Assets | Engineering | Environment | Noise | Spatial | Waste

Geotechnical Investigation
DRAFT

Onslow Site Investigations

Prepared for Shire of Ashburton

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Signature		

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1 Introduction

Talis Consultants Pty Ltd (Talis) was engaged by the Shire of Ashburton (the Shire) to undertake a geotechnical investigation to the west of Onslow Road, approximately 36 kilometres (km) to the south of the town of Onslow, Western Australia (WA) (the Site).

Following the closure of the Onslow Landfill in the latter half of 2015, a Waste Transfer Station (WTS) was constructed at Lot 500 Onslow Road as a replacement service, redirecting waste to the Tom Price Waste Disposal Site. Having to transport the waste out of town prior to disposal has increased operational costs associated with haulage and highlighted the requirement for a more cost effective and efficient waste disposal solution.

A Site Selection Study was undertaken by the Shire in 2013, which identified a preferred site for the development of a waste management facility (WMF) based on best practice siting and design principles as per *Siting, design, operation and rehabilitation of landfills,* Environmental Protection Authority Victoria, 2015, (BEPM, 2015). The Site is located at Lot 150 Onslow Road, Onslow.

This report documents the geotechnical investigations testing carried out at the Site and associated laboratory test results. It should be read in conjunction with the Phase 1 hydrogeological risk assessment (TW17084-Onslow Site Investigations_Hydro.1a, Talis, 2018 (Talis, 2018)).

1.1 Objectives

The objectives of the geotechnical investigation were to:

- Understand the soil properties across the proposed footprint of the WMF; and
- Geotechnical classification of the Site.

1.2 Scope of Works

To achieve the objectives described above, the investigation included:

- The excavation of 112 trial pits, targeting the proposed WMF footprint;
- The installation of 13 boreholes across the Site;
    - Conversion of seven into groundwater monitoring wells; and
    - Conversion of five into combined landfill gas and groundwater monitoring wells;
- In-situ soil testing;
- Geotechnical laboratory testing; and
- Preparation of this report presenting the results of the investigation and testing.

2 Background

2.1 Location

The Site is located approximately 36 km to the south-west of the town of Onslow within Lot 150 Onslow Road, Onslow (Figure 1). The Lot occupies an area of 434 ha, however, the proposed WMF footprint only occupies a total of approximately 26 ha.

The Site is accessible from Onslow Road which is a main road and primary distributor. The Site is located to the west of a long sand dune ridge and therefore most of the Site is not visible from Onslow Road. An aerial view of the Site is provided in Figure 2.

2.2 Surrounding Land Use

Under the Shire of Ashburton Town Planning Scheme No.7 (District Scheme) (TPS No.7), the Site and surrounding sites are zoned as *'Conservation, Recreation and Nature Landscape' (Cane River Conservation Park),* as shown in Figure 3.

2.3 Certificate of Title

The details pertaining to the Certificate of Title (CoT) for Lot 150 Onslow Road, Onslow are provided in Table 2-1, with a copy of the CoT provided in Appendix A.

Table 2-1: Certificate of Title Details

Volume	Folio	Register Number	Description	Status	Primary Interest Holder
LR3046	473	150/DP220207	Lot 150 on Deposited Plan 220207	Unallocated Crown Land	State of Western Australia

3 Environmental Attributes

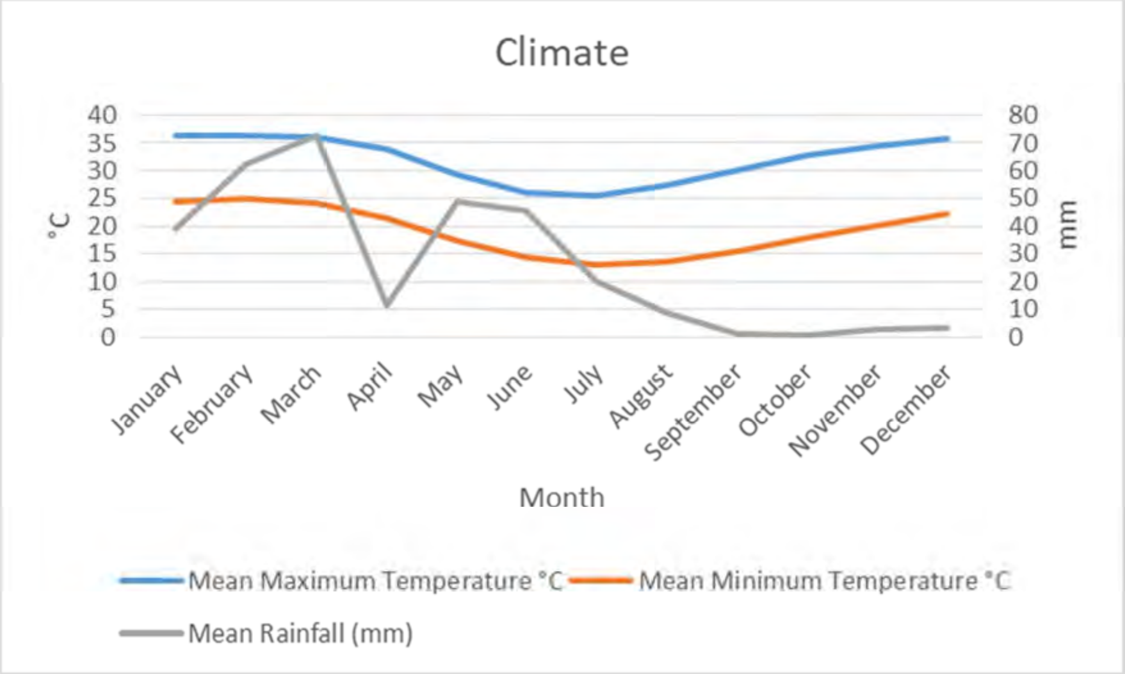
The climate of the Onslow area is considered to be 'grassland' in accordance with the Köppen classification system used by the Bureau of Meteorology (BoM). The area is arid with a hot humid summer zone and experiences low rainfall. Rainfall data was sourced from the Onslow Airport weather station as data available from the nearby Mount Minnie weather station was limited and sporadic. Table 3-1 shows the monthly average rainfall and the mean minimum and mean maximum temperature as recorded at the Onslow Airport from 1940 to 2017.

Table 3-1: Average Rainfall and Temperature 1940-2017 (Onslow Airport)

Aspect	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	39.0	62.2	72.9	11.6	49.0	45.5	20.3	8.6	1.4	0.8	2.8	3.4
Min Temp (°C)	24.4	25.0	24.2	21.4	17.4	14.3	13.0	13.6	15.4	17.9	20.1	22.3
Max Temp (°C)	36.4	36.4	36.1	33.8	29.3	26.0	25.4	27.3	30.1	32.9	34.4	35.9

As shown above, the lowest minimum mean temperature for Onslow is 13.0 °C (July) and highest maximum mean temperature is 36.4 °C (January). The minimum mean monthly rainfall is 0.8 mm (October) and maximum is 72.9 mm (March). The majority of rainfall occurs within the 'wet season' which corresponds to the warmer months. The monthly rainfall and temperature data is also shown in Chart 1.

Chart 1: Meteorological Conditions



BoM website (2016). The above data was recorded at Onslow Airport, located approximately 36 km from the Site.

The total annual and 90th percentile for temperature and rainfall are shown in Table 3-2.

Table 3-2: Total Annual and 90th Percentile Rainfall and Temperature (1940-2017)

	Total Annual	90th Percentile
Rainfall (mm)	315.1	540.6
Minimum Temperature (°C)	19.1	20.1
Maximum Temperature (°C)	32.0	32.8

As shown above, the mean average total annual rainfall received at Onslow Airport is 315.1 mm and the 90th percentile is 540.6 mm.

3.1 Site Conditions

The Site forms part of the Cane River Conservation Park, with majority of the Site covered in scrub. A pindan sand dune ridge is also located to the east of the Site.

3.2 Topography

Landgate is the Statutory Authority that maintains the State's official register of land ownership and survey information. Utilising topographical contour geospatial data sourced from Landgate, the Site is shown to range from 14 m Australian Height Datum (AHD) across the western portion to 40 m AHD at various points along the sand ridge.

The topography is presented in Figure 4.

3.3 Geology

3.3.1 Quaternary Geology

The Department of Mines, Industry Regulation and Safety (DMIRS), has described the near surface geology across the north-eastern portion of the Site (the sand dune ridge) as *"longitudinal and network dunes and residual sand plains-reddish-brown to yellowish quartz sand."* The remainder of the Site is described as *"colluvium-poorly sorted clay, silt, sand and gravel; formed by sheet flood and deflation"*. These horizons were generally confirmed during the investigation.

The superficial geology is presented in Figure 5.

3.3.2 Cenozoic Geology

Information supplied within B*ulletin 133 geology of the Carnarvon Basin Western Australia,* Geological Survey of Western Australia, Department of Mines, R.M. Hockling, H.T.Moors, W.J.E.Van De Graff, 1987 (DoM, 1987) suggested that two distinct Tertiary (Cenozoic) aged units were present within the Peedamullah shelf, namely the following:

Merlinleigh Sandstone

The Merlinleigh Sandstone is a coarse to very coarse grained sandstone with limited finer grained sandstone, siltstones, claystone and conglomerates. The unit has undergone duricrusting making it difficult to determine in field. While this was noted to occur on the Peedamullah shelf, its main outcrop is on top of the Kennedy Range and this unit may not be present within the Onslow area (DoM, 1987).

Trealla Limestone

The Trealla Limestone is a unit of thin to massive-bedded, hard limestone, which can show small scale karst features. This unit is widespread in the subsurface of Onslow but is thought to be absent to the southeast of Onslow, where the Site is situated (DoM, 1987).

3.3.3 Cretaceous Geology

DoM, 1987 has suggested that the Onslow area is underlain by the following Cretaceous formations:

Toolonga Calcilutite

The Toolonga Calcilutite disconformably overlies the Gearle Siltstone. It is known to consist of light coloured calcilutite and calcareous siltstone with some claystone, siltstone and sandstone. Its thickness is highly variable, with its absence noted to the east of Onslow, where the Site is situated. A stratigraphic borehole (Minderoo 1) ~20 km to the north west of the Site did not encounter this formation (*Micropalaeontology and Stratigraphy of Minderoo No.1 Bore, Carnarvon Basin*, WA, H.S. Edgell 1963 (Minderoo 1)).

Winning Group

The Winning group consists of the following formations:

- Gearle Siltstone;
- Windalia Radiolarite;
- Muderong Shale; and
- Birdrong Sandstone.

The depositional history began during a major transgression in the early Cretaceous and continued through the Cretaceous. It resulted in the formation of a basal sand (Birdrong Sandstone) during the onset of the transgression, following which a low energy environment resulted in the deposition of the Muderong Shale. Continued high sea levels and deep weathering resulted in the possible excess of dissolved silica in the ocean, which led to substantial siliceous ocean deposition, forming the Windalia Radiolarite and Gearle Siltstone.

Gearle Siltstone Formation

The Gearle Siltstone conformably overlies the Windalia Radiolarite and conformably underlies the Toolonga Calcilutite. It is known to consist of siltstone and claystone, which can be locally calcareous, and grading into rare limestone beds. It is very similar to the underlying Windalia Radiolarite, and can be glauconitic and pyritic. Average thickness ranges from 190 m and 250 m, but a thickness of 599 m has been reported (*1:250,000 Geological Series-Explanatory Notes, Onslow Western Australia, Sheet SF 50-5 International Index,* Geological Survey of Western Australia, Department of Mines, W.J.E.Van De Graff, P.D.Denman, M. Hockling, 1982 (DoM, 1982)).

Windalia Radiolarite Formation

This formation lies conformably between the Muderong Shale and Gearle Siltstone. Previous wells sunk within this formation reported it as a siltstone and claystone, occasionally sandy, with gradations to very fine sandstone. It is also understood that the duricrust experienced within the Onslow area formed primarily on the Windalia Radiolarite and Toolonga Calcilutite (DoM, 1987), while the Windalia Radiolarite is known to occur near surface within the Onslow area. The thickness of this unit ranges between 20 m and 140 m. This formation was considered to represent the drilled hardrock geology during the investigation.

Muderong Shale Formation

The Muderong Shale lies conformably between the Birdrong Sandstone and the Windalia Radiolarite. It is known to consist of siltstone and claystone, shale and silty sandstone with minor limestone. This unit is the principal oil and gas being unit in the Barrow Island Oil Field. A thickness of 200 m has been proven for this formation (*Petroleum Geology of the Peedamullah Shelf and Onslow Terrace, Northern Carnarvon Basin* Western Australia, Geological Survey of Western Australia, Department of Minerals and Energy, A. Crostella, R. P. Iasky, K. A. Blundell, A. R. Yasin, and K. A. R. Ghori, 2000 (DME, 2000)).

Birdrong Sandstone Formation

The Birdrong Sandstone marks the base of the Cretaceous and is conformably overlain by the Muderong Shale. The formation is known to consist of friable quartz sandstone with minor shales, siltstones and interbedded conglomerates. An average thickness of between 18 m and 30 m was reported, however, a proven thickness of up to 100 m has been recorded (DoM, 1982). Additional information has suggested that this formation may have a thickness of up to 500 m.

Nanutarra Formation and Yarraloola Conglomerate

The Nanutarra Formation and Yarraloola Conglomerate are known to consist of sandstone, siltstone and conglomerate.

Figure 6 depicts the underlying hardrock geology suggesting the Site is underlain by the Winning Group; however, it does not differentiate between the specific formations.

3.3.4 Structural Geology

No major linear structure was identified within the confines of the Site, while no information has been sourced on the dip and strike of the sedimentary lithologies.

The DMIRS GeoVIEW (https://geoview.dmp.wa.gov.au/GeoViews/?Viewer=GeoVIEW) database indicates that the closest fault line is located approximately 42 km and 51 km east of the Site. The fault lines are identified as a fold axial trace type 'syncline (exposed)'.

3.4 Hydrology and Hydrogeology

3.4.1 Hydrology

The investigation identified no surface water bodies to be located at the Site. The nearest surface water body is a lake located approximately 3.5 km to the south-west of the Site. The most significant water body, located down-hydraulic gradient from the Site is the Ashburton River, located approximately 20 km to the west/north-west. The Cane River is located hydraulically-up gradient, approximately 25 km to the east of the Site, see Figure 7.

The Site was noted to be situated in a ‘Surface Water Resource Proclaimed Area’ in accordance with the *Rights in Water and Irrigation Act 1914.* This would mean a licence would be required to draw water from any surface water course.

3.4.2 Hydrogeology- Superficial

NationalMap (https://nationalmap.gov.au/) indicates that the Site is located within a superficial hydrogeological unit described as "*surficial sediments - shallow aquifers, quaternary surficial sediments - shallow aquifers*".

3.4.3 Hydrogeology – Regional

The Site is believed to be situated within the Carnarvon Artesian Basin (CAB) which is the largest area of artesian conditions of any aquifer in WA. However, it is understood that only a small percentage of the CAB actually exhibit artesian conditions. The CAB extends along the coast in the mid-west region of WA, extending from close to the Murchison River in the South to the mouth of the Fortescue River in the North. It covers ~150,000 km^2 onshore with the majority of the basin located within the Gascoyne Groundwater Area (GGA), though it extends north in the Ashburton subarea and the Pilbara Groundwater Area (PGA), with the Site situated within the PGA.

A Water Management Plan completed by the Department of Water (DoW) (*Carnarvon Artesian Basin, Water Management Plan*, DoW, 2007 (DoW, 2007) highlighted that, regionally, the CAB may be underlain by several aquifers, namely as follows:

- Windalia Radiolarite Formation;
- Windalia Sand Member;
- Birdrong Sandstone Formation;
- Nannyarra Sandstone Formation;
- Kopke Sandstone Formation; and
- Tumblagooda Sandstone Formation.

DoW, 2007 goes on to use the terminology 'Birdrong Aquifer' to represent all these units. As detailed within DoM, 1987, the majority of Tertiary age sediments are absent from the Peedamullah shelf, and the area is dominated by Cretaceous sediments. The geological formations/members mentioned within DoW, 2007 are all Cretaceous in age and are likely present within the greater Onslow area.

Windalia Radiolarite Formation and Windalia Sand Member

The Windalia Radiolarite Formation is known to outcrop locally along the eastern areas of the CAB, with the *Geology of the Carnarvon Basin 1:1,000,000* map recording outcropping of this unit ~20 km south west of the Site. The Windalia Sand Member is restricted to the area south of Shark Bay and is not envisaged to be present within the Onslow area.

The Windalia Radiolarite Formation is known to be non-flowing and free-flowing and is typically brackish. DoM, 1987 suggests that the aquifer is a '*local aquifer in weathered outcrop, subcrop and in deep bores; small to moderate supplies; occasionally artesian; brackish to brine*'. It also suggested that the aquifer has a maximum thickness of 125 m, though a thickness of 140 m has been proven.

It is anticipated that this aquifer was intercepted during Site investigations.

Birdrong Sandstone Formation

The Birdrong Sandstone is present throughout the CAB, with recharge along the eastern margins of the CAB where it is known to outcrop. The average thickness of the aquifer is 20-30 m, however, it can reach thicknesses of >500 m around Carnarvon. A stratigraphic borehole (Minderoo 1) intercepted what was considered to represent the Birdrong Sandstone at ~1,150 feet (~350 m). This bore is ~20 km North West of the Site. DoM, 1987 suggests that this aquifer is a '*Major aquifer, moderate to large supplies, commonly artesian; minor freshwater near outcrop; generally brackish to saline*'.

It is understood that recharge of the aquifer is restricted to areas of outcrop, and areas where favourable structures allow groundwater to recharge through other formations. The majority of bores drilled within the CAB target this aquifer, with this use primarily within the GGA. The Site is however situated within the PGA and is known to have limited users of this aquifer (DoW, 2007).

Groundwater salinity varies across the aquifer, with high salinity within the confined areas of the aquifer and fresh conditions near areas of recharge. The aquifer is also known to become saline towards Onslow.

Nannyarra Sandstone, Kopke Sandstone and the Tumblagooda Sandstone Formations

A further three known aquifers underlie the Birdrong Sandstone, namely the Tumblagooda, Kopke and Nannyarra Sandstone Formations. The Nannyarra Sandstone uncomfortably underlies the Birdrong Sandstone in the Carnarvon-Lake McLeod area and is potentially in hydraulic connection with the Birdrong Sandstone. DoM, 1987 suggests that this aquifer is a '*local aquifer; small supplies in outcrop; fresh to brackish'*. In the Shark Bay region, the Kopke Sandstone underlies the Birdrong Sandstone and can be a significant groundwater source. The Tumblagooda Sandstone in the oldest unit in the CAB and is separated from the Kopke Sandstone by the Dirk Hartog Group. This aquifer is found at extensive depths (~1,000 m). DoM, 1987 has suggested that the Kopke and Tumblagooda Sandstone Formations may be absent from the Peedamullah shelf.

Figure 8 shows hydrogeological conditions of the subject area.

3.5 Groundwater Use

As of March 2006, the greatest use of groundwater from the CAB is 'Mining and Industrial' which accounts for ~50% of its use. Beyond this, 'Pastoral Stations' accounts for ~30 %, while 'Public Services', 'Public Water Supply' and 'Commercial (other)' account for the remaining ~20% (DoW, 2007). It should be noted that all bores into the CAB may not have been registered, so the full use cannot be fully quantified.

As per the Rights in Water and Irrigation Act 1914, a license is required to install a bore into an artesian aquifer. However, the investigation has highlighted the aquifer is not under pressure at the Site.

3.6 Acid Sulfate Soils

As the development will see the excavation and stockpiling of soils, it was considered prudent to consider the possibility of Acid Sulfate Soils (ASS). ASS are naturally occurring soils that contain iron sulfide (iron pyrite) minerals that if disturbed by soil excavation, dewatering or drainage, can then oxidise resulting in the release of acidity and potentially causing environmental impacts.

The CSIRO Australian Soil Resource Information System (ASRIS) online system was utilised to determine ASS risk. The ASRIS provides information on soil and land resources in a consistent format across Australia at varying scales. With regard to ASS, the system brings together ASS mapping from all States and Territories, and in the event that these maps do not cover an area of investigation ASS mapping is "backfilled" with a provisional ASS classification inferred from national and state soils, hydrography and landscape coverage's. This component is referred to as the 'Inland' ASS mapping and is provided at a scale of 1:2M.

A review of inland ASS mapping revealed that the entire Site is located in an area with an extremely low probability of occurrence. Additionally, soils with iron sulfides, such as pyrite, were not identified during site work. Information presented in DoM, 1987 suggests that pyrite can be present within the Windalia Radiolarite, however, only in small amounts.

4 Hydrogeological Investigation

A Phase 1 hydrogeological risk assessment was completed for the Site and included the sinking of 13 soil bores across the Site which allowed for the assessment of the shallow soils, groundwater resource and underlying aquifer and their relationship. The details pertaining to the full hydrogeological investigation undertaken are provided in a separate report *(TW17084-Onslow Site Invesitgations_Hydro.1a* (Talis, 2018)), with a brief summary pertaining to this investigation is provided in the proceeding sections. The locations of the bores are displayed in Figure 9.

4.1 Superficial/Perched groundwater

The investigation showed no presence of a perched shallow aquifer to be located at the Site. However, a seasonal one may be present within unconsolidated portions of the subsoils or situated above the cemented gravel/silcrete.

4.2 Aquifer Conditions

The groundwater across the Site was identified to be located within a sandstone horizon, interfingered with cemented gravels and clayey sands. The aquifer was described as an unconfined sedimentary aquifer will flow primarily within secondary porosity. This is anticipated to be the Windalia Radiolarite Formation which forms part of the CAB.

4.3 Groundwater Parameters

4.3.1 Depth to Groundwater

The 12 groundwater wells were gauged using an interface meter in January 2018, March 2018 and in April 2018 again, with the results provided in Table 4-1, Table 4-2 and Table 4-3.

Table 4-1: Gauging Data - January 2018

Well ID	Well depth (m below ToC)	ToC elevation (m AHD)	Depth to groundwater (m below ToC)	RL SWL (m AHD)
BH01	11.17	19.242	7.216	12.026
BH02	11.27	21.532	9.810	11.722
BH03	11.15	17.248	5.903	11.345
BH04	11.07	13.305	6.615	6.690
BH05	11.05	13.076	6.490	6.586
BH10	27.46	32.183	21.264	10.919
BH11	26.27	27.322	17.997	9.325
BH12	11.04	17.671	6.600	11.071
BH13	11.05	16.353	6.760	9.593
BH14	11.06	16.781	7.560	9.221
BH15	11.16	14.992	6.135	8.857
BH16	11.06	16.188	6.545	9.643
BH17	11.25	17.443	6.852	10.591

ToC – Top of Casing

RL SWL – Relative Level 'Standing Water Level' m Australian Height Datum

Table 4-2: Gauging Data - March 2018

Well ID	Well depth (m below ToC)	ToC elevation (m AHD)	Depth to groundwater (m below ToC)	RL SWL (m AHD)
BH01	11.17	19.242	7.314	11.928
BH02	11.27	21.532	9.90	11.632
BH03	11.15	17.248	5.948	11.300
BH04	11.07	13.305	6.671	6.634
BH05	11.05	13.076	6.540	6.536
BH10	27.46	32.183	21.31	10.873
BH11	26.27	27.322	18.031	9.291
BH12	11.04	17.671	6.652	11.019
BH13	11.05	16.353	6.805	9.548
BH14	11.06	16.781	7.722	9.059
BH15	11.16	14.992	6.185	8.807
BH16	11.06	16.188	6.610	9.578
BH17	11.25	17.443	6.904	10.539

ToC – Top of Casing

RL SWL – Relative Level 'Standing Water Level' m Australian Height Datum

Table 4-3: Gauging Data - April 2018

Well ID	Well depth (m below ToC)	ToC elevation (m AHD)	Depth to groundwater (m below ToC)	RL SWL (m AHD)
BH01	11.17	19.242	7.350	11.892
BH02	11.27	21.532	9.935	11.597
BH03	11.15	17.248	5.980	11.268
BH04	11.07	13.305	6.700	6.605
BH05	11.05	13.076	6.570	6.506
BH10	27.46	32.183	21.335	10.848
BH11	26.27	27.322	18.080	9.242
BH12	11.04	17.671	6.680	10.991
BH13	11.05	16.353	6.860	9.493
BH14	11.06	16.781	7.790	8.991
BH15	11.16	14.992	6.220	8.772
BH16	11.06	16.188	6.635	9.553
BH17	11.25	17.443	6.934	10.509

ToC – Top of Casing

RL SWL – Relative Level 'Standing Water Level' m Australian Height Datum

4.3.2 Groundwater Flow Direction

Utilising the gauging data from the three monitoring rounds and survey information, groundwater contour plans have been created for the Site and are shown in Figure 10, Figure 11 and Figure 12. The gauging show that groundwater flows in a westerly/north-westerly direction, towards the Ashburton River and Indian Ocean located.

5 Investigation Methodology

5.1 Intrusive Investigation Techniques

A total of 112 trial pits (TP01-TP112) were excavated across the Site to assess the shallow subsurface soils, and to allow the collection of bulk soil samples for laboratory testing. The trial pits were initially excavated using a 30-tonne excavator, however, this was substituted for a 20-tonne excavator during the investigations.

The intrusive investigation also included the drilling of 13 boreholes. As previously stated in Section 4, these were drilled to intercept groundwater but were also utilised to assess the subsurface conditions (BH01-BH05 and BH10-BH17).

All field work, including logging of subsurface profiles and collection of samples were undertaken by Talis' experienced geo-environmental engineer. The soil profile was logged in accordance with *Australian Standard (AS) 1726:2017-Geotechnical Site Investigation*. Subsurface conditions are summarised in Section 6.

5.2 Insitu Testing

The Perth Sand Penetrometer (PSPs) tests were completed to 1.05 m below ground level (BGL), adjacent to 33 trial pits. The PSPs were undertaken in accordance with the following standards:

- *AS 1289.6.3.1: Soil strength and consolidation tests-Determination of the penetration resistance of a soil-Standard Penetrometer test*; and
- *AS 1289.6.3.3: Soil strength and consolidation tests-Determination of the penetration resistance of a soil-Perth Sand Penetrometer test.*

5.3 Soil Testing

To assess subsoil conditions, laboratory analysis on selected disturbed and undisturbed samples recovered during the intrusive field works was undertaken. This comprised of the following testing:

- *Soil moisture content tests-Determination of moisture content of a soil-Oven drying method (standard method) (AS1289.2.1.1);*
- *Soil Classification tests-Determination of the liquid limit of a soil-four point Casagrande method (AS1289.3.1.1);*
- *Soil Classification tests- Determination of the plastic limit of a soil-Standard method (AS1289.3.2.1);*
- *Soil Classification tests-Determination of the linear shrinkage of a soil-standard method; liquid limit of a soil-four point Casagrande method (AS1289.3.4.1);*
- *Soil classification tests-Determination of the particle size distribution of a soil-Standard method of analysis by sieving (AS1289.3.6.1);*
- *Soil classification tests-Determination of the particle size distribution of a soil-Standard method of fine analysis using hydrometer (AS1289.3.6.3);*
- *Soil compaction and density tests-Determination of the dry density/moisture content relation of a soil using modified compactive effort (AS1289.5.2.1);*
- *Triaxial permeability testing-Determination of the permeability of a soil – Constant head method using a flexible wall permeameter (AS1289.6.7.3;*
- *Falling head permeability testing-Determination of the permeability of a soil – falling head method for a remoulded specimen (AS1289.6.7.2); and*

- *Unconsolidated triaxial compression tests – Determination of the compressive strength of a soil – Compressive strength of a saturated specimen tested in undrained triaxial compression with measurement of pore water pressure (AS1289.6.4.2).*

Results of the laboratory testing undertaken on selected soil samples are summarised in Section 7.

6 Soil Conditions

A total of 112 trial pits were excavated at the Site to assess the shallow soils, predominantly focused on the proposed development footprint of the WMF. A further 13 boreholes were drilled across the Site, which intercepted the underlying aquifer. The following sections describe the subsurface conditions, while Appendix B presents the engineering logs, with photographs presented in Appendix C. Geotechnical laboratory test result certificates are presented in Appendix D.

The locations of the trial pits are presented in Figure 13.

6.1 Geology

6.1.1 Generalised Soil Profile

The soil conditions recorded across the Site consisted of the following:

- SAND – loose, fine to medium grained (Pindan) generally corresponding to the sand dune ridge;
- Sandy clayey SILT/Silty clayey SAND – loose to dense, fine to medium grained, rounded to sub-rounded, red brown and dry (Pindan); underlain by
- Cemented GRAVEL/SILCRETE – cemented gravels in silty sand/sandy silt matrix – hard, red brown and white, becoming brown with depth, and dry; underlain by
- SANDSTONE interfingered with cemented gravel – medium grained, occasional clasts, siliceous veins and vugs, dry, red to yellow.

6.2 Superficial Soils

6.2.1 Sand, Silty Sand/Sandy Silt Horizon

The trial excavations described the underlying soil horizon to primarily be a SAND, with its structure described as fine to medium grained, rounded to sub rounded, dry and loose with occasional roots. It was also described as a SILTY SAND/SANDY SILT of low plasticity. This horizon is colloquially known as ‘Pindan’. This horizon was encountered to a maximum depth of 0.5 m (TP42) to 5 m BGL (TP28).

Additionally, cores collected during the drilling and installation of groundwater monitoring wells were assessed. These generally confirmed the profiling during the trial excavations, describing the initial soil horizon as a SAND. However, its composition was described as SAND with trace gravel, silt and clay. This horizon was encountered from ground level to a depth of between 0.94 m BGL (BH13) and 4.13 m BGL (BH2), though BH2 is situated on the other side of the sand ridge.

Laboratory analysis undertaken on this horizon, consisting of Particle Size Distribution (PSD) analysis, generally confirmed the visual logging, described this horizon as SAND to Silty/Clayey SAND with trace gravel, gap graded and fine to medium grained.

6.2.2 Sandy Gravel

While not encountered during the trial excavations, a gravelly SAND was recorded during the drilling of boreholes, with these bores allowing for a more thorough assessment of soil conditions. The horizon was encountered within BH01, BH03, BH11, BH12, BH13, BH14 and BH17 and was described as a Gravelly SAND with trace silt/clay. The horizon was encountered immediately beneath the pervious sand horizon at a depth of 0.94 m BGL (BH13) and 2.57 m BGL (BH14), with a thickness of between 0.43 m (BH14) and 2.7 m (BH13). It is likely this horizon represents the transition into the underlying cemented gravel/silcrete.

6.2.3 Cemented Gravel/Silcrete Horizon

SILCRETE/Cemented GRAVEL was encountered underlying the aforementioned horizons. This horizon was described as a weakly to moderately cemented GRAVEL, bound by a sand cement. The gravel was described as sub angular to sub rounded, up to 60 mm in size; while the horizon was described as hard/dense causing refusal of trial excavations. The colour was noted to be generally red and white, becoming brown with depth. Within the trail excavations the horizon was encountered at a minimum of 0.5 m BGL (TP42) to a maximum depth of 5.0 m BGL (TP28), with the excavations terminated in this horizon due to hard digging. The boreholes managed to penetrate this horizon fully and encountered it at a depth of between 2 m BGL (BH1 and BH5) and 4.13 m BGL (BH2). A proven thickness of between 0.38 m (BH16) and 4.89 m (BH12) was recorded.

6.2.4 Sandstone Horizon

Bedrock was intersected during the drilling of the soil bores at a depth of between 2.04 m BGL (BH16) and 7 m BGL (BH12). It was generally described as SANDSTONE, interbedded with cemented GRAVEL and clayey SAND horizons. The SANDSTONE was described as fine to medium grained, with occasional clasts of quartz, vugs and silicious veins, and was pale brown to yellow/red. The GRAVEL was described as weakly cemented, sub angular to rounded and consisting of quartz, lateritic gravel and shale. The clayey SAND horizons were described as medium to coarse grained, sub angular to sub rounded and gap graded with the clay being of low plasticity.

This deposit was considered to be representative of the Windalia Radiolarite Formation.

6.3 Sand Ridge

The investigation undertaken on the sand ridge encountered similar conditions to the rest of the Site, with SAND encountered at all trial excavations. Two bores (BH10 and BH11) were sunk on the ridge to assess in more detail its composition. Recovery was poor due to the loose nature of the soil but the soils were generally described as a SAND with trace silt, clay and gravel. This material continued to approximately 15 m BGL (BH10) and 12 m BGL (BH11). Again, the sand was gap graded, fine to coarse grained, and sub-angular to rounded. Cemented gravel, representing the ‘silcrete’ was encountered beneath this sand horizon, followed by the sandstone.

6.4 Perth Sand Penetrometer

PSPs were undertaken adjacent to 33 trial pit locations to a maximum 1.050 m BGL, generally confined to the sandy SILT/silty SAND horizon. The number of blows can be utilised for the correlation of strength of soils and relative density as detailed in the *Penetration Test and bearing capacity of cohesionless soils, Journal of the Soil Mechanics and Foundation Division ASCE, 82* (SM1) (Meyerhoff, 1956). The correlation is shown in Table 6-1.

Table 6-1: Blows and Strength Correlation

Blows/0.3 m	Strength	Relative Density (%)
<4	Very Loose	<20
4-10	Loose	20-40
10-30	Compact	40-60
30-50	Dense	60-80

Blows/0.3 m	Strength	Relative Density (%)
>50	Very Dense	>80

Table 6-2 details the outcome of this in-situ testing, while Figure 14 presents the PSP locations.

Table 6-2: Proposed WMF footprint-Surficial Horizon

Location	Depth (mm BGL)	Blows (N)	Consistency Terms	Soil
TP03	150-450	9	Loose	Silty SAND
	450-750	17	Compact	Silty SAND
	750-1050	23	Compact	Silty SAND
TP05	150-450	7	Loose	SAND
	450-750	10	Loose	SAND
	750-1050	14	Compact	SAND
TP19	150-450	6	Loose	SAND
	450-750	17	Compact	SAND
	750-1050	27	Compact	SAND
TP28	150-450	15	Compact	Sandy SILT
	450-750	26	Compact	Sandy SILT
	750-1050	42	Dense	Sandy SILT
TP34	150-450	10	Loose	Silty SAND
	450-750	20	Compact	Silty SAND
	750-1050	38	Dense	Silty SAND
TP38	150-450	11	Compact	Silty SAND
	450-750	25	Compact	Silty SAND
	750-1050	40	Dense	Silty SAND
TP40	150-450	13	Compact	Silty SAND
	450-750	23	Compact	Silty SAND
	750-1050	37	Dense	Silty SAND
TP42	150-450	66	Very Dense	Sandy SILT
	450-750	118	Very Dense	SILCRETE
	750-1050	145	Very Dense	SILCRETE
TP44	150-450	51	Very Dense	Sandy SILT
	450-600	40	Dense	Sandy SILT
TP47	150-450	55	Very Dense	Sandy SILT
	450-750	71	Very Dense	Sandy SILT
	750-1050	96	Very Dense	Sandy SILT
TP50	150-450	78	Very Dense	Sandy SILT
	450-750	115	Very Dense	Sandy SILT

Location	Depth (mm BGL)	Blows (N)	Consistency Terms	Soil
	750-900	60	Very Dense	Sandy SILT
TP53	150-450	64	Very Dense	Silty SAND
	450-750	118	Very Dense	Silty SAND
TP54	150-450	69	Very Dense	Silty SAND
	450-700	>90	Very Dense	Silty SAND
TP55	150-450	46	Dense	Silty SAND
	450-750	>80	Very Dense	SILCRETE
TP60	150-400	70	Very Dense	Sandy SILT/SILCRETE
TP62	150-300	>60	Very Dense	SILCRETE
TP66	150-450	71	Very Dense	Sandy SILT
TP68	150-450	53	Very Dense	Sandy SILT
	450-500	>50	Very Dense	SILCRETE
TP71	150-450	65	Very Dense	Sandy SILT
	450-650	>115	Very Dense	Sandy SILT
TP72	150-450	62	Very Dense	Sandy SILT
	450-750	116	Very Dense	Sandy SILT
	750-1050	153	Very Dense	SILCRETE
TP77	150-450	69	Very Dense	Sandy SILT
	450-700	>131	Very Dense	Sandy SILT
TP78	150-450	49	Dense	Sandy SILT
	450-750	80	Very Dense	SILCRETE
	750-1050	123	Very Dense	SILCRETE
TP80	150-450	23	Compact	Sandy SILT
	450-750	79	Very Dense	Sandy SILT
	750-1050	119	Very Dense	Sandy SILT/SILCRETE
TP84	150-450	47	Dense	Sandy SILT
	450-600	>80	Very Dense	Sandy SILT
TP90	150-450	61	Very Dense	Sandy SILT
	450-750	110	Very Dense	Sandy SILT
	750-1050	169	Very Dense	Sandy SILT/SILCRETE
TP92	150-450	46	Dense	Sandy SILT
	450-750	75	Very Dense	Sandy SILT
	750-1050	125	Very Dense	Sandy SILT
TP93	150-450	63	Very Dense	Sandy SILT
	450-750	114	Very Dense	Sandy SILT/SILCRETE

Location	Depth (mm BGL)	Blows (N)	Consistency Terms	Soil
	750-900	>60	Very Dense	SILCRETE
TP102	150-450	63	Very Dense	Sandy SILT/SILCRETE
	450-500	>40	Very Dense	SILCRETE
TP103	150-450	60	Very Dense	Sandy SILT
	450-750	126	Very Dense	SILCRETE
TP104	150-450	28	Compact	Sandy SILT
	450-750	55	Very Dense	Sandy SILT
	750-1050	101	Very Dense	Sandy SILT
TP106	150-450	58	Very Dense	Silty SAND
	450-750	110	Very Dense	Silty SAND
	750-1050	150	Very Dense	Silty SAND
TP107	150-450	48	Dense	Silty SAND
	450-750	78	Very Dense	Silty SAND
	750-1050	121	Very Dense	Silty SAND
TP110	150-300	48	Dense	Sandy SILT

A review of the PSP results from the proposed WMF footprint has shown that the ground conditions ranged from ‘loose’ to ‘very dense’. The ‘loose’ soils were encountered in locations along and on the edge of the sand dune ridge. The remaining PSP tests were conducted through the sandy SILT/Silty SAND soil of the Site and show these soils to range in consistency from ‘compact’ to ‘very dense’. Refusal of the PSP tests generally occurred at or slightly above the cemented gravel/SILCRETE as identified in the test pit logs.

6.5 Standard Penetration Tests

To gain an understanding of the inherent soil strength and consistency at depth, SPT's were undertaken at each bore location, to a depth of 3.45 m BGL. The correlation of SPT blows and inherent strength is shown in the following tables and is in accordance with Meyerhoff, 1956:

Table 6-3: Blows and Strength Correlation-Sand

Blows/0.3 m	Strength	Relative Density (%)
<4	Very Loose	<20
4-10	Loose	20-40
10-30	Compact	40-60
30-50	Dense	60-80
>50	Very Dense	>80

Table 6-4 details the results of the SPT analysis.

Table 6-4: SPT results

Location	Depth (mm BGL)	Soil	Blows (N)	Consistency Terms
BH01	1500-1950	Gravelly SAND with clay and silt	44	Dense
	3000-3450	Cemented GRAVEL	30, 30/60	N/A*
BH02	1500-1950	Core Loss	24	Compact
	3000-3450	Core Loss	48	Dense
BH03	1500-1950	Gravelly SAND with trace clay and silt	5,26,36/40	N/A*
BH04	1500-1950	SAND with gravel and trace silt and clay	6,21/70	N/A*
BH05	1500-1950	SAND with gravel and silt and clay	32	Dense
	3000-3450	Sandy CLAY	6, 23/90	N/A
BH12	1500-1950	Gravelly SAND with trace silt and clay	58	Very Dense
BH13	1500-1950	Clayey SAND and GRAVEL	65	Very Dense
BH14	1500-1950	SAND with trace clay and silt	Dense	Hard
	3000-3450	Weakly cemented GRAVEL with clay lenses	8, 27/90	N/A*
BH15	1500-1950	Weakly cemented GRAVEL	1,19 5/10	N/A*
BH16	1500-1950	Clayey gravelly SAND	22, 6/1	N/A*
BH17	1500-1950	Clayey SAND and GRAVEL	42	Dense

**Failure due to soil conditions i.e. cemented gravel.*

The SPT results, which were primarily undertaken on the ‘cemented gravel’ or the transition into this horizon, showed the consistency of the soils range from ‘compact’ to ‘very dense’. Cemented gravels and silcrete have prevented completion of the SPT at a number of locations.

7 Laboratory Analysis

Laboratory testing on soil samples was undertaken by E-Precision Laboratories, in their National Association of Testing Authorities (NATA) accredited laboratory and consisted of the testing detailed in Section 5.3.

The laboratory test results, along with the test methods followed are presented in Appendix D while results are summarised in the following sections.

7.1 Soil Index Testing

7.1.1 Sandy Clayey SILT / Silty Clayey SAND

Table 7-1: Soil Index Silty Clayey SAND/Sandy clayey SILT

Location	Depth (m BGL)	% Gravel (63– 2.36) mm	% Coarse Grained Sand (2.36– 0.6) mm	% Medium Grained Sand (0.6– 0.2) mm	% Fine Grained Sand (0.2 – 0.075) mm	% Silt (0.075- 0.002) mm	% Clay ≤0.002 mm	LL (%)	PL (%)	PI (%)	SL (%)	LS (%)	Classification	Iss(%)	MC (%)
BH17	2.1	1.2	3.0	24.3	38.6	13.6	19.3	45.91	28.06	17.85	21.11	11.12	ML	1.65	-
TP14	0.5-1.0	0.0	0.5	42.5	35.5	7.7	13.8	-	-	-	-	-	-	-	-
TP29	0-0.5	4.5	4.5	31.0	27.0	19.3	13.7	-	-	-	-	-	-	-	-
TP29	0.5-1.0	0.0	0.6	45.7	35.0	11.4	7.3	-	-	-	-	-	-	-	2.954
TP29	3-3.5	5.1	3.0	37.9	27.1	14.7	12.2	19.94	11.66	8.29	10.35	2.20	CL	0.86	2.602
TP36	3-3.5	12.4	4.6	44.5	16.7	11.8	10.0	19.80	12.50	7.30	11.21	4.07	CL	0.62	-
TP38	1.5-1.9	1.6	3.1	45.2	21.6	16.6	11.9	-	-	-	-	-	-	-	-
TP44	0-0.5	2.5	4.9	34.0	20.5	18.7	19.4	-	-	-	-	-	-	-	2.927
TP54	0.5-1.0	16.4	3.3	25.9	16.8	14.4	23.2	-	-	-	-	-	-	-	-
TP68	0-0.5	8.0	5.1	36.2	19.7	18.1	12.9	-	-	-	-	-	-	-	3.261
TP78	0-0.5	6.4	5.0	40.1	27.3	11.7	9.5	-	-	-	-	-	-	-	0.697
TP90	0-0.5	7.1	4.7	35.9	22.6	17.9	11.8	-	-	-	-	-	-	-	1.498

Size ranges as per ISO14688-1:2002
LL = Liquid Limit, PL = Plastic Limit, PI = Plastic Index, SL = Shrinkage Limit, LS= Linear Shrinkage, MC = Moisture Content, ISS=Shrink swell index

Review of the results for the laboratory analysis on soils from this horizon found soils to generally consist of clayey silty SAND, medium grained and gap graded, with varying proportions of gravel. Fines component of the soils varied from 18.7% at TP29 (0.5-1.0 m) to 38.1% at TP44 (0-0.5 m). Atterberg limits testing undertaken on selected samples showed the fines to be classified as clay and silt of low plasticity. The shrink-swell assessment has also suggested a relatively low potential for expansion.

7.1.2 Cemented Gravels / Silcrete

Table 7-2: Soil Index Cemented gravel / Silcrete

Location	Depth (m BGL)	% Gravel (63– 2.36) mm	% Coarse Grained Sand (2.36– 0.6) mm	% Medium Grained Sand (0.6– 0.2) mm	% Fine Grained Sand (0.2 – 0.075) mm	% Silt (0.075- 0.002) mm	% Clay ≤0.002 mm	LL (%)	PL (%)	PI (%)	SL (%)	LS (%)	Atterberg Classification	Iss(%)	MC (%)
BH10	15.5	61.2	1.7	16.8	11.4	4.6	4.3	-	-	-	-	-	-	-	-
BH13	2.0	38.9	4.0	11.7	10.5	25.6	9.3	-	-	-	-	-	-	-	-
BH14	3.6	50.0	10.0	17.8	6.1	8.6	7.5	38.07	15.28	22.78	11.24	2.52	CL	0.38	-
BH14	5.0	68.1	10.4	12.4	3.2	2.4	3.5	35.46	13.79	21.68	10.36	1.73	CL	0.36	-
TP44	2.5-3.0	41.2	2.9	13.7	11.3	15.0	15.9	26.88	14.43	12.45	12.02	9.25	CL	0.97	4.863

Size ranges as per ISO14688-1:2002

LL = Liquid Limit, PL = Plastic Limit, PI = Plastic Index, SL = Shrinkage Limit, LS= Linea Shrinkage, MC = Moisture Content, ISS=Shrink swell index

Review of the results for the laboratory analysis on soils from this horizon found soils to generally consist of sandy GRAVEL with silt and clay. Fines component of the soils varied from 5.9% at BH14 (5.0 m) to 34.9% at BH13 (2.0 m). Atterberg limits testing undertaken on selected samples shows the fines to be classified as clay of low plasticity. The shrink-swell assessment has also suggested a relatively low potential for expansion.

7.2 Soil Permeability

7.2.1 Silty Clayey Sand Horizon

A number of *falling head permeability tests* (AS1289.6.7.2) were conducted on the silty clayey sand component of this horizon. Table 7-3 summarises the falling head permeability results.

Table 7-3: Falling Head Permeability Test Results

Location	Depth (m BGL)	Permeability (m/s)
TP29	3.0	4.773×10^{-8}
TP36	3.0	1.634×10^{-7}
TP38	1.0	4.859×10^{-9}
TP44	2.5	1.861×10^{-8}
TP84	1.0	6.107×10^{-9}

Results of falling head permeability testing recorded a permeability of between 1.8634×10^{-7} m/s and 4.859×10^{-9} m/s, suggesting the material is relatively impermeable.

7.2.2 Cemented Gravel/Silcrete Horizon

In addition, a number of *triaxial permeability tests* were run on core samples collected from the cemented gravel/silcrete. Table 7-4 details the triaxial permeability test results.

Table 7-4: Cemented Gravel-Silcrete Permeability Test Results

Location	Depth (m BGL)	Permeability (m/s)
BH10*	15.5	7.356×10^{-9}
BH13*	2.0	3.382×10^{-9}
BH14*	3.6	4.739×10^{-9}
BH14*	5.0	1.188×10^{-8}

Triaxial permeability testing conducted on this horizon recorded a permeability of between 1.188×10^{-8} m/s and 7.356×10^{-9} m/s, suggesting the material is relatively impermeable.

7.3 Compaction Tests

To aid with the assessment of the engineering parameters of the sandy clayey sand horizon, a number of compactions tests (Proctor) were undertaken to calculate the modified maximum dry density (MMDD) and the optimum moisture content (OMC). The results of this testing are summarised within Table 7-5.

Table 7-5: Compaction Results Shallow Surface Soils

Location	Depth (m BGL)	OMC (%)	MMDD (t/m^3)
TP42	0-0.5	7.0	2.21
TP44	0-0.5	8.5	2.16
TP68	0-0.5	8.0	2.21
TP78	0-0.5	7.0	2.19

Location	Depth (m BGL)	OMC (%)	MMDD (t/m^3)
TP107	0-0.5	8.0	2.17

Compaction testing on the surface soil showed a MMDD of between 2.16 t/m^3 and 2.21 t/m^3, with an OMC of between 7 % and 8.5 %.

Table 7-6: Compaction Results Deeper Soils

Location	Depth (m BGL)	OMC (%)	MMDD (t/m^3)
TP14	0.5-1.0	8.0	1.75
TP29	0.5-1.0	9.5	1.93
TP29	3.0-3.5	7.0	2.14
TP36	3.0-3.5	7.5	2.20
TP54	0.5-1.0	9.5	2.14

Compaction testing on the underlying deeper soils showed a MMDD of between 1.75 t/m^3 and 2.20 t/m^3, with an OMC of between 7 % and 9.5 %.

7.4 CBR

To aid in the construction of the likely access road and pavements within the Site, California Bearing Ratio (CBR) testing was completed, at a compaction state of 95% MMDD. The summary of this testing is presented in Table 7-7.

Table 7-7: CBR Results

Location	Depth (m BGL)	MC (%)	DD (t/m^3)	CBR (%) at 5mm
TP42	0-0.5	7.1	2.214	20
TP44	0-0.5	8.5	2.161	10
TP29	0.5-1.0	9.6	1.925	35

7.5 Consolidated Undrained Triaxial Tests

Soils were subject to consolidated undrained triaxial analysis to determine the shear strength of the soil for engineering purposes. The summary of this testing is presented in Table 7-8.

Table 7-8: CU Triaxial Test Results

Location	Depth (m BGL)	Soil		Interpreted From Mohr Circle			MIT Stress Path	Modified Mohr Coulomb Path
				Stage 1 & 2	Stage 1 & 3	Stage 2 & 3		
TP7	4.5-5.0	SAND	Cohesion C’ (kPa)	-	2.13	32.97	0.00	0.19
			Angle of Shear Resistance Ø (degrees)	-	39.35	34.22	39.48	39.27
TP14	0.5-1.0	SAND	Cohesion C’ (kPa)	3.07	3.94	7.51	3.86	3.88

Location	Depth (m BGL)	Soil		Interpreted From Mohr Circle			MIT Stress Path	Modified Mohr
			Angle of Shear Resistance Ø (degrees)	39.69	38.66	37.60	38.98	38.97
TP22	3.0-3.5	SAND	Cohesion C' (kPa)	0.46	1.86	11.29	0.52	0.59
			Angle of Shear Resistance Ø (degrees)	37.23	36.58	35.45	37.37	37.32
TP55	0.0-0.5	Sandy SILT	Cohesion C' (kPa)	0.07	4.54	13.49	7.64	7.86
			Angle of Shear Resistance Ø (degrees)	40.36	34.99	32.62	34.54	34.40
TP80	0.0-0.5	Sandy SILT	Cohesion C' (kPa)	12.28	13.71	18.40	14.26	14.30
			Angle of Shear Resistance Ø (degrees)	34.95	33.82	18.40	33.92	33.95
TP84	1.0-1.4	Sandy SILT	Cohesion C' (kPa)	0.21	1.74	7.69	4.24	4.35
			Angle of Shear Resistance Ø (degrees)	39.01	37.60	36.50	37.16	37.13
TP90	0.0-0.5	Sandy SILT	Cohesion C' (kPa)	0.15	5.27	19.09	6.86	7.22
			Angle of Shear Resistance Ø (degrees)	43.05	40.03	37.23	39.97	39.86
TP93	0.5-1.0	Sandy SILT	Cohesion C' (kPa)	0.49	5.00	19.33	7.83	8.26
			Angle of Shear Resistance Ø (degrees)	38.73	36.50	33.82	36.11	35.99

8 Geotechnical Assessment

8.1 Site Classification

AS 2870-2011 Residential Slabs and Footings establishes performance requirements and specific designs for common foundation conditions as well as providing guidance on the design of footing systems using engineering principles. While this guideline will not be applicable to the construction of the landfill cells, it will be applicable to any associated small building, such as the gate house. Site classes, as defined on Table 2.1 and 2.3 of *AS 2870,* are presented in Table 8-1.

Table 8-1: Site Classification Summary

Site Class	Foundation	Characteristic Surface Movement
A	Most sand and rock sites with little or no ground movement from moisture changes	-
S	Slightly reactive clay sites, which may experience only slight ground movement from moisture changes	0 – 20 mm
M	Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes	20 – 40 mm
H1	Highly reactive clay sites, which may experience high ground movement from moisture changes	40 – 60 mm
H2	Highly reactive clay sites, which may experience very high ground movement from moisture changes	60 – 75 mm
E	Extremely reactive sites, which may experience extreme ground movement from moisture changes	>75 mm
A-P	Filled sites (refer to clause 2.4.6 of AS 2870)	
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise.	

Based on the subsurface profiles encountered during the investigations and laboratory results of the clayey/silty sand, and in accordance with the *AS2870-2011*, Talis deems that the site would achieve a 'Site Class S' due to the presence of clays of low reactivity at greater than 15% weight within the soil portions of the investigation area, and the low reactivity of these clays.

Therefore, should all conventional style structures with modest loadings be founded within the shallow silty clayey sand horizon, it is likely that normal slab, pad or strip footings may be possible but designed for a potential surface movement (y_s) of 0-20 mm.

8.2 Preliminary Bearing Pressure

At this time, there is no indication of structural loading or layout for the development. Therefore, for the purpose of this preliminary investigation, Talis has assumed a square foundation of 1 m, embedded at 0.5 m depth.

Utilising Terzaghi's bearing capacity theory allows for the evaluation of the bearing capacity of shallow foundations. A factor of safety of three has been adopted for the investigation in line with industry standards (Principles of Foundation Engineering, Braja M. DAS). The adopted soil properties are presented in Table 8-2.

Table 8-2: Adopted Soil Properties

Soil Type	Ø (^{o})	Y (kN/m^3)	c (kPa)	N_c	N_q	N
SAND, medium grained, gap graded-Loose	29	19.5	0	34.24	19.98	16.18
Silty SAND - Dense	34	20.5	0	52.64	36.50	38.04

Ø-Angle of Friction, Y-Unit weight or density of soil, C-cohesion of Soil, Nc/Nq/ N - Terzaghi's bearing capacity factors

Ø-Angle of Friction from USCS typical published values based on PSP and SPT results - (Peck, R., Hanson,W., and Thornburn, T. (1974). Foundation Engineering Handbook. Wiley, London. & Carter, M. and Bentley, S. (1991). Correlations of soil properties. Penetech Press Publishers, London.)

Terzaghi's bearing capacity (square foundation)

$Q(u) = 1.3\, cN_c + \gamma\, DN_q + 0.4\, \gamma\, BN_{\gamma}$, where B = foundation width, and D = Foundation depth

Footings founded within these shallow soils may exhibit an indicative allowable bearing pressure of between 107 kPa and 229 kPa.

8.3 Earthworks

Earthworks related to the construction of buildings associated with the WMF are anticipated to be limited to a depth of <0.5 m, with foundations within the initial silty clayey sand horizon. At this depth, excavations should easily be achieved. However, should excavations extend beyond the initial soil horizon and into the cemented gravel/silcrete, then a larger more powerful hydraulic excavator may be required.

All earthworks for the development should be undertaken in accordance with *AS 3798-2007, Guidelines on Earthworks for Commercial and Residential Developments.*

8.4 Drainage

In relation to buildings constructed on Site, due to the identified low permeability of the soils, it is likely that on-Site disposal of storm water runoff would be difficult. Flow through silty clayey sands can be slow and difficult to predict. Consequently, storm water should be diverted to storm water drains and channels then to infiltration/evaporation basins. To aid in the design of storm water drainage systems, the permeability and grading of subsoils are presented in Section 7.1. Any design should move storm water away from buildings, while preventing the ponding of storm water under buildings or storm water entering a building. The system should also be designed with consideration to a 100 year annual recurring interval (ARI) storm.

All stormwater drainage design should be undertaken in accordance *AS 3500.3-2015 Plumbing and drainage, Part 3: Stormwater drainage.*

8.5 Groundwater

Shallow groundwater (<3.0 m) was not identified across the Site, therefore, it is not envisaged that groundwater would impact any conventional foundations or excavations.

8.6 Pavement Design

Laboratory CBR (at 95% MDD) results ranges from 12% to 35% and correlations with the PSD results yielded a CBR range of 8% to 20%. While no relationship exists between PSP and CBR, the mean results from the PSP for 0.15-0.45 m, 0.45-0.75 m and 0.75-1.05 m were 45, 74 and 89 respectively. Overall, the results suggest a subgrade of excellent strength. It is common practice to apply an upper limit of 10% to the subgrade design CBR, unless there is significant knowledge of the subgrade, and for conservatism, the design CBR has been selected as the minimum result, 8%. Traffic forecasts on the site have predicted an anticipated nine waste vehicles and twelve semi-trailers per week. Over a 20 year design life, this predicted traffic will generate $1.62\text{x}10^5$ design equivalent standard axles. Using these inputs, a granular pavement has been designed which comprises a 100 mm granular subbase (CBR>30), overlaid by a 115 mm granular basecourse (CBR>80).

9 Conclusions

An investigation was undertaken to characterise the surface and near surface soils at the Site, while also providing information to support the construction of the proposed WMF.

The intrusive investigation identified the superficial soils which included an initial sand horizon across the sand dune ridge up to a maximum recorded depth of 15.5 m BGL, located east within the Site. Surface soil across the remainder of the Site consisted of silty clayey SAND and sandy clayey SILT with trace gravels. This was generally described as gap graded, fine to medium grained sand, with the clayey silt component being of low plasticity. This horizon extended to a maximum depth of 5 m BGL.

This horizon was underlain by cemented gravel/silcrete. The thickness could not be proven across the trail pitting, however, the horizon was encountered at a minimum of 0.5 m BGL (TP42) to a maximum depth of 5.0 m BGL (TP28), with the excavations terminated in this horizon due to hard digging. The boreholes managed to penetrate this horizon fully and encountered it at a depth of between 2 m BGL (BH1 and BH5) and 4.13 m BGL (BH2). A proven thickness of between 0.38 m (BH16) and 4.89 m (BH12) was recorded.

Underlying this horizon was a sandstone layer, which was interfingered with cemented gravel horizons and clayey sand horizons. This deposit is considered to represent the Windalia Radiolarite Formation, which forms part of the CAB.

Based on the subsurface profiles encountered, insitu testing and laboratory results, and in accordance with AS2870-2011, the investigation area in its current condition would be classified as per the following:

- **Class S,** Slightly reactive clay sites, which may experience only slight ground movement from moisture changes.

Based on the Site assessment and visual assessment of the shallow soils, footings founded within the shallow soils may be designed using a Safe Bearing Capacity of at least 123 kPa, with a potential surface movement of 0-20 mm. Inspection of footings by a geotechnical consultant or experienced engineer is required to provide confirmation of founding conditions and bearing pressures.

9.1 Limitations

Talis has performed the investigation and consulting services for this project in general accordance with current professional and industry standards. Please see Appendix E for commonly used terminology within this report.

The findings of the geotechnical Site classification and bearing pressures are only applicable to the construction of low loading buildings associated with the WMF and are not applicable to the construction of any waste cell.

Investigations of this nature are not capable of locating all soil conditions (which can vary even over short distances) and certainly beyond the depth of the trial excavations. The advice given in this report is based on the assumption that the test results are representative of the overall soil conditions. However, it should be noted that actual conditions in some parts of the Site might differ from those found. If further works reveal soil conditions significantly different from those shown in the report, further assessments should be undertaken.

A geotechnical consultant or qualified engineer should inspect foundations and excavations to confirm assumed conditions in this assessment.

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AS 1289.3.2.1, Soil Classification tests- Determination of the plastic limit of a soil-Standard method.

AS 1289.3.3.1Soil Classification tests- Calculation of the cone plasticity index of a soil.

AS 1289.3.6.1 Soil classification tests-Determination of the particle size distribution of a soil-Standard method of analysis by sieving.

AS 1289.3.6.3 Soil classification tests-Determination of the particle size distribution of a soil-Standard method of fine analysis using hydrometer.

AS 1289.3.4.1 Soil Classification tests-Determination of the linear shrinkage of a soil-standard method; liquid limit of a soil-four point Casagrande method.

AS 1289.5.2.1 Soil compaction and density tests-Determination of the dry density/moisture content relation of a soil using modified compactive effort.

AS 1289.6.3.1: Soil strength and consolidation tests-Determination of the penetration resistance of a soil-Standard Penetrometer test.

AS 1289.6.3.3: Soil strength and consolidation tests-Determination of the penetration resistance of a soil-Perth Sand Penetrometer test.

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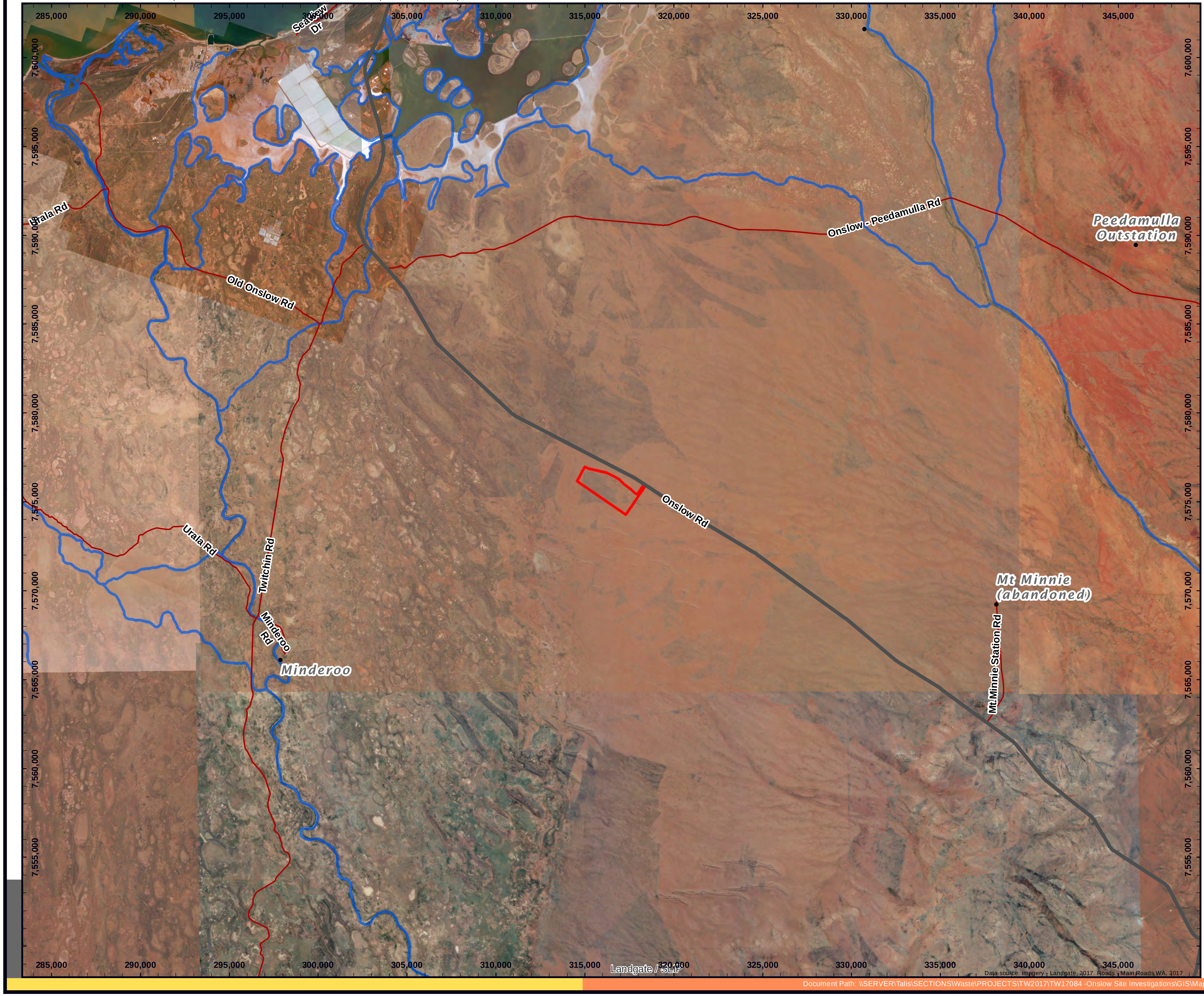
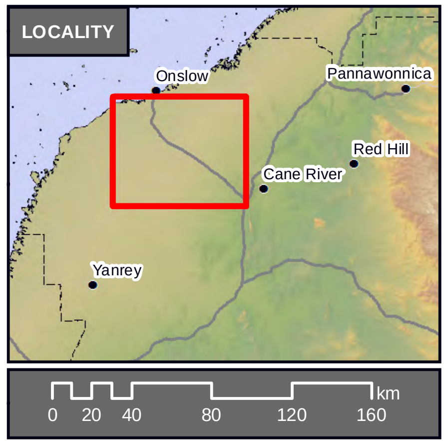
Figures



Data source: Imagery - Landgate, 2017. Roads - Main Roads WA, 2017

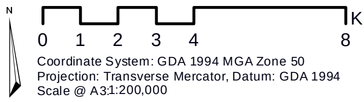
LEGEND

🟥	Site Boundary
▬	Primary Distributor Road
―	Access Road
―	River



SITE LOCATION

Geotechnical Investigation
Lot 150 Onslow Road
Onslow, WA 6710



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Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:200,000

Prepared: F Walker	Date: 23/05/2018
Checked: J. Skiba	Project No: TW17084
Reviewed: N King	Revision: A

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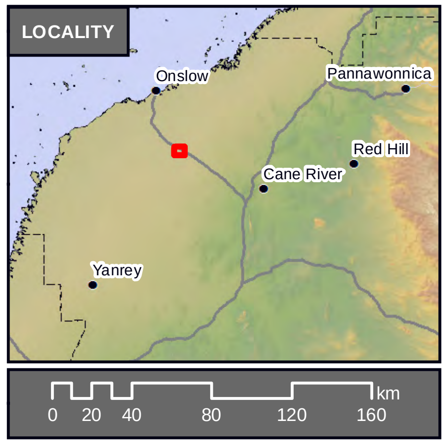
Figure 01

Data source: Imagery - Landgate, 2017.

LEGEND

🟥 Site Boundary



AERIAL PLAN

Geotechnical Investigation
Lot 150 Onslow Road
Onslow, WA 6710

0 75 150 300 450 600 metres

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:15,000

Prepared: F Walker	Date: 23/05/2018
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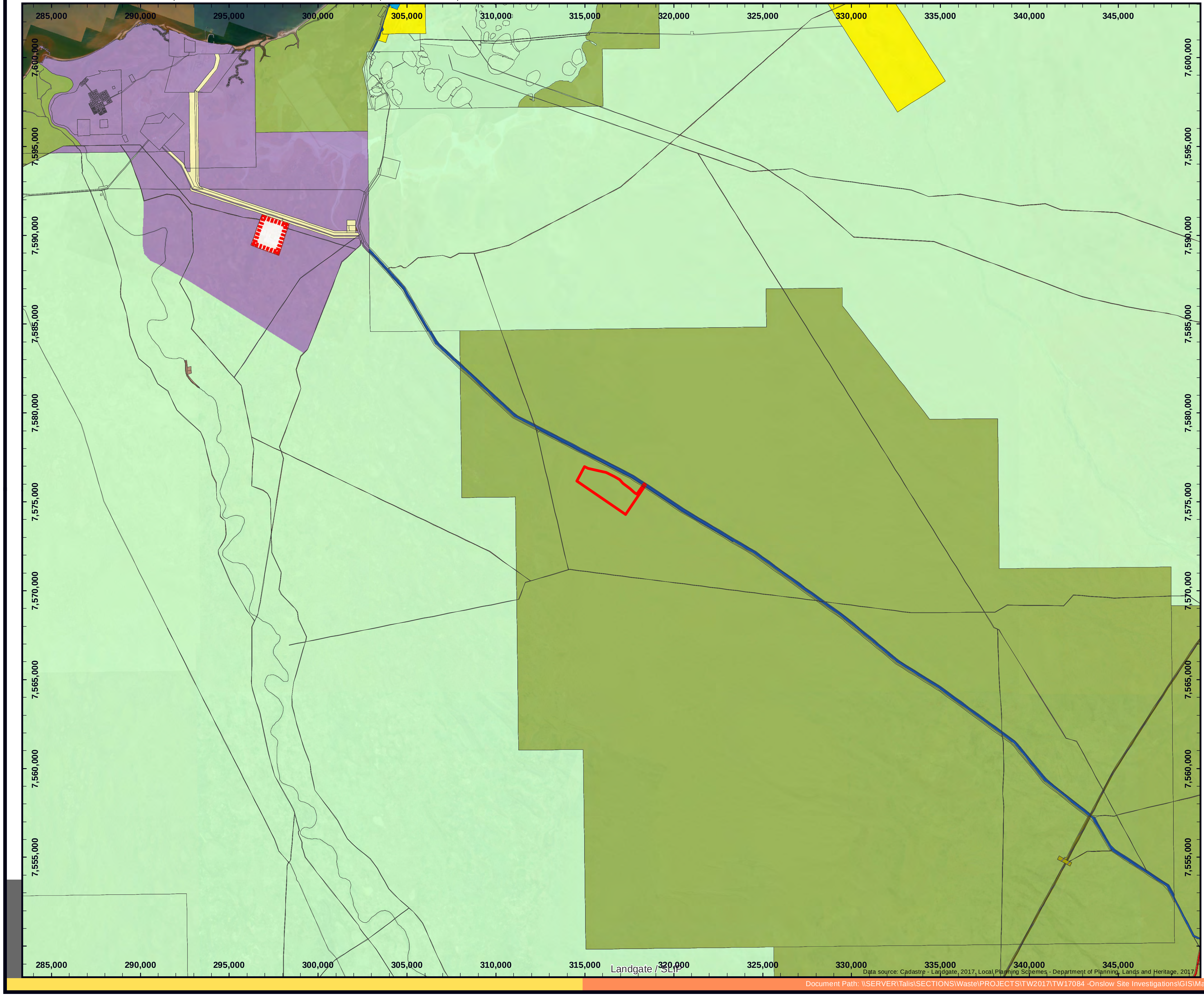
Figure 02



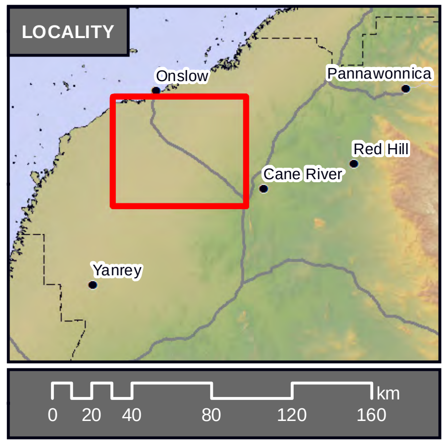
Data source: Cadastre - Landgate, 2017, Local Planning Schemes - Department of Planning, Lands and Heritage, 2017

LEGEND

🟥	Site Boundary
☐	Cadastre

Local Planning Scheme

🟩	Conservation, recreation and nature landscape
🟦	District Road
🟪	Industrial
🟨	Infrastructure Zone
🟦	Mixed Business
▨	Other Purposes - Infrastructure
🟨	Public Purposes
🟩	Rural
▨	Special Use
🟥	State/Regional Road



ZONING

Geotechnical Investigation
Lot 150 Onslow Road
Onslow, WA 6710

0 1 2 3 4 8 Km
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:200,000

Prepared: F Walker	Date: 23/05/2018
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Figure 03

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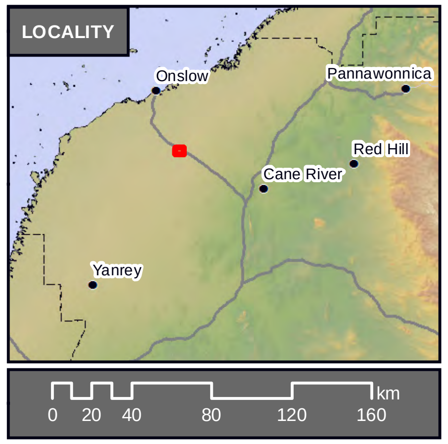
Data source: Imagery - Landgate, 2017. Topography - Denada Surveys, 2017

LEGEND

🟥 Site Boundary

Elevation (mAHD)

LOCALITY



TOPOGRAPHY

Geotechnical Investigation
Lot 150 Onslow Road
Onslow, WA 6710

0 65 130 260 390 520 metres

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:13,000

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Reviewed: N King	Revision: A

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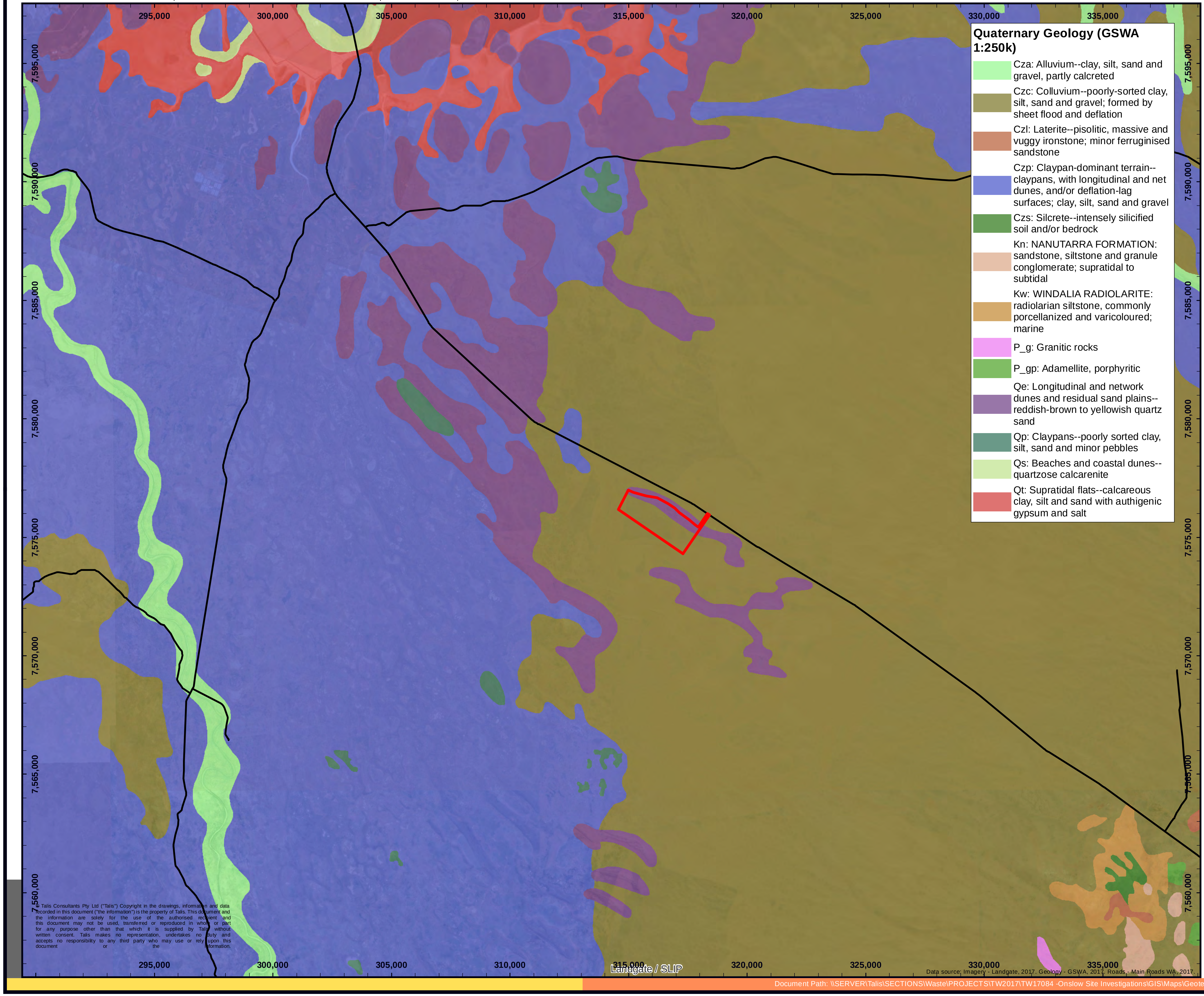
Figure 04



Quaternary Geology (GSWA 1:250k)

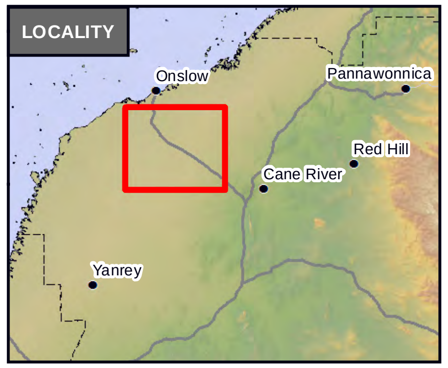
🟩	Cza: Alluvium--clay, silt, sand and gravel, partly calcreted
■	Czc: Colluvium--poorly-sorted clay, silt, sand and gravel; formed by sheet flood and deflation
■	Czl: Laterite--pisolitic, massive and vuggy ironstone; minor ferruginised sandstone
🟦	Czp: Claypan-dominant terrain--claypans, with longitudinal and net dunes, and/or deflation-lag surfaces; clay, silt, sand and gravel
🟩	Czs: Silcrete--intensely silicified soil and/or bedrock
■	Kn: NANUTARRA FORMATION: sandstone, siltstone and granule conglomerate; supratidal to subtidal
🟧	Kw: WINDALIA RADIOLARITE: radiolarian siltstone, commonly porcellanized and varicoloured; marine
🟪	P_g: Granitic rocks
🟩	P_gp: Adamellite, porphyritic
🟪	Qe: Longitudinal and network dunes and residual sand plains--reddish-brown to yellowish quartz sand
■	Qp: Claypans--poorly sorted clay, silt, sand and minor pebbles
■	Qs: Beaches and coastal dunes--quartzose calcarenite
🟥	Qt: Supratidal flats--calcareous clay, silt and sand with authigenic gypsum and salt

Data source: Imagery - Landgate, 2017. Geology - GSWA, 2017. Roads - Main Roads WA, 2017.

LEGEND

🟥 Site Boundary

— Roads



QUATERNARY GEOLOGY

Geotechnical Investigation
Lot 150 Onslow Road
Onslow, WA 6710

0 1.5 3 6 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:150,000

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Figure 05

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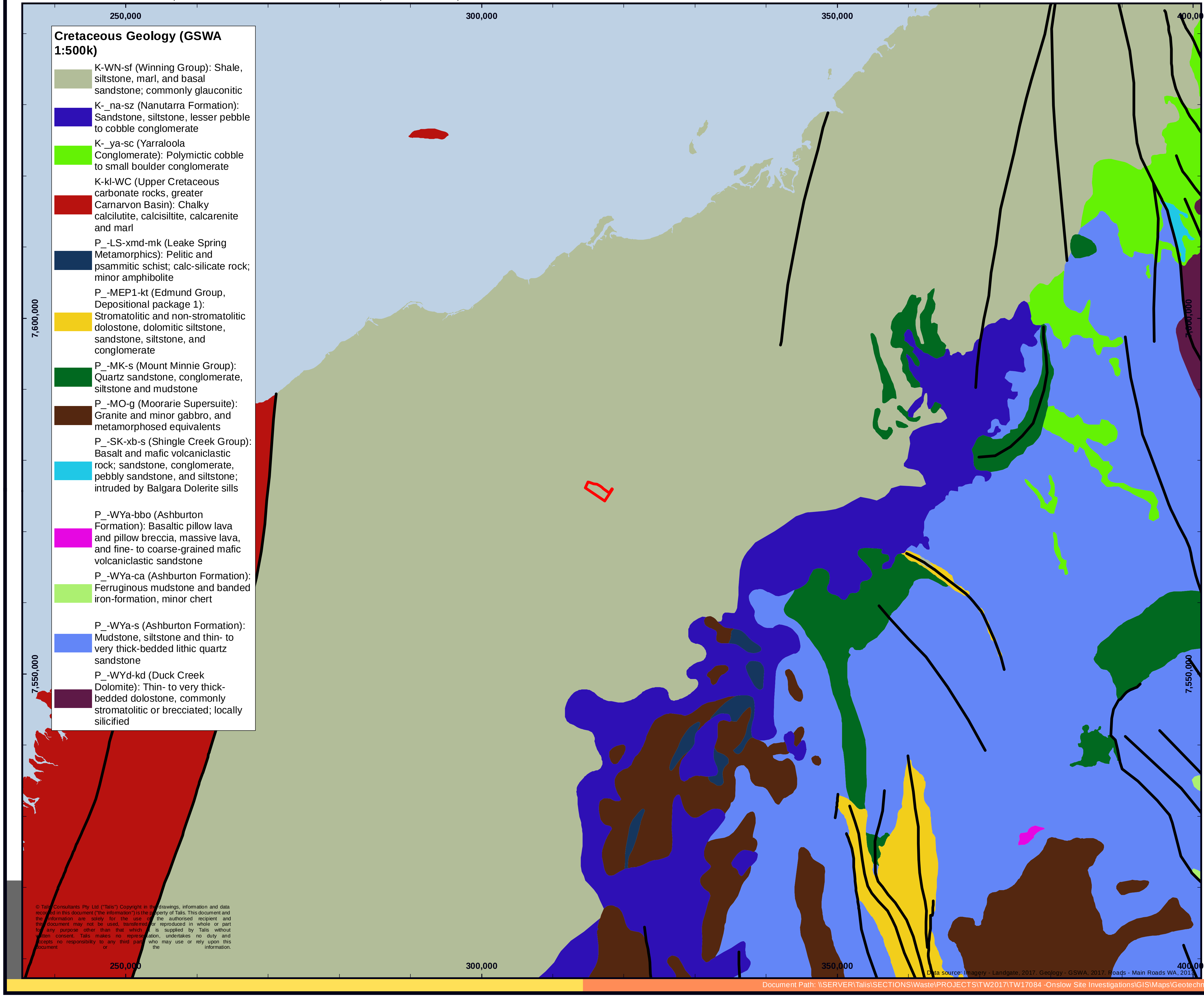

Cretaceous Geology (GSWA 1:500k)

- 🟩 K-WN-sf (Winning Group): Shale, siltstone, marl, and basal sandstone; commonly glauconitic
- 🟦 K-_na-sz (Nanutarra Formation): Sandstone, siltstone, lesser pebble to cobble conglomerate
- 🟩 K-_ya-sc (Yarraloola Conglomerate): Polymictic cobble to small boulder conglomerate
- 🟥 K-kl-WC (Upper Cretaceous carbonate rocks, greater Carnarvon Basin): Chalky calcilutite, calcisiltite, calcarenite and marl
- 🟦 P_-LS-xmd-mk (Leake Spring Metamorphics): Pelitic and psammitic schist; calc-silicate rock; minor amphibolite
- 🟨 P_-MEP1-kt (Edmund Group, Depositional package 1): Stromatolitic and non-stromatolitic dolostone, dolomitic siltstone, sandstone, siltstone, and conglomerate
- 🟩 P_-MK-s (Mount Minnie Group): Quartz sandstone, conglomerate, siltstone and mudstone
- 🟫 P_-MO-g (Moorarie Supersuite): Granite and minor gabbro, and metamorphosed equivalents
- 🟦 P_-SK-xb-s (Shingle Creek Group): Basalt and mafic volcaniclastic rock; sandstone, conglomerate, pebbly sandstone, and siltstone; intruded by Balgara Dolerite sills
- 🟪 P_-WYa-bbo (Ashburton Formation): Basaltic pillow lava and pillow breccia, massive lava, and fine- to coarse-grained mafic volcaniclastic sandstone
- 🟩 P_-WYa-ca (Ashburton Formation): Ferruginous mudstone and banded iron-formation, minor chert
- 🟦 P_-WYa-s (Ashburton Formation): Mudstone, siltstone and thin- to very thick-bedded lithic quartz sandstone
- 🟪 P_-WYd-kd (Duck Creek Dolomite): Thin- to very thick-bedded dolostone, commonly stromatolitic or brecciated; locally silicified

Data source: Imagery - Landgate, 2017. Geology - GSWA, 2017. Roads - Main Roads WA, 2017.

LEGEND

- 🟥 Site Boundary
- ▬ Linear Structures

LOCALITY

CRETACEOUS GEOLOGY

Geotechnical Investigation
Lot 150 Onslow Road
Onslow, WA 6710

0 2.5 5 7.5 10 20 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:500,000

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Figure 06

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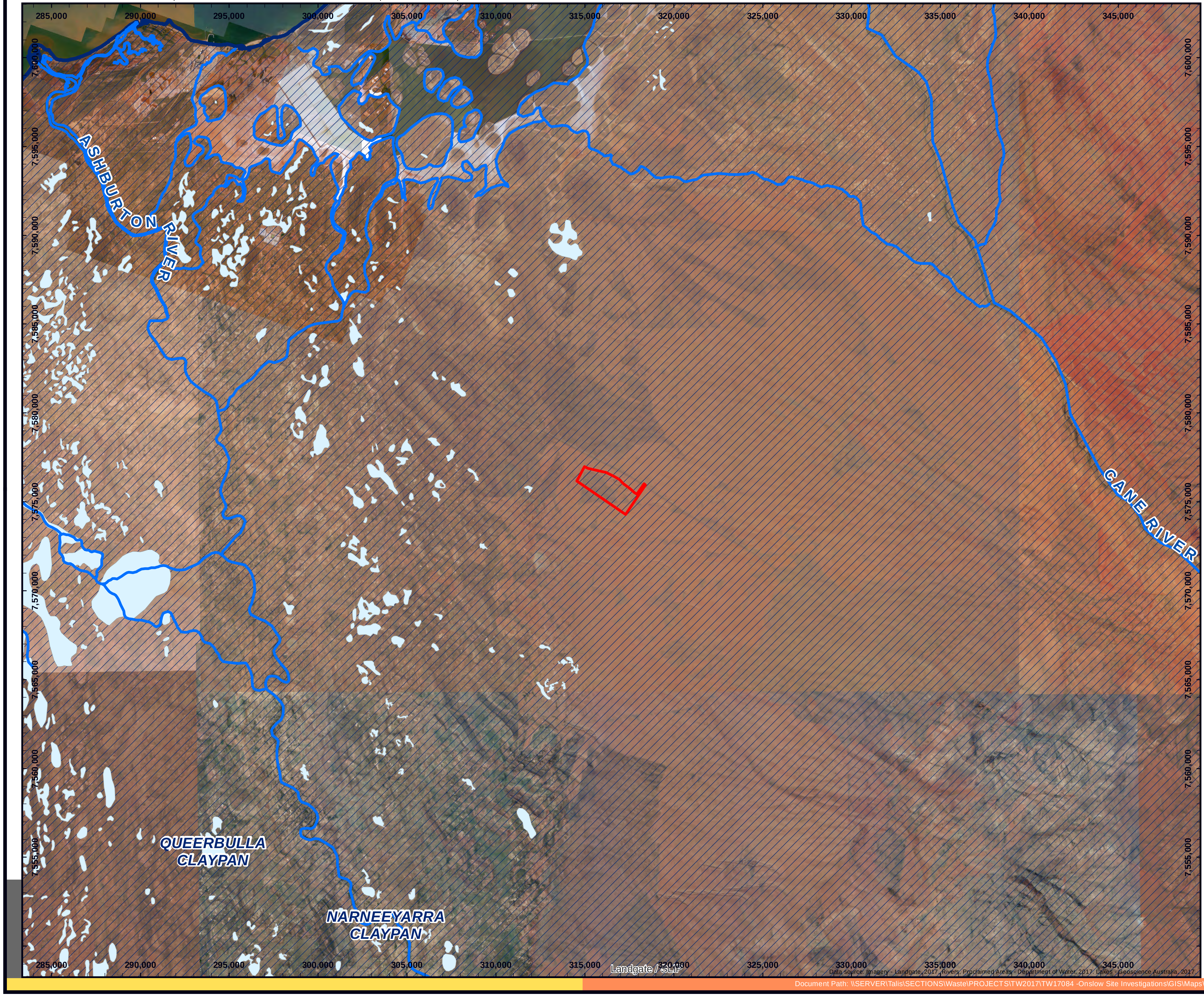
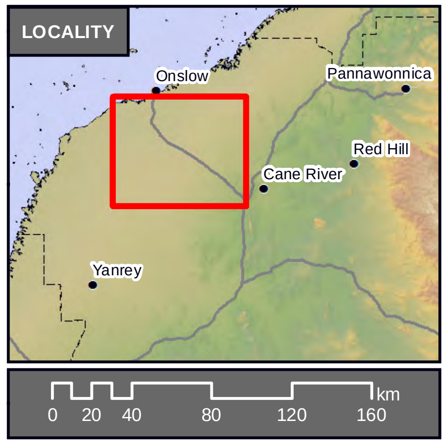


Data source: Imagery - Landgate, 2017. Rivers, Proclaimed Areas - Department of Water, 2017. Lakes - Geoscience Australia, 2017.

LEGEND

🟥 Site Boundary
― Rivers
▭ Lakes
▨ Surface Water Resource Proclaimed Area (RIWI Act)



HYDROLOGY

Geotechnical Investigation
Lot 150 Onslow Road
Onslow, WA 6710

0 1 2 3 4 8 Km

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:200,000

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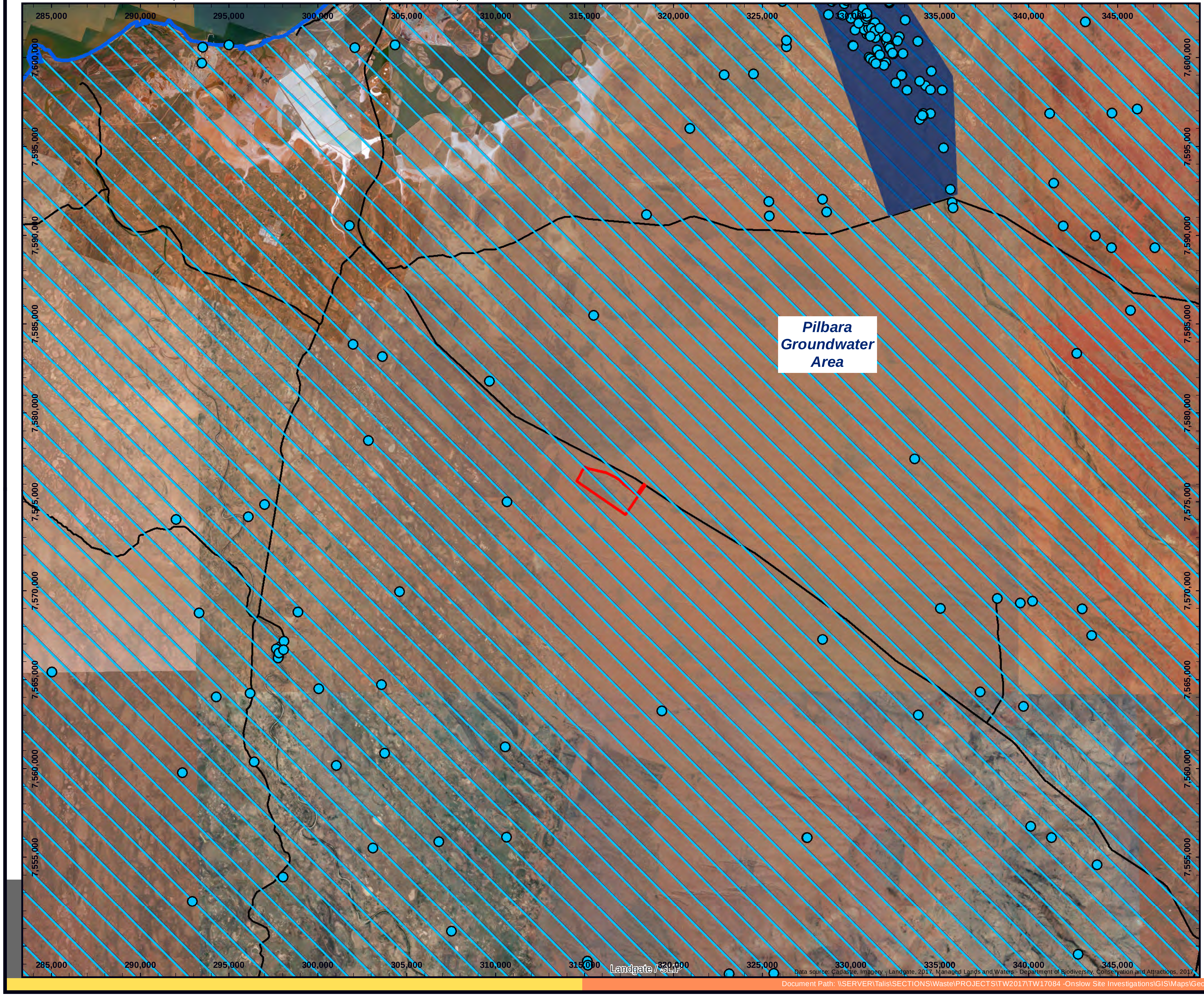
Figure 07



Data source: Cadastre, Imagery - Landgate, 2017. Managed Lands and Waters - Department of Biodiversity, Conservation and Attractions, 2017.

LEGEND

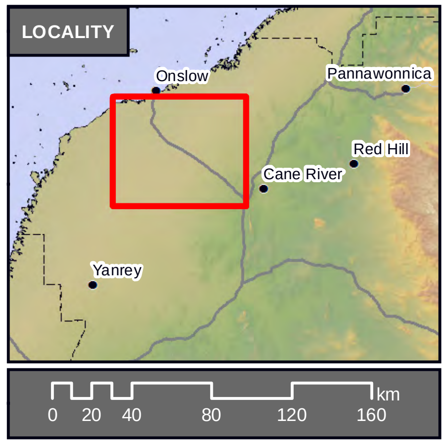
🟥	Site Boundary
●	WIN Monitoring Sites
▨	Groundwater Areas (RIWI Act)

Public Drinking Water Source Areas

PRIORITY

🟦	P1

LOCALITY



HYDROGEOLOGY

Geotechnical Investigation
Lot 150 Onslow Road
Onslow, WA 6710

N
0 2,000 4,000 6,000 8,000 metres
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:200,000

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Figure 08

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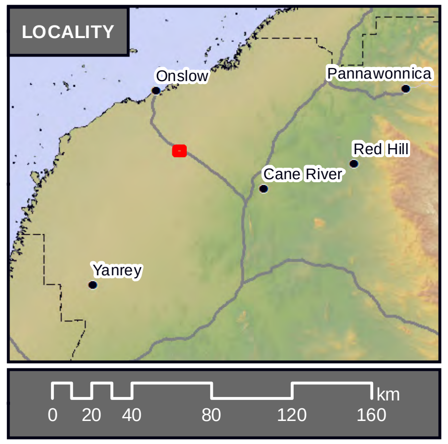
Data source: Imagery - Landgate, 2017.

LEGEND

🟥	Site Boundary
⊕	Groundwater Monitoring Well



BORE LOCATIONS

Geotechnical Investigation
Lot 150 Onslow Road
Onslow, WA 6710

N
0 65 130 260 390 520 metres

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:13,000

Prepared: F Walker	Date: 29/06/2018
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Reviewed: N King	Revision: A

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Figure 09

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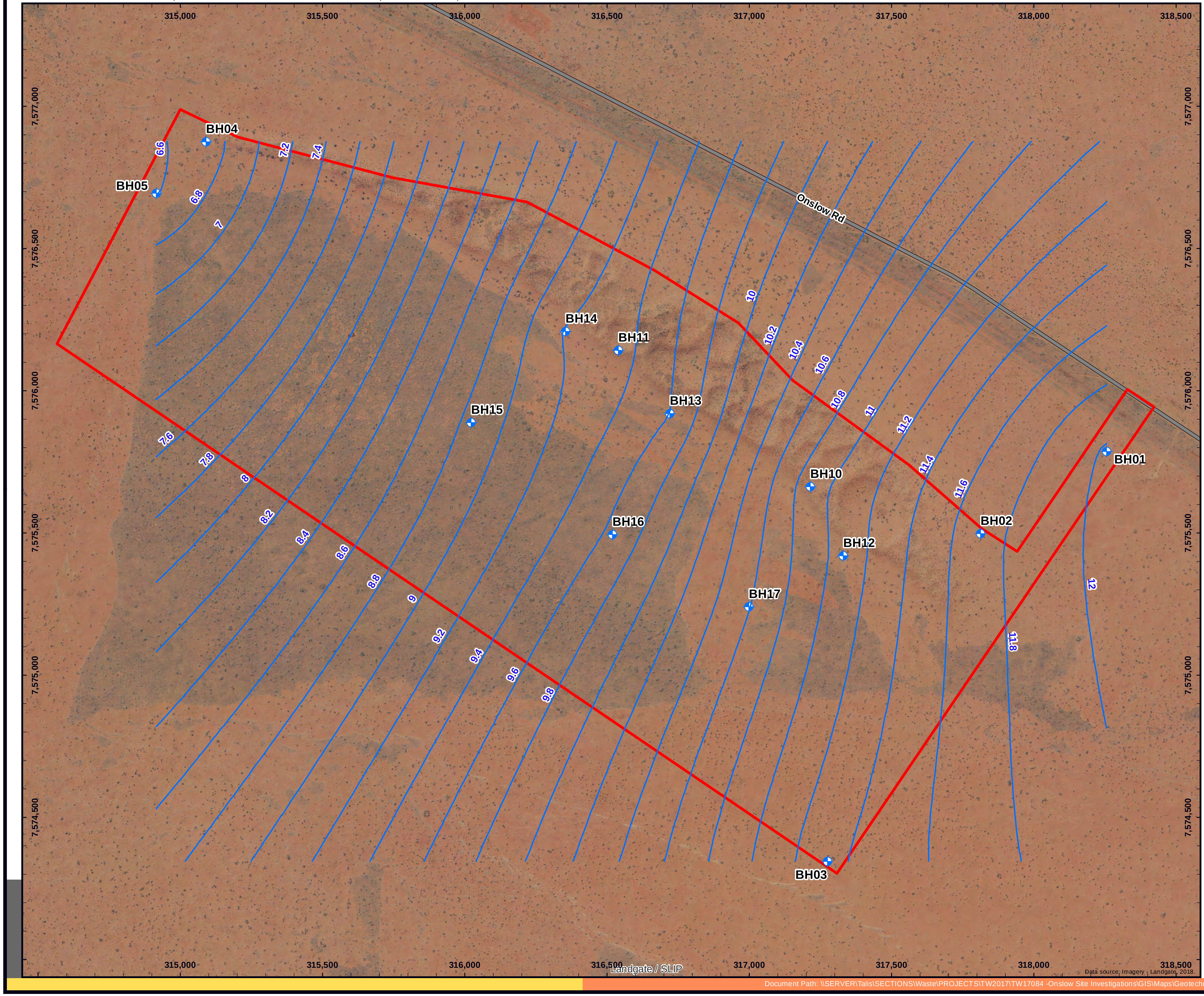
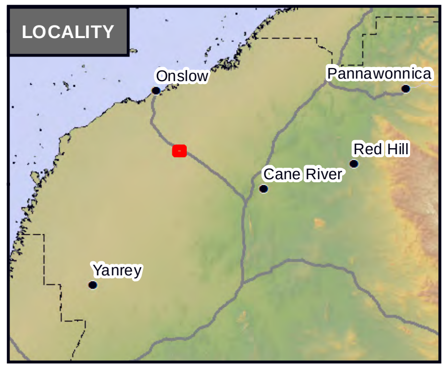


Data source: Imagery - Landgate, 2018.

LEGEND

🟥	Site Boundary
⊕	Groundwater Monitoring Well
—	Groundwater Contours (RL SWL mAHD)

LOCALITY



GROUNDWATER CONTOURS JANUARY 2018

Geotechnical Investigation
Lot 150 Onslow Road
Onslow, WA 6710

N
0 62.5 125 250 375 500 metres
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:12,500

Prepared:	F Walker	Date:	29/06/2018
Checked:	J. Skiba	Project No:	TW17084
Reviewed:	N King	Revision:	A

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Figure 10

Data source: Imagery - Landgate, 2018.

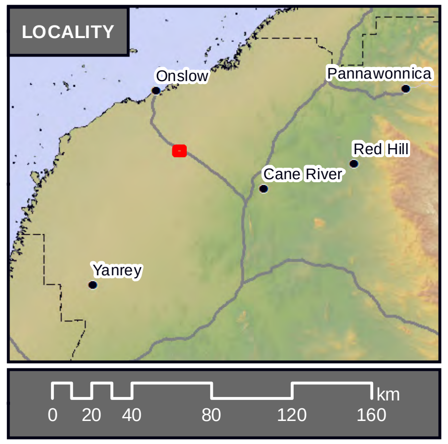
LEGEND

🟥 Site Boundary

● Groundwater Monitoring Well

— Groundwater Contours (RL SWL mAHD)

LOCALITY



GROUNDWATER CONTOURS MARCH 2018

Geotechnical Investigation
Lot 150 Onslow Road
Onslow, WA 6710

0 62.5 125 250 375 500 metres

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:12,500

Prepared:	F Walker	Date:	23/05/2018
Checked:	J. Skiba	Project No:	TW17084
Reviewed:	N King	Revision:	A

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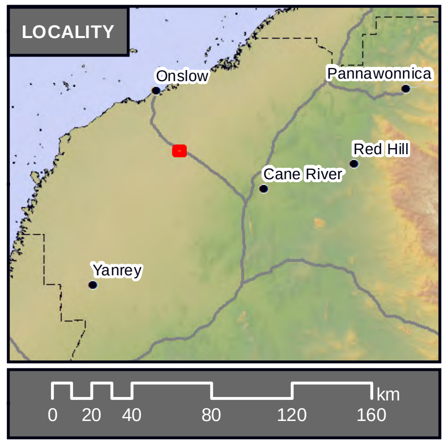
Figure 11

LEGEND

🟥	Site Boundary
⊕	Groundwater Monitoring Well
—	Groundwater Contours (RL SWL mAHD)

LOCALITY



GROUNDWATER CONTOURS APRIL 2018

Geotechnical Investigation
Lot 150 Onslow Road
Onslow, WA 6710

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:12,500

Prepared: F Walker	Date: 29/06/2018
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Figure 12

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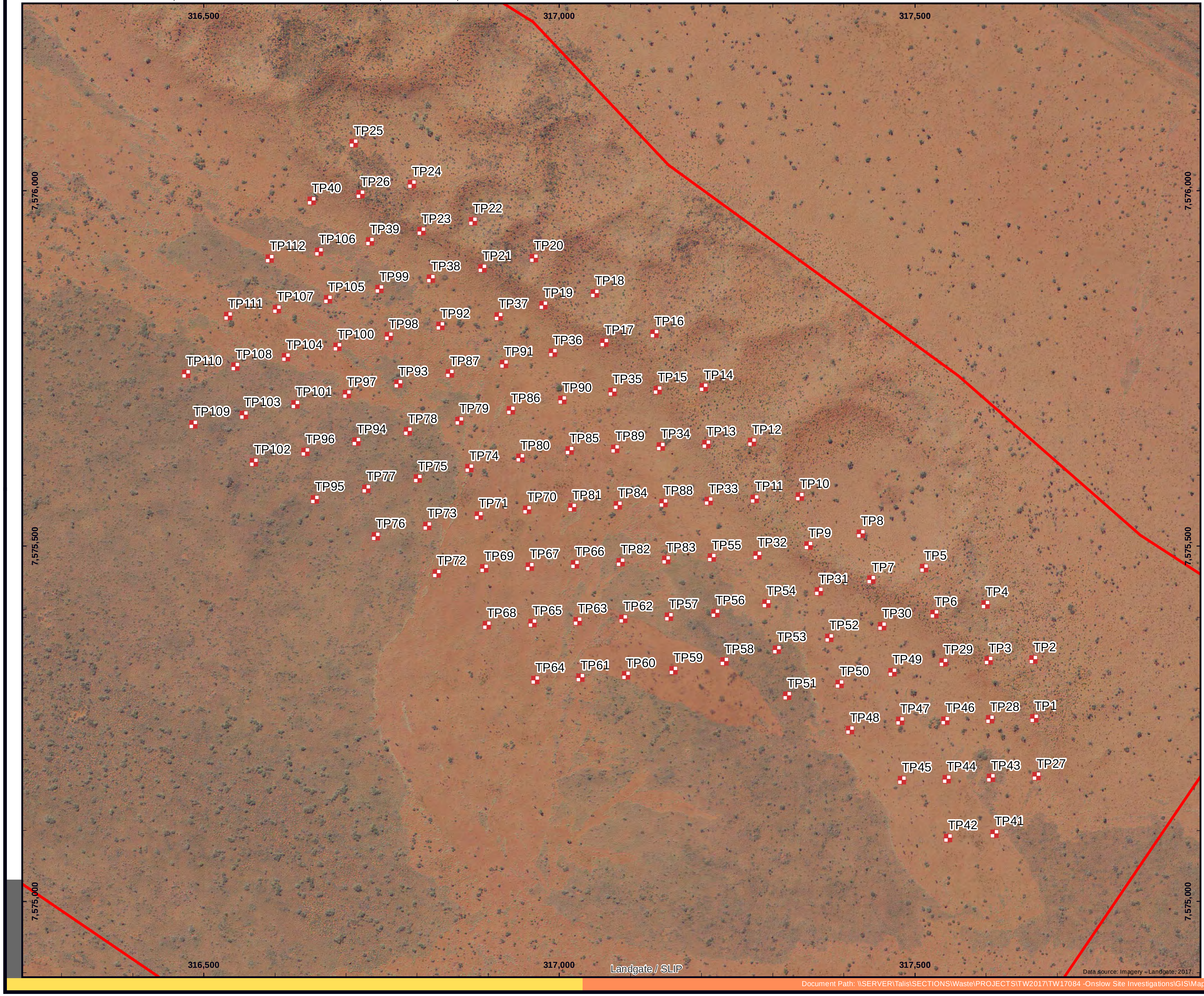
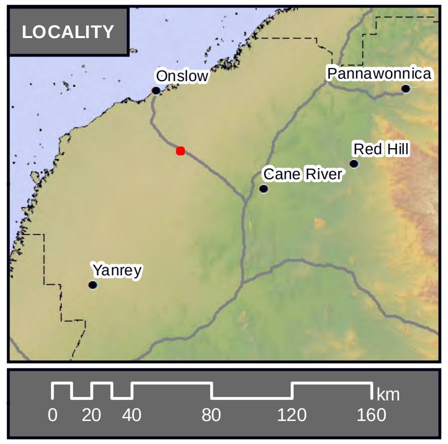


Data source: Imagery – Landgate, 2017.

LEGEND

🟥 Site Boundary

▨ Trial Pits



TRIAL PIT LOCATIONS

Geotechnical Investigation
Lot 150 Onslow Road
Onslow, WA 6710

N
0 25 50 100 150 200 metres

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:5,000

Prepared: F Walker	Date: 29/06/2018
Checked: J. Skiba	Project No: TW17084
Reviewed: N King	Revision: A

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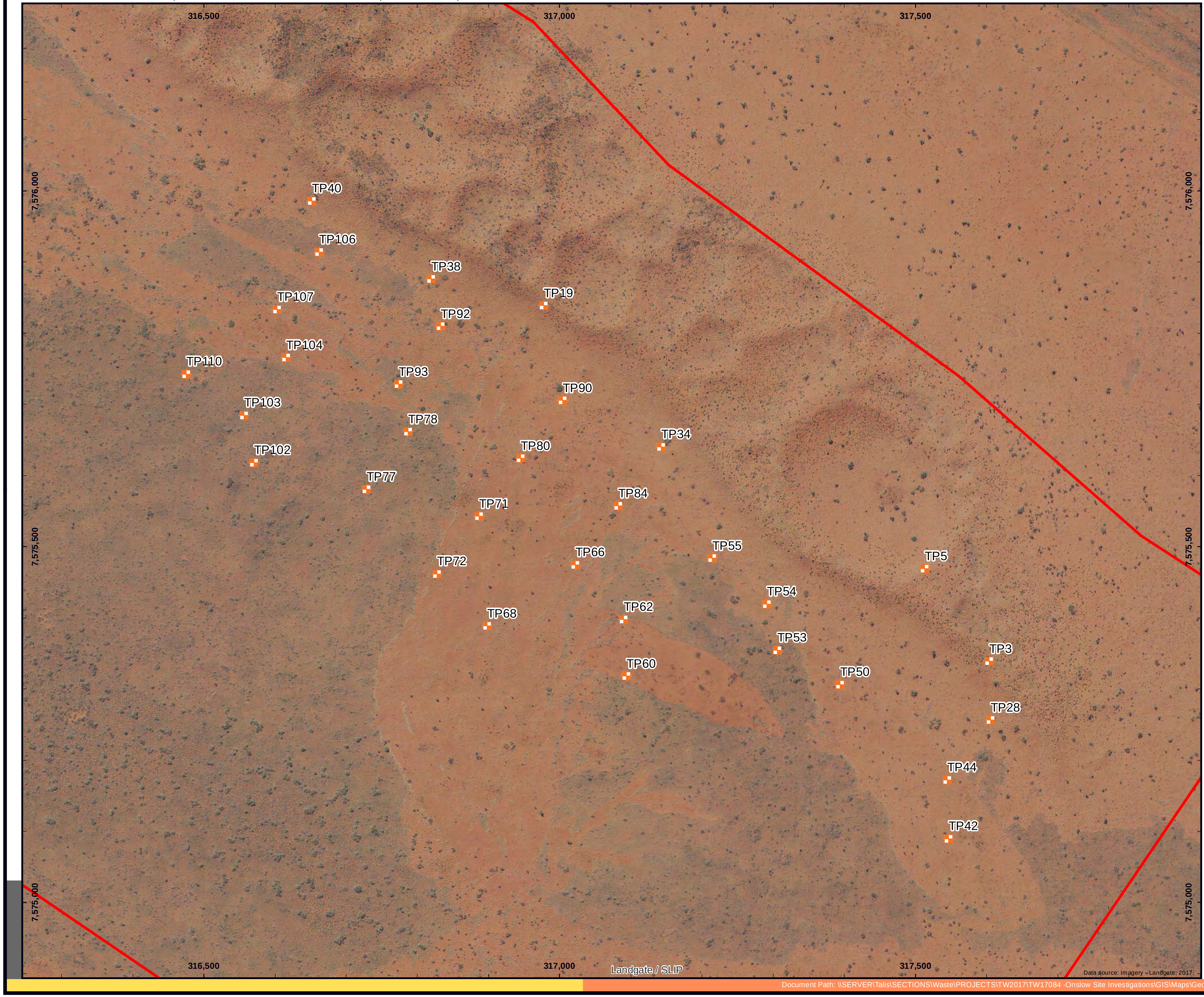
Figure 13

P: PO Box 454, Leederville WA 6903 | A: Level 1 660 Newcastle St, Leederville WA 6007 | T: 1300 251 070 | W: www.talisconsultants.com.au



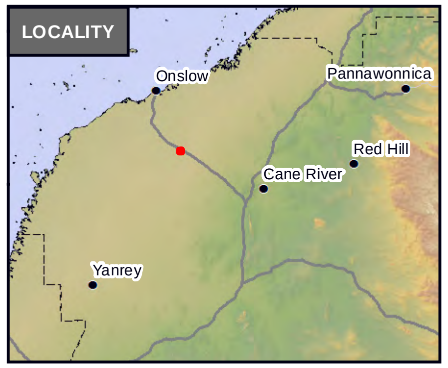
Data source: Imagery - Landgate, 2017.

LEGEND

🟥 Site Boundary

● PSP Location

LOCALITY



PSP LOCATIONS

Geotechnical Investigation
Lot 150 Onslow Road
Onslow, WA 6710

0 25 50 100 150 200 metres
N
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:5,000

Prepared: F Walker	Date: 29/06/2018
Checked: J. Skiba	Project No: TW17084
Reviewed: N King	Revision: A

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Figure 14

Document Path: \\SERVER\Talis\SECTIONS\Waste\PROJECTS\TW2017\TW17084 -Onslow Site Investigations\GIS\Maps\Geotechnical_Investigation\TW17084_14_GI_PSPLocations_RevA.mxd

Appendix A: Certificate of Title

REGISTER NUMBER	
150/DP220207	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
N/A	**N/A**

WESTERN AUSTRALIA

VOLUME	FOLIO
LR3046	**473**

RECORD OF CERTIFICATE OF CROWN LAND TITLE

UNDER THE TRANSFER OF LAND ACT 1893
AND THE LAND ADMINISTRATION ACT 1997
NO DUPLICATE CREATED

The undermentioned land is Crown land in the name of the STATE OF WESTERN AUSTRALIA, subject to the interests and Status Orders shown in the first schedule which are in turn subject to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

LAND DESCRIPTION:

LOT 150 ON DEPOSITED PLAN 220207

STATUS ORDER AND PRIMARY INTEREST HOLDER:

(FIRST SCHEDULE)

STATUS ORDER/INTEREST: UNALLOCATED CROWN LAND

PRIMARY INTEREST HOLDER: STATE OF WESTERN AUSTRALIA

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:

(SECOND SCHEDULE)

1. I156121 THE PORTION OF THE WITHIN LAND NOW COMPRISED IN LOTS 265-269 INCLUSIVE ON DP29779 TO VOL. 3127 FOLS. 478-482 INCLUSIVE. REGISTERED 28/6/2002.
2. L173666 PORTION COMPRISED IN LOT 278 ON DP219235 TO VOL 3131 FOL 927. REGISTERED 15/12/2009.
3. L597535 PORTIONS COMPRISED IN LOTS 502,514,515,516 AND 517 ON DEPOSITED PLAN 69201 TO VOL.3160 FOL.552 TO VOL.3160 FOL.556 REGISTERED 8/4/2011.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.

---------------------------------------END OF CERTIFICATE OF CROWN LAND TITLE---------------------------------------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: LR3046-473 (150/DP220207)
PREVIOUS TITLE: LR3046-473
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY: SHIRE OF ASHBURTON
RESPONSIBLE AGENCY: DEPARTMENT OF LANDS (SLSD)

NOTE 1: A000001A CORRESPONDENCE FILE 3493/1964 V3.

END OF PAGE 1 - CONTINUED OVER

NOTE 2:	SUBJECT TO SURVEY - NOT FOR ALIENATION PURPOSES
NOTE 3:	LAND PARCEL IDENTIFIER OF ASHBURTON LOCATION 150 ON SUPERSEDED PAPER CERTIFICATE OF CROWN LAND TITLE CHANGED TO LOT 150 ON DEPOSITED PLAN 220207 ON 17-SEP-02 TO ENABLE ISSUE OF A DIGITAL CERTIFICATE OF TITLE.
NOTE 4:	THE ABOVE NOTE MAY NOT BE SHOWN ON THE SUPERSEDED PAPER CERTIFICATE OF TITLE.

Appendix B: Engineering Logs

BOREHOLE NUMBER BH01

PAGE 1 OF 1

Talis

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 13/12/17 **COMPLETED** 13/12/17
R.L. SURFACE 18.739 **DATUM** m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90° **BEARING** -90°
EQUIPMENT DR002
HOLE LOCATION 318256.15,7575786.9
HOLE SIZE 96
LOGGED BY FD **CHECKED BY** LM
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	Is(50) MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
DD			18		SAND with trave gravel, clay and silt. Medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is sub rounded remanent shale, chert and iron formation. Loose, red, dry. (Pindan)						
				1	SAND with gravel and trace clay and silt. Sand is medium to coarse, sub angular to sub rounded, gap graded. Gravel is sub rounded, <4mm, consisting of shale and chert fragments. Dense, red, dry.						
			17	2	GRAVELLY SAND with trace clay and silt.Sand is medium to coarse, sub angular to sub rounded, gap graded and forming weak cement. Gravel is sub angular to sub rounded, 2mm-50mm, consisting of shale and chert fragments. Dense, red to cream, dry.(Hardpan)						
			16	3	GRAVELLY SAND with clay and silt.Sand is medium to coarse, sub angular to sub rounded, gap graded and forming cement. Gravel is sub angular to sub rounded, <30mm, consisting of shale and chert fragments. Dense, Mottled red yellow, dry.(Hardpan)						
			15	4	GRAVELLY SAND.Sand is medium to coarse, sub angular to sub rounded, gap graded and forming hard cement. Gravel is sub angular to sub rounded. Dense/hard, Mottled red yellow, dry.(Hardpan)	SW/MW EW/HW					
					Cemented GRAVEL. Sand cement. Hard, mottled red to cream, dry. (Hardpan)	EW/HW MW					
			14		SANDSTONE. Fine to medium grained, occasional vugs with no infill, and silicious veins. Clasts of gravel, <40mm consisting of chert and shale. Brown.						Small joint set, planar and rough
				5	Sandy gravelly CLAY. Clay pocket, clay is of low plasticity. Brown.	MW					
					Weathered SANDSTONE presenting as clayey gravelly sand. Brown.						
			13	6	SANDSTONE. Fine to medium grained, occasional vugs with no infill, and silicious veins. Clasts of gravel, <40mm consisting of chert and shale. Brown.	MW					
			12		SANDSTONE. Fine to medium grained with clasts of gravel. Gravel is sub angular to sub rounded chert and shale. Occasional vugs with clay infill. Yellow to brown.						
				7	SANDSTONE. Fine to medium grained with clasts of gravel. Yellow to brown.				100		Planar and rough, tabular Planer and rough, tabular
			11	8	SANDSTONE. Fine to medium grained with clasts of gravel. Gravel is sub angular to sub rounded consisting of shale and chert. Yellow to brown.	MW HW/MW					
					Cemented GRAVEL, sand cement. Gravel is sub angular to rounded, <10 mm, showing signs of water flow.	MW			100		
			10 9	9 10	SANDSTONE. Fine to medium grained with clasts of gravel.				100		
			8	11	BH01 terminated at 10.5m						

CORED BOREHOLE TW17084-ONSLOW.GPJ GINT STD AUSTRALIA.GDT 28/6/18

BOREHOLE NUMBER BH02

talis Talis

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 13/12/17 **COMPLETED** 14/12/17
R.L. SURFACE 20.937 **DATUM** m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90° **BEARING** -90°
EQUIPMENT DR002
HOLE LOCATION 317813.234,7575498.556
HOLE SIZE 96
LOGGED BY FD **CHECKED BY** LM
NOTES

Method	RL (m)	Depth (m)	Material Description	Weathering	RQD %	Defect Description
DD	20	1	CORE LOSS. (PINDAN soil as below).			
			SAND with trace clay and silt. Medium to coarse grained, sub angular to sub rounded. Clay/silt portion is of low plasticity. Loose to compact, dry, red. (PINDAN).			
	19	2	CORE LOSS			
	18	3	SAND with trace clay and silt. Medium to coarse grained, sub angular to sub rounded. Clay/silt portion is of low plasticity. Loose to compact, dry, red. (PINDAN).			
			CORE LOSS			
	17	4	SAND with trace clay and silt. Medium to coarse grained, sub angular to sub rounded. Clay/silt portion is of low plasticity. Loose to compact, dry, red. (PINDAN).			
			SAND with gravel and trace clay and silt. Medium to coarse grained, sub angular to sub rounded. Clay/silt portion is of low plasticity. Compact, dry, red.	EW		
	16	5	Cemented GRAVEL. Sand cement. Gravel is sedimentary in origin, consisting of shale and chert. Angular to sub rounded, <40mm.	MW		
			CORE LOSS.			
			Cemented GRAVEL. Sand cement. Gravel is sedimentary in origin, consisting of shale and chert. Angular to sub rounded, <40mm.			
	15	6	SANDSTONE. Fine to medium grained, pale yellow.		<<	Joint. Planer, rough, tabualr.
						Rubble zone.
	14	7				Rubble zone.
	13	8			<<	
	12	9	SANDSTONE. Fine to medium grained with gravel clasts of sedimentary origin. Pale yellow.	MW		
			Cemented GRAVEL. Sand cement. Gravel is sub angular to rounded, mainly shale, chert and iron formation. Showing signs of water flow. Red.	MW		Rubble zone.
	11	10				
	10	11	BH02 terminated at 10.5m			

Water | Well Details | Graphic Log | Estimated Strength EL VL L M H VH EH | Is(50) MPa D- diametral A- axial | Defect Spacing mm 30 100 300 1000 3000

BOREHOLE NUMBER BH03

Talis

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 18/12/17 **COMPLETED** 18/12/17
R.L. SURFACE 16.734 **DATUM** m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90° **BEARING** -90°
EQUIPMENT DR002
HOLE LOCATION 317274.685,7574345.443
HOLE SIZE 96
LOGGED BY FD **CHECKED BY** LM
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength EL VL L M H VH EH	$Is_{(50)}$ MPa D- diam- etral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Defect Description
DD						CORE LOSS. (PINDAN soil as below)						
						SAND with trace clay and silt. Medium to coarse grained, sub angular to sub rounded, gap graded. Loose, dry, red. (PINDAN)						
			16	1		SAND with trace clay and silt. Medium to coarse grained, sub angular to sub rounded, gap graded. Medium dense, dry, red. (PINDAN)						
			15	2		Gravelly SAND with trace clay and silt. Medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is sub angular to sub rounded, 2mm - 35 mm. Dense, dry, red. (PINDAN)						
			14	3		Weakly cemented GRAVEL. Sand cement. Gravel is sub angular to sub rounded, 2 mm to 45 mm. Occasional silicious veins. Yellow to Red.	EW					
			13			SANDSTONE. Medium grained with silicious veins and occasional vugs and secondary porosity. Pale yellow.	MW			86		Joint. Undulating and rough, tabular. Rubble zone. Joint. Undulating and rough, tabular. Joint. Undulating and rough, tabular.
			12	4		SANDSTONE. Medium grained with occasional clasts, 2 mm - 5mm. Clasts are gravel of chert and shale, sub angular to sub rounded. Secondary porosity developed.Yellow to red.	MW					
				5		Cemented GRAVEL. Sand cement. Gravel is sub angular to rounded, 2 mm - 12 mm. Gravel is chert and shale. Pale yellow.	MW MW MW			77		
			11			Cemented GRAVEL. Sand cement. Gravel is 2 mm - 20 mm, showing signs of water flow. Pale yellow.	MW					
				6		Cemented GRAVEL. Sand cement. Gravel is 2 mm - 20 mm, showing signs of water flow. Pale yellow.	MW					
			10			SANDSTONE. Medium grained with clasts of chert and lateritic material. Pale brown to yellow.	MW					Joint. Undulating and rough, tabular.
				7		SANDSTONE. Medium grained with clasts of chert and lateritic material. Secondary porosity developed. Pale brown to yellow.	EW MW MW			77		
						Core Loss.						
			9			SANDSTONE. Medium grained with clasts of chert and lateritic material. Secondary porosity developed. Pale brown to yellow.	EW					
				8		SANDSTONE. Medium grained with vugs with silicious infill. Pale cream.	MW					
						Clayey gravel SAND. Gravel is sub angular to sub rounded clasts of chert and shale. (Weathered sandstone).	MW			69		
			8			SANDSTONE. Medium grained with occasional clasts. Yellow.						
				9		Cemented GRAVEL. Sand cement. Gravel is sub rounded to rounded, 2 mm - 8 mm. Gravel is shale and chert and showing signs of water flow. Red to yellow.	EW MW MW					
			7	10		Weakly cemented GRAVEL. Sand cement. Gravel is sub rounded to rounded, 2 mm - 8 mm. Gravel is shale and chert and showing signs of water flow. Red to yellow.				87		
						CORE LOSS.						
			6			Cemented GRAVEL. Sand cement. Gravel is sub angular to rounded, 2 mm - 25 mm. Gravel is shale and chert, with shale presenting as larger clasts. Red to yellow.						Joint. Undulating and rough, tabular.
				11		Cemented GRAVEL. Gravel is sub rounded to						

Talis

BOREHOLE NUMBER BH03

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 18/12/17
COMPLETED 18/12/17
R.L. SURFACE 16.734
DATUM m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90°
BEARING -90°
EQUIPMENT DR002
HOLE LOCATION 317274.685,7574345.443
HOLE SIZE 96
LOGGED BY FD
CHECKED BY LM
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa D- diam- etral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Defect Description
						rounded with occasional angular clasts of shale and chert up to 30 mm. Horizon showing signs of water flow. Light red,						
			5			Weakly cemented GRAVEL. Sand cement. Gravel is sub angular to rounded, 2 mm - 28mm, chert and shale. Red to brown.						
				12		SANDSTONE. Medium grained with occasional clasts which are sub angular to rounded, 2 mm - 15 mm. Brown.						
						SANDSTONE. Medium grained, pale yellow.						
			4			BH03 terminated at 10.5m						
				13								
			3									
				14								
			2									
				15								
			1									
				16								
			0									
				17								
			-1									
				18								
			-2									
				19								
			-3									
				20								
			-4									
				21								
			-5									
				22								

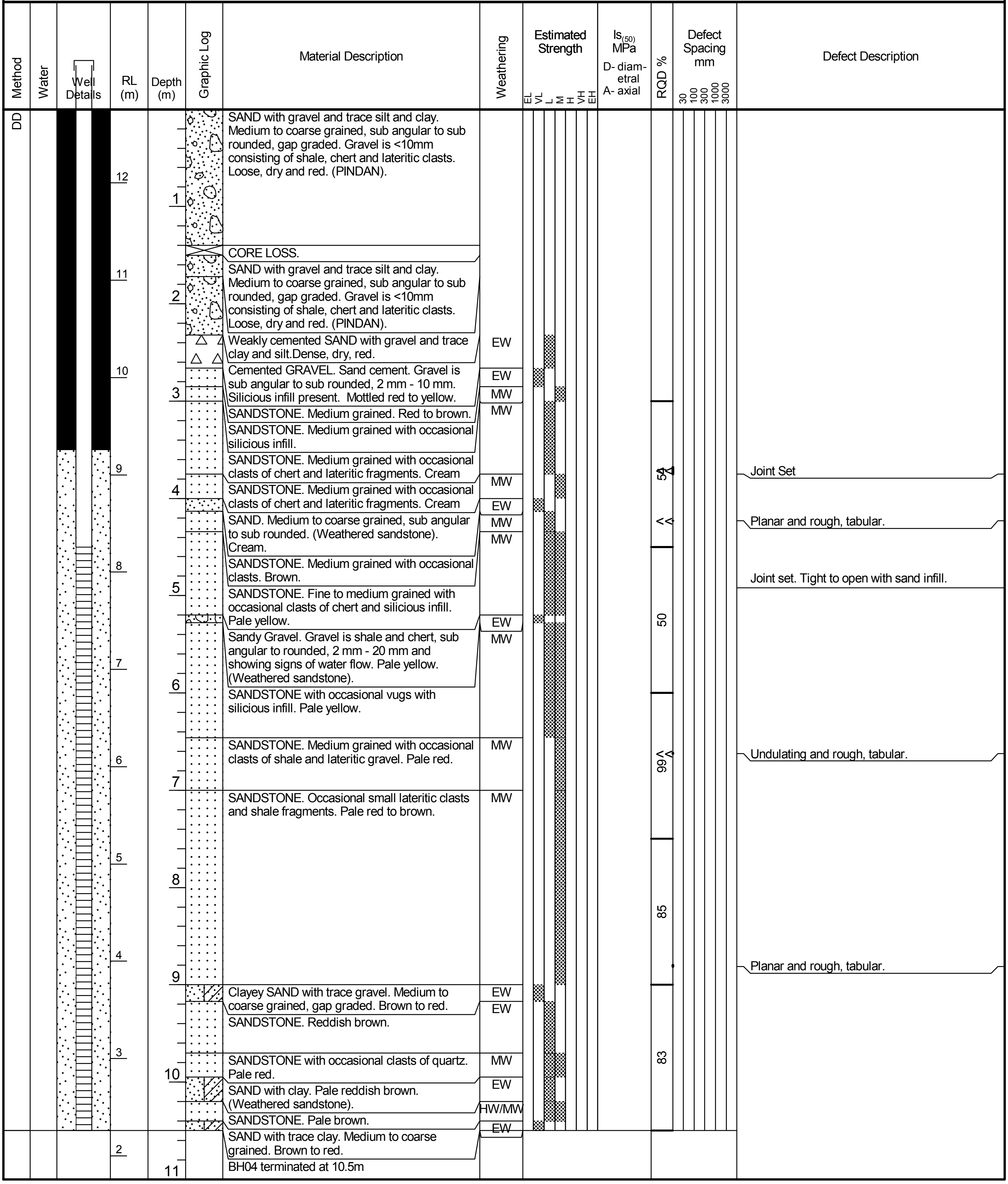
BOREHOLE NUMBER BH04

PAGE 1 OF 1

Talis

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 15/12/17 **COMPLETED** 15/12/17
R.L. SURFACE 12.758 **DATUM** m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90° **BEARING** -90°
EQUIPMENT DR002
HOLE LOCATION 315090.893,7576876.191
HOLE SIZE 96
LOGGED BY FD **CHECKED BY** LM
NOTES



Material Description	Weathering
SAND with gravel and trace silt and clay. Medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is <10mm consisting of shale, chert and lateritic clasts. Loose, dry and red. (PINDAN).	
CORE LOSS.	
SAND with gravel and trace silt and clay. Medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is <10mm consisting of shale, chert and lateritic clasts. Loose, dry and red. (PINDAN).	
Weakly cemented SAND with gravel and trace clay and silt.Dense, dry, red.	EW
Cemented GRAVEL. Sand cement. Gravel is sub angular to sub rounded, 2 mm - 10 mm. Silicious infill present. Mottled red to yellow.	EW MW
SANDSTONE. Medium grained. Red to brown.	MW
SANDSTONE. Medium grained with occasional silicious infill.	
SANDSTONE. Medium grained with occasional clasts of chert and lateritic fragments. Cream	
SANDSTONE. Medium grained with occasional clasts of chert and lateritic fragments. Cream	MW EW
SAND. Medium to coarse grained, sub angular to sub rounded. (Weathered sandstone). Cream.	MW MW
SANDSTONE. Medium grained with occasional clasts. Brown.	
SANDSTONE. Fine to medium grained with occasional clasts of chert and silicious infill. Pale yellow.	EW
Sandy Gravel. Gravel is shale and chert, sub angular to rounded, 2 mm - 20 mm and showing signs of water flow. Pale yellow. (Weathered sandstone).	MW
SANDSTONE with occasional vugs with silicious infill. Pale yellow.	
SANDSTONE. Medium grained with occasional clasts of shale and lateritic gravel. Pale red.	MW
SANDSTONE. Occasional small lateritic clasts and shale fragments. Pale red to brown.	MW
Clayey SAND with trace gravel. Medium to coarse grained, gap graded. Brown to red.	EW
SANDSTONE. Reddish brown.	EW
SANDSTONE with occasional clasts of quartz. Pale red.	MW
SAND with clay. Pale reddish brown. (Weathered sandstone).	EW
SANDSTONE. Pale brown.	HW/MW
SAND with trace clay. Medium to coarse grained. Brown to red.	EW
BH04 terminated at 10.5m	

RQD %	Defect Description
54	Joint Set Planar and rough, tabular.
50	Joint set. Tight to open with sand infill.
99	Undulating and rough, tabular.
85	Planar and rough, tabular.
83	

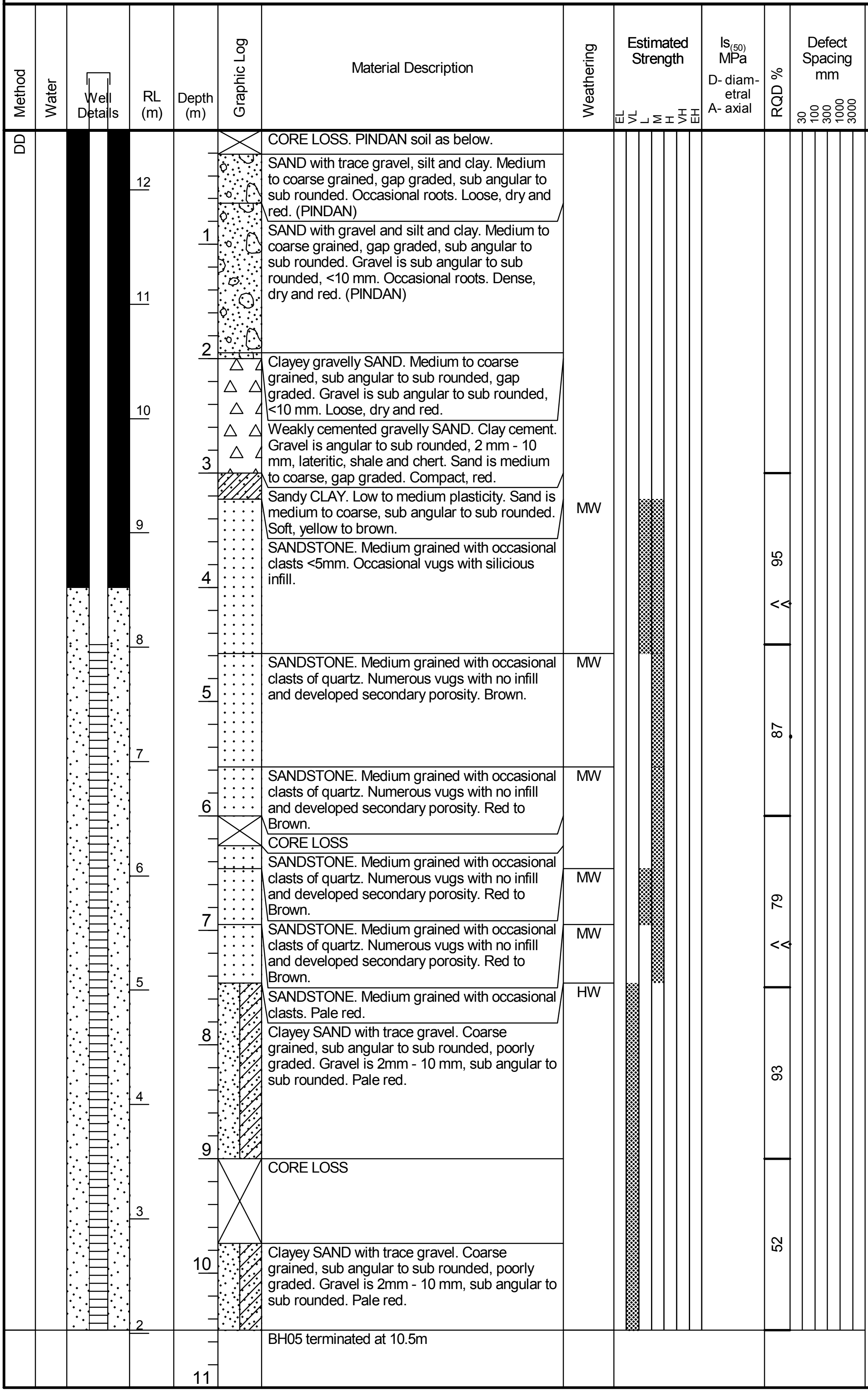
Talis

BOREHOLE NUMBER BH05

PAGE 1 OF 1

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 16/12/17
COMPLETED 16/12/17
R.L. SURFACE 12.524
DATUM m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90°
BEARING -90°
EQUIPMENT DR002
HOLE LOCATION 314916.308,7576694.188
HOLE SIZE 96
LOGGED BY FD
CHECKED BY LM
NOTES



Material Description	Weathering	Defect Description
CORE LOSS. PINDAN soil as below.		
SAND with trace gravel, silt and clay. Medium to coarse grained, gap graded, sub angular to sub rounded. Occasional roots. Loose, dry and red. (PINDAN)		
SAND with gravel and silt and clay. Medium to coarse grained, gap graded, sub angular to sub rounded. Gravel is sub angular to sub rounded, <10 mm. Occasional roots. Dense, dry and red. (PINDAN)		
Clayey gravelly SAND. Medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is sub angular to sub rounded, <10 mm. Loose, dry and red.		
Weakly cemented gravelly SAND. Clay cement. Gravel is angular to sub rounded, 2 mm - 10 mm, lateritic, shale and chert. Sand is medium to coarse, gap graded. Compact, red.		
Sandy CLAY. Low to medium plasticity. Sand is medium to coarse, sub angular to sub rounded. Soft, yellow to brown.	MW	
SANDSTONE. Medium grained with occasional clasts <5mm. Occasional vugs with silicious infill.		
SANDSTONE. Medium grained with occasional clasts of quartz. Numerous vugs with no infill and developed secondary porosity. Brown.	MW	
SANDSTONE. Medium grained with occasional clasts of quartz. Numerous vugs with no infill and developed secondary porosity. Red to Brown.	MW	
CORE LOSS		
SANDSTONE. Medium grained with occasional clasts of quartz. Numerous vugs with no infill and developed secondary porosity. Red to Brown.	MW	
SANDSTONE. Medium grained with occasional clasts of quartz. Numerous vugs with no infill and developed secondary porosity. Red to Brown.	MW	
SANDSTONE. Medium grained with occasional clasts. Pale red.	HW	
Clayey SAND with trace gravel. Coarse grained, sub angular to sub rounded, poorly graded. Gravel is 2mm - 10 mm, sub angular to sub rounded. Pale red.		
CORE LOSS		
Clayey SAND with trace gravel. Coarse grained, sub angular to sub rounded, poorly graded. Gravel is 2mm - 10 mm, sub angular to sub rounded. Pale red.		
BH05 terminated at 10.5m		

Talis

BOREHOLE NUMBER BH10

PAGE 1 OF 3

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 20/12/17
COMPLETED 20/12/17
R.L. SURFACE 31.541
DATUM m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90°
BEARING -90°
EQUIPMENT DR002
HOLE LOCATION 317214.529,7575662.634
HOLE SIZE 96
LOGGED BY FD
CHECKED BY LM
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa D- diam- etral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Defect Description
DD			31	1		CORE LOSS. (PINDAN soils as below).						
			30			SAND with trace gravel, silt and clay. Medium to coarse, sub angular to sub rounded, gap graded. Loose, dry and red. (PINDAN).						
			29	2		CORE LOSS.						
				3		SAND with trace gravel, silt and clay. Medium to coarse, sub angular to sub rounded, gap graded. Loose, dry and red. (PINDAN).						
			28	4		CORE LOSS.						
						SAND with trace gravel, silt and clay. Medium to coarse, sub angular to sub rounded, gap graded. Loose, dry and red. (PINDAN).						
			27	5		CORE LOSS.						
			26	6		SAND with trace gravel, silt and clay. Medium to coarse, sub angular to sub rounded, gap graded. Loose, dry and red. (PINDAN).						
			25	7		CORE LOSS.						
			24			SAND with trace gravel, silt and clay. Medium to coarse, sub angular to sub rounded, gap graded. Loose, dry and red. (PINDAN).						
						CORE LOSS.						
			23	8 9		SAND with trace gravel, silt and clay. Medium to coarse, sub angular to sub rounded, gap graded. Loose to dense, dry and red. (PINDAN).						
			22	10		CORE LOSS.						
						SAND with trace gravel, silt and clay. Medium to coarse, sub angular to sub rounded, gap graded. Loose to dense, dry and red. (PINDAN).						
			21	11		CORE LOSS.						

BOREHOLE NUMBER BH10

PAGE 2 OF 3

Talis

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 20/12/17
COMPLETED 20/12/17
R.L. SURFACE 31.541
DATUM m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90°
BEARING -90°
EQUIPMENT DR002
HOLE LOCATION 317214.529,7575662.634
HOLE SIZE 96
LOGGED BY FD
CHECKED BY LM
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa D- diam- etral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Defect Description
DD			20	12		SAND with trace gravel, silt and clay. Medium to coarse, sub angular to sub rounded, gap graded. Loose to dense, dry and red. (PINDAN).						
			19	13		CORE LOSS.						
			18	14		SAND with trace gravel, silt and clay. Medium to coarse, sub angular to sub rounded, gap graded. Loose to dense, dry and red. (PINDAN).						
			17	15		SAND with trace gravel, silt and clay. Medium to coarse, sub angular to sub rounded, gap graded. Dense, dry and red. (PINDAN).						
						CORE LOSS.						
			16			SAND with trace gravel, silt and clay. Medium to coarse, sub angular to sub rounded, gap graded. Dense, dry and red. (PINDAN).						
			15	16 17		Weakly cemented GRAVEL. Sand cement. Gravel is angular to sub rounded, 2mm - 55 mm, clasts of quartz and chert. Angular clasts are generally larger. Dense, red to brown.						
			14	18		SANDSTONE. Medium grained with occasional clasts and silicious veins. Pale brown to yellow.	MW			73		Joint, undulating and rough, tabular. Joint, undulating and rough, tabular. Joint, undulating and rough, tabular. Joint, undulating and rough, tabular.
			13 12	19 20		CORE LOSS.				0		
			11	21		SANDSTONE. Medium grained with silicious veins.	SW			86		Joint, undulating and rough, tabular.
			10			Gravelly SAND with trace clay. Medium to coarse grained. Gravel is sub angular to rounded, 2 mm - 10 mm.	EW					
						Cemented GRAVEL. Sand cement. Gravel is sub angular to rounded, 2 mm - 18 mm. Gravel is clasts of chert and quartz. Light brown.	EW			60		
				22			MW					

Talis

BOREHOLE NUMBER BH10

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 20/12/17 **COMPLETED** 20/12/17
R.L. SURFACE 31.541 **DATUM** m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90° **BEARING** -90°
EQUIPMENT DR002
HOLE LOCATION 317214.529,7575662.634
HOLE SIZE 96
LOGGED BY FD **CHECKED BY** LM
NOTES

Method	RL (m)	Depth (m)	Material Description	Weathering	RQD %	Defect Description
DD	9		SANDSTONE with black surface staining (Charcoal??). Limited secondary porosity developing. Light brown. *(continued)*	MW	60	
			Gravelly SAND with clay (weathered sandstone). Brown.	EW		
		23	CORE LOSS.			
	8		SANDSTONE. Medium grained with secondary porosity. Pale yellow.	MW	85	Joint, undulating and rough, tabular. Joint, undulating and rough, tabular.
		24	CORE LOSS.			
	7		SANDSTONE. Medium grained with secondary porosity. Pale yellow.			Joint, undulating and rough, tabular.
		25	SANDSTONE. Medium grained with clasts. Clasts are sub angular to sub rounded and showing signs of water flow.	MW		Joint, undulating and rough, tabular.
	6		Cemented GRAVEL. Sand cement. Gravel is sub angular to sub rounded, 2 mm - 20 mm.	MW		
			BH10 terminated at 25.5m			
		26				
	5	27				
	4	28				
	3	29				
	2	30				
	1	31				
	0	32				
	-1	33				

BOREHOLE NUMBER BH11

PAGE 1 OF 3

Talis

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 19/12/17 **COMPLETED** 19/12/17
R.L. SURFACE 26.708 **DATUM** m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90° **BEARING** -90°
EQUIPMENT DR002
HOLE LOCATION 316539.783,7576142.138
HOLE SIZE 96
LOGGED BY FD **CHECKED BY** LM
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa D- diametral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Defect Description
DD			26 25 24	1 2		CORE LOSS. (PINDAN soil as below).						
				3		SAND with trace clay, silt and gravel. Medium to coarse grained, sub angular to sub rounded,gap graded. Loose, dry and red. (PINDAN).						
			23	4		CORE LOSS.						
						SAND with trace clay, silt and gravel. Medium to coarse grained, sub angular to sub rounded, gap graded. Loose, dry and red. (PINDAN).						
			22	5		CORE LOSS.						
			21	6		SAND with trace clay, silt and gravel. Medium to coarse grained, sub angular to sub rounded, gap graded. Loose, dry and red. (PINDAN).						
			20	7		SAND with gravel and trace clay and silt. Sand is medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is sub angular to sub rounded, 2 mm - 4 mm. Loose to dense, dry and red. (PINDAN).						
			19	8		CORE LOSS.						
			18	9		SAND with gravel and trace clay and silt. Sand is medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is sub angular to sub rounded, 2 mm - 4 mm. Loose, dry and red. (PINDAN).						
			17	10		CORE LOSS.						
			16			SAND with gravel and trace clay and silt. Sand is medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is sub angular to sub rounded, 2 mm - 4 mm. Loose, dry and red. (PINDAN).						
				11		CORE LOSS.						

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 19/12/17 **COMPLETED** 19/12/17
R.L. SURFACE 26.708 **DATUM** m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90° **BEARING** -90°
EQUIPMENT DR002
HOLE LOCATION 316539.783,7576142.138
HOLE SIZE 96
LOGGED BY FD **CHECKED BY** LM
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa D- diametral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Defect Description
DD			15			SAND with gravel and trace clay and silt. Sand is medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is sub angular to sub rounded, 2 mm - 4 mm. Dense, dry and red. (PINDAN).						
				12		SAND with gravel and trace clay and silt. Sand is medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is sub angular to sub rounded, 2 mm - 4 mm. Loose to dense, dry and red. (PINDAN). *(continued)*	EW					
			14	13		GRAVELLY SAND with trace clay and silt. Sand is medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is sub angular to sub rounded, 2 mm - 32 mm consisting of shale and chert. Dense, red.				93		
			13			Weakly cemented GRAVEL. Sand cement. Gravel is angular to sub rounded, 2 mm - 37 mm consisting of chert, shale and lateritic gravel. Pale brown.	EW MW					
				14		Weakly cemented GRAVEL. Sand cement. Gravel is angular to rounded, reduction in gravel sizes. Pale brown.	MW					
			12	15		Cemented GRAVEL. Sand cement. Gravel is angular to sub rounded, 2 mm - 60 mm. Smaller gravel is rounded, larger gravel is angular. Gravel of shale, chert and lateritic gravel. Occasional silicious veins. Pale brown.				71		
						Cemented GRAVEL. Sand cement. Gravel is angular to sub rounded, 2 mm - 15 mm. Occasional silicious veins. Pale brown.	MW MW					
			11	16		Cemented GRAVEL. Sand cement. Gravel is angular to sub rounded, 2 mm - 60 mm. Smaller gravel is rounded, larger gravel is angular. Gravel of shale, chert and lateritic gravel. Occasional silicious veins. Pale brown.	MW			90		
			10			Weakly cemented GRAVEL. Sand cement. Gravel is sub angular to rounded, 2 mm - 8 mm showing signs of water flow. Gravel is sedimentary in origin. Yellow to red.	MW					
				17		Cemented GRAVEL. Sand cement. Gravel is sub angular to rounded, 2 mm - 22mm. Yellow to red.						Joint, undulating and rough, tabular.
			9			SANDSTONE. Medium grained with occasional clasts. Secondary porosity developed. Small black surface staining (Charcoal??).	MW			91		Joint, undulating and rough, tabular.
				18		SANDSTONE with occasional silicious clasts (quartz). Clasts are sub angular to sub rounded, 4 mm - 40 mm. No discernible secondary porosity. Pale brown.	MW					Joint, undulating and rough, tabular.
			8	19		Cemented GRAVEL. Sand cement. Gravel is sub angular to rounded, 2 mm - 22 mm consisting of chert, quartz and shale and silicious veins. Pale yellow. (Small weathered zone at 18.41, gravelly sand).						Joint, undulating and rough, tabular. Clay infill. Joint, undulating and rough, tabular. Joint, undulating and rough, tabular. Joint, undulating and rough, tabular. Joint, undulating and rough, tabular. Joint, undulating and rough, tabular.
			7	20		SANDSTONE. Medium grained with clasts and silicious veins.	MW					
			6			Cemented GRAVEL. Sand cement. Gravel is sub angular to sub rounded, 2mm - 23 mm with occasional larger clasts (>32 mm). Gravel is quartz and chert. Yellow to red.	MW			69		
				21		Sandy GRAVEL with clay. Gravel is sub rounded to rounded. (Weathered sandstone)	EW MW					
			5			Cemented GRAVEL. Sand cement. Gravel is sub angular to sub rounded, 2mm - 23 mm with occasional larger clasts (>32 mm). Gravel is quartz and chert.	EW EW MW			79		Joint, undulating and rough, tabular.
				22		Sandy GRAVEL with clay. Gravel is sub rounded to rounded. (Weathered sandstone)	EW MW					

BOREHOLE NUMBER BH11

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 19/12/17
COMPLETED 19/12/17
R.L. SURFACE 26.708
DATUM m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90°
BEARING -90°
EQUIPMENT DR002
HOLE LOCATION 316539.783,7576142.138
HOLE SIZE 96
LOGGED BY FD
CHECKED BY LM
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa D- diametral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Defect Description
DD						Cemented GRAVEL. Sand cement. Gravel is sub rounded to rounded consisting of quartz and lateritic gravel.	EW MW			79		Joint, undulating and rough, tabular. Joint, undulating and rough, tabular.
			4			SANDSTONE. Fine to medium grained with occasional sub rounded clasts. Pale yellow.						
				23		Clayey SAND. Pale yellow (Weathered sandstone).	MW					
						SANDSTONE. Fine to medium grained with occasional sub rounded clasts. Pale yellow.				65		
			3			Cemented GRAVEL. Sand cement. Gravel is sub angular to rounded, 2 mm - 8 mm.						
				24		SANDSTONE. Medium grained with limited black staining (Charcoal??). Pale yellow. *(continued)*						
						SANDSTONE. Medium grained with secondary porosity. Occasional sub angular to sub rounded clasts. Pale yellow.	MW			50		Joint, undulating and rough, tabular.
			2			CORE LOSS.						Joint, undulating and rough, tabular. Joint, undulating and rough, tabular.
				25		SANDSTONE. Medium grained with secondary porosity. Occasional sub angular to sub rounded clasts. Pale yellow.						Rubble zone.
						SANDSTONE. MEdium grained with occasional clasts and limited vugs. Pale yellow.						
			1	26		BH11 terminated at 25.5m						
			0	27								
			-1	28								
			-2	29								
			-3	30								
			-4	31								
			-5	32								
			-6	33								

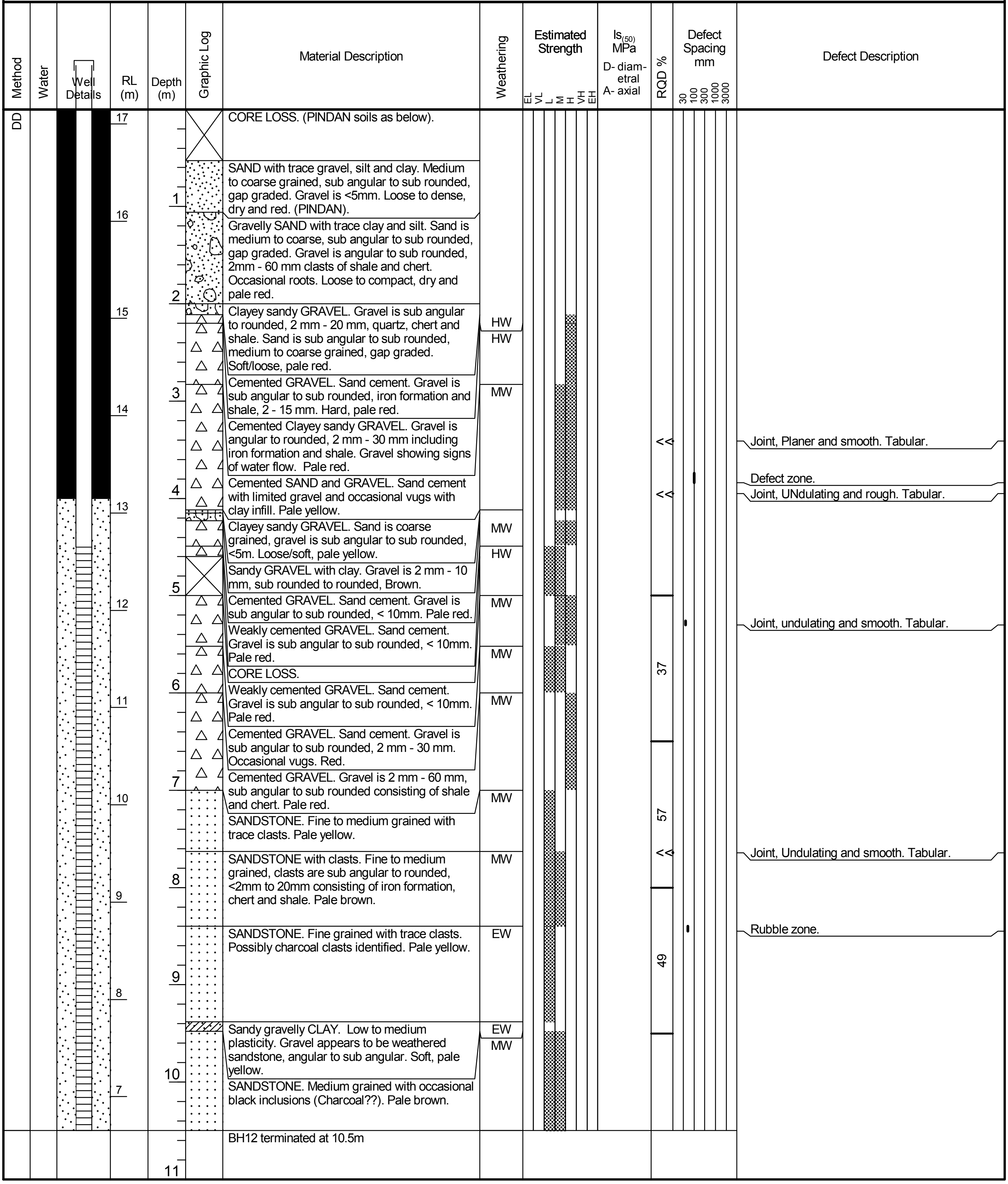
BOREHOLE NUMBER BH12

PAGE 1 OF 1

Talis

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 14/12/17 **COMPLETED** 14/12/17
R.L. SURFACE 17.15 **DATUM** m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90° **BEARING** -90°
EQUIPMENT DR002
HOLE LOCATION 317331.367,7575420.705
HOLE SIZE 96
LOGGED BY FD **CHECKED BY** LM
NOTES



Method	Material Description	Weathering	RQD %	Defect Description
DD	CORE LOSS. (PINDAN soils as below).			
	SAND with trace gravel, silt and clay. Medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is <5mm. Loose to dense, dry and red. (PINDAN).			
	Gravelly SAND with trace clay and silt. Sand is medium to coarse, sub angular to sub rounded, gap graded. Gravel is angular to sub rounded, 2mm - 60 mm clasts of shale and chert. Occasional roots. Loose to compact, dry and pale red.			
	Clayey sandy GRAVEL. Gravel is sub angular to rounded, 2 mm - 20 mm, quartz, chert and shale. Sand is sub angular to sub rounded, medium to coarse grained, gap graded. Soft/loose, pale red.	HW HW		
	Cemented GRAVEL. Sand cement. Gravel is sub angular to sub rounded, iron formation and shale, 2 - 15 mm. Hard, pale red.	MW		
	Cemented Clayey sandy GRAVEL. Gravel is angular to rounded, 2 mm - 30 mm including iron formation and shale. Gravel showing signs of water flow. Pale red.		<<	Joint, Planer and smooth. Tabular.
	Cemented SAND and GRAVEL. Sand cement with limited gravel and occasional vugs with clay infill. Pale yellow.		<<	Defect zone. Joint, UNdulating and rough. Tabular.
	Clayey sandy GRAVEL. Sand is coarse grained, gravel is sub angular to sub rounded, <5m. Loose/soft, pale yellow.	MW		
	Sandy GRAVEL with clay. Gravel is 2 mm - 10 mm, sub rounded to rounded, Brown.	HW		
	Cemented GRAVEL. Sand cement. Gravel is sub angular to sub rounded, < 10mm. Pale red.	MW	37	Joint, undulating and smooth. Tabular.
	Weakly cemented GRAVEL. Sand cement. Gravel is sub angular to sub rounded, < 10mm. Pale red.	MW		
	CORE LOSS.			
	Weakly cemented GRAVEL. Sand cement. Gravel is sub angular to sub rounded, < 10mm. Pale red.	MW		
	Cemented GRAVEL. Sand cement. Gravel is sub angular to sub rounded, 2 mm - 30 mm. Occasional vugs. Red.			
	Cemented GRAVEL. Gravel is 2 mm - 60 mm, sub angular to sub rounded consisting of shale and chert. Pale red.	MW	57	
	SANDSTONE. Fine to medium grained with trace clasts. Pale yellow.			
	SANDSTONE with clasts. Fine to medium grained, clasts are sub angular to rounded, <2mm to 20mm consisting of iron formation, chert and shale. Pale brown.	MW	<<	Joint, Undulating and smooth. Tabular.
	SANDSTONE. Fine grained with trace clasts. Possibly charcoal clasts identified. Pale yellow.	EW	49	Rubble zone.
	Sandy gravelly CLAY. Low to medium plasticity. Gravel appears to be weathered sandstone, angular to sub angular. Soft, pale yellow.	EW		
	SANDSTONE. Medium grained with occasional black inclusions (Charcoal??). Pale brown.	MW		
	BH12 terminated at 10.5m			

CORED BOREHOLE TW17084-ONSLOW.GPJ GINT STD AUSTRALIA.GDT 28/6/18

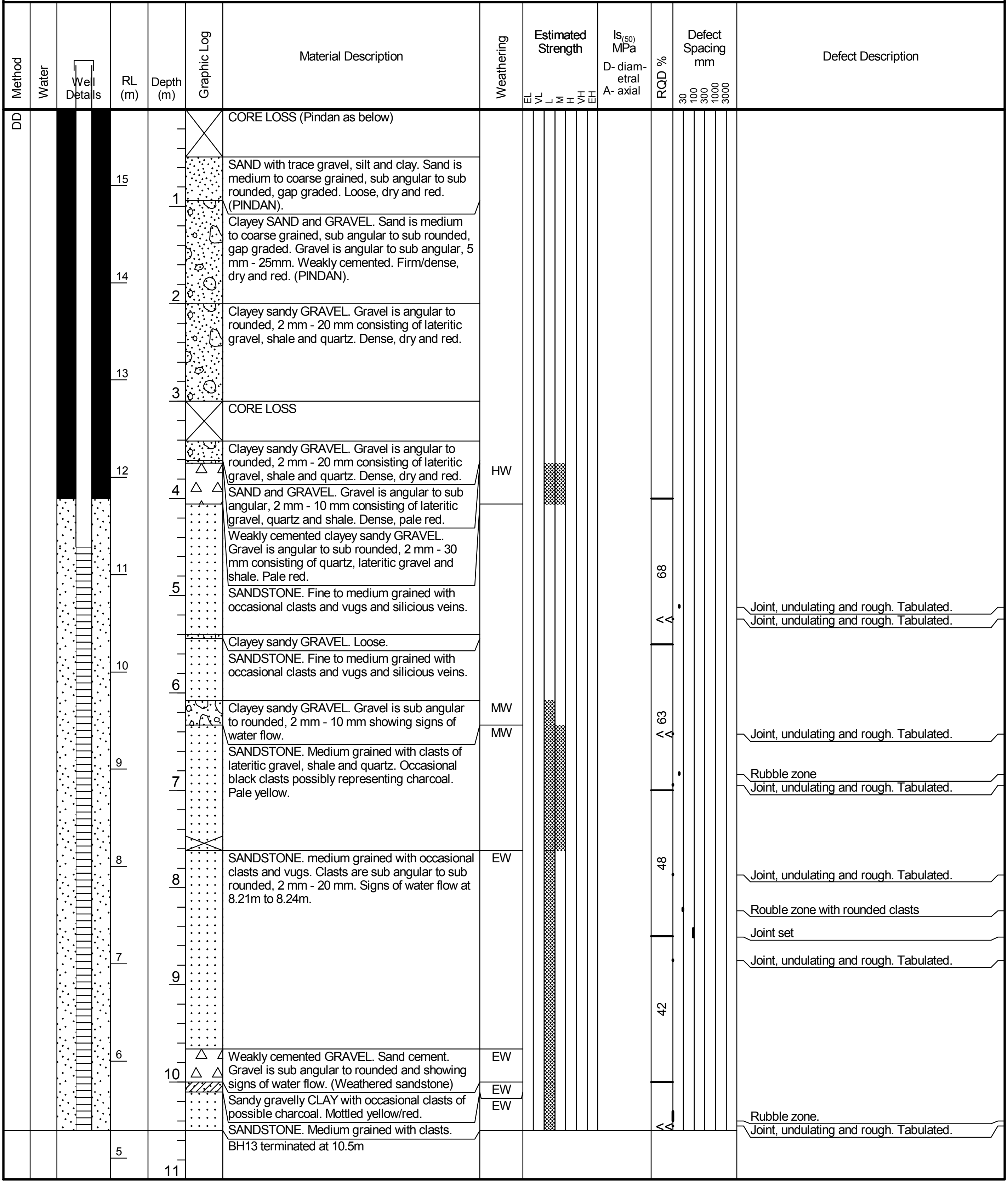
BOREHOLE NUMBER BH13

PAGE 1 OF 1

Talis

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 14/12/17
COMPLETED 14/12/17
R.L. SURFACE 15.784
DATUM m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90°
BEARING -90°
EQUIPMENT DR002
HOLE LOCATION 316721.742,7575920.412
HOLE SIZE 96
LOGGED BY FD
CHECKED BY LM
NOTES



CORE LOSS (Pindan as below)

SAND with trace gravel, silt and clay. Sand is medium to coarse grained, sub angular to sub rounded, gap graded. Loose, dry and red. (PINDAN).

Clayey SAND and GRAVEL. Sand is medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is angular to sub angular, 5 mm - 25mm. Weakly cemented. Firm/dense, dry and red. (PINDAN).

Clayey sandy GRAVEL. Gravel is angular to rounded, 2 mm - 20 mm consisting of lateritic gravel, shale and quartz. Dense, dry and red.

CORE LOSS

Clayey sandy GRAVEL. Gravel is angular to rounded, 2 mm - 20 mm consisting of lateritic gravel, shale and quartz. Dense, dry and red.

SAND and GRAVEL. Gravel is angular to sub angular, 2 mm - 10 mm consisting of lateritic gravel, quartz and shale. Dense, pale red.

Weakly cemented clayey sandy GRAVEL. Gravel is angular to sub rounded, 2 mm - 30 mm consisting of quartz, lateritic gravel and shale. Pale red.

SANDSTONE. Fine to medium grained with occasional clasts and vugs and silicious veins.

Clayey sandy GRAVEL. Loose.

SANDSTONE. Fine to medium grained with occasional clasts and vugs and silicious veins.

Clayey sandy GRAVEL. Gravel is sub angular to rounded, 2 mm - 10 mm showing signs of water flow.

SANDSTONE. Medium grained with clasts of lateritic gravel, shale and quartz. Occasional black clasts possibly representing charcoal. Pale yellow.

SANDSTONE. medium grained with occasional clasts and vugs. Clasts are sub angular to sub rounded, 2 mm - 20 mm. Signs of water flow at 8.21m to 8.24m.

Weakly cemented GRAVEL. Sand cement. Gravel is sub angular to rounded and showing signs of water flow. (Weathered sandstone)

Sandy gravelly CLAY with occasional clasts of possible charcoal. Mottled yellow/red.

SANDSTONE. Medium grained with clasts.

BH13 terminated at 10.5m

Joint, undulating and rough. Tabulated.
Joint, undulating and rough. Tabulated.
Joint, undulating and rough. Tabulated.
Rubble zone
Joint, undulating and rough. Tabulated.
Joint, undulating and rough. Tabulated.
Rouble zone with rounded clasts
Joint set
Joint, undulating and rough. Tabulated.
Rubble zone.
Joint, undulating and rough. Tabulated.

BOREHOLE NUMBER BH14

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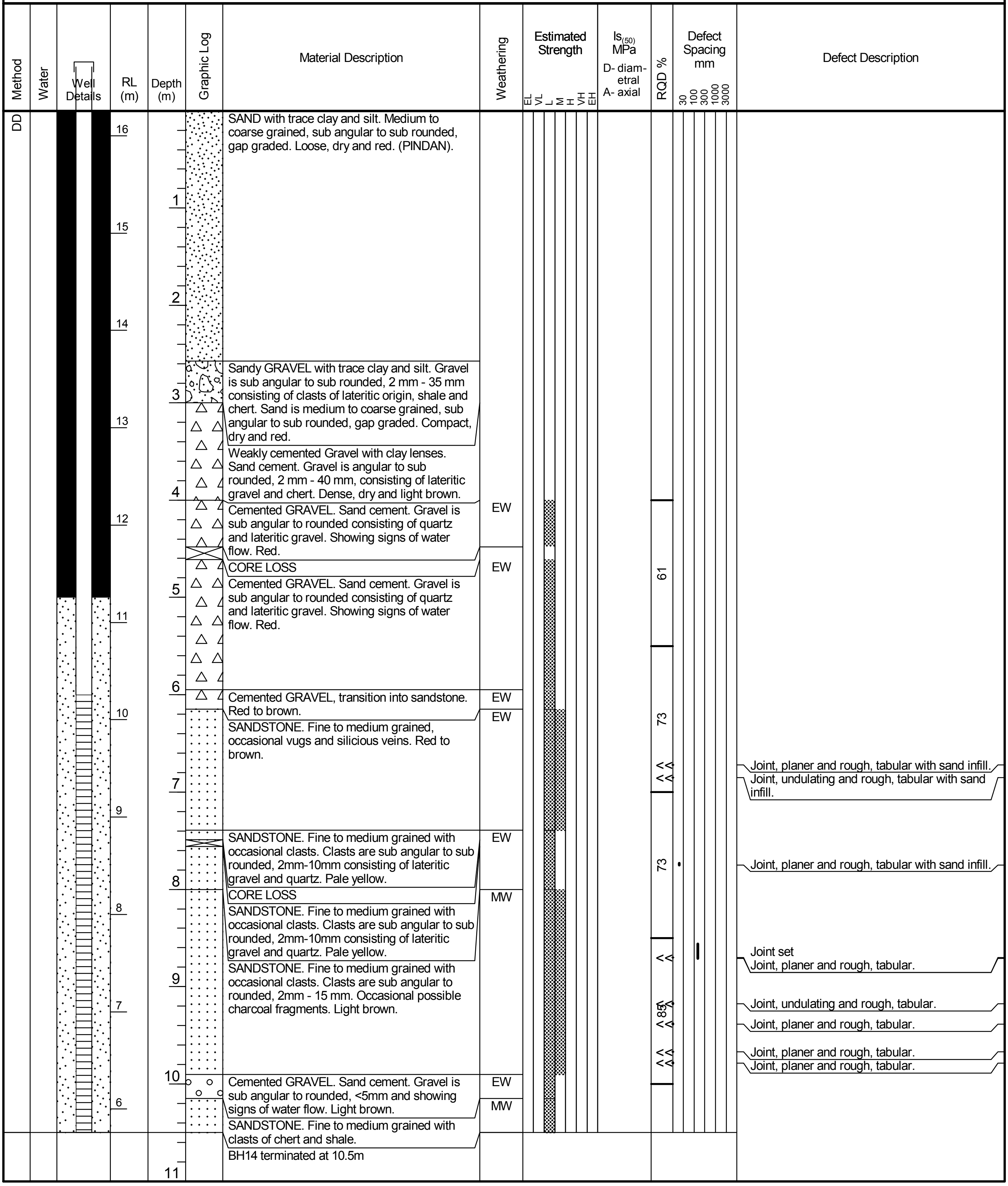
Talis

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 15/12/17
COMPLETED 15/12/17
R.L. SURFACE 16.257
DATUM m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90°
BEARING -90°
EQUIPMENT DR002
HOLE LOCATION 316354.224,7576209.023
HOLE SIZE 96
LOGGED BY FD
CHECKED BY LM
NOTES



Material Description	Weathering
SAND with trace clay and silt. Medium to coarse grained, sub angular to sub rounded, gap graded. Loose, dry and red. (PINDAN).	
Sandy GRAVEL with trace clay and silt. Gravel is sub angular to sub rounded, 2 mm - 35 mm consisting of clasts of lateritic origin, shale and chert. Sand is medium to coarse grained, sub angular to sub rounded, gap graded. Compact, dry and red.	
Weakly cemented Gravel with clay lenses. Sand cement. Gravel is angular to sub rounded, 2 mm - 40 mm, consisting of lateritic gravel and chert. Dense, dry and light brown.	
Cemented GRAVEL. Sand cement. Gravel is sub angular to rounded consisting of quartz and lateritic gravel. Showing signs of water flow. Red.	EW
CORE LOSS	EW
Cemented GRAVEL. Sand cement. Gravel is sub angular to rounded consisting of quartz and lateritic gravel. Showing signs of water flow. Red.	
Cemented GRAVEL, transition into sandstone. Red to brown.	EW
SANDSTONE. Fine to medium grained, occasional vugs and silicious veins. Red to brown.	EW
SANDSTONE. Fine to medium grained with occasional clasts. Clasts are sub angular to sub rounded, 2mm-10mm consisting of lateritic gravel and quartz. Pale yellow.	EW
CORE LOSS	MW
SANDSTONE. Fine to medium grained with occasional clasts. Clasts are sub angular to sub rounded, 2mm-10mm consisting of lateritic gravel and quartz. Pale yellow.	
SANDSTONE. Fine to medium grained with occasional clasts. Clasts are sub angular to rounded, 2mm - 15 mm. Occasional possible charcoal fragments. Light brown.	
Cemented GRAVEL. Sand cement. Gravel is sub angular to rounded, <5mm and showing signs of water flow. Light brown.	EW
SANDSTONE. Fine to medium grained with clasts of chert and shale.	MW

BH14 terminated at 10.5m

Joint, planer and rough, tabular with sand infill.
Joint, undulating and rough, tabular with sand infill.
Joint, planer and rough, tabular with sand infill.
Joint set
Joint, planer and rough, tabular.
Joint, undulating and rough, tabular.
Joint, planer and rough, tabular.
Joint, planer and rough, tabular.
Joint, planer and rough, tabular.

BOREHOLE NUMBER BH15

Talis

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 17/12/17 **COMPLETED** 17/12/17
R.L. SURFACE 14.376 **DATUM** m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90° **BEARING** -90°
EQUIPMENT DR002
HOLE LOCATION 316023.468,7575888.03
HOLE SIZE 96
LOGGED BY FD **CHECKED BY** LM
NOTES

Method	RL (m)	Depth (m)	Material Description	Weathering	RQD %	Defect Description
DD			CORE LOSS. (PINDAN soils as below).			
	14		SAND with trace gravel, clay and silt. Sand is medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is angular to sub rounded with occasional roots. Loose, dry and red. (PINDAN).			
	13	1	SAND with travel gravel, clay and silt. Sand is medium to corse grained, sub angular to sub rounded, gap graded. Gravel is angular to sub rounded, 8 mm - 8 mm with occasional roots. Dense, dry and red. (PINDAN).			
		2	Weakly cemented GRAVEL. Sand cement. Gravel is angular to sub rounded, 2 - 15 mm. Dense, red.			
	12	3	Weakly cemented GRAVEL. Sand cement. Gravel is angular to sub rounded, 2 - 15 mm. Dense to hard, red.			
			CORE LOSS.	EW		
	11		Cemented GRAVEL. Sand cement. Gravel is angular to sub rounded, 2 - 15 mm. Dense to hard, red.		63	
	10	4	Weakly cemented GRAVEL. Sand cement. Gravel is sub angular to sub rounded, 2mm-20mm. Showing signs of water flow. Dense, brown to red.	EW MW		Joint, undulating and rough. Tabular. Joint, undulating and rough. Tabular.
		5	SANDSTONE. Fine to medium grained and occasional sub rounded to rounded clasts. Occasional silicious veins and occasional vugs. Pale yellow.			
			CORE LOSS.	EW		Joint, undulating and rough. Tabular.
	9		SANDSTONE. Fine to medium grained and occasional sub rounded to rounded clasts. Occasional silicious veins and occasional vugs. Pale yellow.	MW	75	Joint, undulating and rough. Tabular.
		6	Clayey gravelly SAND. Medium to coarse grained, gap graded. Yellow to brown (weathered sandstone).			
	8		SANDSTONE. Medium grained with occasional clasts. Clasts are 2 mm - 15 mm, quartz and shale, sub angular to rounded. Yellow to red.	MW		Joint, undulating and rough. Tabular.
		7	SANDSTONE. Medium grained with occasional clasts. Clasts are 2 mm - 15 mm, quartz and shale, sub angular to rounded. Yellow to red.	EW MW MW	87	
	7		Clayey gravelly SAND. Light brown (weathered sandstone).	MW		
			SANDSTONE. Medium grained with occasional clasts. Clasts are 2 mm - 15 mm, quartz and shale, sub angular to rounded. Yellow to red.	EW		Joint, undulating and rough. Tabular.
	6	8	SANDSTONE with clay and gravel (weathered). Gravel is sub angular to rounded with occasional black staining (charcoal?). Light brown.	MW	61	Joint, undulating and rough. Tabular.
			SANDSTONE. Medium grained with occasional clasts. Clasts are sub rounded to rounded, 2 mm - 10 mm including shale and chert.	EW MW		Joint, undulating and rough. Tabular.
		9	Clayey gravelly SAND (weathered sandstone).	MW		
	5		SANDSTONE. Medium grained with occasional clasts. Clasts are sub rounded to rounded, 2 mm - 10 mm including shale and chert.	HW/MW MW		
			Clayey gravelly SAND (weathered sandstone).			
		10	SANDSTONE. Medium grained with occasional clasts.			
	4		SANDSTONE. Medium grained with large clasts which are sub angular to sub rounded, 2 - 22 mm consisting of chert and shale. Yellow to brown.	MW		
			CORE LOSS.			
		11	Cemented GRAVEL. Sand cement. Gravel is sub angular to sub rounded, 2 mm - 15mm.			

Talis

BOREHOLE NUMBER BH15

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 17/12/17 **COMPLETED** 17/12/17
R.L. SURFACE 14.376 **DATUM** m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90° **BEARING** -90°
EQUIPMENT DR002
HOLE LOCATION 316023.468,7575888.03
HOLE SIZE 96
LOGGED BY FD **CHECKED BY** LM
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength EL VL L M H VH EH	$Is_{(50)}$ MPa D- diam-etral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Defect Description
			3 2 1 0 -1 -2 -3 -4 -5 -6 -7	12 13 14 15 16 17 18 19 20 21 22		Signs of water flow. Cemented GRAVEL. Sand cement. Gravel is sub angular to sub rounded, 2 mm - 15mm. Signs of water flow. SANDSTONE. BH15 terminated at 10.5m						

BOREHOLE NUMBER BH16

PAGE 1 OF 1

Talis

CLIENT Shire of Ashburton

PROJECT NAME Phase 1 Hydrogeological Risk Asssessment

PROJECT NUMBER TW17084

PROJECT LOCATION Onslow

DATE STARTED 17/12/17 **COMPLETED** 17/12/17

R.L. SURFACE 15.629 **DATUM** m mAHD

DRILLING CONTRACTOR Soil Mechanics

SLOPE 90° **BEARING** -90°

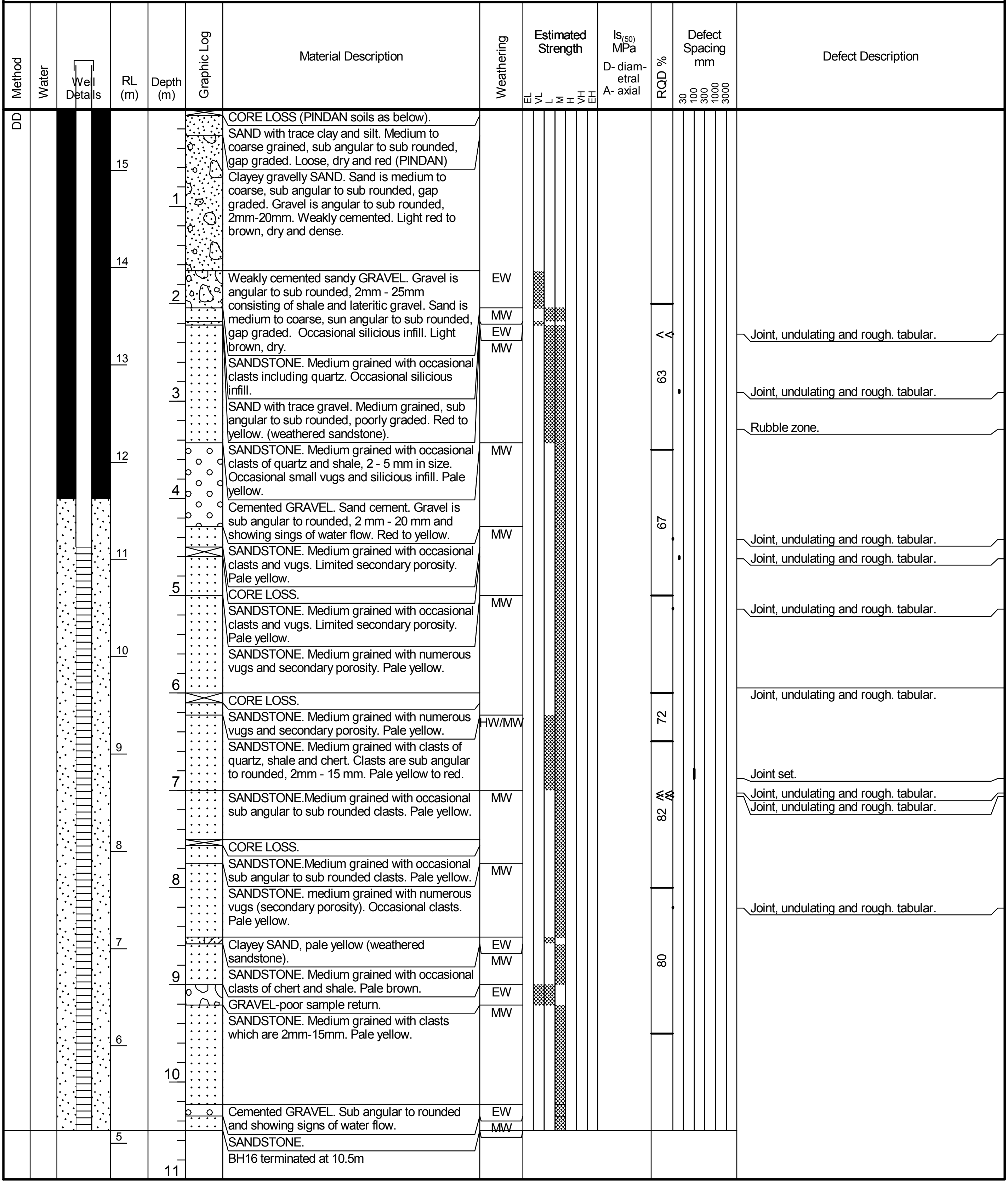
EQUIPMENT DR002

HOLE LOCATION 316519.834,7575494.496

HOLE SIZE 96

LOGGED BY FD **CHECKED BY** LM

NOTES



Material Description:

- CORE LOSS (PINDAN soils as below).
- SAND with trace clay and silt. Medium to coarse grained, sub angular to sub rounded, gap graded. Loose, dry and red (PINDAN)
- Clayey gravelly SAND. Sand is medium to coarse, sub angular to sub rounded, gap graded. Gravel is angular to sub rounded, 2mm-20mm. Weakly cemented. Light red to brown, dry and dense.
- Weakly cemented sandy GRAVEL. Gravel is angular to sub rounded, 2mm - 25mm consisting of shale and lateritic gravel. Sand is medium to coarse, sun angular to sub rounded, gap graded. Occasional silicious infill. Light brown, dry.
- SANDSTONE. Medium grained with occasional clasts including quartz. Occasional silicious infill.
- SAND with trace gravel. Medium grained, sub angular to sub rounded, poorly graded. Red to yellow. (weathered sandstone).
- SANDSTONE. Medium grained with occasional clasts of quartz and shale, 2 - 5 mm in size. Occasional small vugs and silicious infill. Pale yellow.
- Cemented GRAVEL. Sand cement. Gravel is sub angular to rounded, 2 mm - 20 mm and showing sings of water flow. Red to yellow.
- SANDSTONE. Medium grained with occasional clasts and vugs. Limited secondary porosity. Pale yellow.
- CORE LOSS.
- SANDSTONE. Medium grained with occasional clasts and vugs. Limited secondary porosity. Pale yellow.
- SANDSTONE. Medium grained with numerous vugs and secondary porosity. Pale yellow.
- CORE LOSS.
- SANDSTONE. Medium grained with numerous vugs and secondary porosity. Pale yellow.
- SANDSTONE. Medium grained with clasts of quartz, shale and chert. Clasts are sub angular to rounded, 2mm - 15 mm. Pale yellow to red.
- SANDSTONE.Medium grained with occasional sub angular to sub rounded clasts. Pale yellow.
- CORE LOSS.
- SANDSTONE.Medium grained with occasional sub angular to sub rounded clasts. Pale yellow.
- SANDSTONE. medium grained with numerous vugs (secondary porosity). Occasional clasts. Pale yellow.
- Clayey SAND, pale yellow (weathered sandstone).
- SANDSTONE. Medium grained with occasional clasts of chert and shale. Pale brown.
- GRAVEL-poor sample return.
- SANDSTONE. Medium grained with clasts which are 2mm-15mm. Pale yellow.
- Cemented GRAVEL. Sub angular to rounded and showing signs of water flow.
- SANDSTONE.
- BH16 terminated at 10.5m

Weathering: EW, MW, EW, MW, MW, MW, MW, HW/MW, MW, MW, EW, MW, EW, MW, EW, MW

RQD %: 63, 67, 72, 82, 80

Defect Description:

- Joint, undulating and rough. tabular.
- Joint, undulating and rough. tabular.
- Rubble zone.
- Joint, undulating and rough. tabular.
- Joint, undulating and rough. tabular.
- Joint, undulating and rough. tabular.
- Joint, undulating and rough. tabular.
- Joint set.
- Joint, undulating and rough. tabular.
- Joint, undulating and rough. tabular.
- Joint, undulating and rough. tabular.

BOREHOLE NUMBER BH17

Talis

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 16/12/17
COMPLETED 16/12/17
R.L. SURFACE 16.822
DATUM m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90°
BEARING -90°
EQUIPMENT DR002
HOLE LOCATION 316999.449,7575240.647
HOLE SIZE 96
LOGGED BY FD
CHECKED BY LM
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa D- diam- etral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Defect Description

RL (m): 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6

Depth (m): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Material Description:

SAND with trace gravel, clay and silt. Sand is medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is sub angular to sub rounded, 2mm-12mm consisting of chert and hematite. Loose, dry and red (PINDAN).

SAND with trace gravel, clay and silt. Sand is medium to coarse grained, sub angular to sub rounded, gap graded. Gravel is sub angular to sub rounded, 2mm-12mm consisting of chert and hematite. Dense, dry and red (PINDAN).

Clayey SAND and GRAVEL. Sand is medium grained, sub angular to sub rounded, gap graded. Gravel is aub angular to sub rounded, 2 - 10mm consisting of chert, shale and hematite. Dense, dry and red.

Clayey gravelly SAND. Sand is medium to coarse grained, sub angular to rounded, gap graded. Clay is low to medium plasticity. Loose/soft, dry and light brown.

Clayey gravelly SAND, weakly cemented. Sand is medium to coarse, sub angular to sub rounded, gap graded. Gravel is angular to sub angular, 2mm-15mm consisting of shale and chert. Occasional silicious veins. Mottled red to yellow.

SANDSTONE. Medium grained with occasional clasts and silicious veins. Red to yellow.

SANDSTONE. Medium grained with occasional clasts and quartz veins and occasional vugs with silicious infill. Red to yellow.

SANDSTONE. Fine to medium grained with occasional clasts. Red to yellow.

SANDSTONE. Medium grained with clasts of chert and shale which are sub angular to rounded. 2mm - 15 mm. Red to brown.

CORE LOSS

Cemented GRAVEL. Sand cement. Gravel is sub angular to rounded, 2mm-20mm. Gravel is quartz, chert, shale and showing signs of water flow. Red to yellow.

SANDSTONE. Medium grained with occasional clasts. Mottled yellow to red.

SANDSTONE. Medium grained with occasional vugs. Vugs showing no infill and sand infill. Light brown.

SAND with gravel. Medium grained. Yellow.

SANDSTONE. Medium grained with occasional clasts. Pale yellow.

Cemented GRAVEL. Sand cement. Gravel is lateritic gravel, shale. Sub angular to rounded, 2mm-10mm. Reddish brown.

Cemented GRAVEL. Sand cement. Gravel is sub rounded to rounded, <5mm and showing signs of water flow. Gravel is chert, quartz and lateritic gravel. Light brown.

SANDSTONE. Medium grained with numerous clasts of quartz, shale and chert. Sub angular to rounded. Reddish brown.

SANDSTONE. Medium grained with occasional clasts. Light brown.

CORE LOSS

SANDSTONE. Medium grained with clasts, 2mm-15mm. Light brown.

Cemented GRAVEL. Sand cement. Gravel is angular to rounded, 2 - 15 mm consisting of chert, quartz and shale. Brown.

CORE LOSS

Cemented GRAVEL. Sand cement. Gravel is angular to rounded, 2 - 15 mm consisting of chert, quartz and shale. Brown.

Weathering: EW, EW, EW, MW, MW, MW, EW, MW, MW, EW, MW, EW/HW, MW, MW, MW, MW, MW, MW, EW, MW, MW

RQD %: 79, 31, 62, 47, 60

Defect Description: Joint, undulating and rough. Tabular.

BOREHOLE NUMBER BH17

Talis

CLIENT Shire of Ashburton
PROJECT NAME Phase 1 Hydrogeological Risk Asssessment
PROJECT NUMBER TW17084
PROJECT LOCATION Onslow

DATE STARTED 16/12/17
COMPLETED 16/12/17
R.L. SURFACE 16.822
DATUM m mAHD
DRILLING CONTRACTOR Soil Mechanics
SLOPE 90°
BEARING -90°
EQUIPMENT DR002
HOLE LOCATION 316999.449,7575240.647
HOLE SIZE 96
LOGGED BY FD
CHECKED BY LM
NOTES

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength EL VL L M H VH EH	Is(50) MPa D- diametral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Defect Description
						Clayey SAND with gravel. Gravel is angular to rounded, 2 - 15 mm consisting of chert, quartz and shale. Pale brown.						
						SANDSTONE. Medium grained with occasional clasts of quartz and chert, 2mm - 5 mm. Red to brown.						
						SANDSTONE. Medium grained.						
						BH17 terminated at 10.5m						
			5	12								
			4	13								
			3	14								
			2	15								
			1	16								
			0	17								
			-1	18								
			-2	19								
			-3	20								
			-4	21								
			-5	22								

TEST PIT NUMBER TP01

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 5/12/17
COMPLETED 5/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317668.30, 7575257.94
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5	⁙	SP	Silty SAND, fine-medium grained, rounded to sub rounded. Silt of low plasticity. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP01 terminated at 5m		

Talis Consultants

TEST PIT NUMBER TP02

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 6/12/17 **COMPLETED** 6/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317666.44, 7575340.49

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5	░	SP	SAND with trace silt, fine grained, rounded, well graded. Root inclusions. Gap graded, loose, dry, red.		
			6			Borehole TP02 terminated at 5m		

BOREHOLE / TEST PIT TW17084-ONSLOW-TP.GPJ GINT STD AUSTRALIA.GDT 11/4/18

TEST PIT NUMBER TP03

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 7/12/17 **COMPLETED** 7/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317603.63, 7575339.078

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5	▨	SP	Silty SAND, fine to medium grained, rounded to sub rounded Silt of low plasticity. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP03 terminated at 5m		

TEST PIT NUMBER TP04

Talis Consultants

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 15/12/17 **COMPLETED** 15/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317599.2288, 7575418.116

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5	░	SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP04 terminated at 5m		

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TEST PIT NUMBER TP05

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 7/12/17

COMPLETED 7/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317512.9517, 7575469.491

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4	⁘	SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			5	⁘	SP	SAND, fine to medium grained, rounded to sub rounded. Gap graded, loose, dry, red.		
			6			Borehole TP05 terminated at 5m		

BOREHOLE / TEST PIT TW17084-ONSLOW-TP.GPJ GINT STD AUSTRALIA.GDT 11/4/18

TEST PIT NUMBER TP06

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 7/12/17 **COMPLETED** 7/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317527.5718, 7575404.525

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			4 5 6			Borehole TP06 terminated at 3m		

TEST PIT NUMBER TP07

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 15/12/17 **COMPLETED** 15/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317439.0945, 7575452.87

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Loose, dry, red.		
			2 3 4 5		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, slightly moist, red.		
			6			Borehole TP07 terminated at 5m		

TEST PIT NUMBER TP08

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 7/12/17 **COMPLETED** 7/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317424.4744, 7575517.835

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP08 terminated at 5m		

TEST PIT NUMBER TP09

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 14/12/17 **COMPLETED** 14/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317350.6172, 7575501.214

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			1					
			2					
			3					
			4					
			5			Borehole TP09 terminated at 5m		
			6					

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TEST PIT NUMBER TP10

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 7/12/17

COMPLETED 7/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317338.6813, 7575569.877

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5	⁘	SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP10 terminated at 5m		

Talis Consultants

TEST PIT NUMBER TP11

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 14/12/17 **COMPLETED** 14/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317274.6691, 7575566.815

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			2 3 4		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, slightly moist, red.		
			5 6			Borehole TP11 terminated at 4.5m		

Talis Consultants

TEST PIT NUMBER TP12

PAGE 1 OF 1

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 14/12/17 **COMPLETED** 14/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317270.8503, 7575646.658
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP12 terminated at 5m		

TEST PIT NUMBER TP13

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 7/12/17

COMPLETED 7/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317206.8381, 7575643.596

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			2 3 4 5		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, slightly moist, red.		
			6			Borehole TP13 terminated at 5m		

TEST PIT NUMBER TP14

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 7/12/17 **COMPLETED** 7/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317203.0193, 7575723.439

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP14 terminated at 5m		

Talis Consultants

TEST PIT NUMBER TP15

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 7/12/17 **COMPLETED** 7/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317138.6516, 7575719.887

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			5 6			Borehole TP15 terminated at 4.5m		

TEST PIT NUMBER TP16

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 7/12/17 **COMPLETED** 7/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317134.1935, 7575798.849

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			5		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, moist, red.		
			6			Borehole TP16 terminated at 5m		

TEST PIT NUMBER TP17

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 14/12/17 **COMPLETED** 14/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317063.5918, 7575786.712

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5	▨	SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP17 terminated at 5m		

TEST PIT NUMBER TP18

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 14/12/17 **COMPLETED** 14/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317050.1866, 7575853.351

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			0–4.8	▨	SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			4.8–5	▨	SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, moist, red.		
			5			Borehole TP18 terminated at 5m		

Depth scale: 1, 2, 3, 4, 5, 6

TEST PIT NUMBER TP19

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 7/12/17 **COMPLETED** 7/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316977.829, 7575838.795

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	SAND with trace silt, fine to medium grained, rounded to sub rounded. Roots present. Silt of low plasticity. Gap graded, loose, dry, red.		
			1					
			2					
			3					
			4					
			5					
						Borehole TP19 terminated at 5m		
			6					

TEST PIT NUMBER TP20

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 14/12/17 **COMPLETED** 14/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 316964.4238, 7575905.434
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			1					
			2					
			3					
			4					
			5		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, moist, red.		
						Borehole TP20 terminated at 5m		
			6					

TEST PIT NUMBER TP21

Talis Consultants

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 13/12/17 **COMPLETED** 13/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316892.0662, 7575890.879

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP21 terminated at 5.1m		

TEST PIT NUMBER TP22

Talis Consultants

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 14/12/17 **COMPLETED** 14/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316878.661, 7575957.518

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			0–5		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			5			Borehole TP22 terminated at 5m		

Depth scale: 1, 2, 3, 4, 5, 6

BOREHOLE / TEST PIT TW17084-ONSLOW-TP.GPJ GINT STD AUSTRALIA.GDT 11/4/18

TEST PIT NUMBER TP23

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 13/12/17 **COMPLETED** 13/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316806.3035, 7575942.962

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5	░	SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP23 terminated at 5m		

TEST PIT NUMBER TP24

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 13/12/17 **COMPLETED** 13/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316792.8982, 7576009.601

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5		SP	SAND, fine grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP24 terminated at 5m		

TEST PIT NUMBER TP25

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 14/12/17 **COMPLETED** 14/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316710.8248, 7576066.766

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5		SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP25 terminated at 5m		

TEST PIT NUMBER TP26

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Talis Consultants

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 5/12/17 **COMPLETED** 5/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 316720.6622, 7575995.213
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5	░	SP	SAND, fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP26 terminated at 5m		

TEST PIT NUMBER TP27

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 5/12/17 **COMPLETED** 5/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317671.0837, 7575176.673

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2		SP	Sandy SILT, low plasticity. Sand is medium to coarse grained, rounded to sub rounded. Roots present. Gap graded, soft, dry, red.		
					GP	SILCRETE with trace silt. Silt is low plasticity. Hard, dry, red and white.		
			3 4 5 6			Borehole TP27 terminated at 2.8m		

TEST PIT NUMBER TP28

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CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 5/12/17
COMPLETED 5/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317605.4889, 7575256.534
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5		SP	Sandy SILT, low plasticity. Sand is fine to medium rained, rounded to sub rounded. Roots present. Gap graded, soft, dry, red.		
					GP	SILCRETE with trace silt and sand. Silt is low plasticity. Sand is medium to coarse grained. Hard, dry, red, white and grey .		
			6			Borehole TP28 terminated at 5.1m		

Talis Consultants

TEST PIT NUMBER TP29

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 6/12/17

COMPLETED 6/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

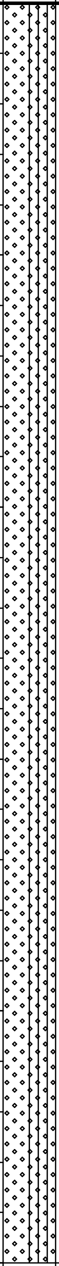
TEST PIT LOCATION 317540.2253, 7575336.851

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4 5		SP	Sandy SILT, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP29 terminated at 5m		

TEST PIT NUMBER TP30

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 8/12/17 **COMPLETED** 8/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317453.7146, 7575387.904

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3 4		SP	Silty SAND, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, loose, dry, red.		
			5		GP	Silty SAND with silcrete and rounded pebble inclusions, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Silcrete is is hard. Roots present. Gap graded, loose, dry, red.		
			6			Borehole TP30 terminated at 5m		

TEST PIT NUMBER TP31

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 9/12/17

COMPLETED 9/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317365.2373, 7575436.249

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2		SP	Sandy SILT with rounded pebbles, low plasticity. Sand is fine to medium grained. Roots present. Gap graded,, firm, dry, red.		
			3		GP	SILCRETE with trace sandy silt. Sand is fine to medium grained, Silt is low plasticity. Roots present. Very stiff, dry, red and white.		
			4 5 6			Borehole TP31 terminated at 3.6m		

TEST PIT NUMBER TP32

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 9/12/17 **COMPLETED** 9/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317278.7252, 7575487.3

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained. Roots present. Gap graded, soft, dry, red.		
			2		GP	SILCRETE with trace sandy silt. Sand is fine to medium grained, Silt is low plasticity. Roots present. Very stiff, dry, red and white.		
					GP	SILCRETE with trace sandy silt and cemented gravels. Sand is fine to medium grained, Silt is low plasticity. Roots present. Very stiff, dry, brown with occasional yellow mottles.		
			3 4 5 6			Borehole TP32 terminated at 2.9m		

TEST PIT NUMBER TP33

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 10/12/17

COMPLETED 10/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317210.4085, 7575563.412

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Silty SAND, fine to coarse grained, rounded to sub rounded. Silt is low plasticity. Roots present. Poorly graded, firm, dry, red.		
			1					
			2					
			3		GP	SILCRETE with trace silt. Silt is low plasticity. Hard, dry, red and white.		
						Borehole TP33 terminated at 3m		
			4					
			5					
			6					

TEST PIT NUMBER TP34

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 10/12/17 **COMPLETED** 10/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317142.8259, 7575640.535

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3		SP	Silty SAND with trace gravels, fine to coarse grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			4 5		GP	SILCRETE with trace silt. Silt is low plasticity. Hard, dry, red, light brown, white and grey.		
			6			Borehole TP34 terminated at 2.2m		

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TEST PIT NUMBER TP35

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CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 10/12/17
COMPLETED 10/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317074.9529, 7575717.258
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3		SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained. Roots present. Gap graded, firm, dry, red.		
			4 5		GP	SILCRETE with trace silt. Silt is low plasticity. Hard, dry, red, light brown, white and grey.		
			6			Borehole TP35 terminated at 5.1m		

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TEST PIT NUMBER TP36

PAGE 1 OF 1

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 10/12/17
COMPLETED 10/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 316991.23, 7575772.16
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2 3		SP	Silty SAND, fine to coarse grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, firm, dry, red.		
			4		GP	SILCRETE with trace silt and gravels. Silt is low plasticity. Hard, dry, red, light brown, yellow and white.		
			5 6			Borehole TP36 terminated at 4.5m		

TEST PIT NUMBER TP37

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 12/12/17 **COMPLETED** 12/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316905.47, 7575824.24

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2		SP	Silty SAND, fine to coarse grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, firm, dry, red.		
			3 4		GP	SILCRETE with trace silt and gravels. Silt is low plasticity. Hard, dry, red, light brown, yellow and white.		
			5 6			Borehole TP37 terminated at 4.2m		

TEST PIT NUMBER TP38

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 13/12/17 **COMPLETED** 13/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316819.71, 7575876.32

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			 1		SP	Silty SAND, fine to coarse grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			2 3		GP	SILCRETE. Roots present. Hard, dry, red, and white.		
			4 5 6			Borehole TP38 terminated at 3.7m		

TEST PIT NUMBER TP39

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 13/12/17

COMPLETED 13/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316733.95, 7575928.41

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1 2		SP	SAND with trace silt, fine grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, loose, dry, red.		
			3 4		GP	SILCRETE with silty sand, with rounded pebbles and cemented gravels at depth. Fine to medium grained. Hard, dry, red and white.		
			5 6			Borehole TP39 terminated at 4.5m		

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TEST PIT NUMBER TP40

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 13/12/17 **COMPLETED** 13/12/17 **R.L. SURFACE** **DATUM**

EXCAVATION CONTRACTOR Drilline **SLOPE** --- **BEARING** ---

EQUIPMENT 20 T Excavator **TEST PIT LOCATION** 316652.0197, 7575985.774

TEST PIT SIZE **LOGGED BY** JS **CHECKED BY** FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Silty SAND, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft, dry, red.		
			2		GP	SILCRETE with silty sand. Silt is low plasticity. Sand is fine to coarse grained, rounded to sub rounded. Hard, dry, red, light brown, white and grey.		
			3		GP	SILCRETE with silty sand and gravels. Silt is low plasticity. Sand is fine to coarse grained, rounded to sub rounded. Hard, dry, red, light brown, white and grey.		
			4 5 6			Borehole TP40 terminated at 3.4m		

TEST PIT NUMBER TP41

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 5/12/17 **COMPLETED** 5/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 316652.0197, 7575985.774
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT, low plasticity. Sand is medium grained, rounded to sub rounded. Roots present. Gap graded, soft, dry, red.		
			1		GP	SILCRETE with trace silt. Silt is low plasticity. Hard, dry, red, white and grey.		
			2		GP	SILCRETE with trace silt. Silt is low plasticity. Roots present. Hard, dry, red, white and brown.		
			3 4 5 6			Borehole TP41 terminated at 2.8m		

Talis Consultants

TEST PIT NUMBER TP42

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CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 5/12/17
COMPLETED 5/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317546.4535, 7575090.123
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT, low plasticity. Sand is medium grained, rounded to sub rounded. Roots present. Gap graded, soft, dry, red.		
			1		GP	SILCRETE with trace silt. Silt is low plasticity. Roots present. Hard, dry, red, white and grey.		
			2 3 4 5 6			Borehole TP42 terminated at 1.4m		

TEST PIT NUMBER TP43

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 5/12/17 **COMPLETED** 5/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317607.3463, 7575173.99

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT, low plasticity. Sand is medium grained, rounded to sub rounded. Roots present. Gap graded, soft, dry, red.		
			1		GP	SILCRETE with trace silt. Silt is low plasticity. Roots present. Hard, dry, red, white and grey.		
			2		GP	SILCRETE with trace silt and cemented gravels. Silt is low plasticity. Roots present. Hard, brittle, dry, white and light brown.		
			3 4 5 6			Borehole TP43 terminated at 2.8m		

TEST PIT NUMBER TP44

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 5/12/17 **COMPLETED** 5/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317544.5308, 7575172.577

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Sandy SILT, low plasticity. Sand is medium grained, rounded to sub rounded. Roots present. Gap graded, soft, dry, red.		
			2 3		GP	SILCRETE with trace silt and cemented gravels. Silt is low plasticity. Roots present. Hard, brittle, dry, red, white, yellow and black.		
			4 5 6			Borehole TP44 terminated at 3.1m		

TEST PIT NUMBER TP45

PAGE 1 OF 1

Talis Consultants

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 5/12/17 **COMPLETED** 5/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317481.7153, 7575171.163
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT, low plasticity. Sand is medium grained, rounded to sub rounded. Roots present. Gap graded, soft, dry, red.		
			1		GP	SILCRETE with trace silt. Silt is low plasticity. Roots present. Hard, brittle, dry, red and white.		
			2 3 4 5 6			Borehole TP45 terminated at 1.4m		

TEST PIT NUMBER TP46

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Talis Consultants

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 5/12/17 **COMPLETED** 5/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317542.6734, 7575255.12
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				▨	SP	Silty SAND, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft, dry, red.		
			1 2	▨	GP	SILCRETE with trace silty sand. Silt is low plasticity. Sand is fine to coarse grained, rounded to sub rounded. Hard and brittle, dry, red, white and yellow.		
			3 4 5 6			Borehole TP46 terminated at 2.1m		

TEST PIT NUMBER TP47

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Talis Consultants

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 5/12/17 **COMPLETED** 5/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317479.4847, 7575254.175
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained. Roots present. Gap graded, firm, dry, red.		
			2		GP	SILCRETE with trace sandy silt. Silt is low plasticity. Sand is fine to medium grained, rounded to sub rounded. Hard, dry, red, light brown, white and grey.		
			3 4 5 6			Borehole TP47 terminated at 2.7m		

TEST PIT NUMBER TP48

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CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 6/12/17
COMPLETED 6/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317409.0976, 7575241.351
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Silty SAND, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			1		GP	SILCRETE with silty sand. Silt is low plasticity. Sand is fine to coarse grained, rounded to sub rounded. Hard, dry, red, and white.		
			2		GP	Cemented GRAVELS with sand and silt. Gravels are rounded. Sand is medium to coarse grained, rounded to sub rounded. Silt is low plasticity. Hard, dry, brown.		
			3 4 5 6			Borehole TP48 terminated at 2.9m		

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TEST PIT NUMBER TP49

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 6/12/17 **COMPLETED** 6/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317468.3347, 7575322.938

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Silty SAND, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			1		GP	SILCRETE with trace sandy silt and quartz gravels. Silt is low plasticity. Sand is fine to coarse grained, rounded to sub rounded. Hard, dry, red, and white.		
			2 3 4 5 6			Borehole TP49 terminated at 1.9m		

TEST PIT NUMBER TP50

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 6/12/17 **COMPLETED** 6/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317394.4775, 7575306.317

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained. Roots present. Gap graded, firm, dry, red.		
			1		SP	Sandy SILT with gravels and silcrete, low plasticity. Sand is fine to medium grained. Roots present. Gap graded, firm, dry, red.		
			2		GP	SILCRETE with trace sandy silt and gravels. Silt is low plasticity. Sand is fine to coarse grained, rounded to sub rounded. Roots present. Hard, dry, red, and white.		
			3 4 5 6			Borehole TP50 terminated at 2.7m		

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TEST PIT NUMBER TP51

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CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 6/12/17 **COMPLETED** 6/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317320.6204, 7575289.696
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Silty SAND, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			1 2		GP	SILCRETE with trace sandy silt. Silt is low plasticity. Sand is medium to coarse grained, rounded to sub rounded. Hard, dry, red, and white.		
					GP	SILCRETE with cemented gravels in sand. Sand is medium to coarse grained, rounded to sub rounded. Hard, dry, red, and white.		
			3 4 5 6			Borehole TP51 terminated at 2.9m		

TEST PIT NUMBER TP52

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 8/12/17 **COMPLETED** 8/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317379.8574, 7575371.283

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Silty SAND, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			1 2		GP	SILCRETE with trace silt. Silt is low plasticity. Hard, dry, red, and white.		
			3 4 5 6			Borehole TP52 terminated at 2m		

TEST PIT NUMBER TP53

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 8/12/17

COMPLETED 8/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317306.0003, 7575354.662

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Silty SAND with rounded gravels, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			1 2		GP	SILCRETE with trace sandy silt. Silt is low plasticity. Sand is medium to coarse grained, rounded to sub rounded. Hard, dry, red, and white.		
			3 4 5 6			Borehole TP53 terminated at 2.4m		

TEST PIT NUMBER TP54

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Talis Consultants

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 9/12/17
COMPLETED 9/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317291.3802, 7575419.628
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			2 3		GP	SILCRETE. Hard, dry, red, and white.		
			4 5 6			Borehole TP54 terminated at 3.2m		

TEST PIT NUMBER TP55

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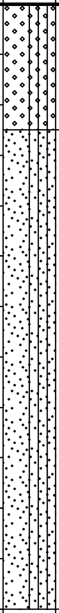
PAGE 1 OF 1

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 9/12/17
COMPLETED 9/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317214.4757, 7575483.911
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			1 2		GP	SILCRETE with trace sandy silt. Silt is low plasticity. Sand is fine to coarse grained. Hard, dry, red, and white.		
			3 4 5 6			Borehole TP55 terminated at 2.4m		

BOREHOLE / TEST PIT TW17084-ONSLOW-TP.GPJ GINT STD AUSTRALIA.GDT 11/4/18

TEST PIT NUMBER TP56

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 9/12/17 **COMPLETED** 9/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317219.722, 7575406.035

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			1 2		GP	SILCRETE. Roots present. Hard, dry, red, and white.		
			3 4 5 6			Borehole TP56 terminated at 2.2m		

TEST PIT NUMBER TP57

PAGE 1 OF 1

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 8/12/17 **COMPLETED** 8/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317154.2822, 7575401.007
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			1 2		GP	SILCRETE. Roots present. Hard, dry, red, and white.		
			3 4 5 6			Borehole TP57 terminated at 2.7m		

TEST PIT NUMBER TP58

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 8/12/17 **COMPLETED** 8/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317232.1431, 7575338.041

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Silty SAND, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			1 2		GP	SILCRETE with trace sandy silt. Silt is low plasticity. Sand is fine to medium grained, rounded to sub rounded. Hard, dry, red and white.		
			3 4 5 6			Borehole TP58 terminated at 2.3m		

TEST PIT NUMBER TP59

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 8/12/17 **COMPLETED** 8/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317160.3482, 7575325.429

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			2		GP	SILCRETE with trace sandy silt and gravles. Silt is low plasticity, Sand if fine to medium grained, rounded to sub rounded. Roots present. Hard, dry, red, and white.		
			3		GP	SILCRETE with trace sandy silt and cemented gravels. Silt is low plasticity, Sand if fine to medium grained, rounded to sub rounded. Roots present. Hard, dry, red, and white.		
			4 5 6			Borehole TP59 terminated at 3.7m		

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TEST PIT NUMBER TP60

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 8/12/17 **COMPLETED** 8/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317094.2426, 7575318.315

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT, low plasticity. Quartz on the surface. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			1		GP	SILCRETE with trace sandy silt and gravels. Silt is low plasticity, Sand if fine to medium grained, rounded to sub rounded. Roots present. Hard, dry, red, and white.		
			2		GP	Cemented GRAVELS with silt and rounded pebbles. Silt is low plasticity. Hard, dry, red and white.		
			3			Borehole TP60 terminated at 2.5m		
			4					
			5					
			6					

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TEST PIT NUMBER TP61

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 8/12/17 **COMPLETED** 8/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317030.0766, 7575315.042

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT, low plasticity. Quartz on the surface. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			1 2		GP	SILCRETE. Roots present. Hard, dry, red, and white.		
			3 4 5 6			Borehole TP61 terminated at 2.5m		

BOREHOLE / TEST PIT TW17084-ONSLOW-TP.GPJ GINT STD AUSTRALIA.GDT 11/4/18

TEST PIT NUMBER TP62

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 8/12/17 **COMPLETED** 8/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317090.27, 7575397.946
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			1 2 3		GP	SILCRETE with cemented gravels in sand. Sand is medium to coarse grained. Roots present. Hard, dry, red, and white.		
			4 5 6			Borehole TP62 terminated at 3.3m		

TEST PIT NUMBER TP63

PAGE 1 OF 1

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 8/12/17 **COMPLETED** 8/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317026.2578, 7575394.884

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Sandy SILT, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			2 3		GP	SILCRETE with cemented gravels in sand. Sand is medium to coarse grained. Roots present. Hard, dry, red, and white.		
			4 5 6			Borehole TP63 terminated at 3.4m		

TEST PIT NUMBER TP64

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 8/12/17 **COMPLETED** 8/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316966.0644, 7575311.98

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			1 2 3		GP	SILCRETE with rounded gravels. Hard, dry, red, and white.		
			4 5 6			Borehole TP64 terminated at 3.3m		

TEST PIT NUMBER TP65

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 8/12/17

COMPLETED 8/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316962.2456, 7575391.823

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace rounded gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			1 2		GP	SILCRETE with cemented gravels in sand. Sand is medium to coarse grained. Roots present. Hard, moderately brittle, dry, red, and white.		
			3 4 5 6			Borehole TP65 terminated at 2.4m		

TEST PIT NUMBER TP66

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 9/12/17 **COMPLETED** 9/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317022.439, 7575474.727

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				⁘	SP	Sandy SILT, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, loose, dry, red.		
			1 2	⁘	GP	SILCRETE. Roots present. Hard, dry, red, and white.		
			3	▨	SP	Sandy CLAY with gravels and silcrete. Clay is low plasticity. Sand is fine grained, rounded to sub rounded. Dry, yellowish brown, red and white.		
			4 5 6			Borehole TP66 terminated at 3.2m		

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TEST PIT NUMBER TP67

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 9/12/17 **COMPLETED** 9/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316958.4268, 7575471.665

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1		GP	SILCRETE. Roots present. Hard, dry, red, and white.		
			2		GP	SILCRETE with cemented gravels and trace silt. Silt is low plasticity. Roots present. Hard, moderately brittle, dry, red, and white.		
			3 4 5 6			Borehole TP67 terminated at 2.2m		

TEST PIT NUMBER TP68

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 8/12/17 **COMPLETED** 8/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316898.2334, 7575388.761

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, soft to firm, dry, red.		
			1		GP	SILCRETE. Roots present. Hard, dry, red, and white.		
			2 3		GP	SILCRETE with cemented gravels and trace silt. Silt is low plasticity. Roots present. Hard, moderately brittle, dry, red, and white.		
			4 5 6			Borehole TP68 terminated at 3.2m		

TEST PIT NUMBER TP69

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 9/12/17 **COMPLETED** 9/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316894.4146, 7575468.603

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1 2		GP	SILCRETE with cemented gravels and trace silt. Silt is low plasticity. Roots present. Hard, dry, red, and white.		
			3 4 5 6			Borehole TP69 terminated at 2.5m		

TEST PIT NUMBER TP70

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 10/12/17 **COMPLETED** 10/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316954.608, 7575551.507

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1		GP	SILCRETE. Roots present. Hard, dry, red, and white.		
			2		GP	SILCRETE with cemented gravels and trace silt. Silt is low plasticity. Roots present. Hard, moderately brittle, dry, brown.		
			3 4 5 6			Borehole TP70 terminated at 2.7m		

TEST PIT NUMBER TP71

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CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 10/12/17
COMPLETED 10/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 316886.735, 7575543.128
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				▨	SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1 2	▨	GP	SILCRETE. Roots present. Hard, dry, red, and white.		
				▨	GP	SILCRETE with cemented gravels and trace sandy silt. Silt is low plasticity. Sand is fine to medium grained. Roots present. Hard, moderately brittle, dry, brown.		
			3 4 5 6			Borehole TP71 terminated at 2.8m		

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TEST PIT NUMBER TP72

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CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 9/12/17 **COMPLETED** 9/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 316827.7827, 7575461.933
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1		GP	SILCRETE with trace silt and gravels. Silt is low plasticity. Roots present. Hard, dry, red, and white.		
			2		GP	SILCRETE with cemented gravels and trace sand. Sand is medium to coarse grained, rounded to sub rounded. Roots present. Hard, moderately brittle, dry, brown.		
			3 4 5 6			Borehole TP72 terminated at 2.9m		

TEST PIT NUMBER TP73

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 9/12/17 **COMPLETED** 9/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316814.3774, 7575528.572

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1		GP	SILCRETE with trace sandy silt and gravels. Silt is low plasticity. Sand if fine to medium grained, rounded to sub rounded. Roots present. Hard, dry, red, and white.		
			2		GP	SILCRETE with trace sandy silt and gravels. Silt is low plasticity. Sand if fine to medium grained, rounded to sub rounded. Roots present. Hard, dry, brown.		
			3 4 5 6			Borehole TP73 terminated at 2.4m		

TEST PIT NUMBER TP74

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CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 10/12/17 **COMPLETED** 10/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 316873.3297, 7575609.767
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			2		GP	SILCRETE with cemented gravels in sandy silt. Silt is low plasticity. Sand if fine to medium grained, rounded to sub rounded. Roots present. Very stiff, dry, red, and white.		
			3 4 5 6			Borehole TP74 terminated at 2.4m		

TEST PIT NUMBER TP75

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Talis Consultants

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 10/12/17
COMPLETED 10/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 316800.9722, 7575595.211
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1		GP	SILCRETE. Roots present. Hard, dry, red, and white.		
			2		GP	SILCRETE with trace sandy silt and gravels. Silt is low plasticity. Sand if fine to medium grained, rounded to sub rounded. Roots present. Very stiff, dry, brown.		
			3 4 5 6			Borehole TP75 terminated at 2.9m		

TEST PIT NUMBER TP76

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 9/12/17 **COMPLETED** 9/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316742.0199, 7575514.017

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1 2		GP	SILCRETE with trace silt and gravels. Silt is low plasticity. Roots present. Hard, dry, red, and white.		
			3		SM	Cemented sandy SILT, low plasticity. Sandy is medium to coarse grained. Hard, dry, white and brown.		
			4 5 6			Borehole TP76 terminated at 3m		

TEST PIT NUMBER TP77

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Talis Consultants

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 10/12/17
COMPLETED 10/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 316728.6147, 7575580.656
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1 2		GP	SILCRETE. Roots present. Hard, dry, red, and white.		
					GP	SILCRETE with cemented gravels in sandy silt. Silt is low plasticity. Sand if fine to medium grained, rounded to sub rounded. Roots present. Hard, dry, brown.		
			3 4 5 6			Borehole TP77 terminated at 2.8m		

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TEST PIT NUMBER TP78

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 11/12/17 **COMPLETED** 11/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316787.5669, 7575661.85

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1		GP	SILCRETE with gravels cemented in sandy silt. Silt is low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Hard, dry, red, white and grey.		
			2		GP	SILCRETE with gravels cemented in sandy silt. Silt is low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Hard, dry, brown.		
			3 4 5 6			Borehole TP78 terminated at 2.4m		

TEST PIT NUMBER TP79

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 11/12/17 **COMPLETED** 11/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316859.9245, 7575676.406

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1		GP	SILCRETE with gravels and sandy silt. Silt is low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Hard, dry, red, white and grey.		
			2		GP	Cemented gravels in sandy SILT with silcrete, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Hard, dry, brown, white and yellow.		
			3 4 5 6			Borehole TP79 terminated at 2.5m		

TEST PIT NUMBER TP80

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 11/12/17 **COMPLETED** 11/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316945.6873, 7575624.323

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1 2		GP	SILCRETE with rounded pebbles and sandy silt. Silt is low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Hard, dry, red, white and grey.		
			3 4 5 6			Borehole TP80 terminated at 2.7m		

TEST PIT NUMBER TP81

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 10/12/17 **COMPLETED** 10/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317018.4425, 7575554.324

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1		GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and grey.		
			2		GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and brown.		
			3 4 5 6			Borehole TP81 terminated at 2.7m		

TEST PIT NUMBER TP82

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CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 10/12/17
COMPLETED 10/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317086.4512, 7575477.788
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1		GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
			2		GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, brown.		
			3 4 5 6			Borehole TP82 terminated at 2.5m		

TEST PIT NUMBER TP83

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 9/12/17
COMPLETED 9/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317150.4635, 7575480.85
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
				░	SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1	░	GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and grey.		
			2	░	GP	SILCRETE with cemented gravels in sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and brown.		
			3 4 5 6			Borehole TP83 terminated at 2.3m		

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TEST PIT NUMBER TP84

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 10/12/17 **COMPLETED** 10/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317082.6325, 7575557.631

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			2		GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and grey.		
			3		GP	SILCRETE with cemented sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, brown.		
			4 5 6			Borehole TP84 terminated at 3.1m		

TEST PIT NUMBER TP85

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 11/12/17

COMPLETED 11/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317014.8015, 7575634.411

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			2		GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and grey.		
					GP	SILCRETE with pebbles and gravels cemented in sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and brown.		
			3 4 5 6			Borehole TP85 terminated at 2.8m		

TEST PIT NUMBER TP86

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 11/12/17 **COMPLETED** 11/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316932.282, 7575690.962

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, soft to firm, dry, red.		
			1		GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and grey.		
			2		GP	SILCRETE with cemented gravels in sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, brown, white and yellow.		
			3 4 5 6			Borehole TP86 terminated at 2.5m		

TEST PIT NUMBER TP87

Talis Consultants

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 11/12/17 **COMPLETED** 11/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 316846.5192, 7575743.045
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
					GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
			2		GP	SILCRETE with cemented gravels in sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and brown.		
			3 4 5 6			Borehole TP87 terminated at 2.5m		

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TEST PIT NUMBER TP88

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 11/12/17

COMPLETED 11/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317146.6447, 7575560.692

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			2		GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and grey.		
			3		GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and brown.		
			4 5 6			Borehole TP88 terminated at 3.1m		

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TEST PIT NUMBER TP89

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 11/12/17 **COMPLETED** 11/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 317078.8137, 7575637.473

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1					
					GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
			2					
					GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and brown.		
						Borehole TP89 terminated at 2.5m		
			3					
			4					
			5					
			6					

TEST PIT NUMBER TP90

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CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 11/12/17
COMPLETED 11/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 317004.64, 7575705.52
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1		GP	SILCRETE with rounded pebbles, gravels and trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
			2					
					GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and brown.		
						Borehole TP90 terminated at 2.8m		
			3					
			4					
			5					
			6					

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TEST PIT NUMBER TP91

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 12/12/17 **COMPLETED** 12/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316918.8767, 7575757.601

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1					
			2		GP	SILCRETE with rounded pebbles, gravels and trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and grey.		
			3 4 5 6			Borehole TP91 terminated at 2.5m		

TEST PIT NUMBER TP92

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 12/12/17 **COMPLETED** 12/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316833.11, 7575809.68

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			2		GP	SILCRETE with sandy silt. Silt is low plasticity, sand is fine to medium grained. Roots present. Hard, dry, red and white.		
					GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and brown.		
			3 4 5 6			Borehole TP92 terminated at 2.8m		

BOREHOLE / TEST PIT TW17084-ONSLOW-TP.GPJ GINT STD AUSTRALIA.GDT 11/4/18

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TEST PIT NUMBER TP93

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CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 11/12/17 **COMPLETED** 11/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 316774.16, 7575728.49
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1		GP	SILCRETE with trace sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
			2		GP	SILCRETE with gravels cemented in sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and brown.		
			3 4 5 6			Borehole TP93 terminated at 2.5m		

TEST PIT NUMBER TP94

PAGE 1 OF 1

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 11/12/17 **COMPLETED** 11/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316715.2094, 7575647.295

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1 2		GP	SILCRETE with cemented GRAVELS in sandy SILT. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
					GP	Sandy silty CLAY with GRAVELS. Silt is low plasticity, sand is medium grained, rounded to sub rounded. Roots present. Hard, red, yellow, and black.		
			3 4 5 6			Borehole TP94 terminated at 2.9m		

TEST PIT NUMBER TP95

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 11/12/17 **COMPLETED** 11/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316656.2571, 7575566.1

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1 2		GP	SILCRETE with cemented GRAVELS in sandy SILT. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
					GP	SILCRETE with cemented GRAVELS in sandy silty CLAY. Silt and clay of low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
			3 4 5 6			Borehole TP95 terminated at 2.9m		

TEST PIT NUMBER TP96

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 11/12/17 **COMPLETED** 11/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316642.8519, 7575632.739

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1 2		GP	SILCRETE with cemented GRAVELS in sandy SILT. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
					GP	SILCRETE with cemented gravels in sandy silty clay. Silt and clay of low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white, brown with yellow mottles.		
			3 4 5 6			Borehole TP96 terminated at 1.6m		

TEST PIT NUMBER TP97

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 12/12/17 **COMPLETED** 12/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316701.8041, 7575713.934

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1 2		GP	SILCRETE with cemented GRAVELS in sandy SILT. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white, with yellow mottles with depth.		
			3 4 5 6			Borehole TP97 terminated at 2.5m		

TEST PIT NUMBER TP98

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 12/12/17 **COMPLETED** 12/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316760.7564, 7575795.128

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			 1 2		SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
					GP	SILCRETE with gravels and sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and brown.		
			3 4 5 6			Borehole TP98 terminated at 2.7m		

TEST PIT NUMBER TP99

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 13/12/17 **COMPLETED** 13/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316747.3512, 7575861.767

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Silty SAND with rounded gravels, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			1		GP	SILCRETE with sandy silt and gravels. Silt is low plasticity. Sand is medium to coarse grained, rounded to sub rounded. Hard, dry, red, and white.		
			2					
					GP	SILCRETE with sandy silt and gravels. Silt is low plasticity. Sand is medium to coarse grained, rounded to sub rounded. Hard, dry, white-brown.		
			3 4 5 6			Borehole TP99 terminated at 1.1m		

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TEST PIT NUMBER TP100

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 12/12/17 **COMPLETED** 12/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316688.3989, 7575780.573

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Silty SAND with rounded gravels, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			1 2		GP	SILCRETE with sandy silt and gravels. Silt is low plasticity. Sand is medium to coarse grained, rounded to sub rounded. Hard, dry, red, and white.		
					GP	SILCRETE with sandy silt and gravels. Silt is low plasticity. Sand is medium to coarse grained, rounded to sub rounded. Hard, dry, white-brown.		
			3 4 5 6			Borehole TP100 terminated at 0.7m		

TEST PIT NUMBER TP101

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 12/12/17 **COMPLETED** 12/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316629.4466, 7575699.378

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			2 3		GP	SILCRETE with cemented GRAVELS in sandy SILT. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white, with yellow mottles with depth.		
			4 5 6			Borehole TP101 terminated at 3m		

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TEST PIT NUMBER TP102

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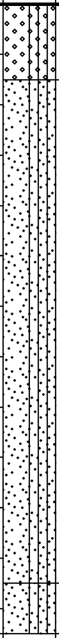
CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 12/12/17 **COMPLETED** 12/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 316570.4943, 7575618.184
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES



Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, soft to firm, dry, red.		
			1 2		GP	SILCRETE with cemented GRAVELS in sandy SILT. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
					GP	SILCRETE with sandy silty clay. Silt and clay of low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and brown.		
			3 4 5 6			Borehole TP102 terminated at 2.5m		

TEST PIT NUMBER TP103

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 12/12/17 **COMPLETED** 12/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316557.0891, 7575684.823

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			1		GP	SILCRETE with sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
			2		GP	SILCRETE with cemented gravels and pebbles in sandy silty clay. Silt and clay of low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white, brown with yellow mottles.		
			3 4 5 6			Borehole TP103 terminated at 2.7m		

TEST PIT NUMBER TP104

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 13/12/17 **COMPLETED** 13/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316616.0414, 7575766.017

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Silty SAND with rounded gravels, low plasticity. Sand is fine to medium grained, rounded to sub rounded. Roots present. Gap graded, firm, dry, red.		
			2		GP	SILCRETE with trace gravels and sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
					SC	SANDSTONE, medium to coarse grained, hard, dry, beige.		
			3 4 5 6			Borehole TP104 terminated at 2.4m		

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TEST PIT NUMBER TP105

PAGE 1 OF 1

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 13/12/17 **COMPLETED** 13/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 316674.9936, 7575847.212
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Silty SAND with trace gravels,fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			2		GP	SILCRETE with sandy silt and gravels. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
					SC	SANDSTONE, medium to coarse grained, hard, dry, beige.		
			3 4 5 6			Borehole TP105 terminated at 2.5m		

TEST PIT NUMBER TP106

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CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 13/12/17

COMPLETED 13/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316661.9084, 7575914.292

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Silty SAND with trace gravels,fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			2		GP	SILCRETE with silty sand and gravels. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
			3 4 5 6		GP	SILCRETE with silty sand and gravels. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and grey. Borehole TP106 terminated at 2.7m		

TEST PIT NUMBER TP107

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 13/12/17 **COMPLETED** 13/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316603.1552, 7575833.371

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Silty SAND with gravels, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			2		GP	SILCRETE with sand silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
			3 4 5 6			Borehole TP107 terminated at 2.2m		

TEST PIT NUMBER TP108

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 12/12/17 **COMPLETED** 12/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316544.4021, 7575752.451

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
			1		SP	Silty SAND with trace gravels, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			2		GP	SILCRETE with gravels and silty sand. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
					GP	SILCRETE with cemented gravels in silty sand. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and brown.		
			3 4 5 6			Borehole TP108 terminated at 2.7m		

TEST PIT NUMBER TP109

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 12/12/17 **COMPLETED** 12/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316485.649, 7575671.531

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			1		GP	SILCRETE with gravels and silty sand. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
			2		GP	SILCRETE with cemented gravels in silty sand. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and brown.		
			3 4 5 6			Borehole TP109 terminated at 2.5m		

TEST PIT NUMBER TP110

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Talis Consultants

CLIENT Shire of Ashburton
PROJECT NAME Onslow Site Investigations
PROJECT NUMBER TW17084
PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 12/12/17 **COMPLETED** 12/12/17
R.L. SURFACE
DATUM
EXCAVATION CONTRACTOR Drilline
SLOPE ---
BEARING ---
EQUIPMENT 20 T Excavator
TEST PIT LOCATION 316475.6045, 7575742.798
TEST PIT SIZE
LOGGED BY JS
CHECKED BY FD
NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Sandy SILT with trace gravels, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, firm, dry, red.		
			1		GP	SILCRETE with gravels and silty sand. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
			2		GP	SILCRETE with cemented gravels in silty sand. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red, white and brown.		
			3 4 5 6			Borehole TP110 terminated at 2.6m		

TEST PIT NUMBER TP111

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 13/12/17 **COMPLETED** 13/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316534.4096, 7575823.79

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Silty SAND with trace gravels, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			1		GP	SILCRETE with sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
			2		GP	SILCRETE with sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, red-brown.		
			3 4 5 6			Borehole TP111 terminated at 2.3m		

TEST PIT NUMBER TP112

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Talis Consultants

CLIENT Shire of Ashburton

PROJECT NAME Onslow Site Investigations

PROJECT NUMBER TW17084

PROJECT LOCATION Lot 150 Onslow Road, Onslow WA

DATE STARTED 13/12/17

COMPLETED 13/12/17

R.L. SURFACE

DATUM

EXCAVATION CONTRACTOR Drilline

SLOPE ---

BEARING ---

EQUIPMENT 20 T Excavator

TEST PIT LOCATION 316593.2147, 7575904.782

TEST PIT SIZE

LOGGED BY JS

CHECKED BY FD

NOTES

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
					SP	Silty SAND with trace gravels, fine to medium grained, rounded to sub rounded. Silt is low plasticity. Roots present. Gap graded, soft to firm, dry, red.		
			1 2		GP	SILCRETE with gravels and sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, dry, red and white.		
					GP	SILCRETE with gravels and sandy silt. Silt is low plasticity, sand is medium to coarse grained. Roots present. Hard, red-brown.		
			3 4 5 6			Borehole TP112 terminated at 2.9m		

Appendix C: Photographs

BH01: 0-5 m

BH01: 5-10 m

BH02: 0-5 m

BH02: 5-10 m

BH03: 0-5 m

BH03: 5-10 m

BH04: 0-5 m

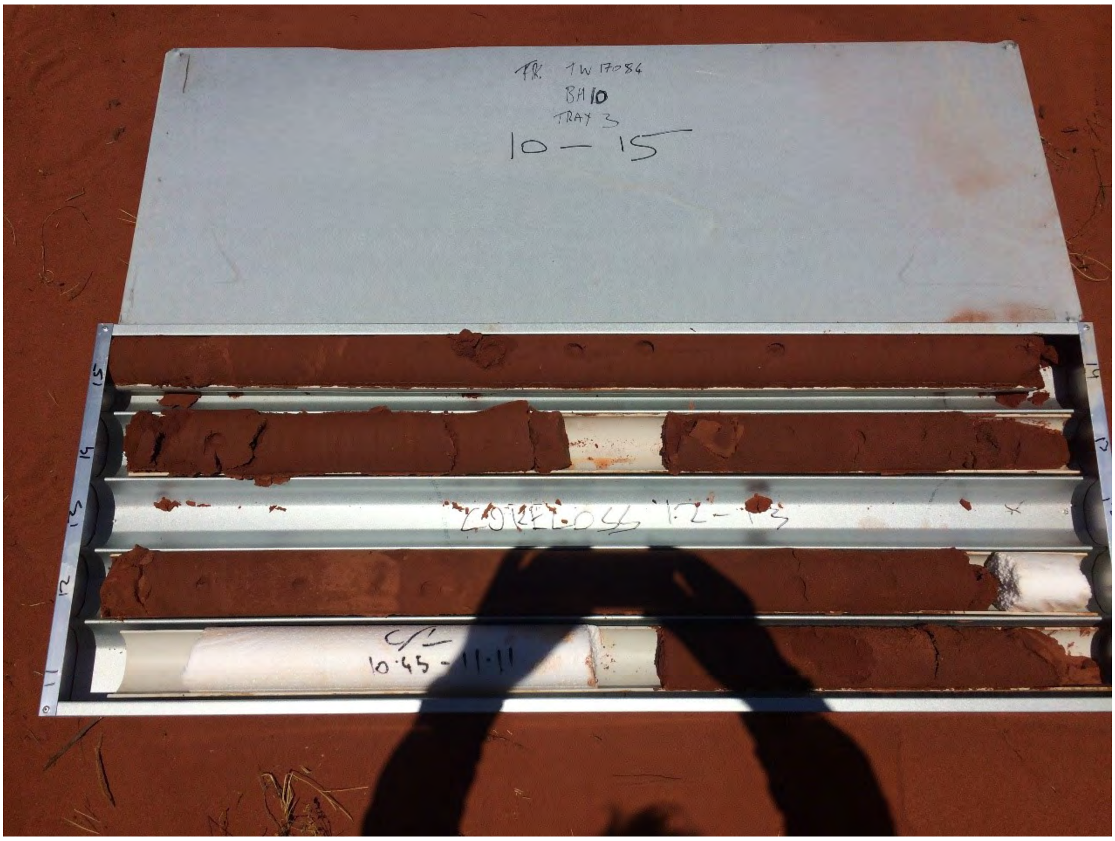
BH04: 5-10 m

BH05: 0-5 m

BH05: 5-10 m

BH10: 0-5 m

BH10: 5-10 m



BH10: 10-15 m

BH10: 15-20 m

BH10: 20-25 m

BH11: 0-8 m

BH11: 8-13 m

BH11: 13-18 m

BH11: 18-23

BH12: 0-5 m

BH12: 5-10 m

BH13: 0-5 m

BH13: 5-10 m

BH14: 0-5 m

BH14: 5-10 m

BH15: 0-5 m

BH15: 5-10 m

BH16: 0-5 m

BH16: 5-10 m

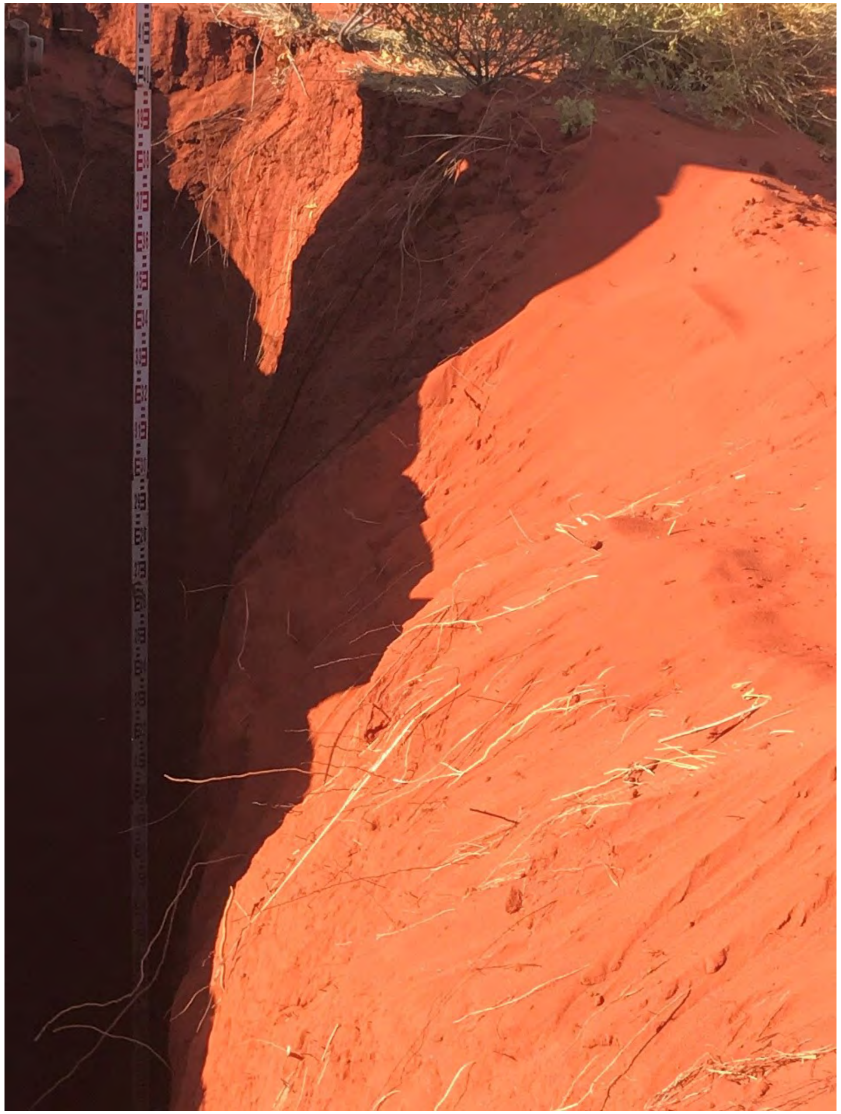
BH17: 0-5 m

BH17: 5-10 m

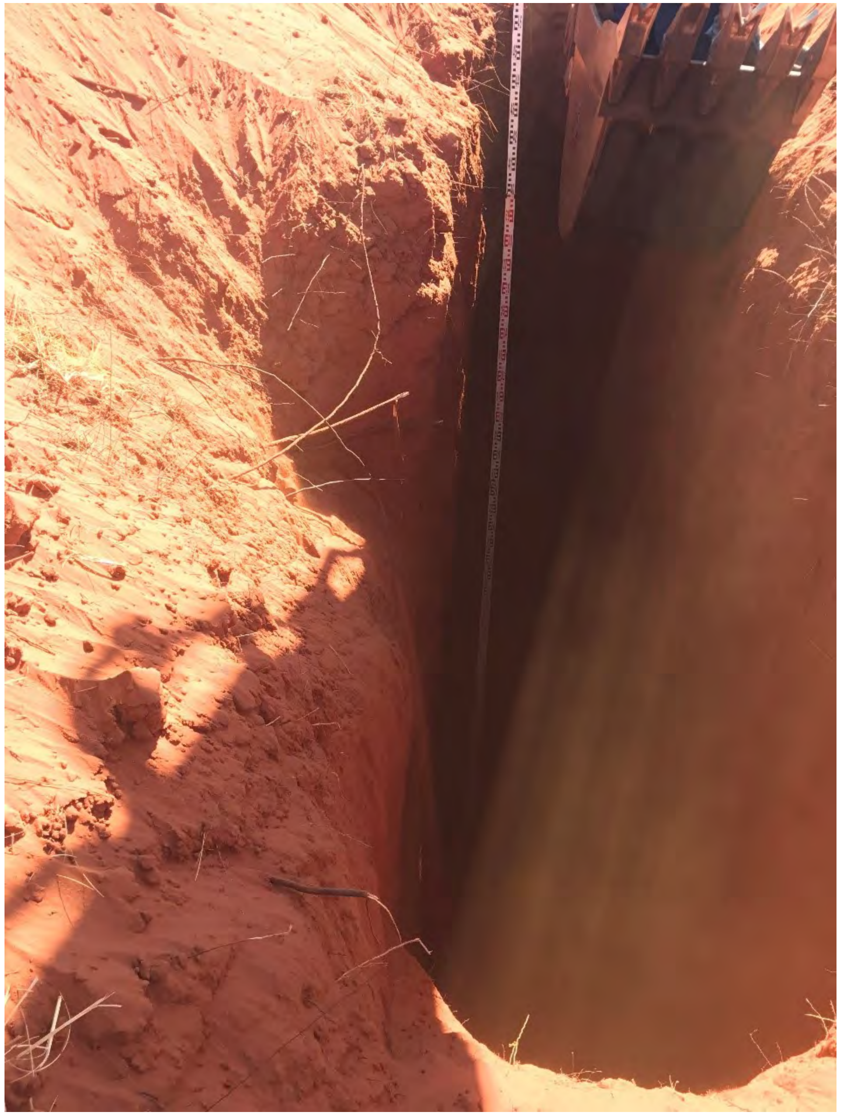
-

.

TP01



TP02



TP03

TP04

TP05

TP06

TP07

TP08

TP09

TP10

TP11

TP12

TP13

TP14

TP15

TP16

TP17

TP18

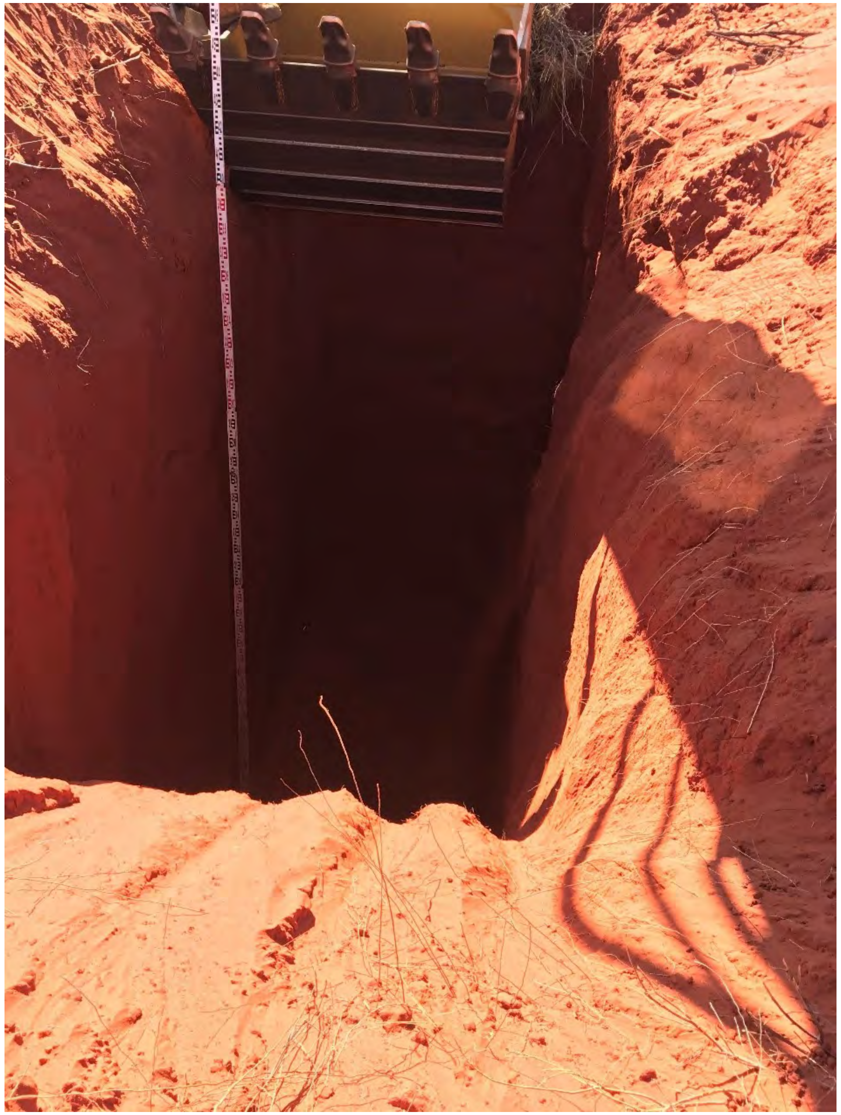
TP19

TP20

TP21

TP22

TP23

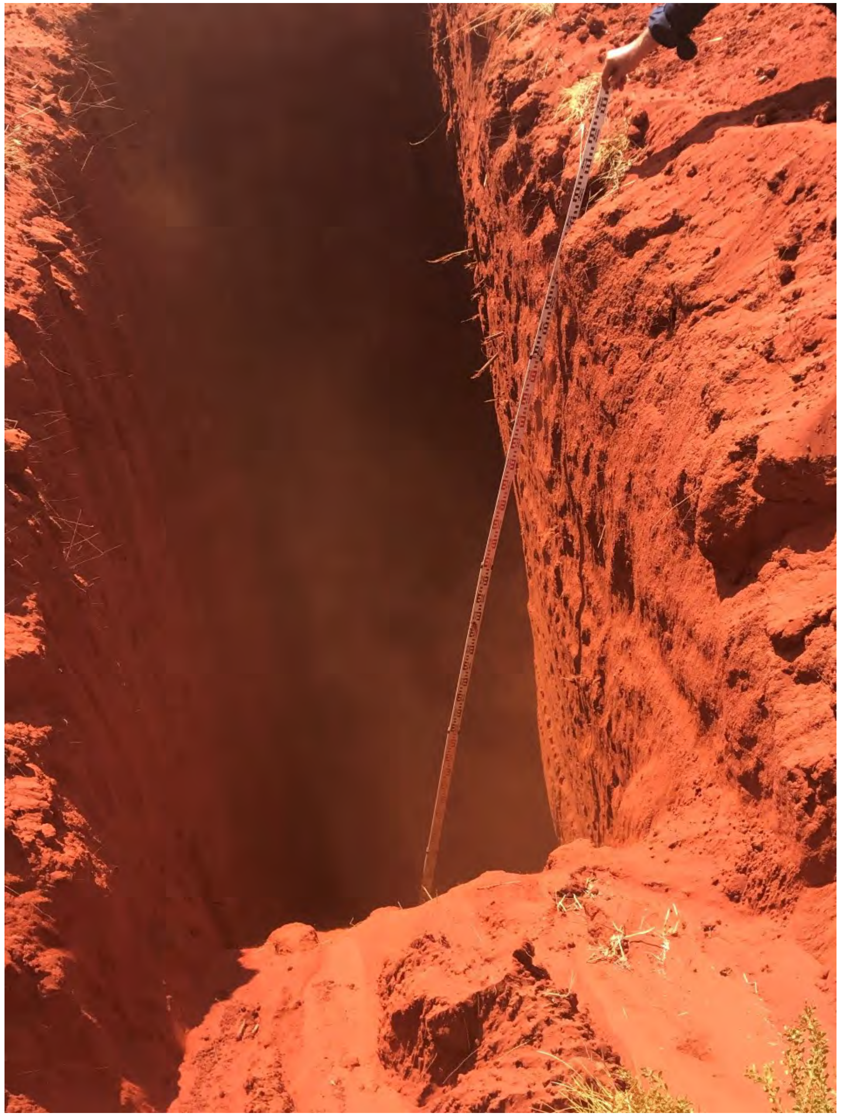


TP24

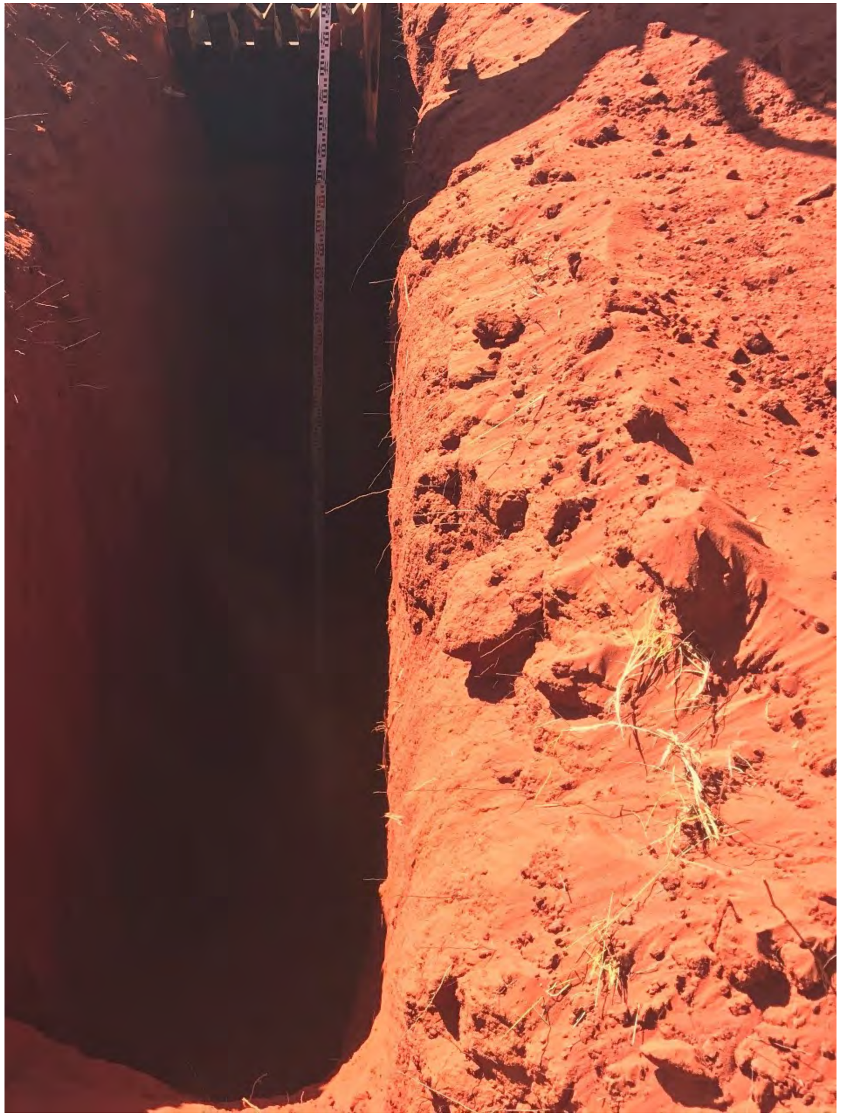
TP25

TP26

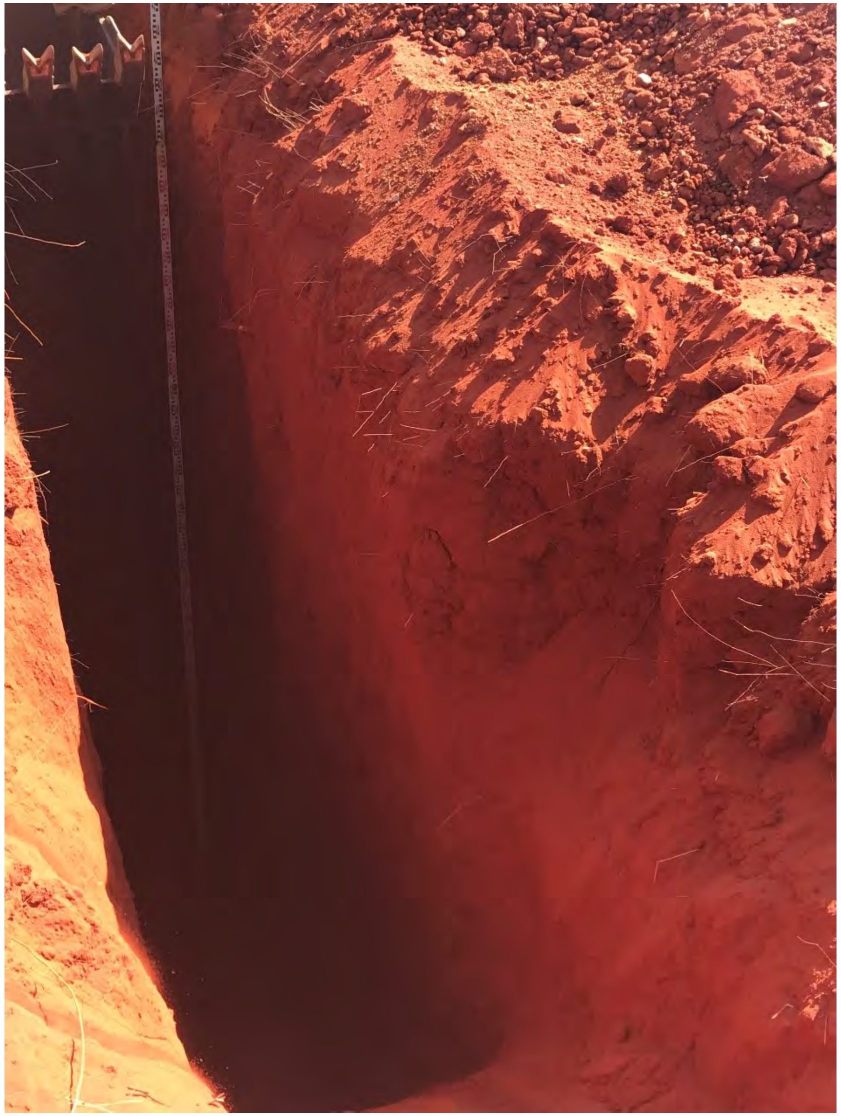
TP27



TP28



TP29



TP30

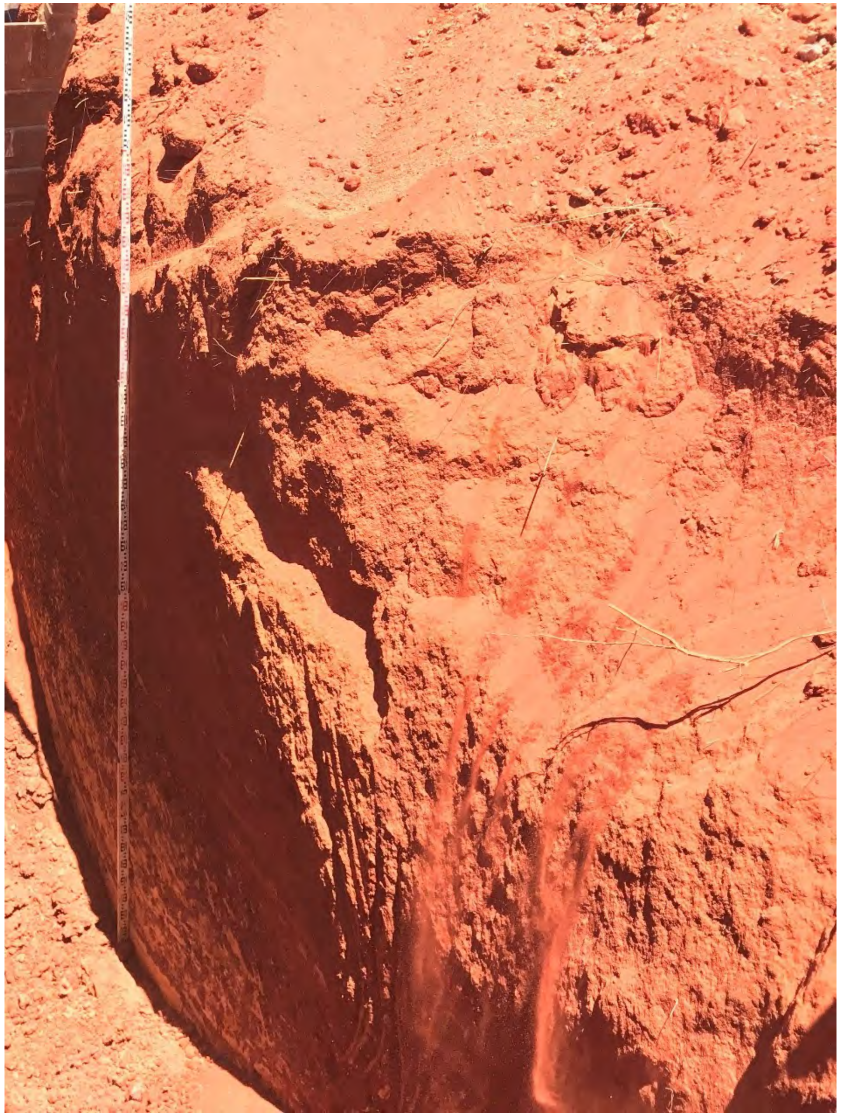
TP31

TP32

TP33

TP34

TP35



TP36

TP37

TP38

TP39

TP40

TP41

TP42

Shire of Ashburton
Onslow Site Investigation, Lot 150 Onslow Road, Onslow WA

TP43

TP44

TP45

TP46

TP47

TP48

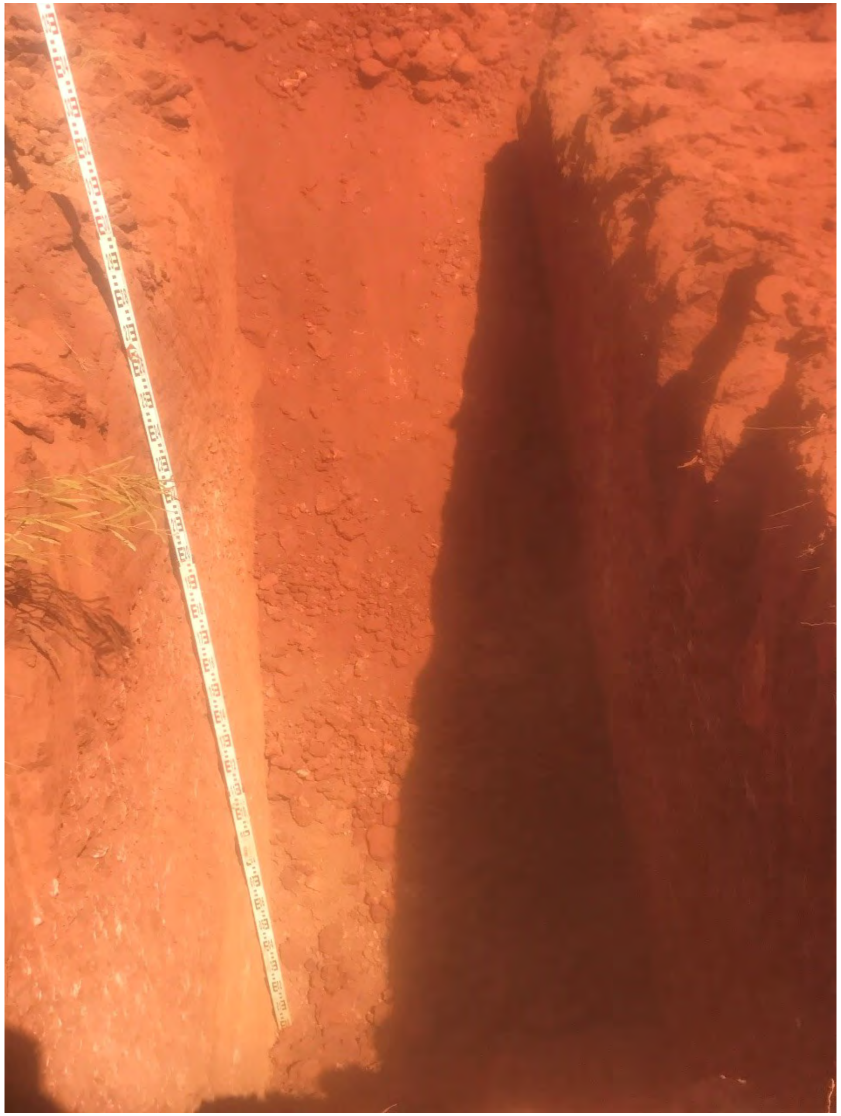
TP49

TP50

TP51

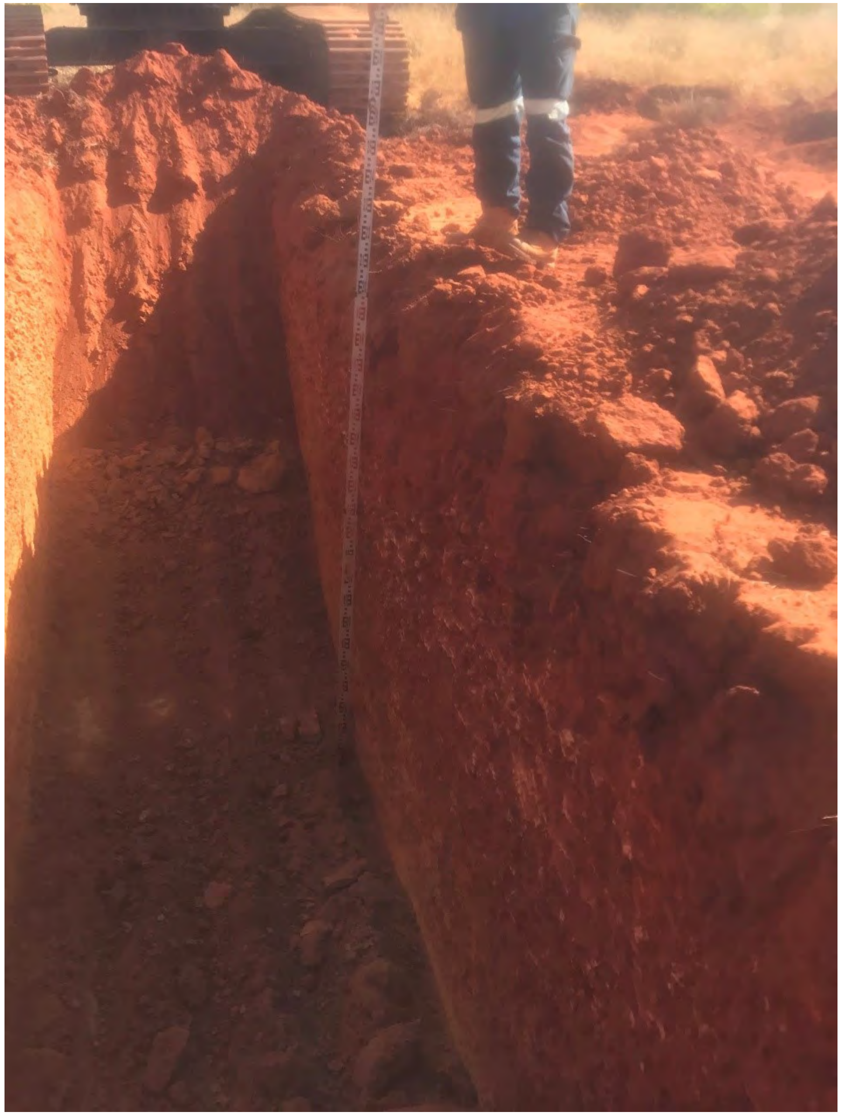
TP52

TP53



TP54

TP55



TP56

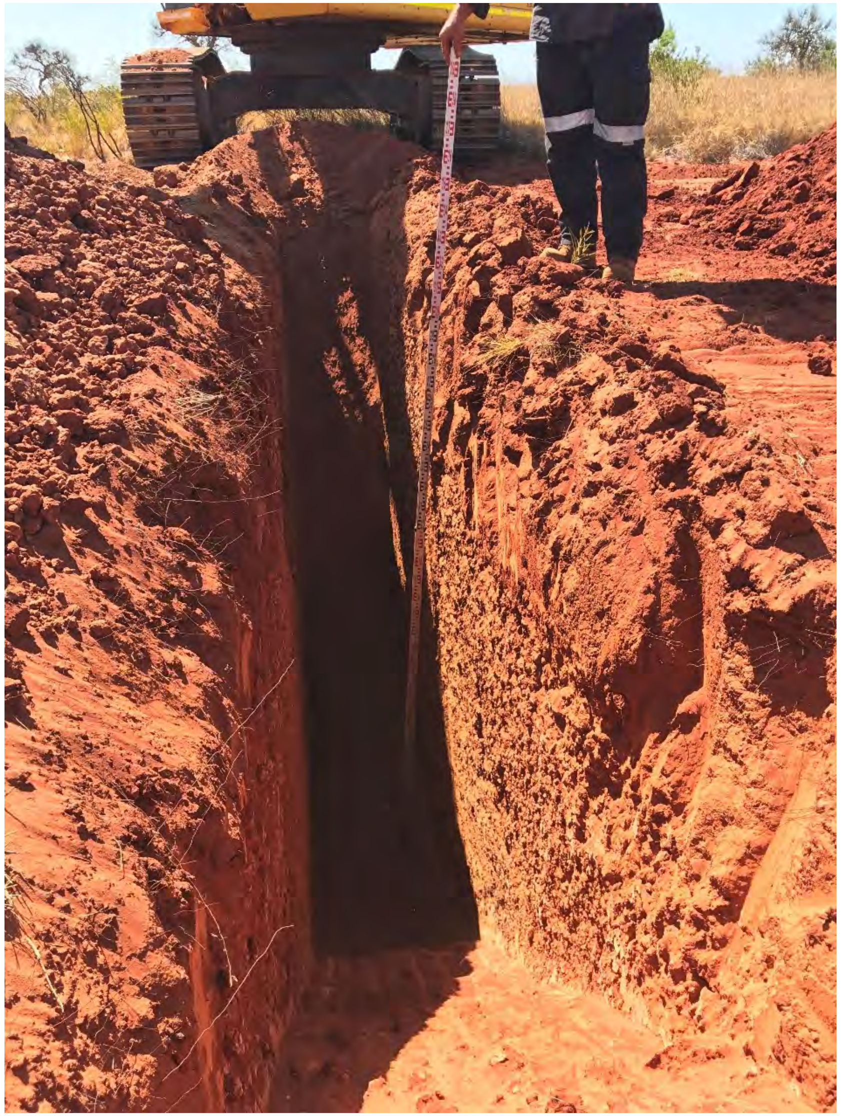
TP57

TP58

TP59

TP60

TP61



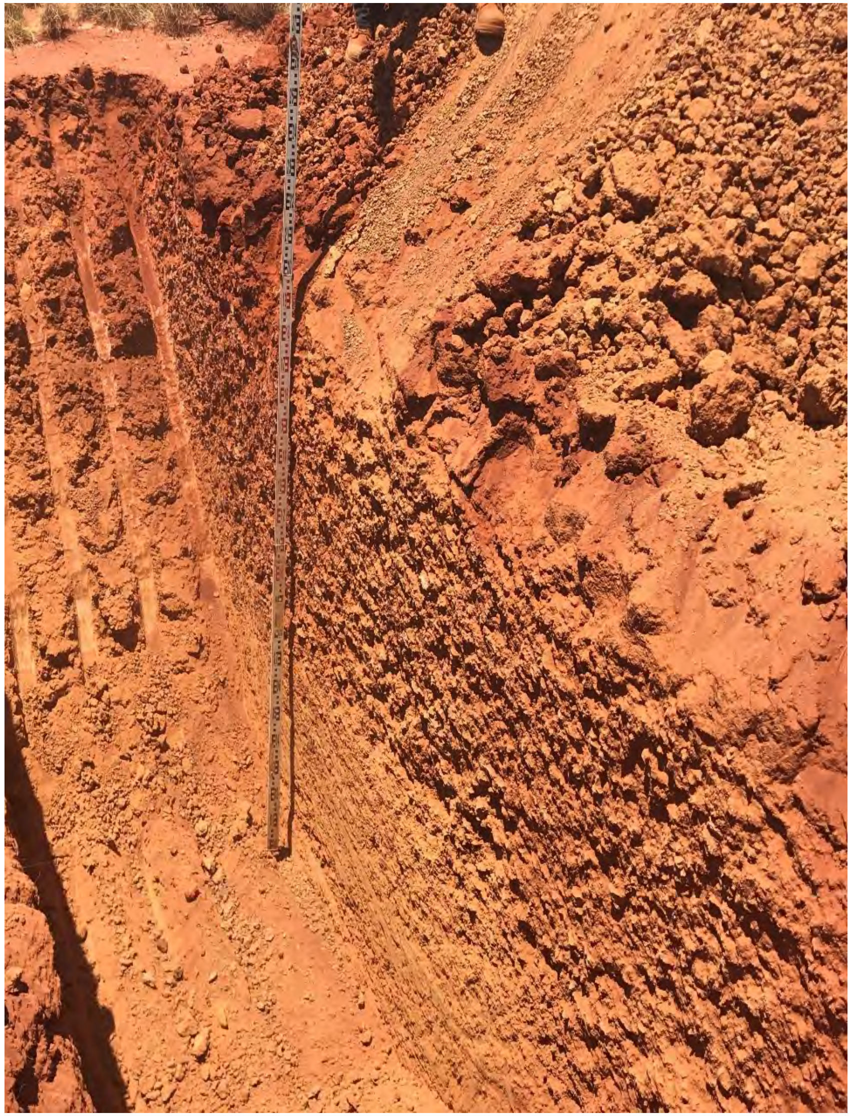
TP62

TP63

TP64

TP65

TP66



TP67

TP68

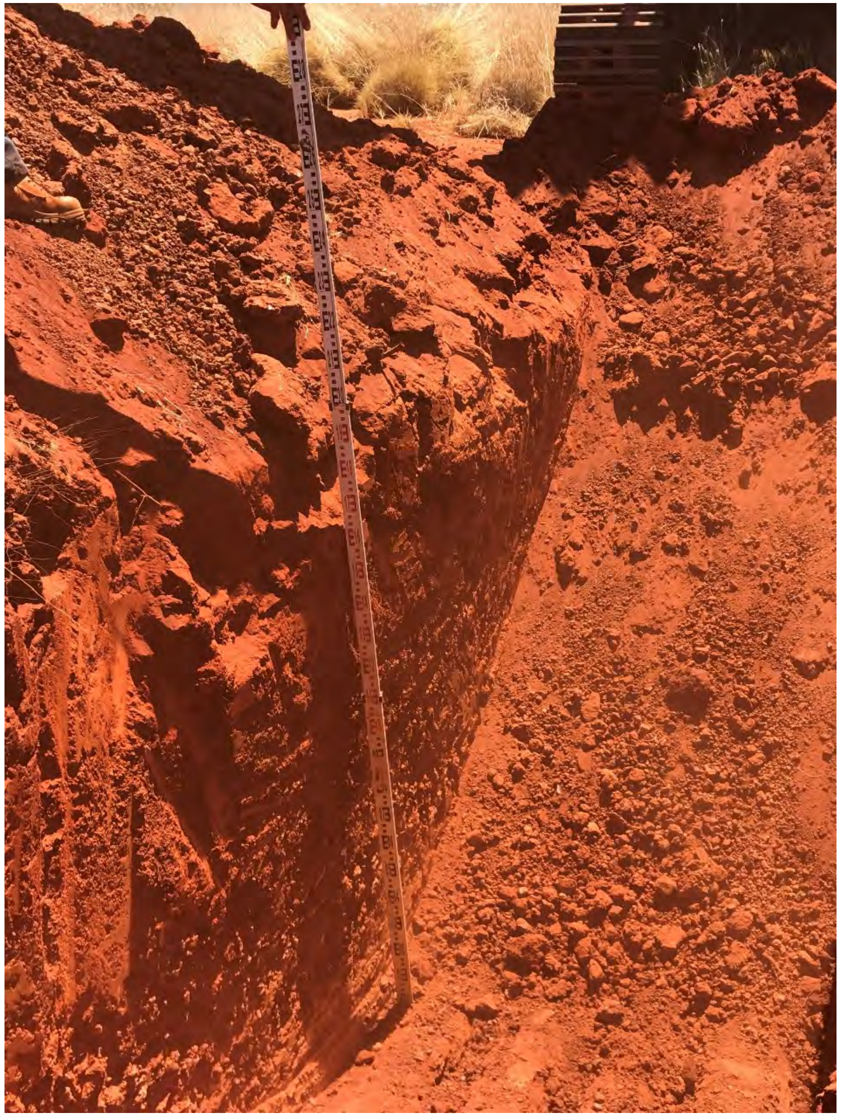
TP69

TP70

TP71

TP72

TP73



TP74

TP75

TP76

TP77

TP78

TP79

TP80

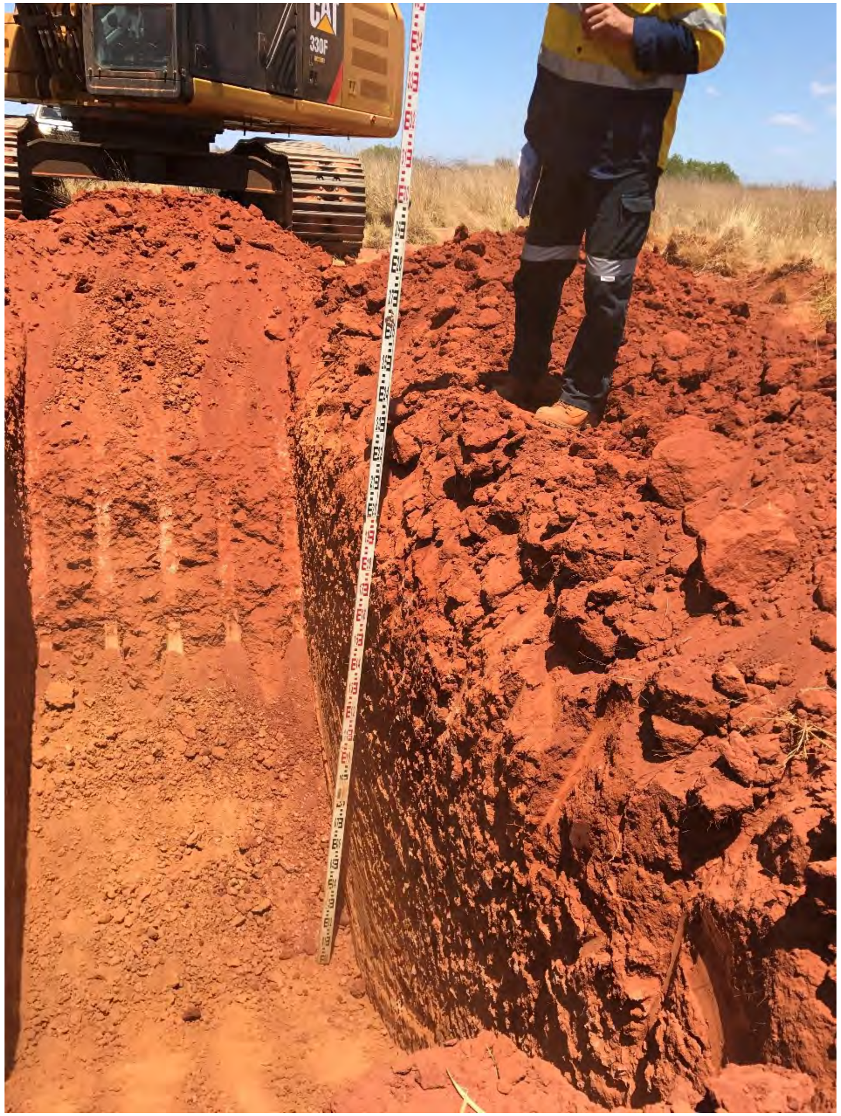
TP81

TP82

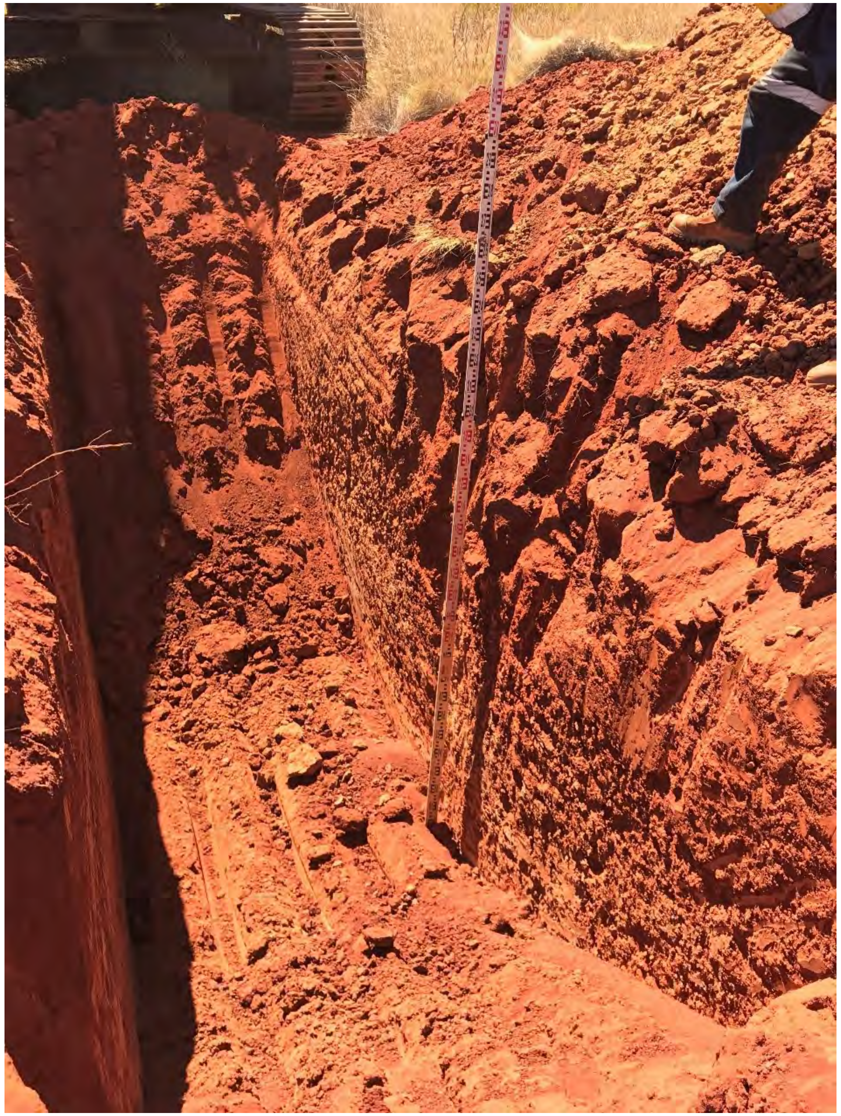
TP83

TP84

TP85



TP86



TP87

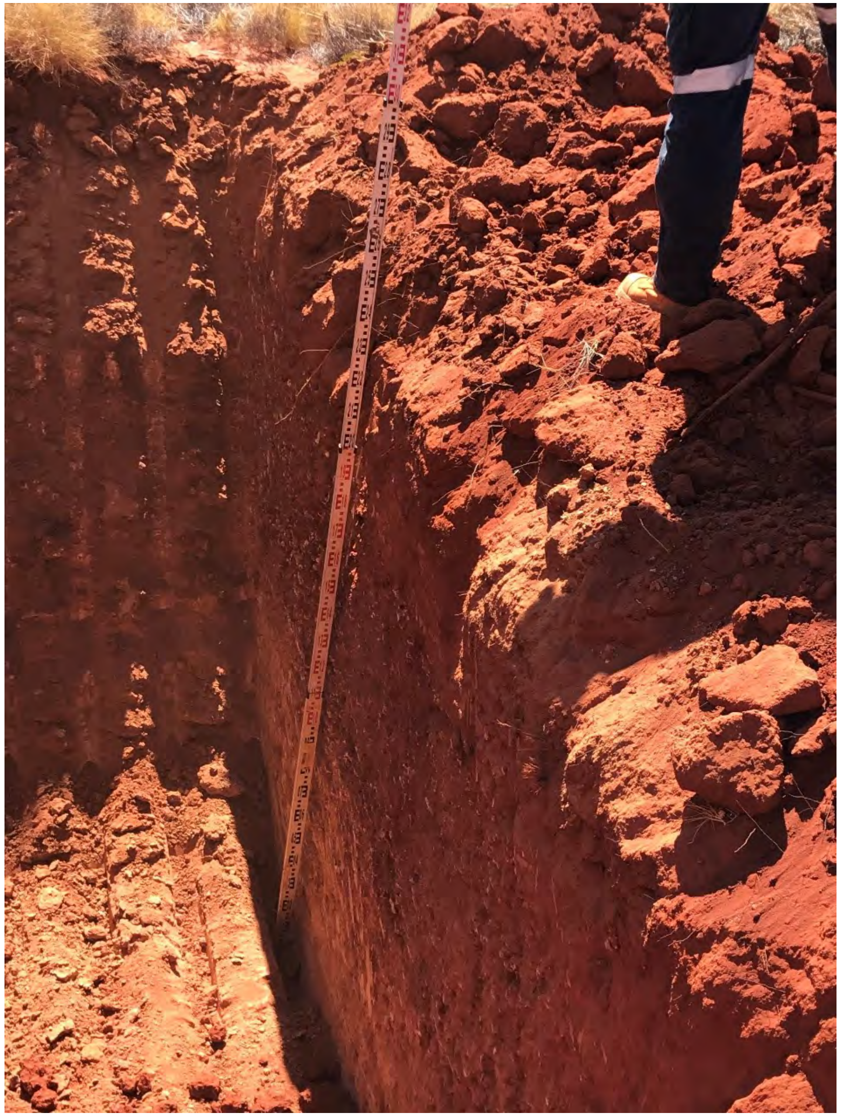
TP88

TP89

TP90

TP91

TP92



TP93

TP94

TP95

TP96

TP97

TP98

TP99

TP100

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Onslow Site Investigation, Lot 150 Onslow Road, Onslow WA

TP101

TP102

TP103

TP104

TP105

TP106

TP107

TP108

TP109

TP110

TP111

TP112

Appendix D: Geotechnical Laboratory Results

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

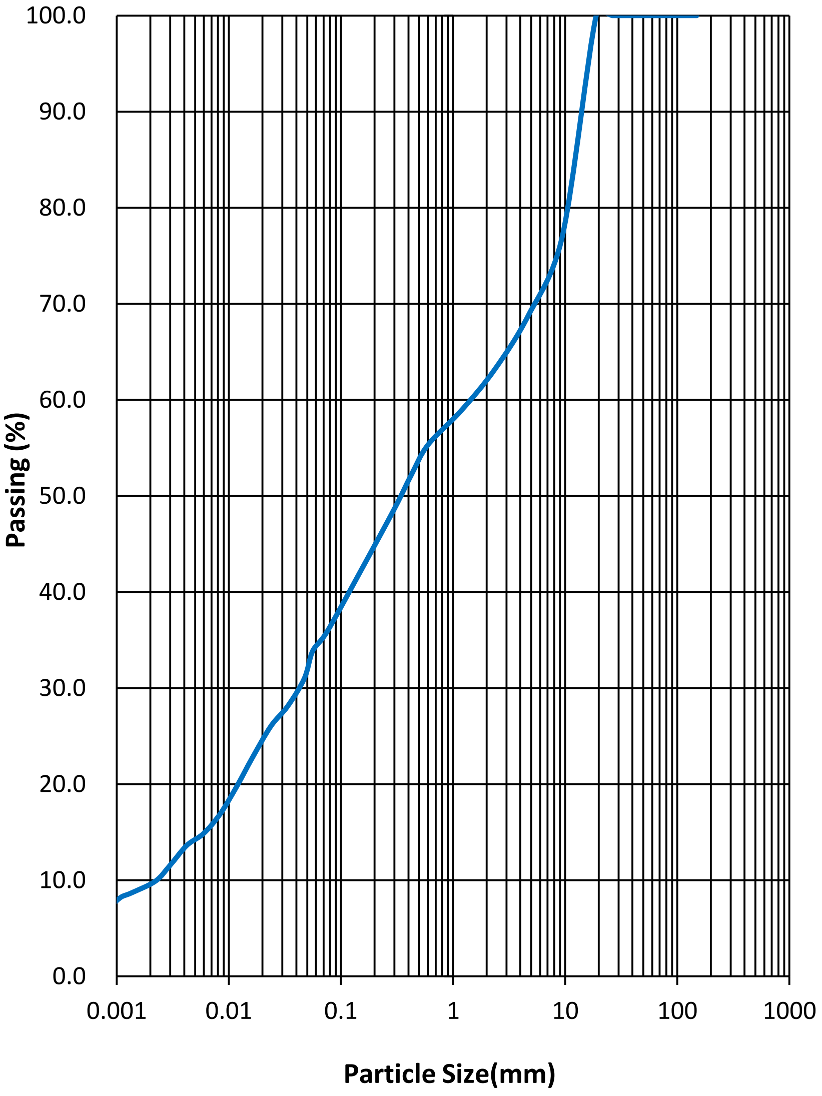
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1 3.6.3

Client:	Talis Consultants	Date Tested:	23/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	BH13 @ 2.00m	Depth(m):	2
Sample ID:	BH13_2.00_TALIS1801_PSD	Room Temperature at Test:	20°
Tested by:	Hank	2.36mm Particle Density (t/m³):	2.69
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	77.1
4.75	68.9
2.36	63.2
1.18	58.9
0.6	55.3
0.425	52.2
0.3	48.6
0.15	42.2
0.075	35.8
0.05631	33.9
0.04729	31.0
0.03355	28.1
0.02378	26.0
0.01623	22.7
0.01189	19.8
0.00844	16.9
0.00598	14.9
0.00424	13.6
0.00300	11.6
0.00222	9.9
0.00135	8.7
0.00110	8.3
0.00092	7.4
0.00083	6.6

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078 **Authorized Signature:**

The results of tests performed apply only to the specific sample at time of test unless otherwise clearly stated. Reference should be made to E-Precision Laboratory's "Standard Terms and Conditions" E-Precision Laboratory ABN 431 559 578 87

Integrity Precision Innovation

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1 3.6.3

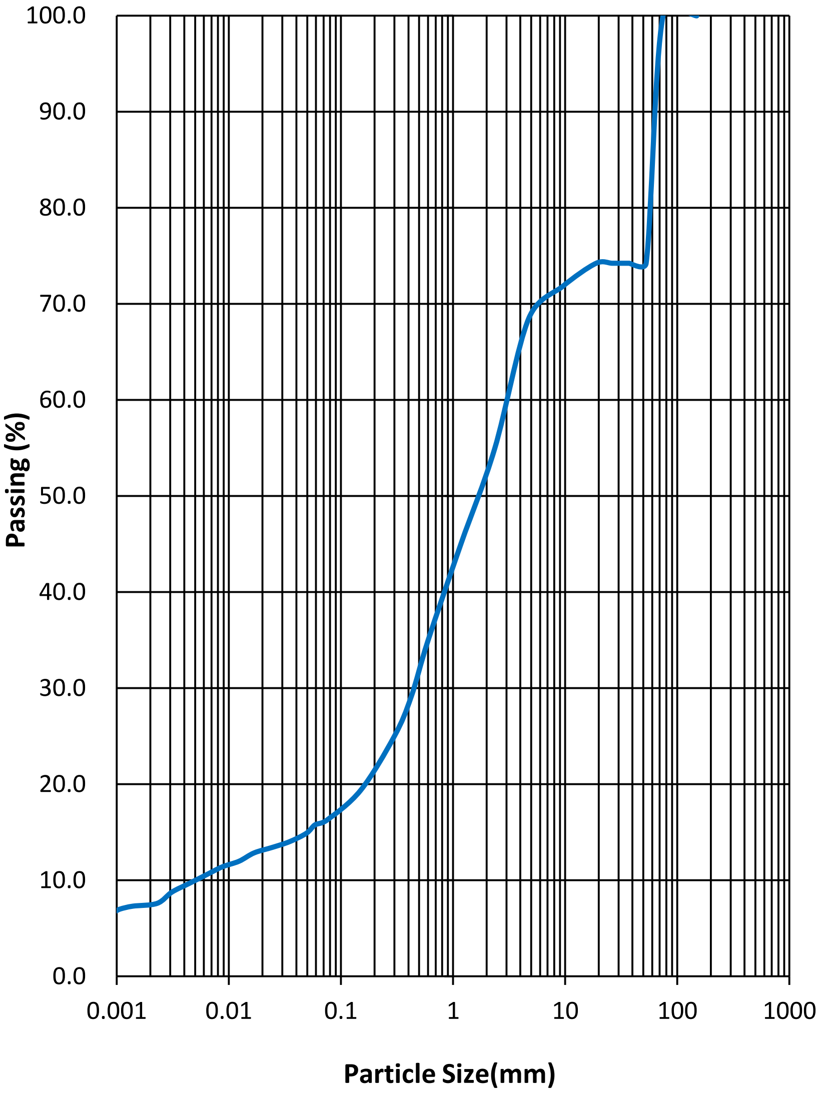
Client:	Talis Consultants	Date Tested:	22/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	BH14 @ 3.50m	Depth(m):	3.6
Sample ID:	BH14_3.60_TALIS1801_PSD	Room Temperature at Test:	20°

Tested by: Hank
Checked by: Phil

2.36mm Particle Density (t/m³): 2.62

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	74.2
37.5	74.2
26.5	74.2
19	74.2
9.5	71.8
4.75	68.5
2.36	54.9
1.18	45.0
0.6	35.0
0.425	29.1
0.3	25.0
0.15	19.4
0.075	16.3
0.05898	15.8
0.04941	14.9
0.03499	14.0
0.02477	13.4
0.01688	12.9
0.01235	12.0
0.00874	11.4
0.00619	10.5
0.00439	9.6
0.00311	8.8
0.00230	7.6
0.00139	7.3
0.00108	7.0
0.00095	6.7
0.00085	6.7

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078 **Authorized Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

ATTERBERG LIMITS TEST REPORT

Test Method: BS1377 AS1289.2.1.1 7.1.1 3.1.1 3.2.1 3.4.1

Client: Talis Consultants
Project: Onslow TW17084
Sample No: BH14 @ 3.60m
Lab ID: BH14_3.60_TALIS1801_ATT
Depth(m): 3.6
Date Tested: 01/02/2018
Lab: EPLAB
Job Number: TALIS
Room Temperature at Test: 20°C

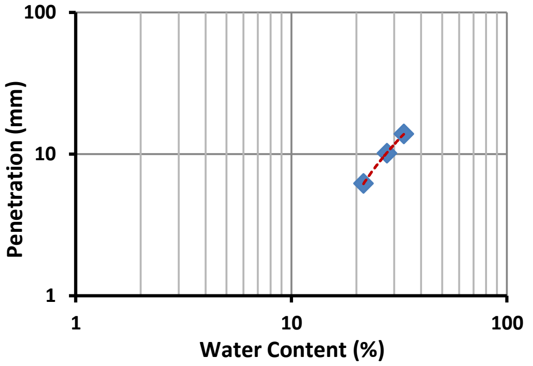
Tested by: Phil
Moisture Content (%): -
Sample Description: -
Wet Density (t/m³): -
Dry Density (t/m³): -

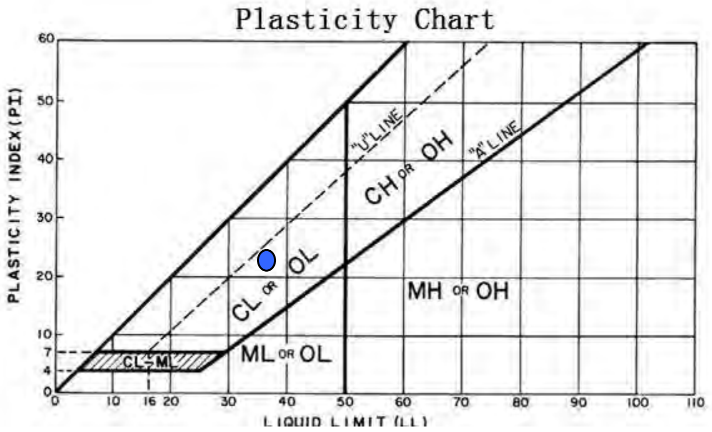
Liquid Limit (%): 38.07
Plastic Limit (%): 15.28

Plasticity Index (%): 22.78
Liquidity Index (%): -

Shrinkage Limit (%): 11.24
Linear Shrinkage(%): 2.52

Results Chart





Notes: The sample/s were tested oven dried, dry sieved and in a 125-250mm mould.

Stored and Tested the Sample as received
Samples supplied by the Client NATA: 19078
Authorised Signature:

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

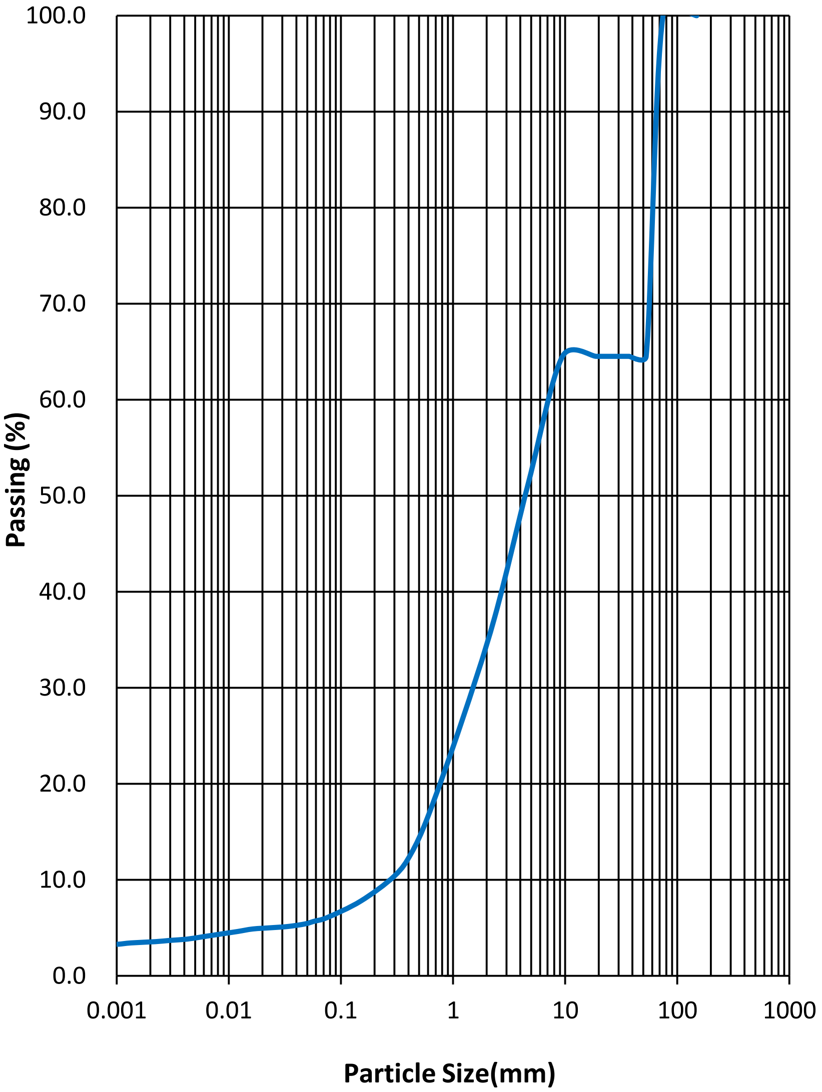
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1 3.6.3

Client:	Talis Consultants	Date Tested:	22/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	BH14 @ 5.00m	Depth(m):	5
Sample ID:	BH14_5.00_TALIS1801_PSD	Room Temperature at Test:	20°
Tested by:	Hank	2.36mm Particle Density (t/m³):	2.74
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	64.5
37.5	64.5
26.5	64.5
19	64.5
9.5	64.5
4.75	51.5
2.36	37.4
1.18	26.3
0.6	16.6
0.425	12.8
0.3	10.4
0.15	7.8
0.075	6.1
0.05720	5.7
0.04790	5.4
0.03391	5.1
0.02399	5.0
0.01634	4.9
0.01195	4.6
0.00846	4.4
0.00599	4.1
0.00424	3.8
0.00300	3.7
0.00222	3.6
0.00134	3.4
0.00104	3.3
0.00091	3.3
0.00082	3.2

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078 **Authorized Signature:**

E-Precision Laboratory ABN 431 559 578 87

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

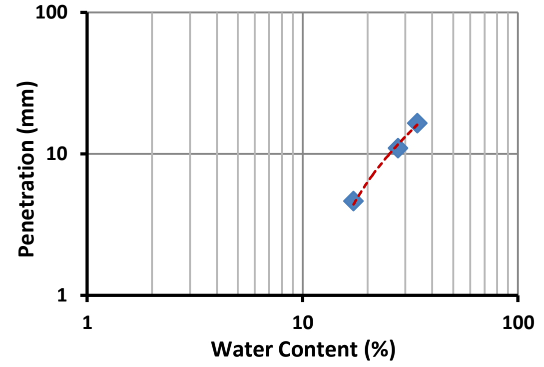
ATTERBERG LIMITS TEST REPORT

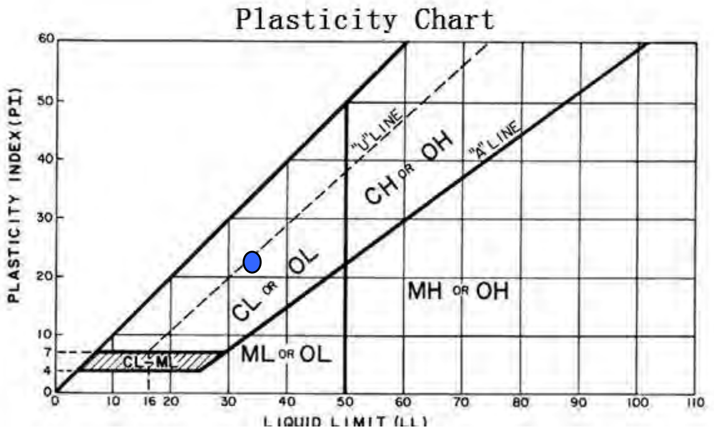
Test Method: BS1377 AS1289.2.1.1 7.1.1 3.1.1 3.2.1 3.4.1

Client:	Talis Consultants	Date Tested:	01/02/2018
Project:	Onslow TW17084	Lab:	EPLAB
Sample No:	BH14 @ 5.00m	Job Number:	TALIS
Lab ID:	BH14_5.00_TALIS1801_ATT		
Depth(m):	5	Room Temperature at Test:	20°C
Tested by:	Phil	Sample Description:	-
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Liquid Limit (%):	35.46
Plastic Limit (%):	13.79
Plasticity Index (%):	21.68
Liquidity Index (%):	-
Shrinkage Limit (%):	10.36
Linear Shrinkage(%):	1.73

Results Chart





Notes: The sample/s were tested oven dried, dry sieved and in a 125-250mm mould.

Stored and Tested the Sample as received

Samples supplied by the Client NATA: 19078 **Authorised Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

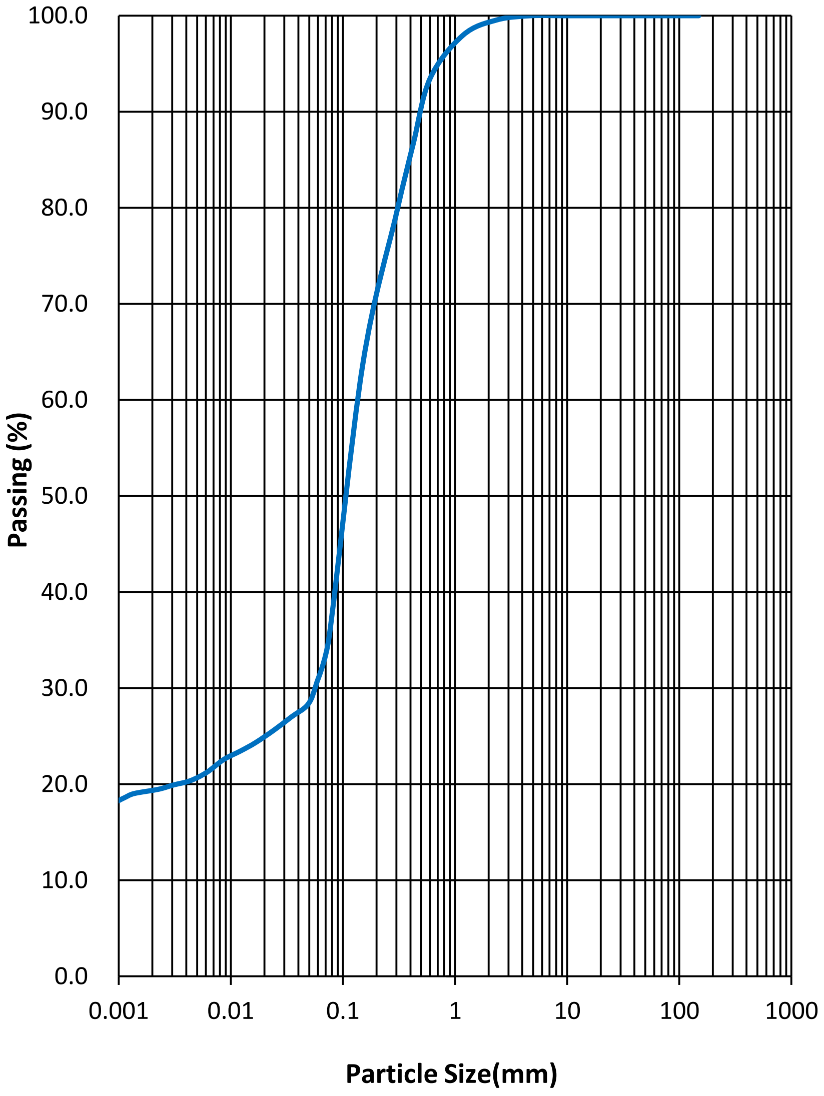
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1 3.6.3

Client:	Talis Consultants	Date Tested:	22/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	BH17 @ 2.10m	Depth(m):	2.1
Sample ID:	BH17_2.10_TALIS1801_PSD	Room Temperature at Test:	20°
Tested by:	Hank	2.36mm Particle Density (t/m³):	2.60
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	100.0
2.36	99.6
1.18	98.0
0.6	93.5
0.425	86.7
0.3	79.4
0.15	63.6
0.075	35.2
0.05827	30.5
0.04886	28.3
0.03460	27.0
0.02450	25.7
0.01668	24.3
0.01219	23.5
0.00863	22.6
0.00611	21.2
0.00433	20.4
0.00306	19.9
0.00226	19.5
0.00137	19.0
0.00112	18.6
0.00093	18.1
0.00084	18.1

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078 **Authorized Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

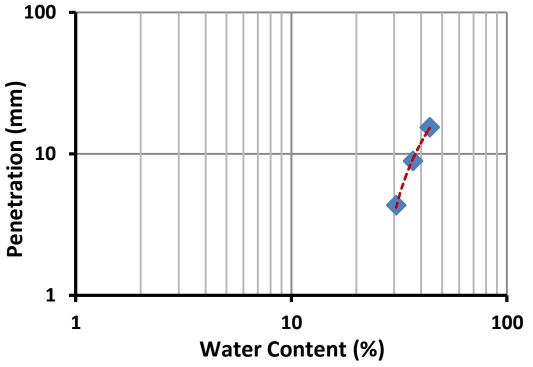
ATTERBERG LIMITS TEST REPORT

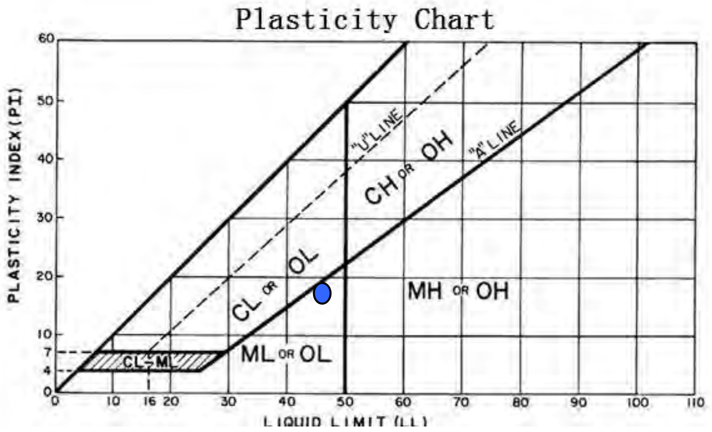
Test Method: BS1377 AS1289.2.1.1 7.1.1 3.1.1 3.2.1 3.4.1

Client:	Talis Consultants	Date Tested:	01/02/2018
Project:	Onslow TW17084	Lab:	EPLAB
Sample No:	BH17 @ 2.10m	Job Number:	TALIS
Lab ID:	BH17_2.10_TALIS1801_ATT		
Depth(m):	2.1	Room Temperature at Test:	20°C
Tested by:	Phil	Sample Description:	-
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Liquid Limit (%):	45.91
Plastic Limit (%):	28.06
Plasticity Index (%):	17.85
Liquidity Index (%):	-
Shrinkage Limit (%):	21.11
Linear Shrinkage(%):	11.12

Results Chart





Notes: The sample/s were tested oven dried, dry sieved and in a 125-250mm mould.

Stored and Tested the Sample as received

Samples supplied by the Client NATA: 19078 **Authorised Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

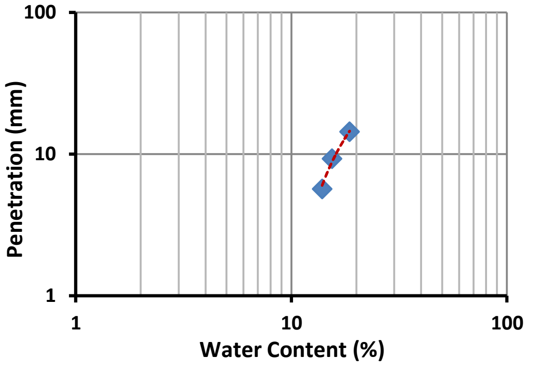
ATTERBERG LIMITS TEST REPORT

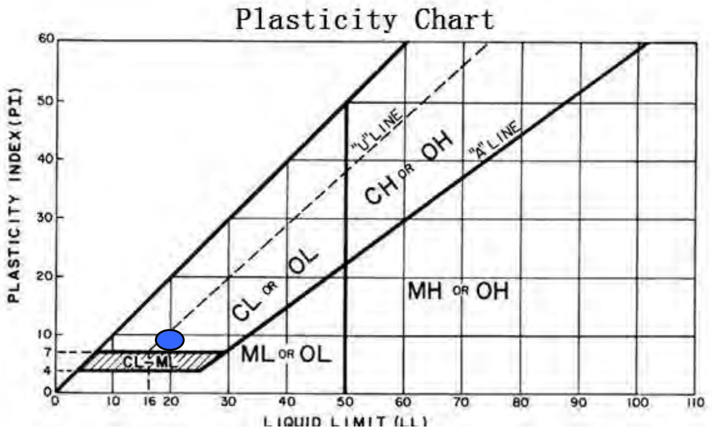
Test Method: BS1377 AS1289.2.1.1 7.1.1 3.1.1 3.2.1 3.4.1

Client:	Talis Consultants	Date Tested:	01/02/2018
Project:	Onslow TW17084	Lab:	EPLAB
Sample No:	BH29 @ 3.00m	Job Number:	TALIS
Lab ID:	BH29_3.00_TALIS1801_ATT		
Depth(m):	3	Room Temperature at Test:	20°C
Tested by:	Phil	Sample Description:	-
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Liquid Limit (%):	19.94
Plastic Limit (%):	11.66
Plasticity Index (%):	8.29
Liquidity Index (%):	-
Shrinkage Limit (%):	10.35
Linear Shrinkage(%):	2.20

Results Chart





Notes: The sample/s were tested oven dried, dry sieved and in a 125-250mm mould.

Stored and Tested the Sample as received

Samples supplied by the Client NATA: 19078 **Authorised Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3 3.5.1

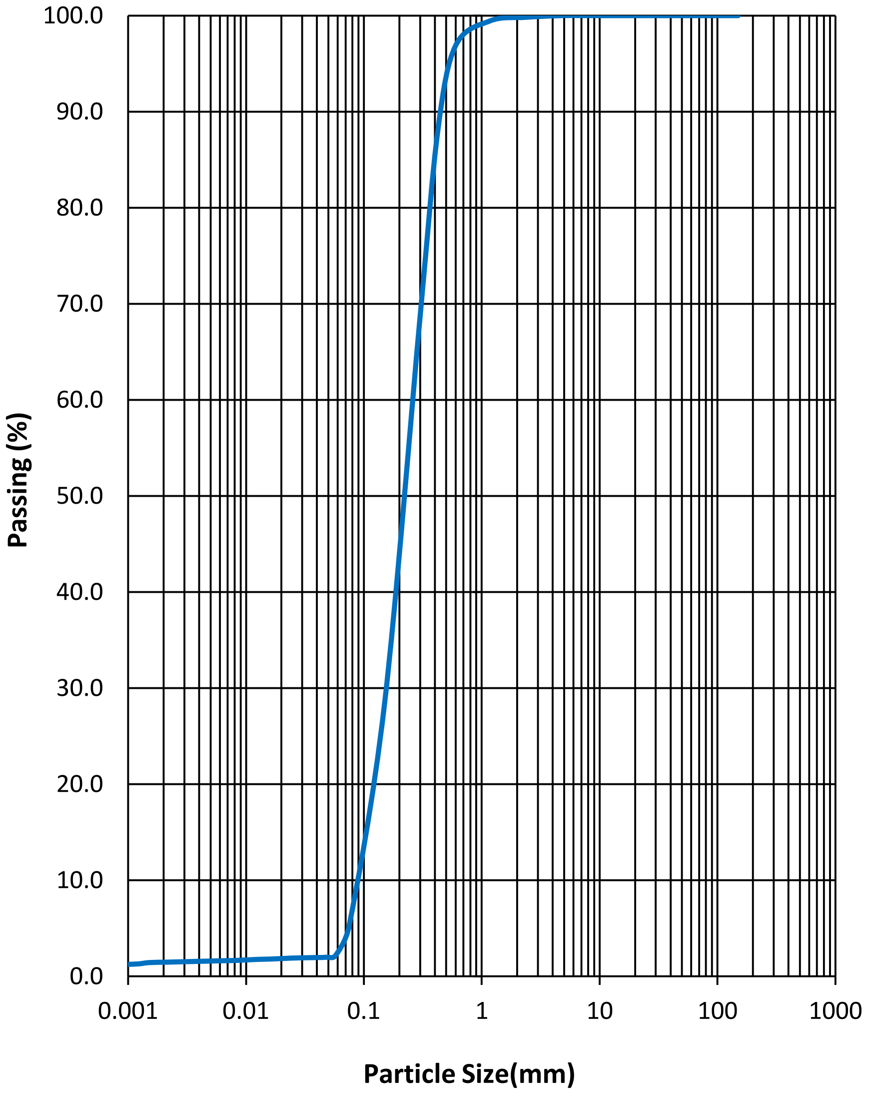
Client:	Talis Consultants	Date Tested:	25/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP7	Depth(m):	4.50 - 5.00
Lab ID:	TP7_4.50_5.00_TALIS1802_PSD	Room Temperature at Test:	19

Tested by: Leigh
Checked by: Phil

2.36mm Particle Density (t/m³): 2.78

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	100.0
2.36	99.8
1.18	99.5
0.6	96.9
0.425	88.1
0.3	68.7
0.15	28.4
0.075	5.2
0.05756	2.2
0.04823	2.0
0.03412	1.9
0.02414	1.9
0.01643	1.8
0.01200	1.8
0.00850	1.7
0.00601	1.6
0.00425	1.6
0.00301	1.5
0.00213	1.5
0.00151	1.4
0.00121	1.3
0.00092	1.2
0.00087	1.2

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078

Authorized Signature:

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

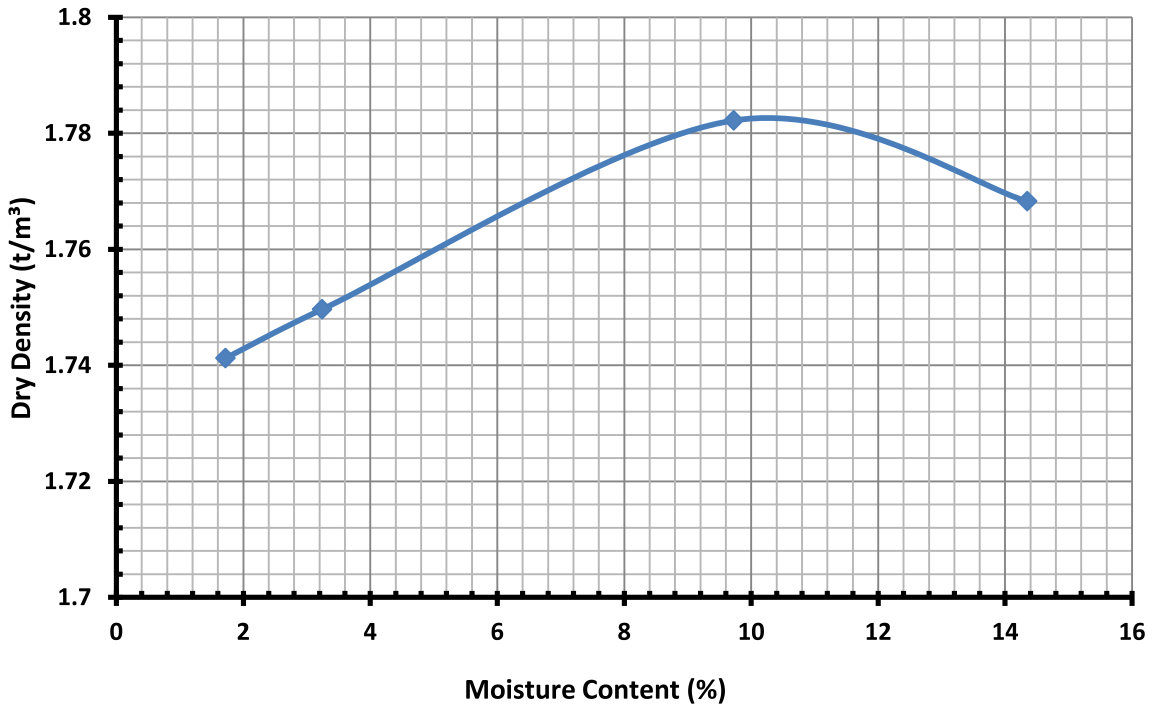
MOISTURE DENSITY RELATIONSHIP REPORT

Test Method: AS1289.5.2.1

Client:	Talis Environmental Consultants	Date Tested:	19/04/2018
Project:	Onslow TW17084	Lab:	EPLAB
Sample No:	TP7	Job Number:	TALIS
Lab ID:	TP7_4.50_5.00_MMDD		
Depth(m):	4.50 - 5.00	Room Temperature at Test:	20°C
Checked by:	Phil	Sample Description:	Tested in Mould A
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Results

Maximum Size (mm):	19.00	**Maximum Dry Density (t/m³):**	**1.780**
Oversize dry (%):	0.00	**Optimum Moisture Content (%):**	**9.90**



Notes:

Stored and Tested the Sample as received

Samples supplied by the Client NATA: 19078 **Authorised Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

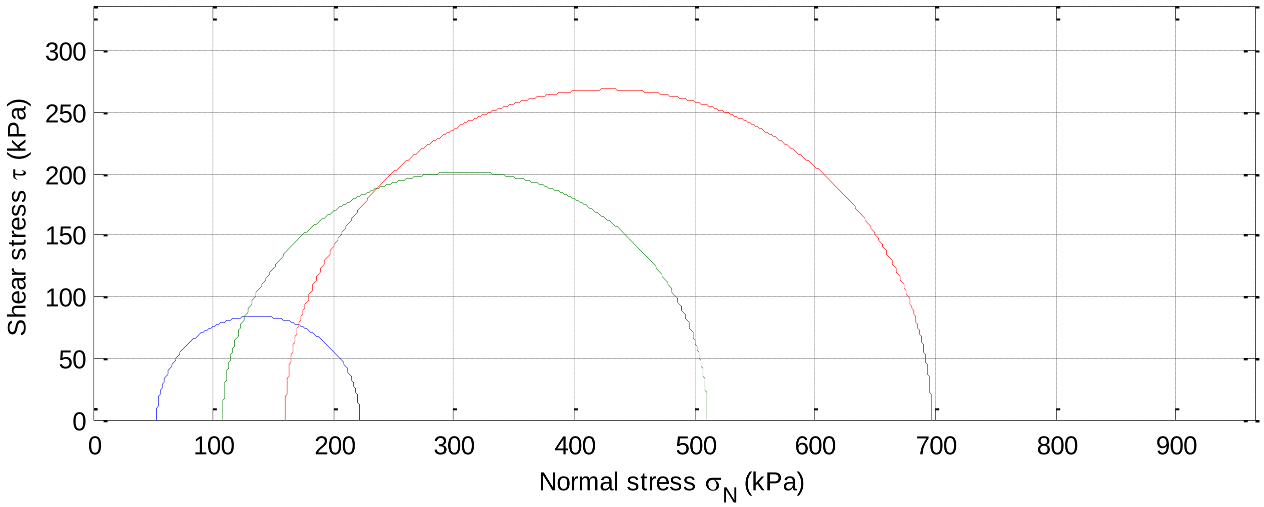
Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	04/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP7	Lab:	EPLab
Sample ID:	TP7_4.50_5.00_TALIS1802_CU		
Depth (m):	4.50 - 5.00	Room Temperature at Test:	~ 18°c

Tested by:	PHIL	Initial Moisture (%):	9.93	Strain Rate (mm/min):	0.0075
Height (mm):	125.11	Final Moisture (%):	4.27	Skempton's (B):	0.99
Diameter (mm):	61.80	Bulk Density (t/m³):	1.86	Geology:	-
L/D Ratio:	2.02	Dry Density (t/m³):	1.69		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

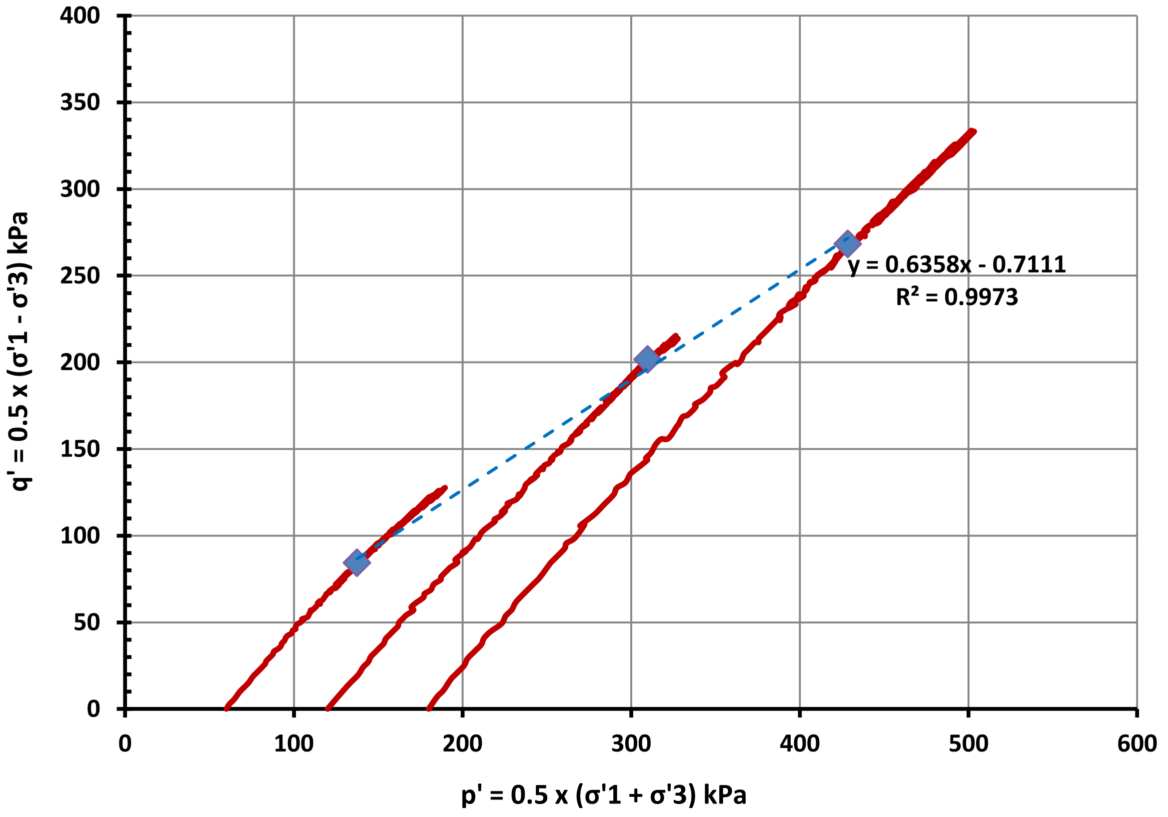
Interpretation from Mohr Circle:	Sample 1 & 2	Sample 1 & 3	Sample 2 & 3
Cohesion C' (kPa):	-	2.13	32.97
Angle of Shear Resistance Φ' (Degrees) :	-	39.35	34.22

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	04/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP7	Lab:	EPLab
Sample ID:	TP7_4.50_5.00_TALIS1802_CU		
Depth (m):	4.50 - 5.00	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	**0.00**
Angle of Shear Resistance Φ' (Deg) :	**39.48**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

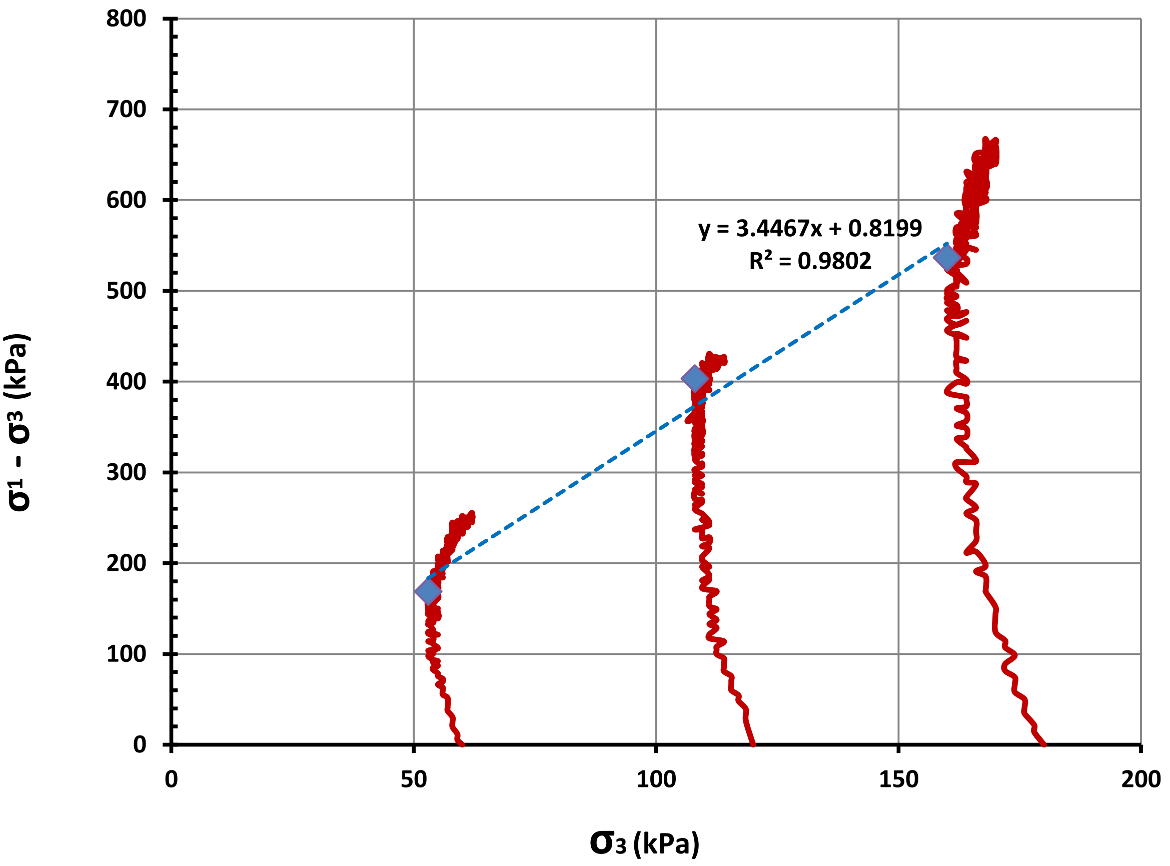
E-Precision Laboratory

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	04/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP7	Lab:	EPLab
Sample ID:	TP7_4.50_5.00_TALIS1802_CU		
Depth (m):	4.50 - 5.00	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	**0.19**
Angle of Shear Resistance Φ' (Deg) :	**39.27**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

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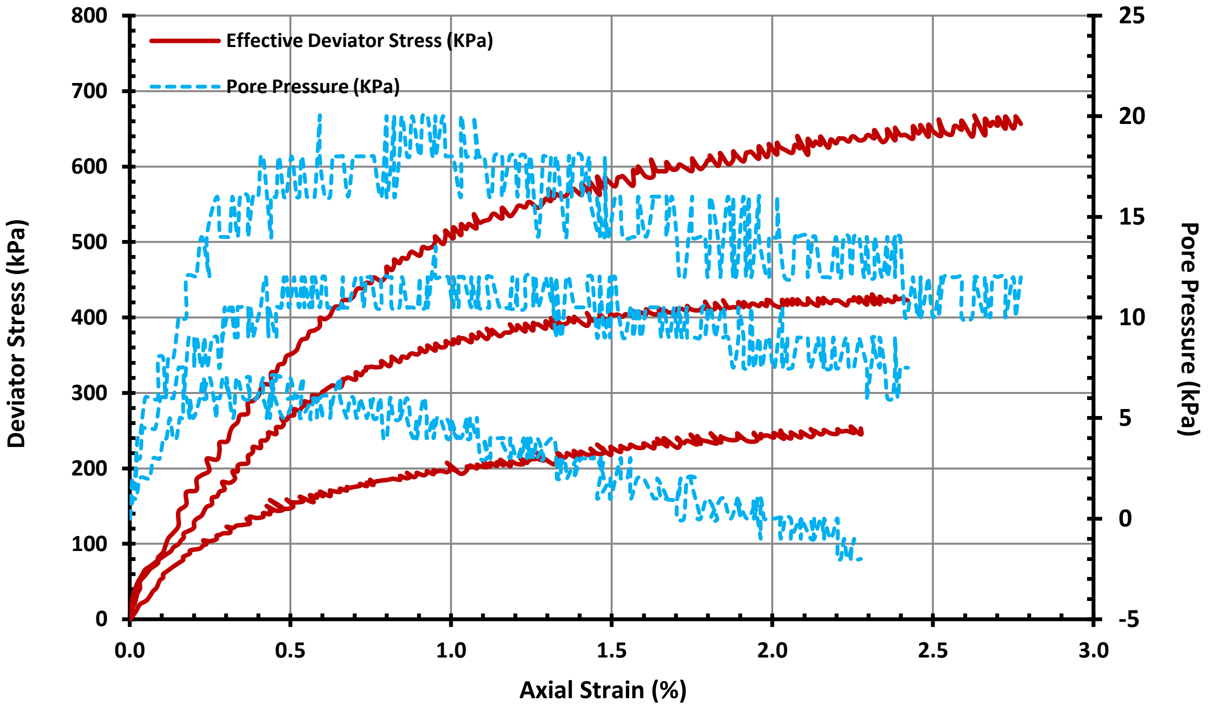
SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client: Talis Consultants
Project: TW17084 Onslow
Sample No: TP7
Sample ID: TP7_4.50_5.00_TALIS1802_CU
Depth (m): 4.50 - 5.00

Date Tested: 04/05/2018
EP Lab Job Number: TALIS
Lab: EPLab
Room Temperature at Test: ~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'_0	U'_f	Principal Effective Stresses			$\sigma'_1 - \sigma'_3$	Strain (%)
				σ'_1	σ'_3	σ'_1 / σ'_3		
1	60	0	7	222	53	4.18	169	0.65
2	120	0	12	511	108	4.73	403	1.51
3	180	0	20	697	160	4.35	537	1.07

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	04/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP7	Lab:	EPLab
Sample ID:	TP7_4.50_5.00_TALIS1802_CU		
Depth (m):	4.50 - 5.00	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID:	TP7	**Depth (m):**	4.50 - 5.00
Lab ID:	TP7_4.50_5.00_TALIS1802_CU	**Date Tested:**	04/05/2018

Stage 1

Stage 2

Stage 3

Failure Mode: Bulging Failures observed for all samples

Notes: **Sample remolded based on 95% MMDD @ OMC**

Stored and Tested the Sample as received Accredited for compliance with ISO/IEC 17025-TESTING

Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

NATA
ACCREDITATION NO: 19078

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

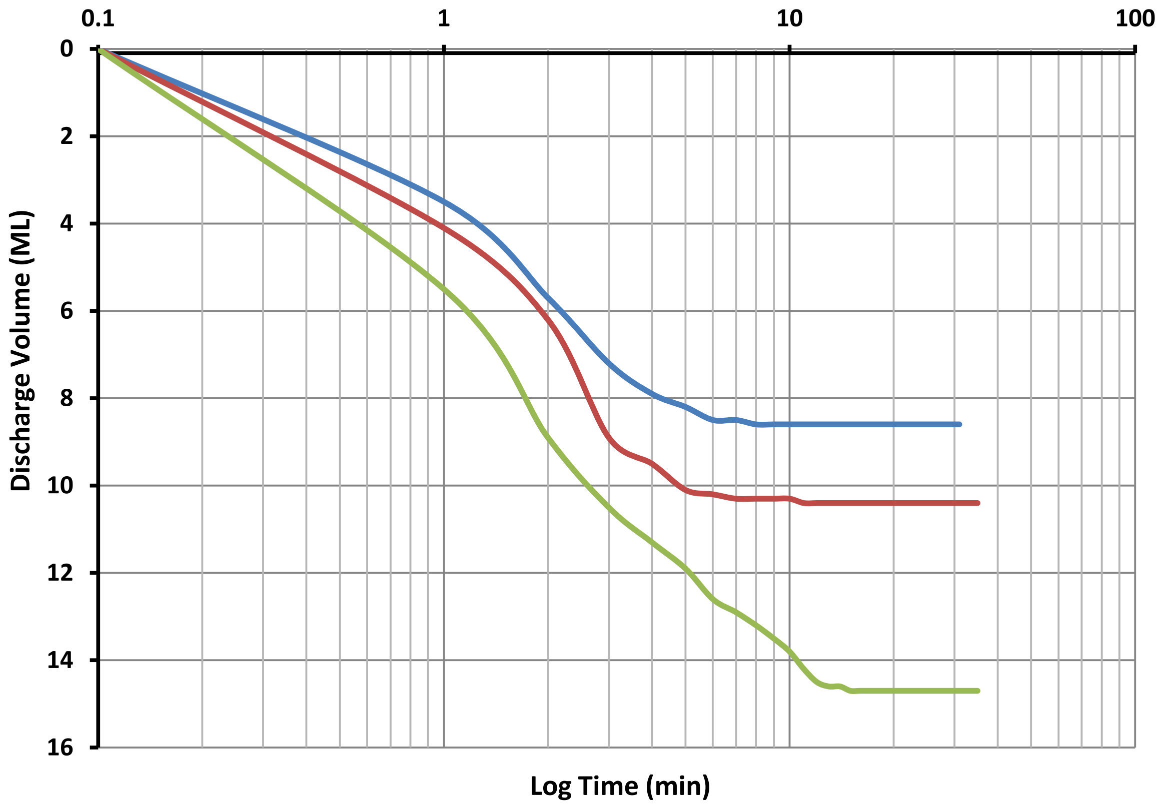
E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	04/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP7	Lab:	EPLab
Sample ID:	TP7_4.50_5.00_TALIS1802_CU		
Depth (m):	4.50 - 5.00	Room Temperature at Test:	~ 18°C

Discharge Volume (ML) Vs Log Time (min)



Sample 1	**Cv (cm^2/s):**	0.761	based on **t_{90}**
Sample 2	**Cv (cm^2/s):**	0.652	based on **t_{90}**
Sample 3	**Cv (cm^2/s):**	0.332	based on **t_{90}**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

PARTICLE SIZE DISTRIBUTION TEST REPORT

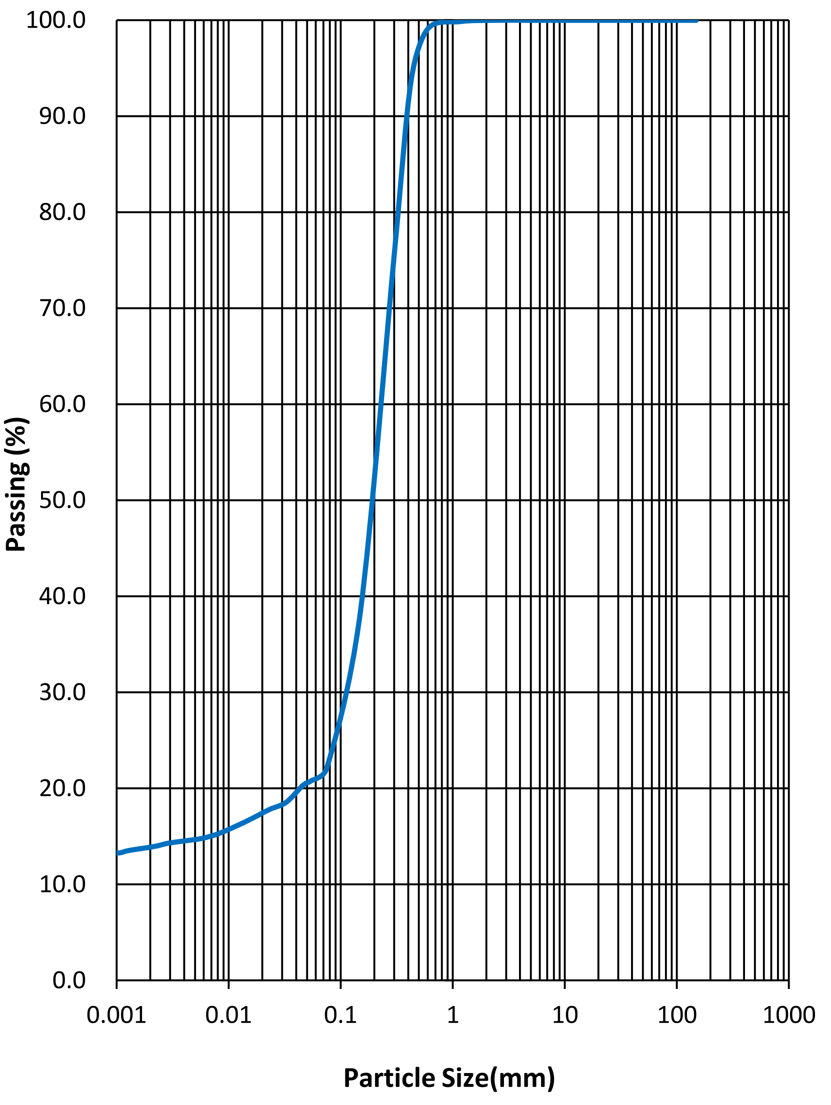
Test Method: AS 1289 3.6.1 3.6.3

Client:	Talis Consultants	Date Tested:	23/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	TP14 @ 0.50m	Depth(m):	0.5
Sample ID:	TP14_0.50_TALIS1801_PSD	Room Temperature at Test:	20°

Tested by: Hank
Checked by: Phil
2.36mm Particle Density (t/m³): 2.78

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	100.0
2.36	100.0
1.18	99.9
0.6	99.1
0.425	93.7
0.3	75.5
0.15	38.4
0.075	22.1
0.05484	20.8
0.04593	20.3
0.03260	18.6
0.02309	17.8
0.01571	16.8
0.01149	16.1
0.00814	15.3
0.00576	14.8
0.00408	14.6
0.00288	14.3
0.00213	14.0
0.00129	13.5
0.00106	13.3
0.00088	13.3
0.00079	13.1

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078 **Authorized Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

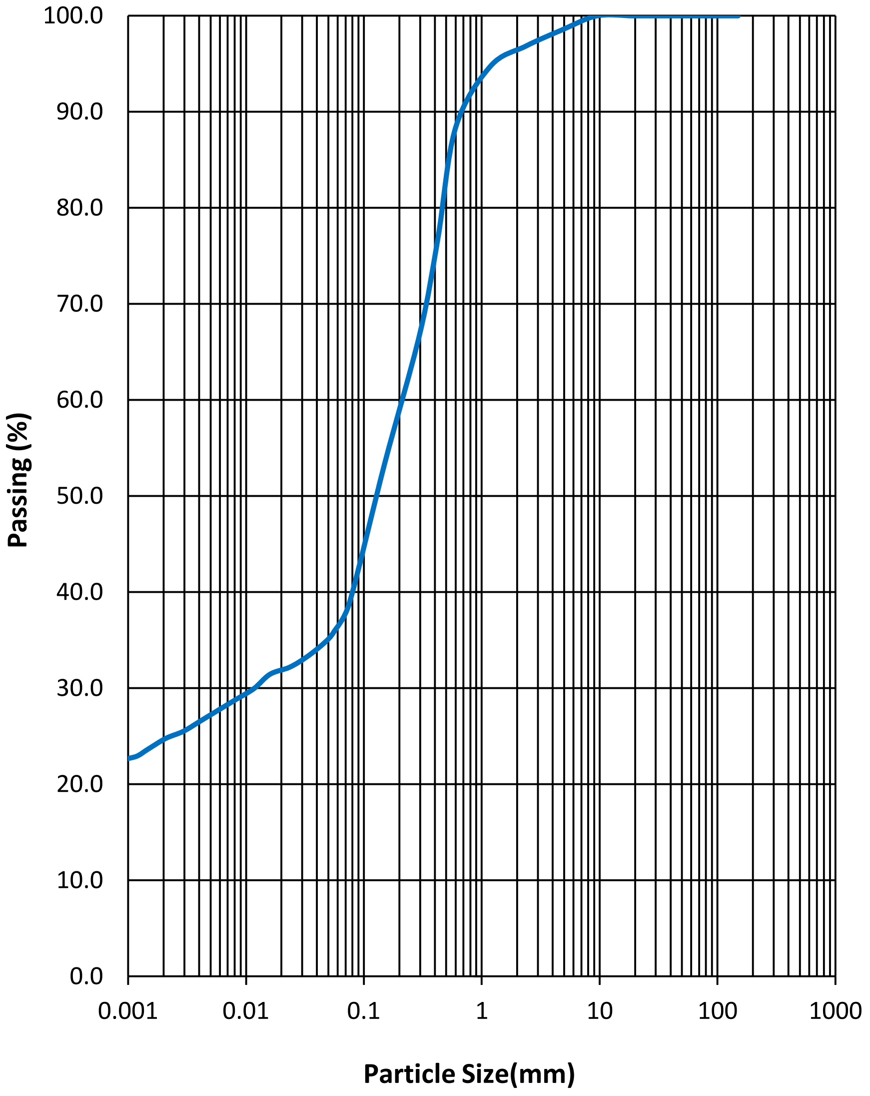
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3 3.5.1

Client:	Talis Consultants	Date Tested:	25/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP14	Depth(m):	0.50 - 1.00
Lab ID:	TP14_0.50_1.00_TALIS1802_PSD	Room Temperature at Test:	19
Tested by:	Leigh	2.36mm Particle Density (t/m³):	2.78
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	98.5
2.36	96.8
1.18	94.7
0.6	88.3
0.425	76.8
0.3	67.0
0.15	53.4
0.075	38.8
0.05594	35.9
0.04687	34.8
0.03322	33.3
0.02354	32.2
0.01599	31.5
0.01171	30.0
0.00829	28.9
0.00588	27.7
0.00416	26.6
0.00295	25.5
0.00209	24.8
0.00148	23.7
0.00118	22.9
0.00090	22.6
0.00086	22.2

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078

Authorized Signature:

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

MOISTURE DENSITY RELATIONSHIP REPORT

Test Method: AS1289.5.2.1

Client: Talis Environmental Consultants
Project: Onslow TW17084
Sample No: TP14
Lab ID: TP14_0.50_1.00_MMDD
Depth(m): 1.00 - 1.40

Date Tested: 18/04/2018
Lab: EPLAB
Job Number: TALIS
Room Temperature at Test: 20ºC

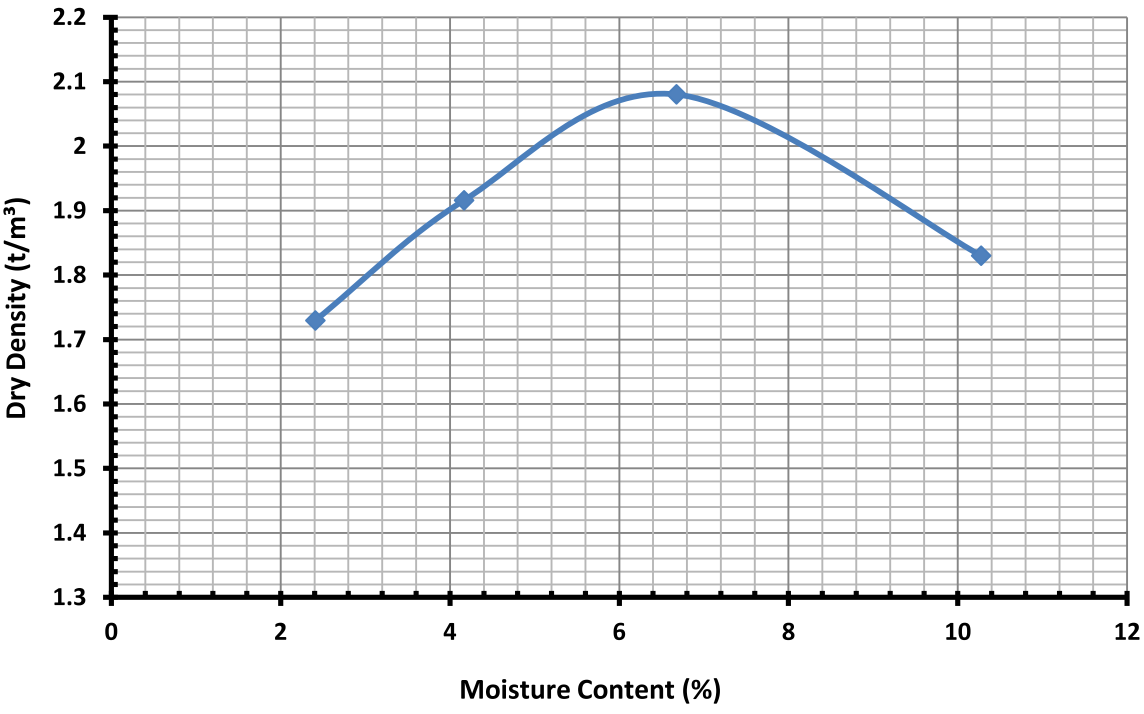
Checked by: Phil
Moisture Content (%): -

Sample Description: Tested in Mould A
Wet Density (t/m³): -
Dry Density (t/m³): -

Results

Maximum Size (mm): 19.00
Oversize dry (%): 0.00

Maximum Dry Density (t/m³): 2.080
Optimum Moisture Content (%): 6.50



Notes:

Stored and Tested the Sample as received

Samples supplied by the Client NATA: 19078 **Authorised Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

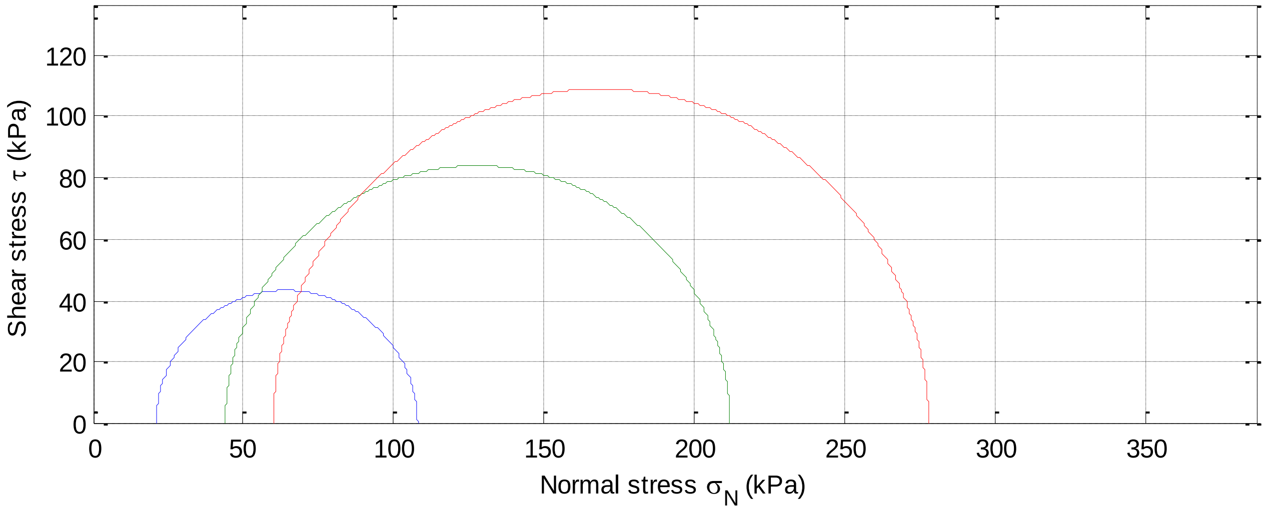
Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP14	Lab:	EPLab
Sample ID:	TP14_0.50_1.00_TALIS1802_CU		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°c

Tested by:	PHIL	Initial Moisture (%):	6.45	Strain Rate (mm/min):	0.0075
Height (mm):	125.11	Final Moisture (%):	3.88	Skempton's (B):	0.99
Diameter (mm):	61.81	Bulk Density (t/m³):	2.10	Geology:	-
L/D Ratio:	2.02	Dry Density (t/m³):	1.98		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

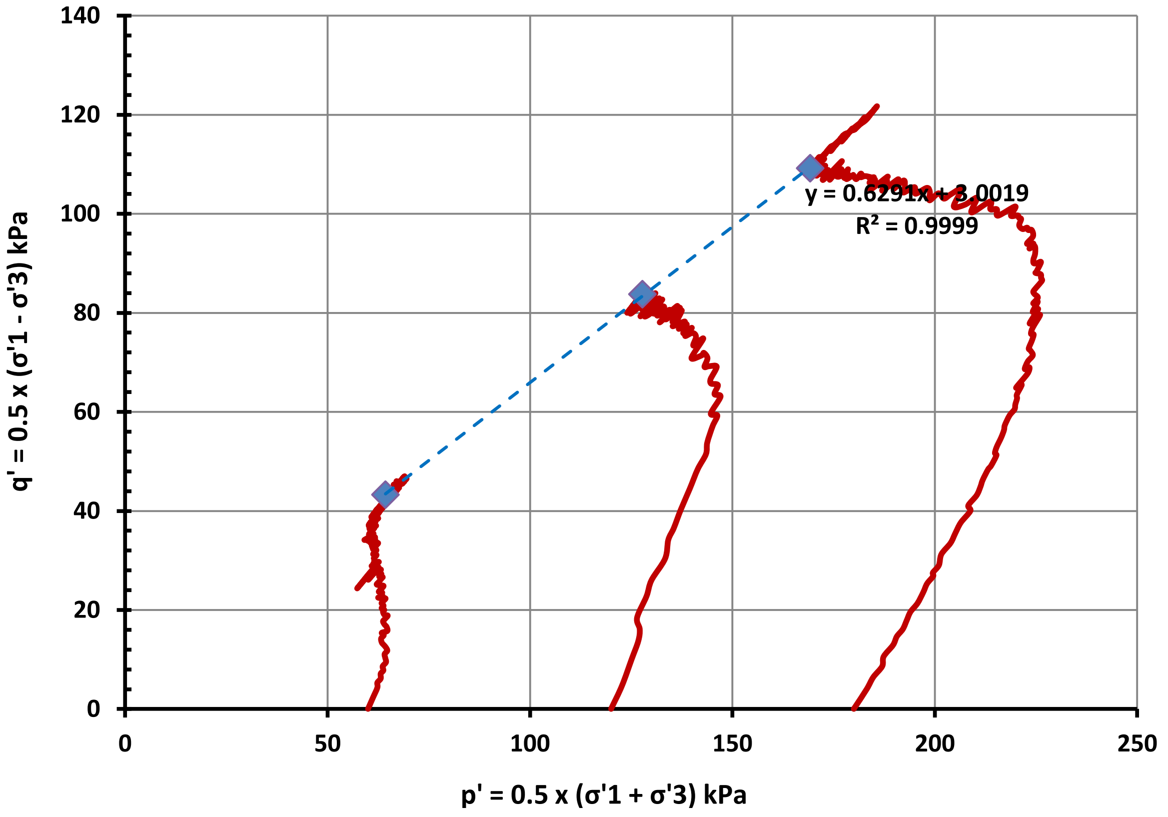
Interpretation from Mohr Circle:	Sample 1 & 2	Sample 1 & 3	Sample 2 & 3
Cohesion C' (kPa):	3.07	3.94	7.51
Angle of Shear Resistance Φ' (Degrees) :	39.69	38.66	37.60

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP14	Lab:	EPLab
Sample ID:	TP14_0.50_1.00_TALIS1802_CU		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : 3.86

Angle of Shear Resistance Φ' (Deg) : 38.98

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

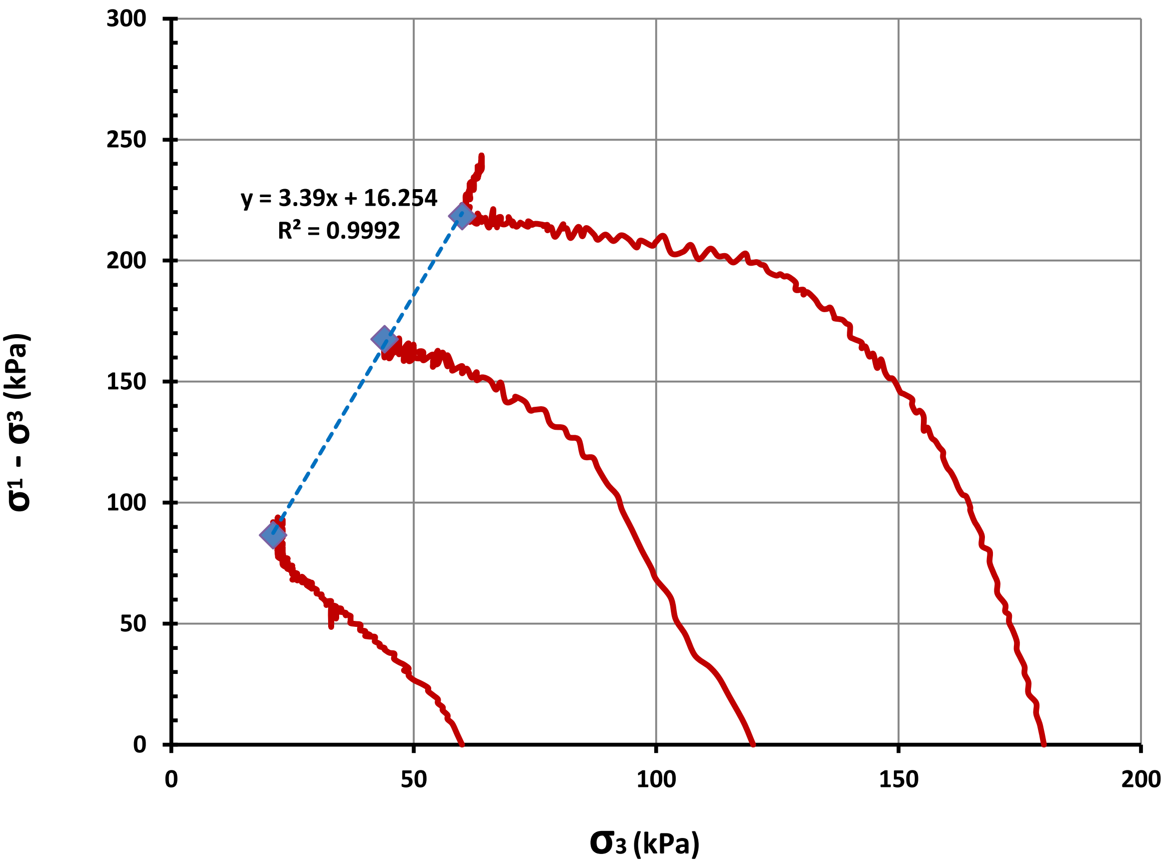
E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP14	Lab:	EPLab
Sample ID:	TP14_0.50_1.00_TALIS1802_CU		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	**3.88**
Angle of Shear Resistance Φ' (Deg) :	**38.97**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

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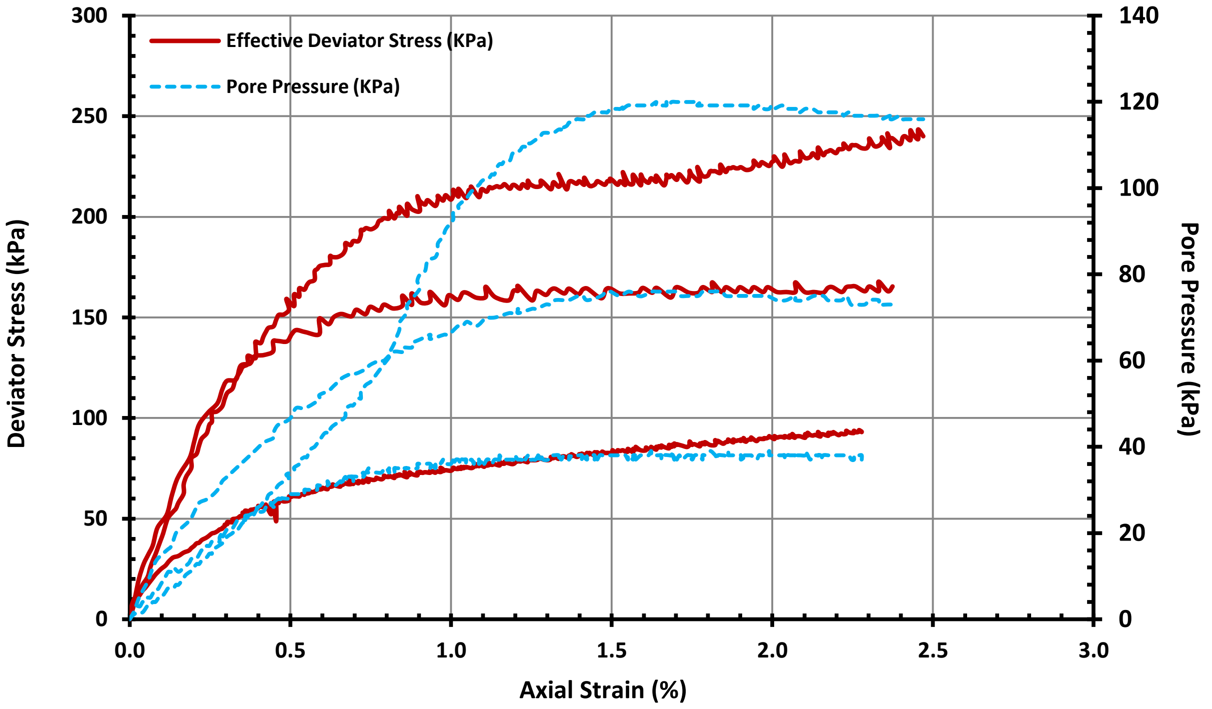
SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP14	Lab:	EPLab
Sample ID:	TP14_0.50_1.00_TALIS1802_CU		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'$_0$	U'$_f$	Principal Effective Stresses			σ'$_1$ - σ'$_3$	Strain (%)
				σ'$_1$	σ'$_3$	σ'$_1$ / σ'$_3$		
1	60	0	39	108	21	5.12	87	1.81
2	120	0	76	212	44	4.81	168	1.81
3	180	0	120	278	60	4.64	218	1.70

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP14	Lab:	EPLab
Sample ID:	TP14_0.50_1.00_TALIS1802_CU		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID:	TP14	**Depth (m):**	0.50 - 1.00
Lab ID:	TP14_0.50_1.00_TALIS1802_CU	**Date Tested:**	26/04/2018

Stage 1 **Stage 2** **Stage 3**

Failure Mode: Bulging Failures observed for all samples

Notes: **Sample remolded based on 95% MMDD @ OMC**

Stored and Tested the Sample as received Accredited for compliance with ISO/IEC 17025-TESTING

Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

NATA ACCREDITATION NO: 19078

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

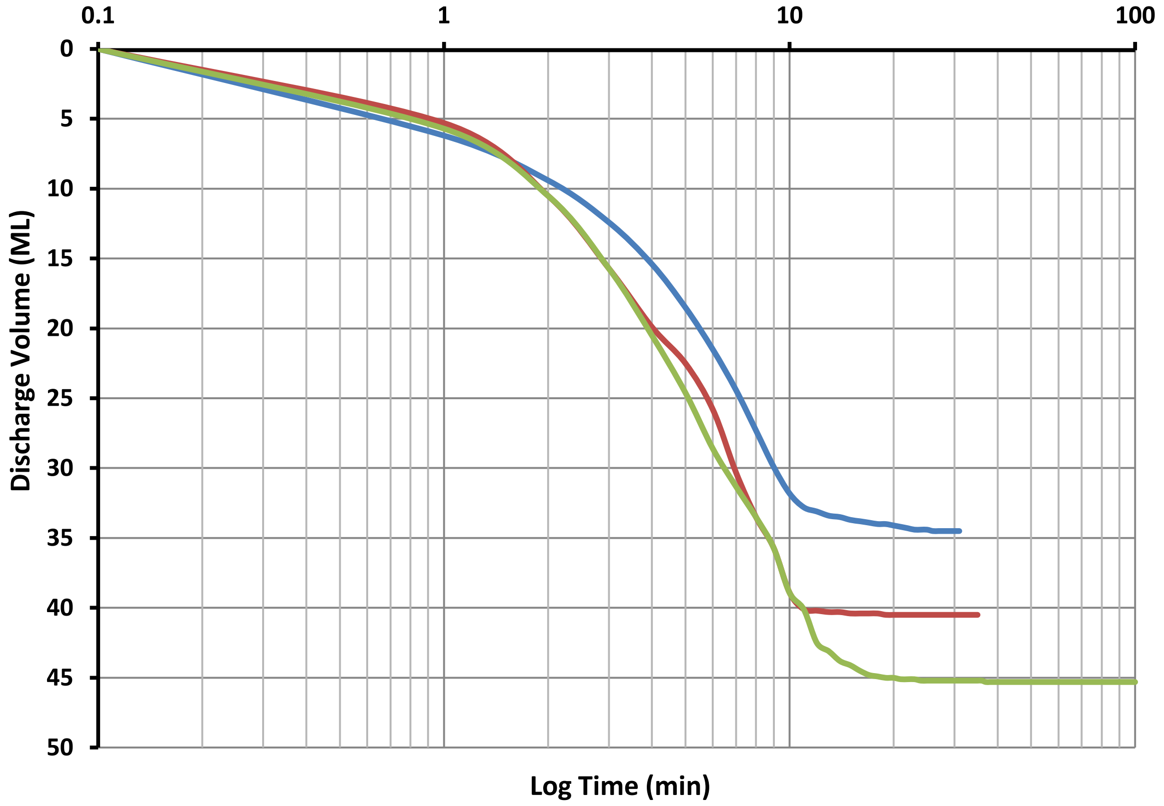
E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP14	Lab:	EPLab
Sample ID:	TP14_0.50_1.00_TALIS1802_CU		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C

Discharge Volume (ML) Vs Log Time (min)



Sample 1	**Cv (cm²/s):**	0.415	based on **t_{90}**
Sample 2	**Cv (cm²/s):**	0.393	based on **t_{90}**
Sample 3	**Cv (cm²/s):**	0.261	based on **t_{90}**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

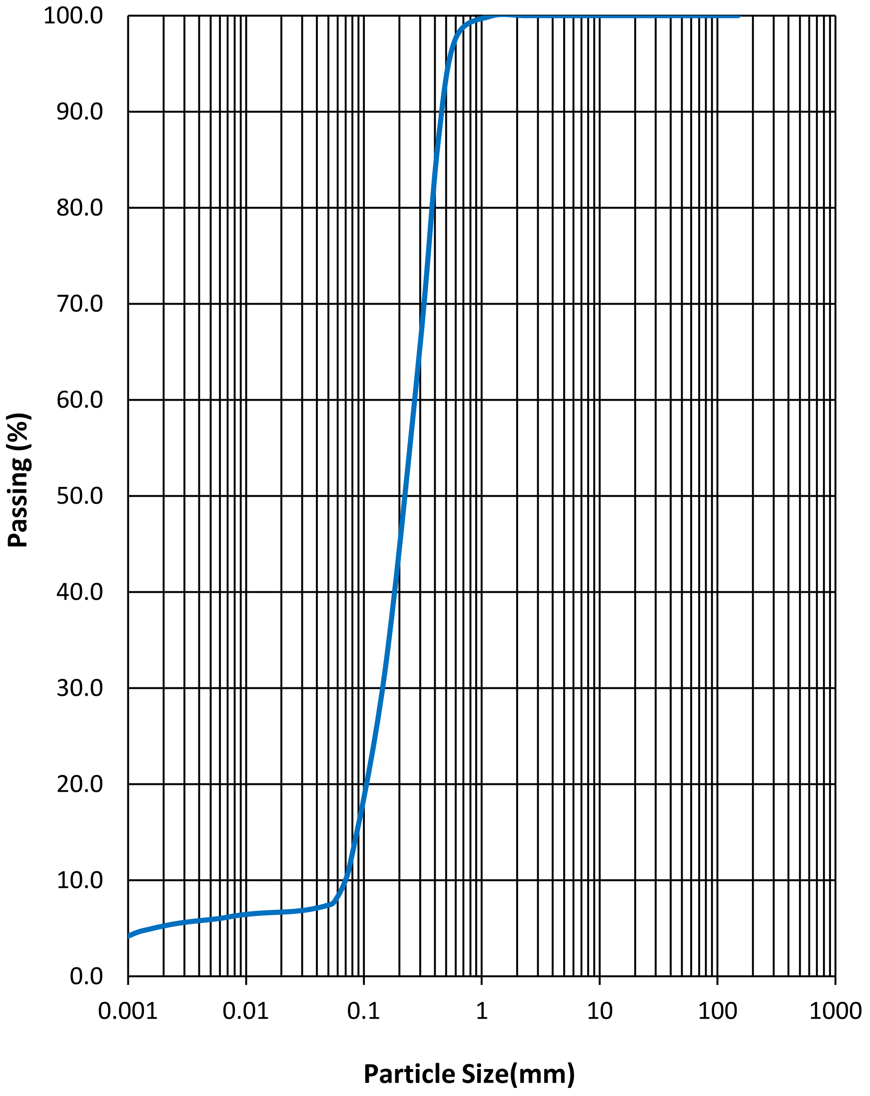
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3 3.5.1

Client:	Talis Consultants	Date Tested:	25/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP22	Depth(m):	0.00 - 0.50
Lab ID:	TP22_0.00_0.50_TALIS1802_PSD	Room Temperature at Test:	19
Tested by:	Leigh	2.36mm Particle Density (t/m³):	2.76
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	100.0
2.36	100.0
1.18	99.9
0.6	97.6
0.425	86.6
0.3	65.7
0.15	31.5
0.075	11.3
0.05693	7.9
0.04776	7.3
0.03385	6.9
0.02396	6.7
0.01628	6.6
0.01190	6.5
0.00842	6.3
0.00596	6.0
0.00422	5.8
0.00299	5.6
0.00212	5.3
0.00150	4.9
0.00120	4.6
0.00092	4.0
0.00087	3.8

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client NATA: 19078

Authorized Signature:

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

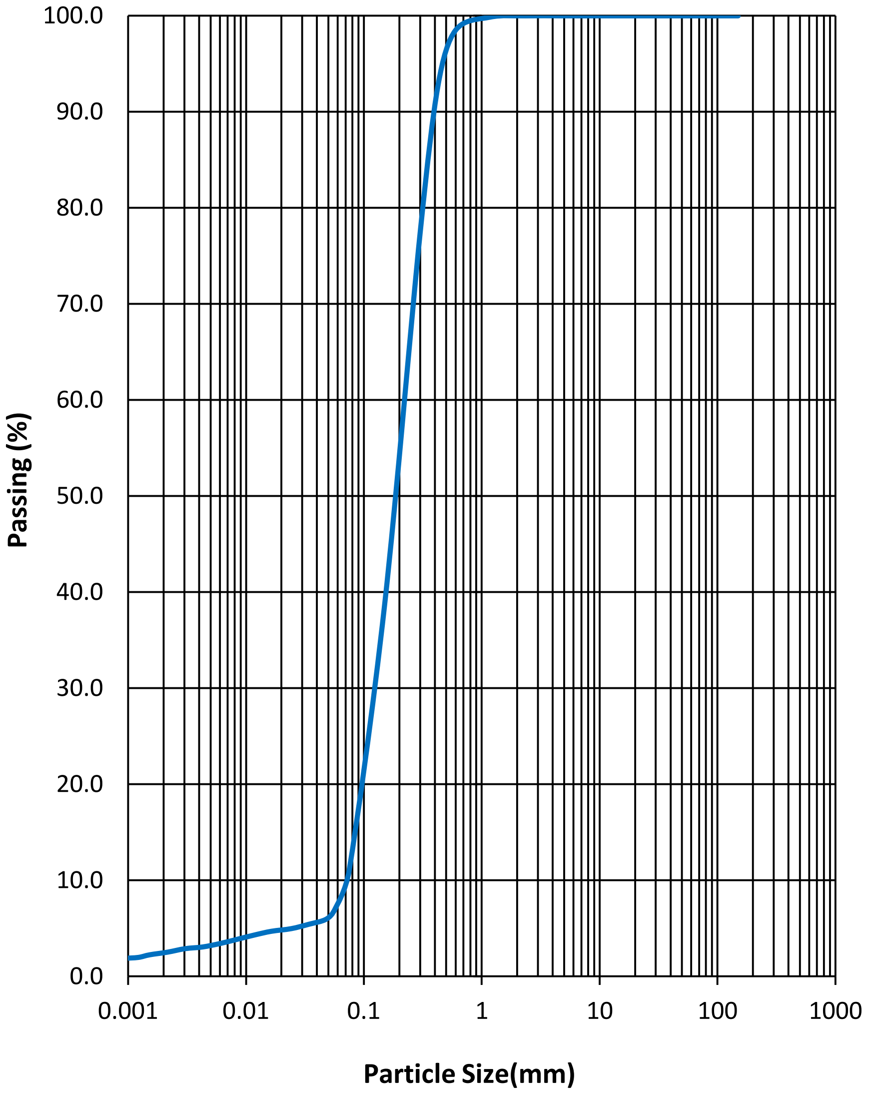
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3 3.5.1

Client:	Talis Consultants	Date Tested:	25/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP22	Depth(m):	3.00 - 3.50
Lab ID:	TP22_3.00_3.50_TALIS1802_PSD	Room Temperature at Test:	19
Tested by:	Leigh	2.36mm Particle Density (t/m³):	2.75
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	100.0
2.36	100.0
1.18	99.9
0.6	98.5
0.425	92.7
0.3	77.4
0.15	38.7
0.075	11.0
0.05714	7.1
0.04812	6.0
0.03413	5.4
0.02419	5.0
0.01646	4.7
0.01205	4.3
0.00854	3.9
0.00605	3.4
0.00429	3.1
0.00304	2.9
0.00215	2.5
0.00152	2.3
0.00122	2.0
0.00093	1.9
0.00088	1.9

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client NATA: 19078

Authorized Signature:

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

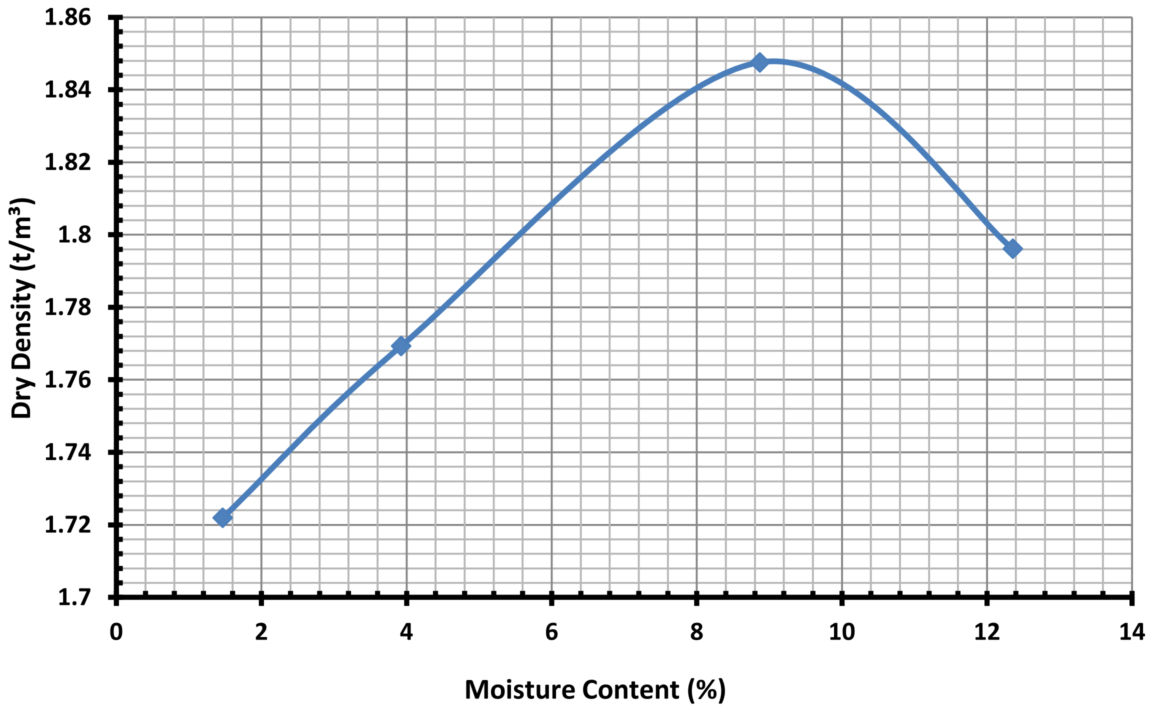
MOISTURE DENSITY RELATIONSHIP REPORT

Test Method: AS1289.5.2.1

Client:	Talis Environmental Consultants	Date Tested:	19/04/2018
Project:	Onslow TW17084	Lab:	EPLAB
Sample No:	TP22	Job Number:	TALIS
Lab ID:	TP22_3.00_3.50_MMDD		
Depth(m):	3.00 - 3.50	Room Temperature at Test:	20°C
Checked by:	Phil	Sample Description:	Tested in Mould A
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Results

Maximum Size (mm):	19.00	**Maximum Dry Density (t/m³):**	**1.845**
Oversize dry (%):	0.00	**Optimum Moisture Content (%):**	**8.80**



Notes:

Stored and Tested the Sample as received

Samples supplied by the Client NATA: 19078 **Authorised Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

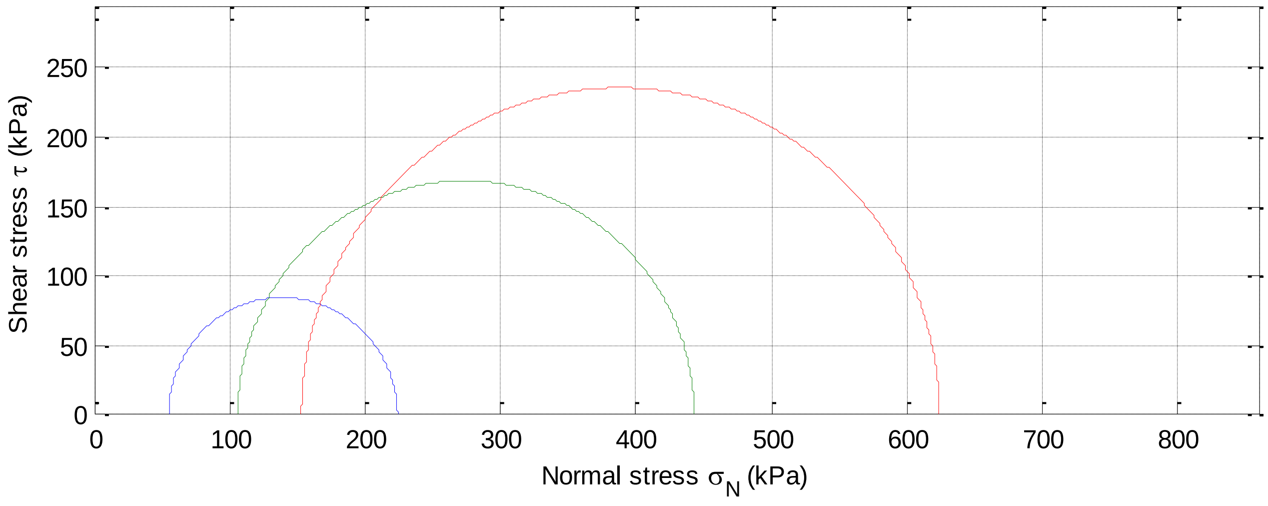
Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP22	Lab:	EPLab
Sample ID:	TP22_3.00_3.50_TALIS1802_CU		
Depth (m):	3.00 - 3.50	Room Temperature at Test:	~ 18°C

Tested by:	PHIL	Initial Moisture (%):	8.84	Strain Rate (mm/min):	0.0075
Height (mm):	125.01	Final Moisture (%):	4.91	Skempton's (B):	0.99
Diameter (mm):	61.78	Bulk Density (t/m³):	1.91	Geology:	-
L/D Ratio:	2.02	Dry Density (t/m³):	1.75		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	Sample 1 & 2	Sample 1 & 3	Sample 2 & 3
Cohesion C' (kPa):	0.46	1.86	11.29
Angle of Shear Resistance Φ' (Degrees) :	37.23	36.58	35.45

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Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
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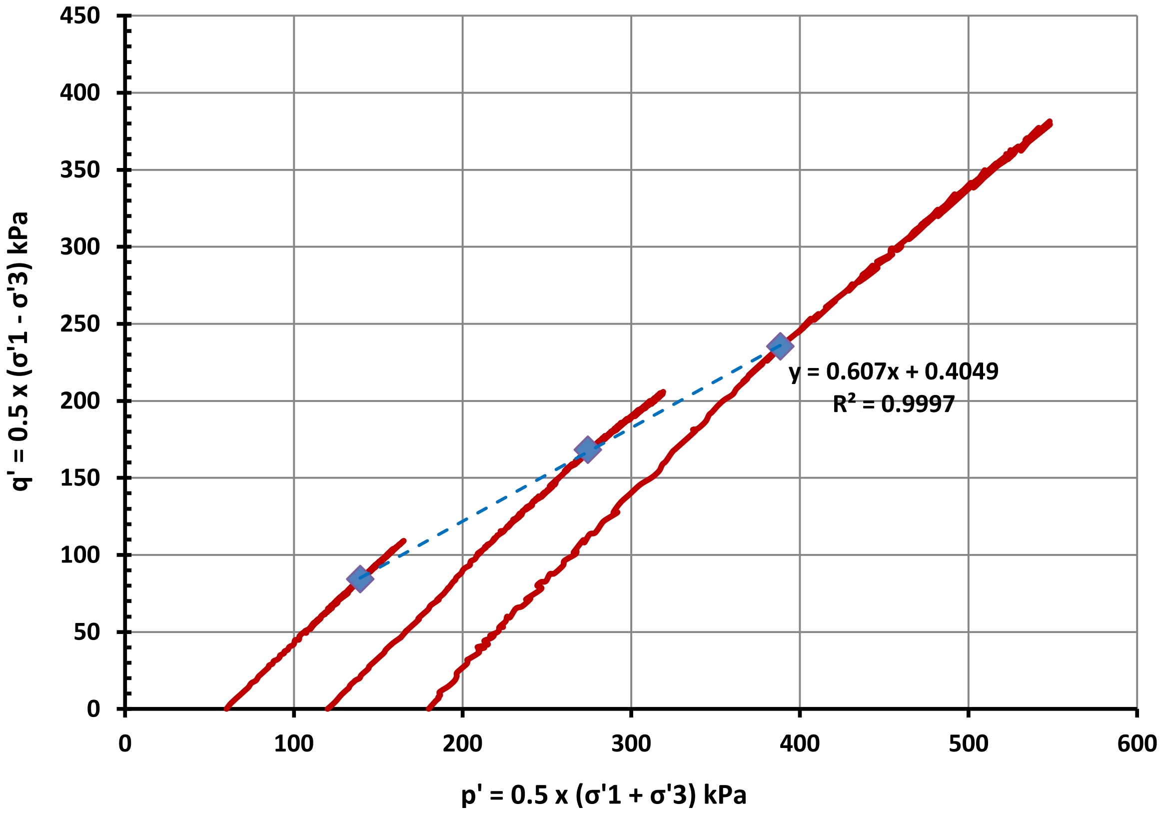
E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP22	Lab:	EPLab
Sample ID:	TP22_3.00_3.50_TALIS1802_CU		
Depth (m):	3.00 - 3.50	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : 0.52
Angle of Shear Resistance Φ' (Deg) : 37.37

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
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Mob: 0422 814 231

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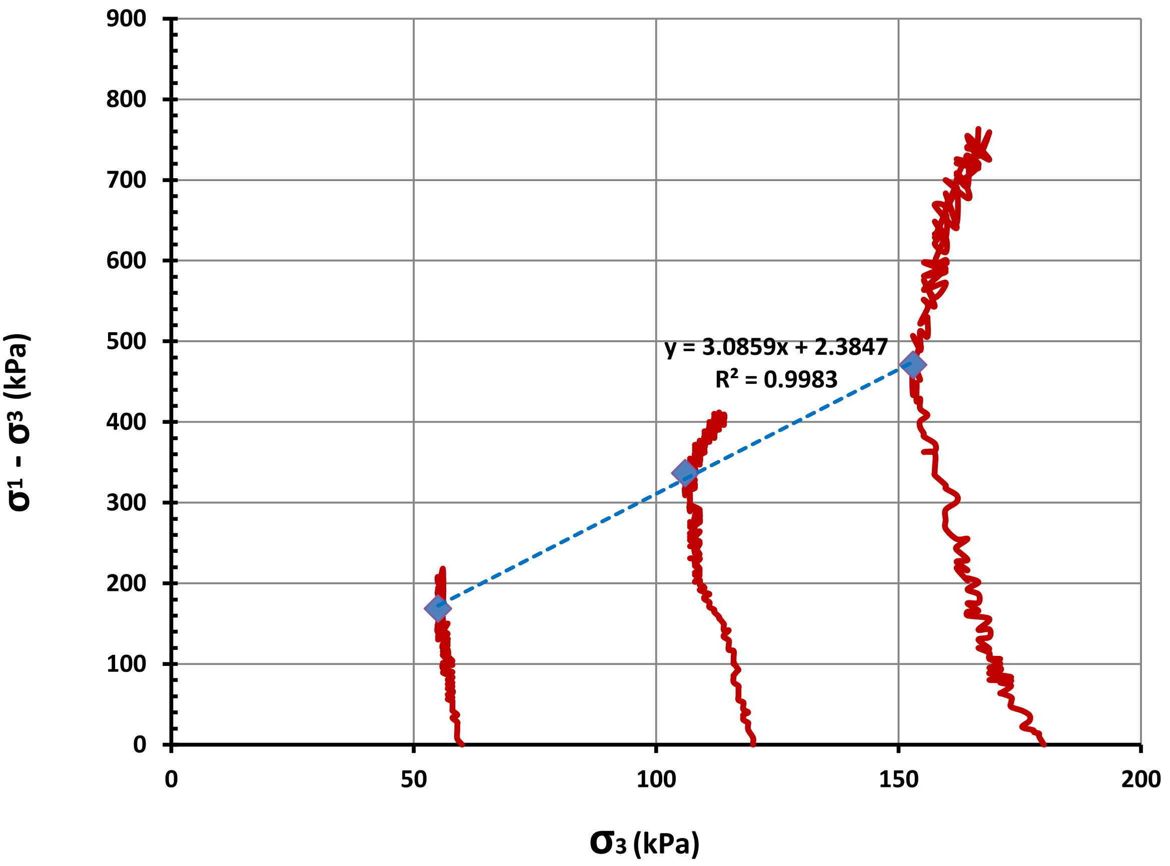
SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP22	Lab:	EPLab
Sample ID:	TP22_3.00_3.50_TALIS1802_CU		
Depth (m):	3.00 - 3.50	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : **0.59**
Angle of Shear Resistance Φ' (Deg) : **37.32**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

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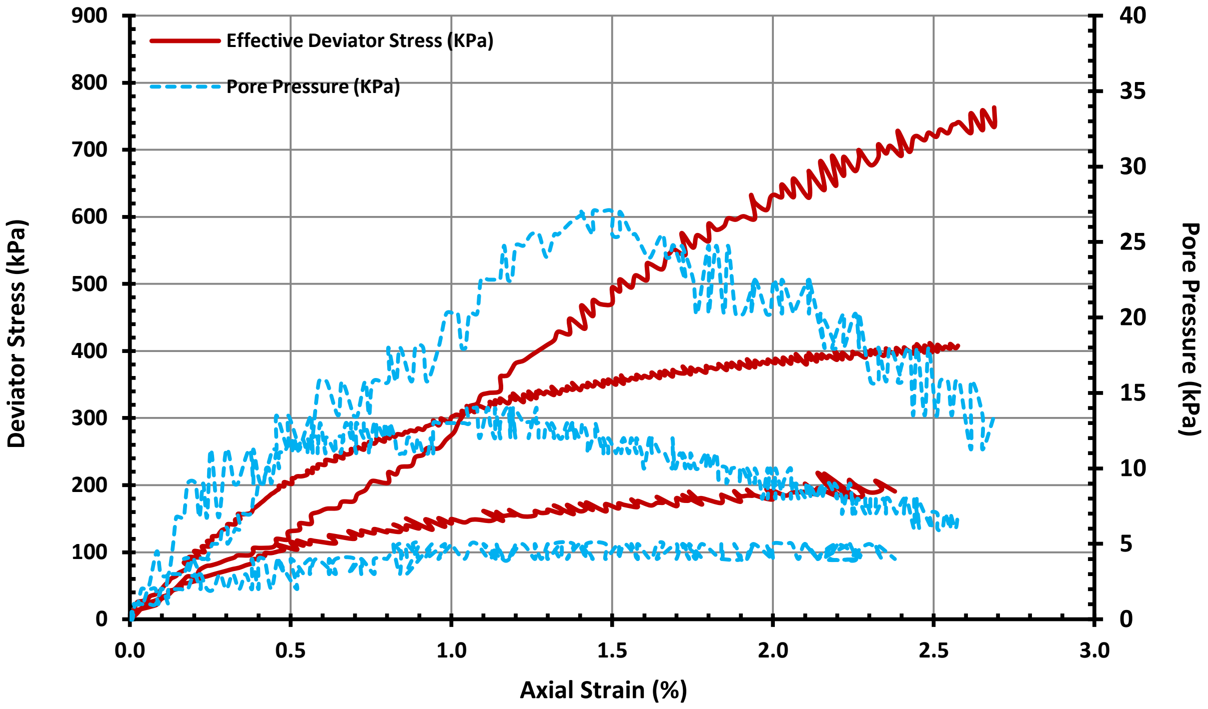
SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP22	Lab:	EPLab
Sample ID:	TP22_3.00_3.50_TALIS1802_CU		
Depth (m):	3.00 - 3.50	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'$_0$	U'$_f$	Principal Effective Stresses			σ'$_1$ - σ'$_3$	Strain (%)
				σ'$_1$	σ'$_3$	σ'$_1$ / σ'$_3$		
1	60	0	5	224	55	4.07	169	1.70
2	120	0	14	443	106	4.18	337	1.19
3	180	0	27	624	153	4.08	471	1.50

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client: Talis Consultants
Project: TW17084 Onslow
Sample No: TP22
Sample ID: TP22_3.00_3.50_TALIS1802_CU
Depth (m): 3.00 - 3.50

Date Tested: 26/04/2018
EP Lab Job Number: TALIS
Lab: EPLab
Room Temperature at Test: ~ 18°C

Photo After Test

Sample ID: TP22
Lab ID: TP22_3.00_3.50_TALIS1802_CU
Depth (m): 3.00 - 3.50
Date Tested: 26/04/2018

Stage 1

Stage 2

Stage 3

Failure Mode: Bulging Failures observed for all samples

Notes: **Sample remolded based on 95% MMDD @ OMC**

Stored and Tested the Sample as received Accredited for compliance with ISO/IEC 17025-TESTING

Samples supplied by the Client

NATA: 19078

Authorised Signatory (Geotechnical Engineer):

NATA
ACCREDITATION NO: 19078

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

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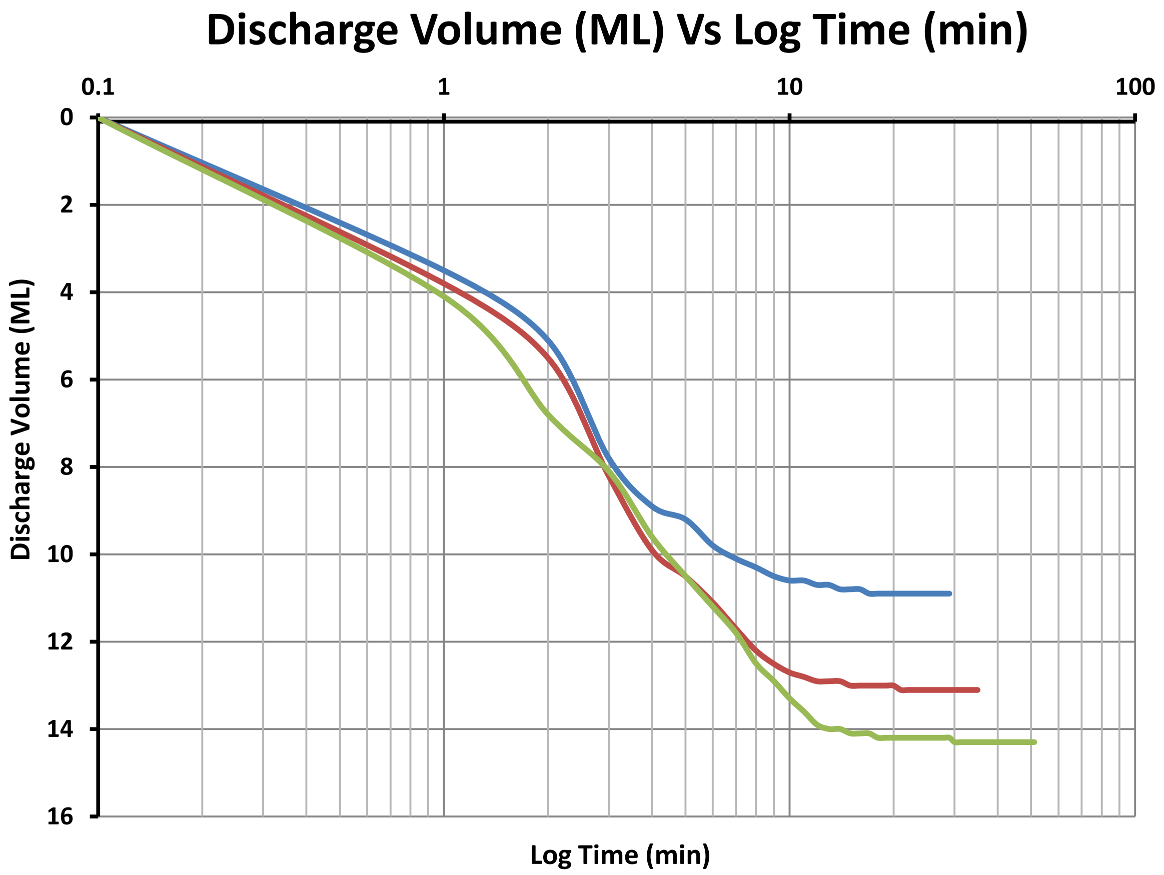
SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP22	Lab:	EPLab
Sample ID:	TP22_3.00_3.50_TALIS1802_CU		
Depth (m):	3.00 - 3.50	Room Temperature at Test:	~ 18°C



Sample 1	**Cv (cm²/s):**	0.486	based on **t₉₀**
Sample 2	**Cv (cm²/s):**	0.456	based on **t₉₀**
Sample 3	**Cv (cm²/s):**	0.365	based on **t₉₀**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

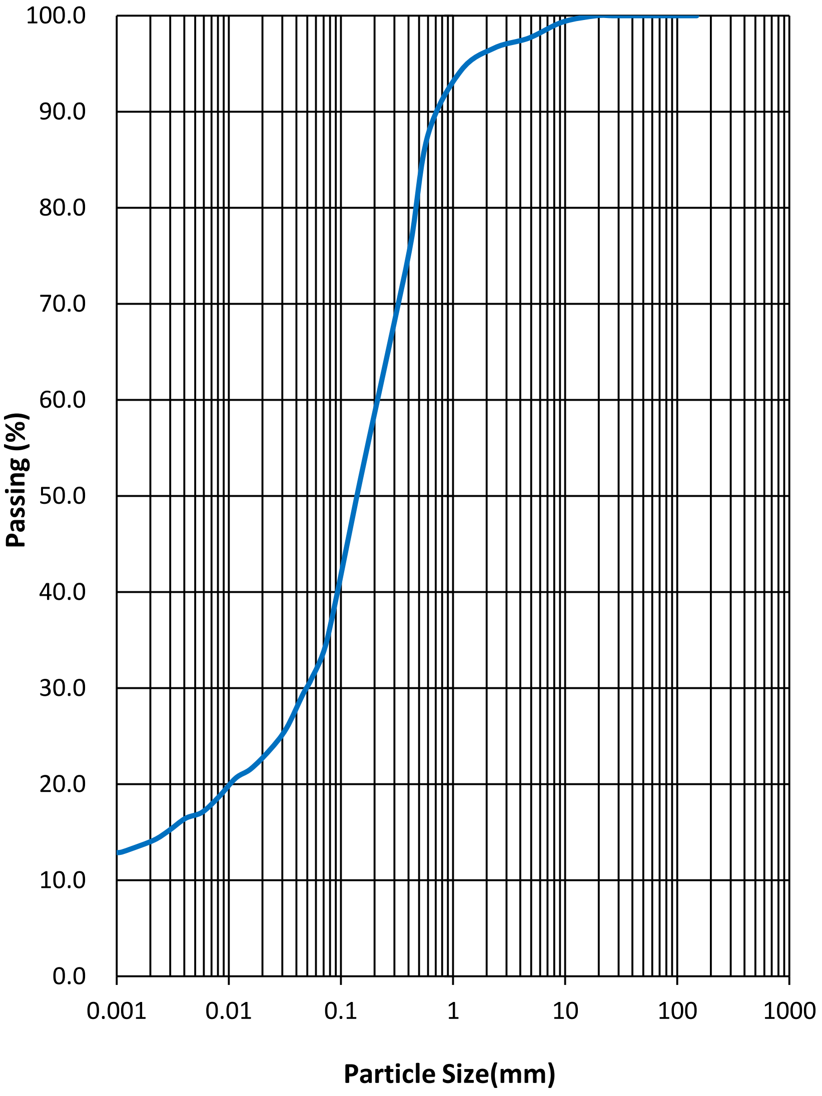
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1 3.6.3

Client:	Talis Consultants	Date Tested:	27/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	TP29 @ 0.00m	Depth(m):	0.00 - 0.50
Sample ID:	TP29_0.00_TALIS1801_PSD	Room Temperature at Test:	20°
Tested by:	Hank	2.36mm Particle Density (t/m³):	2.77
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	99.3
4.75	97.7
2.36	96.7
1.18	94.3
0.6	87.6
0.425	76.6
0.3	68.1
0.15	51.8
0.075	34.9
0.05454	31.0
0.04576	29.3
0.03257	25.8
0.02312	23.5
0.01575	21.6
0.01152	20.6
0.00817	18.7
0.00579	17.1
0.00410	16.4
0.00291	15.2
0.00215	14.2
0.00130	13.2
0.00106	12.9
0.00089	12.9
0.00080	12.6

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078 **Authorized Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

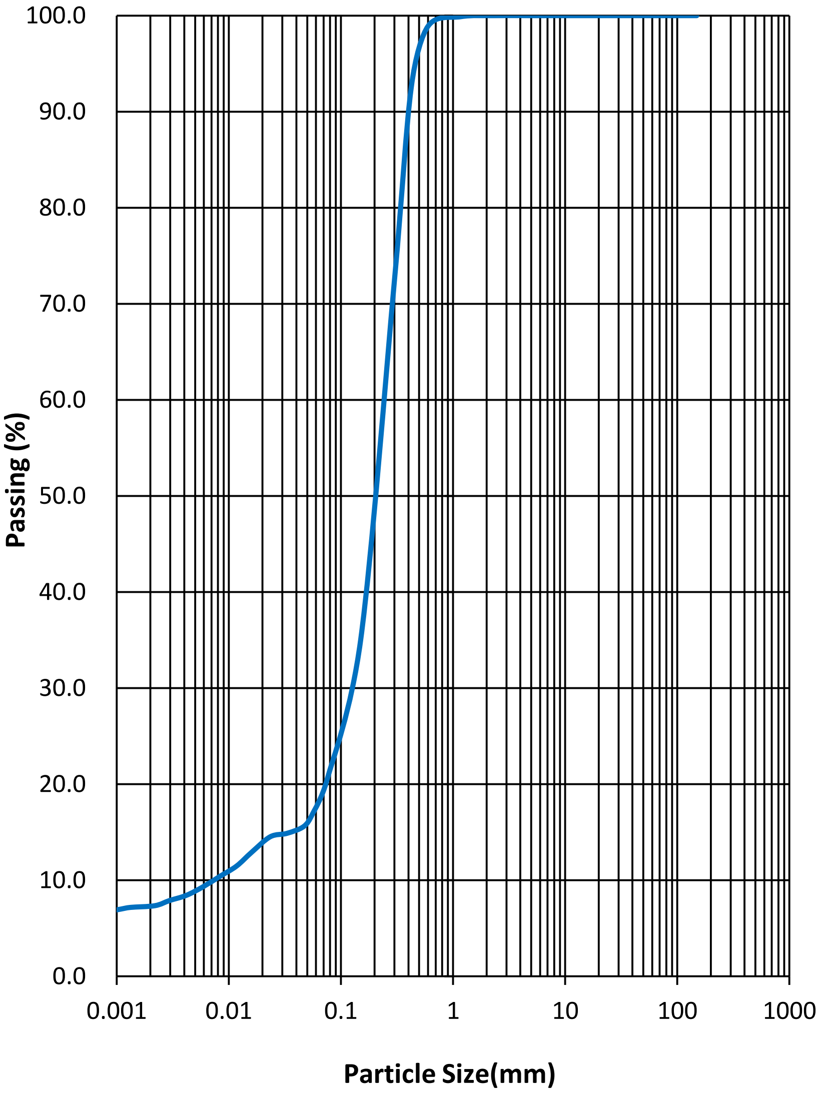
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1 3.6.3

Client:	Talis Consultants	Date Tested:	23/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	TP29 @ 0.50m	Depth(m):	0.5
Sample ID:	TP29_0.50_TALIS1801_PSD	Room Temperature at Test:	20°
Tested by:	Hank	2.36mm Particle Density (t/m³):	2.71
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	100.0
2.36	100.0
1.18	99.9
0.6	98.9
0.425	92.6
0.3	72.3
0.15	35.0
0.075	20.4
0.05555	16.9
0.04666	15.6
0.03307	14.9
0.02341	14.5
0.01598	12.9
0.01172	11.5
0.00831	10.4
0.00590	9.3
0.00418	8.4
0.00296	7.9
0.00219	7.4
0.00133	7.2
0.00108	7.0
0.00090	6.8
0.00081	6.6

PSD Graph



Notes:
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Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

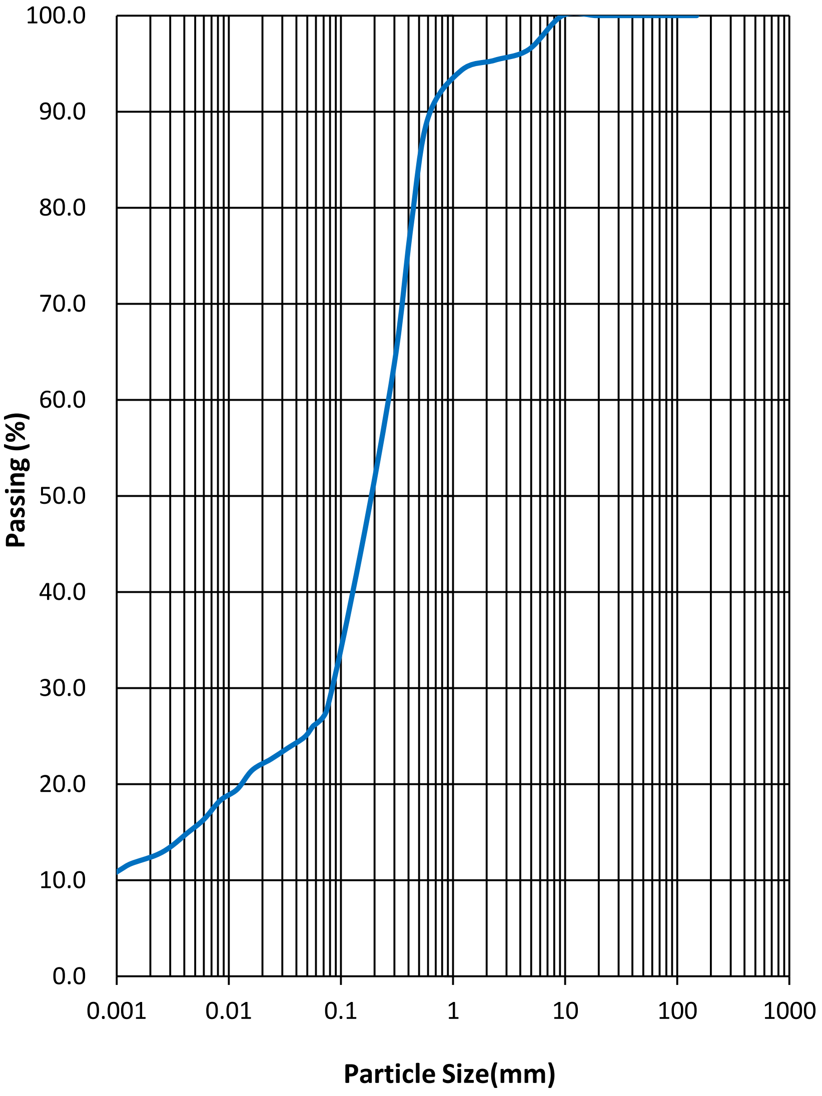
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1 3.6.3

Client:	Talis Consultants	Date Tested:	22/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	TP29 @ 3.00m	Depth(m):	3
Sample ID:	TP29_3.00_TALIS1801_PSD	Room Temperature at Test:	20°
Tested by:	Hank	2.36mm Particle Density (t/m³):	2.66
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	96.5
2.36	95.4
1.18	94.3
0.6	89.4
0.425	78.3
0.3	63.8
0.15	44.1
0.075	27.8
0.05643	26.0
0.04732	24.9
0.03354	23.7
0.02377	22.6
0.01618	21.5
0.01186	19.5
0.00840	18.3
0.00596	16.3
0.00423	14.9
0.00300	13.4
0.00222	12.6
0.00134	11.7
0.00110	11.2
0.00092	10.6
0.00083	10.3

PSD Graph



Notes:
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Samples supplied by the Client

NATA: 19078 **Authorized Signature:**

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Integrity Precision Innovation

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

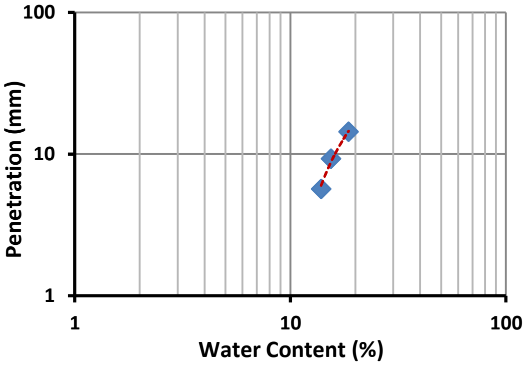
ATTERBERG LIMITS TEST REPORT

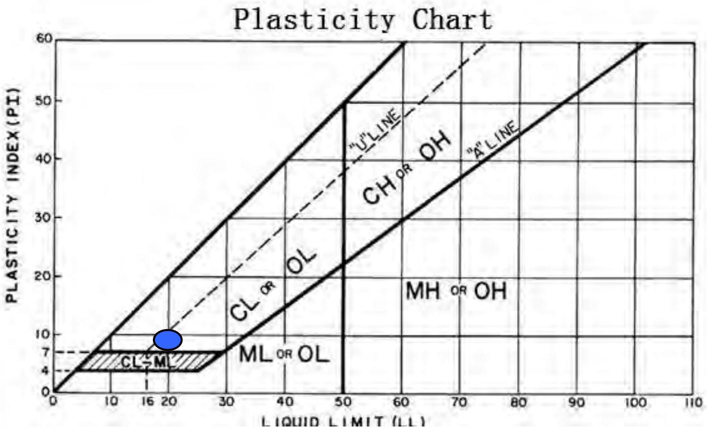
Test Method: BS1377 AS1289.2.1.1 7.1.1 3.1.1 3.2.1 3.4.1

Client:	Talis Consultants	Date Tested:	01/02/2018
Project:	Onslow TW17084	Lab:	EPLAB
Sample No:	BH29 @ 3.00m	Job Number:	TALIS
Lab ID:	BH29_3.00_TALIS1801_ATT		
Depth(m):	3	Room Temperature at Test:	20°C
Tested by:	Phil	Sample Description:	-
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Liquid Limit (%):	19.94
Plastic Limit (%):	11.66
Plasticity Index (%):	8.29
Liquidity Index (%):	-
Shrinkage Limit (%):	10.35
Linear Shrinkage(%):	2.20

Results Chart





Notes: The sample/s were tested oven dried, dry sieved and in a 125-250mm mould.

Stored and Tested the Sample as received

Samples supplied by the Client NATA: 19078 **Authorised Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

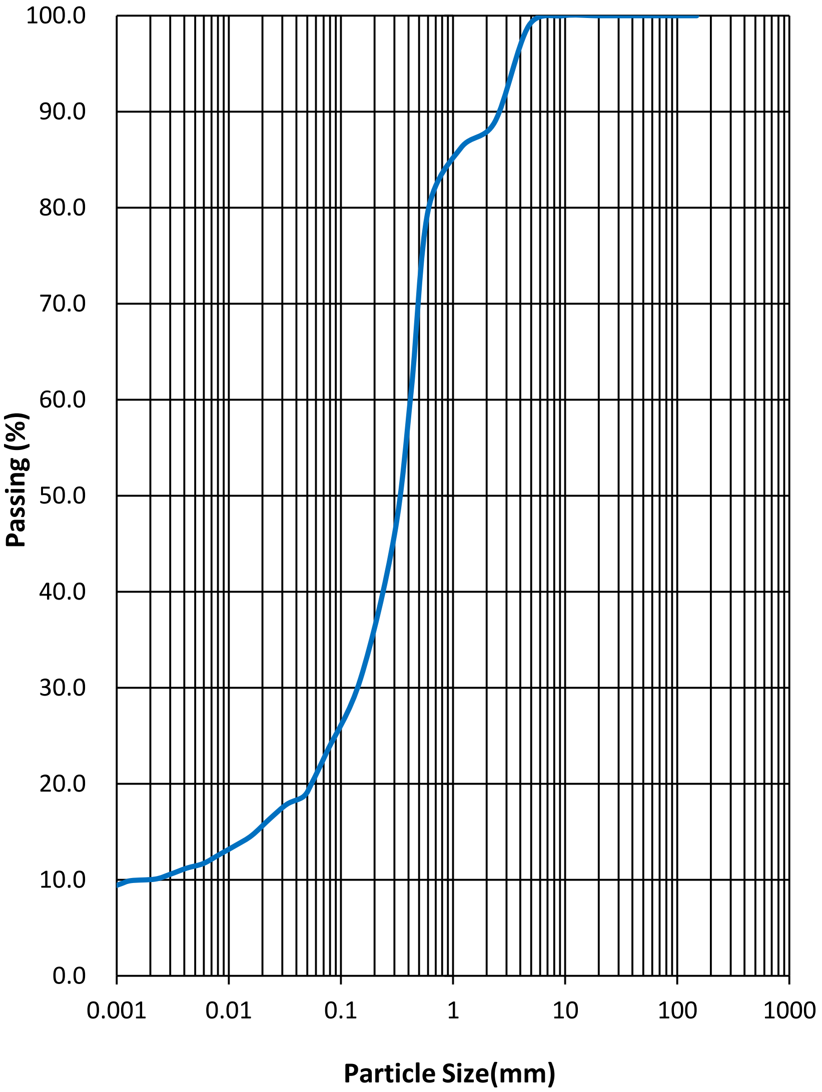
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1 3.6.3

Client:	Talis Consultants	Date Tested:	23/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	TP36 @ 3.00m	Depth(m):	3
Sample ID:	TP36_3.00_TALIS1801_PSD	Room Temperature at Test:	20°
Tested by:	Hank	2.36mm Particle Density (t/m³):	2.66
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	99.0
2.36	88.9
1.18	86.2
0.6	79.7
0.425	61.1
0.3	45.9
0.15	31.0
0.075	23.4
0.05540	20.2
0.04660	18.7
0.03305	17.9
0.02350	16.4
0.01605	14.6
0.01177	13.7
0.00835	12.7
0.00593	11.7
0.00420	11.2
0.00297	10.6
0.00220	10.1
0.00133	9.9
0.00109	9.6
0.00091	9.3
0.00082	9.1

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078 **Authorized Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

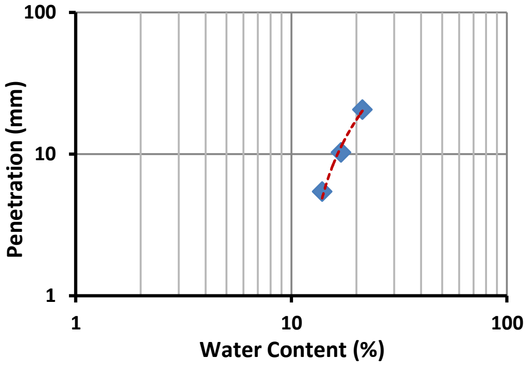
ATTERBERG LIMITS TEST REPORT

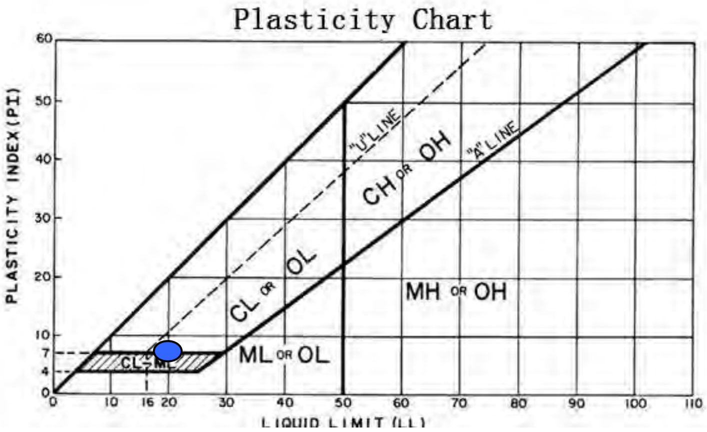
Test Method: BS1377 AS1289.2.1.1 7.1.1 3.1.1 3.2.1 3.4.1

Client:	Talis Consultants	Date Tested:	01/02/2018
Project:	Onslow TW17084	Lab:	EPLAB
Sample No:	TP36 @ 3.00m	Job Number:	TALIS
Lab ID:	TP36_3.00_TALIS1801_ATT		
Depth(m):	3.00 - 3.50	Room Temperature at Test:	20°C
Tested by:	Phil	Sample Description:	-
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Liquid Limit (%):	19.80
Plastic Limit (%):	12.50
Plasticity Index (%):	7.30
Liquidity Index (%):	-
Shrinkage Limit (%):	11.21
Linear Shrinkage(%):	4.07

Results Chart





Notes: The sample/s were tested oven dried, dry sieved and in a 125-250mm mould.

Stored and Tested the Sample as received

Samples supplied by the Client NATA: 19078 **Authorised Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1 3.6.3

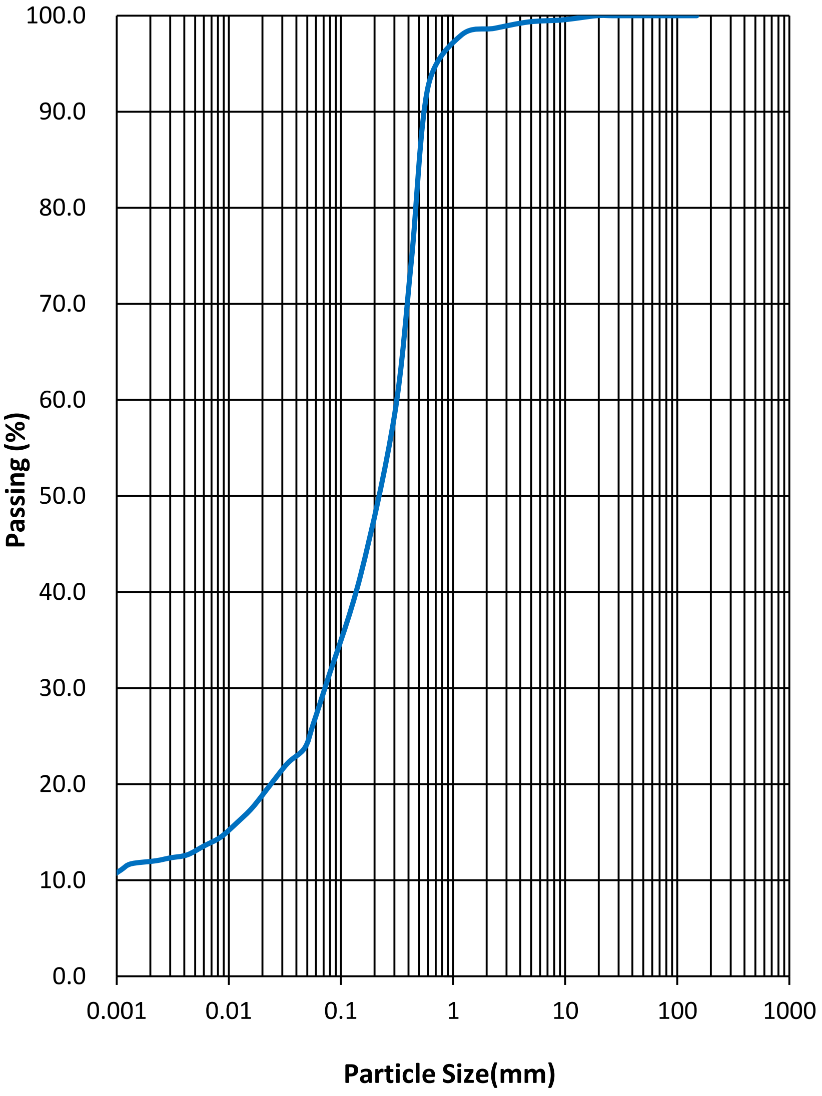
Client:	Talis Consultants	Date Tested:	23/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	TP38 @ 1.50m	Depth(m):	1.5
Sample ID:	TP38_1.50_TALIS1801_PSD	Room Temperature at Test:	20°

Tested by: Hank
Checked by: Phil

2.36mm Particle Density (t/m³): 2.68

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	99.6
4.75	99.4
2.36	98.7
1.18	98.0
0.6	92.6
0.425	74.5
0.3	58.3
0.15	41.8
0.075	30.7
0.05644	26.2
0.04744	23.8
0.03363	22.2
0.02386	20.1
0.01628	17.6
0.01192	16.0
0.00845	14.5
0.00598	13.6
0.00424	12.7
0.00300	12.3
0.00222	12.0
0.00134	11.7
0.00110	11.1
0.00091	10.5
0.00082	10.2

PSD Graph



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Samples supplied by the Client

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Integrity Precision Innovation

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

PARTICLE SIZE DISTRIBUTION TEST REPORT

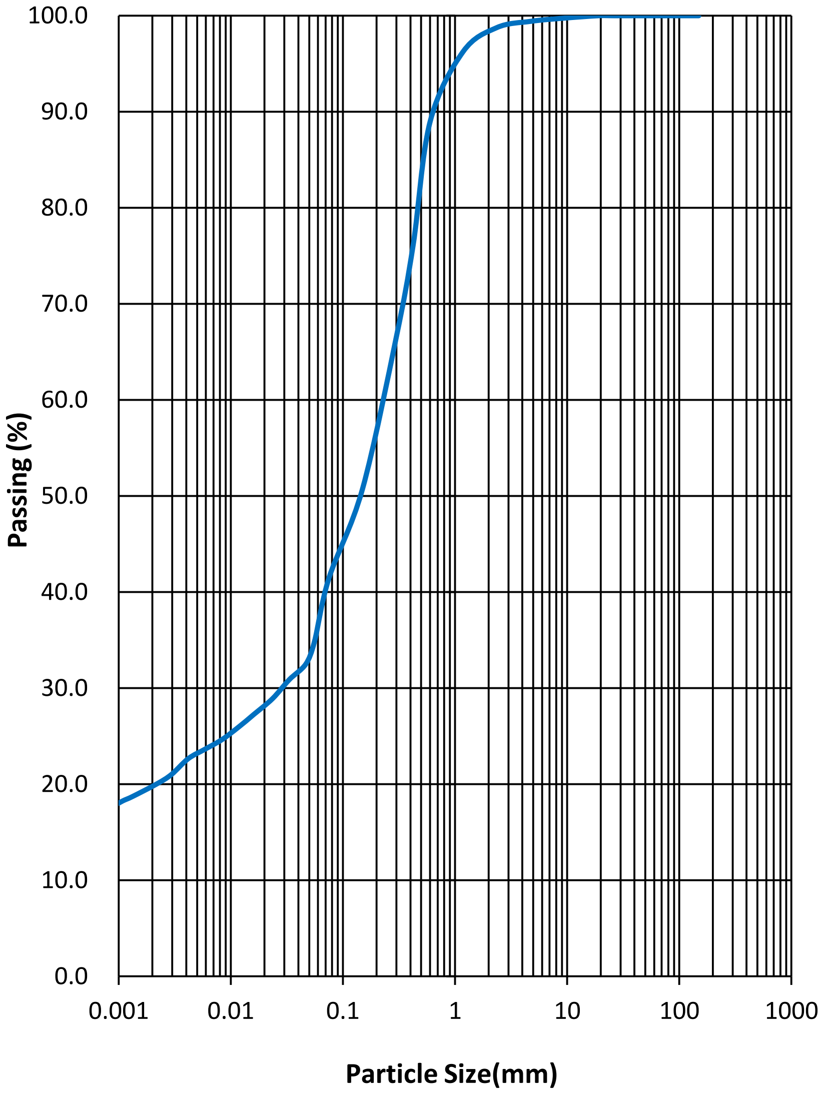
Test Method: AS 1289 3.6.1 3.6.3

Client:	Talis Consultants	Date Tested:	23/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	TP44 @ 0.00m	Depth(m):	0.0 - 0.5
Sample ID:	TP44_0.00_TALIS1801_PSD	Room Temperature at Test:	20°

Tested by: Hank
2.36mm Particle Density (t/m³): 2.67
Checked by: Phil

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	99.8
4.75	99.4
2.36	98.8
1.18	96.2
0.6	88.9
0.425	76.2
0.3	66.5
0.15	50.7
0.075	41.4
0.05584	34.8
0.04691	32.5
0.03327	30.9
0.02361	28.9
0.01607	27.3
0.01177	26.0
0.00834	24.6
0.00591	23.7
0.00418	22.7
0.00297	21.0
0.00219	20.0
0.00133	18.7
0.00109	18.3
0.00091	17.7
0.00082	17.4

PSD Graph



Notes:
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NATA: 19078 **Authorized Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

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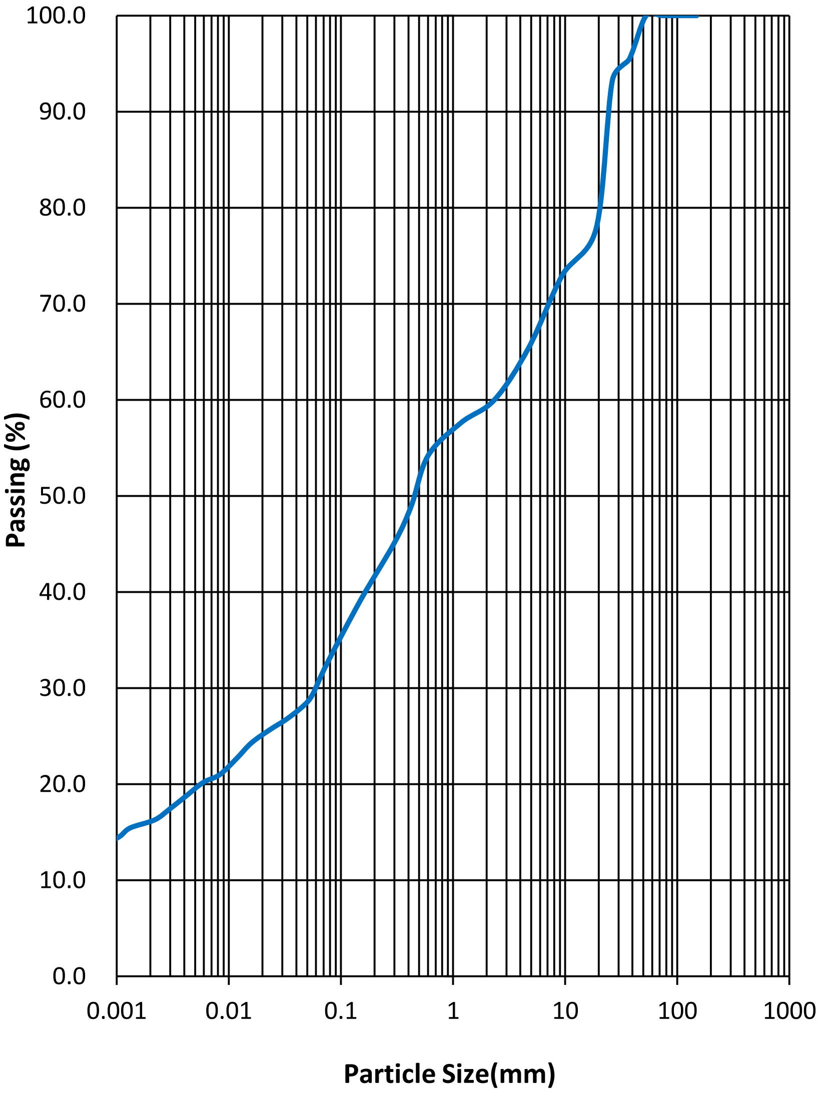
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1 3.6.3

Client:	Talis Consultants	Date Tested:	23/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	TP44 @ 2.50m	Depth(m):	2.5
Sample ID:	TP44_2.50_TALIS1801_PSD	Room Temperature at Test:	20°
Tested by:	Hank	2.36mm Particle Density (t/m³):	2.68
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	95.5
26.5	93.3
19	77.9
9.5	73.0
4.75	65.4
2.36	60.0
1.18	57.6
0.6	54.2
0.425	49.0
0.3	45.1
0.15	39.2
0.075	32.5
0.05566	29.3
0.04667	28.2
0.03310	26.8
0.02346	25.7
0.01597	24.3
0.01171	22.7
0.00831	21.0
0.00589	20.2
0.00417	18.8
0.00296	17.4
0.00219	16.3
0.00133	15.5
0.00109	14.7
0.00090	14.1
0.00082	13.8

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078 **Authorized Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

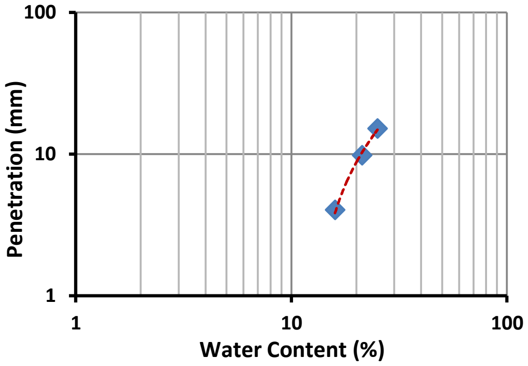
ATTERBERG LIMITS TEST REPORT

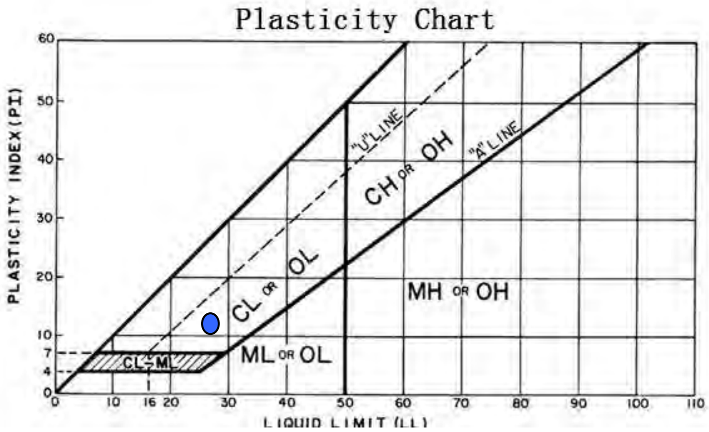
Test Method: BS1377 AS1289.2.1.1 7.1.1 3.1.1 3.2.1 3.4.1

Client:	Talis Consultants	Date Tested:	01/02/2018
Project:	Onslow TW17084	Lab:	EPLAB
Sample No:	TP44 @ 2.50m	Job Number:	TALIS
Lab ID:	TP44_2.50_TALIS1801_ATT		
Depth(m):	2.50 - 3.00	Room Temperature at Test:	20°C
Tested by:	Phil	Sample Description:	-
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Liquid Limit (%):	26.88
Plastic Limit (%):	14.43
Plasticity Index (%):	12.45
Liquidity Index (%):	-
Shrinkage Limit (%):	12.02
Linear Shrinkage(%):	9.25

Results Chart





Notes: The sample/s were tested oven dried, dry sieved and in a 125-250mm mould.

Stored and Tested the Sample as received

Samples supplied by the Client NATA: 19078 **Authorised Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

PARTICLE SIZE DISTRIBUTION TEST REPORT

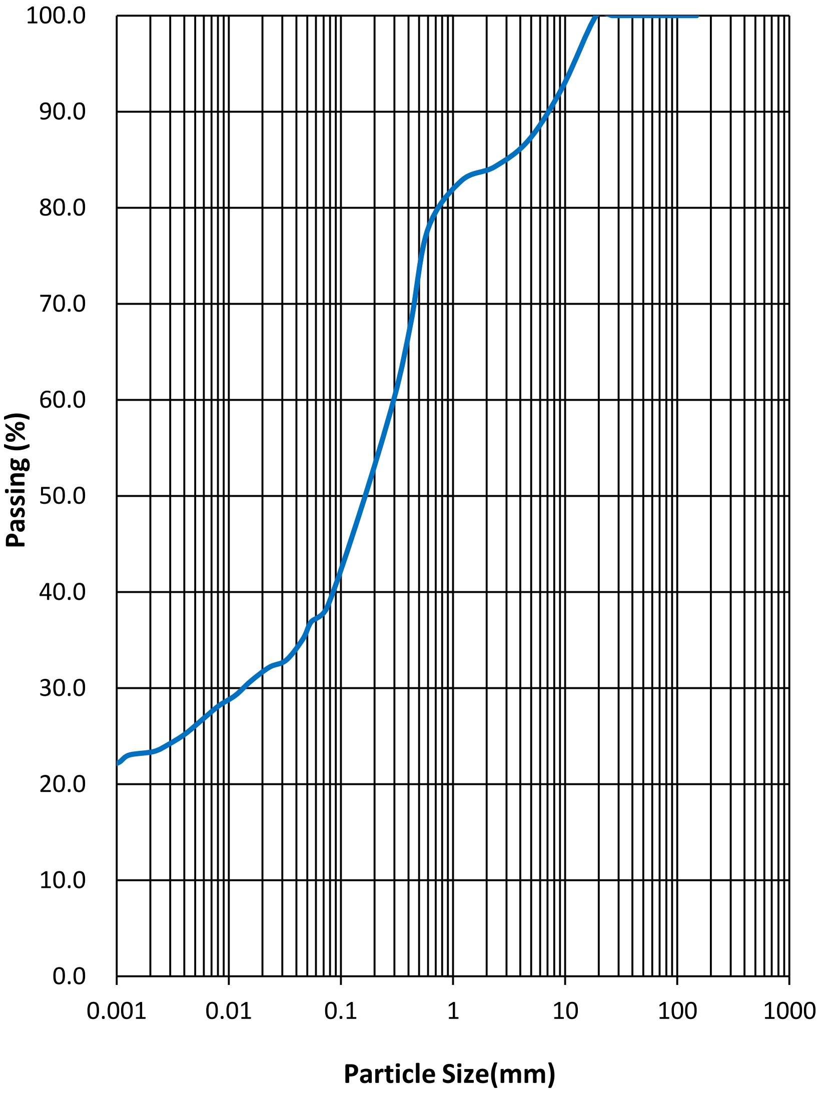
Test Method: AS 1289 3.6.1 3.6.3

Client:	Talis Consultants	Date Tested:	23/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	TP54 @ 0.50m	Depth(m):	0.5
Sample ID:	TP54_0.50_TALIS1801_PSD	Room Temperature at Test:	20°

Tested by: Hank   2.36mm Particle Density (t/m³): 2.75
Checked by: Phil

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	92.5
4.75	87.0
2.36	84.3
1.18	82.8
0.6	77.8
0.425	68.2
0.3	60.2
0.15	48.5
0.075	38.3
0.05470	36.9
0.04590	35.1
0.03257	32.9
0.02306	32.2
0.01569	30.7
0.01149	29.3
0.00814	28.2
0.00577	26.7
0.00409	25.2
0.00289	24.1
0.00214	23.4
0.00130	23.0
0.00106	22.3
0.00088	21.9
0.00080	21.6

PSD Graph



Notes:
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Samples supplied by the Client

NATA: 19078 **Authorized Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

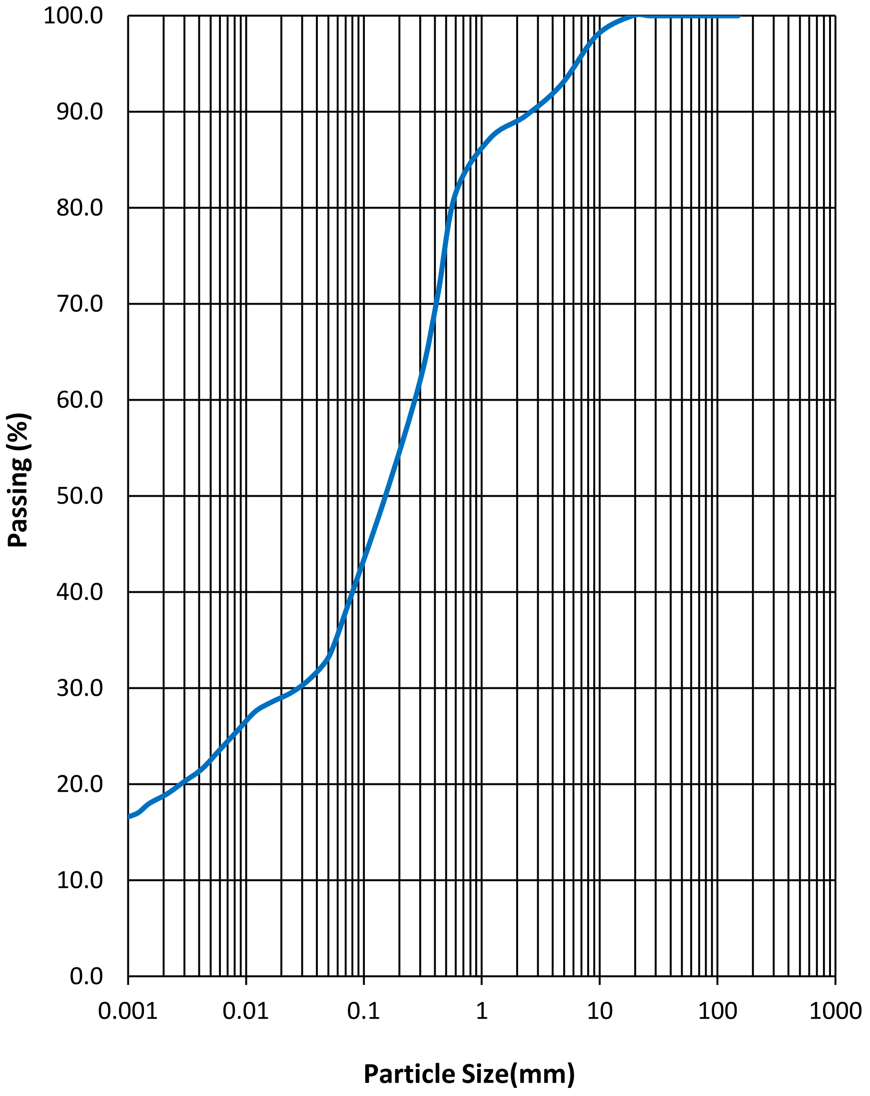
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3 3.5.1

Client:	Talis Consultants	Date Tested:	25/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP55	Depth(m):	0.00 - 0.50
Lab ID:	TP55_0.00_0.50_TALIS1802_PSD	Room Temperature at Test:	19
Tested by:	Leigh	2.36mm Particle Density (t/m³):	2.71
Checked by:	Phil		

Sieve Size (mm)	**Passing %**
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	98.0
4.75	92.9
2.36	89.6
1.18	87.2
0.6	81.5
0.425	71.0
0.3	62.0
0.15	49.7
0.075	39.0
0.05681	34.8
0.04769	32.8
0.03384	30.8
0.02399	29.5
0.01630	28.5
0.01193	27.5
0.00847	25.6
0.00601	23.6
0.00427	21.6
0.00302	20.3
0.00214	19.0
0.00152	18.0
0.00122	17.0
0.00093	16.4
0.00088	15.4

PSD Graph



Notes:
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Samples supplied by the Client

Authorized Signature:

NATA: 19078

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

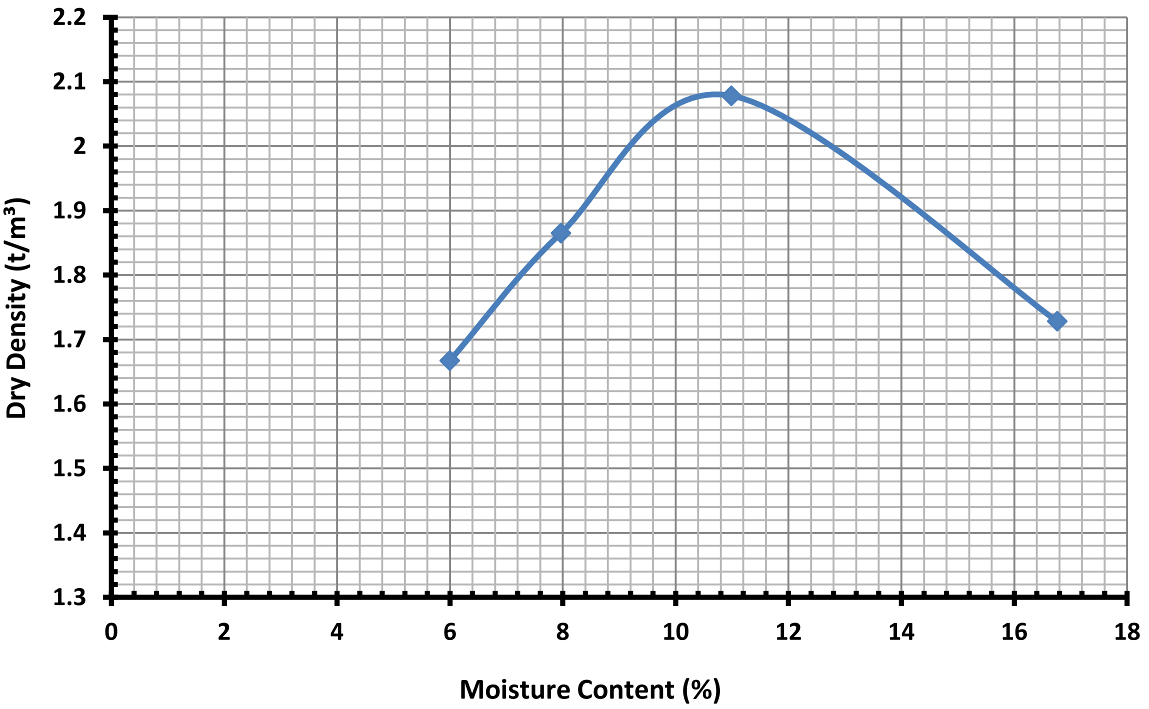
MOISTURE DENSITY RELATIONSHIP REPORT

Test Method: AS1289.5.2.1

Client:	Talis Environmental Consultants	Date Tested:	19/04/2018
Project:	Onslow TW17084	Lab:	EPLAB
Sample No:	TP55	Job Number:	TALIS
Lab ID:	TP55_0.00_0.50_MMDD		
Depth(m):	0.00 - 0.50	Room Temperature at Test:	20ºC
Checked by:	Phil	Sample Description:	Tested in Mould A
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Results

Maximum Size (mm):	19.00	**Maximum Dry Density (t/m³):**	**2.090**
Oversize dry (%):	0.00	**Optimum Moisture Content (%):**	**10.80**



Notes:

Stored and Tested the Sample as received

Samples supplied by the Client NATA: 19078 **Authorised Signature:**

Integrity Precision Innovation

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

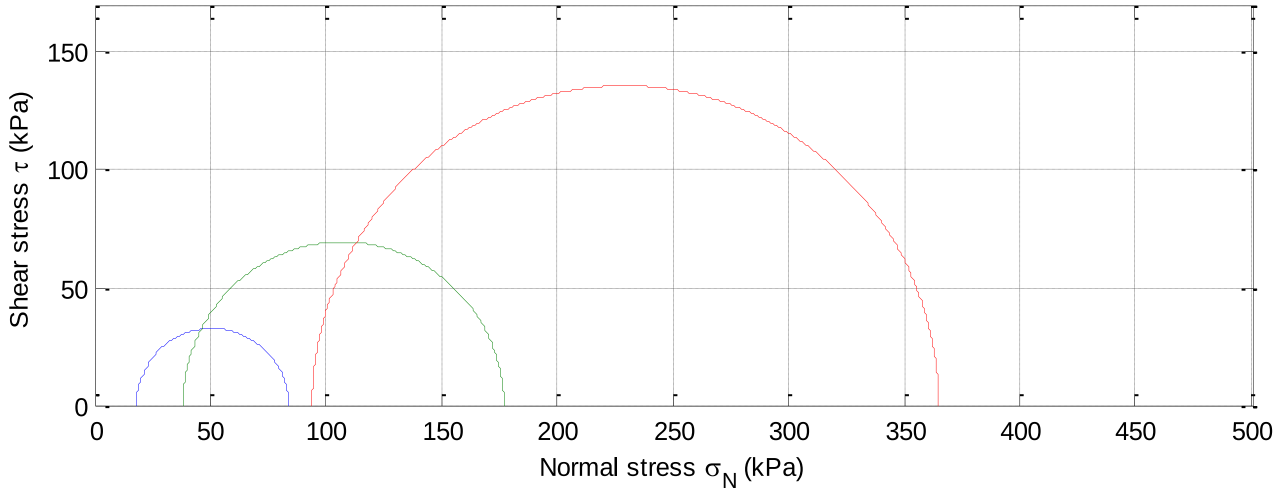
Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP55	Lab:	EPLab
Sample ID:	TP55_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°c

Tested by:	PHIL	Initial Moisture (%):	10.78	Strain Rate (mm/min):	0.0075
Height (mm):	125.26	Final Moisture (%):	7.52	Skempton's (B):	0.99
Diameter (mm):	61.78	Bulk Density (t/m³):	2.20	Geology:	-
L/D Ratio:	2.03	Dry Density (t/m³):	1.99		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

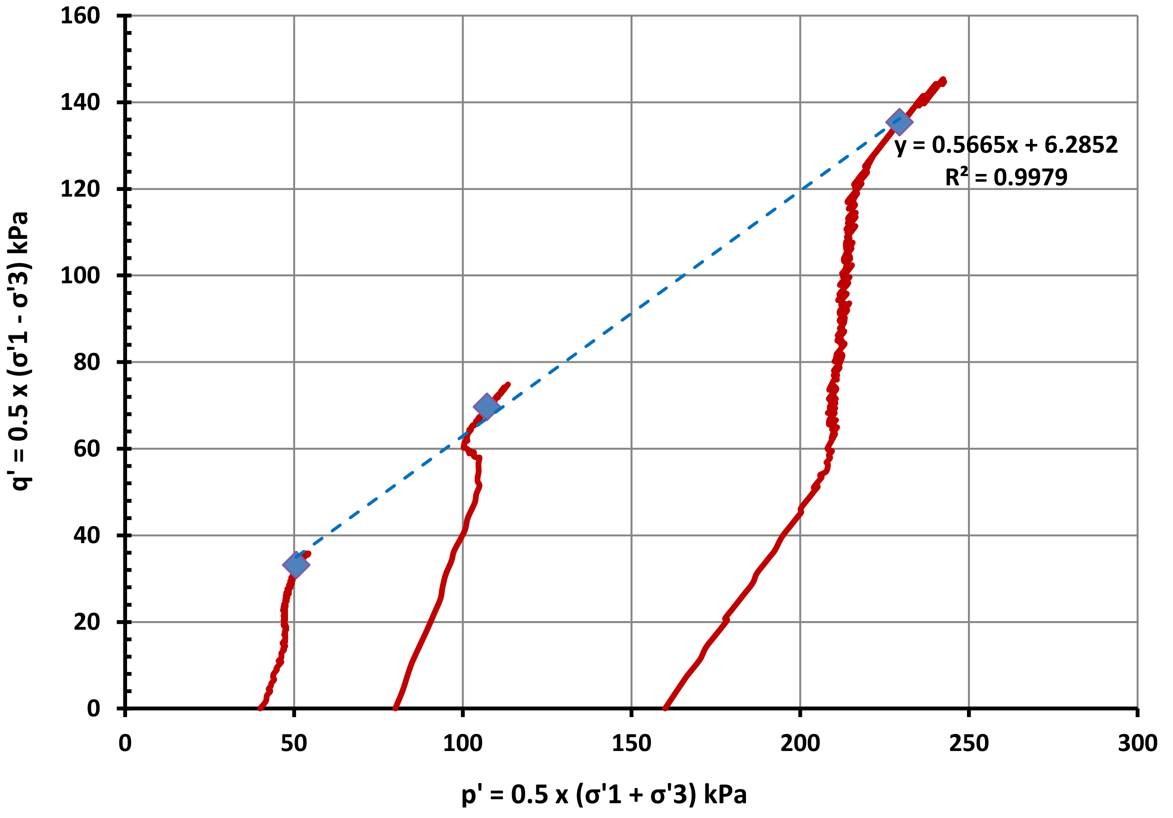
Interpretation from Mohr Circle:	Sample 1 & 2	Sample 1 & 3	Sample 2 & 3
Cohesion C' (kPa):	0.07	4.54	13.49
Angle of Shear Resistance Φ' (Degrees) :	40.36	34.99	32.62

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP55	Lab:	EPLab
Sample ID:	TP55_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : **7.64**

Angle of Shear Resistance Φ' (Deg) : **34.54**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

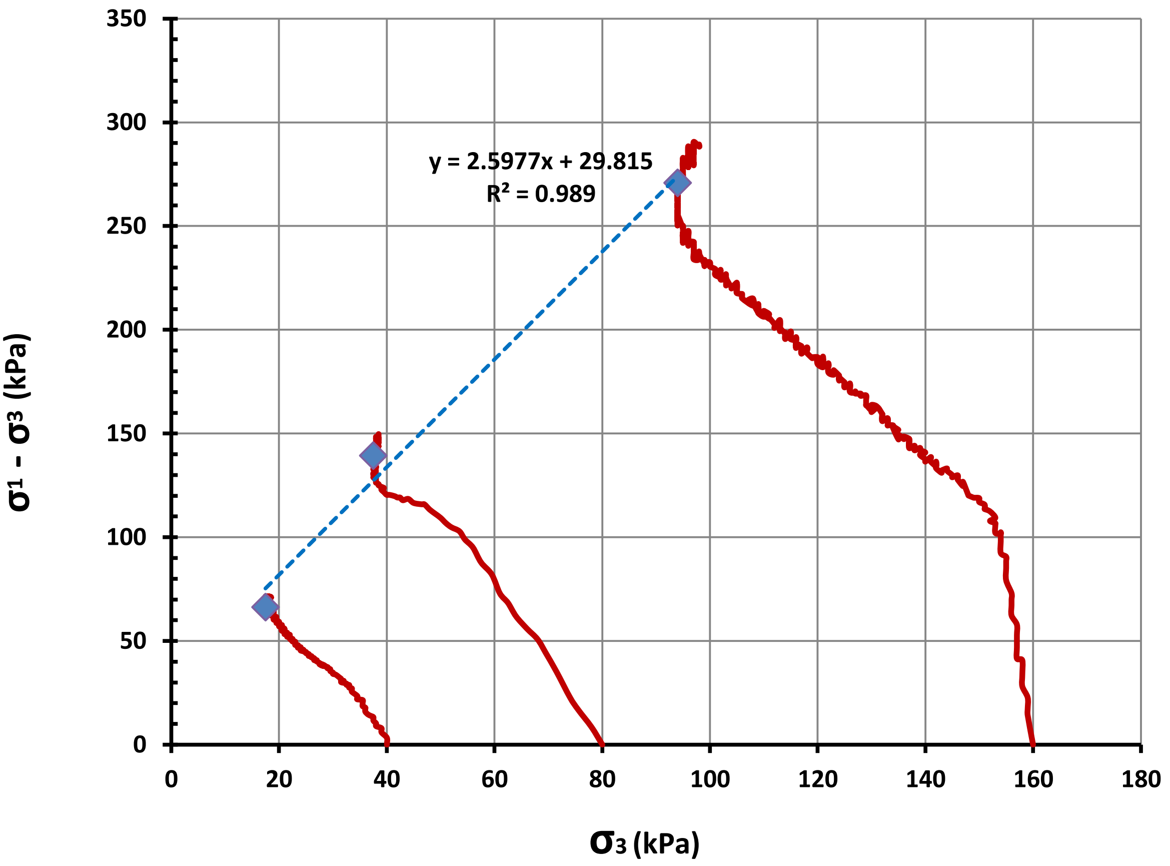
E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP55	Lab:	EPLab
Sample ID:	TP55_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : **7.86**

Angle of Shear Resistance Φ' (Deg) : **34.40**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

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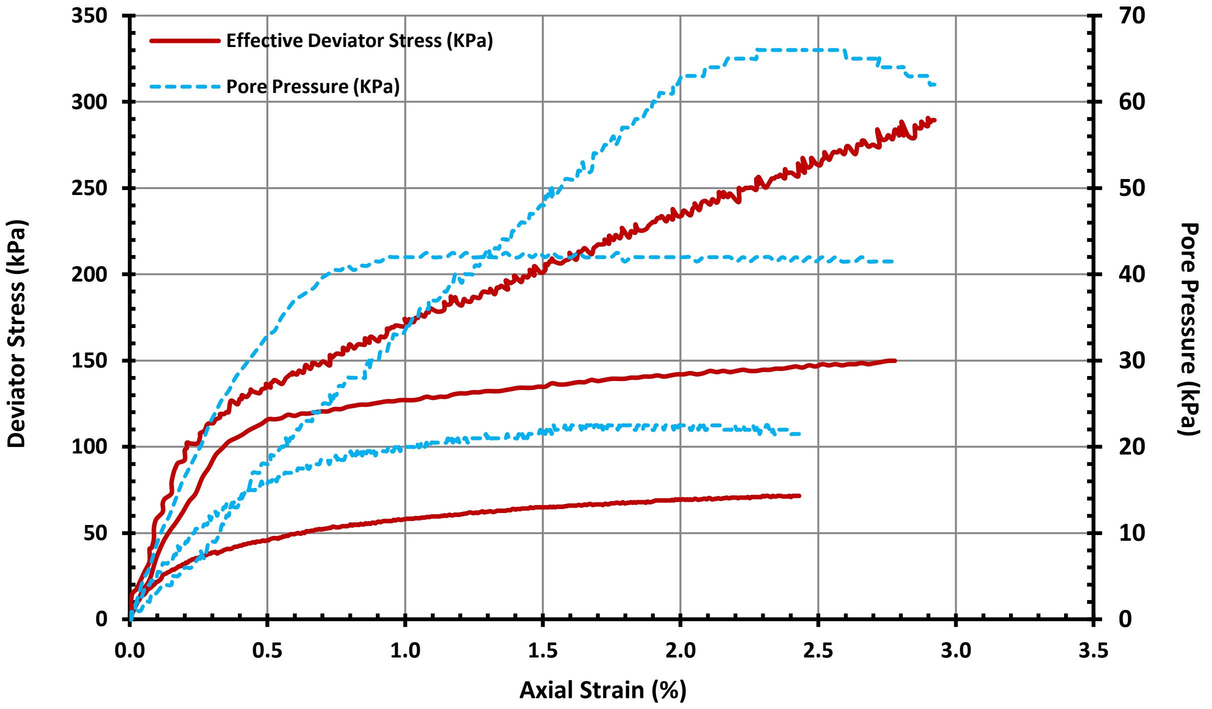
SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client: Talis Consultants
Project: TW17084 Onslow
Sample No: TP55
Sample ID: TP55_0.00_0.50_TALIS1802_CU
Depth (m): 0.00 - 0.50

Date Tested: 26/04/2018
EP Lab Job Number: TALIS
Lab: EPLab
Room Temperature at Test: ~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'0	U'f	Principal Effective Stresses			σ'1 - σ'3	Strain (%)
				σ'1	σ'3	σ'1 / σ'3		
1	40	0	23	84	18	4.79	66	1.65
2	80	0	43	177	38	4.72	139	1.77
3	160	0	66	365	94	3.88	271	2.56

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP55	Lab:	EPLab
Sample ID:	TP55_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID:	TP55	**Depth (m):**	0.00 - 0.50
Lab ID:	TP55_0.00_0.50_TALIS1802_CU	**Date Tested:**	26/04/2018

Stage 1 **Stage 2** **Stage 3**

Failure Mode: Bulging Failures observed for all samples

Notes: **Sample remolded based on 95% MMDD @ OMC**

Stored and Tested the Sample as received Accredited for compliance with ISO/IEC 17025-TESTING

Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

NATA
ACCREDITATION NO: 19078

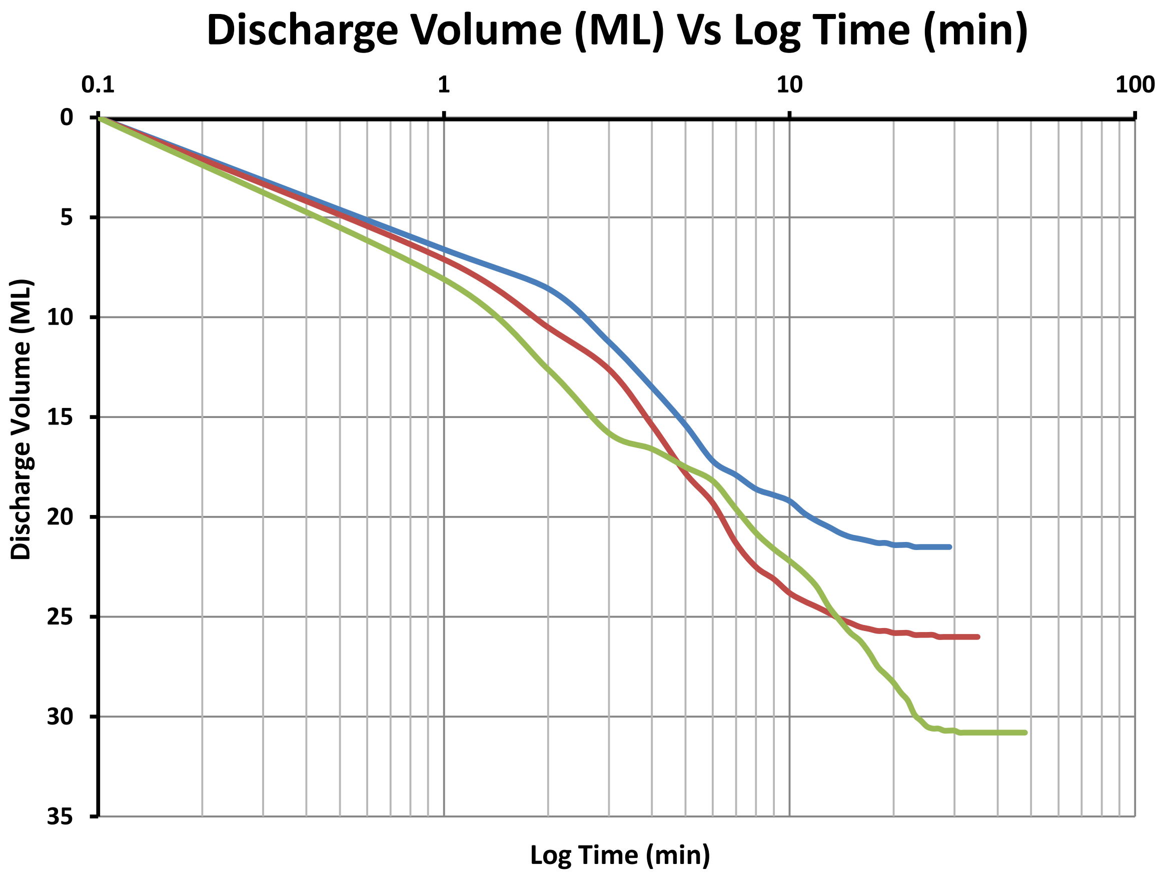
Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	26/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP55	Lab:	EPLab
Sample ID:	TP55_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°C



Sample 1	**Cv (cm²/s):**	0.229	based on $\mathbf{t_{90}}$
Sample 2	**Cv (cm²/s):**	0.174	based on $\mathbf{t_{90}}$
Sample 3	**Cv (cm²/s):**	0.136	based on $\mathbf{t_{90}}$

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

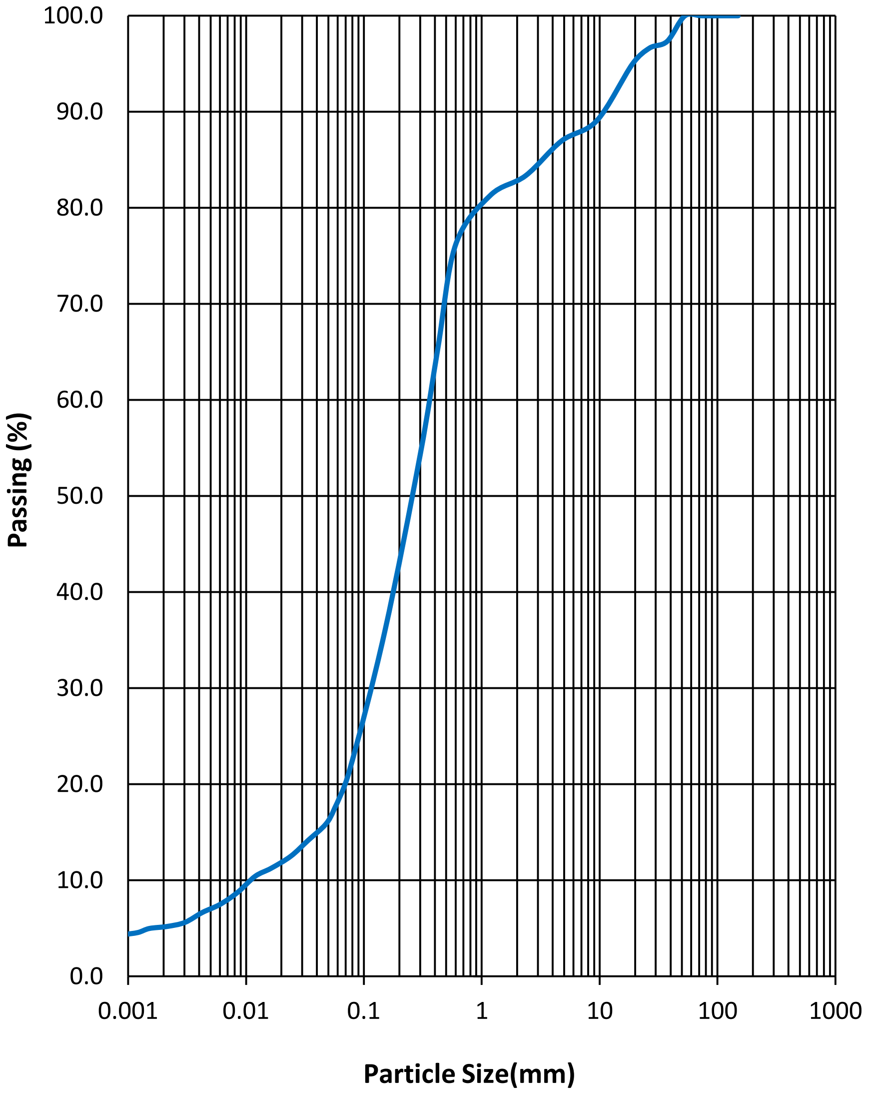
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3 3.5.1

Client:	Talis Consultants	Date Tested:	21/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP60	Depth(m):	0.00 - 0.30
Lab ID:	TP60_0.00_0.30_TALIS1802_PSD	Room Temperature at Test:	19
Tested by:	Leigh	2.36mm Particle Density (t/m³):	2.77
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	97.3
26.5	96.6
19	95.0
9.5	89.1
4.75	87.0
2.36	83.4
1.18	81.3
0.6	76.2
0.425	65.4
0.3	54.3
0.15	35.8
0.075	21.3
0.05652	17.5
0.04750	15.8
0.03374	14.2
0.02395	12.5
0.01632	11.2
0.01195	10.4
0.00848	8.7
0.00602	7.5
0.00426	6.6
0.00302	5.6
0.00214	5.2
0.00151	5.0
0.00121	4.6
0.00092	4.3
0.00088	4.3

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

Authorized Signature:

NATA: 19078

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1 3.6.3

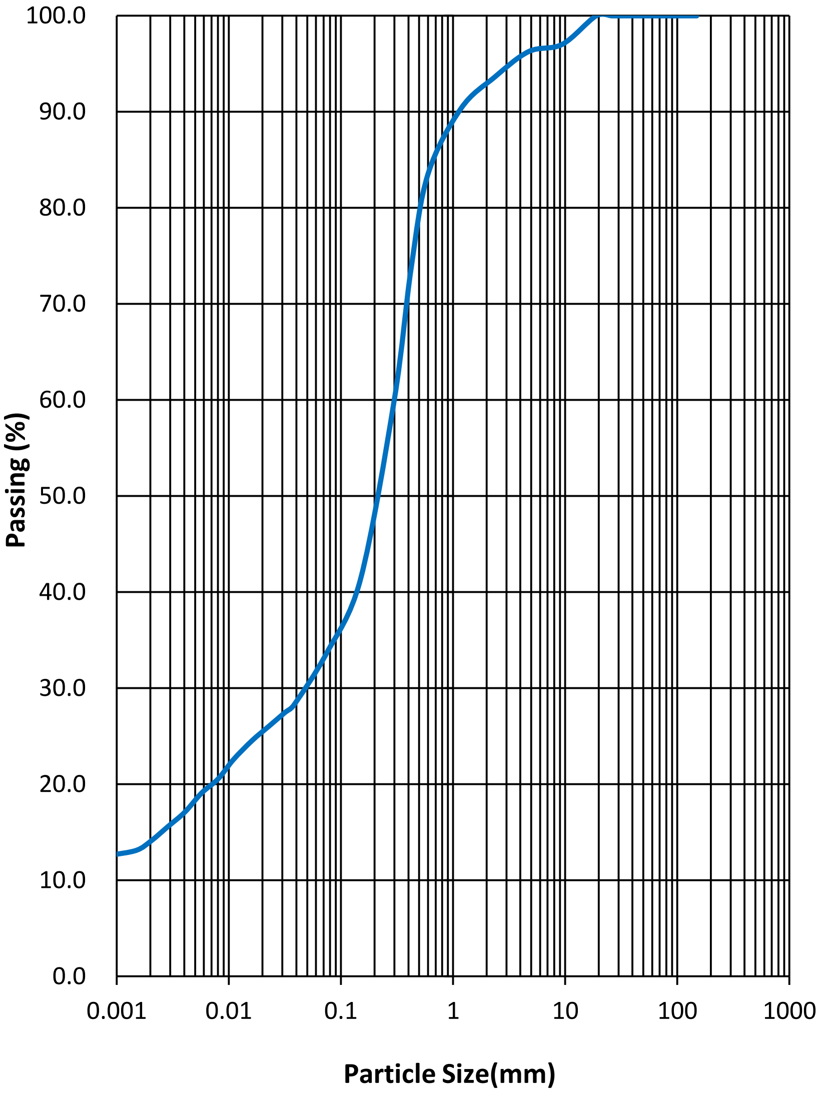
Client:	Talis Consultants	Date Tested:	23/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	TP68 @ 0.00m	Depth(m):	0.00 - 0.50
Sample ID:	TP68_0.00_TALIS1801_PSD	Room Temperature at Test:	20°

Tested by: Hank — 2.36mm Particle Density (t/m³): 4.54

Checked by: Phil

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	97.0
4.75	96.3
2.36	93.6
1.18	90.3
0.6	83.5
0.425	73.8
0.3	60.0
0.15	41.3
0.075	33.7
0.03816	28.2
0.03198	27.5
0.02269	26.0
0.01611	24.5
0.01098	22.5
0.00806	20.6
0.00572	19.1
0.00406	17.1
0.00288	15.6
0.00204	14.1
0.00151	13.1
0.00092	12.6
0.00075	12.4
0.00062	12.4
0.00056	12.1

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078 **Authorized Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

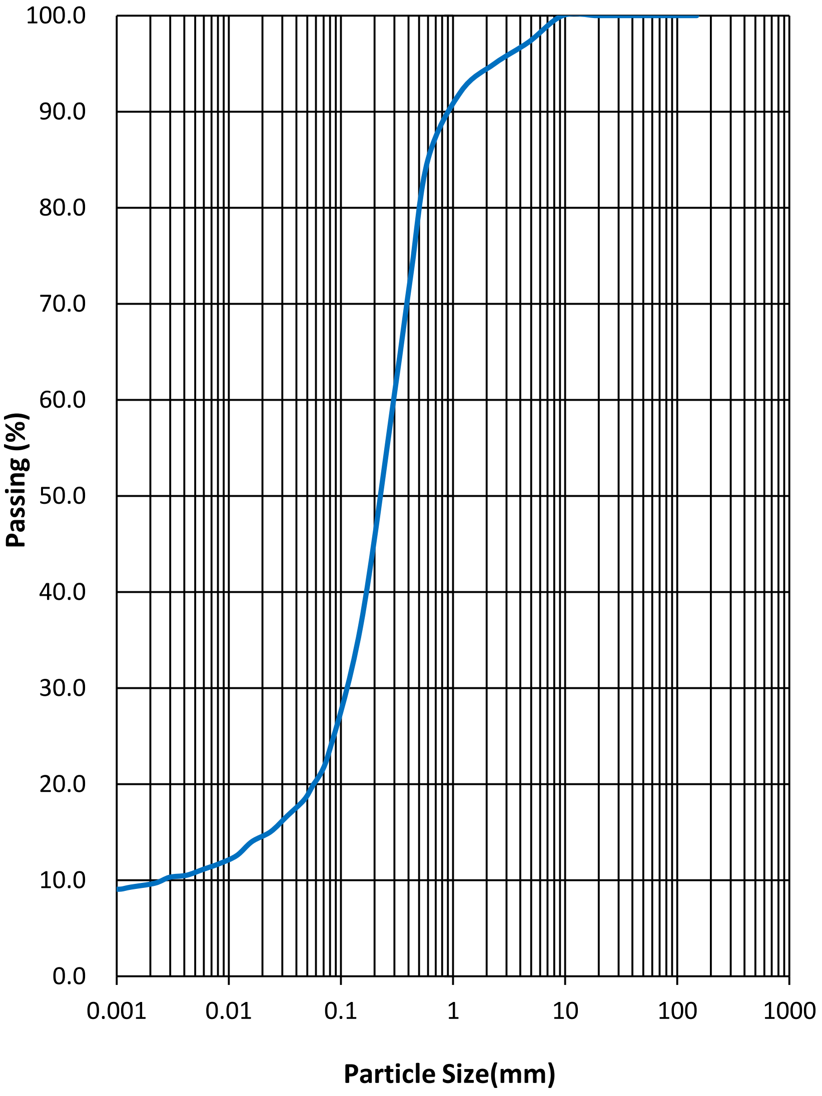
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1 3.6.3

Client:	Talis Consultants	Date Tested:	27/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	TP78 @ 0.00m	Depth(m):	0.00 - 0.50
Sample ID:	TP78_0.00_TALIS1801_PSD	Room Temperature at Test:	20°
Tested by:	Hank	2.36mm Particle Density (t/m³):	2.70
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	97.2
2.36	95.0
1.18	92.1
0.6	85.1
0.425	73.3
0.3	60.5
0.15	36.4
0.075	22.6
0.05571	19.8
0.04680	18.3
0.03325	16.7
0.02361	15.0
0.01608	14.0
0.01179	12.6
0.00835	11.7
0.00591	11.1
0.00419	10.5
0.00296	10.3
0.00219	9.7
0.00133	9.3
0.00109	9.1
0.00090	9.1
0.00081	8.9

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078 **Authorized Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3 3.5.1

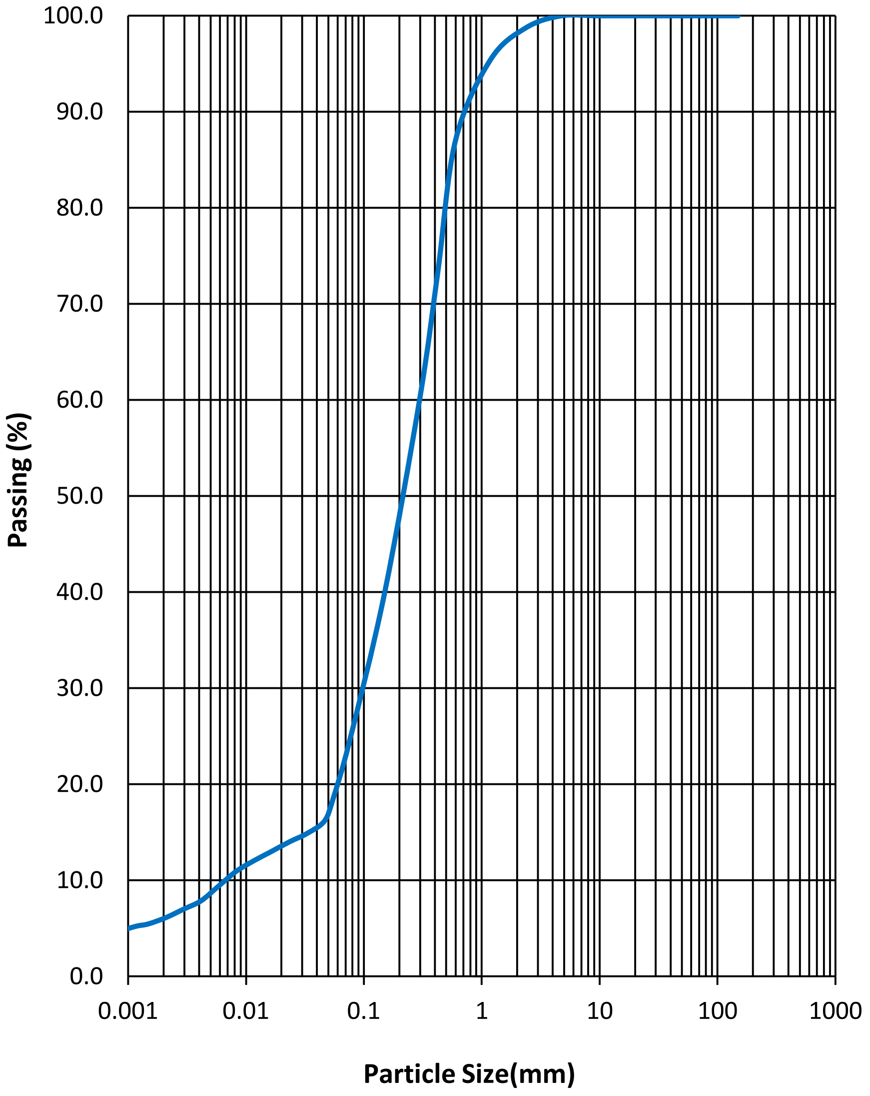
Client:	Talis Consultants	Date Tested:	21/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP80	Depth(m):	0.00 - 0.50
Lab ID:	TP80_0.00_0.50_TALIS1802_PSD	Room Temperature at Test:	19

Tested by: Leigh
Checked by: Phil

2.36mm Particle Density (t/m³): 2.85

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	100.0
2.36	98.7
1.18	95.4
0.6	87.0
0.425	73.4
0.3	60.3
0.15	39.9
0.075	24.3
0.05526	18.6
0.04652	16.2
0.03301	14.9
0.02339	14.0
0.01593	12.9
0.01165	12.0
0.00826	10.9
0.00586	9.4
0.00416	7.9
0.00295	7.0
0.00209	6.1
0.00148	5.4
0.00118	5.2
0.00090	4.8
0.00086	4.6

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client NATA: 19078

Authorized Signature:

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

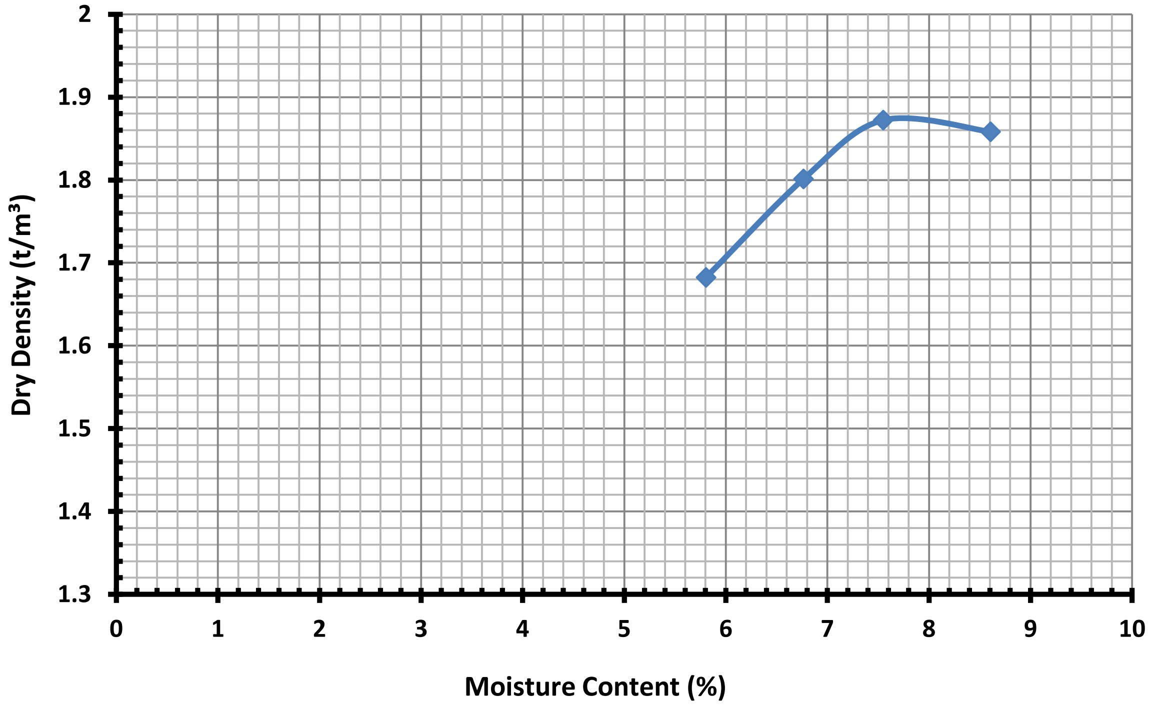
MOISTURE DENSITY RELATIONSHIP REPORT

Test Method: AS1289.5.2.1

Client:	Talis Environmental Consultants	Date Tested:	19/04/2018
Project:	Onslow TW17084	Lab:	EPLAB
Sample No:	TP80	Job Number:	TALIS
Lab ID:	TP80_0.00_0.50_MMDD		
Depth(m):	0.00 - 0.50	Room Temperature at Test:	20°C
Checked by:	Phil	Sample Description:	Tested in Mould A
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Results

Maximum Size (mm):	19.00	**Maximum Dry Density (t/m³):**	**1.870**
Oversize dry (%):	0.00	**Optimum Moisture Content (%):**	**7.60**



Notes:

Stored and Tested the Sample as received

Samples supplied by the Client NATA: 19078 **Authorised Signature:**

The results of tests performed apply only to the specific sample at time of test unless otherwise clearly stated. Reference should be made to E-Precision Laboratory's "Standard Terms and Conditions" E-Precision Laboratory ABN 431 559 578 87

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

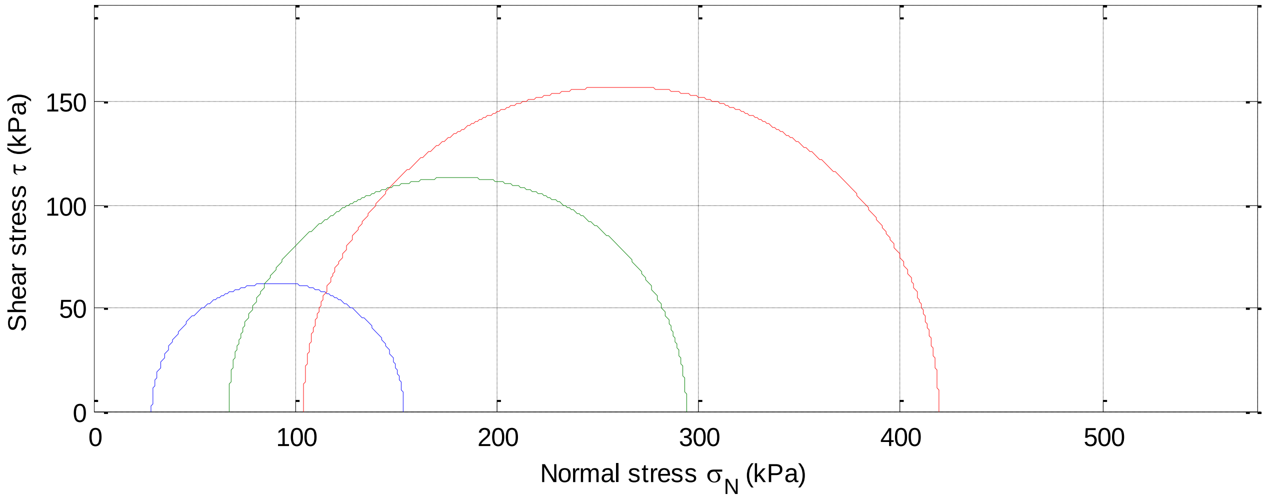
Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP80	Lab:	EPLab
Sample ID:	TP80_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°c

Tested by:	PHIL	Initial Moisture (%):	7.56	Strain Rate (mm/min):	0.0075
Height (mm):	124.69	Final Moisture (%):	6.74	Skempton's (B):	0.99
Diameter (mm):	61.84	Bulk Density (t/m³):	1.92	Geology:	-
L/D Ratio:	2.02	Dry Density (t/m³):	1.78		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	Sample 1 & 2	Sample 1 & 3	Sample 2 & 3
Cohesion C' (kPa):	12.28	13.71	18.40
Angle of Shear Resistance Φ' (Degrees) :	34.95	33.82	33.02

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

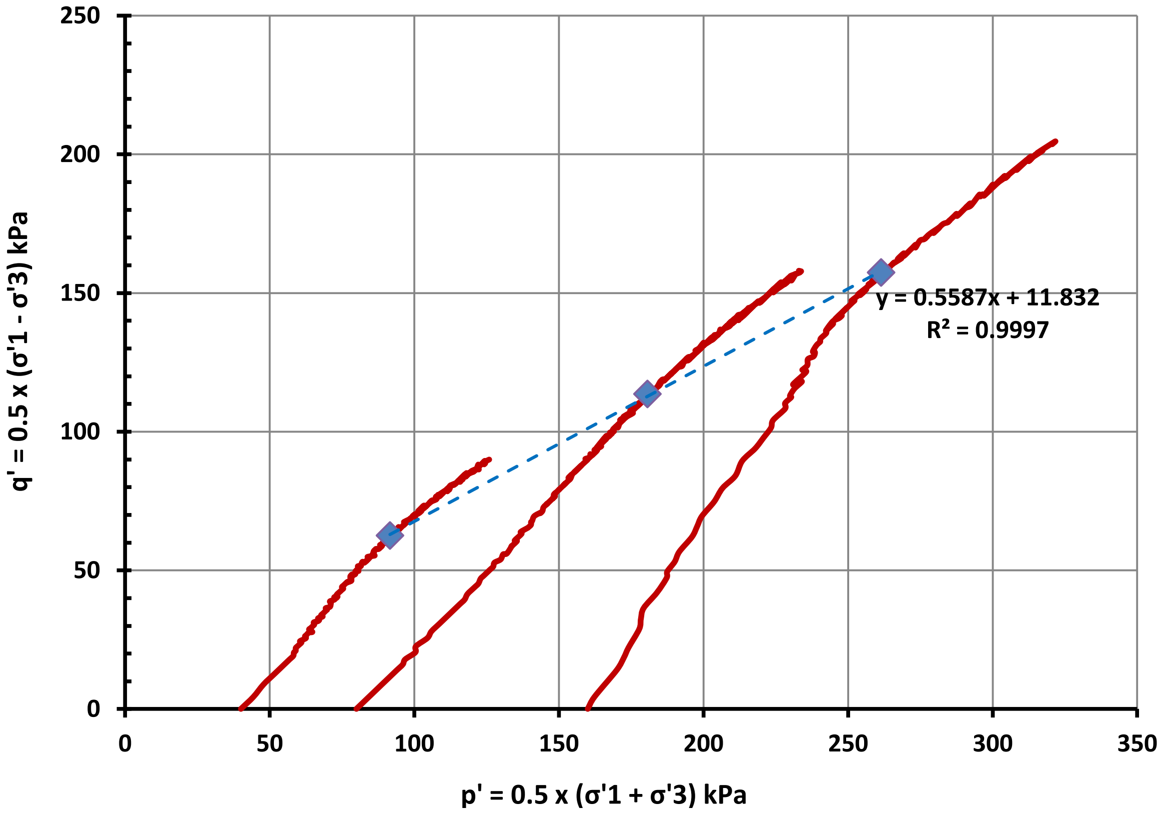
E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP80	Lab:	EPLab
Sample ID:	TP80_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : **14.26**

Angle of Shear Resistance Φ' (Deg) : **33.92**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

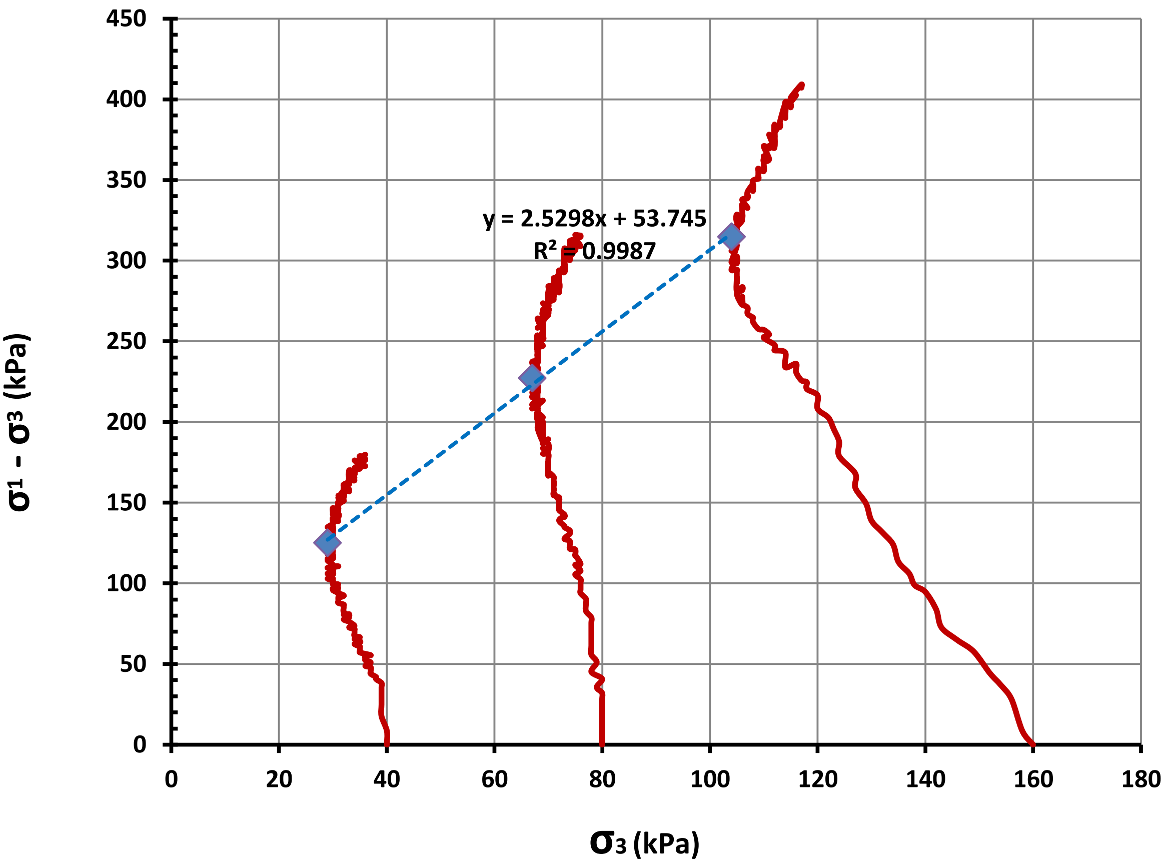
E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP80	Lab:	EPLab
Sample ID:	TP80_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : **14.30**

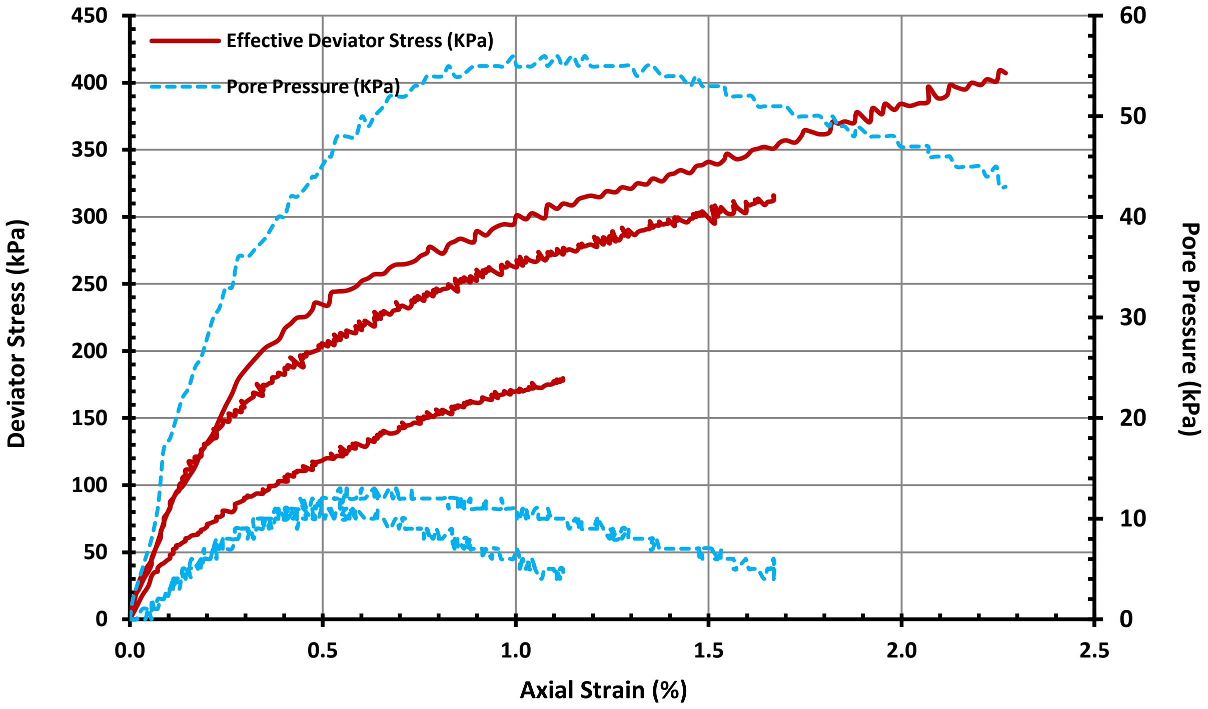
Angle of Shear Resistance Φ' (Deg) : **33.95**

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP80	Lab:	EPLab
Sample ID:	TP80_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'_0	U'_f	Principal Effective Stresses			$\sigma'_1 - \sigma'_3$	Strain (%)
				σ'_1	σ'_3	σ'_1 / σ'_3		
1	40	0	11	154	29	5.32	125	0.56
2	80	0	13	294	67	4.39	227	0.67
3	160	0	56	419	104	4.03	315	1.18

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP80	Lab:	EPLab
Sample ID:	TP80_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID:	TP80	**Depth (m):**	0.00 - 0.50
Lab ID:	TP80_0.00_0.50_TALIS1802_CU	**Date Tested:**	02/05/2018

Stage 1

Stage 2

Stage 3

Failure Mode: Bulging Failures observed for all samples

Notes: **Sample remolded based on 95% MMDD @ OMC**

Stored and Tested the Sample as received Accredited for compliance with ISO/IEC 17025-TESTING

Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

NATA
ACCREDITATION NO: 19078

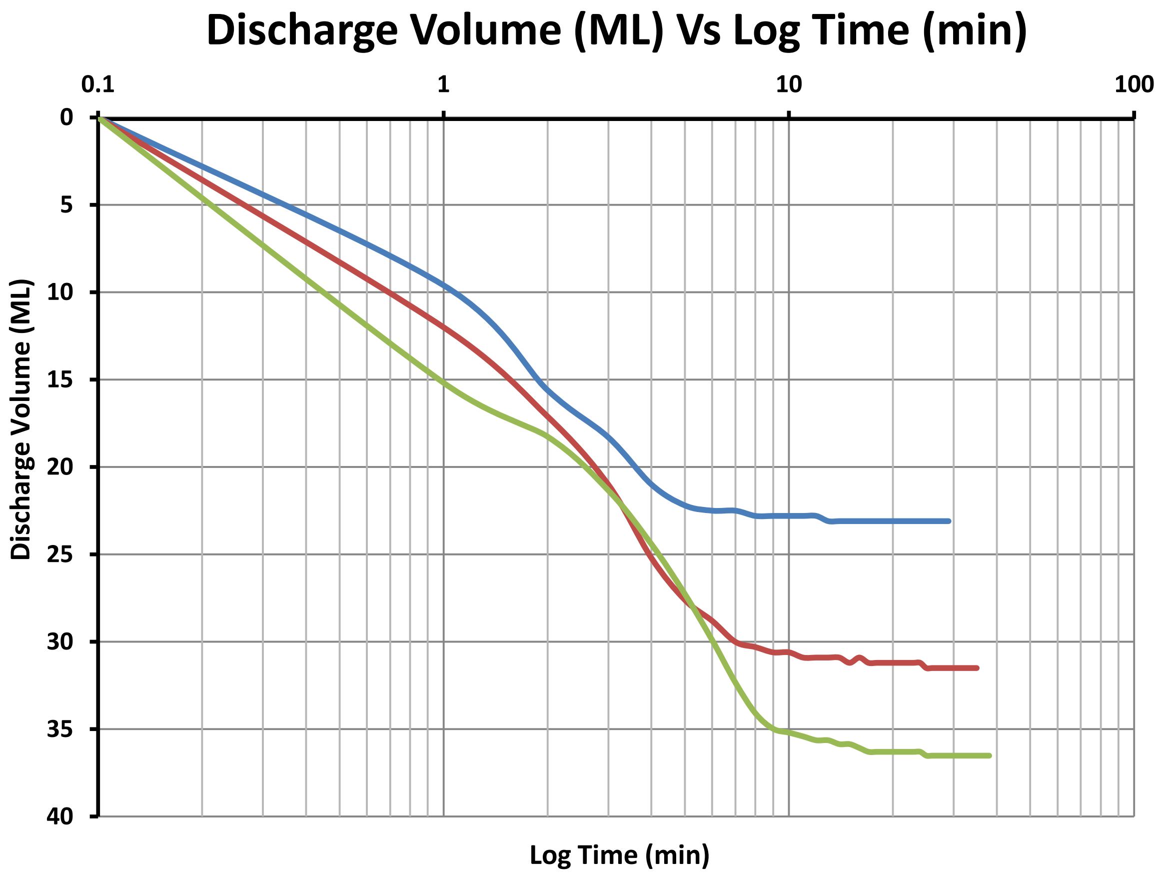
Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP80	Lab:	EPLab
Sample ID:	TP80_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°C



Sample 1	**Cv (cm²/s):**	0.137	based on **t**$_{90}$
Sample 2	**Cv (cm²/s):**	0.113	based on **t**$_{90}$
Sample 3	**Cv (cm²/s):**	0.098	based on **t**$_{90}$

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

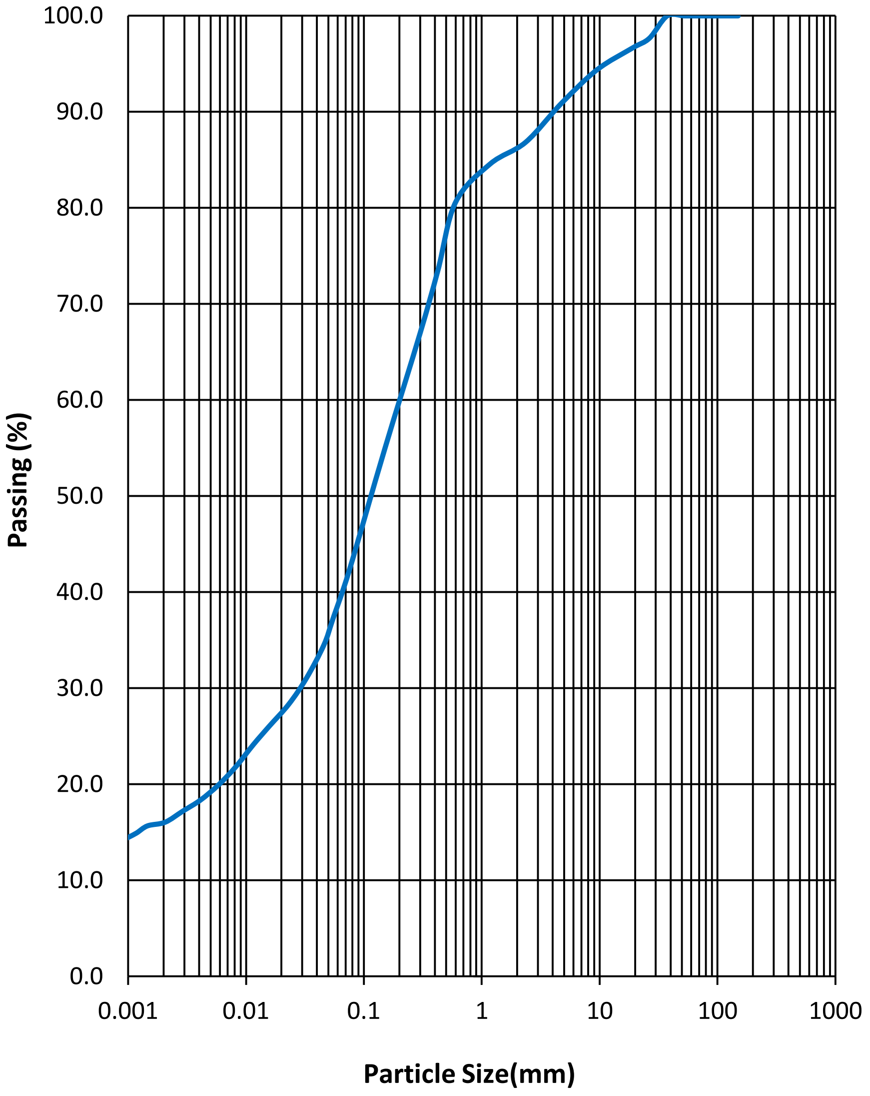
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3 3.5.1

Client:	Talis Consultants	Date Tested:	21/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP84	Depth(m):	1.00 - 1.40
Lab ID:	TP84_1.00_1.40_TALIS1802_PSD	Room Temperature at Test:	19
Tested by:	Leigh	2.36mm Particle Density (t/m³):	2.88
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	97.7
19	96.7
9.5	94.4
4.75	90.9
2.36	86.8
1.18	84.6
0.6	80.6
0.425	73.5
0.3	67.0
0.15	54.9
0.075	42.2
0.05454	37.2
0.04581	34.5
0.03257	31.1
0.02312	28.4
0.01576	26.1
0.01154	24.1
0.00818	21.8
0.00580	19.9
0.00411	18.4
0.00291	17.2
0.00206	16.1
0.00146	15.7
0.00117	14.9
0.00089	14.1
0.00084	13.8

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client NATA: 19078

Authorized Signature:

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

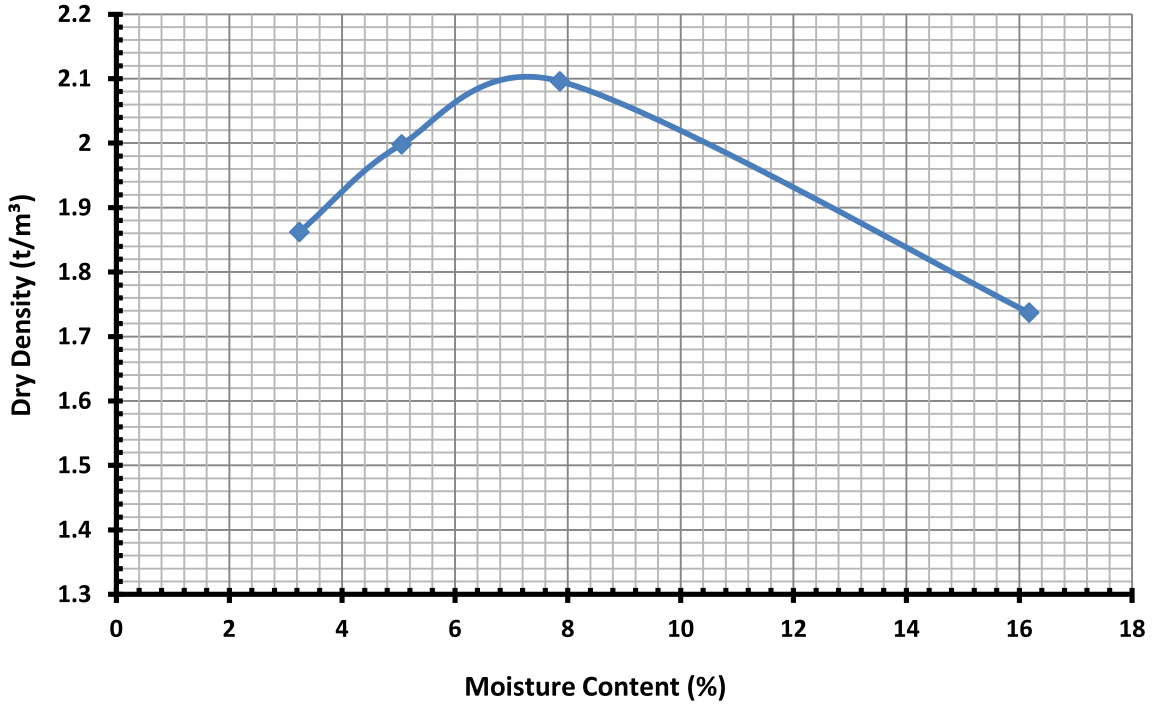
MOISTURE DENSITY RELATIONSHIP REPORT

Test Method: AS1289.5.2.1

Client:	Talis Environmental Consultants	Date Tested:	19/04/2018
Project:	Onslow TW17084	Lab:	EPLAB
Sample No:	TP84	Job Number:	TALIS
Lab ID:	TP84_1.00_1.40_MMDD		
Depth(m):	1.00 - 1.40	Room Temperature at Test:	20°C
Checked by:	Phil	Sample Description:	Tested in Mould A
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Results

Maximum Size (mm):	19.00	**Maximum Dry Density (t/m³):**	**2.100**
Oversize dry (%):	3.30	**Optimum Moisture Content (%):**	**7.10**



Notes:

Stored and Tested the Sample as received

Samples supplied by the Client NATA: 19078 **Authorised Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

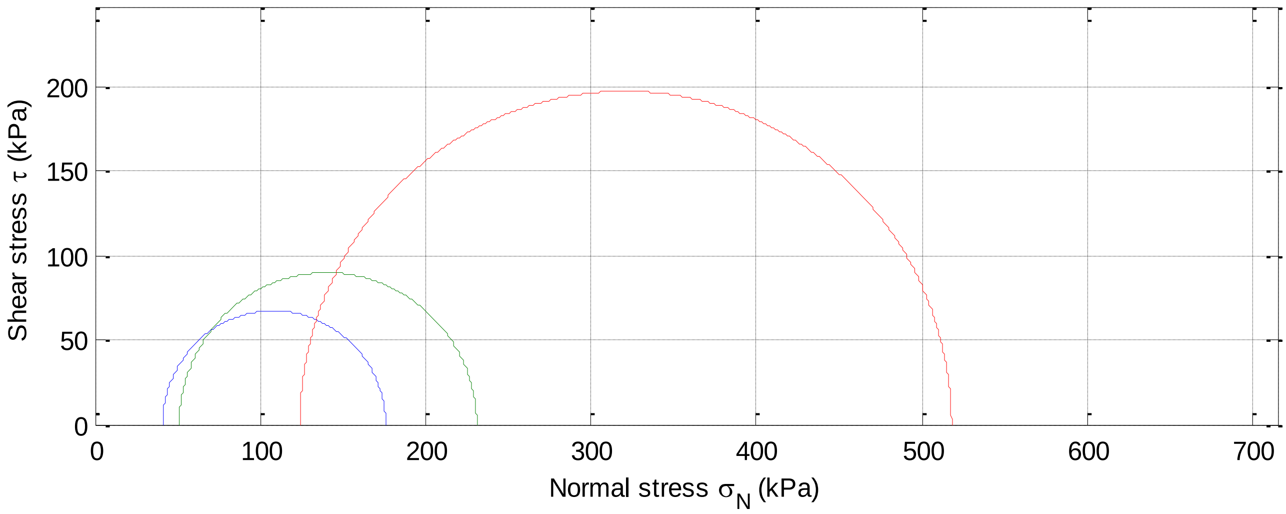
Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP84	Lab:	EPLab
Sample ID:	TP84_1.00_1.40_TALIS1802_CU		
Depth (m):	1.00 - 1.40	Room Temperature at Test:	~ 18°c

Tested by:	PHIL	Initial Moisture (%):	7.20	Strain Rate (mm/min):	0.006
Height (mm):	125.54	Final Moisture (%):	6.52	Skempton's (B):	0.99
Diameter (mm):	61.85	Bulk Density (t/m³):	2.15	Geology:	-
L/D Ratio:	2.03	Dry Density (t/m³):	2.00		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	**Sample 1 & 2**	**Sample 1 & 3**	**Sample 2 & 3**
Cohesion C' (kPa):	0.21	1.74	7.69
Angle of Shear Resistance Φ' (Degrees) :	39.01	37.60	36.50

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

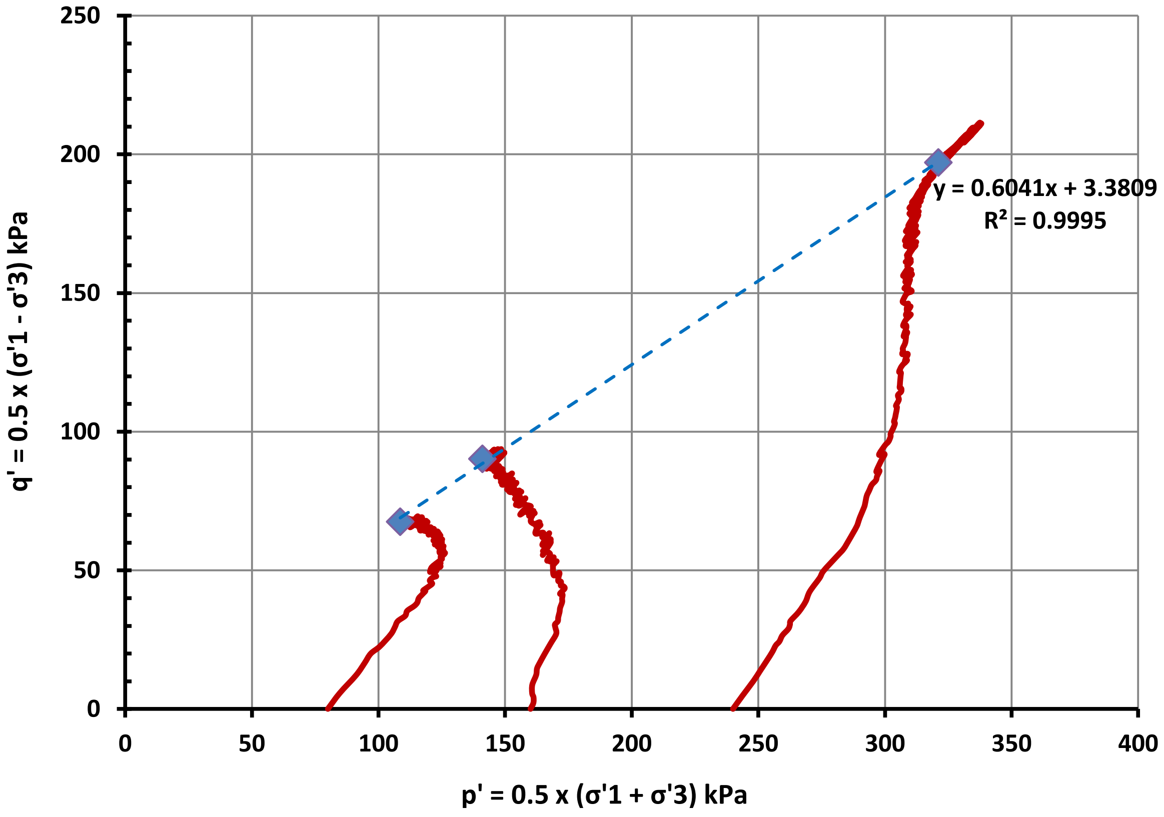
E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP84	Lab:	EPLab
Sample ID:	TP84_1.00_1.40_TALIS1802_CU		
Depth (m):	1.00 - 1.40	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : 4.24

Angle of Shear Resistance Φ' (Deg) : 37.16

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

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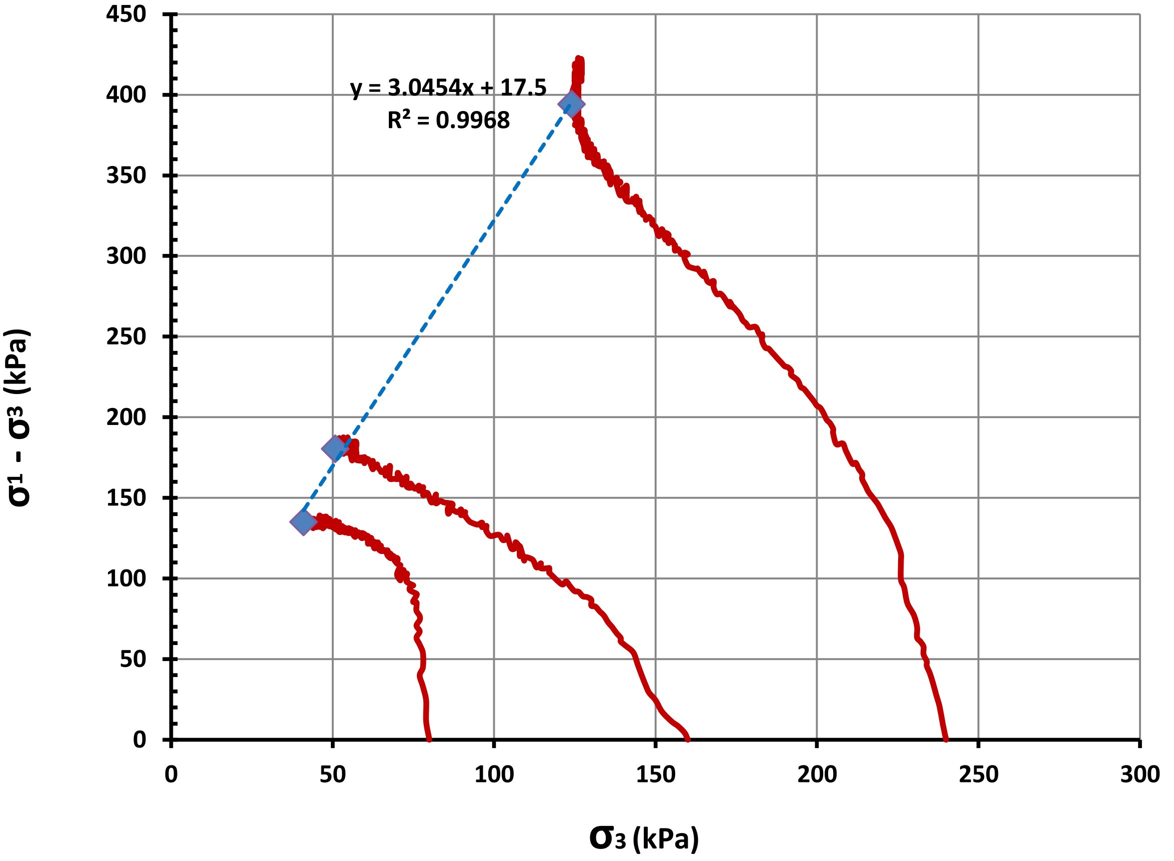
SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP84	Lab:	EPLab
Sample ID:	TP84_1.00_1.40_TALIS1802_CU		
Depth (m):	1.00 - 1.40	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : **4.35**

Angle of Shear Resistance Φ' (Deg) : **37.13**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

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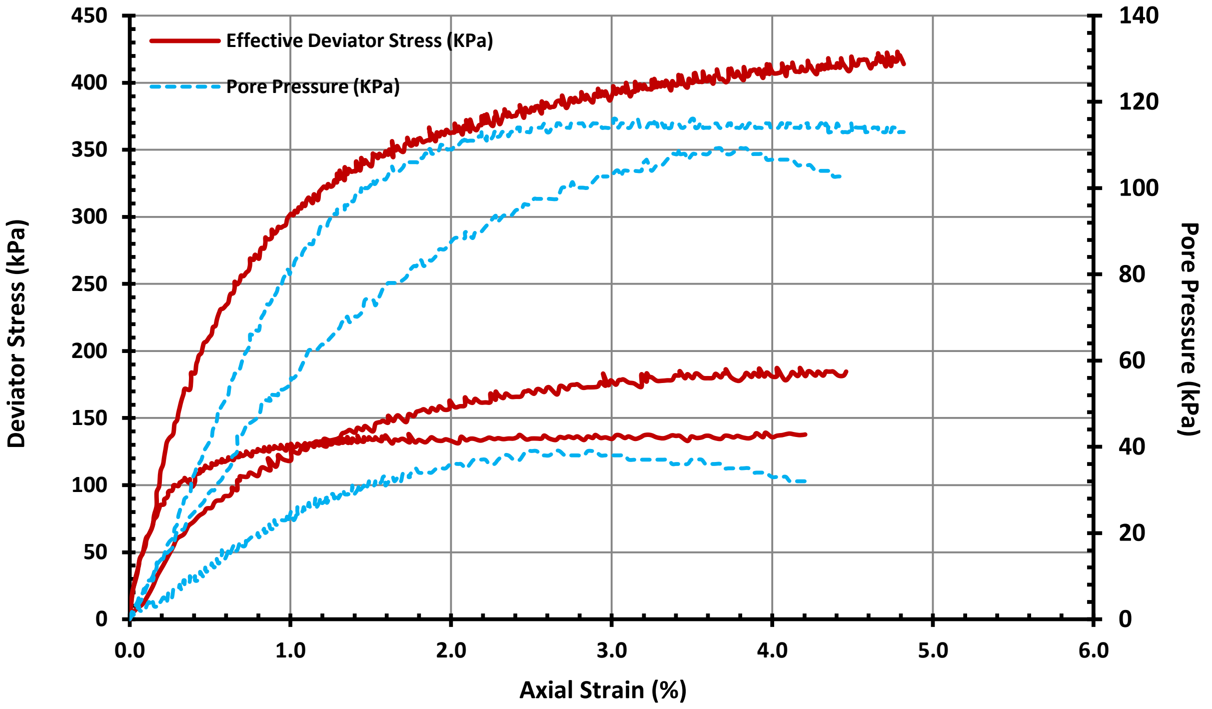
SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP84	Lab:	EPLab
Sample ID:	TP84_1.00_1.40_TALIS1802_CU		
Depth (m):	1.00 - 1.40	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'0	U'f	Principal Effective Stresses			σ'1 - σ'3	Strain (%)
				σ'1	σ'3	σ'1 / σ'3		
1	80	0	39	176	41	4.29	135	2.88
2	160	0	109	231	51	4.55	180	3.68
3	240	0	116	518	124	4.18	394	3.16

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP84	Lab:	EPLab
Sample ID:	TP84_1.00_1.40_TALIS1802_CU		
Depth (m):	1.00 - 1.40	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID:	TP84	**Depth (m):**	1.00 - 1.40
Lab ID:	TP84_1.00_1.40_TALIS1802_CU	**Date Tested:**	02/05/2018

Stage 1

Stage 2

Stage 3

Failure Mode: Bulging Failures observed for all samples

Notes: **Sample remolded based on 95% MMDD @ OMC**

Stored and Tested the Sample as received Accredited for compliance with ISO/IEC 17025-TESTING

Samples supplied by the Client

NATA: 19078

Authorised Signatory (Geotechnical Engineer):

NATA
ACCREDITATION NO: 19078

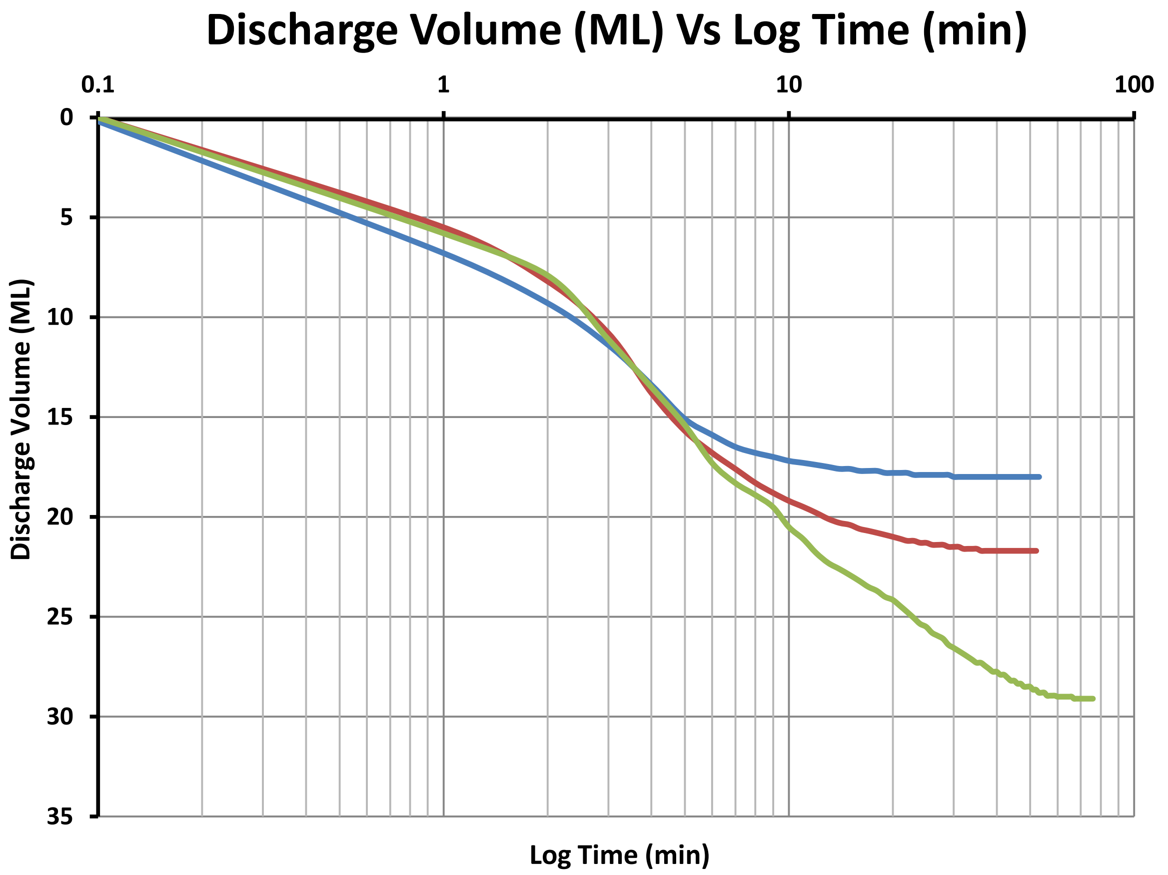
Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP84	Lab:	EPLab
Sample ID:	TP84_1.00_1.40_TALIS1802_CU		
Depth (m):	1.00 - 1.40	Room Temperature at Test:	~ 18°C



Sample 1	**Cv (cm²/s):**	0.096	based on **t_{90}**
Sample 2	**Cv (cm²/s):**	0.057	based on **t_{90}**
Sample 3	**Cv (cm²/s):**	0.015	based on **t_{90}**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.1 3.6.3

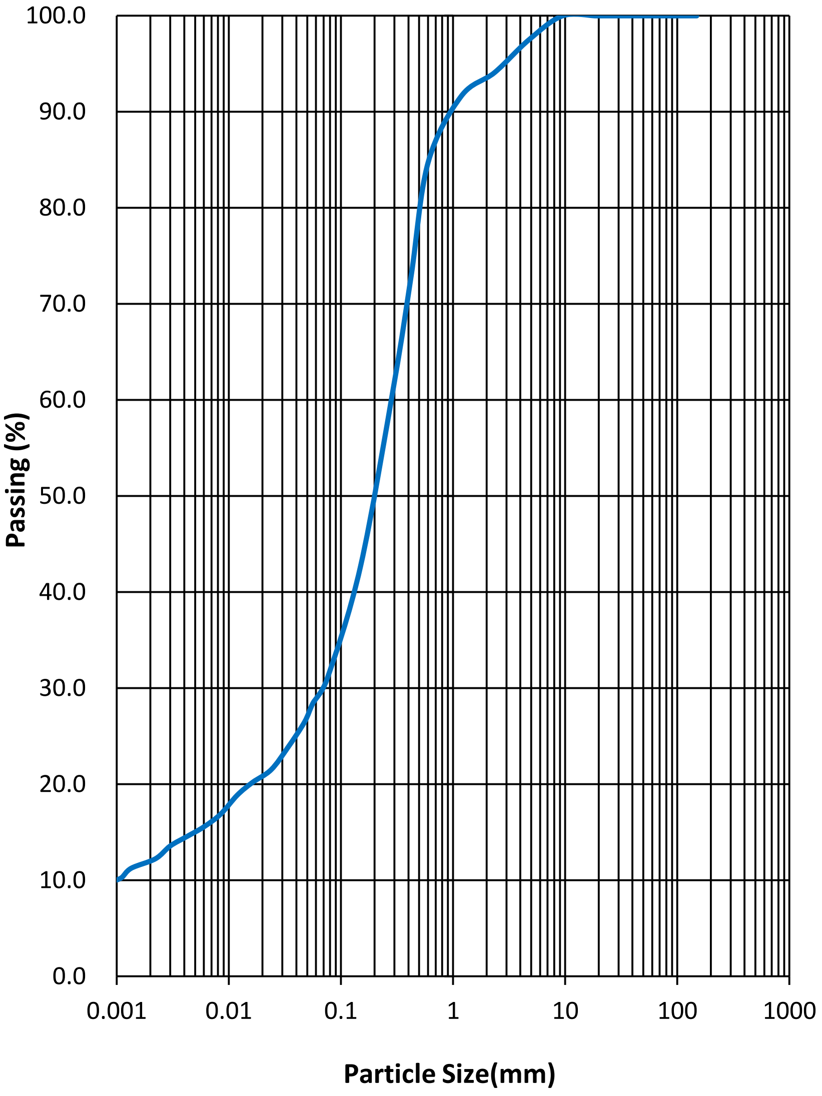
Client:	Talis Consultants	Date Tested:	27/01/2018
Project:	Onslow TW17084	EP Lab Job Number:	TALIS
Sample No:	TP90 @ 0.00m	Depth(m):	0.00 - 0.50
Sample ID:	TP90_0.00_TALIS1801_PSD	Room Temperature at Test:	20°

Tested by: Hank
Checked by: Phil

2.36mm Particle Density (t/m³): 2.67

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	97.5
2.36	94.1
1.18	91.6
0.6	84.7
0.425	73.0
0.3	61.8
0.15	42.7
0.075	30.9
0.05648	28.5
0.04741	26.5
0.03367	23.8
0.02389	21.5
0.01626	20.2
0.01190	18.9
0.00844	16.9
0.00598	15.6
0.00424	14.6
0.00300	13.6
0.00222	12.2
0.00135	11.3
0.00110	10.3
0.00092	9.9
0.00083	9.9

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078 **Authorized Signature:**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

PARTICLE SIZE DISTRIBUTION TEST REPORT

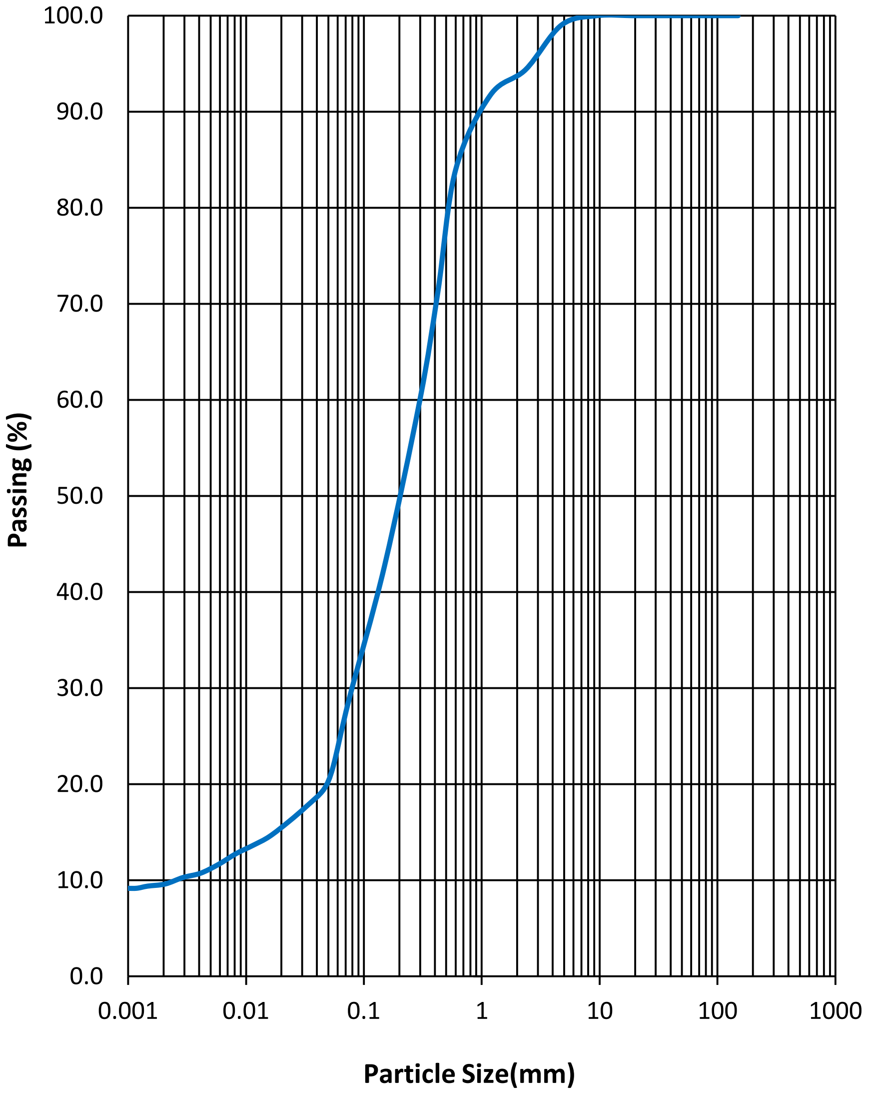
Test Method: AS 1289 3.6.3 3.5.1

Client:	Talis Consultants	Date Tested:	21/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP90	Depth(m):	0.00 - 0.50
Lab ID:	TP90_0.00_0.50_TALIS1802_PSD	Room Temperature at Test:	19

Tested by: Leigh
2.36mm Particle Density (t/m³): 2.87
Checked by: Phil

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	100.0
4.75	99.0
2.36	94.4
1.18	91.7
0.6	83.9
0.425	71.3
0.3	60.1
0.15	42.8
0.075	28.9
0.05466	21.8
0.04599	19.5
0.03267	17.7
0.02320	16.1
0.01582	14.6
0.01158	13.7
0.00820	12.8
0.00581	11.6
0.00412	10.7
0.00292	10.3
0.00207	9.6
0.00146	9.4
0.00117	9.2
0.00089	9.2
0.00084	8.9

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client
NATA: 19078

Authorized Signature:

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
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Mob: 0422 814 231

E-PRECISION LABORATORY

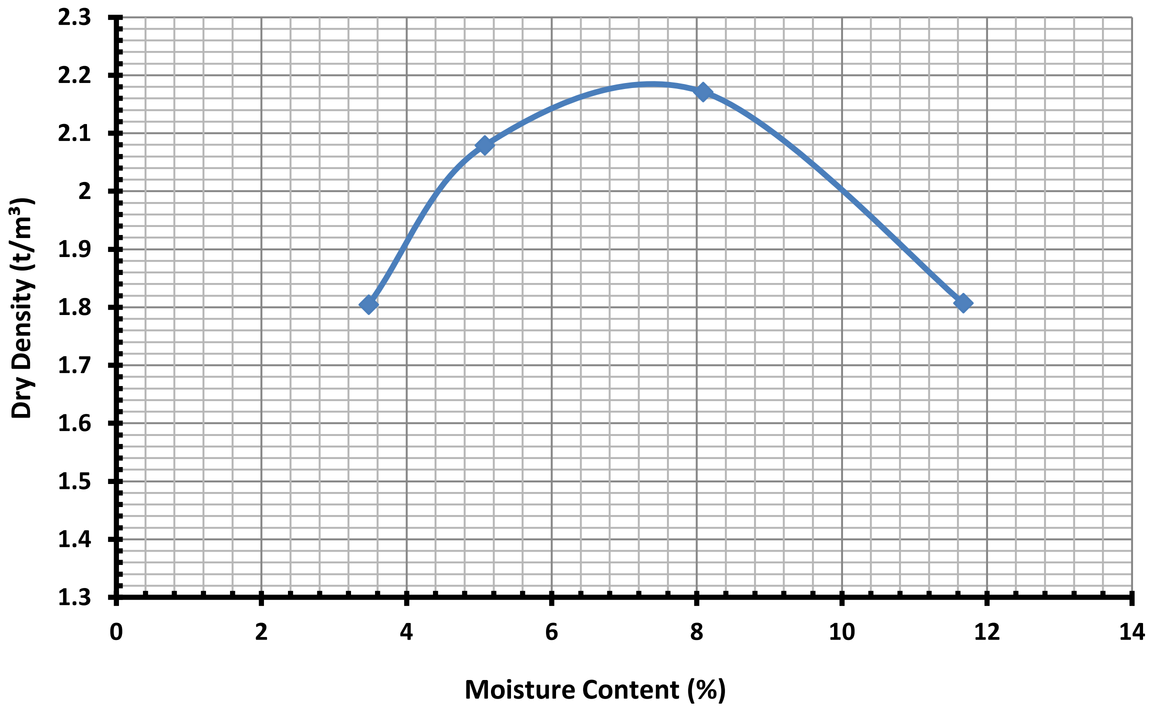
MOISTURE DENSITY RELATIONSHIP REPORT

Test Method: AS1289.5.2.1

Client:	Talis Environmental Consultants	Date Tested:	18/04/2018
Project:	Onslow TW17084	Lab:	EPLAB
Sample No:	TP90	Job Number:	TALIS
Lab ID:	TP90_0.50_1.00_MMDD		
Depth(m):	0.50 - 1.00	Room Temperature at Test:	20°C
Checked by:	Phil	Sample Description:	Tested in Mould A
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Results

Maximum Size (mm):	19.00	**Maximum Dry Density (t/m³):**	**2.220**
Oversize dry (%):	0.00	**Optimum Moisture Content (%):**	**7.50**



Notes:

Stored and Tested the Sample as received

Samples supplied by the Client NATA: 19078 **Authorised Signature:**

The results of tests performed apply only to the specific sample at time of test unless otherwise clearly stated. Reference should be made to E-Precision Laboratory's "Standard Terms and Conditions" E-Precision Laboratory ABN 431 559 578 87

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

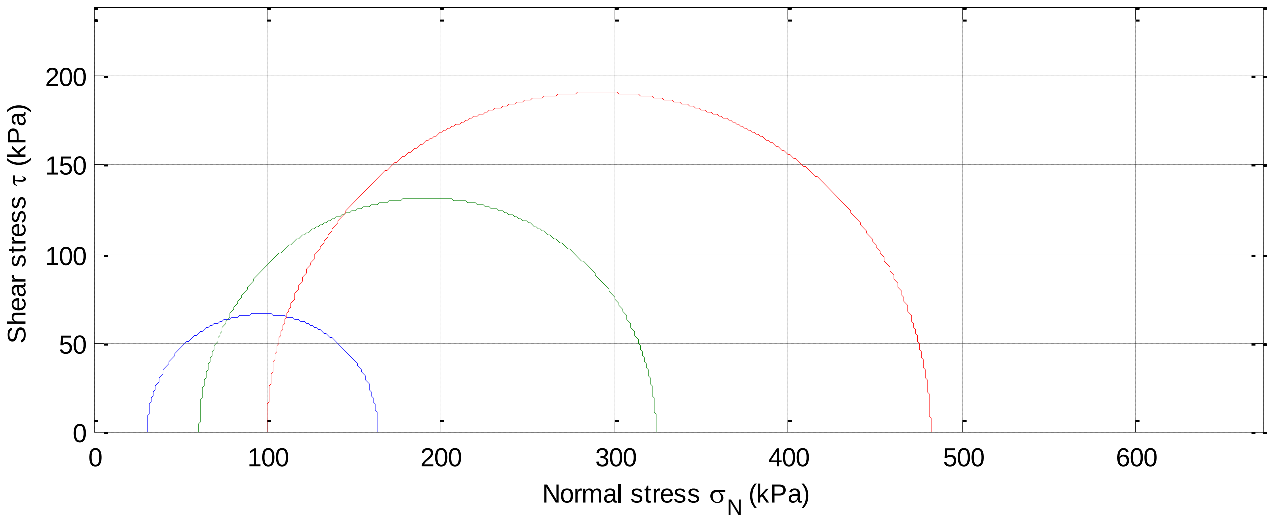
Method: AS1289.6.4.2 / In-house Method

Client: Talis Consultants
Date Tested: 02/05/2018
Project: TW17084 Onslow
EP Lab Job Number: TALIS
Sample No: TP90
Lab: EPLab
Sample ID: TP90_0.00_0.50_TALIS1802_CU
Depth (m): 0.00 - 0.50
Room Temperature at Test: ~ 18°c

Tested by: PHIL
Height (mm): 124.37
Diameter (mm): 61.75
L/D Ratio: 2.01
Initial Moisture (%): 7.56
Final Moisture (%): 6.11
Bulk Density (t/m³): 2.28
Dry Density (t/m³): 2.12
Strain Rate (mm/min): 0.006
Skempton's (B): 0.99
Geology: -

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

Interpretation from Mohr Circle:	**Sample 1 & 2**	**Sample 1 & 3**	**Sample 2 & 3**
Cohesion C' (kPa):	0.15	5.27	19.09
Angle of Shear Resistance Φ' (Degrees) :	43.05	40.03	37.23

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

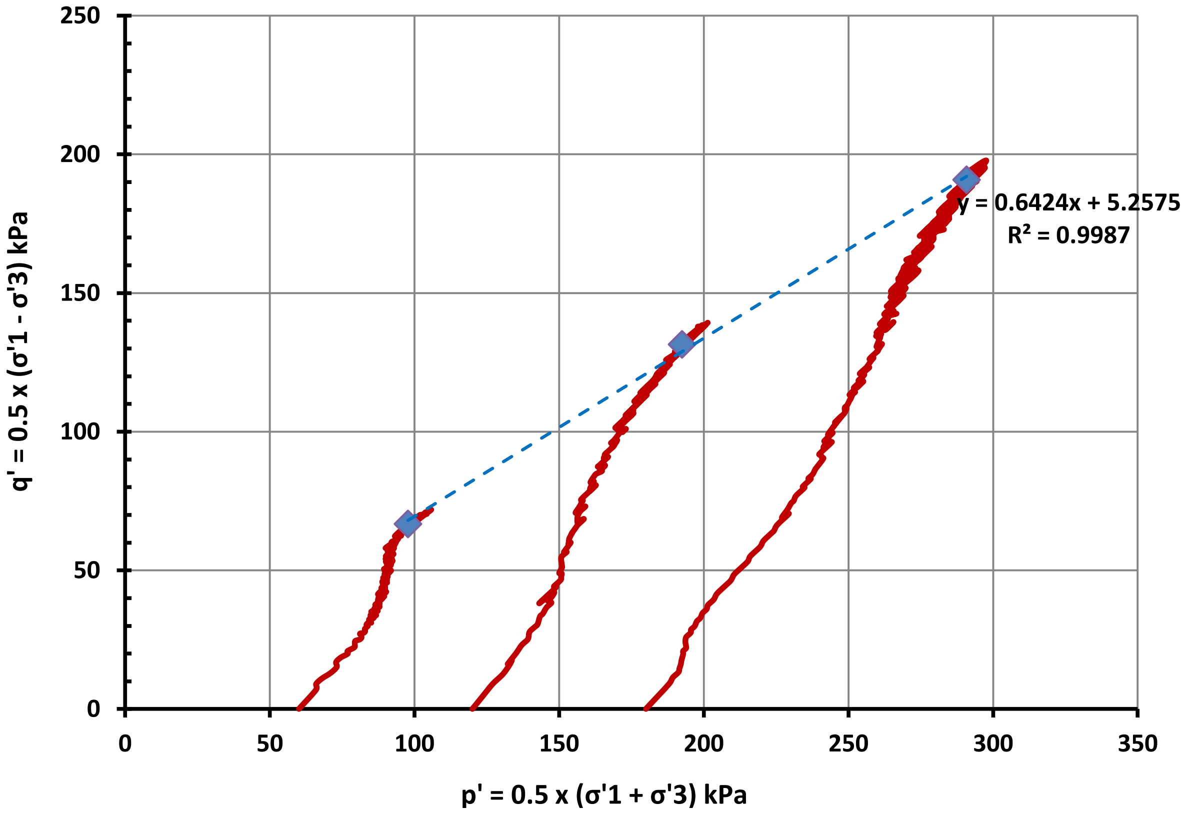
E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP90	Lab:	EPLab
Sample ID:	TP90_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : **6.86**

Angle of Shear Resistance Φ' (Deg) : **39.97**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

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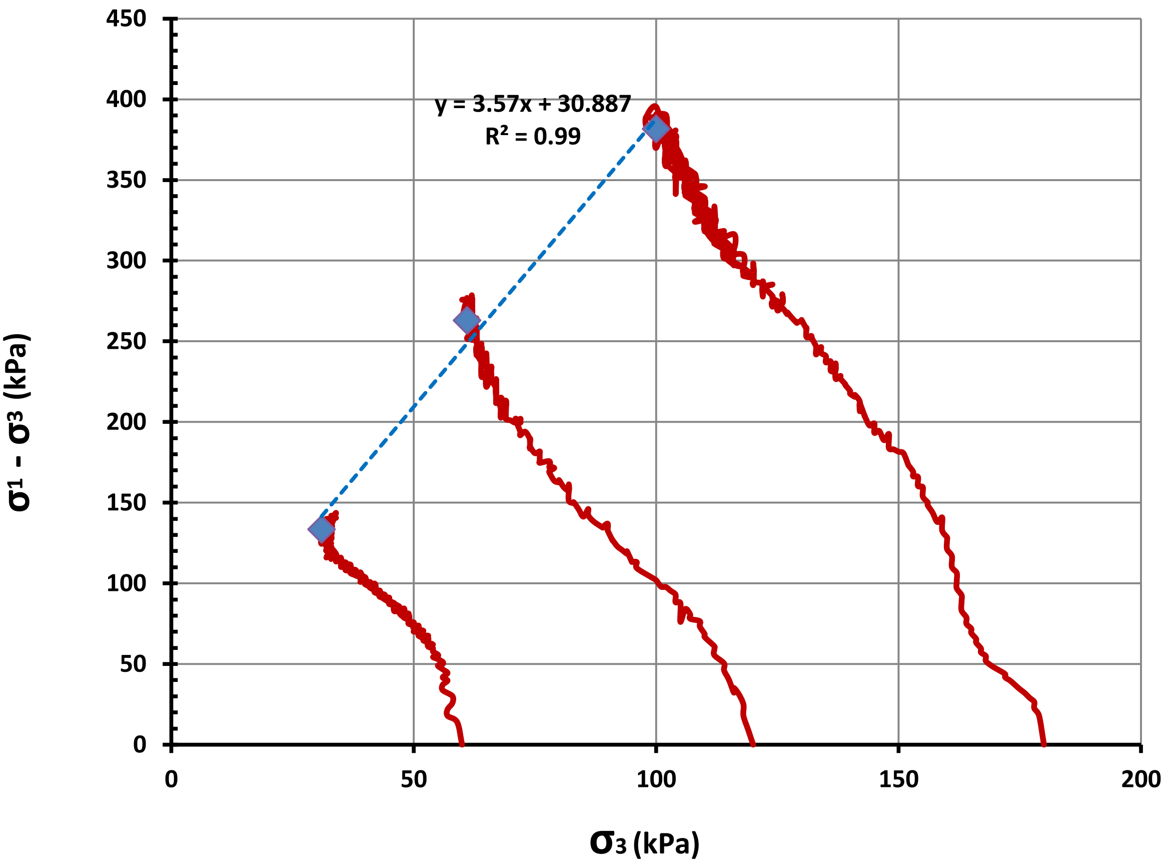
SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP90	Lab:	EPLab
Sample ID:	TP90_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : **7.22**

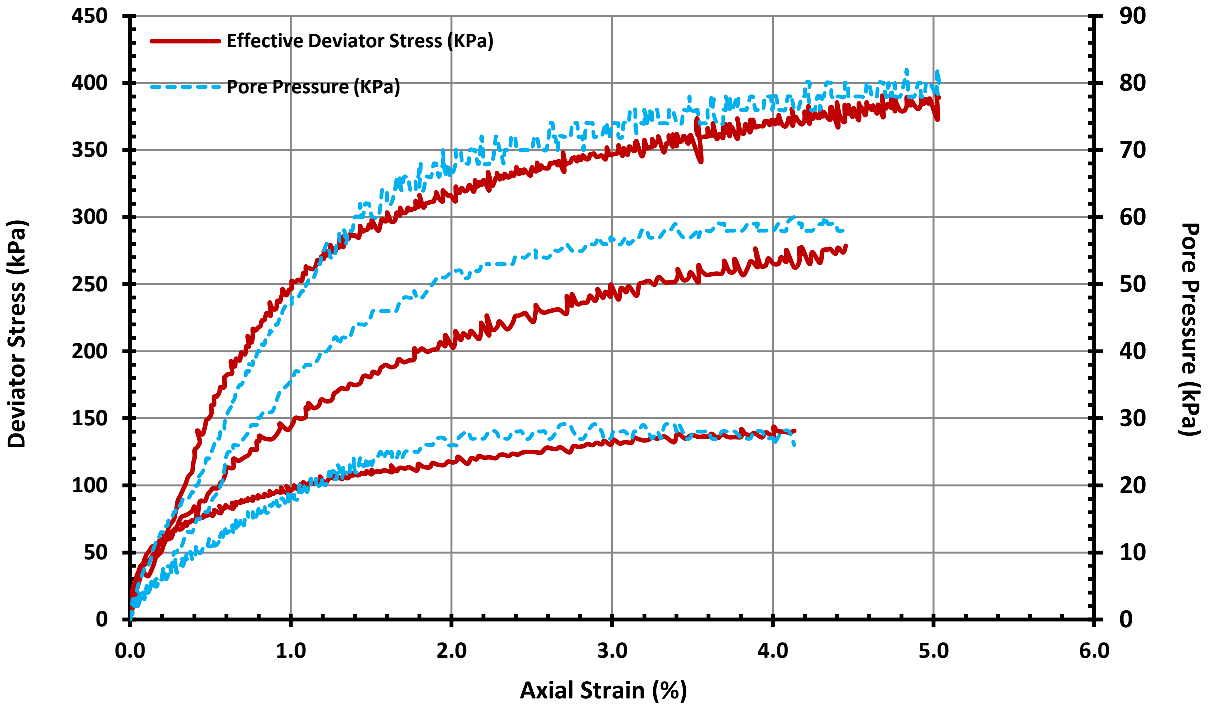
Angle of Shear Resistance Φ' (Deg) : **39.86**

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP90	Lab:	EPLab
Sample ID:	TP90_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'0	U'f	Principal Effective Stresses			σ'1 - σ'3	Strain (%)
				σ'1	σ'3	σ'1 / σ'3		
1	60	0	29	164	31	5.31	133	3.19
2	120	0	59	324	61	5.31	263	3.91
3	180	0	80	482	100	4.82	382	4.36

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

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SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client: Talis Consultants
Project: TW17084 Onslow
Sample No: TP90
Sample ID: TP90_0.00_0.50_TALIS1802_CU
Depth (m): 0.00 - 0.50

Date Tested: 02/05/2018
EP Lab Job Number: TALIS
Lab: EPLab
Room Temperature at Test: ~ 18°C

Photo After Test

Sample ID: TP90
Lab ID: TP90_0.00_0.50_TALIS1802_CU
Depth (m): 0.00 - 0.50
Date Tested: 02/05/2018

Stage 1 **Stage 2** **Stage 3**

Failure Mode: Bulging Failures observed for all samples

Notes: **Sample remolded based on 95% MMDD @ OMC**

Stored and Tested the Sample as received Accredited for compliance with ISO/IEC 17025-TESTING

Samples supplied by the Client

NATA: 19078

Authorised Signatory (Geotechnical Engineer):

NATA
ACCREDITATION NO: 19078

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

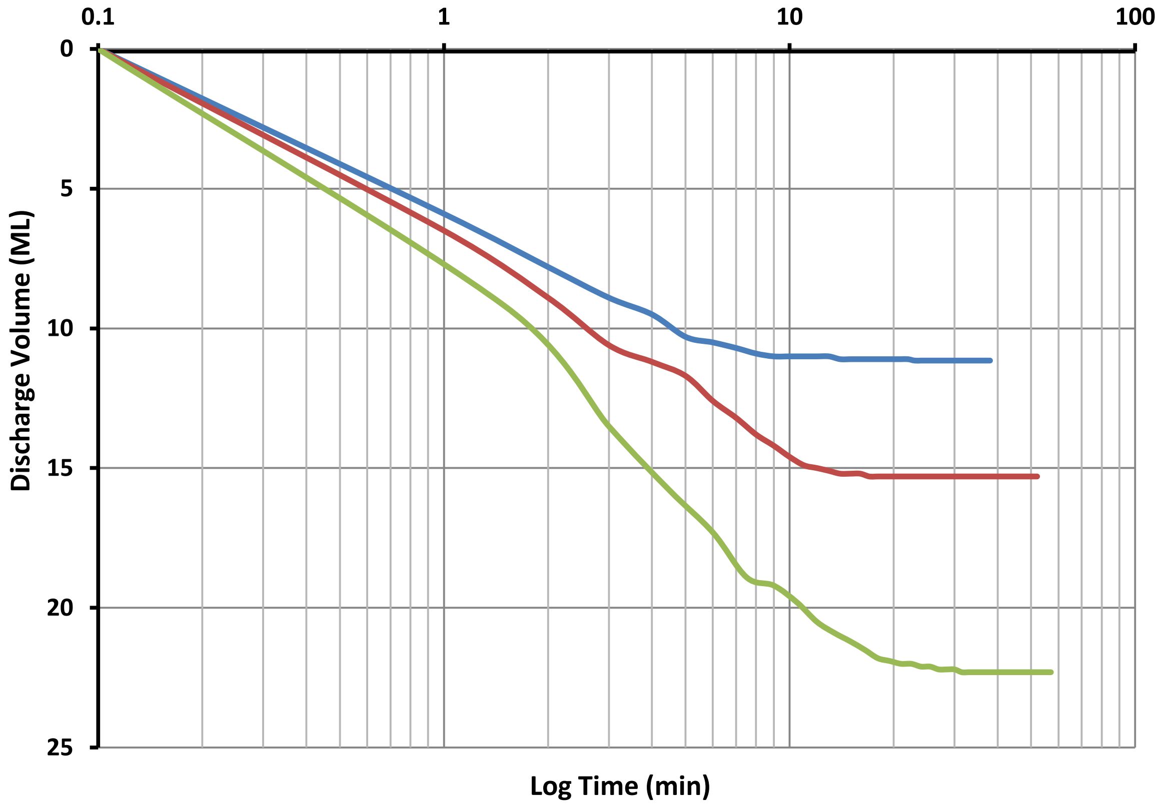
E-PRECISION LABORATORY

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP90	Lab:	EPLab
Sample ID:	TP90_0.00_0.50_TALIS1802_CU		
Depth (m):	0.00 - 0.50	Room Temperature at Test:	~ 18°C

Discharge Volume (ML) Vs Log Time (min)



Sample 1	**Cv (cm²/s):**	0.475	based on **t_{90}**
Sample 2	**Cv (cm²/s):**	0.328	based on **t_{90}**
Sample 3	**Cv (cm²/s):**	0.190	based on **t_{90}**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

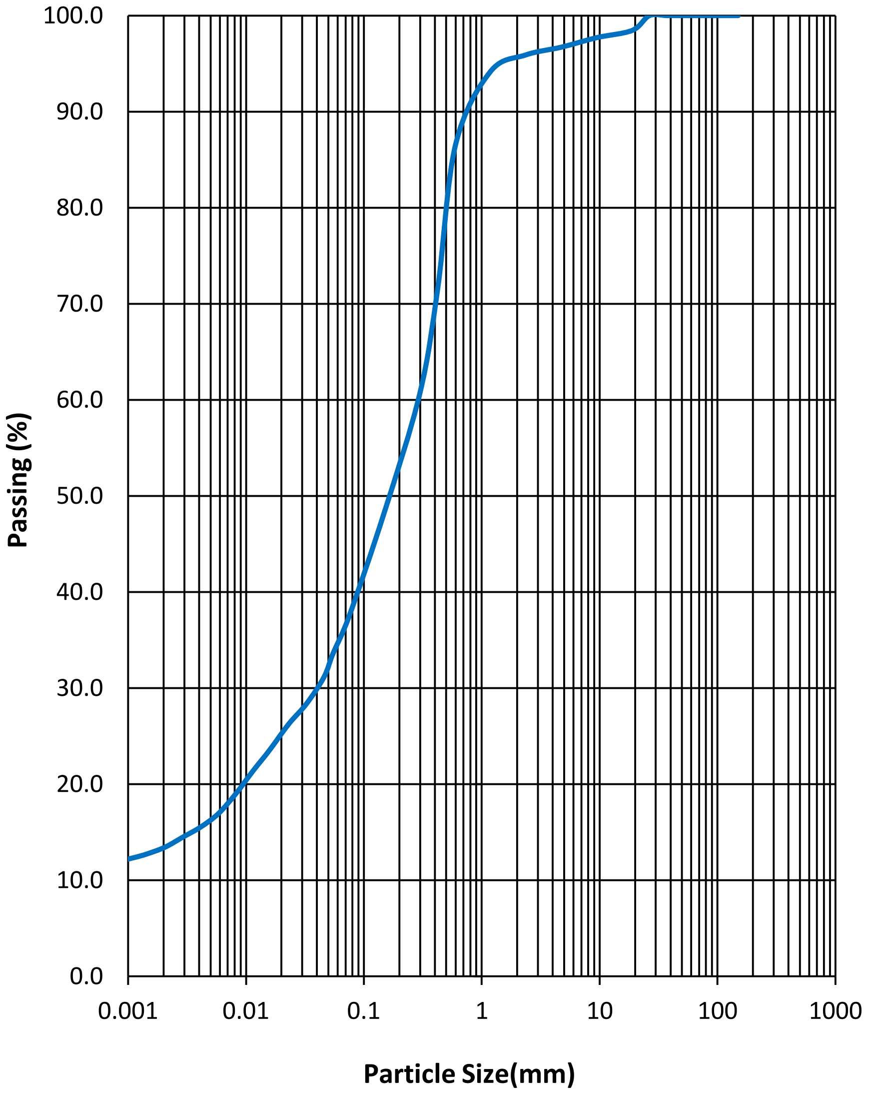
PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3 3.5.1

Client:	Talis Consultants	Date Tested:	21/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP93	Depth(m):	0.50 - 1.00
Lab ID:	TP93_0.50_1.00_TALIS1802_PSD	Room Temperature at Test:	19
Tested by:	Leigh	2.36mm Particle Density (t/m³):	2.87
Checked by:	Phil		

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	98.5
9.5	97.7
4.75	96.7
2.36	95.9
1.18	94.1
0.6	86.5
0.425	71.7
0.3	60.7
0.15	48.4
0.075	37.5
0.05464	33.6
0.04589	31.1
0.03261	28.4
0.02314	26.3
0.01579	23.5
0.01157	21.4
0.00821	19.0
0.00582	16.9
0.00413	15.5
0.00292	14.5
0.00207	13.4
0.00146	12.8
0.00117	12.4
0.00089	12.1
0.00085	12.1

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client NATA: 19078

Authorized Signature:

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-PRECISION LABORATORY

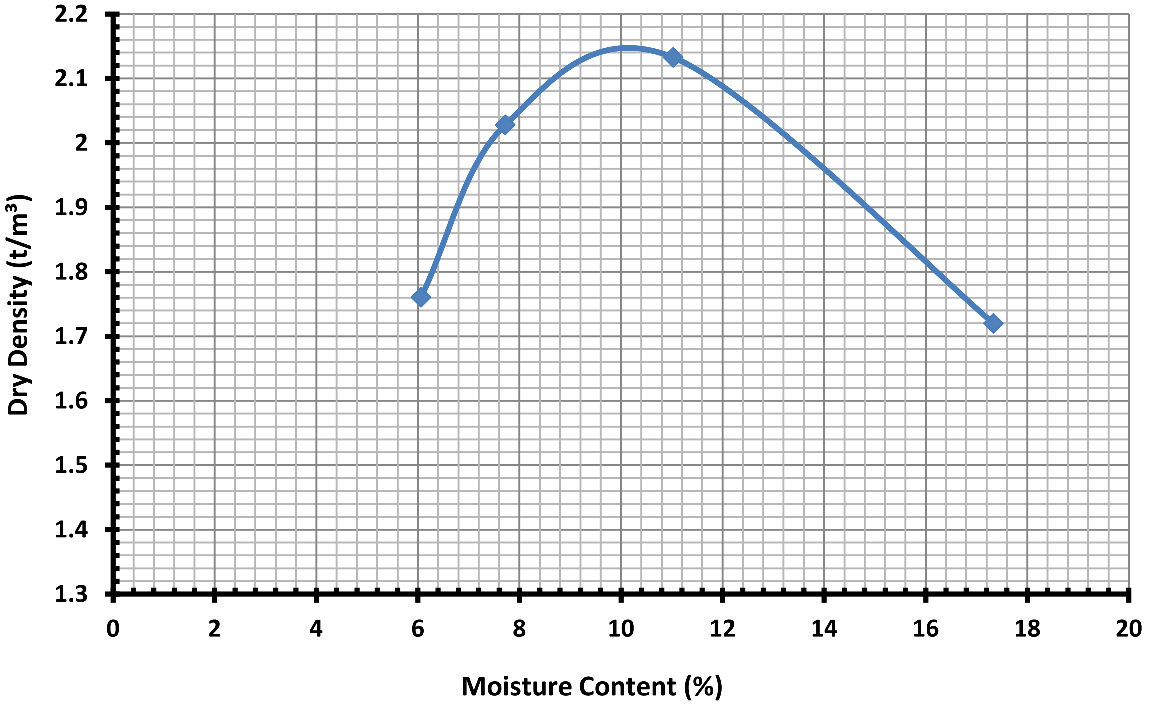
MOISTURE DENSITY RELATIONSHIP REPORT

Test Method: AS1289.5.2.1

Client:	Talis Environmental Consultants	Date Tested:	19/04/2018
Project:	Onslow TW17084	Lab:	EPLAB
Sample No:	TP93	Job Number:	TALIS
Lab ID:	TP93_0.50_1.00_MMDD		
Depth(m):	1.00 - 1.40	Room Temperature at Test:	20ºC
Checked by:	Phil	Sample Description:	Tested in Mould A
Moisture Content (%):	-	Wet Density (t/m³):	-
		Dry Density (t/m³):	-

Results

Maximum Size (mm):	19.00	**Maximum Dry Density (t/m³):**	**2.150**
Oversize dry (%):	1.50	**Optimum Moisture Content (%):**	**10.00**



Notes:

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Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

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SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

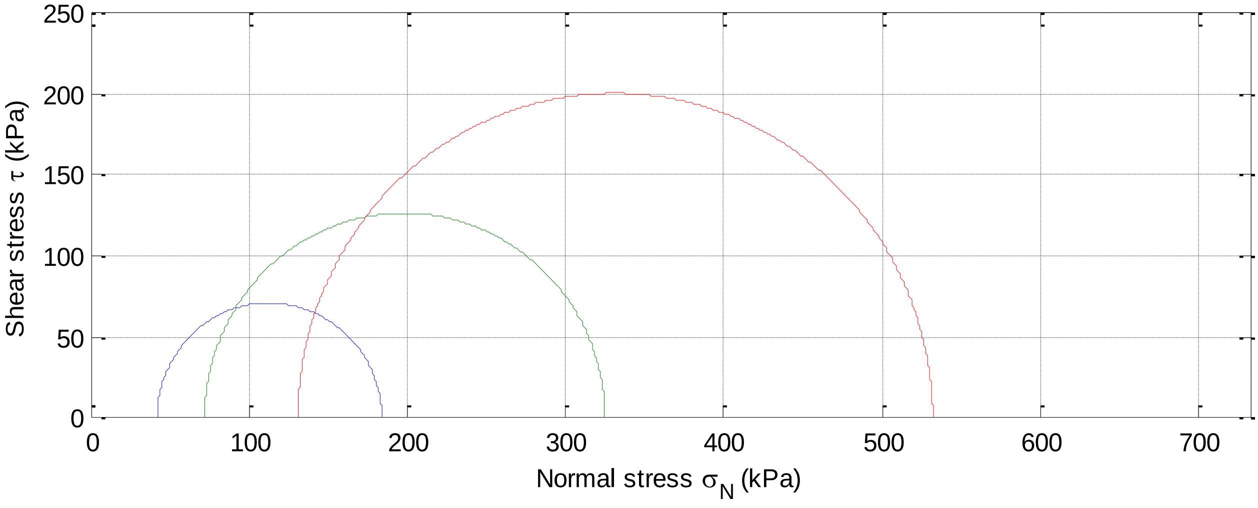
Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP80	Lab:	EPLab
Sample ID:	TP80_0.50_1.00_TALIS1802_CU		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°c

Tested by:	PHIL	Initial Moisture (%):	10.03	Strain Rate (mm/min):	0.006
Height (mm):	125.03	Final Moisture (%):	7.82	Skempton's (B):	0.99
Diameter (mm):	61.82	Bulk Density (t/m³):	2.24	Geology:	-
L/D Ratio:	2.02	Dry Density (t/m³):	2.03		

Failure Criteria used: Peak Principle Stress Ratio

Mohr Circle Diagram



Interpretations conducted using Matlab

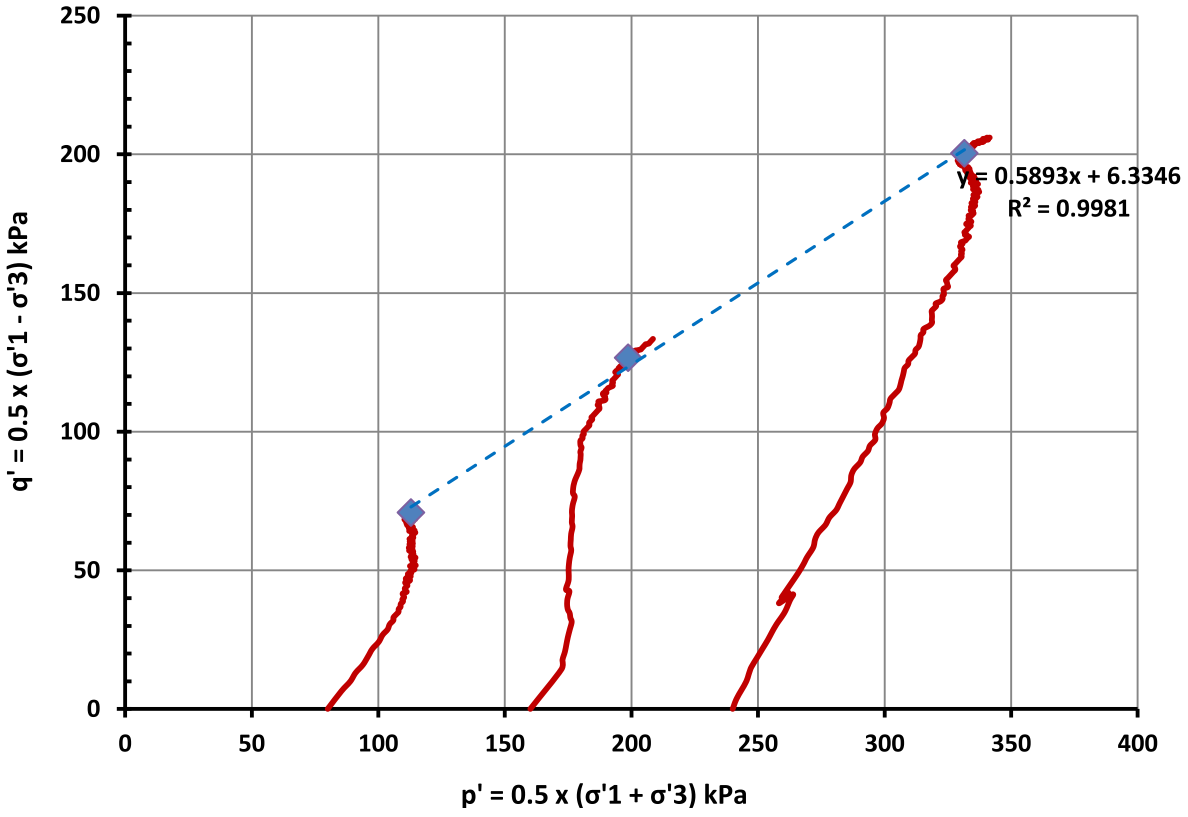
Interpretation from Mohr Circle:	Sample 1 & 2	Sample 1 & 3	Sample 2 & 3
Cohesion C' (kPa):	0.49	5.00	19.33
Angle of Shear Resistance Φ' (Degrees) :	38.73	36.50	33.82

SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP80	Lab:	EPLab
Sample ID:	TP80_0.50_1.00_TALIS1802_CU		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C

MIT Effective Stress Path (q' vs p' diagram)



MIT Stress Path - Using Stress Path Tangency Method

Cohesion C' (kPa) : **7.83**

Angle of Shear Resistance Φ' (Deg) : **36.11**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

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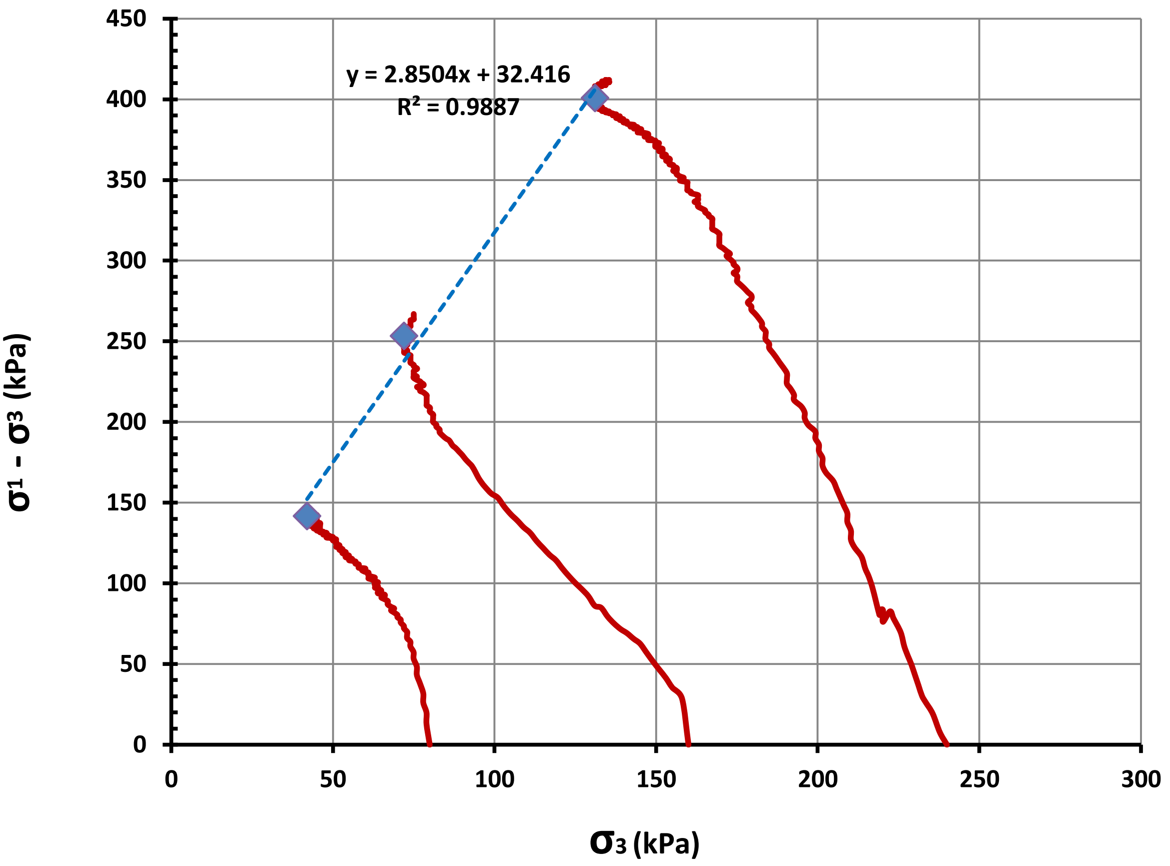
SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP80	Lab:	EPLab
Sample ID:	TP80_0.50_1.00_TALIS1802_CU		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C

Modified Mohr Coulomb Stress Path



Modified Mohr Coulomb Path - Using Stress Path Tangency Method

Cohesion C' (kPa) :	**8.26**
Angle of Shear Resistance Φ' (Deg) :	**35.99**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
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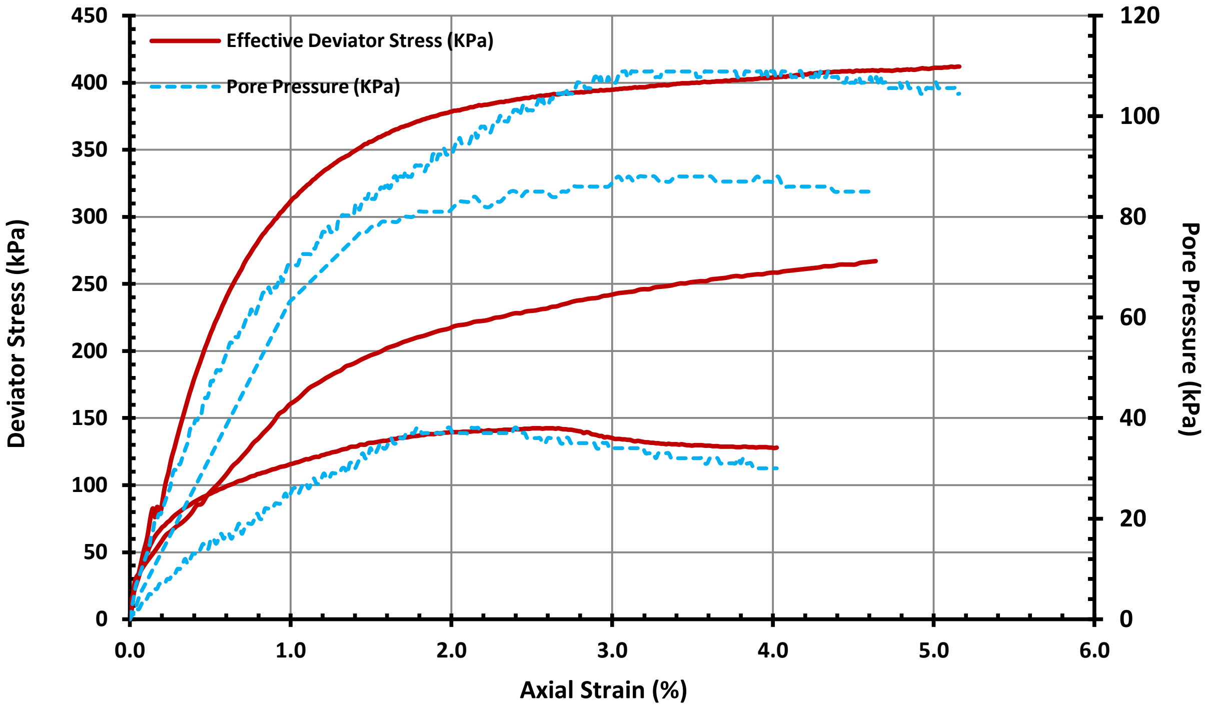
SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP80	Lab:	EPLab
Sample ID:	TP80_0.50_1.00_TALIS1802_CU		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C

Deviator Stress Vs Strain Diagram



SHEAR STAGE DATA AND STRESS MEASUREMENTS (kPa)

Shear Stage	Confining Pressure	U'0	U'f	Principal Effective Stresses			σ'1 - σ'3	Strain (%)
				σ'1	σ'3	σ'1 / σ'3		
1	80	0	38	184	42	4.37	142	2.41
2	160	0	88	325	72	4.52	253	3.62
3	240	0	109	532	131	4.06	401	3.64

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA, 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

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SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client:	Talis Consultants	Date Tested:	02/05/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP80	Lab:	EPLab
Sample ID:	TP80_0.50_1.00_TALIS1802_CU		
Depth (m):	0.50 - 1.00	Room Temperature at Test:	~ 18°C

Photo After Test

Sample ID:	TP80	**Depth (m):**	0.50 - 1.00
Lab ID:	TP80_0.50_1.00_TALIS1802_CU	**Date Tested:**	02/05/2018

Stage 1

Stage 2

Stage 3

Failure Mode: Bulging Failures observed for all samples

Notes: **Sample remolded based on 95% MMDD @ OMC**

Stored and Tested the Sample as received Accredited for compliance with ISO/IEC 17025-TESTING

Samples supplied by the Client

NATA: 19078

Authorised Signatory (Geotechnical Engineer):

NATA
ACCREDITATION NO: 19078

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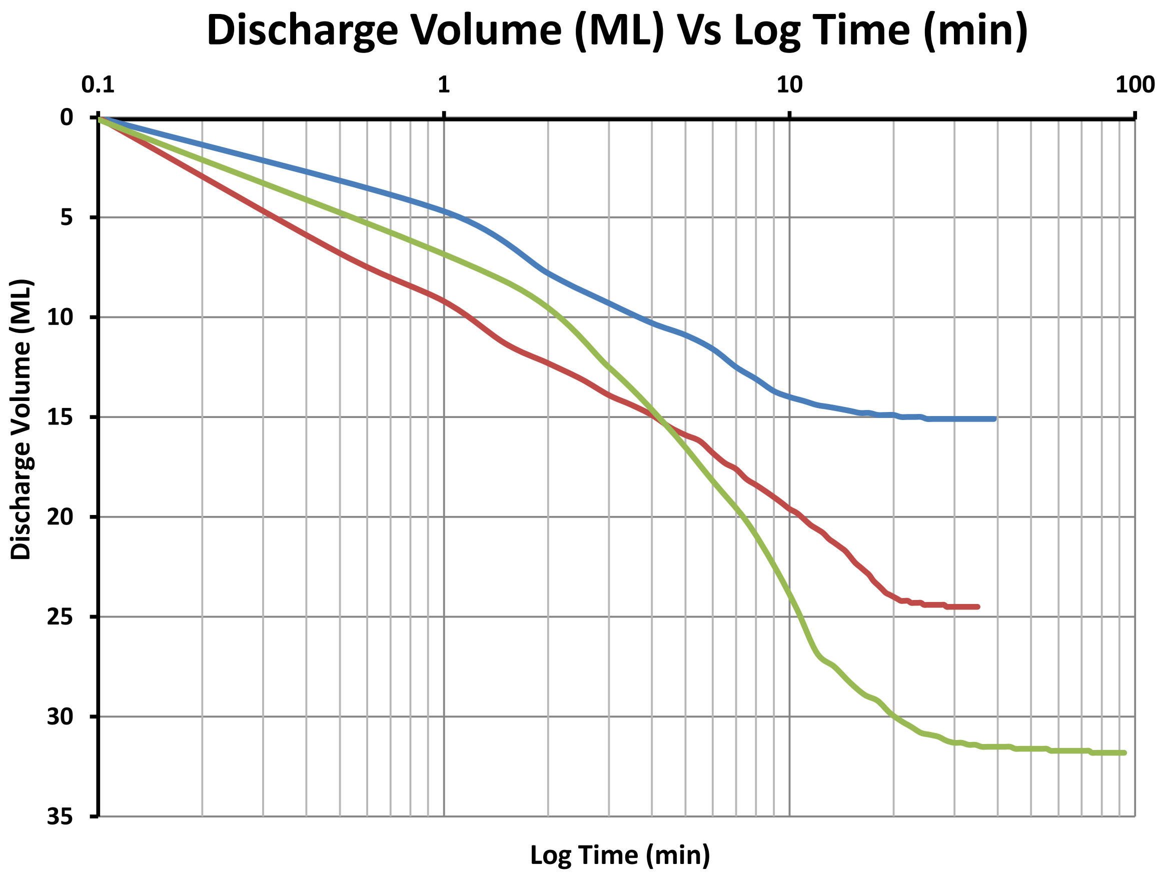
SINGLE STAGE CONSOLIDATED UNDRAINED TRIAXIAL TEST

Method: AS1289.6.4.2 / In-house Method

Client: Talis Consultants
Project: TW17084 Onslow
Sample No: TP80
Sample ID: TP80_0.50_1.00_TALIS1802_CU
Depth (m): 0.50 - 1.00

Date Tested: 02/05/2018
EP Lab Job Number: TALIS
Lab: EPLab
Room Temperature at Test: ~ 18°C



Sample 1	**Cv (cm²/s):**	0.076	based on **t_{90}**
Sample 2	**Cv (cm²/s):**	0.051	based on **t_{90}**
Sample 3	**Cv (cm²/s):**	0.040	based on **t_{90}**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
E-mail: Phillip.li@eprecisionlab.com
Mob: 0422 814 231

E-Precision Laboratory

PARTICLE SIZE DISTRIBUTION TEST REPORT

Test Method: AS 1289 3.6.3 3.5.1

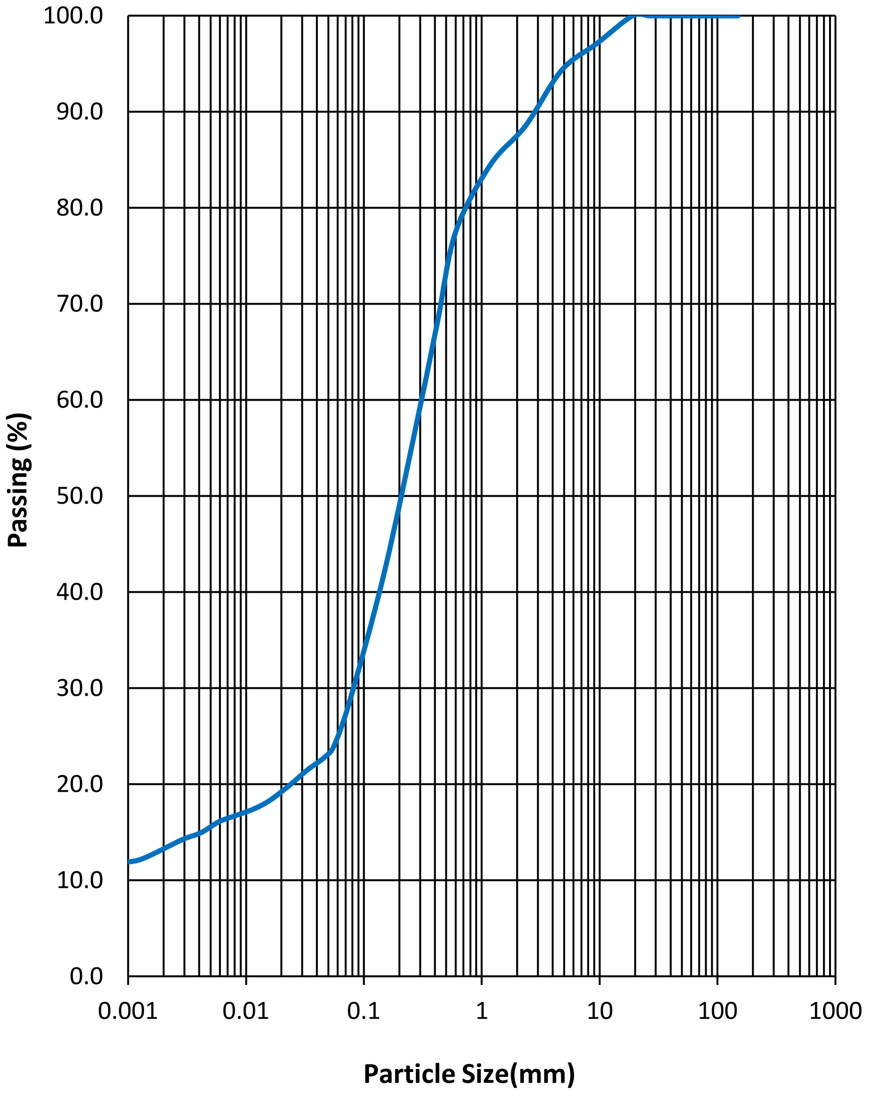
Client:	Talis Consultants	Date Tested:	21/04/2018
Project:	TW17084 Onslow	EP Lab Job Number:	TALIS
Sample No:	TP104	Depth(m):	0.00 - 0.50
Lab ID:	TP104_0.00_0.50_TALIS1802_PSD	Room Temperature at Test:	19

Tested by: Leigh
Checked by: Phil

2.36mm Particle Density (t/m³): 2.79

Sieve Size (mm)	Passing %
150	100.0
75	100.0
53	100.0
37.5	100.0
26.5	100.0
19	100.0
9.5	97.1
4.75	94.3
2.36	88.6
1.18	84.5
0.6	77.5
0.425	68.4
0.3	59.4
0.15	42.2
0.075	28.5
0.05551	24.0
0.04657	22.8
0.03305	21.5
0.02347	19.9
0.01599	18.4
0.01171	17.5
0.00829	16.8
0.00588	16.1
0.00417	15.0
0.00295	14.3
0.00209	13.4
0.00148	12.5
0.00119	12.1
0.00091	11.8
0.00086	11.6

PSD Graph



Notes:
Stored and Tested the Sample as received
Samples supplied by the Client
NATA: 19078

Authorized Signature:

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
Mob: 0422 814 231
E-mail: Phillip.li@eprecisionlab.com

E-PRECISION LABORATORY

MOISTURE CONTENT TEST REPORT

Test Method: AS1289 2.1.1

Client:	Talis Environmental Consultants	Date Tested:	22/12/2017
Project:	TW17084 Onslow	Date Reported:	05/02/2018
		EP Lab Job Number:	TALIS

Tested by: James
Checked by: Phil

Test Results

Sample ID		Moisture (%)
TP1 @ 1.00 - 1.50		3.738
TP29 @ 3.00 - 3.50		2.602
TP29 @ 0.50 - 1.00		2.954
TP01 @ 4.50 - 5.00		1.657
TP44 @ 0.00 - 0.50		2.927
TP42 @ 0.00 - 0.50		5.616
TP50		2.541
TP44 @ 2.50 - 3.00		4.863
TP50 @ 1.00 - 1.20		4.669
TP92@ 0.50 - 1.00		6.051
TP39 @ 3.00 - 3.50		1.451
TP102 @ 0.00 - 0.50		1.873
TP104 @ 0.00 - 0.50		2.451
TP110 @ 0.00 - 0.50		1.146
TP90 @ 0.00 - 0.50		4.452
TP103 @ 0.00 - 0.40		1.850
TP36 @ 0.00 - 0.50		1.381

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
Mob: 0422 814 231
E-mail: Phillip.li@eprecisionlab.com

E-PRECISION LABORATORY

MOISTURE CONTENT TEST REPORT

Test Method: AS1289 2.1.1

Client: Talis Environmental Consultants
Project: TW17084 Onslow

Date Tested: 22/12/2017
Date Reported: 05/02/2018
EP Lab Job Number: TALIS

Tested by: James
Checked by: Phil

Test Results

Sample ID		Moisture (%)
TP93 @ 0.00 - 0.50		1.633
TP78 @ 0.00 - 0.50		0.697
TP90 @ 0.50 - 1.00		1.498
TP11 @ 1.00 - 1.20		1.761
TP11 @ 4.00 - 4.50		0.902
TP07 @ 1.50 - 2.00		0.394
TP09 @ 0.00 - 0.50		1.767
TP06 @ 2.00 - 2.50		1.024
TP19 @ 4.00 - 4.50		3.226
TP77 @ 0.00 - 0.50		0.908
TP60 @ 0.00 - 0.30		0.519
TP66 @ 0.00 - 0.50		1.290
TP80 @ 0.00 - 0.50		3.426
TP55 @ 0.00 - 0.50		5.438
TP71 @ 0.00 - 0.50		2.692
TP34 @ 2.00 - 2.20		4.982
TP68 @ 0.00 - 0.50		3.261

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

NATA: 19078

Authorised Signatory (Geotechnical Engineer):

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
Mob: 0422 814 231
E-mail: Phillip.li@eprecisionlab.com

E-PRECISION LABORATORY

MOISTURE CONTENT TEST REPORT

Test Method: AS1289 2.1.1

Client: Talis Environmental Consultants
Project: TW17084 Onslow

Date Tested: 22/12/2017
Date Reported: 05/02/2018
EP Lab Job Number: TALIS

Tested by: James
Checked by: Phil

Test Results

Sample ID		Moisture (%)
TP84 @ 1.00 - 1.40		4.762
TP66 @ 2.80 - 3.00		7.917
TP80 @ 0.00 - 0.50		1.969
TP53 @ 0.00 - 0.50		5.413
TP34 @ 0.00 - 0.50		3.797
TP62 @ 0.50 - 0.70		3.566
TP72 @ 0.00 - 0.50		4.038

Notes:

Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

Perth
Unit 3, 34 Sphinx Way
Bibra Lake
WA 6163
Ph: (08) 9418 8742
Mob: 0422 814 231
E-mail: Phillip.li@eprecisionlab.com

E-PRECISION LABORATORY

SHRINK SWELL INDEX TEST REPORT

Test Method: AS1289 7.1.1

Client:	Talis Environmental Consultants	Date Tested:	23/01/2018
Project:	TW17084 Onslow	Date Reported:	05/02/2018
		EP Lab Job Number:	TALIS

Tested by: James
Checked by: Phil

Lab ID:	TP29_1_SW	BH14_1_SW	BH14_2_SW	BH17_1_SW	TP44_1_SW	TP36_1_SW
Client ID:	TP29 @ 3.00m	BH14 @ 3.60m	BH14 @ 5.00m	BH17 @ 2.10m	TP44 @ 2.50	TP36 @ 3.00
Depth (m):	3.00 - 3.50	3.6	5	2.1	2.50 - 3.00	3.00 - 3.50
Preparation:	Remolded	Insitu	Insitu	Insitu	Remolded	Remolded
Dry Density (t/m³):	2.05	1.96	2.47	1.38	1.64	2.07
Moisture Content (%):	7.26	3.25	1.11	15.26	8.66	7.56
Thickness (mm):	20.26	20.22	21.63	20.56	20.77	21.69
Diameter (mm):	61.8	60.89	60.27	61.55	60.39	61.37
Surcharge (kPa):	12.5	12.5	12.5	12.5	12.5	12.5
Swell (%):	**0.543**	**0.396**	**0.277**	**1.751**	**0.770**	**0.645**
Swell Moisture Content (%) before	7.26	3.25	1.11	15.26	8.66	7.56
Swell Moisture Content (%) after	9.85	7.11	5.22	19.75	12.79	11.25
Shrinkage (%):	**1.28**	**0.49**	**0.51**	**2.09**	**1.36**	**0.80**
Shrinkage Moisture Content (%)	7.33	3.22	14.26	14.99	14.99	7.34
Shrink Swell Index I_{ss} (%)	**0.86**	**0.38**	**0.36**	**1.65**	**0.97**	**0.62**

Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

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Perth
Unit 3, 34 Sphinx Way
Bibra Lake,
WA 6163
Ph: (08) 9418 8742
Mob: 0422 814 231
E-mail: Phillip.li@eprecisionlab.com

E-PRECISION LABORATORY

FALLING HEAD PERMEABILITY TEST REPORT

Test Method: AS1289 6.7.2 / In-house Method

Client:	Talis Consultants	Date Tested:	29/01/2018
Project:	TW17084 Onslow	Date Reported:	06/02/2018
Lab:	EPLAB	EP Lab Job Number:	TALIS
Tested by:	Phil / Lee		
Checked by:	Phil		

Lab ID:	TP29_1_FH	TP44_1_FH	TP36_1_FH	
Client ID:	TP29 @ 3.00	TP44 @ 2.50	TP36 @ 3.00	
Depth (m):	3.00 - 3.50	2.50 - 3.00	3.00 - 3.50	
Sample Conditions:	Remolded	Remolded	Remolded	
Surcharge Pressure (kPa):	25	25	25	
Initial Dry Density (t/m³):	2.030	1.886	2.076	
Initial Moisture Content (%):	7.16	8.69	7.55	
Saturated Density (t/m³):	2.220	2.130	2.320	
Saturation (Skempton's B):	0.97	0.98	0.97	
K_{20} (10^{-8} m/s):	**4.773**	**1.861**	**16.339**	

Notes:
Stored and Tested the Sample as received
Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

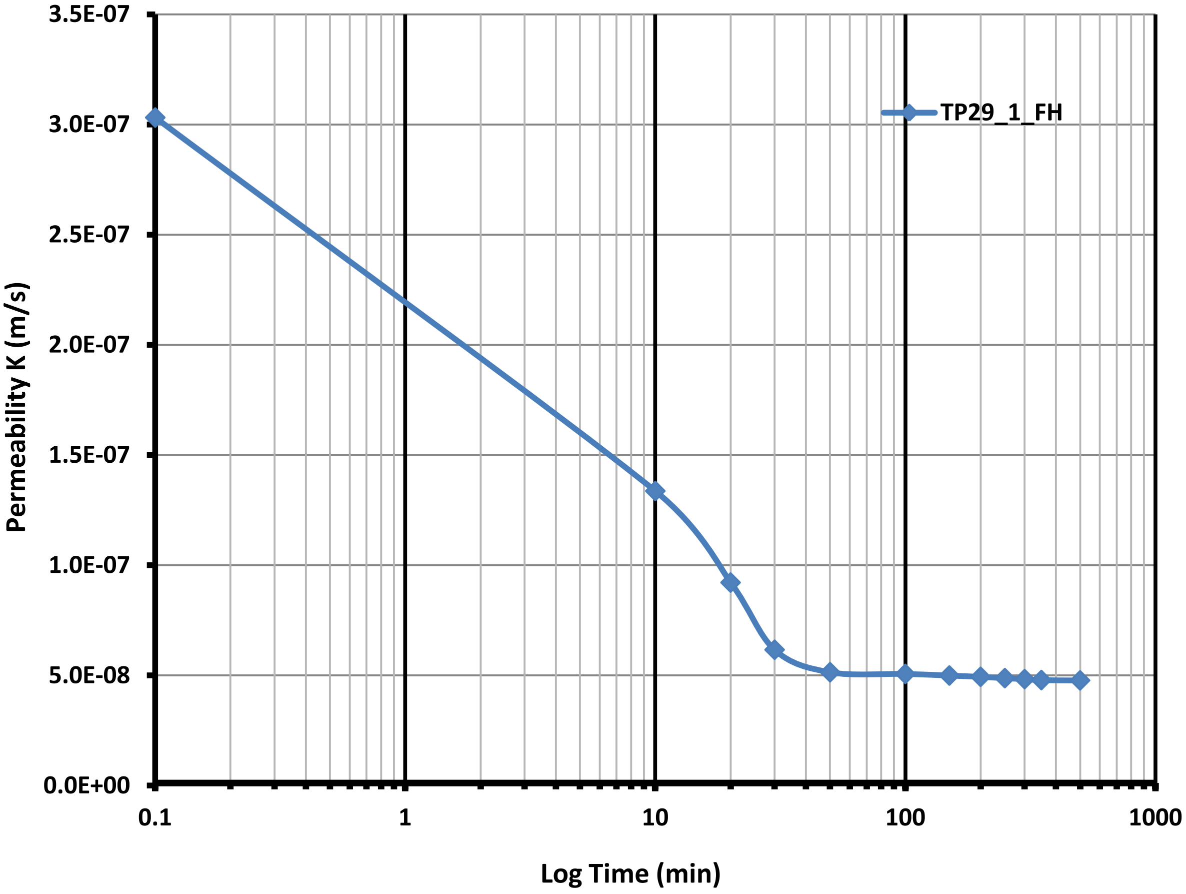
Perth
Unit 3, 34 Sphinx Way
Bibra Lake,
WA 6163
Ph: (08) 9418 8742
Mob: 0422 814 231
E-mail: Phillip.li@eprecisionlab.com

E-PRECISION LABORATORY

FALLING HEAD PERMEABILITY TEST REPORT

Test Method: AS1289 6.7.2 / In-house Method

Client:	Talis Consultants	Date Tested:	29/01/2018
Project:	TW17084 Onslow	Date Reported:	06/02/2018
Lab:	EPLAB	EP Lab Job Number:	TALIS



Notes:

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Samples supplied by the Client

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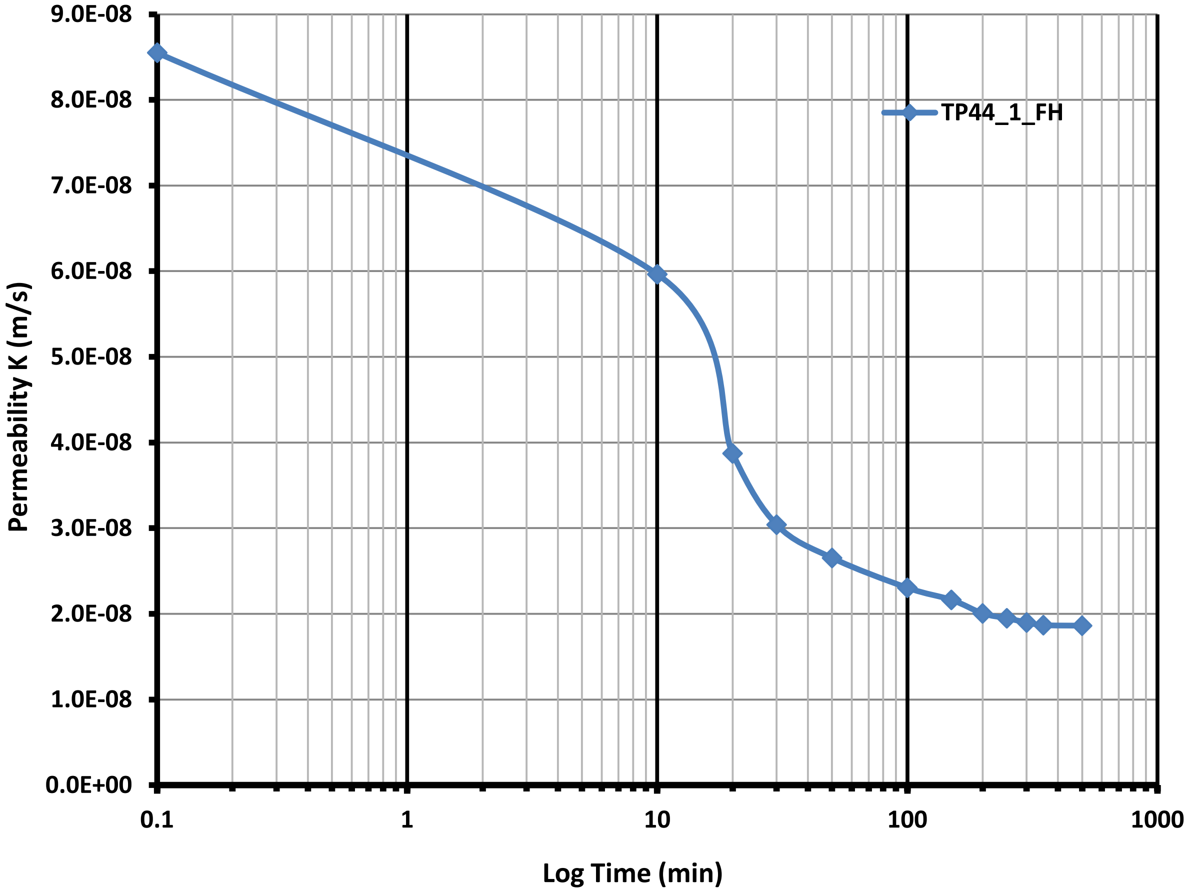
Perth
Unit 3, 34 Sphinx Way
Bibra Lake,
WA 6163
Ph: (08) 9418 8742
Mob: 0422 814 231
E-mail: Phillip.li@eprecisionlab.com

E-PRECISION LABORATORY

FALLING HEAD PERMEABILITY TEST REPORT

Test Method: AS1289 6.7.2 / In-house Method

Client:	Talis Consultants	Date Tested:	29/01/2018
Project:	TW17084 Onslow	Date Reported:	06/02/2018
Lab:	EPLAB	EP Lab Job Number:	TALIS



Notes:

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Samples supplied by the Client

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Unit 3, 34 Sphinx Way
Bibra Lake,
WA 6163
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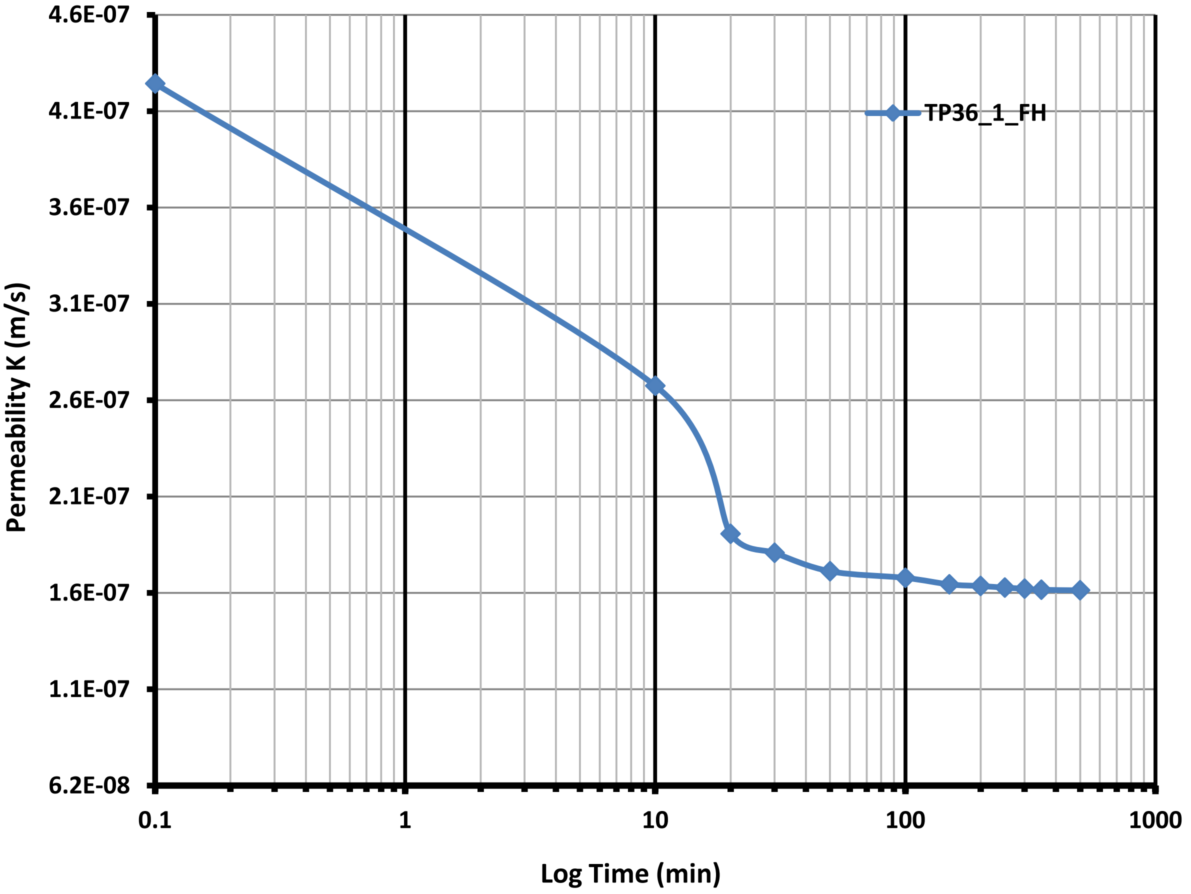
E-PRECISION LABORATORY

FALLING HEAD PERMEABILITY TEST REPORT

Test Method: AS1289 6.7.2 / In-house Method

Client:	Talis Consultants	Date Tested:	29/01/2018
Project:	TW17084 Onslow	Date Reported:	06/02/2018
Lab:	EPLAB	EP Lab Job Number:	TALIS



Notes:

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Samples supplied by the Client

Authorised Signatory (Geotechnical Engineer):

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Perth
Unit 3, 34 Sphinx Way
Bibra Lake,
WA 6163
Ph: (08) 9418 8742
Mob: 0422 814 231
E-mail: Phillip.li@eprecisionlab.com

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FALLING HEAD PERMEABILITY TEST REPORT

Test Method: AS1289 6.7.2 / In-house Method

Client:	Talis Consultants	Date Tested:	29/04/2018
Project:	TW17084 Onslow	Date Reported:	12/05/2018
Lab:	EPLAB	EP Lab Job Number:	TALIS
Tested by:	Phil		
Checked by:	Phil		

Lab ID:	TP84_1_FH	TP38_1_FH		
Client ID:	TP84 @ 1.00	TP38 @ 1.00		
Depth (m):	1.00 - 1.40	1.00 - 1.50		
Sample Conditions:	Remolded	Remolded		
Surcharge Pressure (kPa):	25	25		
Initial Dry Density (t/m³):	1.995	1.813		
Initial Moisture Content (%):	7.17	5.28		
Saturated Density (t/m³):	2.217	1.953		
Saturation (Skempton's B):	0.99	0.99		
K_{20} (10^{-9} m/s):	**6.107**	**48.589**		

Notes:
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Samples supplied by the Client

NATA: 19078 **Authorised Signatory (Geotechnical Engineer):**

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Ph: (08) 9418 8742
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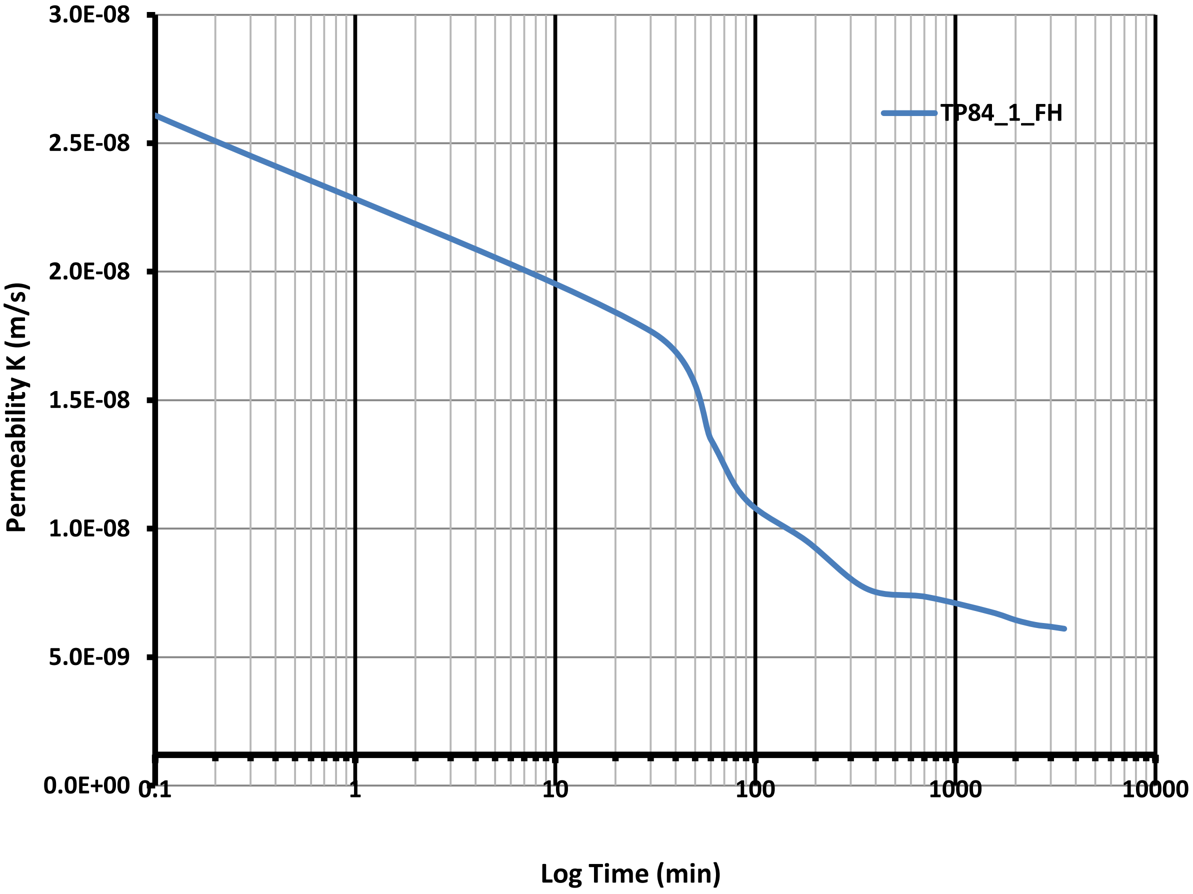
E-mail: Phillip.li@eprecisionlab.com

E-PRECISION LABORATORY

FALLING HEAD PERMEABILITY TEST REPORT

Test Method: AS1289 6.7.2 / In-house Method

Client:	Talis Consultants	Date Tested:	29/04/2018
Project:	TW17084 Onslow	Date Reported:	12/05/2018
Lab:	EPLAB	EP Lab Job Number:	TALIS



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Perth
Unit 3, 34 Sphinx Way
Bibra Lake,
WA 6163
Ph: (08) 9418 8742
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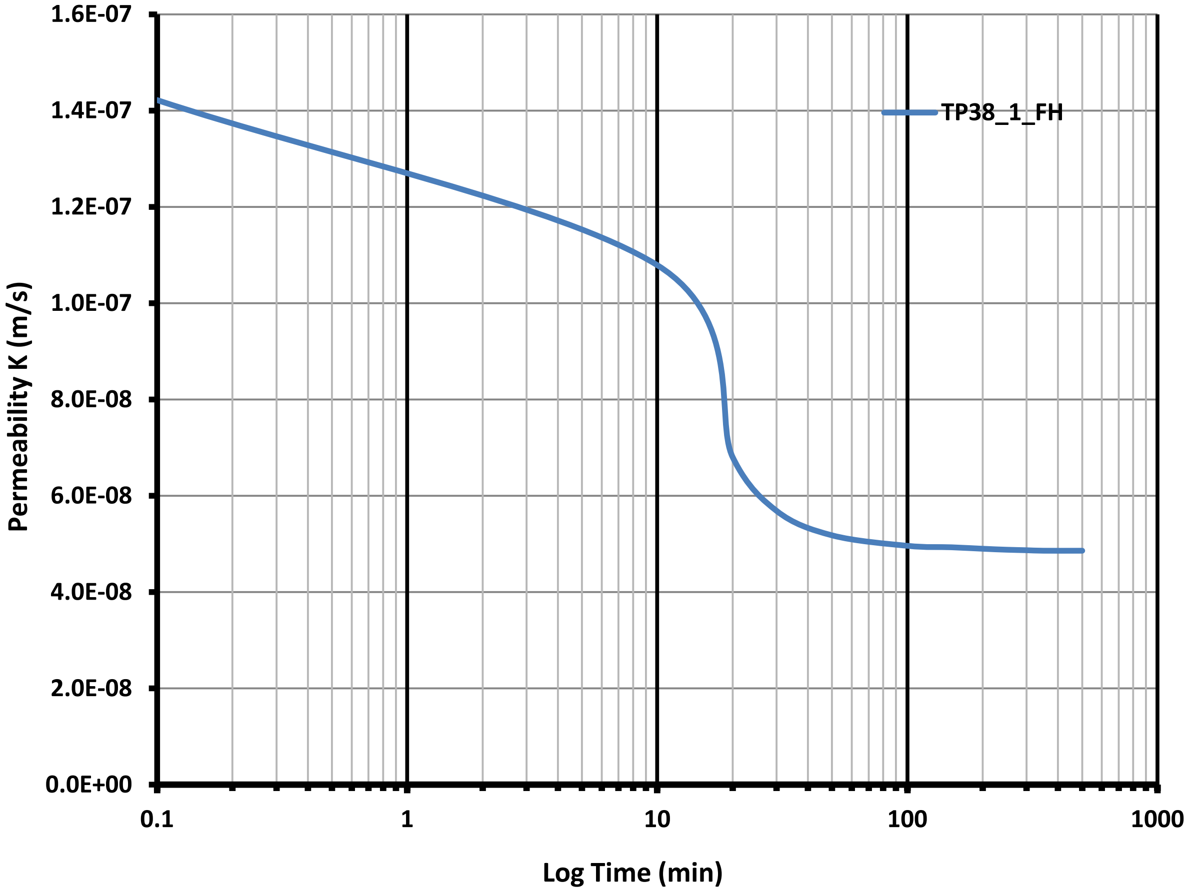
E-PRECISION LABORATORY

FALLING HEAD PERMEABILITY TEST REPORT

Test Method: AS1289 6.7.2 / In-house Method

Client:	Talis Consultants	Date Tested:	29/04/2018
Project:	TW17084 Onslow	Date Reported:	12/05/2018
Lab:	EPLAB	EP Lab Job Number:	TALIS



Notes:

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Samples supplied by the Client

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Perth
Unit 3, 34 Sphinx Way
Bibra Lake,
WA 6163
Ph: (08) 9418 8742
Mob: 0422 814 231
E-mail: Phillip.li@eprecisionlab.com

E-PRECISION LABORATORY

TRIAXIAL PERMEABILITY TEST REPORT

Test Method: AS1289 6.7.3 / KH. Head

Client:	Talis Consultants	Date Tested:	26/01/2018
Project:	TW17084 Onslow	Date Reported:	07/02/2018
Lab:	EPLAB	EP Lab Job Number:	TALIS
Tested by:	Phil		
Checked by:	Phil		

Lab ID:	BH14_1_TP	BH14_2_TP	BH13_1_TP	BH10_1_TP
Client ID:	BH14 @ 3.60m	BH14 @ 5.00m	BH13 @ 2.00m	BH10 @ 15.50m
Sample Conditions:	Insitu	Insitu	Insitu	Insitu
Effective Cell Pressure (kPa):	100	100	100	100
Inlet Pressure / Outlet Pressure (kPa):	300 / 50	100 / 50	300 / 50	300 / 50
Initial Dry Density (t/m³):	1.99	2.48	2.12	2.15
Initial Moisture Content (%):	3.65	1.26	2.93	2.78
Final Saturated Density (t/m³):	2.02	2.49	2.14	2.16
Saturation (Skempton's B):	0.99	0.99	0.97	0.99
K_{20} (m/s):	**4.739 E^{-9}**	**1.188 E^{-8}**	**3.382 E^{-9}**	**7.356 E-9**

Notes:
Stored and Tested the Sample as received
Samples supplied by the Client
NATA: 19078

Authorised Signatory (Geotechnical Engineer):

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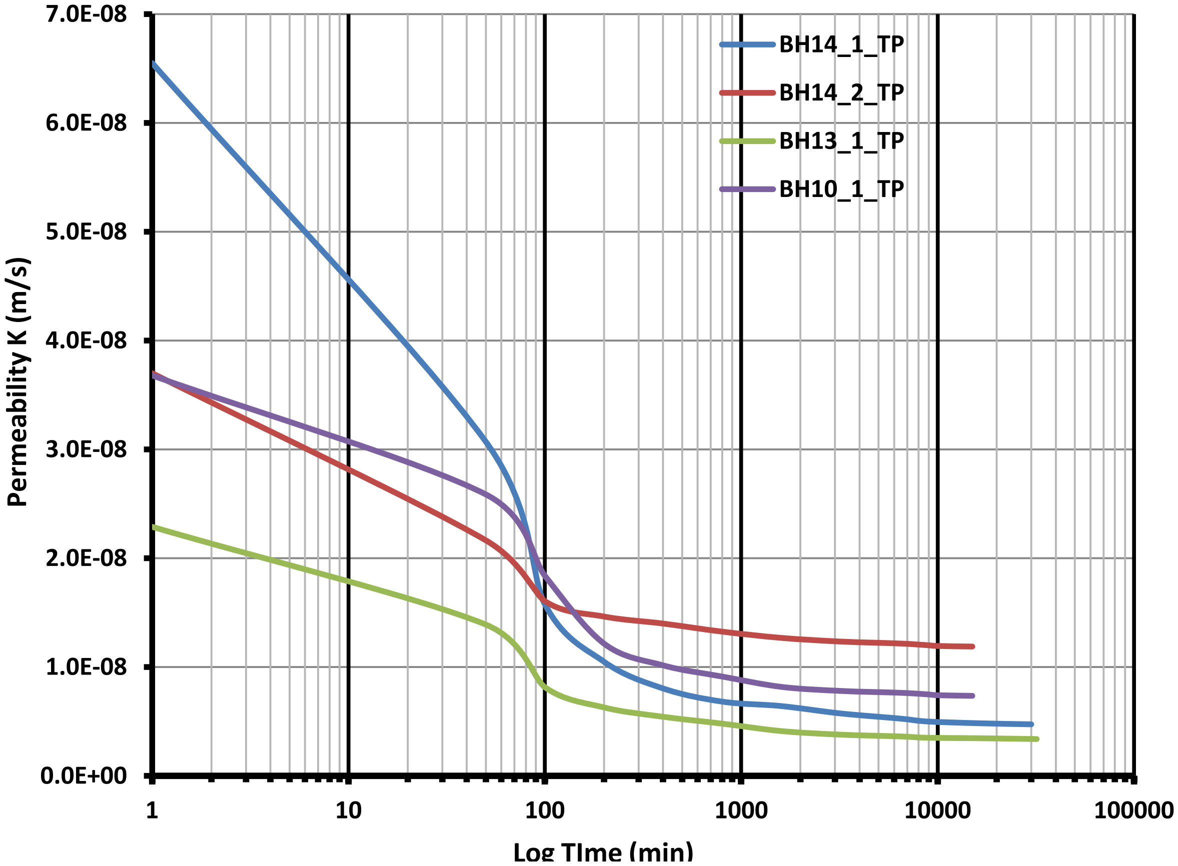
Perth
Unit 3, 34 Sphinx Way
Bibra Lake,
WA 6163
Ph: (08) 9418 8742
Mob: 0422 814 231
E-mail: Phillip.li@eprecisionlab.com

E-PRECISION LABORATORY

TRIAXIAL PERMEABILITY TEST REPORT

Test Method: AS1289 6.7.3 / KH. Head

Client:	Talis Consultants	Date Tested:	26/01/2018
Project:	TW17084 Onslow	Date Reported:	07/02/2018
Lab:	EPLAB	EP Lab Job Number:	TALIS



Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signatory (Geotechnical Engineer):

TRIAXIAL PERMEABILITY TEST REPORT

Test Method: AS1289 6.7.3 / KH. Head

Client:	Talis Consultants	Date Tested:	26/01/2018
Project:	TW17084 Onslow	Date Reported:	07/02/2018
Lab:	EPLAB	EP Lab Job Number:	TALIS

Post Testing Sample Photos

BH14 @ 3.60m

BH14 @ 5.00m

BH13 @ 2.00m

BH10 @ 15.50m

Notes:

Stored and Tested the Sample as received

Samples supplied by the Client

Authorised Signatory (Geotechnical Engineer):

STATS

STATS WA Pty Ltd
Unit 1/24 Baile Road
Canning Vale WA 6155
PH: +61 (08) 9455 3654
ABN: 90 016 537 577
www.statswa.com.au

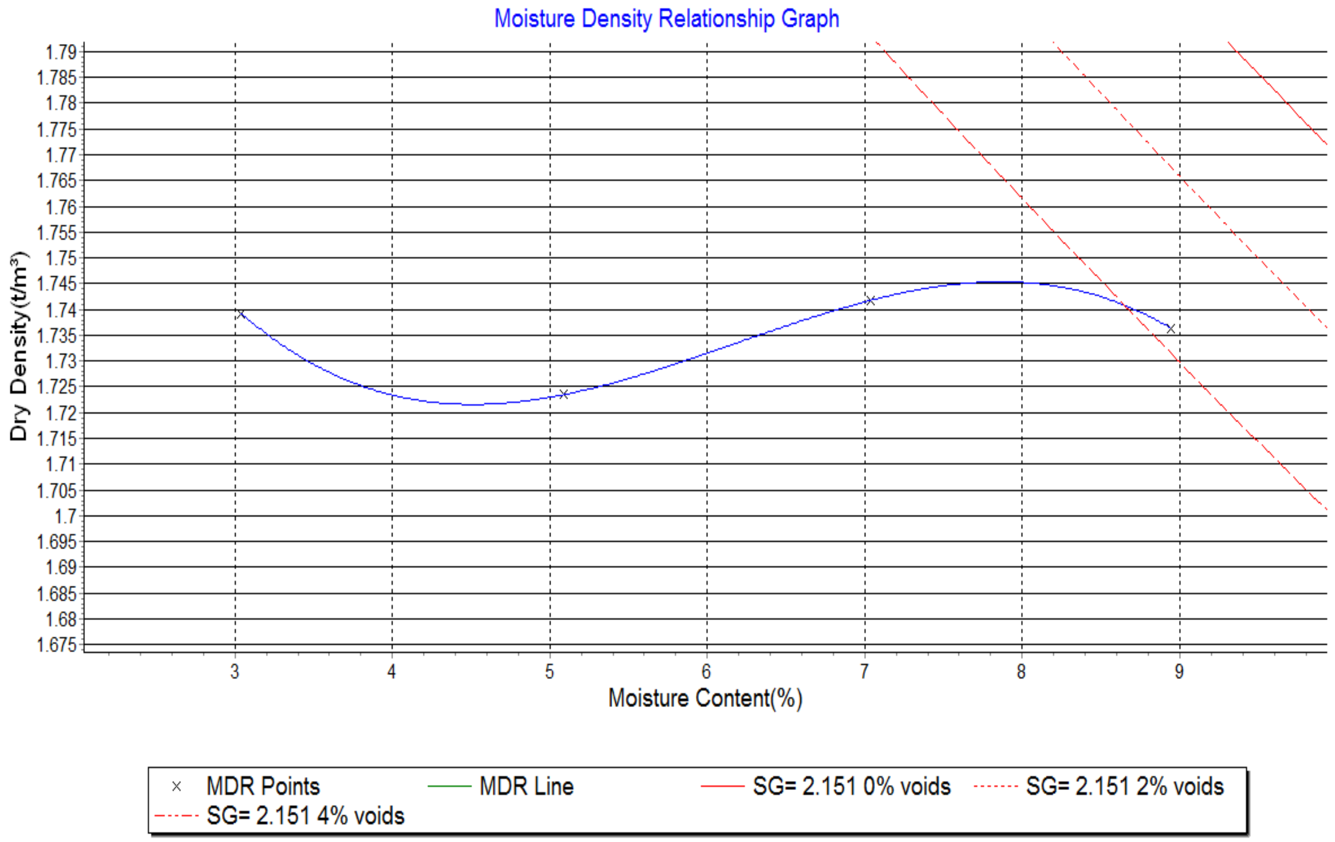
Test Certificate

Moisture Density Relationship Report

Client :	**E-Precision Laboratory**	Report Number:	**PE-101167 - 1/1**
Address :	**Unit 3/34 Sphinx Way, Bibra Lake, WA, 6163**	Report Date :	**7/02/2018**
Project Name :	**TW17084**	Order Number :	
Project Number :	**PE-101167**	Test Method :	**AS1289.5.2.1**
Location:	**Onslow**		**Page 1 of 1**

Sample Number :	S18-13	SAMPLE LOCATION	
Sampling Method :	As Received	TP14 - (0.50-1.00)	
Sampled By :	External		
Date Sampled :	22/01/2018		
Date Tested :	6/02/2018		
Material Type :	Soil Sample	Test Number :	1
Material Source :	Test Pit	Lot Number :	
Remarks :		Moisture Method :	AS1289.2.1.1

Maximum Size (mm) :	19.0	**Maximum Dry Density (t/m³) :**	**1.75**
Oversize Dry (%) :	0	**Optimum Moisture Content (%) :**	**8.0**
Oversize Density (t/m³) :			



Accredited for compliance with ISO/IEC 17025 - Testing.

NATA
WORLD RECOGNISED ACCREDITATION

APPROVED SIGNATORY

Brendon Riordan - Laboratory Manager
NATA Accreditation Number
19186 Site Number 21714

STATS WA Pty Ltd
Unit 1/24 Baile Road
Canning Vale WA 6155
PH: +61 (08) 9455 3654
ABN: 90 016 537 577
www.statswa.com.au

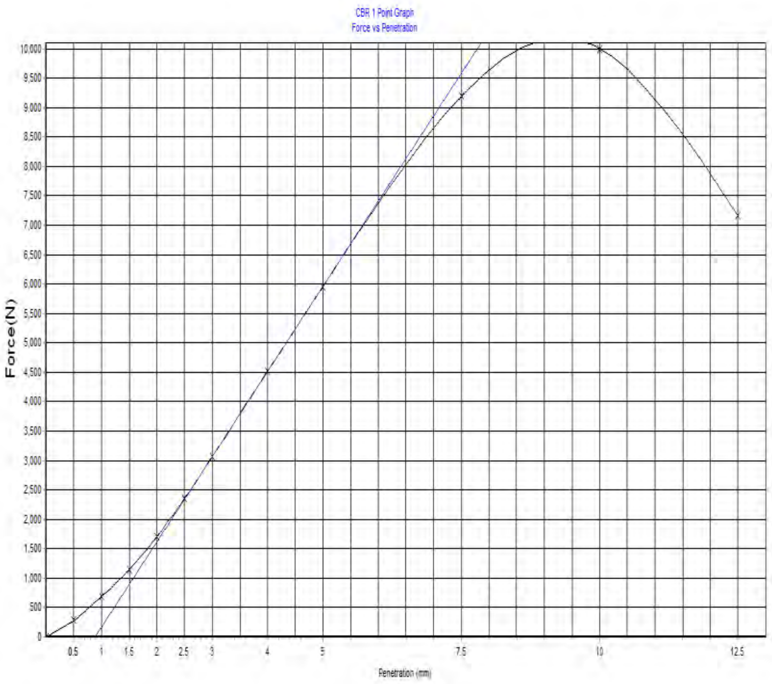
Test Certificate

California Bearing Ratio Report (1 Point)

Client :	**E-Precision Laboratory**	Report Number:	**PE-101167 - 11/1**
Address :	**Unit 3/34 Sphinx Way, Bibra Lake, WA, 6163**	Report Date :	**7/02/2018**
Project Number :	**PE-101167**	Order Number :	
Project Name :	**TW17084**	Test Method :	**AS1289.6.1.1**
Location:	**Onslow**		**Page 1 of 1**

Sample Number :	S18-14	SAMPLE LOCATION	
Date Sampled :	22/01/2018	TP29 - (0.50-1.00)	
Date Tested :	2/02/2018		
Sampled By :	External		
Sampling Method :	As Received		
Material Source :	Test Pit	Lot Number :	
Material Type :	Soil Sample	Test Number :	2
Remarks :			

Moisture Method :	AS1289.2.1.1
Maximum Dry Density (t/m³) :	1.925
Optimum Moisture Content (%) :	9.6
Compactive Effort :	Modified
Nominated Percentage of MDD :	95
Nominated Percentage of OMC :	100
Achieved Percentage of MDD :	95.0
Achieved Percentage of OMC :	100.0
Dry Density Before Soak (t/m³) :	1.833
Dry Density After Soak (t/m³) :	1.832
Moisture Content Before Soak (%) :	9.6
Moisture Content After Soak (%) :	13.3
Density Ratio After Soak (%) :	95.0
Field Moisture Content (%) :	1.2
Top Moisture Content - After Penetration (%) :	11.1
Total Moisture Content - After Penetration (%) :	12.5
Soak Condition :	Soaked
Soak Period (days) :	4
Swell (%) :	0.0



CBR Surcharge (kg) :	4.5	CBR 2.5mm (%) :	25
Oversize (%) :	0	CBR 5.0mm (%) :	**35**
Oversize Material Replaced (%) :	Excluded	**CBR Value (%) :**	**35 @ 5.0mm**

Site Selection :	Client Selected
Soil Description :	

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Brendon Riordan - Laboratory Manager
NATA Accreditation Number : 19186 Site Number 21714

STATS WA Pty Ltd
Unit 1/24 Baile Road
Canning Vale WA 6155
PH: +61 (08) 9455 3654
ABN: 90 016 537 577
www.statswa.com.au

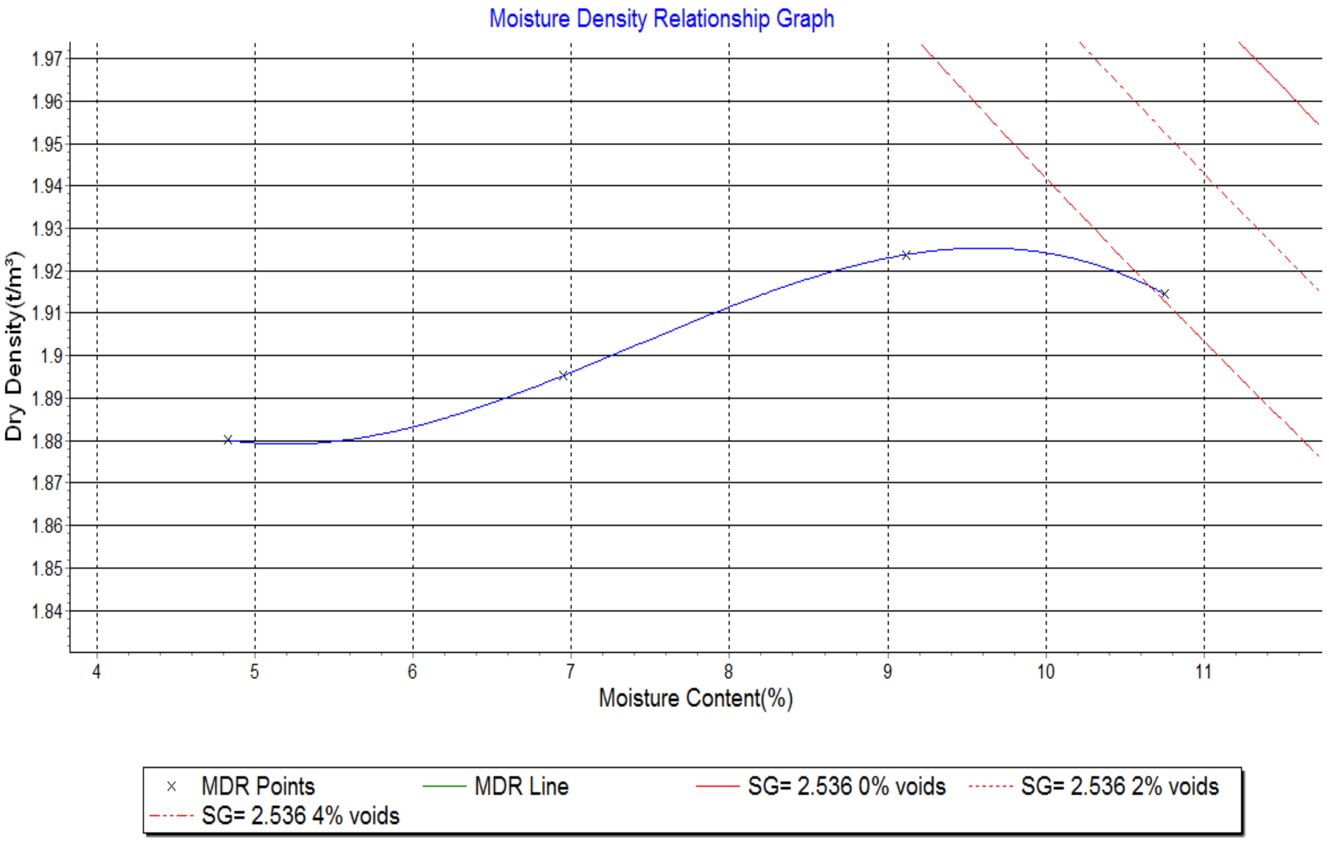
Test Certificate

Moisture Density Relationship Report

Client :	**E-Precision Laboratory**	Report Number:	**PE-101167 - 2/1**
Address :	**Unit 3/34 Sphinx Way, Bibra Lake, WA, 6163**	Report Date :	**7/02/2018**
Project Name :	**TW17084**	Order Number :	
Project Number :	**PE-101167**	Test Method :	**AS1289.5.2.1**
Location:	**Onslow**		**Page 1 of 1**

Sample Number :	S18-14	SAMPLE LOCATION	
Sampling Method :	As Received	TP29 - (0.50-1.00)	
Sampled By :	External		
Date Sampled :	22/01/2018		
Date Tested :	31/01/2018		
Material Type :	Soil Sample	Test Number :	2
Material Source :	Test Pit	Lot Number :	
Remarks :		Moisture Method :	AS1289.2.1.1

Maximum Size (mm) :	19.0	**Maximum Dry Density (t/m³) :**	**1.93**
Oversize Dry (%) :	0	**Optimum Moisture Content (%) :**	**9.5**
Oversize Density (t/m³) :			



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Brendon Riordan - Laboratory Manager
NATA Accreditation Number
19186 Site Number 21714

STATS WA Pty Ltd
Unit 1/24 Baile Road
Canning Vale WA 6155
PH: +61 (08) 9455 3654
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Test Certificate

Moisture Density Relationship Report

Client : **E-Precision Laboratory**
Address : **Unit 3/34 Sphinx Way, Bibra Lake, WA, 6163**
Project Name : **TW17084**
Project Number : **PE-101167**
Location: **Onslow**

Report Number: **PE-101167 - 3/1**
Report Date : **7/02/2018**
Order Number :
Test Method : **AS1289.5.2.1**
Page 1 of 1

Sample Number : S18-15
Sampling Method : As Received
Sampled By : External
Date Sampled : 22/01/2018
Date Tested : 6/02/2018
Material Type : Soil Sample
Material Source : Test Pit
Remarks :

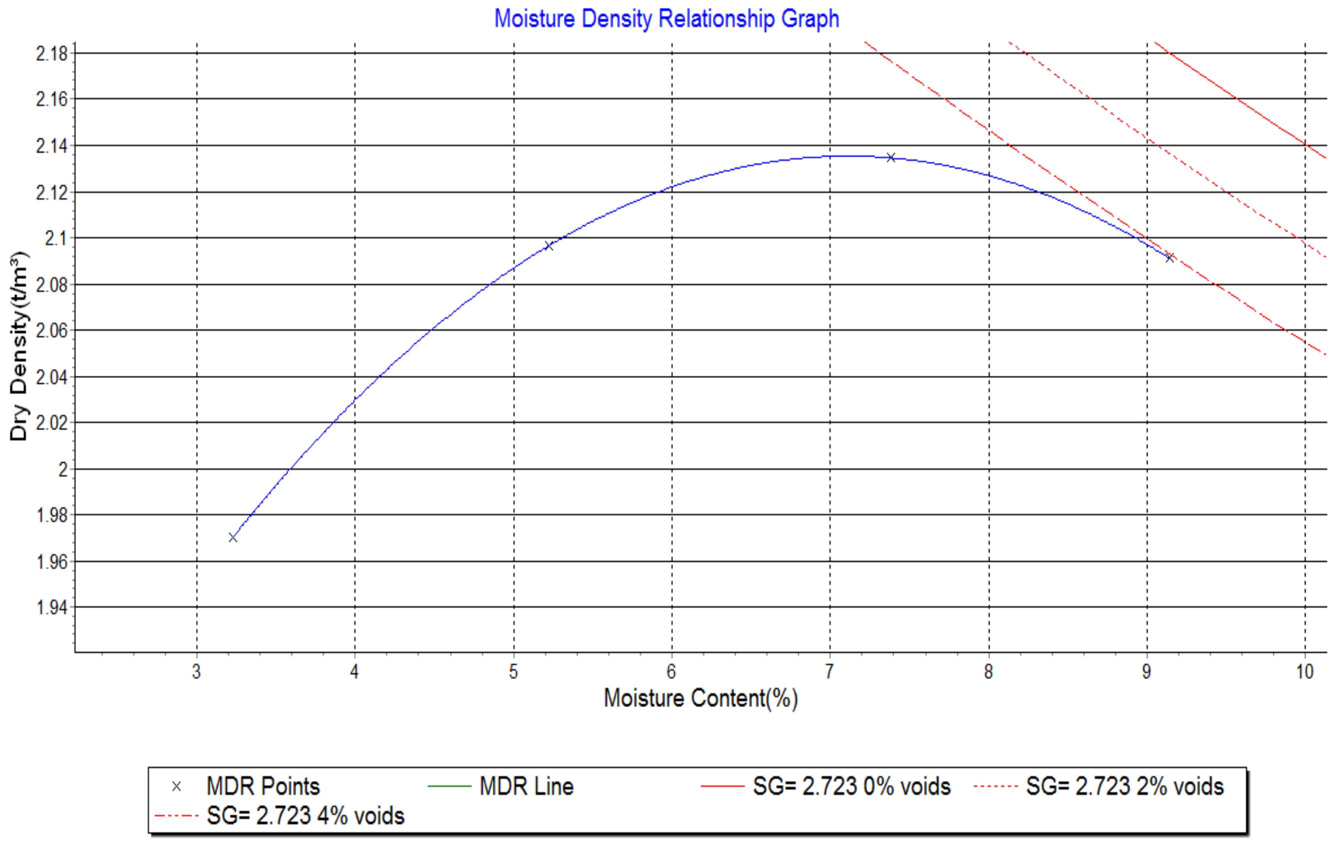
SAMPLE LOCATION

TP29 - (3.00-3.50)

Test Number : 3
Lot Number :
Moisture Method : AS1289.2.1.1

Maximum Size (mm) : 19.0
Oversize Dry (%) : 0
Oversize Density (t/m³) :

Maximum Dry Density (t/m³) : 2.14
Optimum Moisture Content (%) : 7.0



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Brendon Riordan - Laboratory Manager
NATA Accreditation Number
19186 Site Number 21714

STATS WA Pty Ltd
Unit 1/24 Baile Road
Canning Vale WA 6155
PH: +61 (08) 9455 3654
ABN: 90 016 537 577
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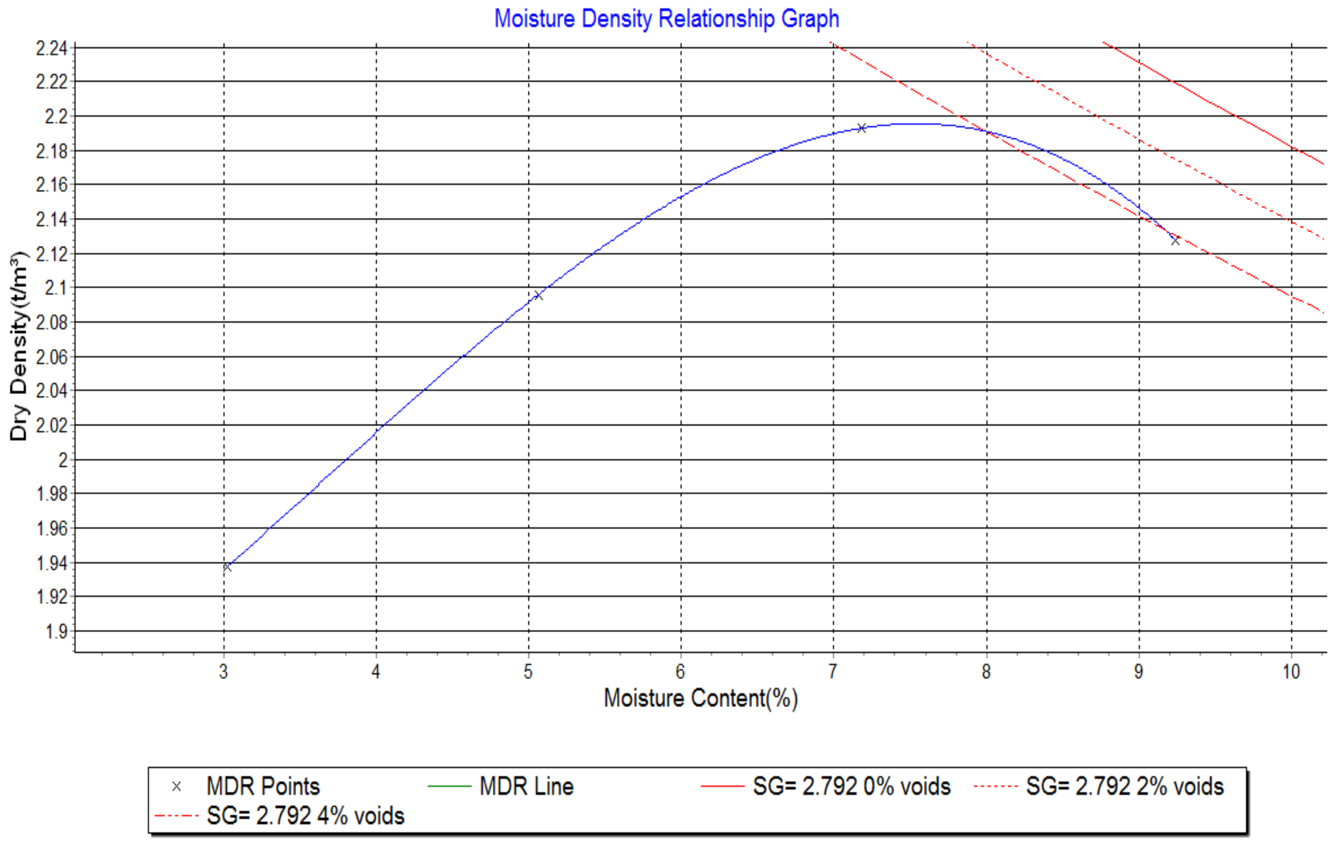
Test Certificate

Moisture Density Relationship Report

Client :	**E-Precision Laboratory**	Report Number:	**PE-101167 - 4/1**
Address :	**Unit 3/34 Sphinx Way, Bibra Lake, WA, 6163**	Report Date :	**7/02/2018**
Project Name :	**TW17084**	Order Number :	
Project Number :	**PE-101167**	Test Method :	**AS1289.5.2.1**
Location:	**Onslow**		**Page 1 of 1**

Sample Number :	S18-16	SAMPLE LOCATION	
Sampling Method :	As Received	TP36 - (3.00-3.50)	
Sampled By :	External		
Date Sampled :	22/01/2018		
Date Tested :	6/02/2018		
Material Type :	Soil Sample	Test Number :	4
Material Source :	Test Pit	Lot Number :	
Remarks :		Moisture Method :	AS1289.2.1.1

Maximum Size (mm) :	19.0	**Maximum Dry Density (t/m³) :**	**2.20**
Oversize Dry (%) :	0	**Optimum Moisture Content (%) :**	**7.5**
Oversize Density (t/m³) :			



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19186 Site Number 21714

STATS

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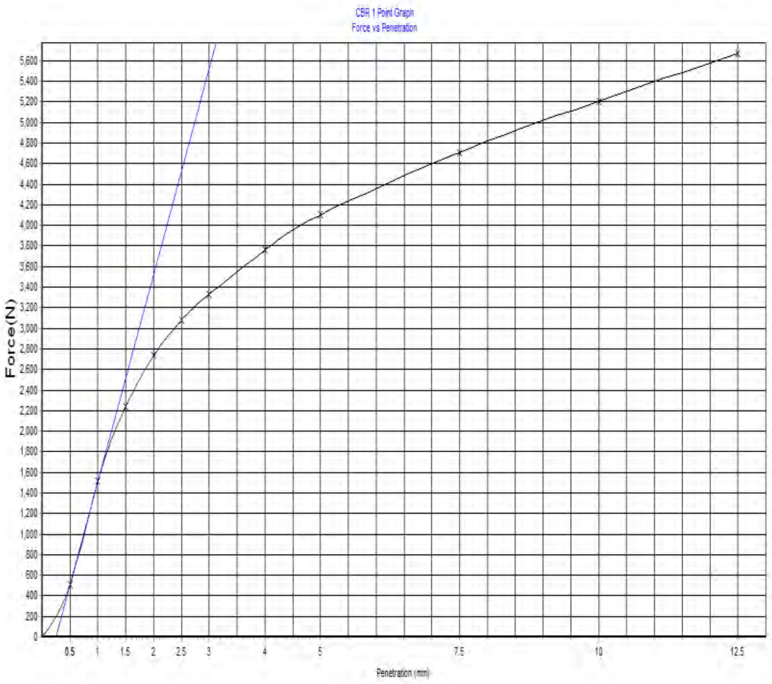
Test Certificate

California Bearing Ratio Report (1 Point)

Client :	**E-Precision Laboratory**	Report Number:	**PE-101167 - 12/1**
Address :	**Unit 3/34 Sphinx Way, Bibra Lake, WA, 6163**	Report Date :	**7/02/2018**
Project Number :	**PE-101167**	Order Number :	
Project Name :	**TW17084**	Test Method :	**AS1289.6.1.1**
Location:	**Onslow**		**Page 1 of 1**

Sample Number :	S18-17	SAMPLE LOCATION
Date Sampled :	22/01/2018	TP42 - (0.00-0.50)
Date Tested :	2/02/2018	
Sampled By :	External	
Sampling Method :	As Received	
Material Source :	Test Pit	Lot Number :
Material Type :	Soil Sample	Test Number : 5
Remarks :		

Moisture Method :	AS1289.2.1.1
Maximum Dry Density (t/m³) :	2.214
Optimum Moisture Content (%) :	7.1
Compactive Effort :	Modified
Nominated Percentage of MDD :	95
Nominated Percentage of OMC :	100
Achieved Percentage of MDD :	95.0
Achieved Percentage of OMC :	100.0
Dry Density Before Soak (t/m³) :	2.107
Dry Density After Soak (t/m³) :	2.093
Moisture Content Before Soak (%) :	7.1
Moisture Content After Soak (%) :	10.1
Density Ratio After Soak (%) :	94.5
Field Moisture Content (%) :	3.2
Top Moisture Content - After Penetration (%) :	10.4
Total Moisture Content - After Penetration (%) :	9.3
Soak Condition :	Soaked
Soak Period (days) :	4
Swell (%) :	0.5



CBR Surcharge (kg) :	4.5	CBR 2.5mm (%) :	**25**
Oversize (%) :	0	CBR 5.0mm (%) :	20
Oversize Material Replaced (%) :	Excluded	**CBR Value (%) :**	**25 @ 2.5mm**

Site Selection :	Client Selected
Soil Description :	

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Unit 1/24 Baile Road
Canning Vale WA 6155
PH: +61 (08) 9455 3654
ABN: 90 016 537 577
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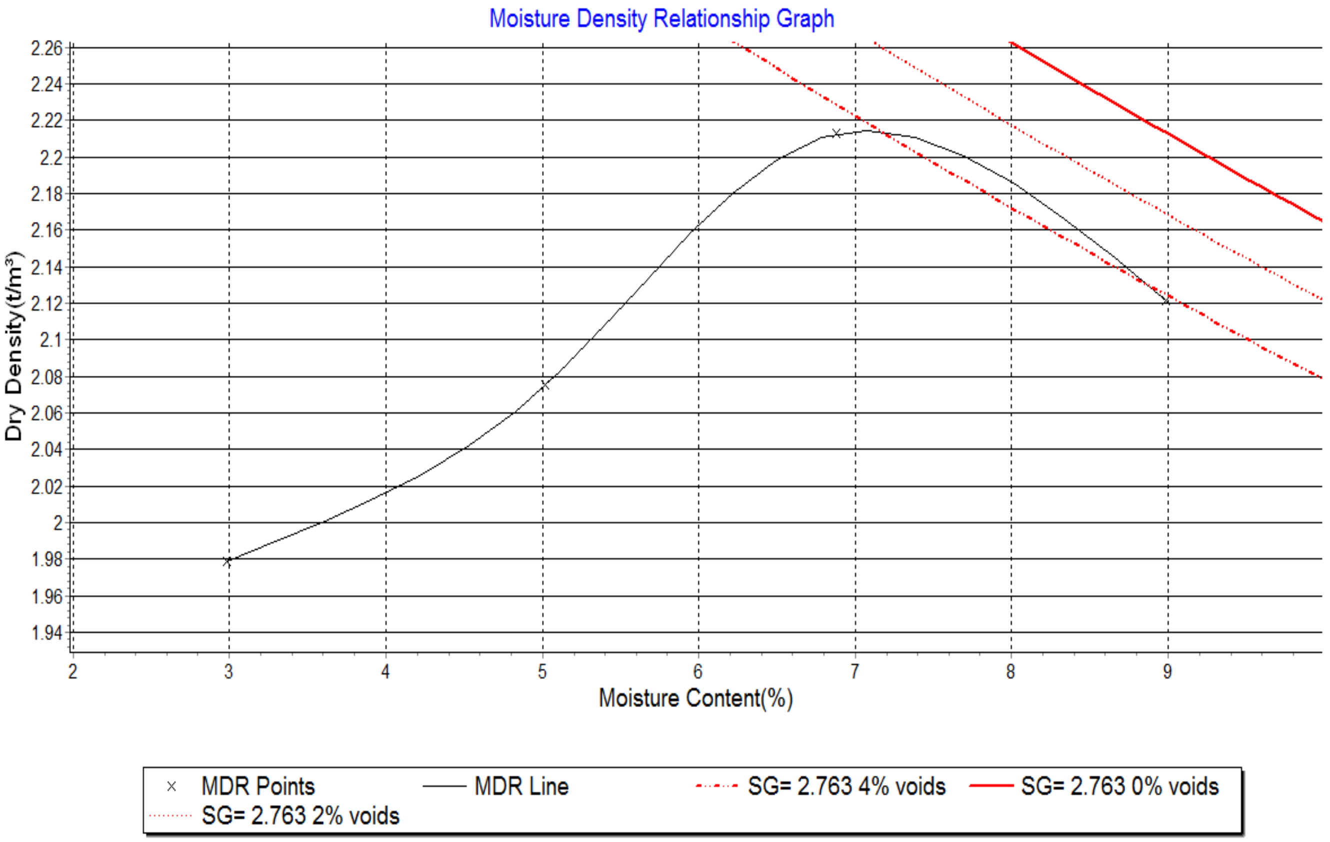
Moisture Density Relationship Report

Client :	**E-Precision Laboratory**	Report Number:	**PE-101167 - 5/1**
Address :	**Unit 3/34 Sphinx Way, Bibra Lake, WA, 6163**	Report Date :	**7/02/2018**
Project Name :	**TW17084**	Order Number :	
Project Number :	**PE-101167**	Test Method :	**AS1289.5.2.1**
Location:	**Onslow**		**Page 1 of 1**

Sample Number :	S18-17	SAMPLE LOCATION	
Sampling Method :	As Received	TP42 - (0.00-0.50)	
Sampled By :	External		
Date Sampled :	22/01/2018		
Date Tested :	31/01/2018		
Material Type :	Soil Sample	Test Number :	5
Material Source :	Test Pit	Lot Number :	
Remarks :		Moisture Method :	AS1289.2.1.1

Maximum Size (mm) :	19.0	**Maximum Dry Density (t/m³) :**	**2.21**
Oversize Dry (%) :	0	**Optimum Moisture Content (%) :**	**7.0**
Oversize Density (t/m³) :			



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NATA Accreditation Number
19186 Site Number 21714

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Unit 1/24 Baile Road
Canning Vale WA 6155
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ABN: 90 016 537 577
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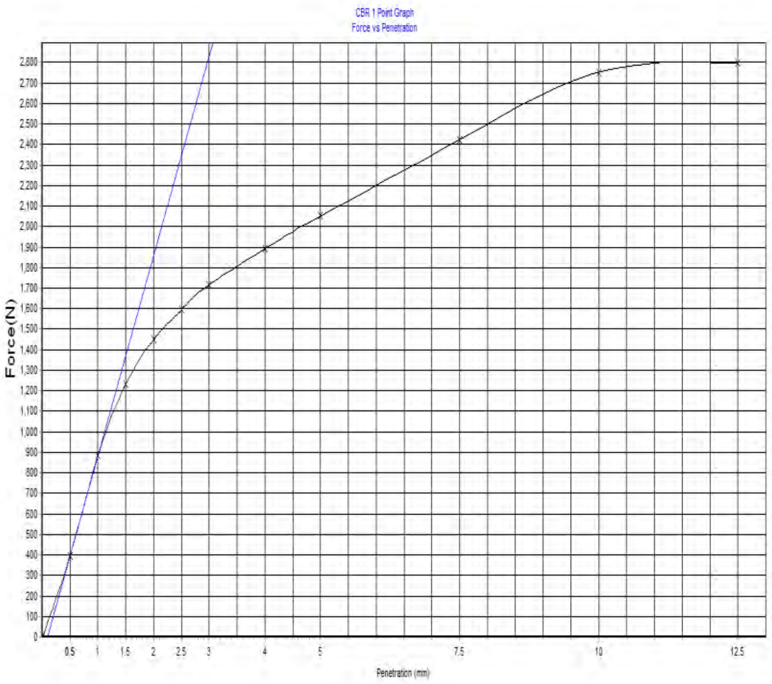
California Bearing Ratio Report (1 Point)

Client :	**E-Precision Laboratory**	Report Number:	**PE-101167 - 13/1**
Address :	**Unit 3/34 Sphinx Way, Bibra Lake, WA, 6163**	Report Date :	**7/02/2018**
Project Number :	**PE-101167**	Order Number :	
Project Name :	**TW17084**	Test Method :	**AS1289.6.1.1**
Location:	**Onslow**		**Page 1 of 1**

Sample Number :	S18-18	SAMPLE LOCATION	
Date Sampled :	22/01/2018	TP44 - (0.00-0.50)	
Date Tested :	2/02/2018		
Sampled By :	External		
Sampling Method :	As Received		
Material Source :	Test Pit	Lot Number :	
Material Type :	Soil Sample	Test Number :	6
Remarks :			

Moisture Method :	AS1289.2.1.1
Maximum Dry Density (t/m³) :	2.161
Optimum Moisture Content (%) :	8.5
Compactive Effort :	Modified
Nominated Percentage of MDD :	95
Nominated Percentage of OMC :	100
Achieved Percentage of MDD :	95.0
Achieved Percentage of OMC :	99.0
Dry Density Before Soak (t/m³) :	2.056
Dry Density After Soak (t/m³) :	2.023
Moisture Content Before Soak (%) :	8.4
Moisture Content After Soak (%) :	11.7
Density Ratio After Soak (%) :	93.5
Field Moisture Content (%) :	3.5
Top Moisture Content - After Penetration (%) :	12.9
Total Moisture Content - After Penetration (%) :	10.8
Soak Condition :	Soaked
Soak Period (days) :	4
Swell (%) :	1.5



CBR Surcharge (kg) :	4.5	CBR 2.5mm (%) :	**12**
Oversize (%) :	18	CBR 5.0mm (%) :	10
Oversize Material Replaced (%) :	Excluded	**CBR Value (%) :**	**12 @ 2.5mm**

Site Selection :	Client Selected
Soil Description :	

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NATA Accreditation Number :
19186 Site Number 21714

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STATS WA Pty Ltd
Unit 1/24 Baile Road
Canning Vale WA 6155
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ABN: 90 016 537 577
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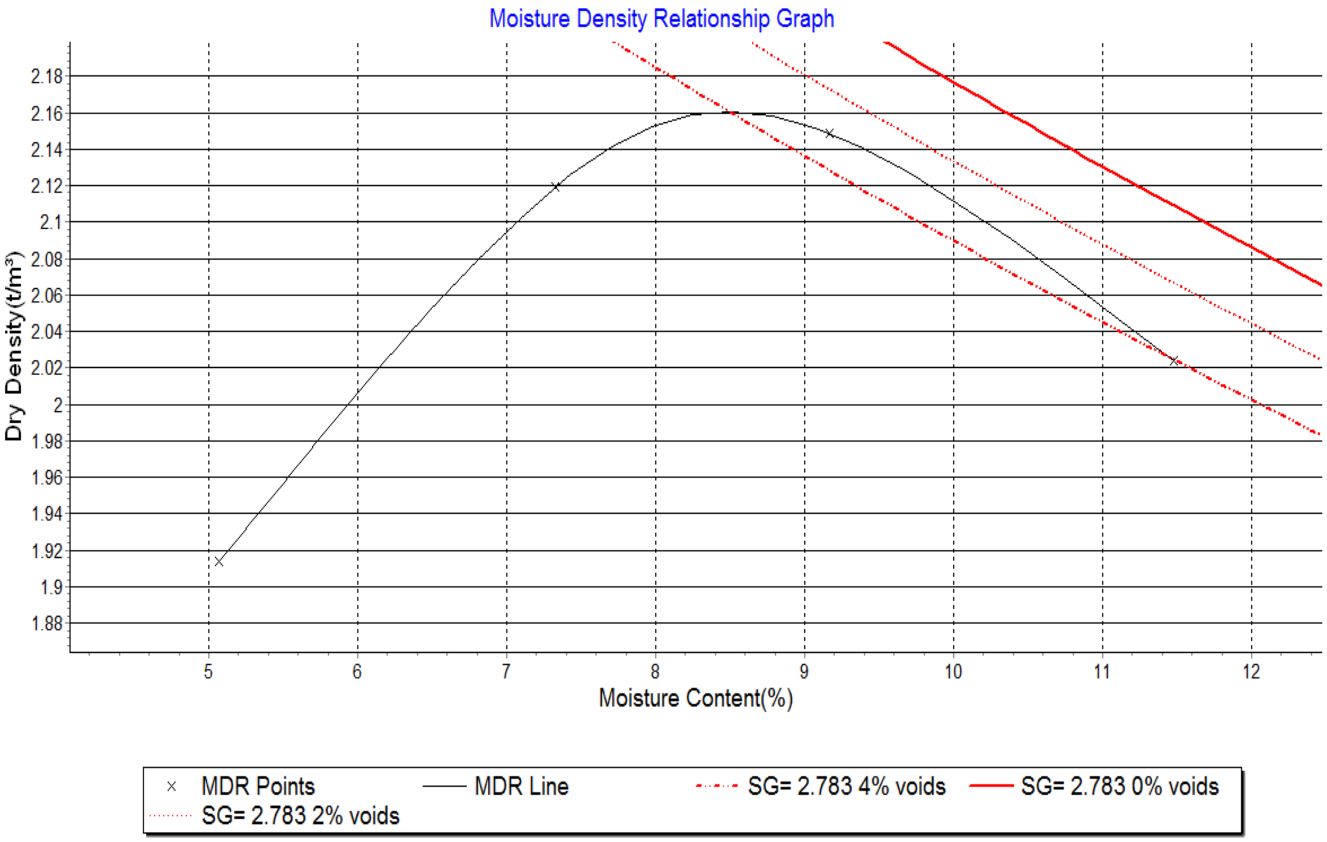
Moisture Density Relationship Report

Client :	**E-Precision Laboratory**	Report Number:	**PE-101167 - 6/1**
Address :	**Unit 3/34 Sphinx Way, Bibra Lake, WA, 6163**	Report Date :	**7/02/2018**
Project Name :	**TW17084**	Order Number :	
Project Number :	**PE-101167**	Test Method :	**AS1289.5.2.1**
Location:	**Onslow**	**Page 1 of 1**	

Sample Number :	S18-18	SAMPLE LOCATION	
Sampling Method :	As Received	TP44 - (0.00-0.50)	
Sampled By :	External		
Date Sampled :	22/01/2018		
Date Tested :	31/01/2018		
Material Type :	Soil Sample	Test Number :	6
Material Source :	Test Pit	Lot Number :	
Remarks :		Moisture Method :	AS1289.2.1.1

Maximum Size (mm) :	19.0	**Maximum Dry Density (t/m³) :**	**2.16**
Oversize Dry (%) :	18	**Optimum Moisture Content (%) :**	**8.5**
Oversize Density (t/m³) :			



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Brendon Riordan - Laboratory Manager
NATA Accreditation Number
19186 Site Number 21714

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STATS WA Pty Ltd
Unit 1/24 Baile Road
Canning Vale WA 6155
PH: +61 (08) 9455 3654
ABN: 90 016 537 577
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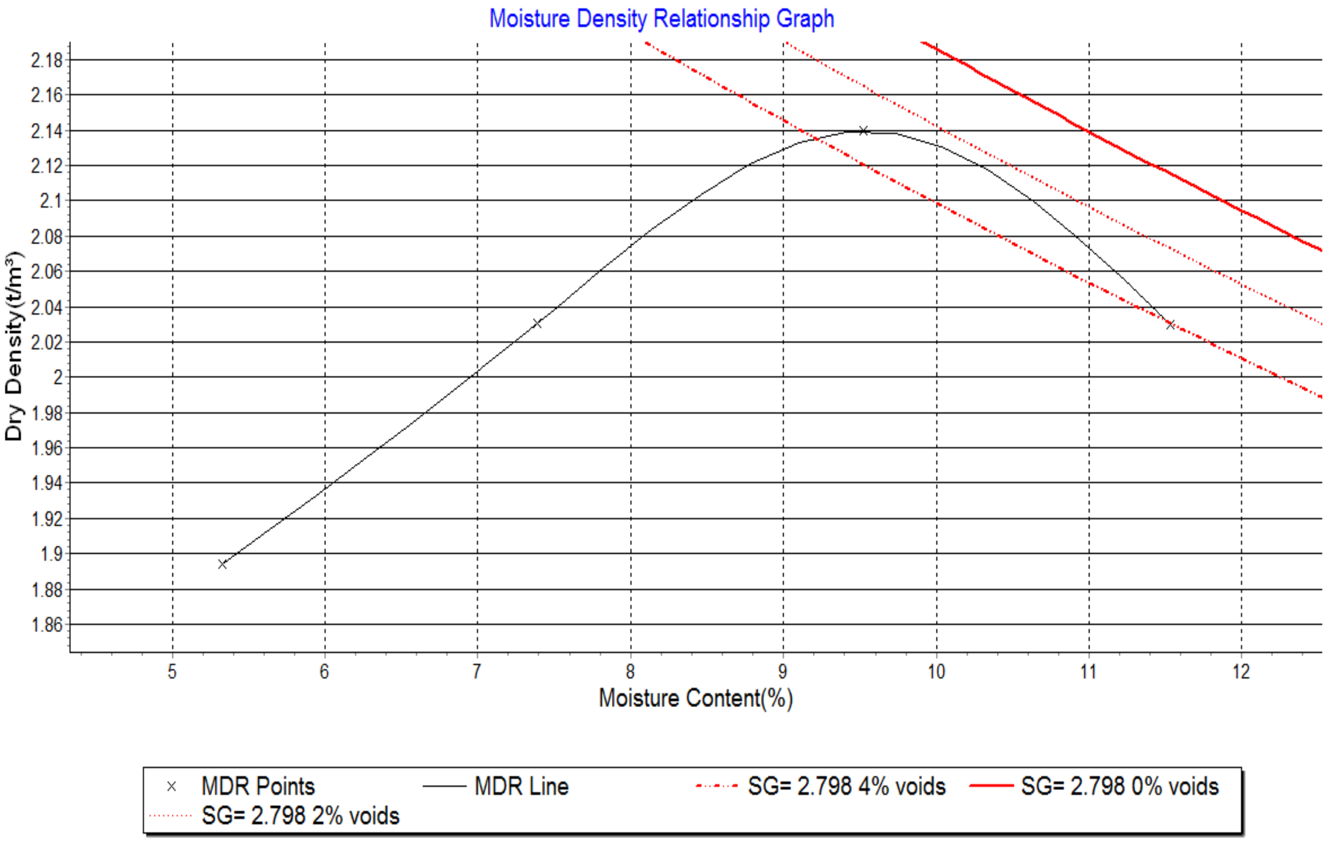
Moisture Density Relationship Report

Client :	**E-Precision Laboratory**	Report Number:	**PE-101167 - 7/1**
Address :	**Unit 3/34 Sphinx Way, Bibra Lake, WA, 6163**	Report Date :	**7/02/2018**
Project Name :	**TW17084**	Order Number :	
Project Number :	**PE-101167**	Test Method :	**AS1289.5.2.1**
Location:	**Onslow**		**Page 1 of 1**

Sample Number :	S18-19	SAMPLE LOCATION	
Sampling Method :	As Received	TP54 - (0.50-1.00)	
Sampled By :	External		
Date Sampled :	22/01/2018		
Date Tested :	6/02/2018		
Material Type :	Soil Sample	Test Number :	7
Material Source :	Test Pit	Lot Number :	
Remarks :		Moisture Method :	AS1289.2.1.1

Maximum Size (mm) :	19.0	**Maximum Dry Density (t/m³) :**	**2.14**
Oversize Dry (%) :	0	**Optimum Moisture Content (%) :**	**9.5**
Oversize Density (t/m³) :			



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Canning Vale WA 6155
PH: +61 (08) 9455 3654
ABN: 90 016 537 577
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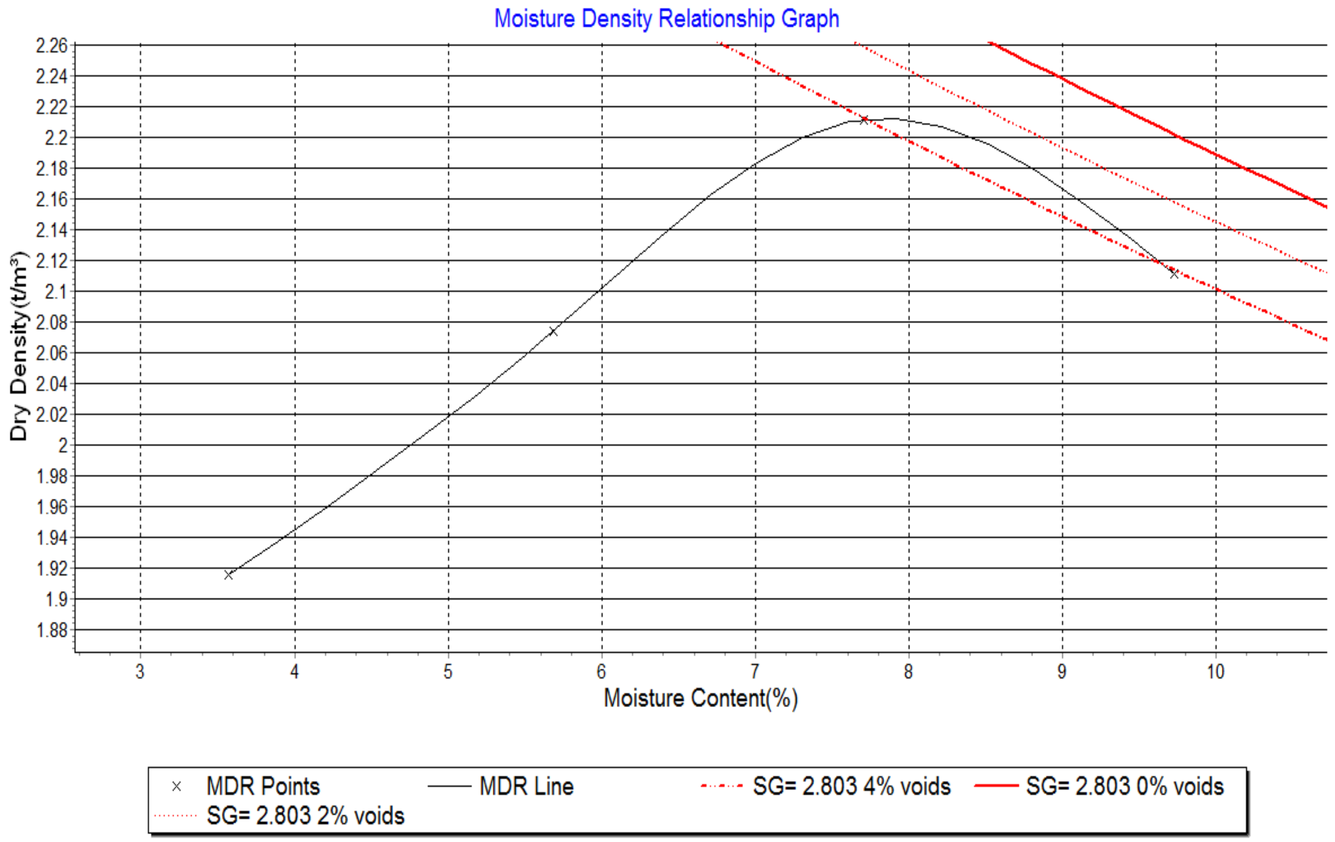
Moisture Density Relationship Report

Client :	**E-Precision Laboratory**	Report Number:	**PE-101167 - 8/1**
Address :	**Unit 3/34 Sphinx Way, Bibra Lake, WA, 6163**	Report Date :	**7/02/2018**
Project Name :	**TW17084**	Order Number :	
Project Number :	**PE-101167**	Test Method :	**AS1289.5.2.1**
Location:	**Onslow**	**Page 1 of 1**	

Sample Number :	S18-20	SAMPLE LOCATION	
Sampling Method :	As Received	TP68 - (0.00-0.50)	
Sampled By :	External		
Date Sampled :	22/01/2018		
Date Tested :	6/02/2018		
Material Type :	Soil Sample	Test Number :	8
Material Source :	Test Pit	Lot Number :	
Remarks :		Moisture Method :	AS1289.2.1.1

Maximum Size (mm) :	19.0	**Maximum Dry Density (t/m³) :**	**2.21**
Oversize Dry (%) :	0	**Optimum Moisture Content (%) :**	**8.0**
Oversize Density (t/m³) :			



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NATA Accreditation Number
19186 Site Number 21714

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Unit 1/24 Baile Road
Canning Vale WA 6155
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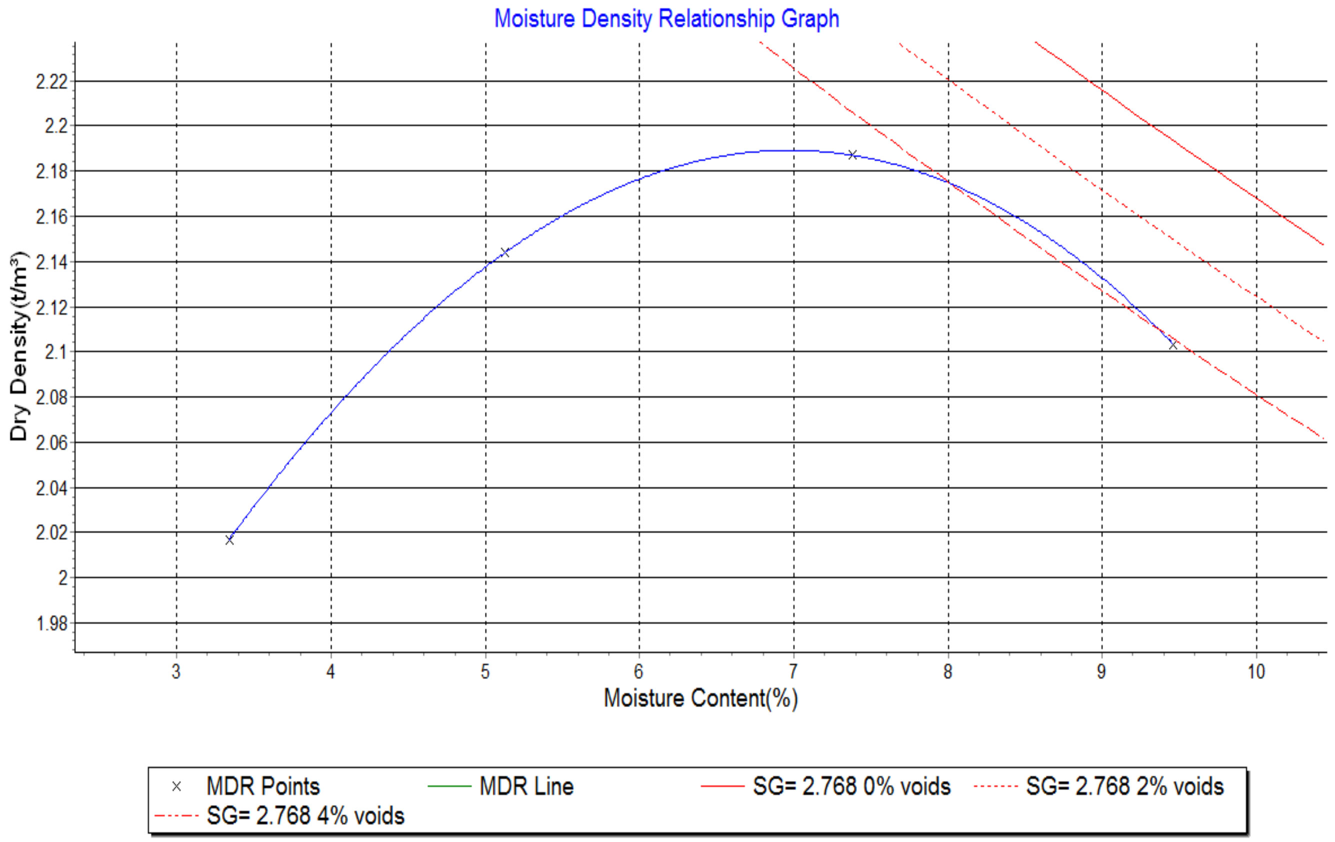
Moisture Density Relationship Report

Client :	**E-Precision Laboratory**	Report Number:	**PE-101167 - 9/1**
Address :	**Unit 3/34 Sphinx Way, Bibra Lake, WA, 6163**	Report Date :	**7/02/2018**
Project Name :	**TW17084**	Order Number :	
Project Number :	**PE-101167**	Test Method :	**AS1289.5.2.1**
Location:	**Onslow**		**Page 1 of 1**

Sample Number :	S18-21	SAMPLE LOCATION	
Sampling Method :	As Received	TP78 - (0.00-0.50)	
Sampled By :	External		
Date Sampled :	22/01/2018		
Date Tested :	6/02/2018		
Material Type :	Soil Sample	Test Number :	9
Material Source :	Test Pit	Lot Number :	
Remarks :		Moisture Method :	AS1289.2.1.1

Maximum Size (mm) :	19.0	**Maximum Dry Density (t/m³) :**	**2.19**
Oversize Dry (%) :	0	**Optimum Moisture Content (%) :**	**7.0**
Oversize Density (t/m³) :			



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Brendon Riordan - Laboratory Manager
NATA Accreditation Number
19186 Site Number 21714

STATS WA Pty Ltd
Unit 1/24 Baile Road
Canning Vale WA 6155
PH: +61 (08) 9455 3654
ABN: 90 016 537 577
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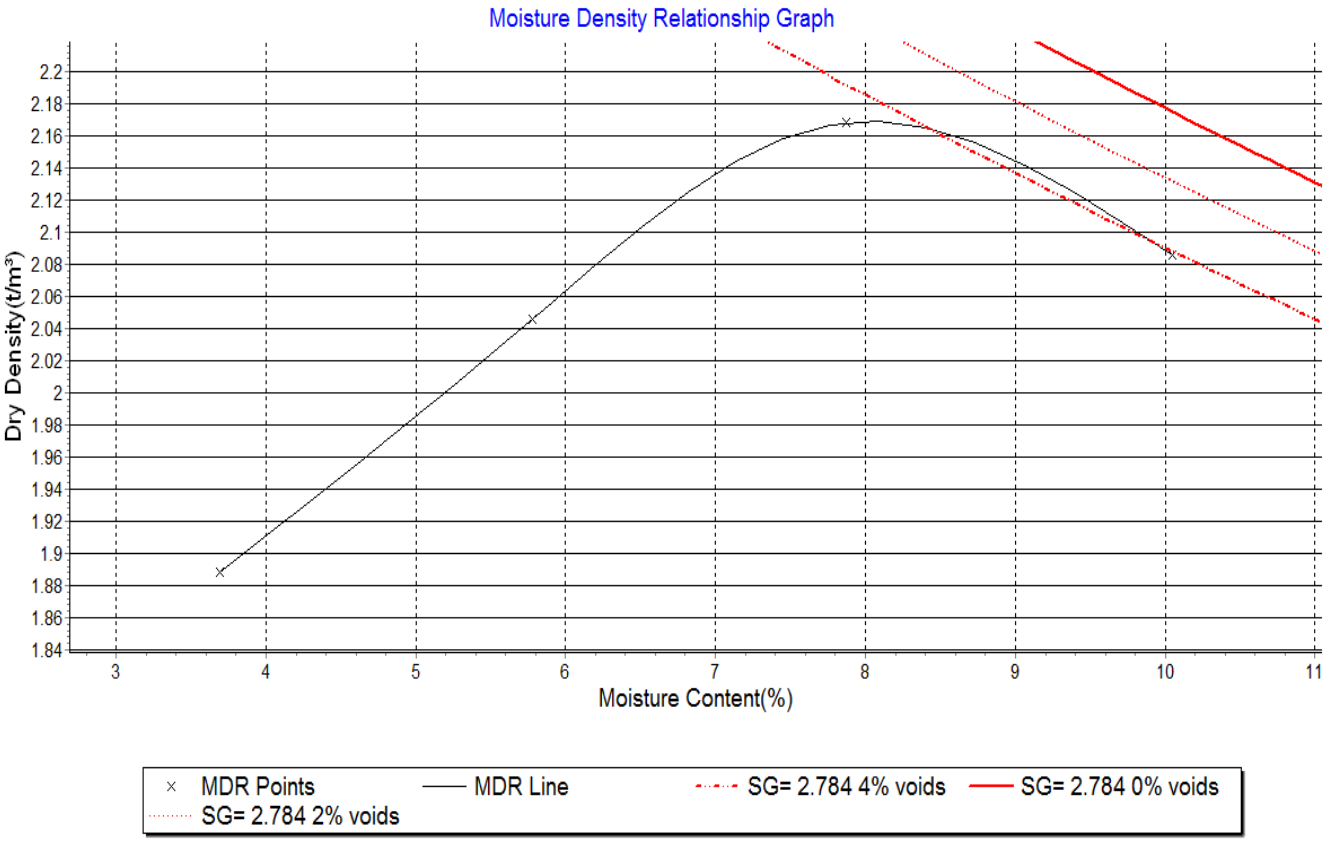
Moisture Density Relationship Report

Client :	**E-Precision Laboratory**	Report Number:	**PE-101167 - 10/1**
Address :	**Unit 3/34 Sphinx Way, Bibra Lake, WA, 6163**	Report Date :	**7/02/2018**
Project Name :	**TW17084**	Order Number :	
Project Number :	**PE-101167**	Test Method :	**AS1289.5.2.1**
Location:	**Onslow**		**Page 1 of 1**

Sample Number :	S18-24	SAMPLE LOCATION	
Sampling Method :	As Received	TP107 - (0.00-0.50)	
Sampled By :	External		
Date Sampled :	22/01/2018		
Date Tested :	6/02/2018		
Material Type :	Soil Sample	Test Number :	10
Material Source :	Test Pit	Lot Number :	
Remarks :		Moisture Method :	AS1289.2.1.1

Maximum Size (mm) :	19.0	**Maximum Dry Density (t/m³) :**	**2.17**
Oversize Dry (%) :	0	**Optimum Moisture Content (%) :**	**8.0**
Oversize Density (t/m³) :			



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NATA Accreditation Number
19186 Site Number 21714

Appendix E: Understanding Your Geotechnical Report

Geotechnical Sampling Methods

Sampling is necessary to enable assessment of the physical and engineering properties of Soil and Rock. Geotechnical sampling using any technique aims to provide the following information:

- Colour;
- Lithology;
- Depending on the level of disturbance information on structure and strength;
- And soil origin

Sampling Methods

Push Tube

Relatively undisturbed samples are taken by pushing a thin walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state.

Continuous Core Drilling

A continuous core sample can be obtained by using a diamond tipped core barrel. With the exception of weak rocks and granular soils, this method can generally achieve full recovery of the drill hole and provides a high quality complete sample of the soil/rock profile. However, water and drilling muds are required for preventing the drill bit from seizing and conditioning the hole, which affects the moisture content of unconsolidated materials.

Test Pits

Test pits are excavations completed using a backhoe or an excavator. Test pits allow close examination of the in situ soil. A significant advantage of test pitting is that it reveals a much larger section of the shallow subsurface than more discrete drilling methods. Test pits, however, cannot be excavated to the depth of most drilling methods and are limited to about three meters for a backhoe and up to six meters for a large excavator.

Large Diameter Augers

Large diameter auger holes (300mm or larger) can be drilled using a rotating plate or short spiral auger commonly mounted onto a standard piling rig. Cuttings are generally returned to the surface at regular intervals and, though highly disturbed, are unchanged in moisture content. Identification of soil lithology is generally more accurate than by continuous spiral flight augers.

Continuous Spiral Flight Augers

Continuous spiral flight augers generally drill a 90 to 115 mm hole by extracting cuttings using a helical screw blade. The main advantage of continuous spiral flight augers is that they are a relatively economic method of investigating the subsurface. However, samples are highly disturbed and are in contact with soils on the outside of the bore, which can lead to some contamination of the sample.

Non-core Rotary Drilling

Non-core rotary drilling uses a rotary bit to cut into the subsurface. Water and drilling muds are pumped down the drill rods and returned up the annulus carrying the cuttings to surface. This method is highly destructive and only major changes in lithology can be identified.

Geotechnical Field Testing

Standard Penetration Tests (SPT)

SPTs are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes – Test 6.3.1.

The test is carried out in a borehole by driving a 50mm diameter split sample tube under the impact of a 63kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value to be taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued. The results of the SPT test can be related empirically to the engineering properties of the soils.

Dynamic Penetrometer Tests

Dynamic penetrometer tests (DCP and PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil, the number of blows required to penetrate each successive 150mm to a depth of 1.2m are recorded.

- Perth Sand Penetrometer (AS 1289, Test 6.3.3) - A 16mm diameter flat ended rod is driven using a 9kg hammer dropping 600mm. This test is suitable for the testing of granular soils and filling; and
- Cone Penetrometer (AS 1289, Test 6.3.2) – A 16mm diameter rod with a 20mm diameter cone end is driven using a 9kg hammer dropping 510 mm. This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Description and Classification of Soils and Rocks

All logging of soils and rocks completed by Talis Consultants are to Australian Standard AS1726-Geotechincal Site Investigation. In general, the descriptions cover soil or rock type, strength or density, colour, structure and inclusions.

Soil Types

Soil types are initially described by the predominant particle size, i.e. CLAY. Table 1 shows the definitions of different particle sizes.

Table 1: Soil Grain Sizes

Type	Particle Size (mm)
Boulder	>200
Cobble	63 – 200
Course Gravel	20 – 63
Medium Gravel	6 – 20
Fine Gravel	2.36 - 6
Course Sand	0.6 – 2.36
Medium Sand	0.2 – 0.6
Fine Sand	0.075 – 0.2
Silt	0.002 – 0.075
Clay	<0.002

Where soils are of more than one particle size it becomes necessary to describe the secondary soil constituents. The proportion of a secondary soil constituent can be described by the terms described in Table 2.

Table 2: Proportions of secondary constituents

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 – 35 %	Sandy Clay
Slightly	12 – 20 %	Slightly Sandy Clay
With some	5 – 12 %	Clay with some sand
With a trace of	0 – 5 %	Clay with a trace of sand

For a granular deposit (fine sand to fine gravel, the way different particle sizes vary in a soil can be described by its grading. The four grading terms commonly used are as follows:

- **Well graded** – A good representation of all particle sizes;
- **Poorly graded** – An excess or deficiency of particular particle sizes within the specified range;
- **Uniformly graded** – An excess of a particular particle size; and
- **Gap graded** – A deficiency of a particular particle size within the range.

Strength

Cohesive Soils

Cohesive soils, generally soils with a significant proportion of clay; are classified on the basis of undrained shear strength. This strength may be measured by laboratory testing, or estimated by field tests. The strength terms for cohesive soils are described in Table 3.

Table 3: Cohesive Soil Strength

Description	Undrained Shear Strength (kPa)	SPT N Value
Very soft	<12	0-2
Soft	12 – 25	3-4
Firm	25 – 50	5-8
Stiff	50 – 100	9-16
Very stiff	100 – 200	16-32
Hard	>200	>32

Non-Cohesive Soils

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), Perth Sand Penetrometers (PSP) or similar. The relative density terms are given in table 4.

Table 4: Non-cohesive soil strength

Relative Density	SPT/PSP N value	CPT qc value (MPA)
Very loose	<4	<2
Loose	4-10	2 - 5
Medium dense	10-30	5 - 15
Dense	30-50	15 – 25
Very dense	>50	>25

Soil Origin

While it is often difficult to accurately determine the origin of a soil, they can generally be classified as:

- **Residual soil** – derived from in-situ weathering of the underlying rock;
- **Transported soils** – formed somewhere else and transported by nature to the site; or
- **Fill** – moved by man.

Transported soils can be further subdivided into:

- **Alluvium** – river deposits;
- **Lacustrine** – lake deposits;
- **Aeolian** – wind deposits;
- **Littoral** – beach deposits;
- **Estuarine** – tidal river deposits;
- **Talus** – scree or course colluvium; and
- **Slopewash or colluvium** – transported downslope by gravity.

Talis Consultants

Level 1, 660 Newcastle Street,
Leederville,
Western Australia 6007

PO Box 454,
Leederville,
Western Australia 6903

Phone: 1300 251 070
Email: info@talisconsultants.com.au