Southern Basins - RC00027 - Basement	Eastern Whitcherry	Aileron Station	<0.00001 - 0.0004	0.00001 - 0.00004	<0.00001	<0.00001 - 0.00006	<0.00001	4.2	<0.00001 - 0.00942	0.00007 - 0.00043	0.00325 - 0.00565	0.00479 - 0.109	<0.00002	0.013 - 0.0145	<0.00001 - 0.00374	0.0002 - 0.0046	<0.02 - 0.08	<0.1	<0.05
Weathered Basement	RC00062	Mine Area - Basement	Arunta Basement	Aileron Station	-	-	-	-	-	<0.02 - 0.02	-	<0.001	-	<0.005 - 0.005	<0.0001	<0.005	-	<0.002	-	-	-
Weathered Basement	RC00063	Mine Area - Basement	Arunta Basement	Aileron Station	<0.00005 - 0.00003	<0.00005 - 0.00036	<0.00005	<0.00005	<0.00005 - 0.00008	0 - 5.35	<0.00005 - 0.00009	<0.00005 - 0.0002	0.006 - 0.0074	0.00887 - 0.085	<0.0001	0.0115 - 0.035	<0.00005 - 0.00006	0.00014 - 0.008	<0.1	<0.5	<0.25 - 0.25
Weathered Basement	RC00064	Mine Area - Basement	Arunta Basement	Aileron Station	-	-	-	-	-	0.04 - 0.86	-	<0.001	-	<0.005 - 0.01	<0.0002	0.015	-	<0.002 - 0.004	-	-	-
Weathered Basement	RC00075	Mine Area - Basement	Arunta Basement	Aileron Station	<0.00005 - 0.00043	<0.00005 - 0.00174	<0.00005	<0.00005	<0.00005 - 0.00052	0 - 0.86	<0.00005	<0.00005 - 0.00042	0.0105 - 0.012	0.0141 - 0.0422	<0.0002 - 0.00234	0.00335 - 0.00405	<0.00005	0.00039 - 0.00074	<0.1	<0.5	<0.25 - 0.8
Weathered Basement	RC00078	Southern Basins - Basement	Arunta Basement	Aileron Station	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	0	<0.00005	0.00036	0.0053	0.00191	<0.0001	0.0195	<0.00005	0.00014	<0.1	<0.5	<0.25
Weathered Basement	RC00079	Southern Basins - Basement	Arunta Basement	Aileron Station	<0.00005	0.00013	<0.00005	<0.00005	<0.00005	0	<0.00005	0.00041	0.00655	0.008	<0.0001	0.023	<0.00005	0.0002	<0.1	<0.5	<0.25
Weathered Basement	RC00081	Southern Basins - Basement	Arunta Basement	Aileron Station	<0.0002	0.00041	<0.0002	<0.0002	<0.0002	<0.02 - 0	<0.0002	<0.0002	0.0285	<0.00001	<0.0001	<0.005 - 0.0055	<0.0002	<0.002 - 0.00058	<0.4	<2	<1
Weathered Basement	RC00083	N/A	Arunta Basement	Aileron Roadhouse	<0.00005	0.00017	<0.00005	<0.00005	<0.00005	0	0.00106	0.00187	0.0185	0.00092	<0.0001	0.0135	0.00094	0.00118	<0.1	<0.5	<0.25
Weathered Basement	RC00086	Margins Area	Arunta Basement	Aileron Station	<0.00005	<0.00005 - 0.00021	<0.00005	<0.00005	<0.00005	<0.04 - 0	<0.00005	<0.00005 - 0.00016	0.0665 - 0.0875	<0.005 - 0.00523	<0.0001	0.005 - 0.00935	<0.00005	<0.002 - 0.00041	<0.1	<0.5	<0.25
Weathered Basement	RC00098	Margins Area	Arunta Basement	Aileron Station	0.00011	0.00003	<0.00001	<0.00001	<0.00001	300	0.00021	0.00015	0.00025	0.274	<0.00002	0.00255	0.0003	0.00047	0.36	<0.1	<0.05
Weathered Basement	RC00099	Margins Area	Arunta Basement	Aileron Station	<0.00001	0.00003 - 0.00004	<0.00001	<0.00001	<0.00001	0 - 1.32	0.00002 - 0.0003	<0.00001 - 0.00009	0.0023 - 0.0029	0.00015 - 0.015	<0.00002	0.00465 - 0.01	0.00003 - 0.00041	<0.002 - 0.00058	<0.02	<0.1	<0.05

Statistical Summary - all sample events	Gallium	Gold	Hafnium	Holmium	Indium	Iron	Lanthanum	Lead	Lithium	Manganese	Mercury	Molybdenum	Neodymium	Nickel	Niobium	Osmium	Palladium
Number of Results	138	138	138	138	138	109	138	150	138	150	150	150	138	150	138	138	138
Number of Detects	78	71	21	28	15	102	99	118	137	138	12	144	102	139	34	6	8
Minimum Concentration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Detect	0.00001	0.00001	0.00001	0.00001	0.00001	0.02	0.00001	0.00001	0.0001	0.0001	0.00008	0.00095	0.00001	0.00003	0.04	ND	0.25
Maximum Concentration	0.00444	0.00174	0.00039	0.00055	0.00052	2710	0.0551	0.034	0.0875	0.464	0.00234	0.035	0.0469	0.0199	0.54	<2	<1
Maximum Detect	0.00444	0.00174	0.00039	0.00055	0.00052	2710	0.0551	0.034	0.0875	0.464	0.00234	0.035	0.0469	0.0199	0.54	ND	0.8
Average Concentration	0.00022	0.000083	0.000025	0.000035	0.000024	63	0.0015	0.001	0.0069	0.033	0.00007	0.0057	0.0013	0.0018	0.069	0.19	0.1
Median Concentration	0.00003	0.000025	0.000025	0.000025	0.000025	0.02	0.000125	0.000185	0.002025	0.0133	0.00005	0.00305	0.00013	0.000935	0.05	0.25	0.125
Standard Deviation	0.00061	0.00018	0.000039	0.000063	0.000046	303	0.0059	0.0034	0.012	0.061	0.00021	0.0058	0.0047	0.0032	0.086	0.17	0.11
Number of Guideline Exceedances	0	0	0	0	0	38	0	24	0	10	94	35	0	6	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	38	0	24	0	10	6	35	0	6	0	0	0

					Metals																			
					Praseodymium	Promethium	Rhenium	Rubidium	Samarium	Scandium	Selenium	Silica (SiO2)	Silver	Strontium	Tantalum	Tellurium	Terbium	Thallium	Thorium	Thulium	Tin	Titanium	Tungsten	Uranium
					ug/L	ug/L	ug/L	mg/L	ug/L	ug/L	mg/L	ug/L	mg/L	mg/L	ug/L	ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L
ADWG 2011 Aesthetic																								
ADWG 2011 Health											0.01		0.1											0.017
ANZECC 2000 FW 99%											0.005		0.00002											
ANZECC 2000 Irrigation - Long-term Trigger Values											0.02													0.01
ANZECC 2000 Stock Watering											*0.02*													*0.2*
Monitoring_Zone	**Location Code**	**Grouping**	**GW Basin**	**Location Type**																				
Alluvial	RC00001	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.05 - 0.63	<0.05 - 0.63	<0.05	0.0418 - 0.0566	<0.05 - 0.47	<0.25	0.0056	58,400 - 78,600	<0.00025	1.88 - 2.57	<0.25	<0.5	<0.05	<0.00005	<0.00005 - 0.0006	<0.05	<0.0005	<0.01	<0.00025 - 0.00085	0.0171 - 0.0379
Alluvial	RC00002	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.05	<0.05	<0.05	0.0266 - 0.035	<0.05	<0.25	0.0062 - 0.0066	72,400 - 76,600	<0.00025	1.28 - 1.33	<0.25	<0.5	<0.05	<0.00005 - 0.00006	<0.00005	<0.05	<0.0005	<0.01	<0.00025 - 0.0003	0.0595 - 0.0669
Alluvial	RC00003	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.05 - 0.11	<0.05 - 0.11	<0.05	0.0437 - 0.0463	<0.05	<0.25	0.0062 - 0.0076	10,800 - 13,200	<0.00025	1.83 - 2.08	<0.25	<0.5	<0.05	<0.00005	<0.00005 - 0.00008	<0.05	<0.0005	<0.01 - 0.016	<0.00025 - 0.00025	0.0301 - 0.0476
Alluvial	RC00007	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.05	<0.05	<0.05	0.0487 - 0.0521	<0.05	<0.25	0.0108 - 0.013	72,400 - 79,400	<0.00025	1.94 - 1.98	<0.25	<0.5	<0.05	<0.00005 - 0.00011	<0.00005 - 0.00011	<0.05	<0.0005	<0.01	<0.00025 - 0.0011	0.075 - 0.0829
Alluvial	RC00059	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.05 - 0.26	-	<0.05	0.0446 - 0.0509	<0.05 - 0.12	<0.25 - 0.3	0.005 - 0.006	51,000 - 84,600	<0.00025	-	<0.25	<0.5	<0.05	<0.00005	<0.00005 - 0.00047	<0.05	<0.0005	<0.01 - 0.016	<0.00025 - 0.00185	0.0185 - 0.0313
Alluvial	RC00060	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.05 - 0.2	-	<0.05	0.0469 - 0.047	<0.05 - 0.18	<0.25	0.0048 - 0.0066	56,600 - 73,000	<0.00025	-	<0.25	<0.5	<0.05	<0.00005	0.0001 - 0.00011	<0.05	<0.0005	<0.01 - 0.012	<0.00025 - 0.00395	0.0235 - 0.0396
Alluvial	RC00084	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.05	-	<0.05	0.032	<0.05	<0.25	0.0036	60,600	<0.00025	-	<0.25	<0.5	<0.05	<0.00005	<0.00005	<0.05	<0.0005	<0.01	<0.00025	0.00928
Alluvial	RC00085	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	<0.05	-	<0.05	0.0331	<0.05	0.4	0.003	82,000	<0.00025	-	<0.25	<0.5	<0.05	<0.00005	<0.00005	<0.05	<0.0005	<0.01	<0.00025	0.0144
Alluvial	RC00106	Margins Area	NE Burt	Aileron Station	<0.01	-	<0.01	0.018 - 0.0188	<0.01	0.2 - 0.35	0.0026 - 0.003	49,800 - 79,000	<0.00005	-	<0.05	<0.1	<0.01	<0.00001	<0.00001 - 0.00002	<0.01	<0.0001	<0.002	<0.00005 - 0.0002	0.00485 - 0.0075
Alluvial	RC00109	Margins Area	NE Burt	Aileron Station	<0.01	-	<0.01	0.016	<0.01	0.3	0.003	69,400 - 70,000	<0.00005	-	<0.05	<0.1	<0.01	<0.00001	<0.00001	<0.01	<0.0001	<0.002	<0.00005	0.00655 - 0.0067
Alluvial/Fluvial	RC00040	Margins Area	NE Burt/Arunta	Aileron Station	0.12	-	<0.01	0.0263	0.11	0.35	0.0018	70,000	<0.00005	-	<0.05	<0.1	0.01	0.00004	0.00014	<0.01	<0.0001	0.01	0.002	0.0079
Alluvial/Fluvial	RC00044	Margins Area	NE Burt	Aileron Station	<0.01	-	<0.01	0.0229	<0.01	0.4	0.0018	73,800	<0.00005	-	<0.05	<0.1	<0.01	<0.00001	0.00005	<0.01	<0.0001	<0.002	0.00055	0.00044
Alluvial/Fluvial	RC00045	Margins Area	NE Burt	Aileron Station	0.08	-	<0.01	0.0275	0.08	0.4	0.0014	80,000	<0.00005	-	<0.05	<0.1	<0.01	0.00002	0.00007	<0.01	0.0019	0.008	0.00025	0.00486
Alluvial/Fluvial	RC00046	Margins Area	NE Burt	Aileron Station	0.51	-	<0.2	0.0333	0.22	<1	0.014	30,000	<0.001	-	<1	<2	<0.2	<0.0002	<0.0002	<0.2	<0.002	0.056	<0.001	0.219
Alluvial/Fluvial	RC00047	Margins Area	NE Burt	Aileron Station	0.12	-	0.02	0.0188	0.07	0.5	0.0032	44,200	<0.00005	-	<0.05	<0.1	<0.01	0.00003	0.00013	<0.01	0.001	0.016	0.0004	0.0118
Alluvial/Fluvial	RC00048	Margins Area	NE Burt	Aileron Station	0.02	-	<0.01	0.0247	0.02	0.35	0.0014	76,200	<0.00005	-	<0.05	<0.1	<0.01	0.00002	0.00002	<0.01	<0.0001	<0.002	0.0026	0.00269
Alluvial/Fluvial	RC00049	Margins Area	NE Burt	Aileron Station	0.16	-	0.05	0.0254	0.15	0.4	0.003	57,400	<0.00005	-	<0.05	<0.1	0.02	0.00007	0.0001	0.01	<0.0001	0.014	0.00115	0.0026
Alluvial/Fluvial	RC00053	Margins Area	NE Burt	Aileron Station	0.05 - 0.2	-	<0.01	0.0274 - 0.028	0.04 - 0.12	0.35 - 0.4	0.0014 - 0.0016	77,200 - 84,800	<0.00005	-	<0.05	<0.1	<0.01	0.00001 - 0.00003	0.00004 - 0.0001	<0.01	<0.0001	0.002 - 0.006	0.00055 - 0.0008	0.00175 - 0.00282
Alluvial/Fluvial	RC00057	Margins Area	NE Burt	Aileron Station	0.1	-	<0.01	0.0233	0.06	0.45	0.0004	49,000	<0.00005	-	<0.05	<0.1	<0.01	<0.00001	0.00009	<0.01	0.0002	0.012	0.0005	0.0103
Calcrete	RC00100	Margins Area	Arunta Basement	Aileron Station	<0.01	-	<0.01	0.00951	<0.01	0.35	0.0044	65,200	<0.00005	-	<0.05	<0.1	<0.01	<0.00001	0.00001	<0.01	<0.0001	<0.002	0.00055	0.00859
Calcrete	RC00103	Margins Area	NE Burt	Aileron Station	<0.05	-	<0.05	0.0243	<0.05	<0.25	0.0064	73,200	<0.00025	-	<0.25	<0.5	<0.05	<0.00005	<0.00005	<0.05	<0.0005	<0.01	<0.00025	0.0083
Calcrete	RC00104	Margins Area	Ti Tree	Aileron Station	<0.01	-	0.01	0.00857	<0.01	0.35	0.0054	75,200	<0.00005	-	<0.05	<0.1	<0.01	<0.00001	<0.00001	<0.01	<0.0001	<0.002	0.00005	0.00777
Calcrete/Alluvial	RC00052	Margins Area	Ti Tree/Arunta	Aileron Station	0.16	-	0.01	0.0249	0.1	0.45	0.0038	48,600	<0.00005	-	<0.05	<0.1	<0.01	0.00003	0.00011	<0.01	0.0002	0.01	0.0002	0.00929
Calcrete/Alluvial/Fluvial	RC00030	Margins Area	NE Burt	Aileron Station	<0.01	-	0.01	0.0215	<0.01	0.35	0.0054	84,000	<0.00005	-	<0.05	<0.1	<0.01	0.00003	<0.00001	<0.01	<0.0001	<0.002	0.00095	0.00408
Calcrete/Alluvial/Fluvial	RC00031	Margins Area	Ti Tree	Aileron Station	0.44	-	0.01	0.0204	0.34	0.35	0.004	45,000	<0.00005	-	<0.05	<0.1	0.03	0.00004	0.00046	0.01	0.0009	0.082	0.00025	0.00398
Calcrete/Alluvial/Fluvial	RC00033	Margins Area	Ti Tree	Aileron Station	3.8	-	<0.01	0.0459	2.52	0.25	0.0038	49,000	<0.00005	-	<0.05	<0.1	0.17	0.0001	0.00247	0.02	0.0002	0.024	0.0155	0.00399
Calcrete/Basement	RC00032	Margins Area	Ti Tree/Arunta	Aileron Station	1.15	-	<0.01	0.0214	0.84	0.55	0.0024	76,800	<0.00005	-	<0.05	<0.1	0.08	0.0001	0.00218	0.02	0.0008	0.046	0.0003	0.00387
Calcrete/Basement	RC00035	Margins Area	Ti Tree/Arunta	Aileron Station	<0.01	-	<0.01	0.0137	<0.01	0.35	0.002	75,400	<0.00005	-	<0.05	<0.1	<0.01	0.00003	0.00006	<0.01	<0.0001	<0.002	0.00155	0.00175
Calcrete/Basement	RC00036	Margins Area	Ti Tree/Arunta	Aileron Station	0.02	-	<0.01	0.0152	0.02	0.3	0.0016	73,800	<0.00005	-	<0.05	<0.1	<0.01	0.00001	0.00003	<0.01	<0.0001	<0.002	0.00055	0.00069
Calcrete/Basement	RC00037	Margins Area	Ti Tree/Arunta	Aileron Station	0.05 - 0.49	-	<0.01	0.0183 - 0.0271	0.04 - 0.35	0.45 - 0.6	0.0052	66,800 - 71,000	<0.00005	-	<0.05	<0.1	<0.01 - 0.04	<0.00001 - 0.00005	0.00005 - 0.00027	<0.01 - 0.01	0.0002 - 0.0006	0.01 - 0.092	0.00005 - 0.0002	0.00672 - 0.00708
Calcrete/Basement	RC00041	Margins Area	NE Burt/Arunta	Aileron Station	0.04	-	<0.01	0.0262	0.03	0.35	0.0018	80,400	<0.00005	-	<0.05	<0.1	<0.01	0.00001	0.00005	<0.01	0.0001	0.004	0.00025	0.0041
Calcrete/Basement	RC00042	Margins Area	NE Burt	Aileron Station	1.63	-	<0.01	0.0333	1.66	1.3	0.0022	56,400	<0.00005	-	<0.05	<0.1	0.23	0.00008	0.00197	0.1	0.001	0.138	0.0001	0.00529
Calcrete/Basement	RC00043	Margins Area	NE Burt	Aileron Station	0.72	-	<0.01	0.0182	0.46	0.25	0.002	40,400	<0.00005	-	<0.05	<0.1	0.05	0.00001	0.00008	0.02	0.0001	0.012	0.00025	0.00831
Calcrete/Basement	RC00050	Margins Area	NE Burt/Arunta	Aileron Station	0.23 - 2.89	-	<0.1 - 0.01	0.0145 - 0.134	0.12 - 2.19	<0.5 - 3.6	*0.0048 - 0.0286*	43,000 - 76,600	<0.00005	-	<0.05	<0.1	<0.1 - 0.27	<0.0001 - 0.00025	0.00018 - 0.00214	<0.1 - 0.03	<0.001 - 0.0015	0.062 - 0.3	<0.0005 - 0.00135	0.00365 - 0.0327
Calcrete/Basement	RC00054	Margins Area	NE Burt/Arunta	Aileron Station	1.42	-	0.01	0.0267	1.05	0.45	0.0048	43,000	<0.00005	-	0.09	0.46	<0.1	0.00003	0.072	3.65	0.0015	0.00005	0.0041	0.0155
Calcrete/Basement	RC00056	Margins Area	Ti Tree/Arunta	Aileron Station	0.16	-	<0.05	0.0146	0.15	0.35	0.0072	41,000	<0.00025	-	<0.25	<0.5	<0.05	<0.00005	0.00019	<0.05	<0.0005	0.03	0.00075	0.013
Reaphook Paleochannel	RC00004	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	<0.01 - 0.12	0.09 - 0.12	<0.01	0.022 - 0.0421	<0.01 - 0.08	<0.25 - 0.26	0.0044 - 0.0052	54,200 - 79,000	<0.00005	0.696 - 0.856	<0.05	<0.1	<0.01	<0.00001	<0.00001 - 0.00023	<0.01	<0.0001	<0.002 - 0.072	<0.00005 - 0.00085	0.0947 - 0.19
Reaphook Paleochannel	RC00006	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.09 - 0.14	0.09 - 0.14	<0.05	0.0253 - 0.027	0.07 - 0.15	<0.25	0.0046 - 0.0054	79,000 - 82,200	<0.00025	1.08 - 1.13	<0.25	<0.5	<0.05	<0.00005	0.00012 - 0.00015	<0.05	<0.0005 - 0.0005	<0.01 - 0.01	0.00055	0.0585 - 0.06
Reaphook Paleochannel	RC00012	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.15 - 0.2	0.15 - 0.2	<0.05	0.0442 - 0.0459	0.14 - 0.16	0.31 - 0.33	0.0052 - 0.0058	48,800 - 50,400	<0.00025	1.39 - 1.41	<0.25	<0.5	<0.05	<0.00005	0.00032 - 0.00033	<0.05	<0.0005	0.018 - 0.026	0.0007	0.0338 - 0.0345
Reaphook Paleochannel	RC00013	Southern Basins - Reaphook	Eastern Mt Wedge	Aileron Station	<0.05	<0.05	<0.05	0.0485 - 0.0573	<0.05	<0.25 - 0.25	0.0052 - 0.0064	75,000 - 77,800	<0.00025	1.32 - 1.59	<0.25	<0.5	<0.05	<0.00005 - 0.00007	<0.00005 - 0.00005	<0.05	<0.0005	<0.01	<0.00025 - 0.00045	0.018 - 0.0198
Reaphook Paleochannel	RC00014	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	<0.05 - 0.04	-	<0.01	0.0266 - 0.0394	0.04 - 0.05	<0.25 - 0.15	0.0042 - 0.0058	79,400 - 83,200	<0.00005	0	<0.05	<0.1	<0.01	<0.00001	<0.00005 - 0.00004	<0.01	<0.0001	<0.01 - 0.004	<0.00025 - 0.00035	0.0288 - 0.035
Reaphook Paleochannel	RC00015	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.04 - 0.5	-	<0.01 - 0.02	0.0394 - 0.0503	0.04 - 0.39	0.15 - 0.35	0.0058 - 0.0066	76,400 - 79,400	<0.00005	1.03 - 1.09	<0.05	<0.1	<0.01 - 0.05	<0.00001 - 0.00077	0.00004 - 0.00094	<0.01 - 0.01	<0.0001 - 0.0002	0.004 - 0.044	0.00015 - 0.00035	0.0288 - 0.0489
Reaphook Paleochannel	RC00016	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	<0.05	-	<0.05	0.0433	<0.05	<0.25	0.006	73,200	<0.00025	0	<0.25	<0.5	<0.05	<0.00005	<0.00005	<0.05	<0.0005	<0.01	<0.00025	0.0185
Reaphook Paleochannel	RC00017	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.05 - 0.4	-	<0.01 - 0.01	0.0418 - 0.0449	0.06 - 0.24	0.2 - 0.45	0.0048	78,200 - 86,600	<0.00005	0	<0.05	<0.1	<0.01 - 0.03	0.00002	0.00007 - 0.00069	<0.01	<0.0001 - 0.0002	0.004 - 0.046	0.0004 - 0.00055	0.026 - 0.0354
Reaphook Paleochannel	RC00018	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	<0.01 - 0.59	-	<0.05 - 0.73	0 - 0.105	<0.01 - 0.46	<0.5 - 0.4	*0 - 0.0292*	0 - 79,400	<0.00005 - 0	-	<0.05 - 0	<0.1 - 0	<0.01 - 0.05	0 - 0.00138	0 - 0.00301	<0.01 - 0	<0.0001 - 0	<0.002 - 0.02	0 - 0.0006	0 - 0.0447
Reaphook Paleochannel	RC00019	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0.07	-	<0.05	0.0499	<0.05	0.35	0.0076	83,400	<0.00025	-	<0.25	<0.5	<0.05	<0.00005	0.00019	<0.05	<0.0005	0.012	0.00015	0.0265
Reaphook Paleochannel	RC00021	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	<0.05 - 0.09	-	<0.05 - 0	0 - 0.0476	<0.05 - 0.06	<0.25 - 0	0 - 0.0076	0 - 79,600	<0.00025 - 0	0	<0.25 - 0	<0.5 - 0	<0.05 - 0	<0.00005 - 0.00009	0 - 0.00018	<0.05 - 0	<0.0005 - 0	<0.01 - 0	<0.00025 - 0	0 - 0.0232
Reaphook Paleochannel	RC00022	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	<0.01 - 0.01	-	<0.01 - 0.01	0.0428 - 0.0466	<0.01 - 0.01	0.15 - 0.2	0.0052 - 0.0058	70,800 - 73,000	<0.00005	1.04 - 1.15	<0.05	<0.1	<0.01	0.00002 - 0.00008	<0.00001 - 0.00007	<0.01	<0.0001 - 0.0004	<0.002 - 0.004	<0.00005 - 0.00005	0.03 - 0.0365
Reaphook Paleochannel	RC00023	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	<0.05	-	<0.05	0.0315	<0.05	0.4	0.0026	88,000	<0.00025	-	<0.25	<0.5	<0.05	<0.00005	0.00012	<0.05	<0.0005	<0.01	<0.00025	0.0274
Reaphook Paleochannel	RC00024	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	<0.05 - 0.06	-	<0.05	0.0458 - 0.0556	0.06	0.35 - 0.4	0.0048 - 0.0062	83,200 - 85,600	<0.00025	-	<0.25	<0.5	<0.05	<0.00005	0.00007 - 0.00011	<0.05	<0.0005	<0.01	<0.00025 - 0.00075	0.0391 - 0.0438
Reaphook Paleochannel	RC00025	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	<0.05 - 1.08	-	<0.05	0.0505 - 0.0717	<0.05 - 0.85	<0.25 - 0.5	0.005 - 0.0068	78,800 - 88,600	<0.00025	-	<0.25	<0.5	<0.05 - 0.08	<0.00005 - 0.00007	<0.00005 - 0.00189	<0.05	<0.0005 - 0.0008	<0.01 - 0.138	<0.00025 - 0.0005	0.0397 - 0.0586
Reaphook Paleochannel	RC00026	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	<0.05 - 13.2	-	<0.01 - 0	0 - 0.0551	<0.05 - 8.94	<0.25 - 2.1	0 - 0.0068	0 - 68,200	<0.00005 - 0	-	<0.05 - 0	<0.1 - 0	<0.05 - 0.68	0 - 0.00022	<0.00005 - 0.0252	<0.05 - 0.2	<0.0005 - 0.0007	<0.01 - 0.078	<0.00025 - 0.00115	0 - 0.0924
Reaphook Paleochannel	RC00028	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	<0.05 - 0.72	-	<0.05	0.0261 - 0.0303	<0.05 - 0.43	<0.25 - 0.55	0.0036 - 0.0054	59,000 - 72,200	<0.00025	-	<0.25	<0.5	<0.05 - 0.05	<0.00005 - 0.00006	<0.00005 - 0.00155	<0.05	<0.0005	<0.01 - 0.072	<0.00025 - 0.0009	0.0417 - 0.0648
Reaphook Paleochannel	RC00061	Southern Basins - Reaphook	Eastern Whitcherry	Public Road	<0.05	-	<0.05	0.0242	<0.05	<0.25	0.0058	87,400	<0.00025	0	<0.25	<0.5	<0.05	<0.00005	<0.00005	<0.05	<0.0005	<0.01	<0.00025	0.0661
Ti Tree Basin Aquifer	RC00092	Ti Tree Basins	Ti Tree	Aileron Station	<0.01	-	<0.01	0.0203 - 0.0207	<0.01	0.2 - 0.4	0.0056 - 0.0064	69,200 - 72,400	<0.00005	-	<0.05	<0.1	<0.01	<0.00005 - 0.00001	<0.00001	<0.01	<0.0001	<0.002	<0.00025 - 0.00015	0.0218 - 0.0222
Unknown	RC00198	N/A	Unknown	Aileron Station	-	-	-	-	-	-	0.006	81,800	<0.01	-	-	-	-	-	-	-	<0.01	-	-	0.0205
Unknown	RC00222	N/A	Unknown	Aileron Roadhouse	<0.05	-	<0.05	0.00322 - 0.00439	<0.05	<2.5 - 0.25	0.0048 - 0.0054	63,600 - 65,200	<0.00025	1.25 - 1.27	<0.25	<0.05	<0.05	<0.00005	<0.00005	<0.05	<0.00005	<0.01	<0.00025	0.489 - 0.589
Unknown	RC00344	Margins Area	Unknown	Yambah Station	-	-	-	-	-	-	0.003	78,600	<0.01	-	-	-	-	-	-	-	<0.01	-	-	0.0051
Weathered Basement	RC00005	Southen Basins - Basement	Eastern Whitcherry	Aileron Station	0.06 - 0.11	0.06 - 0.11	<0.05	0.0343 - 0.0353	<0.05 - 0.08	<0.25	0.0062	67,200 - 68,400	<0.00025	1.48 - 1.5	<0.25	<0.5	<0.05	<0.00005	0.00018 - 0.00025	<0.05	<0.0005	<0.01 - 0.034	0.0015 - 0.00155	0.118 - 0.119
Weathered Basement	RC00027	Southern Basins - RC00027 - Basement	Eastern Whitcherry	Aileron Station	<0.01 - 1.2	-	<0.01	0.0191 - 0.0226	<0.01 - 0.69	0.25	0.0014 - 0.0018	0 - 71,600	<0.00005	-	<0.05	<0.1	<0.01 - 0.07	0.00001 - 0.00003	<0.00001 - 0.00143	<0.01 - 0.02	<0.0001 - 0.0001	<0.002 - 0.052	<0.00005 - 0.00005	0.0733 - 0.0826
Weathered Basement	RC00062	Mine Area - Basement	Arunta Basement	Aileron Station	-	-	-	-	-	-	0.006 - 0.008	74,800 - 76,400	<0.01	-	-	-	-	-	-	-	<0.01	-	-	0.205 - 0.231
Weathered Basement	RC00063	Mine Area - Basement	Arunta Basement	Aileron Station	<0.05	-	<0.05	0.00986 - 0.0121	<0.05	<0.25 - 0.3	0.009 - 0.011	77,800 - 85,800	<0.00025	1.08 - 1.15	<0.25	<0.05	<0.05	<0.00005	<0.00005	<0.05	<0.00005	<0.01	0.0028 - 0.00315	0.321 - 0.426
Weathered Basement	RC00064	Mine Area - Basement	Arunta Basement	Aileron Station	-	-	-	-	-	-	0.005 - 0.011	63,800 - 82,200	<0.01	-	-	-	-	-	-	-	<0.01	-	-	0.285 - 0.372
Weathered Basement	RC00075	Mine Area - Basement	Arunta Basement	Aileron Station	<0.05	-	<0.05 - 0.45	0.00912 - 0.0097	<0.05	<0.5 - 0.4	0.0128 - 0.0166	63,800 - 68,400	<0.00025	4.04 - 4.1	<0.25	<0.5	<0.05	<0.0001 - 0.00044	<0.00005	<0.05	<0.0005	<0.01	<0.0005 - 0.0003	0.338 - 0.365
Weathered Basement	RC00078	Southern Basins - Basement	Arunta Basement	Aileron Station	<0.05	-	<0.05	0.00842	<0.05	0.3	0.0098	64,200	<0.00025	-	<0.25	<0.5	<0.05	<0.00005	<0.00005	<0.05	<0.0005	<0.01	0.001	0.748
Weathered Basement	RC00079	Southern Basins - Basement	Arunta Basement	Aileron Station	<0.05	-	<0.05	0.00998	<0.05	<0.25	0.012	63,200	<0.00025	-	<0.25	<0.5	<0.05	<0.00005	<0.00005	<0.05	<0.0005	<0.01	0.0012	0.877
Weathered Basement	RC00081	Southern Basins - Basement	Arunta Basement	Aileron Station	<0.2	-	<0.2	0.0263	<0.2	<1	*0.003 - 0.0268*	67,200 - 76,000	<0.001	-	<1	<2	<0.2	<0.0002	<0.0002	<0.2	<0.002	<0.04	<0.001	0.0076 - 0.173
Weathered Basement	RC00083	N/A	Arunta Basement	Aileron Roadhouse	0.28	-	<0.05	0.00365	<0.05	<0.25	0.0066	63,200	<0.00025	-	<0.25	<0.5	<0.05	<0.00005	<0.00005	<0.05	0.0022	<0.01	<0.00025	0.531
Weathered Basement	RC00086	Margins Area	Arunta Basement	Aileron Station	<0.05	-	<0.05	0.0145 - 0.0171	<0.05	<0.25	*0.0142 - 0.036*	25,400 - 77,600	<0.00025	-	<0.25	<0.5	<0.05	<0.00005	<0.00005	<0.05	<0.0005	<0.01	<0.00025	0.149 - 0.292
Weathered Basement	RC00098	Margins Area	Arunta Basement	Aileron Station	0.07	-	<0.01	0.013	0.05	0.6	<0.0002	69,400	<0.00005	-	<0.05	<0.1	<0.01	<0.00001	0.00009	<0.01	<0.0001	0.008	0.0005	0.004
Weathered Basement	RC00099	Margins Area	Arunta Basement	Aileron Station	<0.01 - 0.11	-	<0.01	0.0109 - 0.0127	<0.01 - 0.1	0.15 - 0.25	0.0026 - 0.013	25,800 - 51,600	<0.00005	-	<0.05	<0.1	<0.01	<0.00001	0.00001 - 0.00005	<0.01	<0.0001	<0.002	<0.00005	0.00725 - 0.258

Statistical Summary - all sample events	Praseodymium	Promethium	Rhenium	Rubidium	Samarium	Scandium	Selenium	Silica (SiO2)	Silver	Strontium	Tantalum	Tellurium	Terbium	Thallium	Thorium	Thulium	Tin	Titanium	Tungsten	Uranium
Number of Results	138	19	138	138	138	138	146	157	150	40	138	138	138	137	138	138	150	138	138	150
Number of Detects	71	10	24	138	66	88	145	157	6	40	7	7	27	60	83	21	32	60	84	150
Minimum Concentration	0	<0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Detect	0.01	0.06	0.01	0.00322	0.01	0.15	0.0004	10800	ND	0.696	0.09	0.46	0.01	0.00001	0.00001	0.01	0.0001	0.00005	0.00005	0.00044
Maximum Concentration	13.2	0.63	0.73	0.134	8.94	<5	0.036	88600	<0.01	4.1	<1	<2	0.68	0.00138	0.072	3.65	<0.01	0.3	0.0155	0.877
Maximum Detect	13.2	0.63	0.73	0.134	8.94	3.6	0.036	88600	ND	4.1	0.09	0.46	0.68	0.00138	0.072	3.65	0.0022	0.3	0.0155	0.877
Average Concentration	0.35	0.1	0.029	0.032	0.25	0.4	0.0062	64815	0.00049	1.3	0.098	0.19	0.037	0.000063	0.001	0.049	0.00067	0.017	0.00064	0.095
Median Concentration	0.025	0.06	0.025	0.02725	0.025	0.25	0.0054	71000	0.000125	1.2	0.125	0.25	0.025	0.000025	0.00005	0.025	0.00025	0.005	0.00025	0.03285
Standard Deviation	1.3	0.14	0.073	0.02	0.9	0.54	0.0053	20608	0.0013	1	0.086	0.18	0.077	0.00015	0.0065	0.31	0.0013	0.035	0.0015	0.15
Number of Guideline Exceedances	0	0	0	0	0	0	90	0	144	0	0	0	0	0	0	0	0	0	0	110
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	90	0	0	0	0	0	0	0	0	0	0	0	0	110

					Metals				
					Vanadium	Ytterbium	Yttrium	Zinc	Zirconium
					mg/L	ug/L	ug/L	mg/L	mg/L
ADWG 2011 Aesthetic								3	
ADWG 2011 Health									
ANZECC 2000 FW 99%								0.0024	
ANZECC 2000 Irrigation - Long-term Trigger Values					0.1			2	
ANZECC 2000 Stock Watering								*20*	
Monitoring_Zone	**Location Code**	**Grouping**	**GW Basin**	**Location Type**					
Alluvial	RC00001	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	0.0048 - 0.00825	<0.05	0.05 - 0.42	0.0067 - 0.0143	<0.00025
Alluvial	RC00002	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	0.0079 - 0.022	<0.05	<0.05	0.0026 - 0.005	<0.00025
Alluvial	RC00003	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	0.00465 - 0.0055	<0.05	<0.05 - 0.06	0.0134 - 0.0153	<0.00025
Alluvial	RC00007	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	0.00675 - 0.0115	<0.05	<0.05 - 0.07	0.0039 - 0.0389	<0.00025
Alluvial	RC00059	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	0.00575 - 0.0078	<0.05	0.07 - 0.38	0.0039 - 0.0282	<0.00025
Alluvial	RC00060	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	0.0066 - 0.00715	<0.05	0.1 - 0.24	0.0067 - 0.008	<0.00025
Alluvial	RC00084	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	0.00755	<0.05	<0.05	0.0082	<0.00025
Alluvial	RC00085	Southern Basins - Alluvials and Calcretes	Eastern Whitcherry	Aileron Station	0.0063	<0.05	<0.05	0.0078	<0.00025
Alluvial	RC00106	Margins Area	NE Burt	Aileron Station	0.013 - 0.0175	<0.01	0.02 - 0.03	0.0052 - 0.01	<0.00005
Alluvial	RC00109	Margins Area	NE Burt	Aileron Station	0.015	<0.01	<0.01	<0.01 - 0.0004	<0.00005
Alluvial/Fluvial	RC00040	Margins Area	NE Burt/Arunta	Aileron Station	0.014	0.03	0.33	0.139	0.0001
Alluvial/Fluvial	RC00044	Margins Area	NE Burt	Aileron Station	0.012	<0.01	0.02	0.0123	<0.00005
Alluvial/Fluvial	RC00045	Margins Area	NE Burt	Aileron Station	0.0089	0.02	0.26	0.0168	<0.00005
Alluvial/Fluvial	RC00046	Margins Area	NE Burt	Aileron Station	0.00875	<0.2	0.54	0.218	<0.001
Alluvial/Fluvial	RC00047	Margins Area	NE Burt	Aileron Station	0.00665	0.01	0.19	0.0588	0.0002
Alluvial/Fluvial	RC00048	Margins Area	NE Burt	Aileron Station	0.0165	<0.01	0.04	0.0279	<0.00005
Alluvial/Fluvial	RC00049	Margins Area	NE Burt	Aileron Station	0.00985	0.07	0.84	0.0115	0.00015
Alluvial/Fluvial	RC00053	Margins Area	NE Burt	Aileron Station	0.0135 - 0.014	<0.01 - 0.01	0.1 - 0.23	0.0129 - 0.0155	<0.00005 - 0.00025
Alluvial/Fluvial	RC00057	Margins Area	NE Burt	Aileron Station	0.0034	0.01	0.22	0.0353	0.0002
Calcrete	RC00100	Margins Area	Arunta Basement	Aileron Station	0.0195	<0.01	0.03	0.0058	<0.00005
Calcrete	RC00103	Margins Area	NE Burt	Aileron Station	0.0135	<0.05	<0.05	0.38	<0.00025
Calcrete	RC00104	Margins Area	Ti Tree	Aileron Station	0.0088	<0.01	0.01	0.0028	<0.00005
Calcrete/Alluvial	RC00052	Margins Area	Ti Tree/Arunta	Aileron Station	0.00325	0.03	0.44	0.157	0.00015
Calcrete/Alluvial/Fluvial	RC00030	Margins Area	NE Burt	Aileron Station	0.0083	<0.01	0.03	0.0069	<0.00005
Calcrete/Alluvial/Fluvial	RC00031	Margins Area	Ti Tree	Aileron Station	0.007	0.08	0.91	0.0564	0.00025
Calcrete/Alluvial/Fluvial	RC00033	Margins Area	Ti Tree	Aileron Station	0.013	0.15	2.01	0.0188	0.0002
Calcrete/Basement	RC00032	Margins Area	Ti Tree/Arunta	Aileron Station	0.019	0.16	2.03	0.0473	0.0002
Calcrete/Basement	RC00035	Margins Area	Ti Tree/Arunta	Aileron Station	0.024	<0.01	0.06	0.0036	<0.00005
Calcrete/Basement	RC00036	Margins Area	Ti Tree/Arunta	Aileron Station	0.015	<0.01	0.05	0.0066	<0.00005
Calcrete/Basement	RC00037	Margins Area	Ti Tree/Arunta	Aileron Station	0.011 - 0.0155	0.01 - 0.09	0.24 - 1.02	0.0273 - 0.0571	0.00005 - 0.00015
Calcrete/Basement	RC00041	Margins Area	NE Burt/Arunta	Aileron Station	0.0125	<0.01	0.12	0.0124	0.0001
Calcrete/Basement	RC00042	Margins Area	NE Burt	Aileron Station	0.037	0.56	7.28	0.282	0.0016
Calcrete/Basement	RC00043	Margins Area	NE Burt	Aileron Station	0.019	0.1	1.21	0.0233	0.00005
Calcrete/Basement	RC00050	Margins Area	NE Burt/Arunta	Aileron Station	0.0155 - 0.0535	<0.1 - 0.86	0.77 - 9.15	0.045 - 0.105	<0.0005 - 0.00325
Calcrete/Basement	RC00054	Margins Area	NE Burt/Arunta	Aileron Station	0.00015	105	0.21	0.00025	-
Calcrete/Basement	RC00056	Margins Area	Ti Tree/Arunta	Aileron Station	0.016	<0.05	0.65	0.0821	<0.00025
Reaphook Paleochannel	RC00004	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.00445 - 0.027	<0.01	<0.05 - 0.3	<0.0001 - 0.0163	<0.00005
Reaphook Paleochannel	RC00006	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.025 - 0.026	<0.05	0.27 - 0.4	0.101 - 0.309	<0.00025
Reaphook Paleochannel	RC00012	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.012 - 0.0125	<0.05	0.42 - 0.48	0.0291 - 0.0337	0.0003 - 0.00035
Reaphook Paleochannel	RC00013	Southern Basins - Reaphook	Eastern Mt Wedge	Aileron Station	0.00855 - 0.026	<0.05	0.09 - 0.14	0.0039 - 0.0068	<0.00025
Reaphook Paleochannel	RC00014	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.00725 - 0.011	<0.01	<0.05 - 0.07	0.005 - 0.0271	<0.00005
Reaphook Paleochannel	RC00015	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.00725 - 0.011	<0.01 - 0.09	0.07 - 1.43	0.0271 - 0.406	<0.00005 - 0.0015
Reaphook Paleochannel	RC00016	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.00705	<0.05	0.05	0.01	<0.00025
Reaphook Paleochannel	RC00017	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.0049 - 0.0075	<0.01 - 0.06	0.14 - 1.22	0.0022 - 0.0799	0.00005 - 0.0008
Reaphook Paleochannel	RC00018	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0 - 0.00835	<0.01 - 0	0 - 0.74	0 - 0.0285	<0.0005 - 0.00055
Reaphook Paleochannel	RC00019	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0.00735	<0.05	0.24	0.0146	<0.00025
Reaphook Paleochannel	RC00021	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0 - 0.00725	<0.05 - 0	0 - 0.19	0 - 0.0907	<0.00025 - 0
Reaphook Paleochannel	RC00022	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.0059 - 0.0069	<0.01	<0.01 - 0.04	0.0969 - 0.233	<0.00005 - 0.0001
Reaphook Paleochannel	RC00023	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0.0105	<0.05	0.12	0.0027	<0.00025
Reaphook Paleochannel	RC00024	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0.00755 - 0.0089	<0.05	0.15 - 0.24	0.003 - 0.005	<0.00025
Reaphook Paleochannel	RC00025	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0.00535 - 0.01	<0.05 - 0.16	<0.05 - 1.89	0.0039 - 0.368	<0.00025 - 0.0015
Reaphook Paleochannel	RC00026	Southern Basins - Reaphook	Eastern Whitcherry	Napperby Station	0 - 0.036	<0.05 - 1.23	<0.05 - 16.2	0 - 0.11	<0.00025 - 0.02
Reaphook Paleochannel	RC00028	Southern Basins - Reaphook	Eastern Whitcherry	Aileron Station	0.0078 - 0.021	<0.05	<0.05 - 1.18	0.0015 - 0.0589	<0.00025 - 0.0016
Reaphook Paleochannel	RC00061	Southern Basins - Reaphook	Eastern Whitcherry	Public Road	0.0275	<0.05	<0.05	0.0065	<0.00025
Ti Tree Basin Aquifer	RC00092	Ti Tree Basins	Ti Tree	Aileron Station	0.0245 - 0.0255	<0.01	<0.05 - 0.01	0.0005 - 0.0017	<0.00005
Unknown	RC00198	N/A	Unknown	Aileron Station	-	-	-	<0.01	-
Unknown	RC00222	N/A	Unknown	Aileron Roadhouse	0.0165 - 0.0205	<0.05	<0.1 - 0.08	0.001 - 0.0021	<0.00025
Unknown	RC00344	Margins Area	Unknown	Yambah Station	-	-	-	<0.01	-
Weathered Basement	RC00005	Southen Basins - Basement	Eastern Whitcherry	Aileron Station	0.015	<0.05	0.17 - 0.21	0.522 - 0.529	<0.00025 - 0.0003
Weathered Basement	RC00027	Southern Basins - RC00027 - Basement	Eastern Whitcherry	Aileron Station	0.018 - 0.0185	<0.01 - 0.1	<0.01 - 1.66	0.0137 - 0.0605	<0.00005
Weathered Basement	RC00062	Mine Area - Basement	Arunta Basement	Aileron Station	-	-	-	0.02 - 0.03	-
Weathered Basement	RC00063	Mine Area - Basement	Arunta Basement	Aileron Station	0.051 - 0.0655	<0.05	<0.05 - 0.14	0.0016 - 0.01	<0.00025
Weathered Basement	RC00064	Mine Area - Basement	Arunta Basement	Aileron Station	-	-	-	<0.01	-
Weathered Basement	RC00075	Mine Area - Basement	Arunta Basement	Aileron Station	0.017 - 0.022	<0.05	<0.05 - 0.45	<0.001 - 0.0037	<0.00025 - 0.0005
Weathered Basement	RC00078	Southern Basins - Basement	Arunta Basement	Aileron Station	0.047	<0.05	<0.05	0.0018	0.00025
Weathered Basement	RC00079	Southern Basins - Basement	Arunta Basement	Aileron Station	0.053	<0.05	<0.05	0.003	<0.00025
Weathered Basement	RC00081	Southern Basins - Basement	Arunta Basement	Aileron Station	0.059	<0.2	<0.2	0.0071 - 0.05	<0.001
Weathered Basement	RC00083	N/A	Arunta Basement	Aileron Roadhouse	0.0165	<0.05	0.18	0.0089	<0.00025
Weathered Basement	RC00086	Margins Area	Arunta Basement	Aileron Station	0.00435 - 0.00485	<0.05	<0.05	<0.01 - 0.0752	<0.00025
Weathered Basement	RC00098	Margins Area	Arunta Basement	Aileron Station	0.0015	0.01	0.18	0.0051	0.00015
Weathered Basement	RC00099	Margins Area	Arunta Basement	Aileron Station	0.0091 - 0.0105	<0.01	<0.01 - 0.12	0.0005 - 0.15	<0.00005

Statistical Summary - all sample events	Vanadium	Ytterbium	Yttrium	Zinc	Zirconium
Number of Results	138	138	138	150	137
Number of Detects	138	34	103	142	44
Minimum Concentration	0	0	0	0	0
Minimum Detect	0.00015	0.01	0.01	0.00025	0.00005
Maximum Concentration	0.0655	105	16.2	0.529	0.02
Maximum Detect	0.0655	105	16.2	0.529	0.02
Average Concentration	0.014	0.81	0.56	0.046	0.0004
Median Concentration	0.01	0.025	0.085	0.01	0.000125
Standard Deviation	0.013	8.9	1.8	0.092	0.0018
Number of Guideline Exceedances	0	0	0	125	0
Number of Guideline Exceedances(Detects Only)	0	0	0	119	0

Appendix G Hydraulic Pump Test Summaries

Arafura Bores NE Southern Basins

The Diverse Group, Pump Testing contractor, completed pump testing on the eight (8) *Arafura* NE Southern Basins Production Bores (see location map F1).

These bores are within the Reaphook Paleochannel, associated aquifers or adjacent bedrock aquifers as identified in table F1. Details on the construction of these bores are provided in tables F2 and F3.

Site ID	Site	RN #	Size nom	Easting GDA 53	Northing GDA 53	Property	Aquifers
			mm	m	m		
RC 22	PB 1	RN 19034	250	301273	7479847	Aileron	Reaphook Paleochannel
RC 28	PB 2	RN 18714	250	308061	7479250	Aileron	Adj Reaphook Paleochannel
RC 26	PB 4	RN 19038	150	281270	7488097	Napperby	Reaphook Paleochannel
RC 21	PB 6	RN 19033	250	294452	7482352	Napperby	Reaphook Paleochannel
RC 25	PB 7	RN 19037	150	288454	7483300	Napperby	Reaphook Paleochannel
RC 27	PB 8	RN 19039	150	304175	7484915	Aileron	Arunta Basement

Table F1 Location Arafura NE Southern Basins Investigation Production Bores

Site ID	Site	TD Comp	Drilled hole Ø	SWL bGL	Hole airlift	Cased airlift	Screens
		m	mm	m	L/sec	L/sec	m
RC 22	PB 1	136.0	349	18.48	40	10	260 mm steel SS screens
RC 28	PB 2	123.5	330	19.50	15.1	15	260 mm steel SS screens
RC 26	PB 4	153.0	203	27.47	50	8	153 mm steel slotted
RC 21	PB 6	95.5	349	15.51	20	10	260 mm steel SS screens
RC 25	PB 7	145.0	203	12.33	40	10	153 mm steel slotted
RC 27	PB 8	94.0	203	20.93	5	3.5	153 mm steel slotted

Table F2 Construction Details Arafura NE Southern Basins Investigation Production Bores

Site ID	Site	Drilling circulation	EC	Casing Steel Ø	Drilling Commenced	Drilling Completed	Drilling Contractor
			uS/cm	mm ID			
RC 22	PB 1	Air & mud	1900	250	13/05/14	30/05/14	L2 Drilling
RC 28	PB 2	Air & mud	2544	250	22/11/14	27/11/14	Diverse Group
RC 26	PB 4	Air	2938	153	6/06/14	18/06/14	L2 Drilling
RC 21	PB 6	Air & mud	2370	250	6/05/14	12/05/14	L2 Drilling
RC 25	PB 7	Air	2046	153	1/06/14	5/06/14	L2 Drilling
RC 27	PB 8	Air	1185	153	18/06/14	20/06/14	L2 Drilling

Table F3 Drilling Details Arafura NE Southern Basins Investigation Production Bores

Prior to construction of the production bores, investigation bores were drilled near the proposed site of the investigation production bores e.g. at P1 and P6. These bores were completed, either as permanent groundwater monitoring bores e.g. at 6A or as production bore observation bores e.g. at 1A, i.e. within the expected pump test drawdown cone of depression. Other investigation bores, completed as permanent monitoring bores, were drilled in the general vicinity of several of the production bores e.g. 1B, 1C and 6B. Details of these observation and monitoring bores are provided in table F4.

Site ID	Site	RN #	Casing	Easting GDA 53	Northing GDA 53	Distance To Prod	Bore Type
			ID mm	m	m	m	
RC 22	PB 1	RN 19034	250	301273	7479847		Investigation production bore
RC 15	1A	RN 19027	50	301280	7479870		PB1 observation bore
RC 17	1B	RN 19029	50	300810	7480879		Monitoring bore
RC 16	1C	RN 19028	50	300540	7478871		Monitoring bore
RC 28	PB 2	RN 18714	250	308061	7479250		Investigation production bore
RC 8	B2	RN 18876	125	308117	7479256		PB 2 observation bore
RC 26	PB 4	RN 19038	150	281270	7488097		Investigation production bore
RC 21	PB 6	RN 19033	250	294452	7482352		Investigation production bore
RC 18	6A	RN 19030	50	294434	7482372		Monitoring bore
RC 19	6B	RN 19031	50	239712	7482171		Monitoring bore
RC 20	6C	RN 19032	100	294467	7482369		PB 6 observation bore
RC 25	PB 7	RN 19037	150	288454	7483300		Investigation production bore
RC 27	PB 8	RN 19039	150	304175	7484915		Investigation production bore

Table F4 NE Southern Basins Reaphook Paleochannel Production Bore Monitoring Bores

Site ID	RN #	C/R test	Max d/dn	T	K	Storage	Comments
		L/sec	m	M^2/day	M/day		
RC 22	RN 19034	17	8.1	179	5.3		P1
RC 17	RN 19029		4.2	250	3.6	4.5×10^{-8}	RC 270 observation
RC 28	RN 18714	12	37				P2
RC 8	RN 18876		0.3	95	6.7	1.5×10^{-1}	
RC 12	RN 18879		0				No meas. response
RC 14	RN 19026		0				No meas. response
RC 26	RN 19038	10	3.5	775	27.8		P4
RC 21	RN 19033	11.2	7.3	225	4.4		P6
RC 20	RN 19032		2.7	225	4.4	9×10^{-4}	
RC 18	RN 19030		2.2	240	4.7	1.5×10^{-3}	
RC 25	RN 19037	10	8.1	250	2.6		P7
RC 24	RN 19036		1.4	375	3.9	7×10^{-4}	
RC 27	RN 19039	2.8	32.6	11.5	0.3		P8

Table F5 Arafura Pump Test Results "GHD" NE Southern Basins Reaphook Paleochannel & nearby Investigation Bores

Site ID	Site	RN #	Step test	C/R test	Rates	Aquifers
			step hrs	hrs	L/sec	
RC 22	PB 1	RN 19034	5 x 3		5/10/15/20/25	Reaphook Paleochannel
RC 22				31	17	
RC 28	PB 2	RN 18714	5 x 3		3/6/9/12/15	Adj Reaphook Paleochannel
RC 28				57	12	
RC 26	PB 4	RN 19038	3 x 2		4/8/12	Reaphook Paleochannel
RC 26				31	10	
RC 26	PB 6	RN 19033	3 x 6		5/10/15	Reaphook Paleochannel
RC 26				45.25	11.2	
RC 25	PB 7	RN 19037	3 x 2		4/8/12	Reaphook Paleochannel
RC 25				24.025	10	
RC 27	PB 8	RN 19039	3 x 2		1/2/3	Arunta Basement
RC 27				24	2.8	

Table F6 Arafura Pump Tests NE Southern Basins Reaphook Paleochannel & nearby Investigation Production Bores

Site ID	RN #	Size nom	Easting GDA 53	Northing GDA 53	Property	Aquifers
		mm	m	m		
RC 268	RN 13206	150	276119	7488979	Napperby	Sand lenses within clay
RC 270	RN 13208	150	276140	7488928	Napperby	Sand lenses within clay
RC 271	RN 13209	150	277378	7479690	Napperby	LA - ssd and fract quartzite
RC 275	RN 13213	150	278322	7481194	Napperby	Coarse sands
RC 281	RN 13219	150	275826	7483357	Napperby	silcrete
RC 297	RN 15890	152	278163	7481448	Napperby	Silcrete, sand gravels

Table F 7 NE Southern Basins Production Bores Laramba Aquifer Patty Well & North of Patty Well to Gimcrack Bore

Site ID	RN #	Casing	Easting GDA 53	Northing GDA 53	Distance To Prod	Bore Type
		ID mm	m	m	m	
RC 270	RN 13208	150	276158	7488976		Invest production bore Gimcrack
RC 268	RN 13206	open	301280	7479870		RC 270 observation bore
RC 269	RN 13207	50	300810	7480879		Monitoring bore
RC 112	RN 6867	150	300540	7478871		Monitoring bore Abd Gimcrack
RC 271	RN 13209	150	277642	7479662		Invest production bore Patty's
RC 272	RN 13210	125	277621	7479685		RC 271 observation bore
RC 275	RN 13213	150	278242	7481165		Laramba production bore # 1
RC 276	RN 13214	50	278262	7481195		RC 275 observation bore
RC 281	RN 13219	150	275826	7483357		Abd Invest production bore
RC 282	RN 13220	50	275800	7483357		Monitoring bore

Table F 8 NE Southern Basins Production Bore Observation Bores Laramba Aquifer & Patty Well & North of Patty Well

Site ID	RN #	Yield	Max d/dn	T	Resid T	Storage	Comments
		L/sec	m	M^2/day	M^2/day		
RC 270	RN 13208	1.52	48.3	2.2	5.3		Gimcrack Prod bore
RC 268	RN 13206		3.3	1.1		2.3×10^{-4}	RC 270 observation
RC 269	RN 13207		7.3	2.0		2.6×10^{-4}	RC 270 Mon bore
RC 112	RN 6867		4.9	3.8		1.6×10^{-4}	Abd Gimcrack mon
RC 271	RN 13209	5.5	11.7	101	90		Invest production bore Patty's
RC 272	RN 13210		0.8	158	185	3.4×10^{-4}	RC 271 observation
RC 275	RN 13213	11.64	15.3	92	167		Laramba prod # 1
RC 276	RN 13214		1.4	255	362	1.0×10^{-3}	RC 275 observation
RC 281	RN 13219	10.37	36.9	72	54		Abd Invest prod bore
RC 282	RN 13220		6.1	396		4.3×10^{-2}	Monitoring bore
RC 297	RN 15890	6.05	2.7	183			Laramba prod # 2

Table F 9 NTG Pump Test Results NE Southern Basins Laramba Production Bores & Nearby Investigation Production Bores

Appendix H *Arafura* NE Southern Basins Aquifer Systems

The primary aquifers of the NE Southern Basins with fair to brackish groundwater in storage which have been located to date are the deep and shallow Reaphook Paleochannel aquifers and associated high yielding aquifers in the deep Reaphook “herringbone” paleochannels from the north and adjacent paleochannel south of the southern shoulder of the Ngalia Basin.

The Reaphook Paleochannel occurs in the Eastern Whitcherry Basin where it overlies the synclinal Palaeozoic Ngalia Basin basal unit and Arunta basement rock. The Herringbone paleochannels which join the Reaphook Paleochannel along its northern side overlie and are separated by subcrop of Arunta basement rock.

Hussey and GHD include the basal unit of the Ngalia Basin below the Reaphook Paleochannel and the underlying Arunta Basement rock both as basement rock. The basal Ngalia Basin unit has been subject to considerable structural deformation at different locations in this area and is not believed to be present below the full length of the Reaphook Paleochannel. Most of the *Arafura* investigation bores drilled into the Reaphook Paleochannel were not drilled into basement, either they reached their target depth or the high bore yields prevented drilling further with air circulation. Investigation bore 6A was drilled into a very high yielding fracture zone in the basal Vaughan Springs Quartzite at 218 m bGL below the high yielding massive boulder sand and gravel beds of the Reaphook Paleochannel.

The Reaphook Paleochannel commences east of *Arafura* Production Bore P1 (RN 19034) and is plunging downwards to the west at least as far as Day Creek, 40 km to the west. The *Arafura* AEM model only continues to just west of Day Creek but it is probable that the paleochannel continues much farther west into the main sector of the Whitcherry Basin below Yalpirakinu ALT which, from mineral exploration drilling, intersected deep alluvial/colluvial sediments and then continued westward through other Cenozoic Basins.

Appendix I *Arafura* NE Southern Basins Borefield Development

Five (5) *Arafura* NE Southern Basins Borefields have been established within SW Aileron Station and central eastern sector of Napperby Station.

Currently there is one production bore in each borefield and these are investigation production bores, not high standard permanent production bores. They were constructed to assess particular aquifers and inform the construction of future high standard production bores. These bores are planned to be used for construction and initial operation of the mine.

It is expected that up to five (5) permanent production bores will be constructed in each borefield subject to the results of borefield investigations to be completed during the development and early operational phase of the mine.

The Reaphook production bores will be large diameter, screened and gravel packed with the screen aperture and gravel pack selected following sieve analysis of the aquifers being screened. The potable water production bores may be 150 mm or 200 mm diameter and possibly inert casing.

Borefield investigations will involve drilling groundwater investigation bores within each borefield to assess the hydrogeological variations across the borefields, select the best sites for construction of production bores based on the hydrogeology and minimisation of bore interference and possible environmental effects. This data will also be used to site high standard monitoring bores for borefield and water resource management. These bores are to be constructed at the best locations both inside and outside the borefield areas based on the results from the investigation drilling programs. Groundwater quality monitoring bores need to be cased with inert casing and preferably a minimum of 100 mm ID.

Data loggers will be installed in production, observation and monitoring bores. Infiltrometers will be installed in the borefields and at selected locations where groundwater quality indicates surface infiltration zone. The Infiltrometers are to be set at various depths up to 1.2 m to monitor infiltration from rainfall.

In addition to the borefield investigations, recharge investigations and monitoring bores for resource recharge monitoring and for the *Arafura* (GHD) numerical model will be required. Other monitoring bores will be required downgradient of the treatment plant and other mine infrastructure including south of the main mine access road.

The recharge investigations are to include drilling deep investigation and monitoring bores within the herringbone feeder paleochannels to the Reaphook Paleochannel, shallow investigation and monitoring bores along Day Creek, deep investigation monitoring bores in the feeder channel from the west (north of bore N1) and the Reaphook area S and SW of bore 6B. These investigations are to include a similar scope (range) of groundwater investigations as the borefield investigations.

The borefield investigations will include down hole geophysical logging (groundwater probe suite), downhole 360° imaging, soils and strata sampling, aquifer sampling and sieve analysis, hydraulic pump testing, slug tests, use of the AEM geophysical model, isotope sampling (for groundwater age assessment and strontium as a tracer); gas sampling, standard chemical laboratory analysis and selected trace metal, field water quality testing, land surveying to accurately determine bore GL and height of standing water levelling measuring point/GPS, testing for presence of stygofauna.

The investigations may also require EM survey, cored bores and drone aerial photography over selected areas of the NE Southern Basins.

Appendix J Plates: Selected Photographs

1. Drilling *Arafura* Investigation Bores NE Southern Basins
2. Installing casing, stainless steel screens and slotted casing *Arafura* Production Bores and Monitoring Bores NE Southern Basins
3. Installing gravel pack or stabiliser in *Arafura* Production Bores and Monitoring Bores NE Southern Basins
4. Developing *Arafura* Investigation Production Bores NE Southern Basins
5. Water Sampling *Arafura* Investigation Bores NE Southern Basins
6. Soil Sampling *Arafura* Investigation Bores NE Southern Basins
7. Strata Sampling *Arafura* Investigation Bores NE Southern Basins
8. Bore Headworks *Arafura* Investigation Production Bores NE Southern Basins
9. Hydraulic Pump Testing *Arafura* Investigation Production Bores NE Southern Basins
10. Water Sampling during Pump Testing *Arafura* Production Bores NE Southern Basins
11. Bulk Water Sampling *Arafura* Production Bores NE Southern Basins
12. Gas Sampling *Arafura* Production Bores NE Southern Basins
13. Downhole Geophysical Logging *Arafura* Investigation Bores NE Southern Basins
14. Baseline Standing Water Level Monitoring *Arafura* Investigation Production Bores NE Southern Basins

Murranji Drillers completed the stage 1 rapid water exploration program using a T3 Drilling Rig and air circulation. The 3 small photos are L2 Drillers drilling bores in the Reaphook Paleochannel

Diverse Resources Group drilling PB2 a 250 mm ID steel cased gravel packed bore with inline stainless steel screens using Pac R mud circulation using a T3W Drilling Rig

L2 Drillers completed the majority of the stage 2 water bores using a Schramm Drilling Rig

Three different drilling contractors using heavy duty water bore drilling rigs completed the bores using air and mud circulation.

Client: Arafura Resources Ltd: Nolan Project Aileron, NT

Drilling Arafura NE Southern Basins Water Investigation Bores

NE Southern Basins Groundwater Investigation Program

Ride Consulting

Plate 1

Update:

file: 2017 08 24 plate 1 Drill ver 1.1

L2 Drillers casing *Arafura* Reaphook Paleochannel production bore P1

Arafura Reaphook Paleochannel production bores P1, P2 & P6 were drilled as gravel packed or use of stabiliser using Pack R mud circulation and 250 mm ID steel casing and inline stainless steel screens.

Production bores P4, P7 & P8 were drilled using air circulation and cased with 150 mm steel casing slotted opposite aquifers.

The monitoring bores were cased with either 50 mm or 100 m class 12 PVC casing slotted opposite the main aquifers and either a sand gravel pack or stabiliser with top bentonite seals

L2 Drillers installing stabilser from the bulka bags into the annulus between the drilled hole and casing string. A 200 L drum was used to control the flow rate to ensure a complete pack opposite the stainless steel screens.

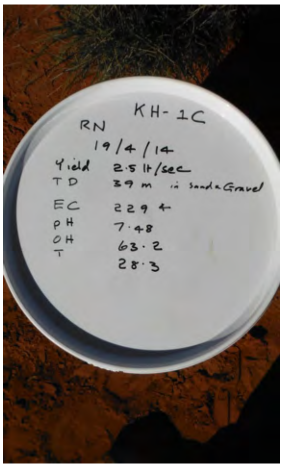
Arafura Reaphook Paleochannel production bores P1, P2 & P6 were drilled as gravel packed or use of a 5 mm aggregate stabiliser with bentonite pellet seal above the stabiliser.

A stabilser or sand pack was also placed opposite the slots of the monitoring bores.

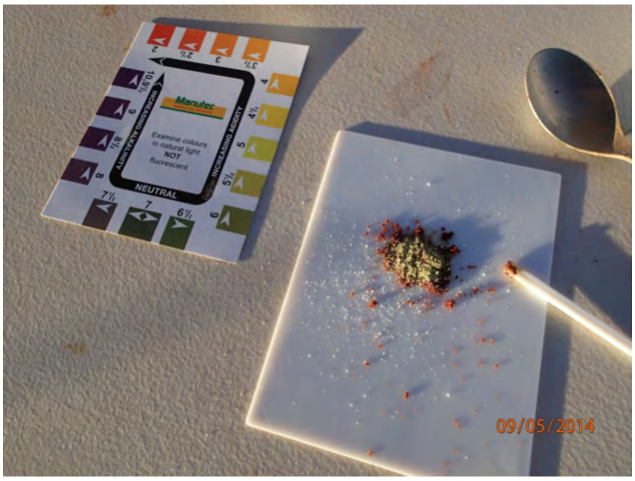
L2 Drillers developing *Arafura* Reaphook Paleochannel production bore P1 to develop removing the fine to medium sand immediately opposite the screens. Required 2 days of development use of a surging tool.

The majority of the NE Southern Basins groundwater investigation bores were not developed but were cleaned out of drill cuttings prior to running the casing string. The 6 production bores were cleaned out after running the casing. The three 250 mm diameter gravel and stabiliser packed production bores were drilled using mud circulation. Samples of aquifer strata were take for sieve analysis to assist design of the permanent high standard production bores planned to be constructed for the operation of the *Arafura* Nolans Mine.

A large number of drilling water samples collected at the end of the bluey line were field tested to provide an indication of the water quality changes with depth drilled.



20 L bucket water samples were taken every rod (6m) following intersection of aquifers. EC, pH, T & OH were measured in the field and from these analyses buckets were selected for standard chemical and trace metal laboratory analyses after the sediment had settled. The samples were then placed in ice and remained in refrigeration until analysed in the Darwin NTEL Laboratory.



Soil samples were taken during drilling all the NE Southern Basins Bore for field pH testing and depot salinity testing. A set of soil samples were collected in chip trays and plastic sample bags for the soil sample library.

The samples were taken at the bore head at 1 m intervals over the first 6 metres drilled.

Update:

file: 2017 08 24 plate 6 soil ver 1.0

Client: Arafura Resources Ltd: Nolan Project Aileron, NT
NE Southern Basins Drilling Soil Samples

NE Southern Basins Groundwater Investigation Program

Ride Consulting

Plate 6

Grab strata samples were taken during drilling all the NE Southern Basins Bores at 3 m intervals. Representative sets of strata samples were placed chip trays and plastic sample bags for the *Arafura* strata sample library.

All samples were logged by geologists and a hydrogeologist.

All *Arafura* groundwater investigation bores were constructed to meet Austrlian Standards and NTG regulations.

Surface casing was cement grouted, bentonite seals were placed below the water table, concrete collars were installed, steel headworks with padlocked covers were installed on all monitoring bores and investigation production bores.

Constant Rate & 4 stage pump test Bore RC # 31 (bore site P1)

Update:

file: 2017 08 17 plate 9 PT ver 1.0

Client: Arafura Resources Ltd: Nolan Project Aileron, NT
Hydraulic Pump Testing Program 6 Production Bores

NE Southern Basins Groundwater Investigation Program

Ride Consulting

Plate 9

20 L water samples taken during hydraulic pump testing for field water analysis and photographs of sediment pumped during the tests.

Water samples for field water analysis EC, OH & pH; bore RC # 21 (bore site PB 6)

All of the 6 bores tested pumped no sediment over most of the pump testing.

Aquifer water samples were taken for laboratory standard chemical (ADWQ) and trace metal analyses by the pump test crew at the end of the constant rate tests on each of the 6 bores pump tested.

Bulk water sample (1000 litres) taken from RC # 22 (PB1) for ore metallurgical testing, pod flushed using pumped groundwater. Twenty litre plastic drums being flushed for isotope water sample testing.

Flushing out plastic water sample drums

Isotope water samples taken in 20 L blue drums at end of constant rate test

Bulk ground water sample taken from one bore (RC # 22: PB 1); 20 litre samples for future isotope laboratory analysis taken at end of constant rate test from each of the 6 investigation production bores pump tested.

Client: Arafura Resources Ltd: Nolan Project Aileron, NT
Bulk Water Sampling during Hydraulic Pump Testing Program

Update:

file: 2017 08 17 plate 11 Gas ver 1.0

NE Southern Basins Groundwater Investigation Program

Ride Consulting

Plate 11

Gas entrapped in Reaphook Paleochannel aquifer being collected during hydraulic pump test on bore RC # 26 (bore site 4A)

Discharging pumped groundwater into Day Creek from bore RC # 26 (4A) note the gas bubbles

Gas collected in20 litre glass bottles & sealed for lab analysis

Gas samples were obtained from the 6 production bores in the Reaphook Paleochannel during hydraulic pump testing; it is not known if the gas was the result of bore development with air following completion of drilling or if the gas (air) was naturally entrapped in the aquifer. No gas bubbles are evident in the bore standing water levels. The gas has no odour and is not radioactive.

Client: Arafura Resources Ltd: Nolan Project Aileron, NT
Down the Hole Geophysical Logging & Imaging

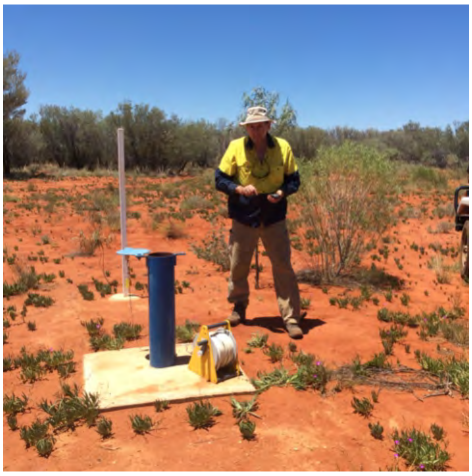
NE Southern Basins Groundwater Investigation Program

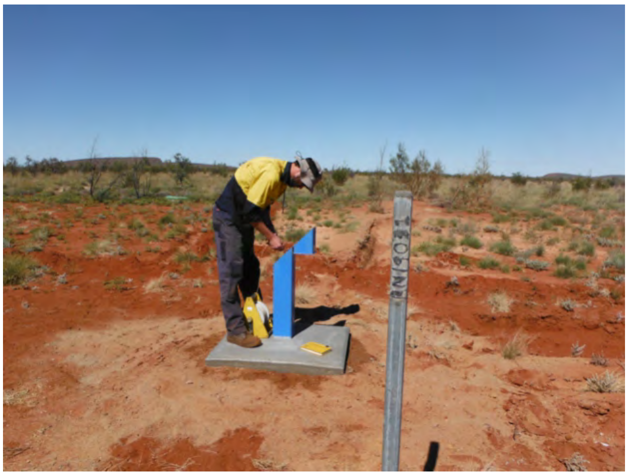
Ride Consulting

Plate 13

Update:

file: 2017 08 17 plate 13 DH ver 1.0

Baseline standing water level are periodically measured each year over the NE Southern Basins, Nolans Arunta Basement and selected bores in the Ti Tree Basin.

There is a short run which takes 3 to 4 days and a long run which takes 5 to 7 days depending on condition of the bore access tracks and vegetation adjacent and across these tracks.

Most SWL's are measured using Ott sounders, a tape and plopper is required in a few bores.

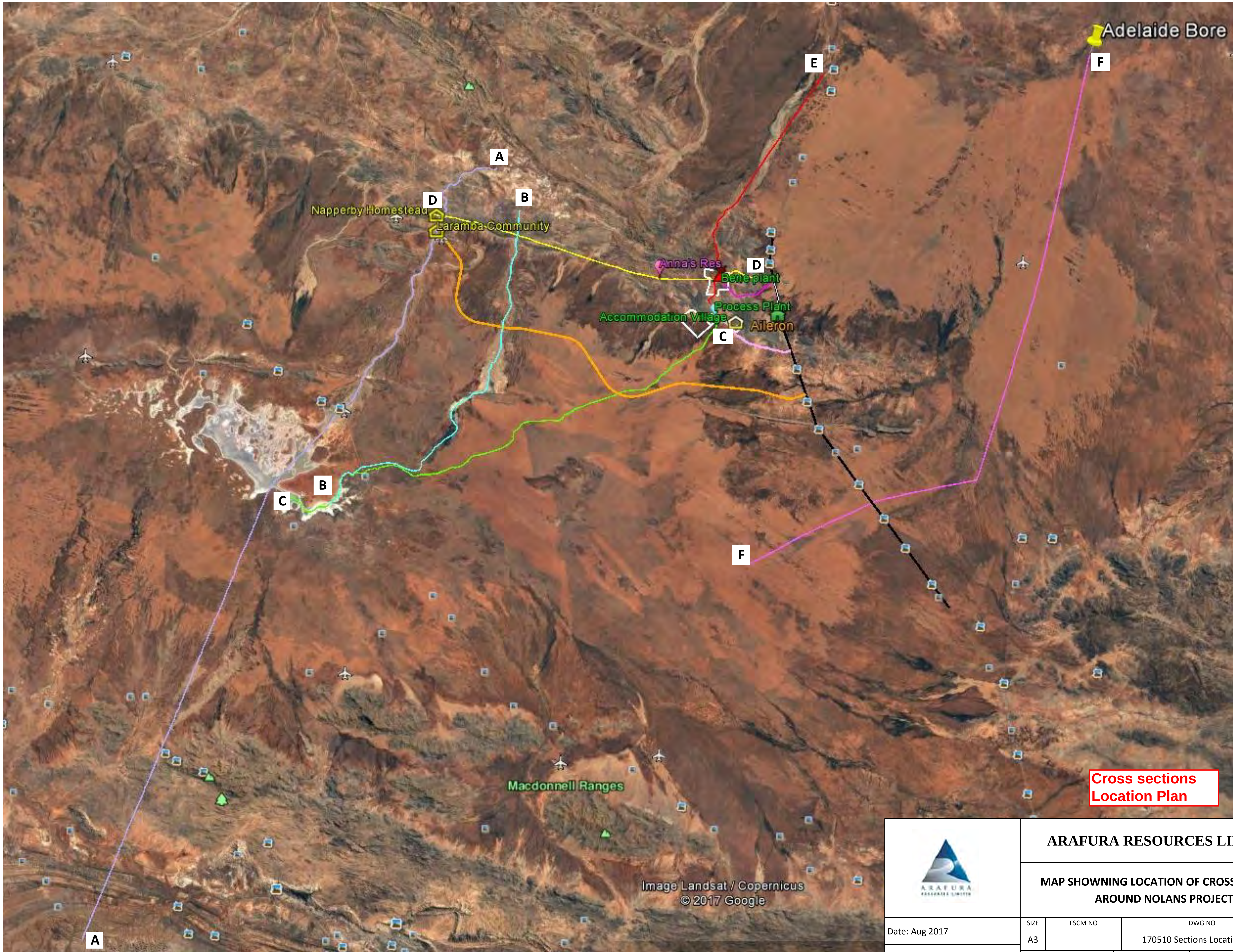
Appendix K *Cross sections, Maps & Drawings*

Cross sections

- Cross sections Location Plan
- Cross section 1: “FF” Old Fred’s Bore to Adelaide Bore through Margins
- Cross section 2: “CC” Lake Lewis to Proposed Plant Site
- Cross section 3: “BB” West MacDonnell Ranges to Yalyirimbi Ranges via Day Creek
- Cross section 4: “AA” West MacDonnell Ranges to Yalyirimbi Ranges via Napperby Creek
- Cross section 5: “DD” Napperby Creek to Mount Boothby via 20 mile Waterhole, Anna’s Reservoir and Nolan Bore
- Cross section 6: “CE” Proposed Plant Site to Ti Tree Farms

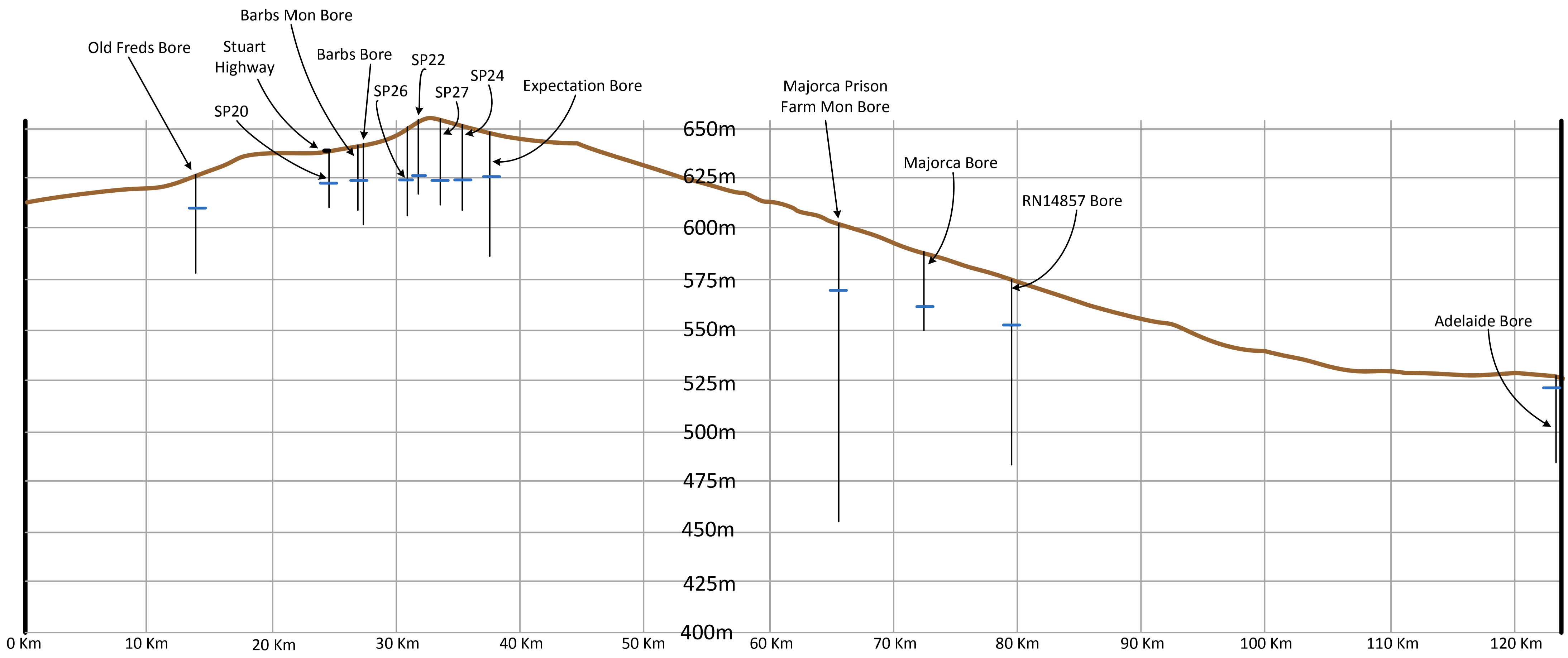
Maps

- Figure 1: Nolans Project Location Map (GHD Map)
- Figure 2: Regional Basins and Paleochannels Location Map (GHD Map)
- Figure 3: Water Bore Locations NE Southern Basins (GHD Map)
- Figure 4: AEM Conductance Map Slice NE Southern Basins & part of Ti Tree Basin
- Figure 5: Simplified schematic of Reaphook Paleochannel (GHD Drawing)
- Figure 6: Cross-section through Bores Reaphook Paleochannel
- Figure 7: Google Image of NE Southern Basins Region
- Figure 8: NE Southern Basins *Arafura* Borefields
- Figure 9: NE Southern Basins Possible Future *Arafura* Borefields
- Figure 10: NE Southern Basins *Arafura* Borefields AR Water Resource Zones
- Figure 11: NE Southern Basins Aquifers & Thickness of Sediments
- Figure 12: NE Southern Basins Groundwater Quality Zones
- Figure 13: NE Southern Basins Surface Water Map
- Figure 14: AEM Conductance & Satellite Image NE Southern Basins
- Figure 15: Ti Tree Basin Water Control District (NTG Map)
- Figure 16: Ti Tree Basin Water Control District (NTG Map)
- Figure 17: Shuttle Radar Surface Catchment of Southern Basins
- Figure 18: Shuttle Radar Eastern Southern Basins DEM 10 m contours
- Figure 19: Eastern Southern Basins DEM
- Figure 20: Arafura Nolans Hydrostations Location Map



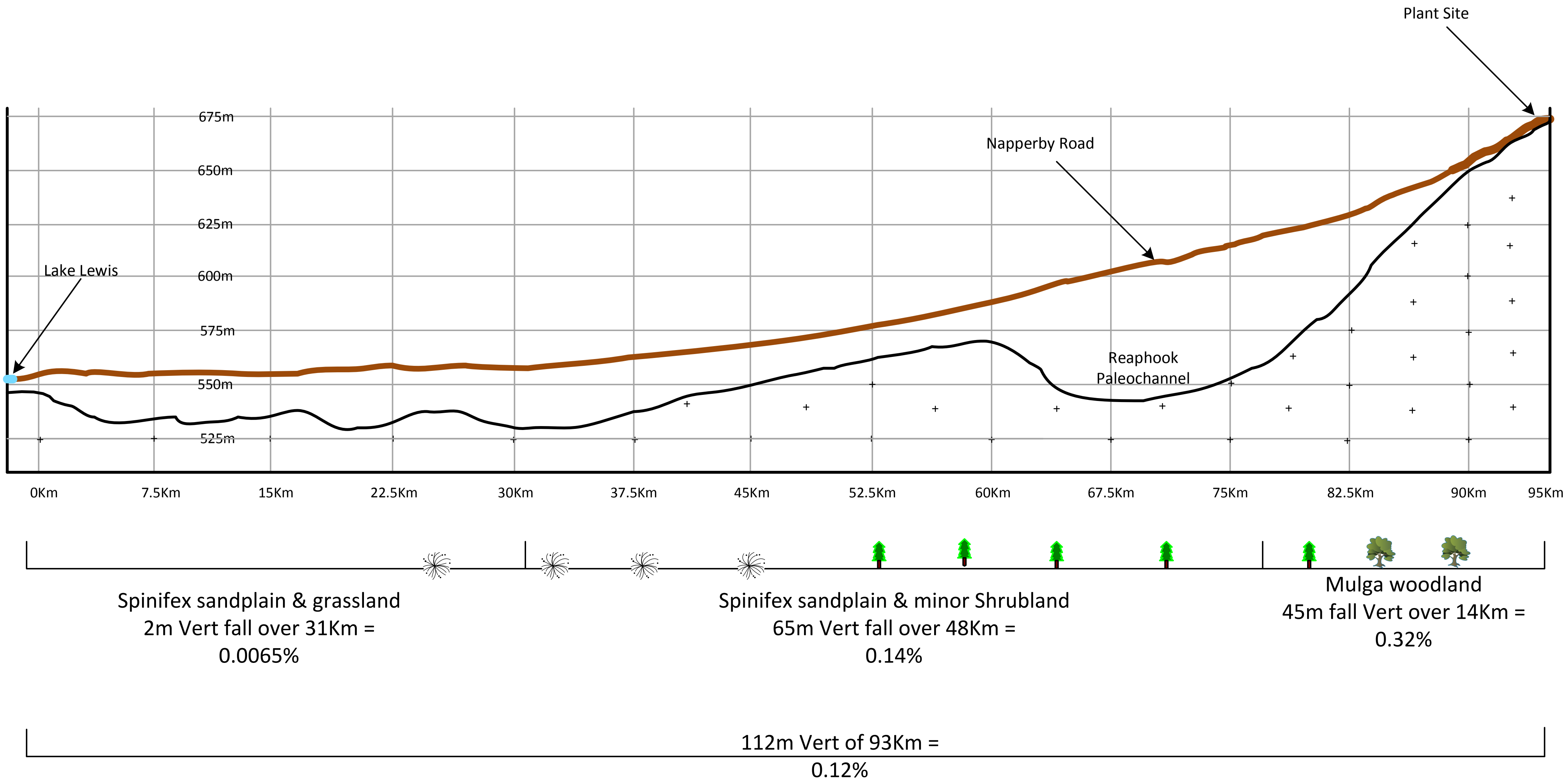
ARAFURA RESOURCES LIMITED				
MAP SHOWNING LOCATION OF CROSS SECTIONS AROUND NOLANS PROJECT				
Date: Aug 2017	SIZE A3	FSCM NO	DWG NO 170510 Sections Location Plan	REV
Drawn by: B Fowler	SCALE 1 : 1		SHEET 1 OF 1	

Section Old Fred's Bore to Adelaide Bore
Via Margins



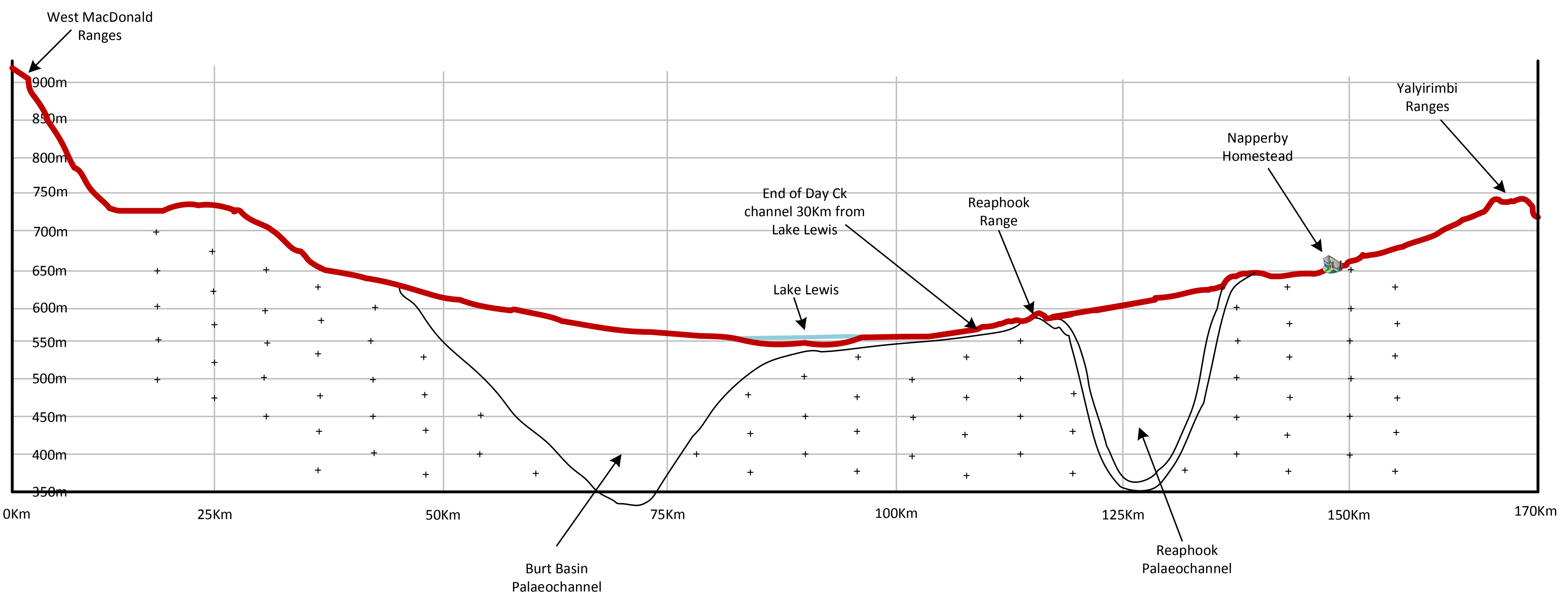
Cross section 1: "FF" Old Freds Bore to Adelaide Bore through Margins

Section Lake Lewis to Proposed Plant Site



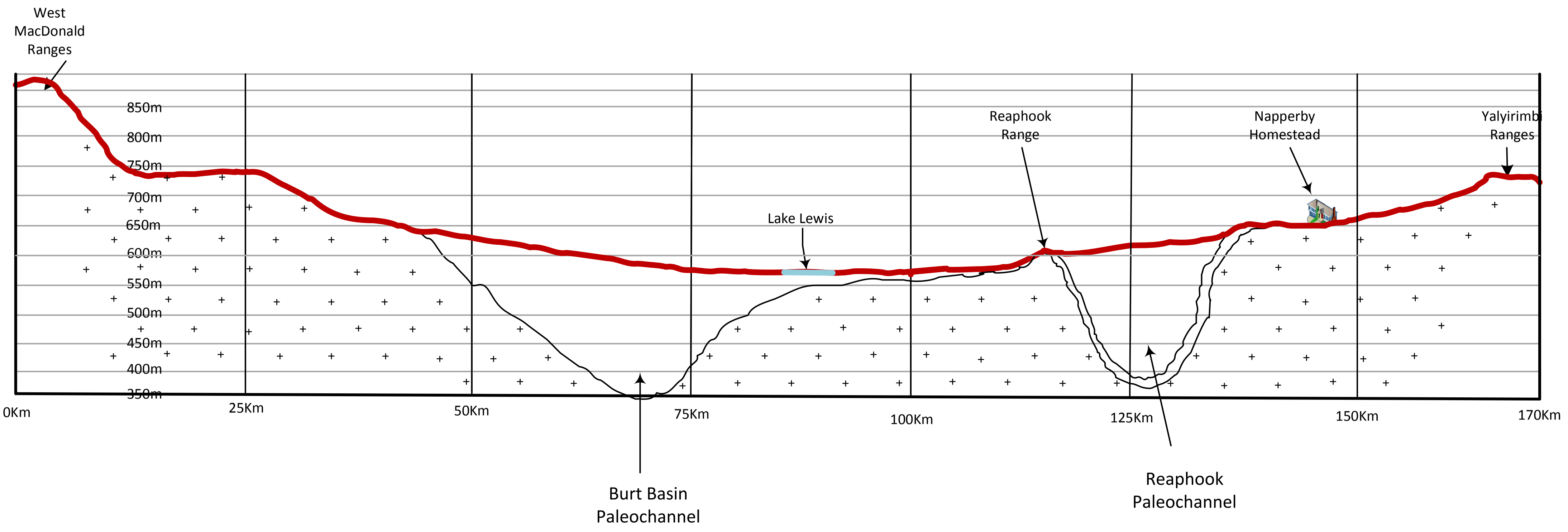
Cross section 2: "CC" Lake Lewis to Proposed Plant Site

West MacDonald Ranges to Yalyirimbi Ranges
Via Day Creek



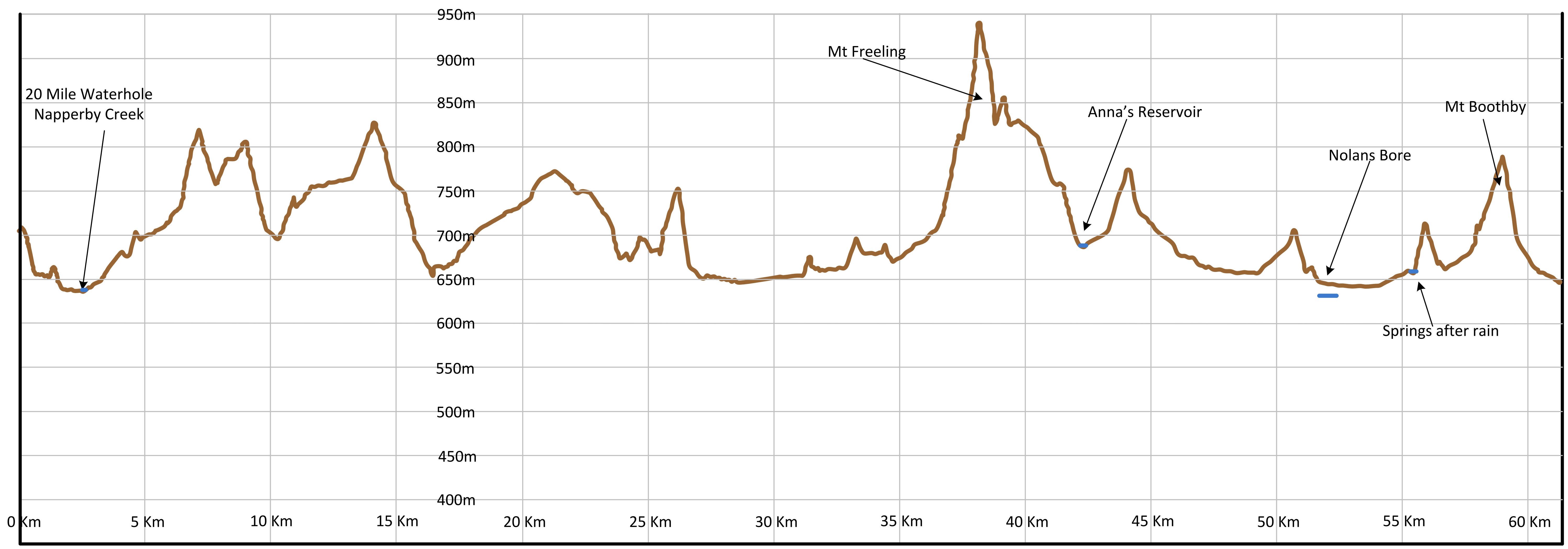
Cross section 3: "BB" West MacDonnell Ranges to Yalyirimbi Ranges via Day Creek

Section West MacDonald Ranges to Yalyirimbi Ranges via Napperby Creek



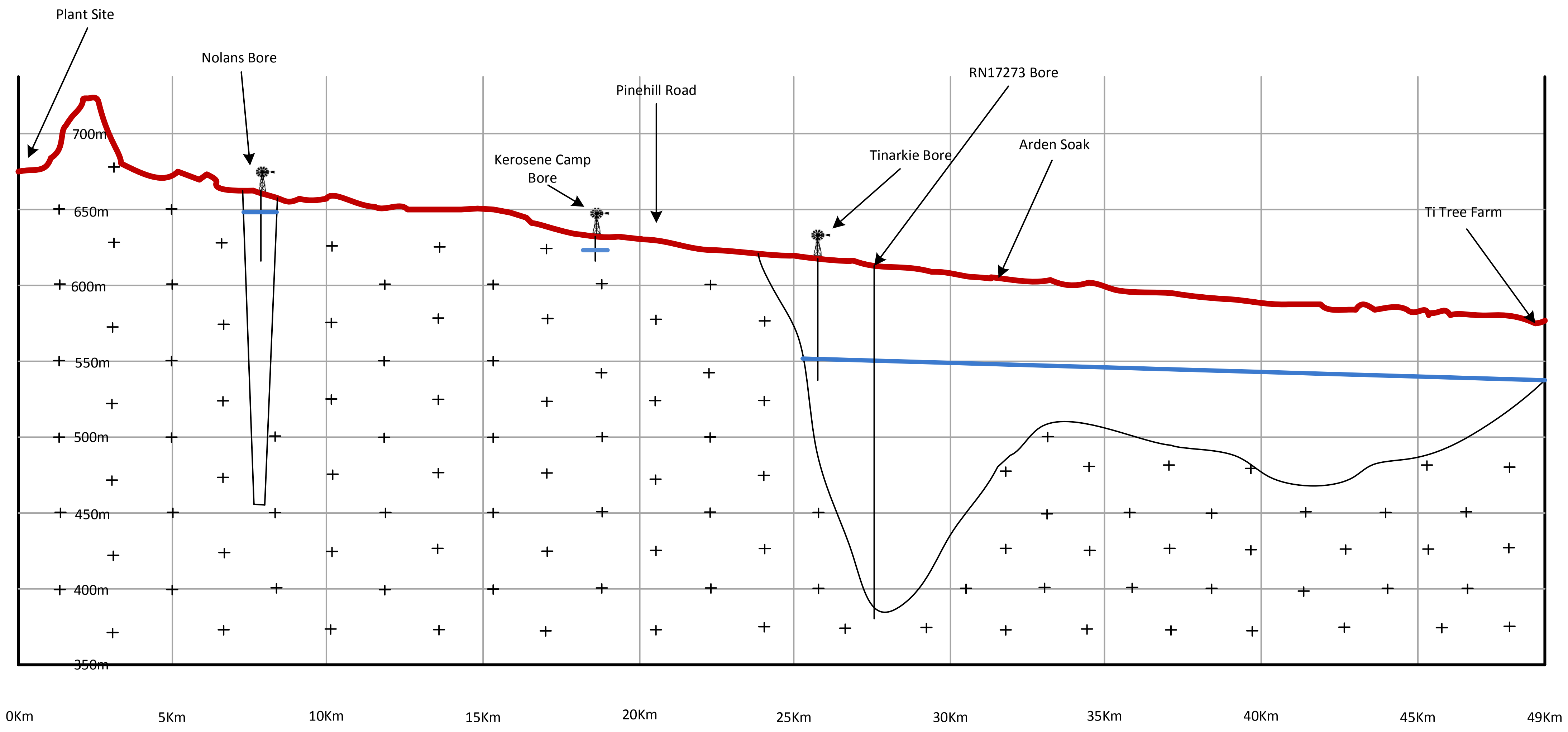
Cross section 4: "AA" Weast MacDonnell Ranges to Yalyirimbi Ranges via Napperby Creek

Section Napperby Creek to Mt Boothby
via 20mile Waterhole, Anna’s Reservoir and Nolans Bore

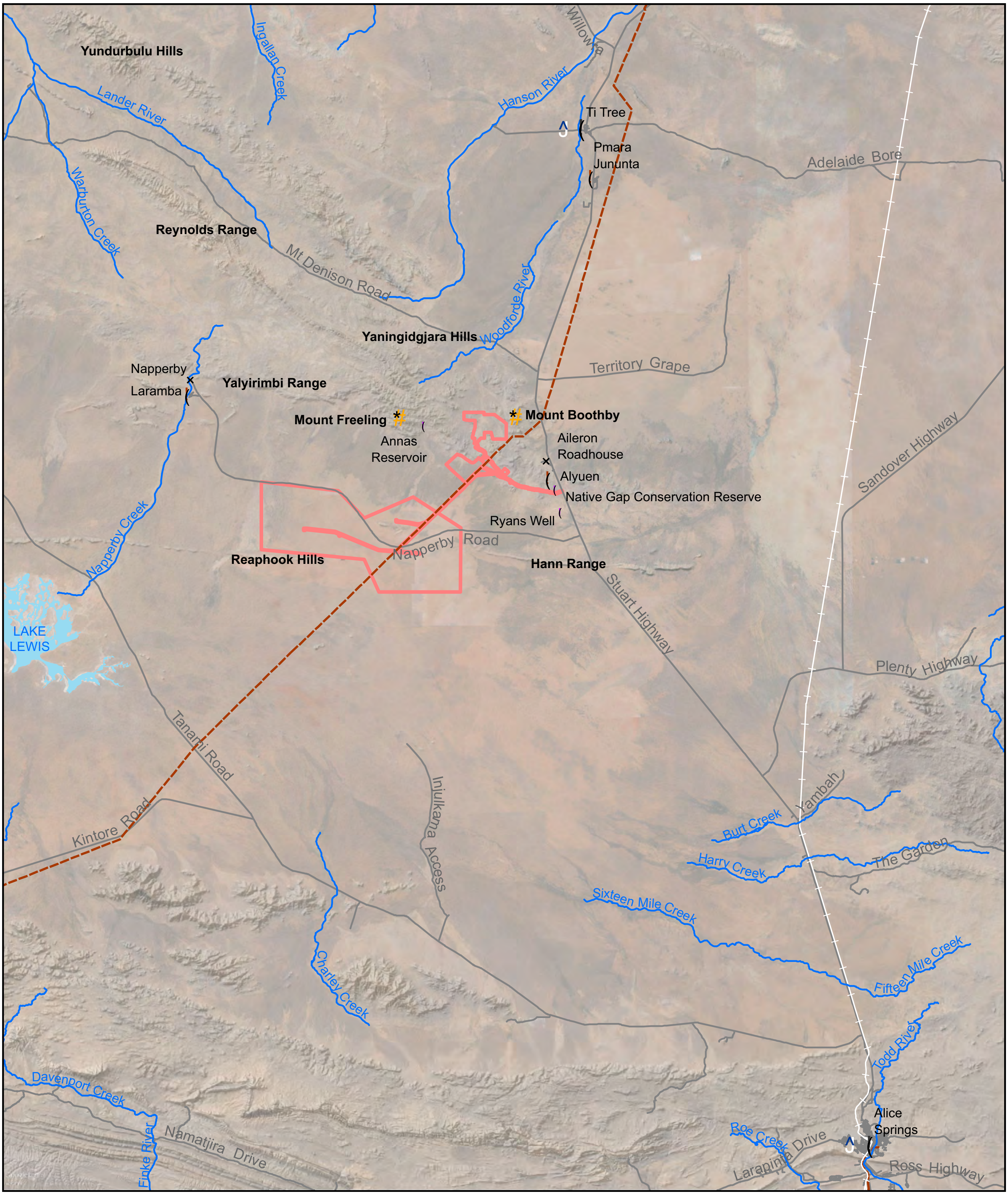


Cross section 5:"DD" Napperby Creek to Mount Boothby via 20 Mile Waterhole, Anna's Reservoir and Nolan Bore

Plant Site to Ti Tree Farms through Nolans



Cross section 6: "CE" Proposed Plant Site to Ti Tree Farms through Nolans



LEGEND

Town	Station	Major Roads
Community	Site of Interest	Gas Pipeline
Mountain	Airport	Major Waterways
Project Areas	Waterbodies	

1:900,000 @ A4

0 10 20 30

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53

Arafura Resources Limited
Nolans Project

Job Number 43-22301
Revision 0
Date 18 Mar 2016

Location map

Figure 1

G:\43\22301\GIS\Maps\4322301_561_LandMarksWaterFeature.mxd

Level 5, 66 Smith Street Darwin NT 0800 Australia T 61 8 8982 0100 F 61 8 8981 1075 E drwmail@ghd.com W www.ghd.com

Data source: GA - Roads, Waterways, Placenames, Placenames, Lakes (2015). ESRI - Shaded Relief (2009). Google Earth Pro - Imagery (Date extracted: 15/12/2015). ARL - Project Areas (2015). Created by: CM

1:3,000,000 @ A4

0 25 50 75 100

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53

LEGEND

Roads	Ti Tree Basin	Mackay (Wilkinkarra)	Lake Lewis Basin
Groundwater Study Area	**Distant Basins & Palaeovalleys**	Waite Basin	Mount Wedge Basin
Southern Basins Borefield	Bundey Basin	**Southern Basins**	Whitcherry Basin
Lakes	Hanson Basin	Burt Basin	The Margins

Arafura Resources Limited
Nolans Project

Job Number	4322301
Revision	0
Date	22 Mar 2016

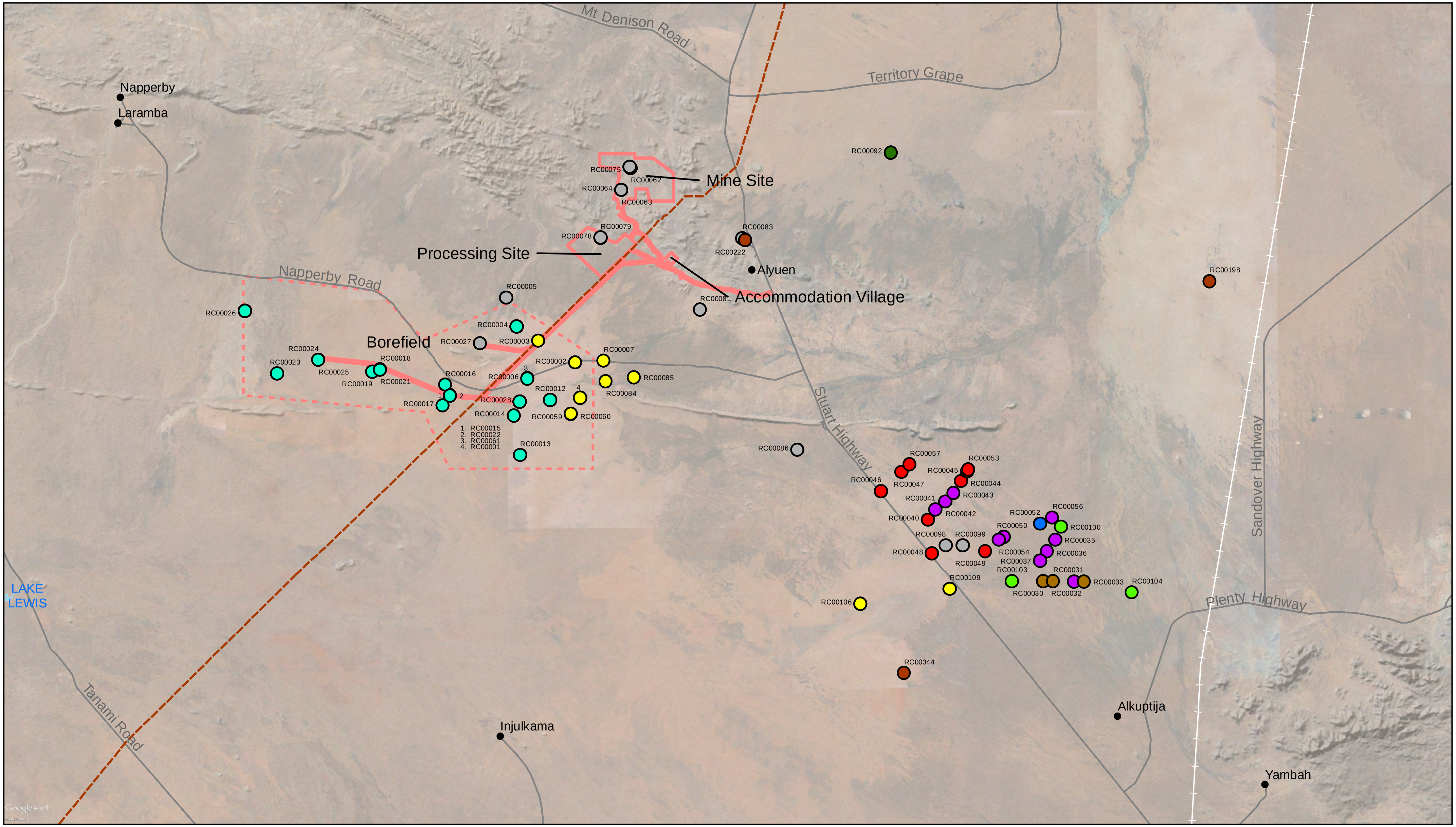
Regional Basins and Palaeovalleys

Figure 2

G:\43\22301\GIS\Maps\4322301_605_RegionalBasinsPalaeovalleys.mxd

Level 5 66 Smith Street Darwin NT 0800 Australia **T** 61 8 8982 0100 **F** 61 8 8981 1075 **E** drwmail@ghd.com **W** www.ghd.com

Data source: Google Earth Pro - Imagery (Date extracted: 14/05/2015). GA - Roads, Lakes, Placenames, Palaeovalleys (2015). GHD - Groundwater Study Area, Southern Basins Borefield (2015). Created by: CM



1:500,000 @ A4

0 5 10 15 20

Kilometres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 53

N

LEGEND

Main Aquifer

- Alluvial
- Alluvial/Fluvial
- Calcrete
- Calcrete/Alluvial
- Calcrete/Alluvial/Fluvial
- Calcrete/Basement
- Reaphook Paleochannel
- Ti Tree Basin Aquifer
- Weathered Basement
- Unknown
- Gas Pipeline
- Major Roads
- Project Areas
- Borefield Area
- Waterbodies

Arafura Resources Limited
Nolans Project

Water Bore Locations

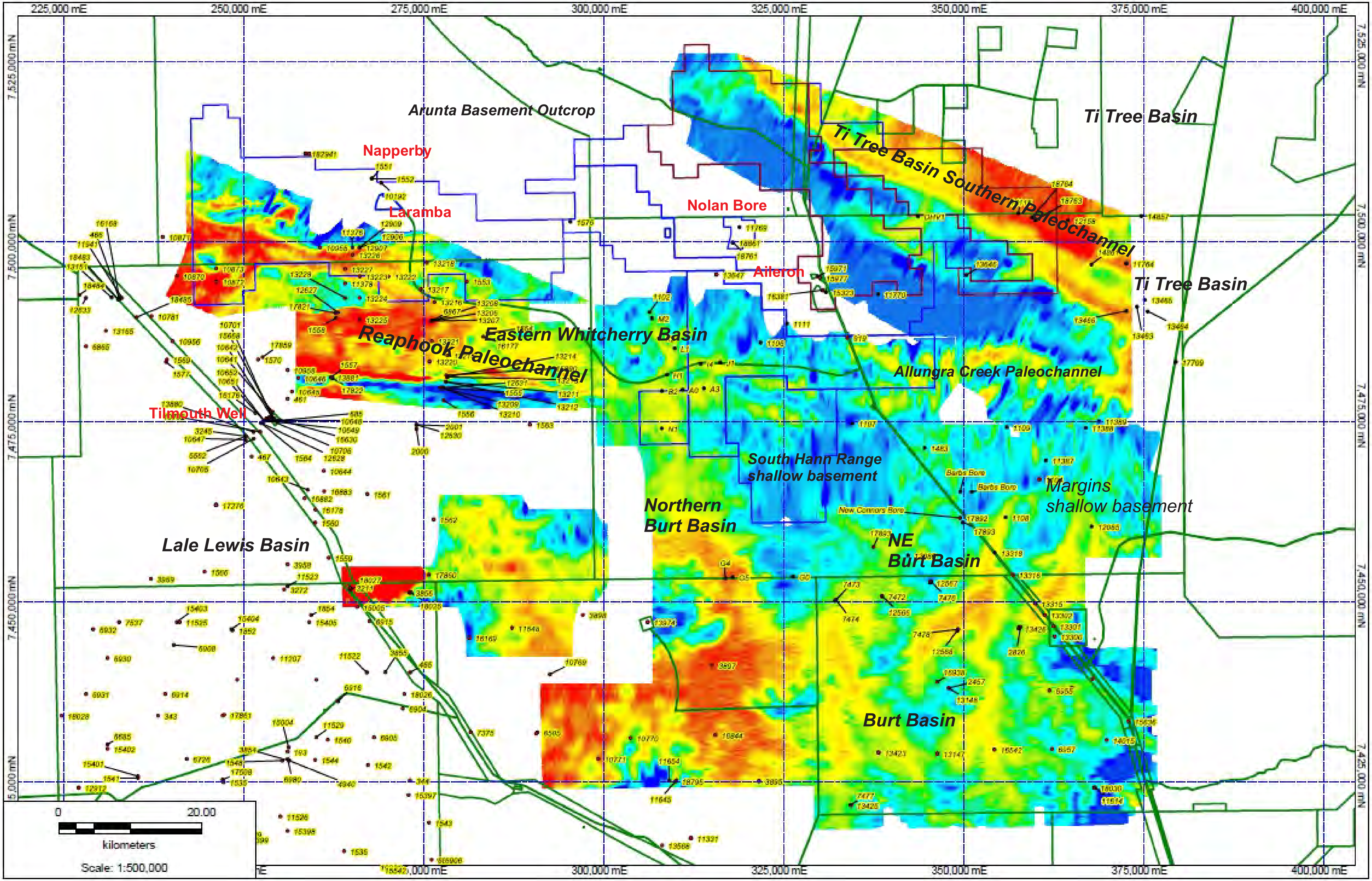
Job Number	4322301
Revision	0
Date	05 May 2016

Figure 3

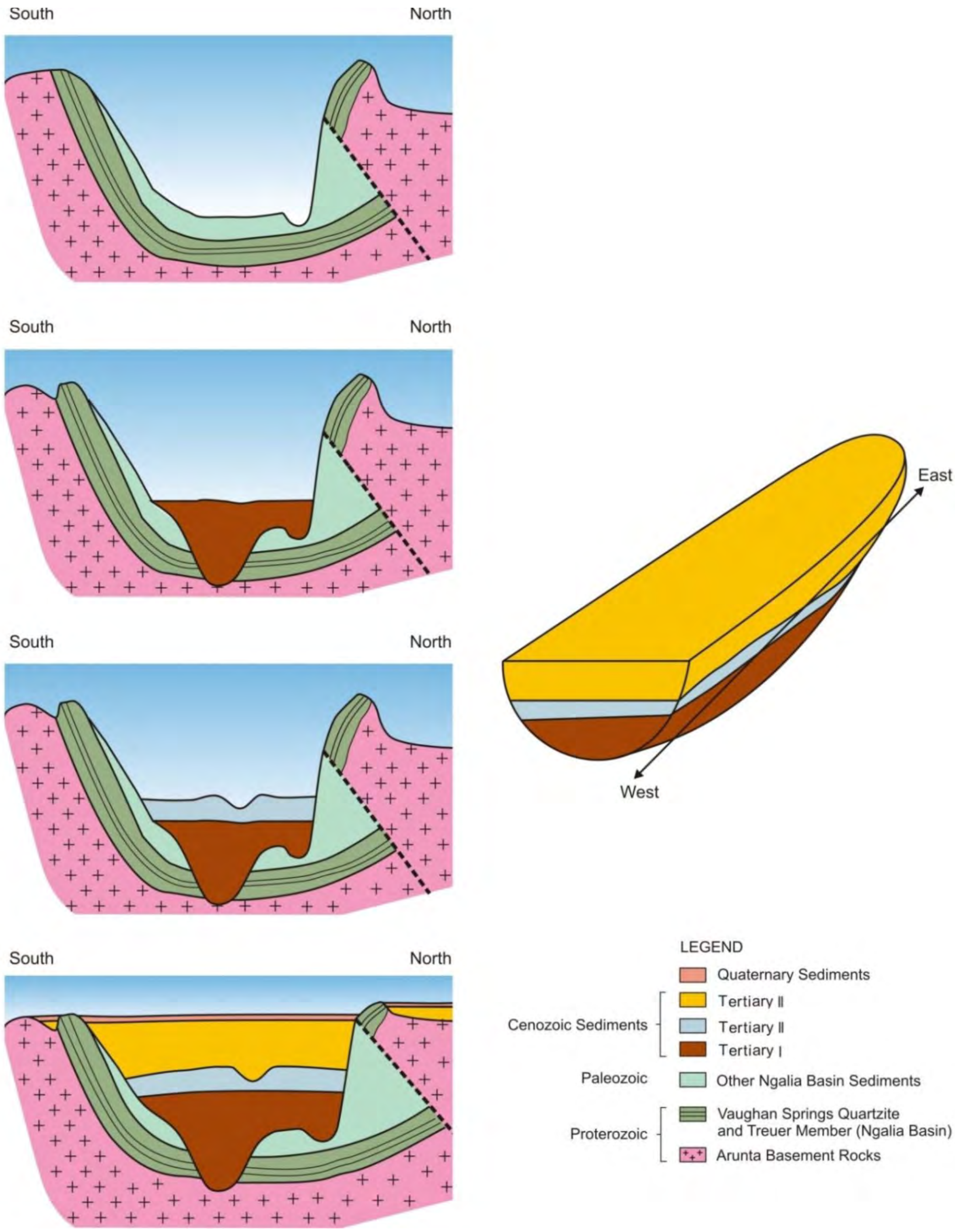
G:\43\22301\GIS\Maps\4322301_601_GroundSamplesAquiferType.mxd

Level 5 66 Smith Street Darwin NT 0800 Australia T 61 8 8982 0100 F 61 8 8981 1075 E drwmail@ghd.com W www.ghd.com

Data source: Google Earth Pro - Imagery (Date extracted: 04/02/2015). Ride - Groundwater Data (2015). ARL - Project Areas (2015). GA - Placenames, Railways, Gas Pipeline, Major Roads, Waterbodies (2015). Created by: CM



AEM Conductance Map Slice NE Southern Basins & section of Southern Ti Tree Basin **Figure 4**



GHD **Simplified geological conceptual model across the Reaphook Palaeochannel, Southern Basins north of the Hann Range and Reaphook Hills (vertically exaggerated), and an idealised orthogonal view of the basin hydrogeological units (Cenozoic Sediments)**

Figure 5

Schematic Cross Section Through Arafura Resources Ltd Groundwater Investigation North Eastern Southern Basins *** December 2015 Section 1 West to East

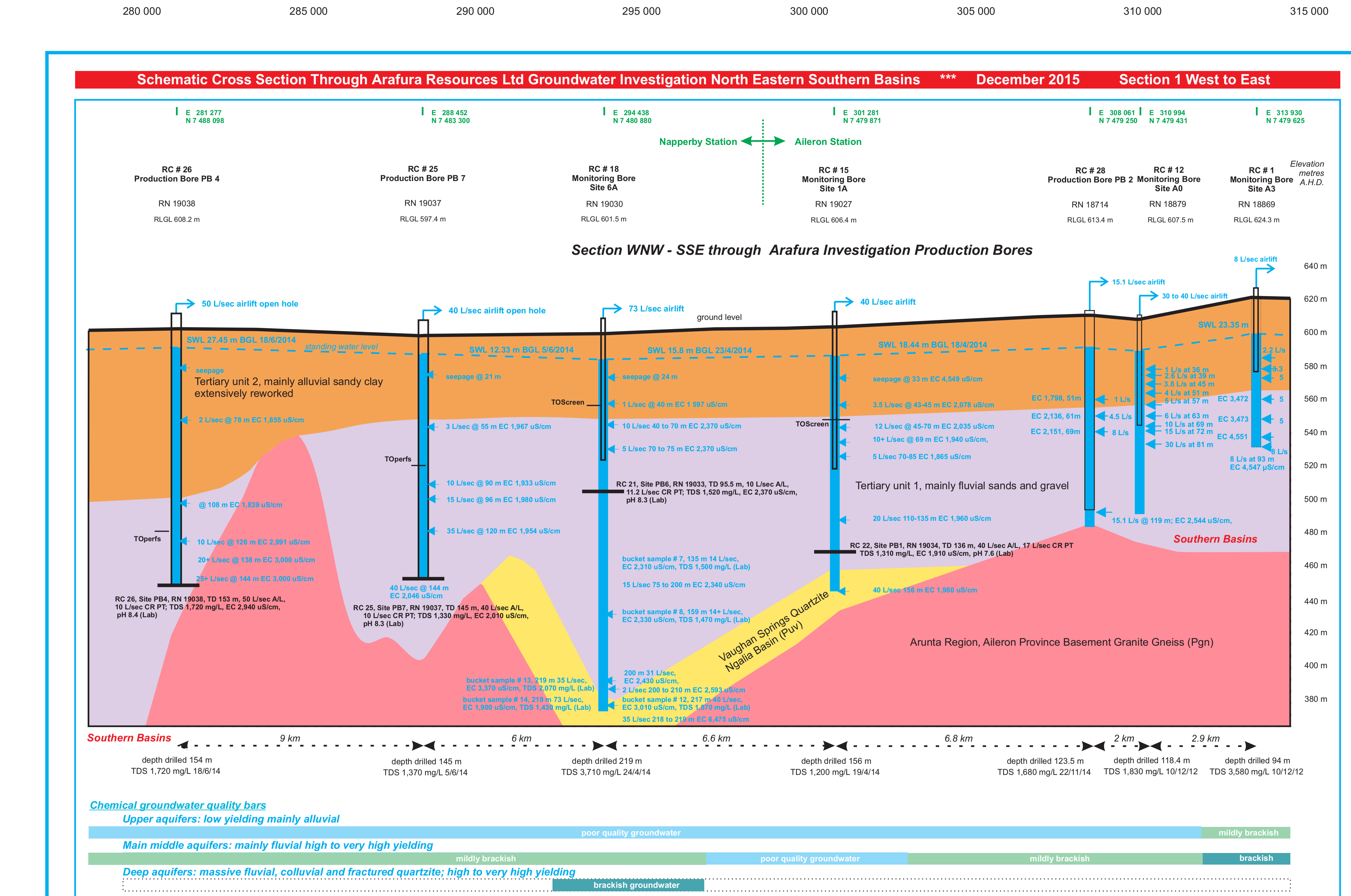
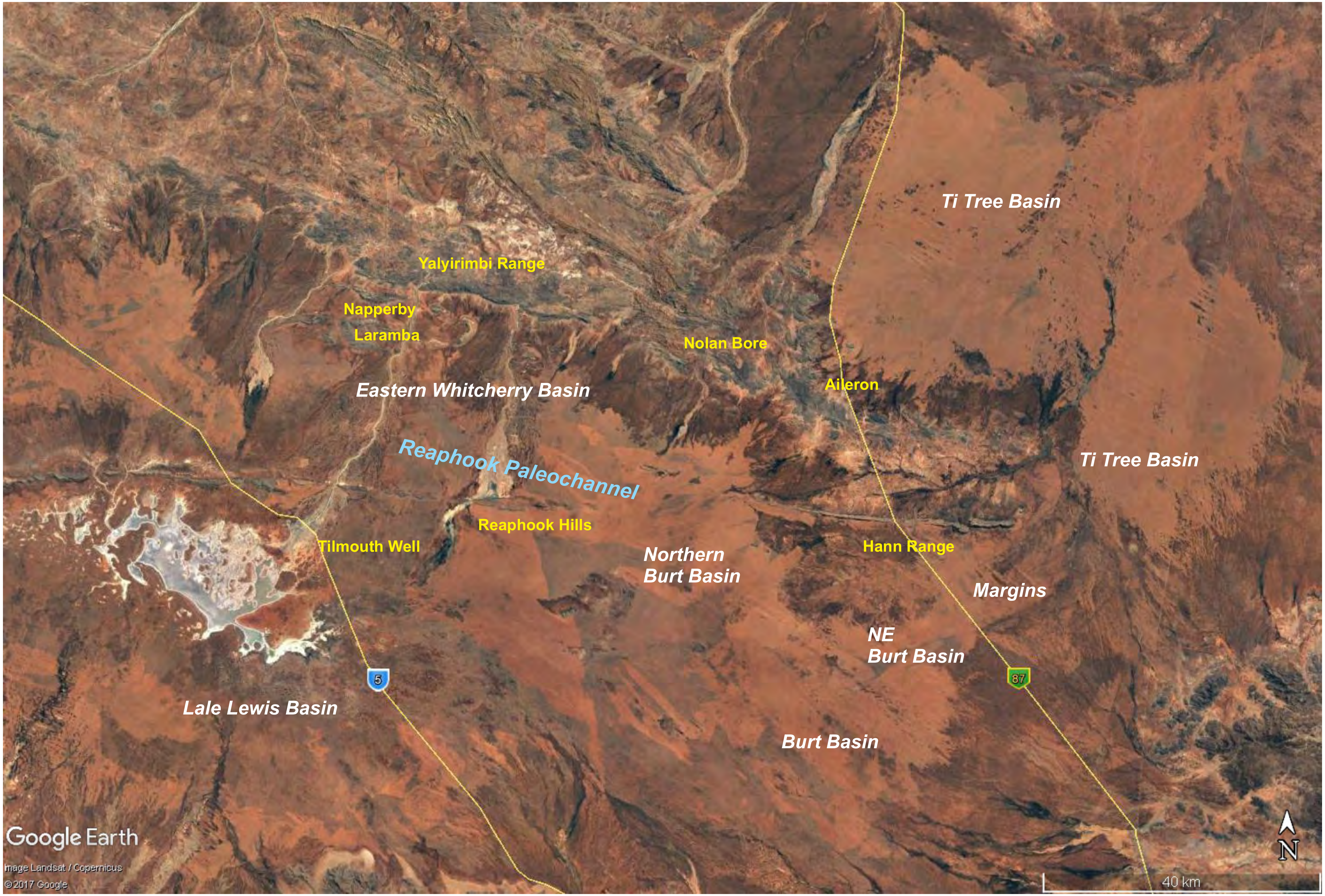
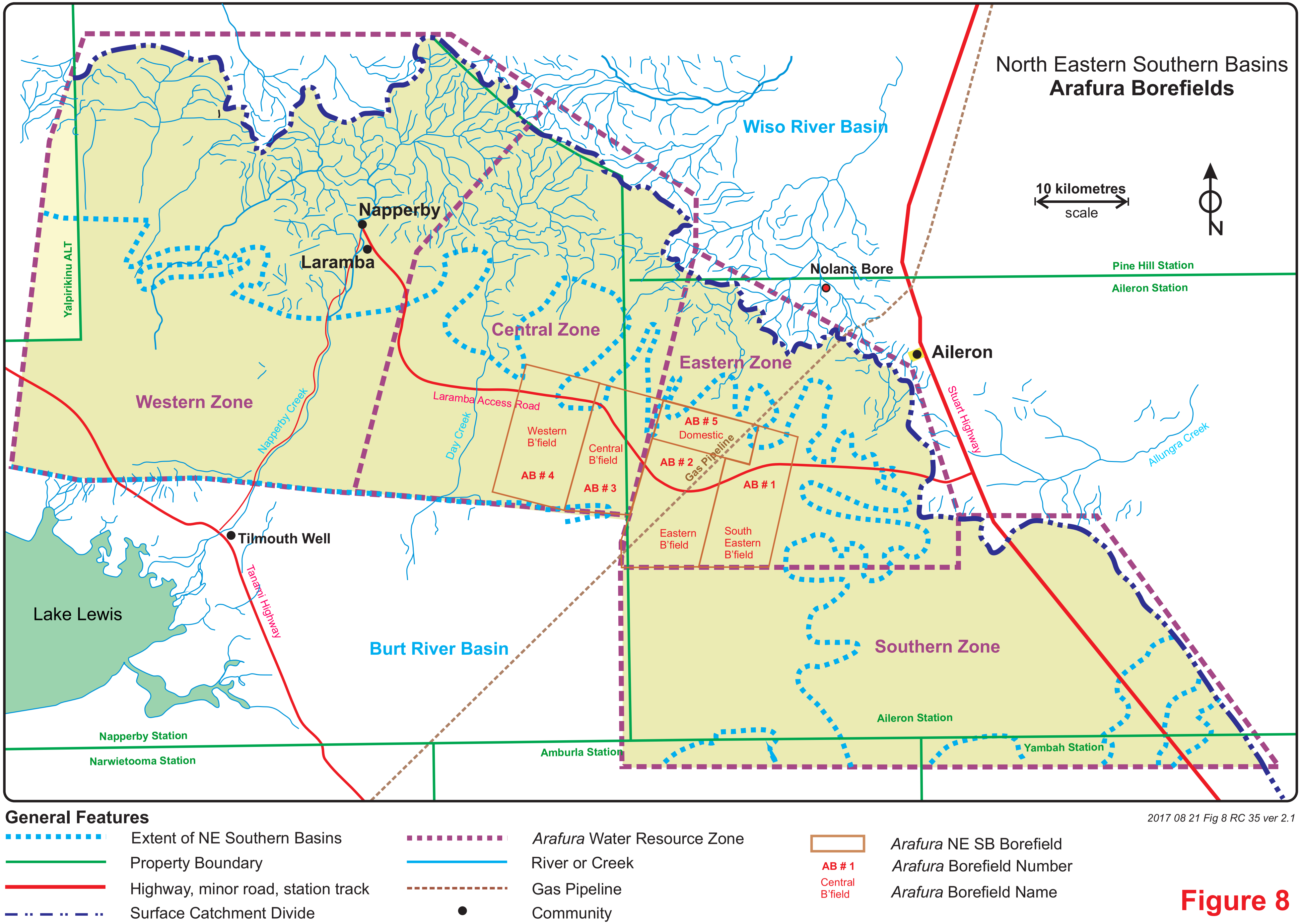


Figure 6



Google Image NE Southern Basins Region **Figure 7**



North Eastern Southern Basins
Arafura Borefields
10 kilometres
scale
N
Wiso River Basin
Burt River Basin
Western Zone
Central Zone
Eastern Zone
Southern Zone
Napperby
Laramba
Nolans Bore
Aileron
Tilmouth Well
Lake Lewis
Yalpirikinu ALT
Pine Hill Station
Aileron Station
Napperby Station
Narwietooma Station
Amburla Station
Yambah Station
Stuart Highway
Tanami Highway
Laramba Access Road
Napperby Creek
Day Creek
Allungra Creek
Gas Pipeline
AB # 5
Domestic
AB # 2
AB # 1
AB # 3
AB # 4
Western B'field
Central B'field
Eastern B'field
South Eastern B'field
General Features
Extent of NE Southern Basins
Property Boundary
Highway, minor road, station track
Surface Catchment Divide
Arafura Water Resource Zone
River or Creek
Gas Pipeline
Community
Arafura NE SB Borefield
AB # 1
Central B'field
Arafura Borefield Number
Arafura Borefield Name
2017 08 21 Fig 8 RC 35 ver 2.1

Figure 8

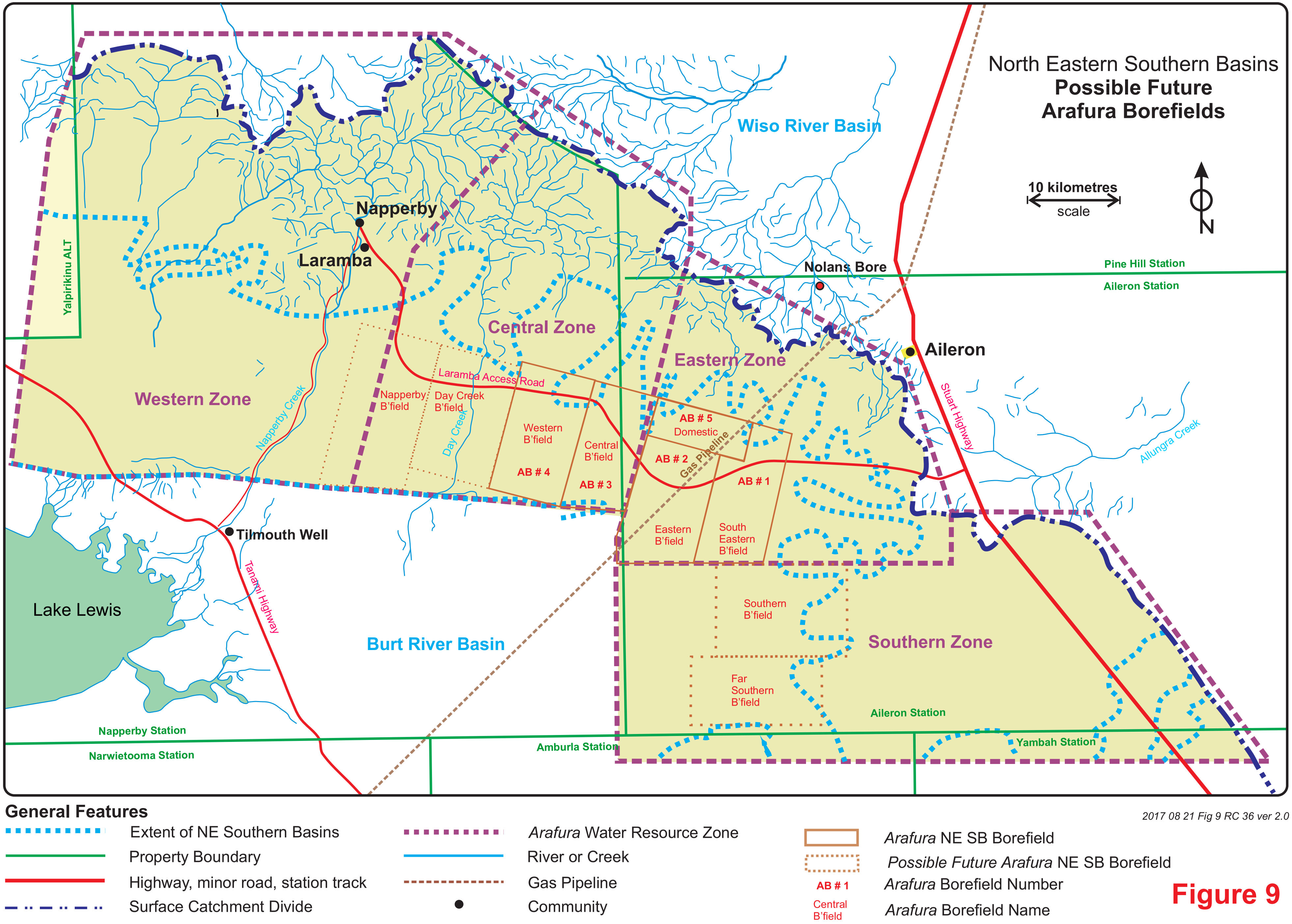
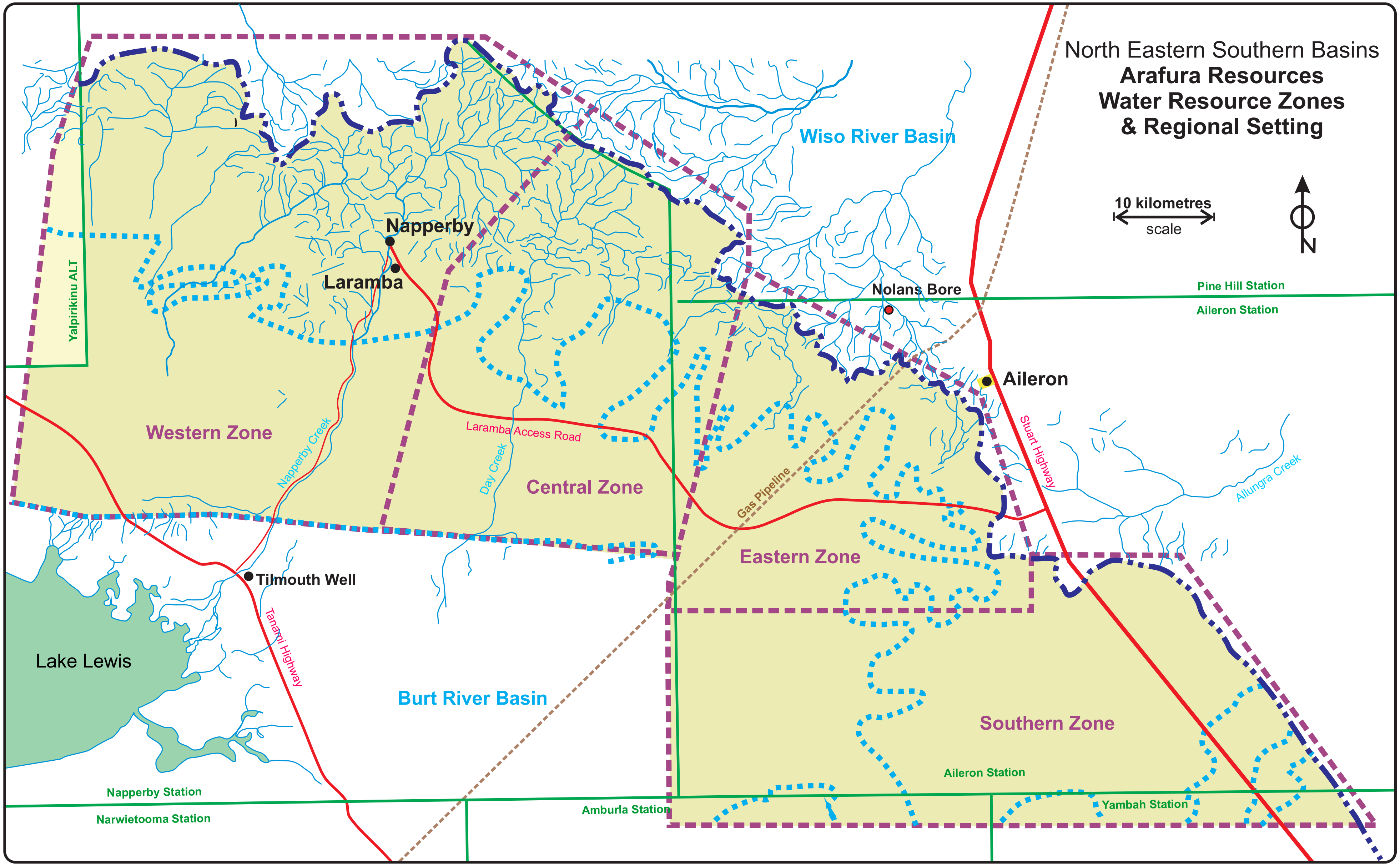

North Eastern Southern Basins
Possible Future
Arafura Borefields
10 kilometres
scale
N
Wiso River Basin
Burt River Basin
Western Zone
Central Zone
Eastern Zone
Southern Zone
Napperby
Laramba
Nolans Bore
Aileron
Tilmouth Well
Lake Lewis
Stuart Highway
Tanami Highway
Laramba Access Road
Gas Pipeline
Napperby Creek
Day Creek
Allungra Creek
Yalpirikinu ALT
Pine Hill Station
Aileron Station
Napperby Station
Narwietooma Station
Amburla Station
Yambah Station
Napperby B'field
Day Creek B'field
Western B'field
Central B'field
AB # 4
AB # 3
AB # 5
Domestic
AB # 2
AB # 1
Eastern B'field
South Eastern B'field
Southern B'field
Far Southern B'field
General Features
Extent of NE Southern Basins
Property Boundary
Highway, minor road, station track
Surface Catchment Divide
Arafura Water Resource Zone
River or Creek
Gas Pipeline
Community
Arafura NE SB Borefield
Possible Future Arafura NE SB Borefield
AB # 1
Arafura Borefield Number
Central B'field
Arafura Borefield Name
2017 08 21 Fig 9 RC 36 ver 2.0

Figure 9



General Features

············	Extent of NE Southern Basins	▪▪▪▪▪▪▪▪	*Arafura* Water Resource Zone
———	Property Boundary	———	River or Creek
———	Highway, minor road, station track	--------	Gas Pipeline
— ·· — ·· —	Surface Catchment Divide	●	Community

2017 08 21 Fig 10 RC 32 ver 2.1

Figure 10

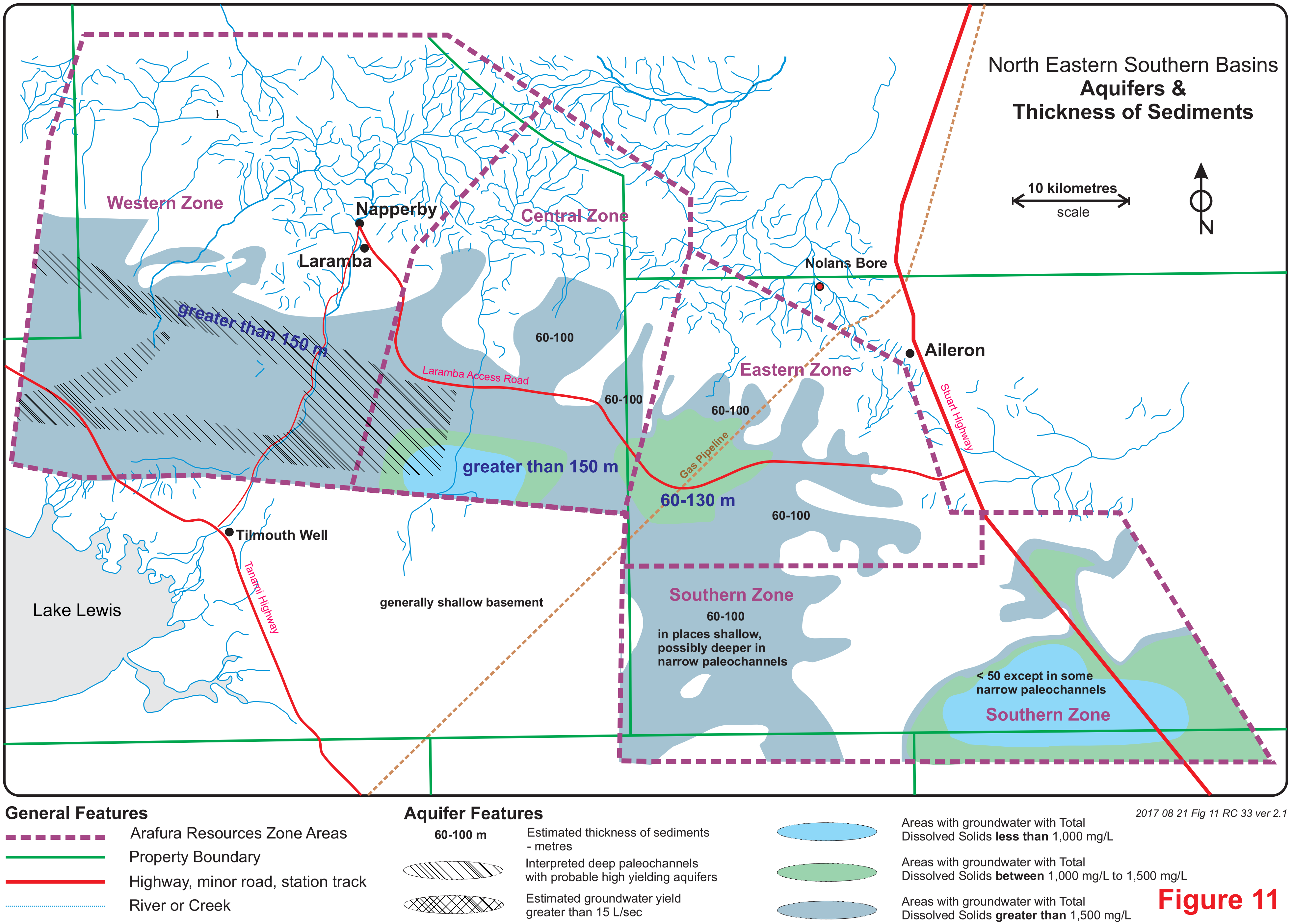

North Eastern Southern Basins
Aquifers &
Thickness of Sediments
10 kilometres
scale
N
Western Zone
Central Zone
Eastern Zone
Southern Zone
Napperby
Laramba
Nolans Bore
Aileron
Tilmouth Well
Lake Lewis
greater than 150 m
greater than 150 m
60-130 m
60-100
Laramba Access Road
Stuart Highway
Tanami Highway
Gas Pipeline
generally shallow basement
in places shallow,
possibly deeper in
narrow paleochannels
< 50 except in some
narrow paleochannels
General Features
Arafura Resources Zone Areas
Property Boundary
Highway, minor road, station track
River or Creek
Aquifer Features
60-100 m
Estimated thickness of sediments - metres
Interpreted deep paleochannels with probable high yielding aquifers
Estimated groundwater yield greater than 15 L/sec
Areas with groundwater with Total Dissolved Solids less than 1,000 mg/L
Areas with groundwater with Total Dissolved Solids between 1,000 mg/L to 1,500 mg/L
Areas with groundwater with Total Dissolved Solids greater than 1,500 mg/L
2017 08 21 Fig 11 RC 33 ver 2.1

Figure 11

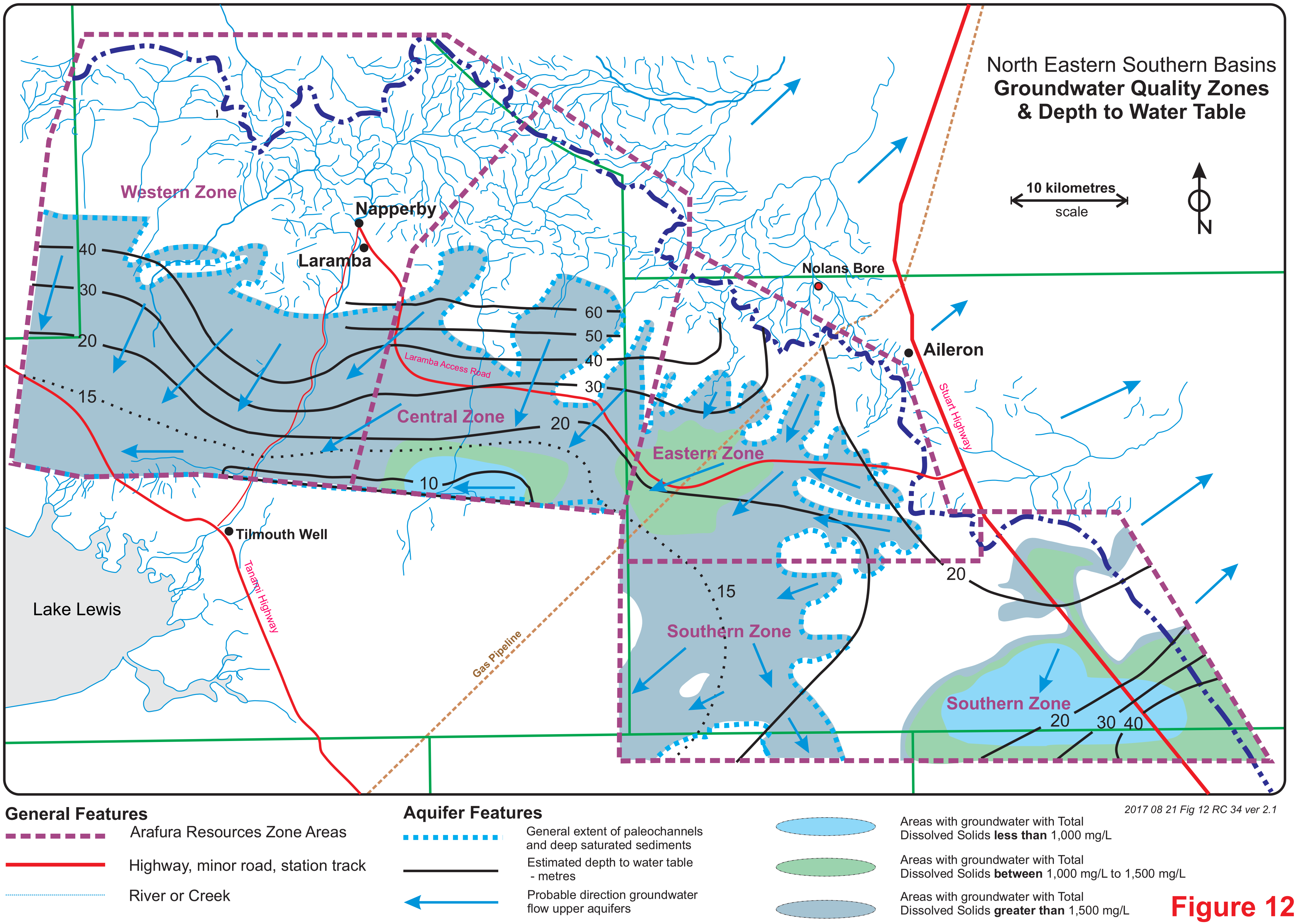
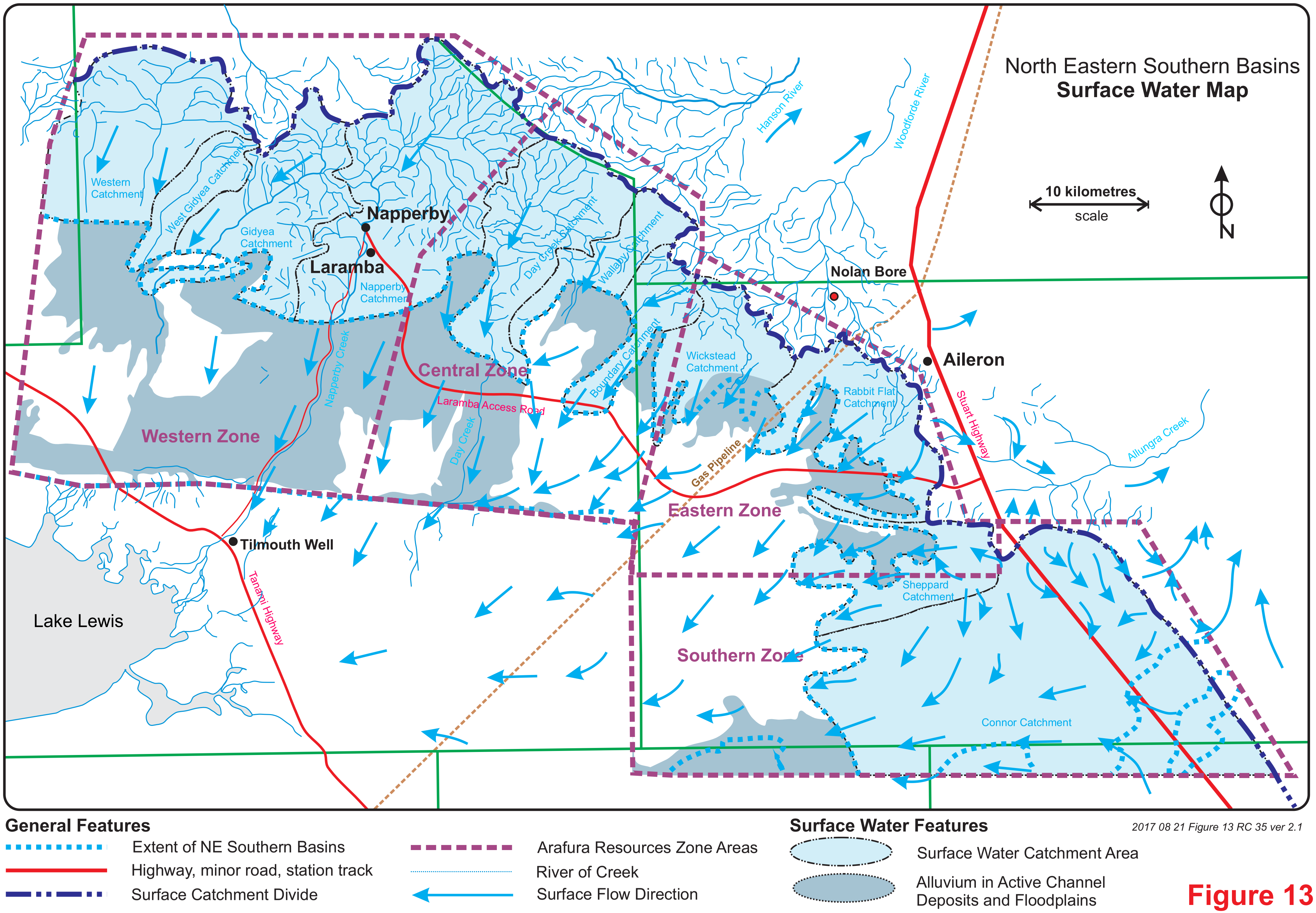
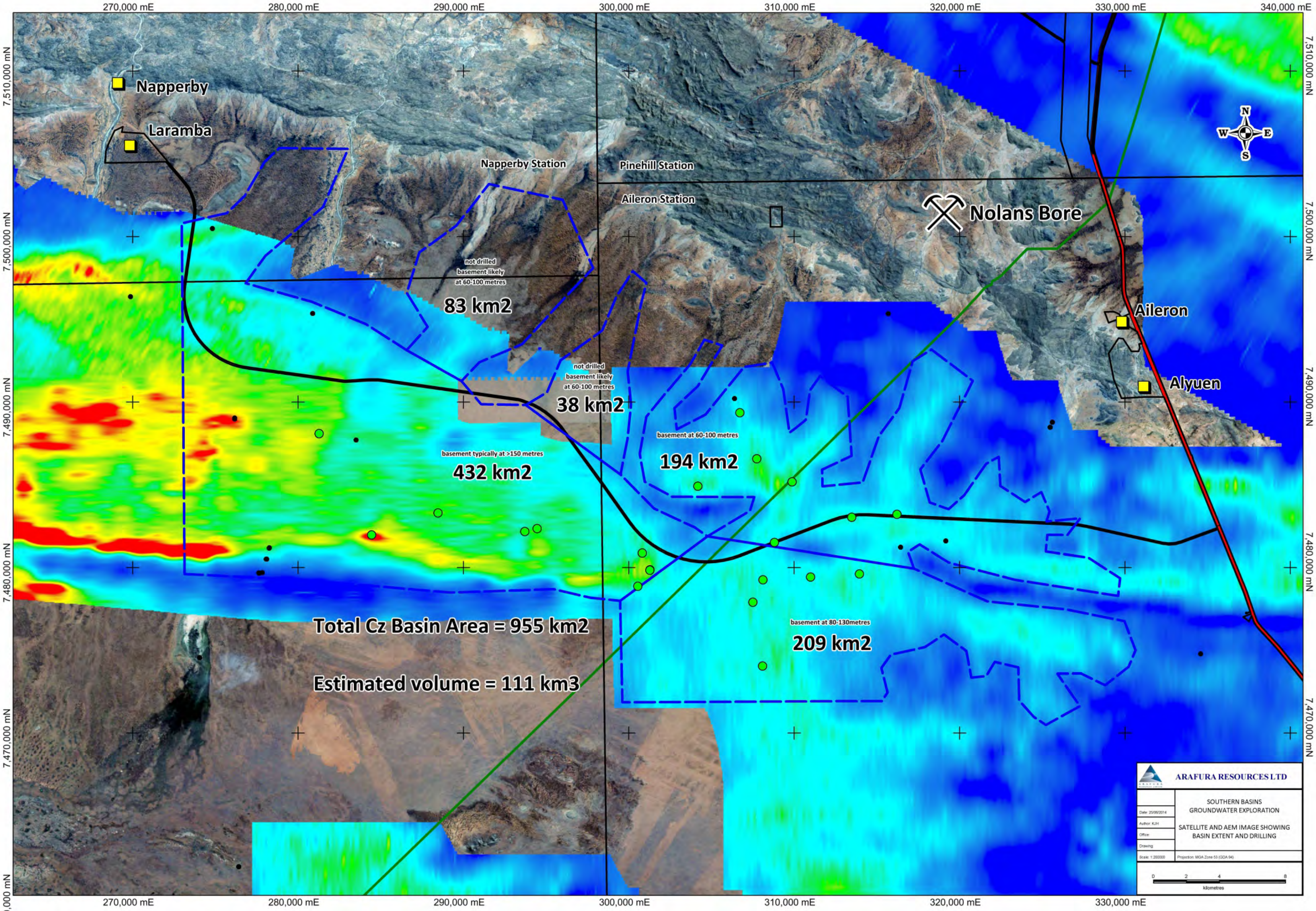

North Eastern Southern Basins
Groundwater Quality Zones
& Depth to Water Table
10 kilometres
scale
N
Western Zone
Central Zone
Eastern Zone
Southern Zone
Southern Zone
Napperby
Laramba
Nolans Bore
Aileron
Tilmouth Well
Lake Lewis
Laramba Access Road
Stuart Highway
Tanami Highway
Gas Pipeline
60
50
40
30
20
15
10
General Features
Arafura Resources Zone Areas
Highway, minor road, station track
River or Creek
Aquifer Features
General extent of paleochannels and deep saturated sediments
Estimated depth to water table - metres
Probable direction groundwater flow upper aquifers
Areas with groundwater with Total Dissolved Solids less than 1,000 mg/L
Areas with groundwater with Total Dissolved Solids between 1,000 mg/L to 1,500 mg/L
Areas with groundwater with Total Dissolved Solids greater than 1,500 mg/L
2017 08 21 Fig 12 RC 34 ver 2.1

Figure 12



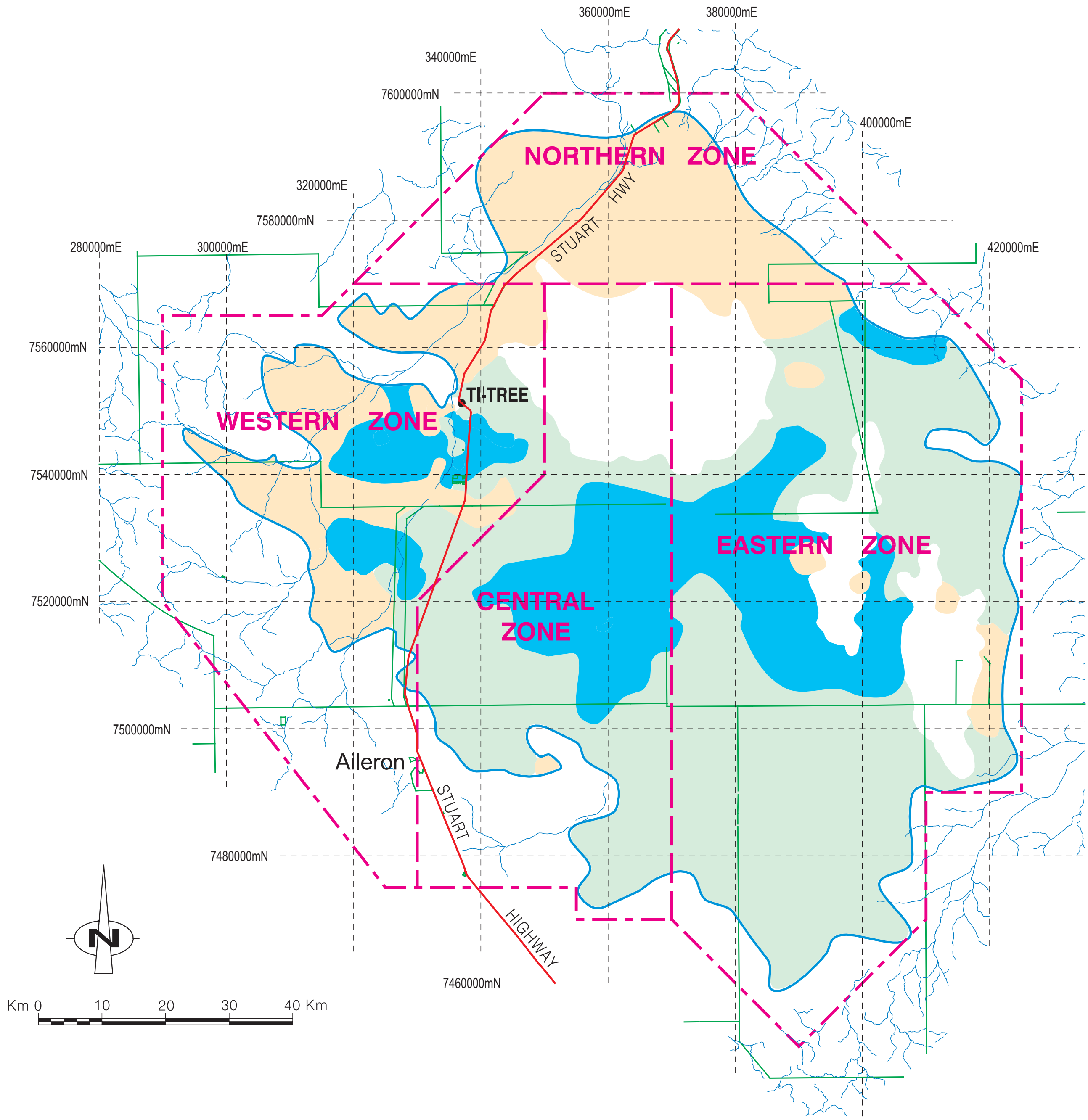
North Eastern Southern Basins
Surface Water Map
10 kilometres
scale
N
Western Catchment
West Gidyea Catchment
Gidyea Catchment
Napperby
Laramba
Napperby Catchment
Day Creek Catchment
Wallaby Catchment
Boundary Catchment
Wickstead Catchment
Rabbit Flat Catchment
Sheppard Catchment
Connor Catchment
Hanson River
Woodforde River
Nolan Bore
Aileron
Stuart Highway
Allungra Creek
Napperby Creek
Day Creek
Laramba Access Road
Central Zone
Western Zone
Eastern Zone
Southern Zone
Gas Pipeline
Tilmouth Well
Tanami Highway
Lake Lewis
General Features
Extent of NE Southern Basins
Highway, minor road, station track
Surface Catchment Divide
Arafura Resources Zone Areas
River of Creek
Surface Flow Direction
Surface Water Features
Surface Water Catchment Area
Alluvium in Active Channel Deposits and Floodplains
2017 08 21 Figure 13 RC 35 ver 2.1

Figure 13



AEM Conductance & Satellite Image showing most of the area of the NE Southern Basin

Figure 14



GENERAL FEATURES

Property Boundary

Highway

River Or Creek

WATER MANAGEMENT FEATURES

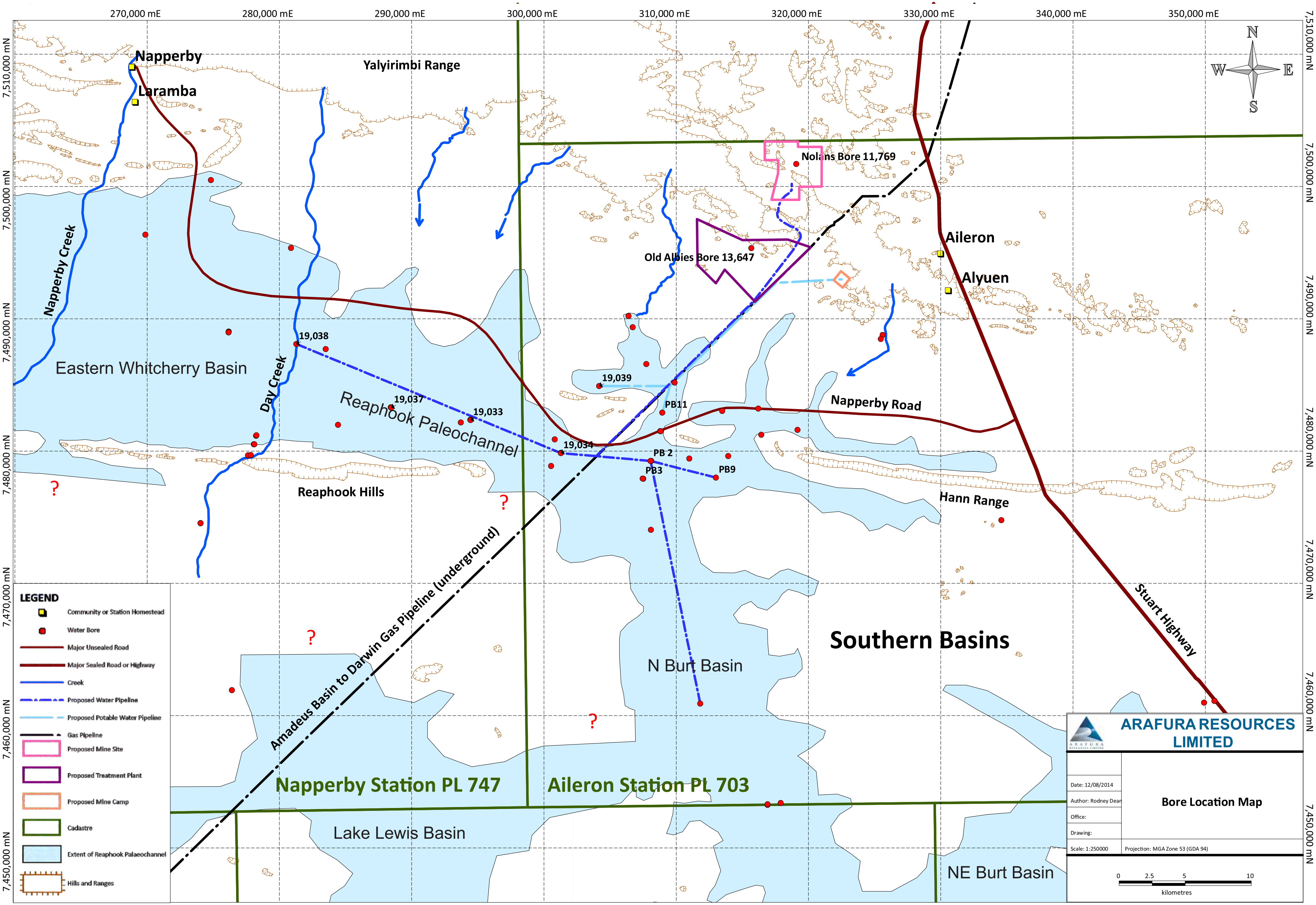
General Extent of Ti-Tree Basin

Areas containing groundwater with Total Dissolved Solids less than 1000 mg/L

Areas containing groundwater with Total Dissolved Solids between 1000 and 1500 mg/L

Areas containing groundwater with Total Dissolved Solids greater than 1500 mg/L

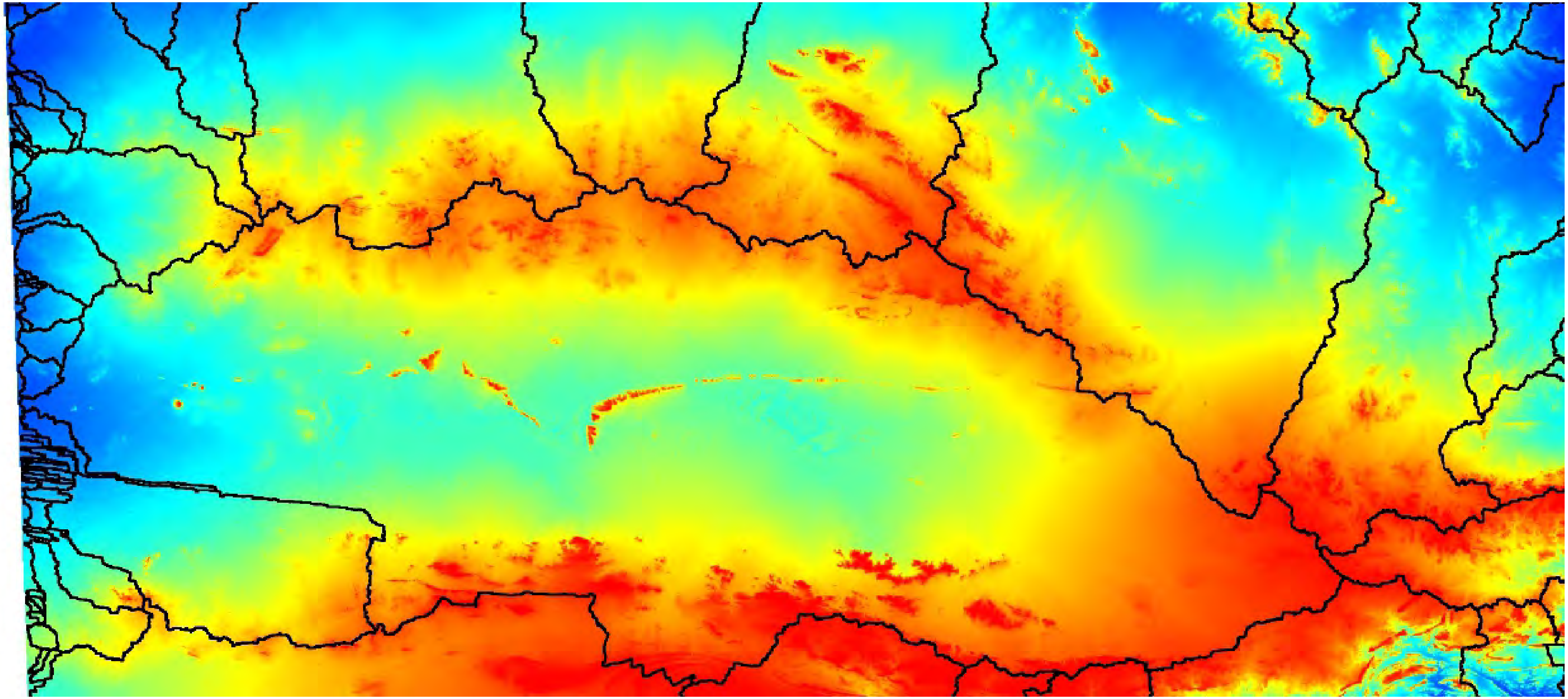
Figure 15



R Dean preliminary interpretation of location of paleochannels 2014

Arafura NE Southern Basins Bore Location Map

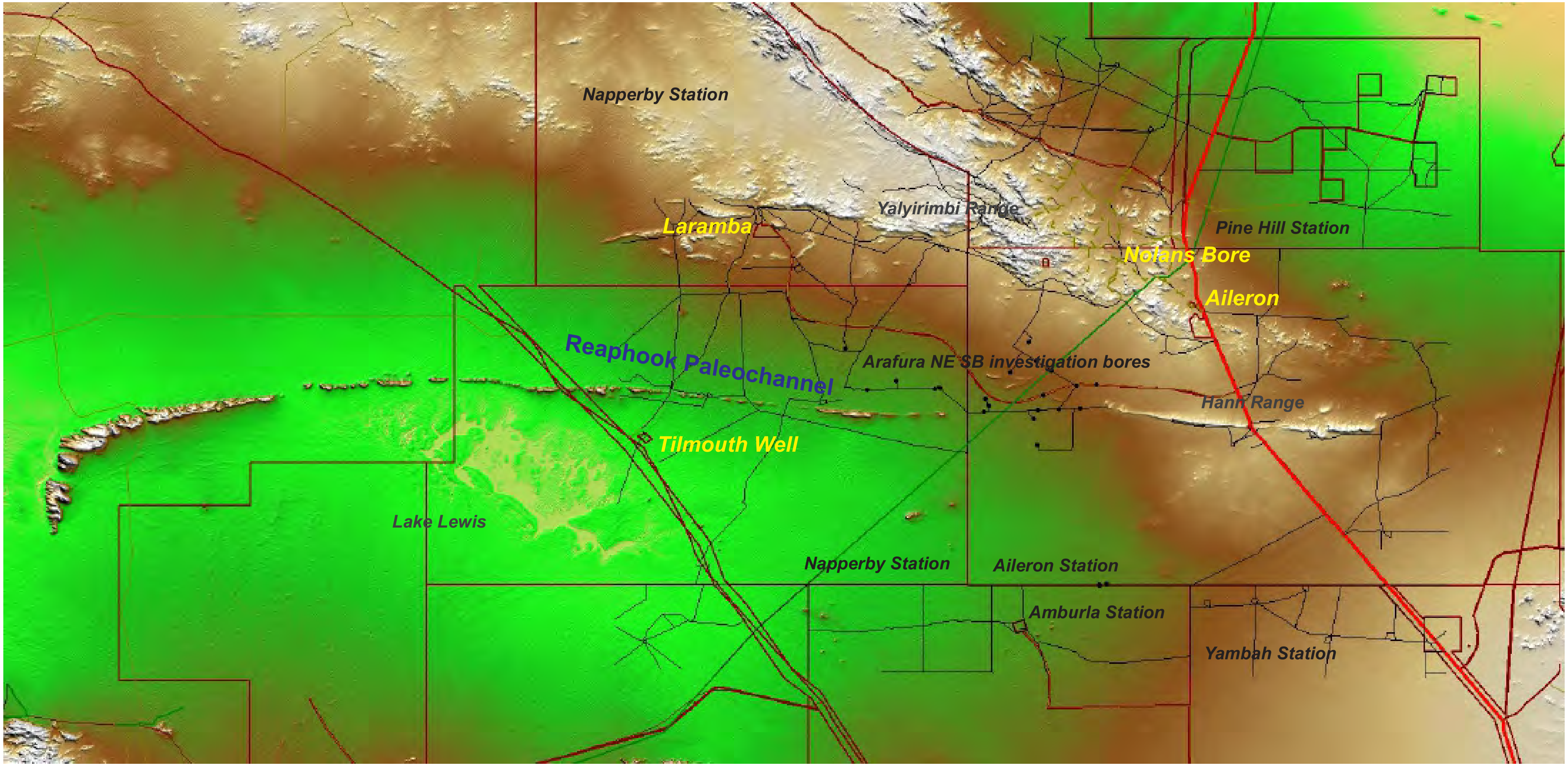
Figure 16



Arafura Principal Geologist Kelvin Hussey calculated the water catchment area of the Southern Basins as 43250 square kilometres

Shuttle Radar DEM Surface Water Catchment, *Arafura* Southern Basins

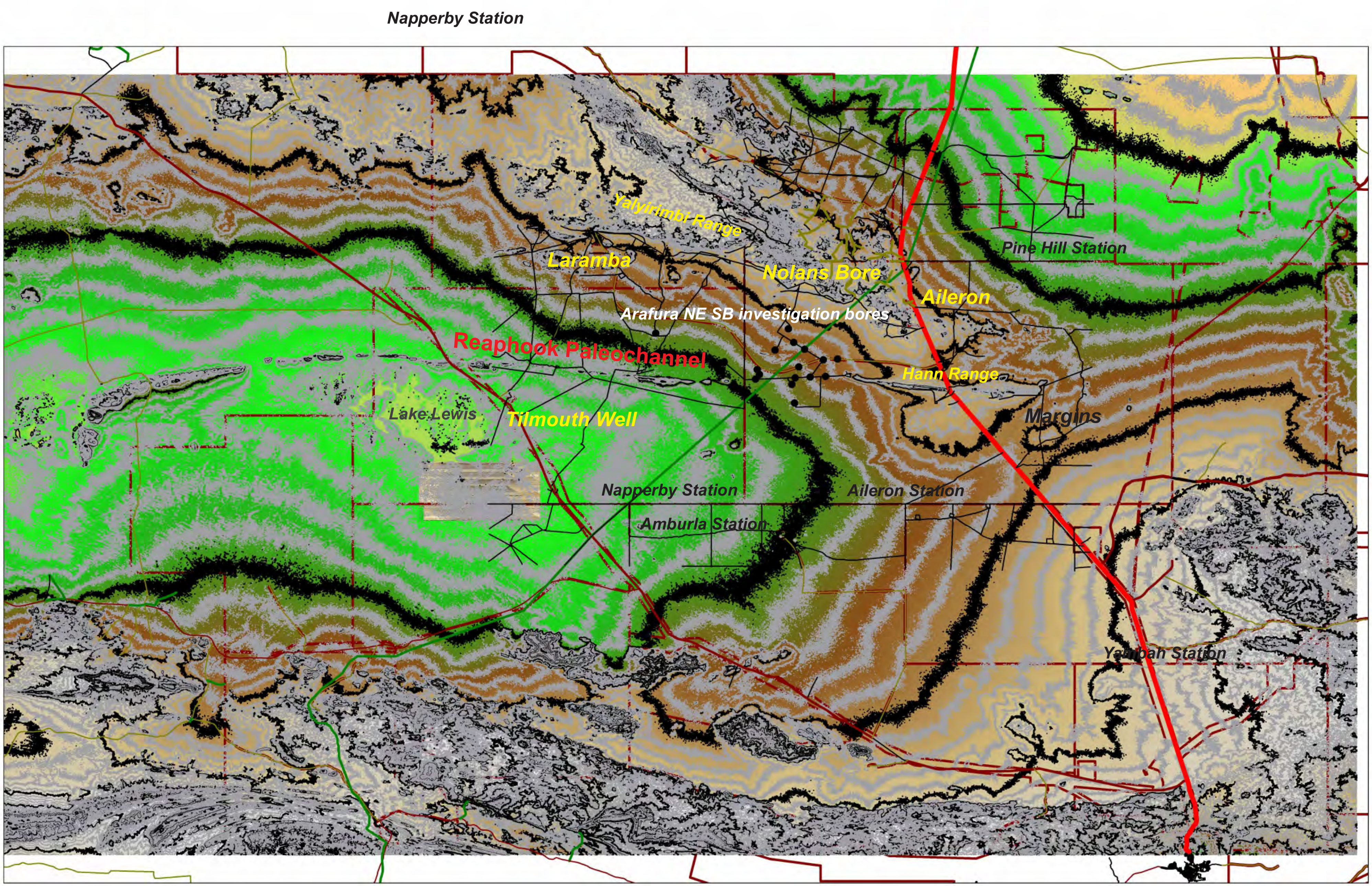
Figure 17



Station Roads shown in black, Mereenie Gas pipeline in green, Stuart Highway thick red, Tanami Road thin red, bores as black dots.

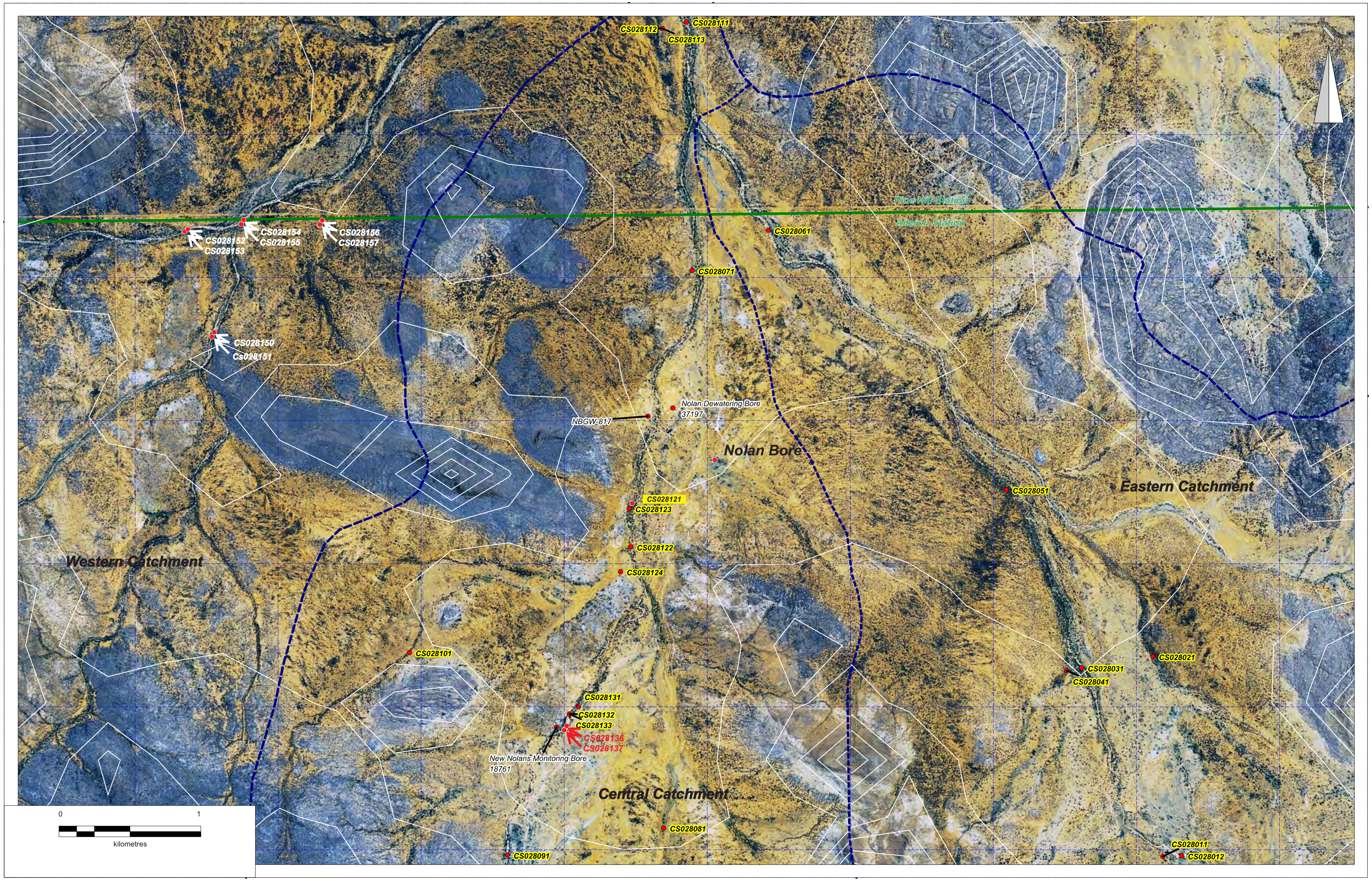
Arafura NE Southern Basins Groundwater Investigation Bores and bore access tracks shown in black

Shuttle Radar DEM Surface Water Catchment, *Arafura* NE Southern Basins **Figure 18**



Arafura Nolans Project; NE Southern Basins Groundwater Investigation Program
Shuttle Radar, Eastern Southern Basins, Regional DEM 30 m pixels, 10 m contours

Shuttle Radar DEM Surface Water Catchment, *Arafura* Eastern Southern Basins **Figure 19**



Arafura Hydrostations Kerosene Camp Creek

Figure 20

Appendix L Arafura Nolans Project Bore Summaries (Spreadsheets)

Arafura Stage 1 NE Southern Basins Water Investigation Bore Summary

RC_ID	***Site #***	***NTG RN***	***Depth Drilled***	***Yield (AL)***	***SWL***	***Est Base***	***Comments***
			m	L/sec	m bGL	m	
RC0001	A3	18869	94	8.0	23.35	>94	Monitoring Bore 50 mm PVC
RC0002	I4	18870	75	3.3	25.12	>75	Backfilled & capped
RC0003	L1	18871	81	5.0	26.22	>81	Backfilled & capped
RC0004	K2	18872	120	8.0	27.92	>120	Monitoring Bore 125 mm PVC
RC0005	M2	18873	118	0.6	32.07	99	Backfilled & capped
RC0006	H1	18874	63	6.0	19.02	>63	Backfilled & capped
RC0007	J1	18875	111	3.0	26.92	105	Monitoring Bore 100 mm PVC
RC0008	B2	18876	118	20.0	19.19	>118.4	Monitoring Bore 125 mm PVC
RC0009	G5	18877	52	1.5	22.51	>52.5	Backfilled & capped
RC0010	G4	18878	65	5.0	22.00	>65	Monitoring Bore 100 mm PVC
RC0011	G0		6	0.0			Backfilled & capped
RC0012	A0	18879	118	30.0	20.06	>118.4	Monitoring Bore 100 mm PVC
RC0013	N1	18880	112	12.0	16.26	86	Monitoring Bore 100 mm PVC
RC0092	DHV1		63	3.3	39.18		Monitoring Bore 100 mm PVC

Arafura Stage 2 NE Southern Basins Water Investigation Bore Summary

RC_ID	***Site #***	***NTG RN***	***Depth***	***Yield (AL)***	***SWL***	***Compl. Depth***	***Comments***
			m	L/sec	m bGL	m	
RC0014	3A	19026	135	25	17.72	48.5	Monitoring Bore 50 mm PVC
RC0015	1A	19027	156	40	18.44	85.0	Monitoring Bore 50 mm PVC
RC0016	1C	19028	39	2.5	20.26	37.6	Monitoring Bore 50 mm PVC
RC0017	1B	19029	63	2.5	16.26	37.7	Monitoring Bore 50 mm PVC
RC0018	6A	19030	219	73	15.80	77.0	Monitoring Bore 50 mm PVC
RC0019	6B	19031	51	17	14.29	38.8	Monitoring Bore 50 mm PVC
RC0020	6C	19032	56	10	15.86	40.7	Monitoring Bore 100 mm PVC
RC0021	PB6	19033	106	20	15.68	95.5	Production Bore 260 mm steel
RC0022	PB1	19034	136	40	18.48	136.0	Production Bore 260 mm steel
RC0023	5A	19035	49	3	10.38	49.0	Monitoring Bore 100 mm PVC
RC0024	7A	19036	55	3	12.51	55.0	Monitoring Bore 100 mm PVC
RC0025	PB7	19037	145	40	12.33	145.0	Production Bore 153 mm steel
RC0026	PB4	19038	154	50	27.47	153.0	Production Bore 153 mm steel
RC0027	PB8	19039	94	3.5	20.93	94.0	Production Bore 153 mm steel
RC0028	PB2	18714	126	15	19.50	123.5	Production Bore 250 mm steel
RC0059	9(1)	18712	114	7	21.6	0.0	Backfilled, plugged & capped
RC0060	9(2)	18713	125	7	21.4	58.0	Monitoring Bore 100 mm PVC

Arafura NE Southern Basins Water Investigation Margins Area, Bore Summary

RC_ID	Site ID	Depth	Current Depth	Yield	SWL	Comments
		m	m	L/sec		
RC0029	SP 1	27	24.150	Dry	Dry	Capped
RC0030	SP 2	36	36.467	0.3	27.030	Monitoring Bore 50mm PVC
RC0031	SP 3	42	42.080	0.1	28.130	Monitoring Bore 50mm PVC
RC0032	SP 4	36	35.025		29.225	Monitoring Bore 50mm PVC
RC0033	SP 5	42	40.152	Water	29.370	Monitoring Bore 50mm PVC
RC0034	SP 6	18	17.063	Dry	Dry	Capped
RC0035	SP 7	27	26.030	Water	20.380	Monitoring Bore 50mm PVC
RC0036	SP 8	30	30.200		20.651	Monitoring Bore 50mm PVC
RC0037	SP 9	42	41.810		22.248	Monitoring Bore 50mm PVC
RC0038	SP 10	18	11.420	Dry	Dry	Capped
RC0039	SP 11	32	26.200		22.980	Monitoring Bore 50mm PVC
RC0040	SP 12	30	30.512		21.380	Monitoring Bore 50mm PVC
RC0041	SP 13	24	24.540		20.923	Monitoring Bore 50mm PVC
RC0042	SP 14	42	33.650		19.380	Monitoring Bore 50mm PVC
RC0043	SP 15	42	40.510		18.442	Monitoring Bore 50mm PVC
RC0044	SP 16	24	26.550		17.172	Monitoring Bore 50mm PVC
RC0045	SP 17	27	23.000		17.183	Monitoring Bore 50mm PVC
RC0046	SP 18	42	41.930		37.710	Monitoring Bore 50mm PVC
RC0047	SP 19	42	42.376		35.870	Monitoring Bore 50mm PVC
RC0048	SP 20	27	27.430		17.805	Monitoring Bore 50mm PVC
RC0049	SP 21	30	30.032	Water	16.400	Monitoring Bore 50mm PVC
RC0050	SP 22	36	39.050		30.260	Monitoring Bore 50mm PVC
RC0051	SP 23	30	29.782	Dry	Dry	Capped
RC0052	SP 24	42	42.252		29.610	Monitoring Bore 50mm PVC
RC0053	SP 25	30	29.330		17.410	Monitoring Bore 50mm PVC
RC0054	SP 26	42	42.890		29.010	Monitoring Bore 50mm PVC
RC0055	SP 27	42	42.568		30.425	Monitoring Bore 50mm PVC
RC0056	SP 28	51	50.790		24.760	Monitoring Bore 50mm PVC
RC0057	SP 29	60	60.344		34.290	Monitoring Bore 50mm PVC
RC0058	SP 30	54	44.200		38.735	Monitoring Bore 50mm PVC

Arafura New Nolans Bores Arunta Basement, Aileron Province, Bore Summary

RC_ID	*Site #*	*NTG RN*	*Depth Drilled*	*Yield (AL)*	*SWL*	*Est Base*	*Comments*
			m	L/sec	m bGL	m	
RC0065	M3B	18760	30	0.3	17.0	3	Monitoring Bore West PVC
RC0063	M3A	18761	59.5	6.0	18.0	2	New Nolan Bore
RC0064	M3C	18762	36	8.0	18.0	4	New Nolan Observation Bore

Arafura Dewatering Investigation Nolans Pit Area, Arunta Basement, Aileron Province Bore Summary

RC_ID	Site ID	Site Name	Depth	Yield	SWL Dec 16	Comments
			m	L/sec	m	
RC0066	NBGW810	Nolan Dewatering Mon 1	114.4	5.0	15.52	
RC0067	NBGW811	Nolan Dewatering Mon 2	90.4	0.2	15.615	
RC0068	NBGW812	Nolan Dewatering Mon 3	114.4	2.2	15.975	
RC0069	NBGW813	Nolan Dewatering Mon 4	120	0.5	15.430	
RC0070	NBGW814	Nolan Dewatering Mon 5	102.4	0.5	16.165	
RC0071	NBGW815	Nolan Dewatering Mon 6	108.6	0.5	15.795	
RC0072	NBGW816	Nolan Dewatering Mon 7	121	0.5	13.000	Blocked at Surface Dec '16
RC0073	NBGW817	Nolan Dewatering Mon 8	120.4	1.0	14.300	Blocked Dec '16
RC0074	NBGW818	Nolan Dewatering Mon 9	97	0.93	15.955	
RC0075	NBGW819	Nolan Dewatering	70	20.0	15.540	

Arafura Allungra North Borefield, Ti Tree Basin, Bore Summary

RC_ID	Site ID	Depth	Current Depth	RLGL	SWL	RL SWL	Comments
		m	m	m AHD	m bGL	m AHD	
RC0093	MB1	227.7	135	585.8	34.66	551.14	
RC0094	PW2	110.0	110	586.0	34.57	551.43	

RC_ID	Site ID	Site Name	Depth	Yield	SWL Dec 16	Comments
			m	L/sec	m	
RC0066	NBGW810	Nolan Dewatering Mon 1	114.4	5.0	15.52	
RC0067	NBGW811	Nolan Dewatering Mon 2	90.4	0.2	15.615	
RC0068	NBGW812	Nolan Dewatering Mon 3	114.4	2.2	15.975	
RC0069	NBGW813	Nolan Dewatering Mon 4	120	0.5	15.430	
RC0070	NBGW814	Nolan Dewatering Mon 5	102.4	0.5	16.165	
RC0071	NBGW815	Nolan Dewatering Mon 6	108.6	0.5	15.795	
RC0072	NBGW816	Nolan Dewatering Mon 7	121	0.5	13.000	Blocked at Surface Dec '16
RC0073	NBGW817	Nolan Dewatering Mon 8	120.4	1.0	14.300	Blocked Dec '16
RC0074	NBGW818	Nolan Dewatering Mon 9	97	0.93	15.955	
RC0075	NBGW819	Nolan Dewatering	70	20.0	15.540	

Notes:

1. A description of the drilling and sampling methodology on each of the above bores is included in the Groundwater Exploration & Investigations Report – Arafura Resources Nolans Project February 2017.
2. Bore cross sections, geological, other logs, GPS positions, groundwater quality data and *Arafura* Nolans water investigation bore summaries are included in the *Arafura* Water Bore Database

Appendix M Arafura Nolans Project Hydrostations

Twenty three (23) *Arafura* hydrographic stations have been constructed in the Nolans Region on Kerosene Camp Creek and at the site of the proposed Arafura beneficial treatment plant near Old Albs Bore.

If you include all the *Arafura* Nolan surface flow monitoring locations and creek cross section though each automatic water sampler and creek underflow sampling locations there are currently forty one (41) *Arafura* Nolans hydrographic stations.

These stations include 34 automatic water samplers, maximum height gauges, creek / bed cross sections to estimated maximum flood widths, environmental traverses & photo points.

Four (4) stations are currently operational within the Burt River Basin on small creeks near base of basement rock outcrop hills at site of beneficial treatment plant

Eighteen (18) stations were constructed within Wiso River Basin on Kerosene Camp Creek up-gradient and down gradient of Nolan mine site, West and East Kerosene Camp Creek in the Nolans area. A number of the rising stage stream flow samplers were damaged by floods during January 2017.

Each station has between 1 and 3 automatic water samplers and there are 22 groups in operation. In addition 150 mm steel pylons have been installed at two additional areas for future construction of two groups of automatic water samplers.

The hydrographic stations include 20 three stage automatic water samplers & 11 seven stage automatic water samplers. Data loggers to obtain creek flow hydrographs are to be installed on Kerosene Camp Creek near the Arafura Resources weather station

The water sampling program includes sampling underflow from two pits up-gradient and two down gradient of Nolan mine site and two sites on Kerosene Camp Creek West. In addition water samples are opportunistically collected from creek and rare temporary spring flows in the area.

The maximum flow recorded in the area since installation of samplers in 2013 was in January 2017 when 7 & 3 stage samplers were overtopped at:

1. Kerosene Camp Creek station CS028123
2. West Kerosene Camp Creek station CS028151
3. East Kerosene Camp Creek station CS028061.

The actual maximum flow depth at these and other hydrographic stations is not exactly known as the creek cross section maximum flood height has yet to be levelled but is estimated to be more than 2 m for Kerosene Camp Creek and more than 3 m for the East and West Kerosene Camp Creeks.

The previous maximum flow event reached a maximum height of 1280 mm above bed level during flow in Kerosene Camp Creek at CS028123 January 2015.

Laboratory trace metal analysis of water samples collected from the automatic rising stage stream flow samplers are included in the Arafura Nolans chemical water analyses database.

An extensive photo library has been established on each hydrographic station, water sampler, creeks and floodouts within the Nolan area.

Group A, Wiso River Basin; Kerosene Camp Creek (Central Nolan Catchment)

Group	*Station #*	*Type*	*Easting*	*Northing*	*RLBM AHD*	*Comments*
1	CS028091	1/3	317606	7498966		Western track *Site* up gradient New Nolan
2	CS028081	1/3	318695	7499153		Eastern track up gradient weather stn crossing
3	CS028136	2/7, 1/3	317970	7499883	666.881	Adjacent New Nolan Bore
4	CS028101	1/3	316918	7500384	671.643	off track west of New Nolan Bore
5	CS028124	1/3	318389	7500945	660.977	Near weather stn crossing small tributary SW
6	CS028122	1/7, 1/3	318494	7501122	660.019	Immediately south weather stn crossing
7	CS028123	1/7, 1/3	318509	7501372	660.019	Weather stn crossing
8	CS028071	1/3	318890	7503043	652.786	near stockyards 500 m south Aileron - Pine Hill boundary
14	CS028111	2/7,1/3	318895	7504797	648.518	2.75 km N dewatering bore Pine Hill Station

Group B, Wiso River Basin; Eastern Kerosene Camp Creek

Group	*Station #*	*Type*	*Easting*	*Northing*	*RLBM AHD*	*Comments*
9	CS028012	1/3	322317	7498975	676.005	Nolan Creek, SE Nolan Dam
10	CS028041	1/3	321512	7500246	668.701	Nolan Creek, N main access road
11	CS028021	1/7	322107	7500348	669.091	North main access road
12	CS028051	1/3	321101	7501518		Nolan Creek, N main access road
13	CS028061	1/3	319412	7503332	653.141	Eastern KCC near northern boundary

Group C, Wiso River Basin; West Kerosene Camp Creek

Group	*Station #*	*Type*	*Easting*	*Northing*	*RLBM AHD*	*Comments*
15	CS028151	1/7, 1/3	315539	7502467	661.816	West Kerosene Camp Creek
16	CS028153	1/7. 1/3	315189	7503249	660.941	Major tributary West Kerosene Camp Creek
17	CS028155	1/7, 1/3	315823	7503434	659.101	West Kerosene Camp Creek
18	CS028156	1/7, 1/3	316339	7503436	658.429	Minor tributary West Kerosene Camp Creek

Group D, Burt River Basin; Floodouts & short creeks of northern basement hills; Site of Beneficial Treatment Plant

Group	*Station #*	*Type*	*Easting*	*Northing*	*RLBM AHD*	*Comments*
19	CS027001	1/3	319972	7495675	672.711	North main track to Old Albs Bore from Gas pipeline crossing
20	CS027002	1/3	319151	7496437	684.439	West of main access track Nolan to Old Albs Bore
21	CS027003	1/3	319539	7495793	674.313	South main track Old Albs from Gas pipeline crossing
22	CS027004	1/3	318642	7494152	666.050	Eroded Old Napperby access road now creek; west pipeline
23	CS027005	P	315110	7495982	678.181	GRG 7 stage site, pylon installed, creek west Old Albs Bore

Attachments

The attachments are documents separate to this report that provide a detailed description of the various water resource investigations completed in the Nolans Region by *Arafura* and others.

These attachments are part of a report prepared by Ride Consultants for *Arafura* on the Water Resources of the Nolan Region, Aileron, Northern Territory.

Arafura Digital Water Database

This database is available on a flash drive and includes the datasets accumulated by *Arafura* in completing the Nolans Region Groundwater Investigations and Assessments.