

ECU Mount Lawley Redevelopment

Precinct Structure Plan Water Management Report

Prepared for:

DevelopmentWA

By Urbaqua

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Summary

Water is a fundamental prerequisite for urban liveability, supporting vegetation in streets and open spaces and providing essential services such as drinking water and wastewater management. This Water Management Report (WMR) has been developed to support the preparation of a Precinct Structure Plan (PSP) for the ECU Mount Lawley Redevelopment, ensuring the site is capable of accommodating a mix of residential, commercial, mixed-use, and public purpose land uses.

The strategy presented in this WMR is consistent with the principles of draft State Planning Policy 2.9 – Planning for Water (WAPC, 2021), and is tailored to the specific environmental, land use, and infrastructure context of the precinct. The key aims and objectives are:

- Water sustainability
 - Ensure the efficient use of all water resources in the redeveloped urban form and aim to achieve highest value use of fit-for-purpose water.
 - Maintain opportunities for future generations by using water more efficiently.
- Stormwater management
 - Protect infrastructure and assets from flooding and inundation.
 - Protect receiving environments from the impacts of urban runoff.
 - Provide opportunities for urban greening, cooling and habitat creation through the application of water sensitive urban design principles.
- Groundwater management
 - Protect infrastructure and assets from flooding and inundation by high seasonal groundwater levels, perching and/or soil moisture.
 - Protect groundwater dependent ecosystems from the impacts of urban runoff.
- Management of disease vectors and nuisance insects
 - Limit the creation of new sites for breeding of nuisance insects.
 - Prevent long-term (>96 hrs) standing water in drainage infrastructure.
 - Improve water quality throughout the development.
- Implementation
 - Provide a robust framework for delivering water management strategies, including measures during construction to prevent damage to existing infrastructure and receiving environments.

There are no significant water related impediments to development within the study area and Sections 4 and 5 discusses key strategies to manage the total water cycle whilst enabling redevelopment of the site to occur.

Known contamination issues present within the study area have been investigated in accordance with DWER guidelines for identifying and managing acid sulfate soils and to determine the extent of contaminated soil in accordance with the Contaminated Sites Act (2003).

The *Environmental Assessment and Management Strategy* (EAMS) prepared by Aurora Environmental was developed in parallel to this Water Management Report to support the PSP. The EAMS provides an overview of the site's environmental conditions, confirming that contamination, groundwater and acid sulfate soil risks are understood and manageable through established environmental controls.

This WMR establishes the framework for integrated management of surface water, groundwater and stormwater across the redevelopment area. The report identifies no significant water-related constraints and outlines how water management objectives will be achieved through the delivery of strategies that guide design, construction and long-term

operation. Implementation of these strategies through subsequent stages of planning and development will ensure sustainable and compliant water outcomes consistent with the intent of the PSP.

The WMR demonstrates that the ECU Mount Lawley Redevelopment can be progressed in a manner consistent with draft State Planning Policy 2.9 – Planning for Water (WAPC, 2021), ensuring the PSP delivers best-practice water management and supports the creation of a sustainable and liveable precinct.

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1 INTRODUCTION AND BACKGROUND

In 2020, the State Government announced the Perth City Deal which included the relocation of Edith Cowan University (ECU) Mount Lawley campus to the Perth City. This WMR has been prepared to support the preparation of a Precinct Structure Plan (PSP) for the ECU Mount Lawley Redevelopment. This report therefore addresses the requirements of a local water management report (Local WMR).

This strategy addresses the study area presented in Figure 1.

Consistent with draft *State Planning Policy 2.9: Planning for Water* (WAPC, 2021) and the draft *Planning for Water Guidelines* (WAPC, 2021) a water management report is required to support adoption of a Precinct Structure Plan to identify appropriate water management strategies. The position of this strategy within the state government planning framework is defined in the draft *Planning for Water Guidelines* (WAPC, 2021) and is outlined in Chart 1.

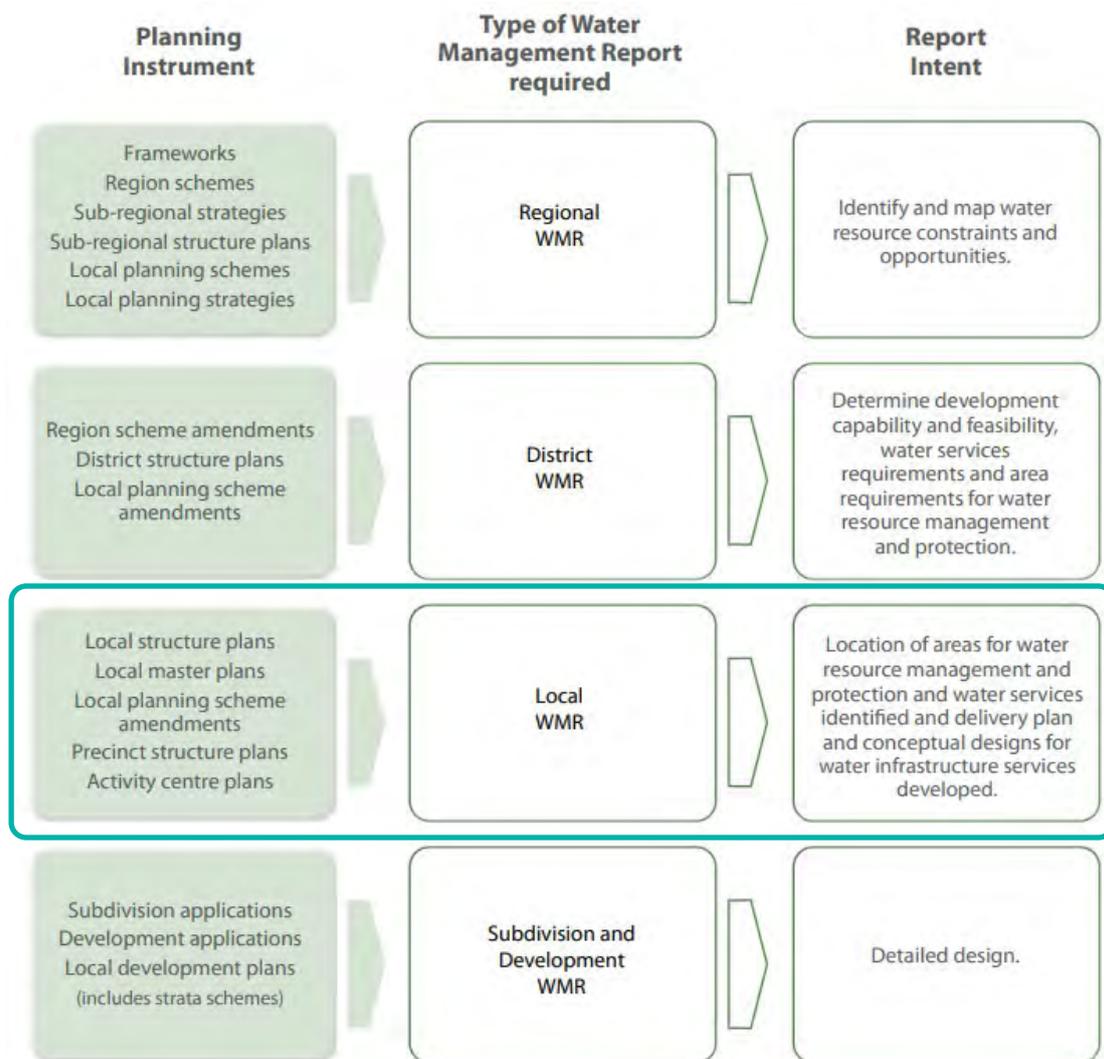


Chart 1: The water management report and planning instrument hierarchy (WAPC, 2021)

Development WA - ECU Mount Lawley Campus WMS

Figure 1 - Location Plan

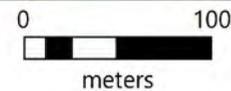


LEGEND:

-  Cadastre
-  Site boundary
-  Roads



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1.1 Planning context and proposed development

1.1.1 Metropolitan Region Scheme

Rezoning of the study area, supported by a district WMR, is currently being progressed to amend the zoning from 'Public Purpose – University' to a mix of 'Urban', 'Public Purposes – Special Use' and 'Other Regional Roads'. under the Metropolitan Region Scheme (MRS).

1.1.2 Local Planning Scheme

Concurrent rezoning of the study area under the City of Stirling's planning framework, Local Planning Scheme No.3 (LPS 3) is also likely to occur. This will result in the study area being rezoned as 'Development'.

1.1.3 Precinct structure plan

A district WMR was prepared to support concurrent amendment of the Metropolitan Region Scheme and City of Stirling Local Planning Scheme LPS3, addressing the requirements of a district water management report (District WMR).

This local WMR builds on the strategies of the district WMR and has been prepared to support the submitted ECU Mount Lawley Redevelopment PSP. The PSP outlines a clear vision for the redevelopment of the ECU Mount Lawley Campus and the WA Academy of Performing Arts (WAAPA).

The PSP provides the framework to guide future land use and development, supporting residential and mixed-use outcomes alongside education facilities and community spaces. The following zones and reservations are proposed through the PSP:

- Mixed Use
- Residential
- Public Purpose Special Use
- Public Open Space
- MRS Public Purpose Reservation – Special Use

The PSP Part Two Map is provided as Appendix A.

1.2 Key site considerations

Detailed analysis of existing study area conditions within the study area is provided in Section 2. Key considerations for water management in the precinct are summarised below.

1.2.1 Current and historic land use

Figure 1 displays the current land uses within and surrounding the study area. The study area has been previously used as a landfill (1896-1932), a pine plantation until 1961 and tertiary education since 1970.

Redevelopment of the ECU Mount Lawley Campus provides great opportunity for integration of water sensitive urban design to deliver urban greening, improved water quality and more sustainable use of water resources.

1.2.2 Climate

It is important to consider historic, current, and future climate as an integral part of water management investigations and modelling to inform development and validation of strategies. This should include an understanding of local monitoring results and demonstrated understanding of how future changes are likely to impact on the total water cycle.

As discussed in Section 2.2, retention of existing trees and vegetation where possible is a key focus for urban greening in the precinct, together with development of a Landscape Master Plan to support the PSP and maximise tree cover and vegetation. The creation of public open space represents a considerable opportunity for urban greening, along with vegetated streetscapes.

Water sensitive urban design is a key contributor to the effectiveness of urban greening. It is critical that strategies are implemented to maintain soil moisture through retention and infiltration of stormwater as close to source as possible.

1.2.3 Geotechnical considerations

Geotechnical investigations, described in section 2.3.3 have confirmed that the soils present in the precinct are generally sandy and highly permeable although there are less permeable soils underlying at variable depths in some areas.

The nature of soils, particularly permeability, is a critical element in determining an appropriate drainage strategy. Highly permeable soils provide opportunities for on-site infiltration strategies to be applied to avoid any increases in peak flows to existing drainage systems and sensitive receiving water bodies and should be applied wherever possible throughout the study area, noting that in some locations the ability to infiltrate stormwater on-site will be constrained by shallow groundwater and/or contamination remediation and management requirements.

According to the DWER Contaminated Sites Database, and as reported in the *Environmental Assessment and Management Strategy* (EAMS) (Aurora Environmental, 2025) prepared for DevelopmentWA, the site has been subject to extensive environmental investigations, with two portions currently classified as 'Remediated for Restricted Use' (ID number 23184 and 23139) under the Contaminated Sites Act 2003. These are shown on the inset of Figure 2 and discussed in more detail in Section 2.3.5.

In February 2025, the Department of Water and Environmental Regulation (DWER) classified the entirety of the site as 'Remediated Restricted Use' due to the presence of landfill waste beneath portions of the campus. DWER has indicated that any proposed redevelopment will require further investigation and assessment to inform potential risks associated with historical landfill material during construction and future land use.

Contaminated sites investigations are ongoing and are being conducted in accordance with the requirements of the Contaminated Sites Act 2003, under the review of an accredited Contaminated Sites Auditor (CSA), as described in the EAMS. Some investigative works cannot be completed until buildings are demolished, and these will be undertaken in a staged and orderly manner as redevelopment progresses. Remediation will be undertaken where required and will be independently reviewed by the CSA to ensure the site is fit for its intended uses.

1.2.4 Surface water – drainage

As detailed in Section 2.4, there are no classified wetlands within the study area. However, it is noted that there is an existing network of local drains and drainage basins in and around the

study area with varying amounts of associated vegetation, including one Water Corporation drainage basin in the adjacent Ron Stone reserve that receives drainage flows from a portion of the study area.

Consistent with the Water Corporation’s Water Services Licence and Water Sensitive Design Principles post development flows from the study area should not exceed predevelopment flows. As such, a key consideration is to implement suitable local strategies to mitigate any increase in predicted post development flows leaving the study area.

1.2.5 Groundwater

Groundwater is present less than 3m below ground level in the northern portion of the study area, which may have implications for lot elevations and drainage features (such as soakwells, storage areas) in those areas.

No groundwater is available for allocation within the City of Stirling groundwater licence subarea. However, as indicated in Section 2.5.1, there is one groundwater licence (number 89379) that encompasses the entire study area, registered to Edith Cowan University for an abstraction volume of 67,500 kL, expiring in August 2029. It is anticipated that this licence will be transferred to DevelopmentWA to support irrigation of future public open spaces.

1.2.6 Services

A *Civil Engineering Servicing Report* prepared for DevelopmentWA by Colliers to support the PSP and discussed further in Section 2.6, has confirmed that reticulated water and sewerage are currently available surrounding the study area. The existing internal networks will be removed and amended to suit the proposed development, including extending networks and upgrading services as required.

2 SITE CONTEXT

The existing environmental conditions and land uses in the study area define the opportunities and constraints for water management. A discussion of these conditions is provided in this Section.

2.1 Current and historic land uses

The EAMS prepared by Aurora Environmental for the ECU Mount Lawley redevelopment outlines that the study area was historically used as a landfill (1896-1932), after which it was used as a pine plantation until 1961 (Aurora Environmental, 2024). The study area has been used for tertiary education since 1970 to present, most recently as the Edith Cowan University Mount Lawley Campus.

Figure 1 displays the location and current surrounding land uses, which include mostly residential and recreational areas:

- Recreation and park areas:
- Mount Lawley Golf Club to the north.
- Ron Stone Park – multiple use wetland/compensation basin to the south.
- Sporting ovals and open space to the east (Hamer Park Reserve and Inglewood Oval)
- Education - Mount Lawley Senior Highschool to the southeast.
- Residential housing, including high density residential housing and aged care facilities to the west.

2.1.1 Implications for future development

It is recognised that the previous uses of the study area present some challenges for redevelopment, including to address site contamination requirements discussed further in Section 2.3.3. Redevelopment of the ECU Mount Lawley Campus provides great opportunity for integration of water sensitive urban design to deliver urban greening, improved water quality and more sustainable use of water resources.

2.2 Climate

The climate for the study area is typical of the Southwestern region of Western Australia and is characterised by the Köppen Climate Classification as Dry Subtropical featuring mild and wet winters and hot to very hot summers. Most of the rainfall is experienced in the winter between May and September and the driest months are between December and March.

The rainfall record at the nearest Bureau of Meteorology weather station (with both long-term rainfall and evaporation data, Perth Airport station no. 9021 approximately 9km to the east) has an annual average rainfall of 757.1 mm since 1944. The average has decreased since 2000, recording an average of 666.5 mm, a 12% decrease in rainfall.

Evaporation data show evaporation exceeds rainfall between September and April, and from May to August rainfall exceeds evaporation.

Decreasing rainfall is noted in the *Selection of future climate projects for Western Australia* (DoW, 2015). Mean annual rainfall decreases projected by DWER, based on the 1961-1990 baseline, varies between -4% (wet scenario) and -25% (dry scenario) by 2050. This extends to -7% (wet) and -47% (dry) by 2090.

Increasing urban heat due to climate change has also been recognised as a significant issue for the Perth region linked to loss of urban canopy and increasing populations. Chart 4 shows the increases that have been observed in mean maximum temperatures recorded at the nearest Bureau of Meteorology weather station (Perth Airport station no. 9021).

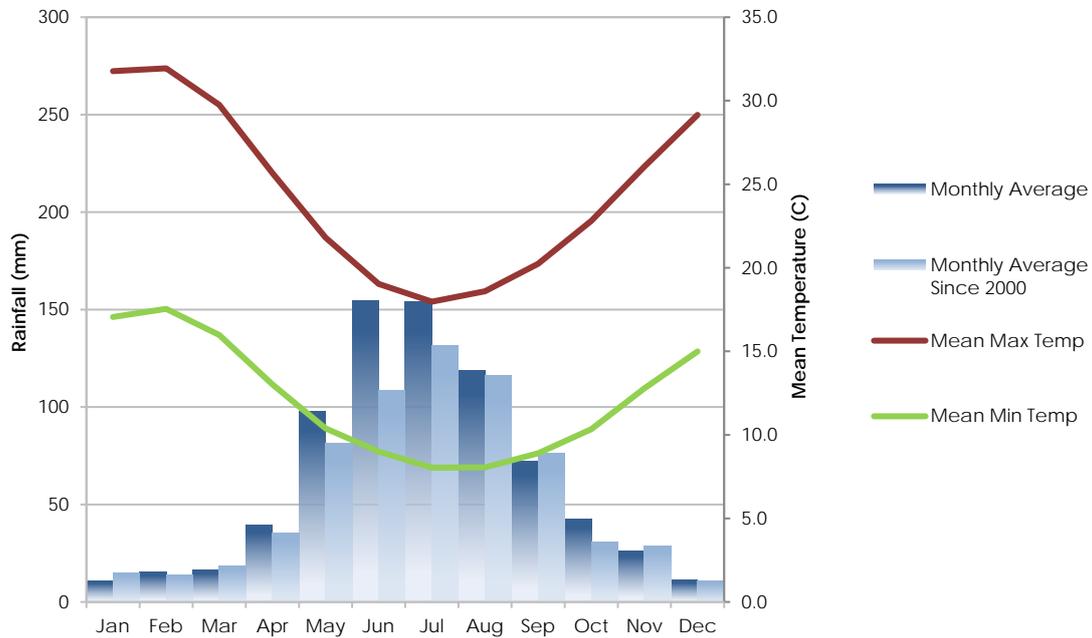


Chart 2: Climate summary data (BoM station no. 9021, BoM, 2024)

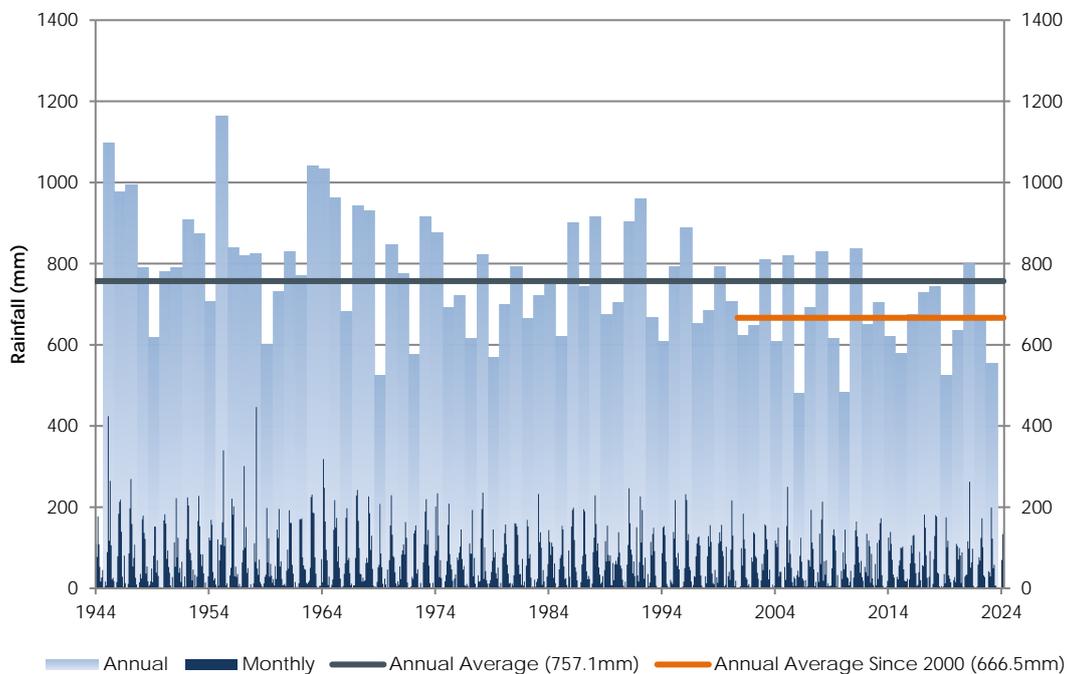


Chart 3: Rainfall summary data (BoM station no. 9021, BoM, 2024)

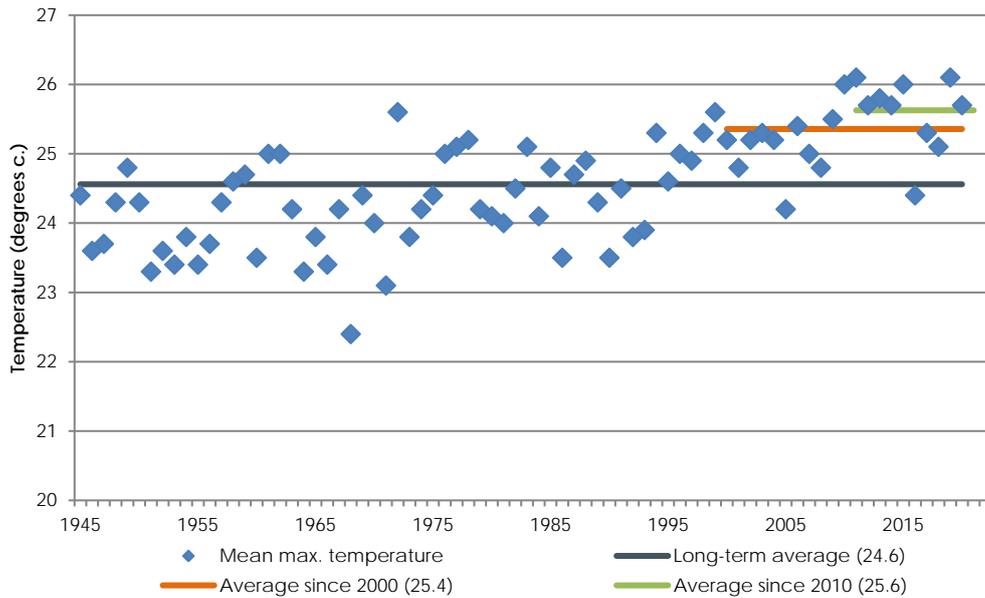


Chart 4: Mean maximum temperature data (BoM station no. 9021, BoM, 2024)

Urban greening is an important way that mitigation of urban heat impacts can be achieved. In recognition of this, the Urban Greening Grant Program was created to expand tree canopy and vegetative cover in high urban heat risk areas in 33 Local Governments within the Boorloo (Perth) and Bindjareb (Peel) regions. Funded by the Department of Water and Environmental Regulation (DWER) and delivered collaboratively with WALGA, the program provides a total of \$3.75 million (ex GST) to support additional planting or to bring forward future tree planting in winter 2025. A UHI rating of 3 or above, based on WALGA mapping available online, has been specified as a criterion for grant eligibility.

Urban heat mapping of the ECU Mount Lawley Campus is shown in Plate 1, showing heat hotspots associated with low vegetation cover to the northwest (high density residential and aged care area), along Alexander Drive, and in the southern portion of the study area. Cooler areas are associated with the parks to the southeast, basin to the south and the golf course to the north of study area.



Plate 1: Urban Heat Mapping (WALGA, 2018/19)

2.2.1 Implications for future development

It is important to consider historic, current, and future climate as an integral part of water management investigations and modelling to inform development and validation of strategies. This should include an understanding of the representativeness of local monitoring results and demonstrated understanding of how future changes are likely to impact on the total water cycle.

The creation of new public open space represents a considerable opportunity for urban greening in the study area, along with vegetated streetscapes. A Landscape Masterplan, currently being developed by Hassell for Development WA to support the PSP, will focus on retaining existing trees and vegetation where possible, and delivering quality areas of new public open spaces and streetscapes maximising tree cover and vegetation.

Water sensitive urban design is a key contributor to the effectiveness of urban greening. It is critical that strategies are implemented to maintain soil moisture through retention and infiltration of stormwater as close to source as possible.

2.3 Topography, geology, and soils

The physical and topographical conditions for the study area influence the hydrological conditions including the ability to retain and infiltrate runoff. A summary is provided below based on regional mapping which are also presented in Figure 2.

2.3.1 Topography

Ground elevations vary across the study area from around 27 m AHD in the south-west corner of the site adjacent to Alexander Drive, and in the central south-eastern part of the site along Leroyd Street. The ground generally slopes down from the eastern and western boundaries of the site quite sharply, and most of the site lies between 23 m AHD and 24 m AHD. The lowest part of the site is in the north-east around two waterbodies at approximately 21.5 m AHD.

The south-west portion of the study area has been raised with imported fill, as documented during geotechnical investigations (Douglas Partners, 2022 & 2023 – Found in Appendix B).

2.3.2 Regional soil mapping

The surface geology of the study area, shown in Figure 2, has been classified as Bassendean Sand (S8) (Gozzard, 1986) as follows:

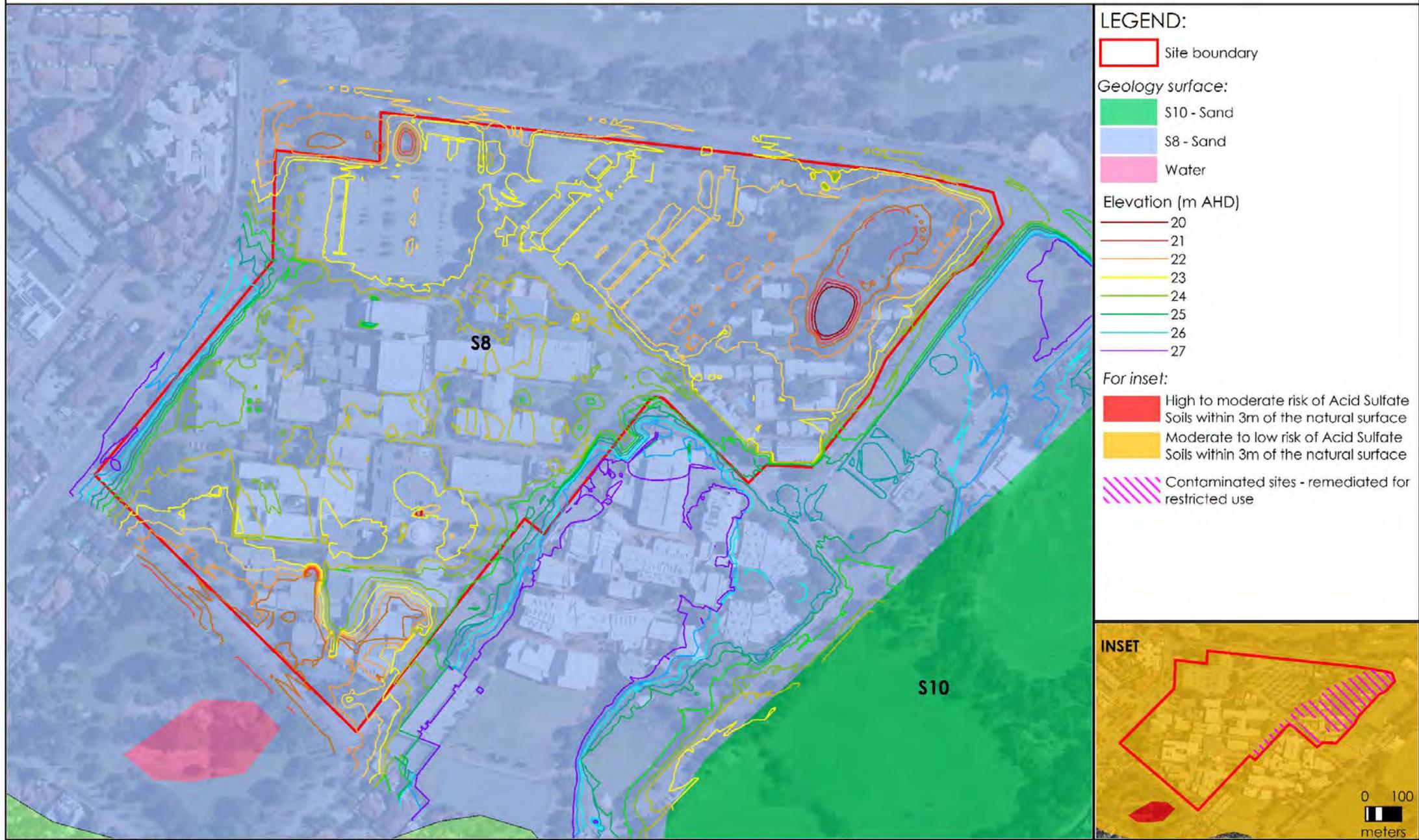
- S8: The Bassendean Sands found on the majority of the study area are described as white to pale grey at surface, yellow at depth, fine to medium-grained, moderately sorted, subangular to subrounded, minor heavy minerals of aeolian origin.

2.3.3 Geotechnical Investigation

Douglas Partners have undertaken two geotechnical investigations for the study area in 2022 and 2023 (Appendix B). The soils present in the precinct are generally sandy and highly permeable although there are less permeable soils underlying at variable depths in some areas. Douglas Partners found uncontrolled fill present at most locations.

Results relevant to groundwater, stormwater drainage, and permeability indicate:

Development WA - ECU Mount Lawley Campus WMS
 Figure 3 - Topography and Soils



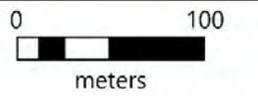
LEGEND:

- Site boundary
- Geology surface:**
 - S10 - Sand
 - S8 - Sand
 - Water
- Elevation (m AHD)**
 - 20
 - 21
 - 22
 - 23
 - 24
 - 25
 - 26
 - 27
- For inset:**
 - High to moderate risk of Acid Sulfate Soils within 3m of the natural surface
 - Moderate to low risk of Acid Sulfate Soils within 3m of the natural surface
 - Contaminated sites - remediated for restricted use

INSET

0 100
meters

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- Field permeability across the two investigations were measured between 3 and 20 m/day for sandy fill material across the study area, and between 6 to 20 m/day for natural sandy soils across the study area.
- Permeability of fill materials is likely to be varied, and drainage systems should preferably not be founded in these materials unless a lower bound value of soil permeability is assumed in their design, or other similar provisions are implemented (such as large infiltration systems, interconnection between infiltration systems, or other).
- Onsite stormwater infiltration via soakwells or sumps is generally feasible where natural sand is present below the base of the systems, and there is suitable clearance above groundwater.
- A preliminary design permeability of 5 m/day is suggested where sufficient clearance exists above groundwater.
- Test pits with lower permeability (below the suggested design permeability of 5 m/day) were found in test pits associated with fill or dense trace silt and gravel:
 - TP138 (3 m/day)– in the northeast carpark area.
 - TP25 (2 m/day) – along the southern border carpark.
 - TP32 (3 m/day) – in the northern carpark.
- Groundwater in September 2022 was encountered in various test pits, ranging from 19 to 20 mAHD across the study area. Depth to groundwater was measured as 0.6 mbGL (northwest corner), to 4.1 mbGL in the east of the study area. This is generally in line with measured groundwater levels by Aurora (Aurora Environmental, 2024), investigations undertaken by Urbaqua in 2023/24 (discussed in more detail in Section 2.5).

2.3.4 Acid sulphate soils

The study area is classified as having moderate to low risk of developing Acid Sulphate Soils (ASS) within the first 3 m from the natural surface, but high to moderate risk of ASS beyond, based on regional mapping (inset to Figure 2).

Groundwater investigations for ASS indicators were undertaken by Aurora Environmental in 2024 and reported in the *Stage 1 Detailed Site Investigation Report ECU Mount Lawley Campus* (DSI) (Aurora Environmental, 2025). Groundwater results were compared to guidance criteria (DER, 2015a), to assess whether indicators of ASS may be present at the Site that require consideration during future dewatering or abstraction.

The results of these investigations indicate there is limited existing buffering capacity for any potential acidification resulting from potential ASS disturbance. Further ASS investigation and groundwater assessment should be considered in the context of the potential redevelopment design and construction (Aurora Environmental, 2025).

Acid sulfate soils can be managed through appropriate management plans, sampling, and treatment, where required during excavation and/or dewatering, which is addressed through a DWER approval process that should be undertaken prior to any subdivision.

2.3.5 Contaminated Sites

According to the DWER Contaminated Sites Database, and as reported in the *Environmental Assessment and Management Strategy* (EAMS) (Aurora Environmental, 2025) prepared for DevelopmentWA, a contaminated site, comprising two separate parcels is present within study area boundaries, currently registered as “Remediated for Restricted Use” (ID number 23184 and 23139) under the *Contaminated Sites Act 2003*. The DWER *Basic Summary of Records* for both parcels state there is asbestos, metals and hydrocarbons present in soils due to the previous land use as a sanitary landfill. Numerous contamination investigations have been

undertaken for the study area due to the presence of the contaminated and potentially contaminated soils. Impacted soils are currently managed under the *Revised Site Management Plan* (Aurora Environmental, 2024) adopted by DWER in February 2025.

The parcels were first classified in 2009 and then reclassified in 2013 as a result of remediation works undertaken in 2009 by 360 Environmental. DWER advice indicates “Remediation rendered the area suitable for the current land use, but more sensitive land uses may not be suitable and is subject to further investigation”. Surface water monitoring was conducted in 2013, which found no evidence of impacts to surface water across the sites.

Aurora Environmental conducted a Due Diligence investigation in 2022, and a Detailed Site Investigation (Stage 1 only, Stage 2 is yet to be completed following demolition) in 2024, aimed at identifying potential environmental and contamination constraints associated with the redevelopment. The investigation found that no contamination of groundwater has occurred as a result of the sites of potential concern (Aurora, 2024), however impacts of diesel storage areas require further investigation due to the presence of hydrocarbons at two locations.

Additional testing undertaken early in 2024 has indicated that contamination is more widespread and has been reported to DWER for 'known or suspected contamination' by Edith Cowan University (as site occupier) in June 2024. It is anticipated the entire study area may be reclassified to 'possibly contaminated - investigation required' as redevelopment progresses.

2.3.6 Implications for future development

The nature of soils, particularly permeability, is a critical element in determining an appropriate drainage strategy. Highly permeable soils provide opportunities for on-site infiltration strategies to be applied to avoid any increases in peak flows to existing drainage systems and sensitive receiving water bodies and should be applied wherever possible throughout the study area, noting that in some locations the ability to infiltrate stormwater on-site will be constrained by shallow groundwater and/or contamination remediation and management requirements.

Site investigations indicate there is limited existing buffering capacity for any potential acidification resulting from potential ASS disturbance and suggests a need for further ASS investigation and groundwater assessment may be necessary (Aurora Environmental, 2024).

Acid sulfate soils can be managed through appropriate management plans, sampling, and treatment, where required during excavation and/or dewatering, which is addressed through a DWER approval process that should be undertaken prior to any subdivision.

The site's previous use as a landfill is the main legacy constraint for redevelopment, as outlined in the Stage 1 DSI and EAMS (Aurora Environmental, 2024 and 2025). Investigations undertaken to date have confirmed that landfill activities have resulted in areas of contaminated soil requiring ongoing management and remediation. Importantly, extensive investigations have found no evidence of surface water or groundwater contamination from the landfill or other historical activities.

Contaminated sites investigations are ongoing and are being conducted in accordance with the requirements of the Contaminated Sites Act 2003, under the review of an accredited Contaminated Sites Auditor (CSA), as described in the EAMS. Some investigative works cannot be completed until buildings are demolished, and these will be undertaken in a staged and orderly manner as redevelopment progresses. Remediation will be undertaken where required and will be independently reviewed by the CSA to ensure the site is fit for its intended uses.

Should containment cells be required to address contamination issues at individual mixed-use sites, there may be implications for construction of drainage features (such as soakwells and storage areas) in those locations.

2.4 Surface water, wetlands, and drainage

The study area contains no natural waterways, however there is an existing network of local urban drainage across the study area.

2.4.1 Vegetation and wetlands

Low vegetation coverage is a significant contributor to urban heat. As shown on Figure 3, the study area currently has relatively high vegetation cover of 15-25% within boundaries, and for landuse to the south, east and north. This contributes to the areas of lower urban heat (Plate 1) associated with the north-east basins.

There are no mapped wetlands located within study area boundaries, however there is one multiple use wetland, shown in Figure 3, (Roy Stone Park compensation basin) located 60m to the south of the study area, which has >25 % vegetation coverage and is associated with low urban heat. Conversely, the high density residential/aged care facilities to the west of the study area have 0 to 10 % vegetation cover, likely contributing to higher urban heat in this area.

There are two connected man-made waterbodies present in the northeast corner of the study area, which appear to take runoff from surrounding roads and roof runoff from nearby buildings. The larger lake to the north has water present year-round (as observed with historical aerial imagery) which could indicate a possible connection to groundwater. However, groundwater levels at nearby ECU02 bore recorded an MGL of 20.11 m AHD, which is approximately 0.7m below the lake water level recorded by survey indicating that the lake is regularly topped up with groundwater. The southern ephemeral basin is observed to be dry throughout the summer months.

Integration of water sensitive urban design approaches into streetscapes, POS and urban drainage system provide significant opportunities to support urban greening initiatives and develop blue-green linkages throughout the precinct and contribute to mitigation of urban heat impacts.

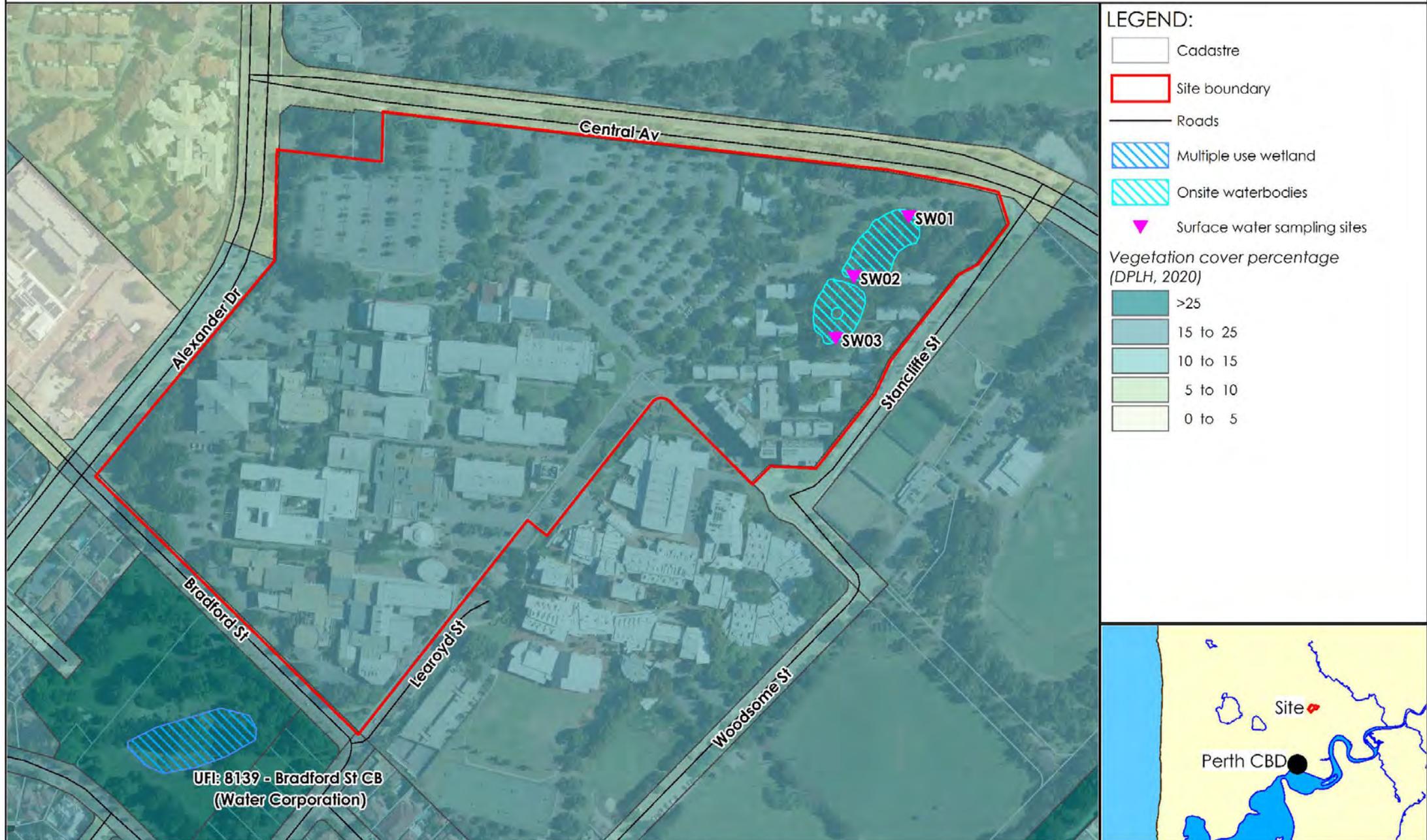
2.4.2 Surface water quality

Water quality sampling has been undertaken at three sites in the existing waterbodies within the site, shown on Figure 3. Sampling during contaminated sites investigations found no analyte concentrations that exceeded applied assessment criteria and concluded that *“The water quality data is inferred to indicate that the landfill body is not impacting the water quality in the drainage ponds and that stormwater inflows have a primary influence on water quality”* (Aurora Environmental, 2023).

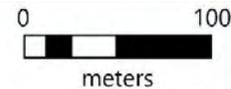
Additional water quality sampling was undertaken at the same three locations in winter and spring 2025. The results indicate that the waterbodies. Sampling included chlorophyll a, Escherichia coli (E.coli), Total coliforms and Thermotolerant coliforms as well as standard physical parameters and a suite of nutrients. Results (provided in Appendix C) indicate:

- pH ranges from neutral to slightly acidic, with some samples lower than the ANZG (2018) guideline values (DGVs) in slightly modified ecosystems for lakes and reservoirs and for wetlands.
- Dissolved oxygen is generally low, below the ANZG (2018) DGV ranges in slightly modified ecosystems for lakes and reservoirs and for wetlands.
- TN concentrations are significantly lower than concentrations at the nearest groundwater monitoring site ECU02 (see section 2.5.3)

Development WA - ECU Mount Lawley Campus WMS
 Figure 3 - Vegetation and Wetlands



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- TP concentrations at SW3 are higher than concentrations at the nearest groundwater monitoring site ECU02 (see section 2.5.3)
- TP concentrations at SW1 and SW2 are lower than concentrations at the nearest groundwater monitoring site ECU02 (see section 2.5.3)
- TP concentrations at SW3 exceed the ANZG (2018) DGVs in slightly modified ecosystems for lakes and reservoirs and for wetlands, while concentrations at SW1 and SW2 are below limits of reporting (<0.05 mg/L).
- TN concentrations at all sites exceed the ANZG (2018) DGV in slightly modified ecosystems for lakes and reservoirs but are below the DGV in slightly modified ecosystems for wetlands except at SW3 in the spring sampling event.
- Chlorophyll-a concentrations are below the ANZ DGVs in slightly modified ecosystems for lakes and reservoirs and for wetlands.
- Coliform counts indicate that the lakes would be classified as “very good” based on a sanitary inspection category of “low” (low bather density; low dilution) under the Guidelines for Managing Risks in Recreational Water (NHMRC, 2008) which was selected as the assessment level due to no current or proposed human contact with the water. At a “moderate” sanitary inspection category (high bather density; low dilution) the lakes would be classified as “good”.

At present, the waterbodies are characterised as having low oxygen levels and high phosphorus levels which indicates that they may be prone to algal blooms and eutrophication when temperatures are high. However, since only the southern basin is proposed for retention in the PSP and this basin is ephemeral, meaning that it regularly dries up in summer months, algal blooms or eutrophication will not be a significant issue in future.

2.4.4 Urban drainage system

There is an existing network of local urban drainage across and surrounding the study area, shown on Figure 4.

In addition to the two connected man-made waterbodies previously discussed and present in the northeast corner of the study area (labelled basins 1 and 2 in Figure 4), there is a third man-made drainage basin (labelled basin 3 in Figure 4) is present in the northwest corner of the study area, which appears to take runoff from the surrounding carparks. This is adjacent to a City of Stirling basin (also shown in Figure 4) located outside of study area boundaries, which is not connected to study area drainage.

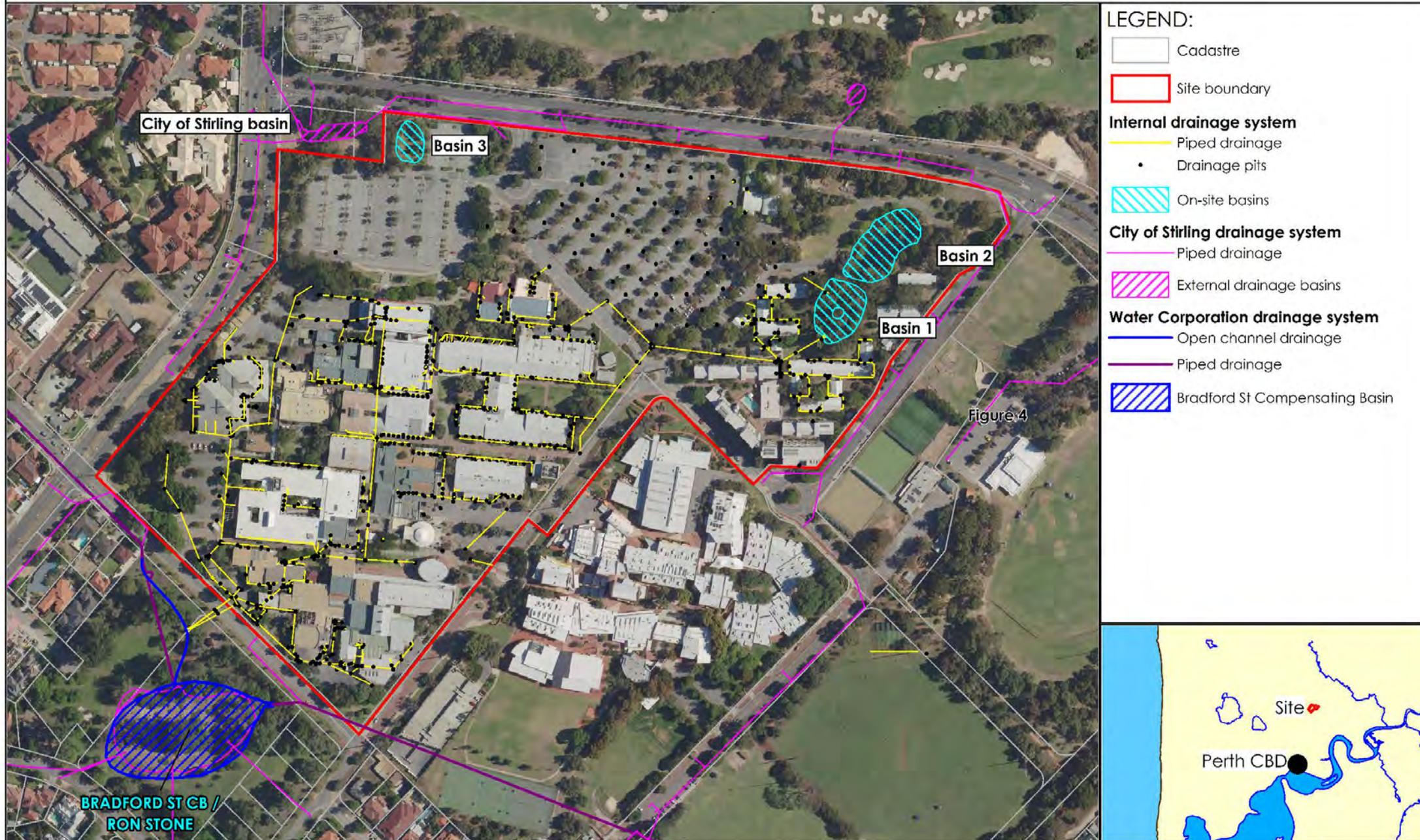
Drainage from the rest of the study area is currently directed to the southern Water Corporation Bradford Street (Ron Stone Park) compensation basin (shown in Figure 4), which ultimately drains to the Swan River via the Maylands-Inglewood Main Drain. study area drainage is connected via two 375 mm pipes, and one 600mm pipe.

The Water Corporation has advised that no upgraded or additional connections to Bradford Street CB will be approved post-development. The basin meets Water Corporation Water Service License requirements and has had no reports of flooding. Sizing and elevation detail has been provided by Water Corporation and used in stormwater system modelling.

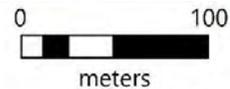
2.4.5 Predevelopment Modelling Results

A 1-dimensional InfoWorks ICM predevelopment model was constructed for the southern catchment of the study area, to inform post-development allowable flows to the Bradford Street CB. Modelling indicates that the existing drainage to the Bradford St CB allows for the following peak flows:

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 Figure 4 - Existing Surface Water and Drainage



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- 1EY event: 0.60 m³/s
- 20% AEP event: 0.89 m³/s
- 1% AEP event: 1.78 m³/s

2.4.6 Implications for future development

The Water Corporation's Main Drains are operated on the basis that post development flows should not exceed predevelopment flows. This is consistent with the Water Services Licence and Water Sensitive Design Principles. As such, a key consideration for the structure plan will be to consider suitable local strategies to mitigate any increase in predicted post development flows into the Water Corporation's system.

The southern ephemeral basin at the site is proposed for retention following development. Detailed engineering and landscape designs for modifications to the basin and connecting urban stormwater management system will be developed consistent with the strategies presented in Section 5, to include water quality treatment for flows entering the basin to prevent increased nutrient levels and minimise the risk of creating mosquito and nuisance insect habitat.

2.5 Groundwater

Groundwater is a resource that provides opportunity and constraints for the development and is an environmental asset that requires protection.

2.5.1 Groundwater allocation

The study area is located within the City of Stirling groundwater management subarea. The Department of Water and Environmental Regulation's (DWER) Water Register (DWER, 2023b) shows that the Superficial, Leederville and Yarragadee aquifers are all 'Fully Allocated'.

There is one groundwater licence (number 89379) that covers the entire study area, registered to Edith Cowan University for an abstraction volume of 67,500 kL, expiring in August 2029. The volume of water included in this allocation would be sufficient for irrigation of approximately 9 hectares of public open space which is almost half of the total study area (18.9 hectares). It is therefore likely that this allocation is used to top up the northern lake consistent with observations that it is full year-round despite being well above the local groundwater level.

2.5.2 Groundwater levels

Based on regional groundwater level information from the Perth Groundwater Map, groundwater is present at approximately 5 to 10m below ground (15 to 18.5 mAHD).

Groundwater monitoring was undertaken by Urbaqua (August 2023 to October 2024) to refine maximum groundwater levels with two peak periods of data, and to inform design levels. The bore network is displayed on Figure 5. Results of these investigations indicate:

- Groundwater flows in a south westerly direction across the study area.
- The maximum groundwater elevation across the study area was recorded at ECU2 (located in the north-east corner of the study area (20.111 mAHD in September 2023). This is shallower than regional groundwater levels at 2.2 m below ground level (mbGL).
- The greatest depth to groundwater was recorded at ECU4 (5.17 mAHD) and ECU6 (4.005 mAHD), located centrally.

Groundwater levels taken from August 2023 to October 2024 are displayed on Chart 5 below.

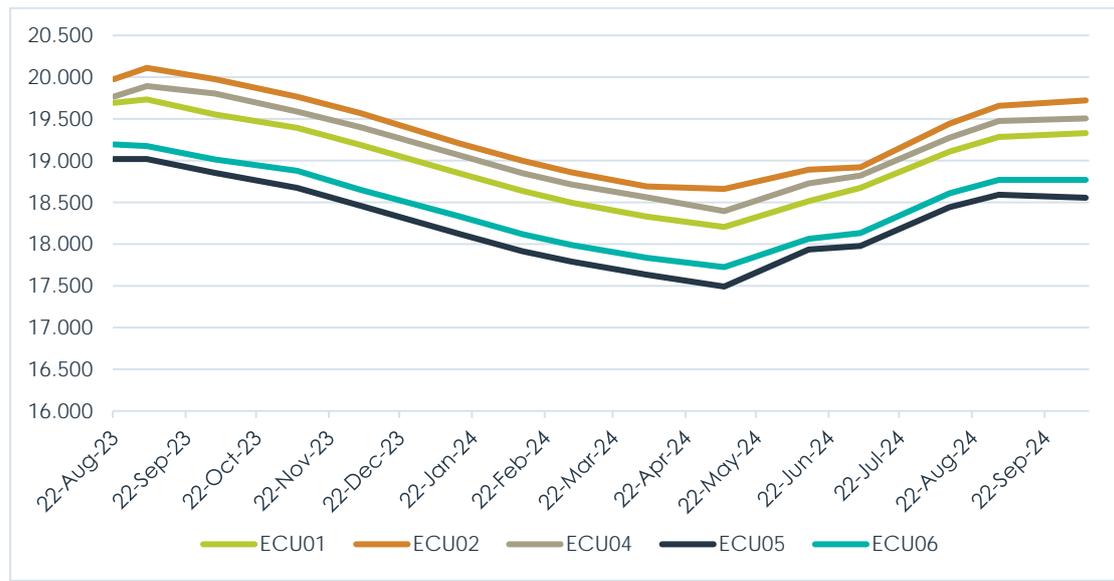
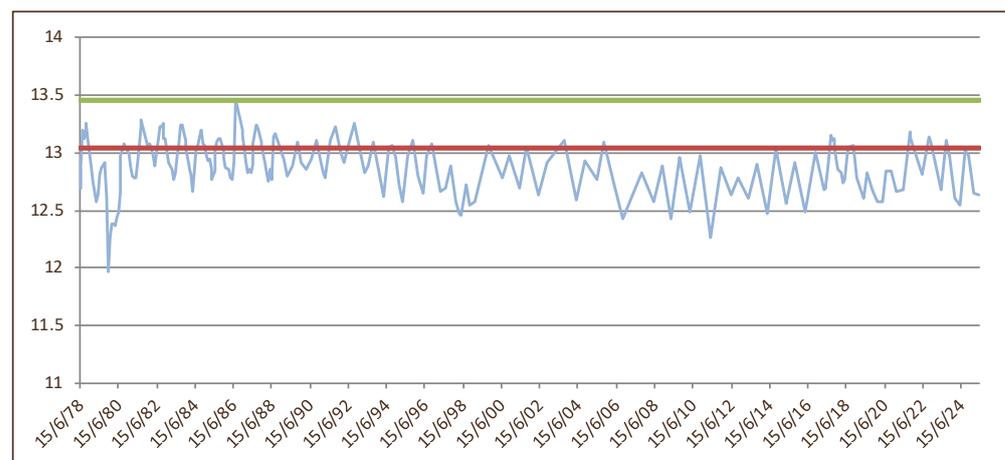


Chart 5: Groundwater Levels 2023-2024

There are three DWER bores from the Department’s Water Information Reporting Network (shown on Figure 5 inset) located within 3km of the site:

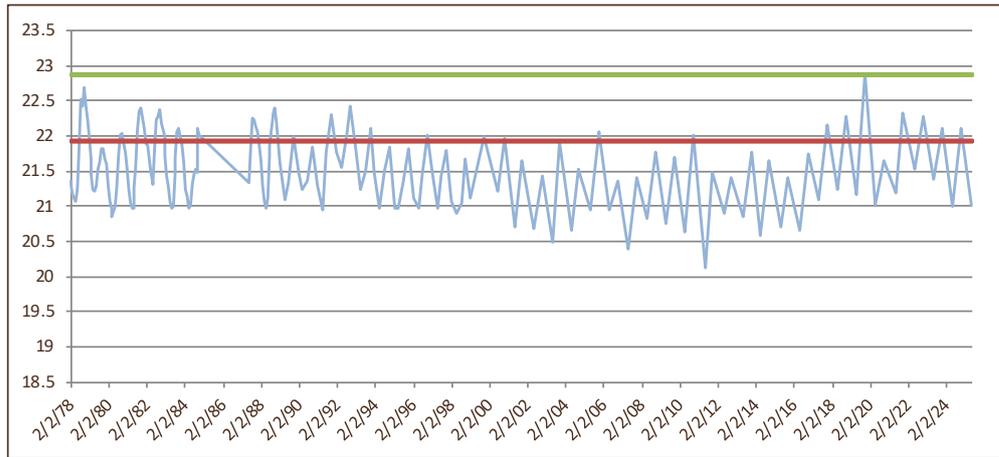
- Site ref: 61610161 is located approximately 2.8km to the south-west of the site.
- Site ref: 61610171 is located approximately 1.3km to the north-west of the site.
- Site ref: 61610200 is located approximately 1km to the north-east of the site.

All three of these bores have available long-term groundwater level data recorded in the Superficial Aquifer commencing before 1978 and ongoing to date. Chart 6 to Chart 8 presents groundwater data available for each of these sites since 1978, highlighting the maximum recorded groundwater level (MGL) in that period and the calculated average annual maximum groundwater level (AAMGL). It is observed that groundwater levels have been relatively stable at all three bores throughout the record and therefore it is considered reasonable to base calculations on the full dataset at each site.



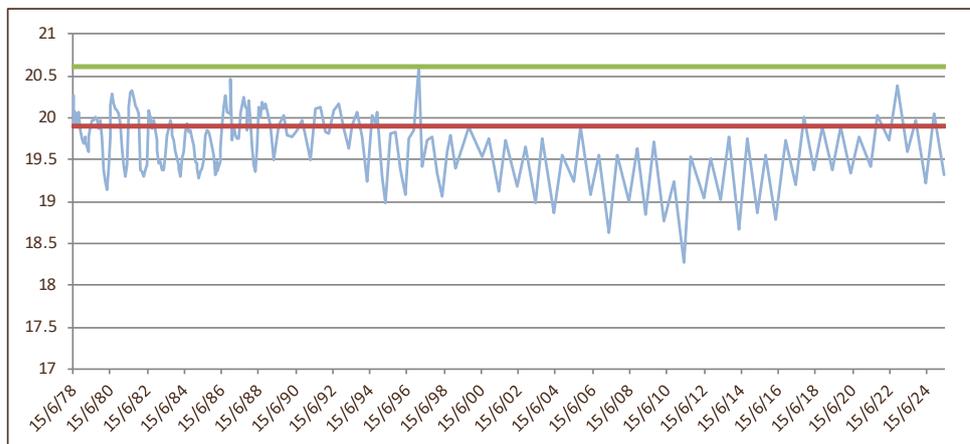
DoW Bore	GD6	Maximum GWL (mAD)	13.46
Win Site	61610161	AAMGL (mAD)	13.04

Chart 6: Groundwater record at DWER bore ref: 61610161



DoW Bore	125	Maximum GWL (mAH)	22.88
Win Site	61610200	AAMGL (mAH)	21.94

Chart 7: Groundwater record at DWER bore ref: 61610200



DoW Bore	GD7	Maximum GWL (mAH)	20.60
Win Site	61610171	AAMGL (mAH)	19.90

Chart 8: Groundwater record at DWER bore ref: 61610171

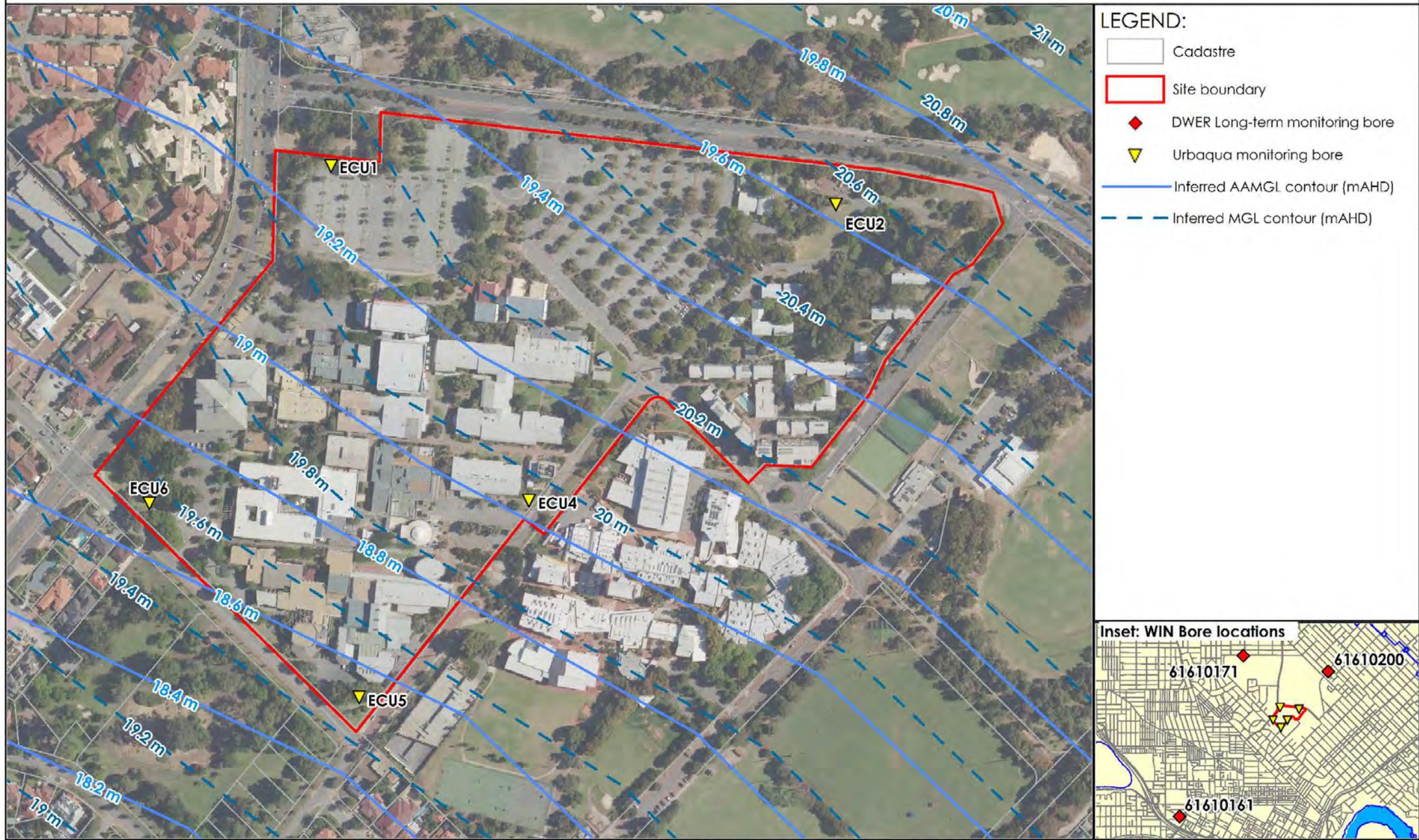
Data from each of the DWER bores has been used to derive an inferred AAMGL and MGL for each of the monitoring bores within the site by adjusting the measured data by an adjustment factor developed through comparison of data measured at the site bores and DWER bores on the same date. The average of levels inferred from each of the three DWER bores has been adopted for the purposes of this study.

The inferred AAMGL and MGL contours are shown on Figure 5. In general, it is appropriate to use the inferred AAMGL for design of drainage infrastructure and landscaping in public and private property. The inferred MGL is provided as additional guidance for future developments in relation to the risk of water ingress into buildings.

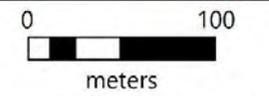
2.5.3 Groundwater Quality

Groundwater quality sampling has occurred at the site as a part of acid sulfate soils and contaminated sites investigations, as discussed in Section 2.3. These investigations were focussed on specific groundwater quality considerations and found that:

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 Figure 5 - Groundwater



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- There is limited existing buffering capacity for any potential acidification resulting from potential ASS disturbance (Aurora Environmental, 2025 and Section 2.3.4).
- No contamination of groundwater has occurred as a result of the sites of potential concern (Aurora Environmental, 2024 and Section 2.3.5).

Additional groundwater monitoring, including nutrient sampling was undertaken quarterly from August 2023 to October 2024 by Urbaqua across bores ECU01 to ECU06 (Figure 5). Results (provided in Appendix C) indicate:

- pH ranges from neutral to slightly acidic, with most samples at most bores lower than the ANZG (2018) guideline values (DGVs) for slightly modified ecosystems and lowland rivers.
- Dissolved oxygen is generally low, below the ANZG (2018) DGV range.
- TN and TP concentrations regularly exceed the ANZG (2018) DGVs at all bores.
- ECU02 and ECU06 recorded the highest average TN concentrations across the monitoring period (8.46 and 8.94 mg/L respectively).
- ECU06 recorded the single highest TN, with 15 mg/L recorded in February 2024.
- ECU01 and ECU06 recorded the greatest average TP concentrations across the monitoring period (2.58 and 1.01 mg/L respectively).

2.5.4 Implications for future development

There is one groundwater licence (number 89379) that encompasses the entire study area, registered to Edith Cowan University for an abstraction volume of 67,500 kL, expiring in August 2029. No groundwater is available for allocation within the City of Stirling groundwater licence subarea. However, it is anticipated that the existing licence will be transferred to DevelopmentWA to support irrigation of future public open spaces.

Groundwater is present less than 3m below ground level in the northern portion of the study area, which has implications for lot elevations, construction of basements, and any drainage features (such as soakwells and storage areas) in those locations.

Inferred AAMGL contours shown on Figure 5 are generally appropriate for design of drainage infrastructure and landscaping in public and private property.

Future development of the study area should also consider the inferred MGL (also shown on Figure 5) to identify where there is a risk of water ingress into new buildings.

2.6 Water and Wastewater Services

A *Civil Engineering Servicing Report* prepared for DevelopmentWA by Colliers to support the PSP has confirmed that reticulated water and sewerage are currently available throughout the study area and provides an outline of servicing upgrades that will be required to support development in the precinct.

2.6.1 Implications for future development

The servicing report outlines that feasibility and planning advice received from the Water Corporation indicates that no significant issues are anticipated to enable servicing the full extent of the proposed development site. Various upgrades to connecting water and wastewater networks are contemplated, including

For drinking water distribution

- A new Ø150mm reticulation main connecting to the existing network at the intersection of Bradford Street and Alexander Drive.
- This Ø150mm reticulation main link will provide adequate capacity for peak demands, 20 L/s fire flows, and security of supply.

For wastewater collection

- An 80m length of new DN225 gravity sewer along Bradford Street.
- Upgrades to gravity sewers upstream of the Bradford Street Pump Station.
- Given the existing topography of the site and the expected final design levels, Colliers does not expect there to be any concern in servicing the full extent of the proposed development site via gravity sewer.

2.7 Social and Heritage Values

There are no registered Aboriginal Cultural Heritage Sites within the study area according to the Department of Planning, Lands and Heritage (DPLH) Aboriginal heritage enquiry system (2024). There are no places listed in the Heritage Council's InHerit online mapping system.

3 WATER MANAGEMENT OBJECTIVES

The principles and strategies contained within this WMR will be implemented as part of detailed land use planning and development requirements and are consistent with the framework and requirements in State Planning Policy 2.9 and the Planning for Water Guidelines (WAPC, 2021).

The objectives in Table 1 have been developed to address the study area and planning context of the ECU redevelopment area consistent with the water management principles in draft *State Planning Policy 2.9 – Planning for Water* (WAPC, 2021). The objectives will be achieved through implementation of water sensitive urban design strategies as described in Sections 3 and 4.

Table 1: Water management objectives

Design Element	Objectives
Water sustainability	<ul style="list-style-type: none"> • Ensure the efficient use of all water resources in the redeveloped urban form and aim to achieve highest value use of fit-for-purpose water. • Maintain opportunities for future generations by using water more efficiently.
Stormwater management	<ul style="list-style-type: none"> • Protect infrastructure and assets from flooding and inundation. • Protect receiving environments from the impacts of urban runoff. • Provide opportunities for urban greening, cooling and habitat creation through the application of water sensitive urban design principles.
Groundwater management	<ul style="list-style-type: none"> • Protect infrastructure and assets from flooding and inundation by high seasonal groundwater levels, perching and/or soil moisture. • Protect groundwater dependent ecosystems from the impacts of urban runoff. • Manage and minimise changes in groundwater levels and groundwater quality following development.
Management of disease vectors and nuisance insects	<ul style="list-style-type: none"> • Limit the creation of new sites for breeding of nuisance insects. • Prevent long-term (>96 hrs) standing water in drainage infrastructure. • Improve water quality throughout the development.
Implementation	<ul style="list-style-type: none"> • Provide a robust framework for delivering water management strategies, including measures during construction to prevent damage to existing infrastructure and receiving environments.

4 WATER SUSTAINABILITY INITIATIVES

Water sustainability measures including the supply of water and the treatment and disposal of wastewater for the residential lots is described below.

4.1 Water supply

The study area is located in an area served by the Water Corporation's integrated water supply scheme. All future development will be connected to the reticulated drinking water distribution network.

There is approximately 2.5 ha of Public Open Space (POS) in the proposed design concept. Based on the DWER target irrigation rate of 6,750 kL/ha/yr up to 16,875 kL/yr of allocation may be required with additional requirements possibly associated with streetscapes and to ensure the health of retained trees and vegetation during development.

There is one groundwater licence (number 89379) that encompasses the entire study area, registered to Edith Cowan University for an abstraction volume of 67,500 kL, expiring in August 2029.

Transfer of the current licence to DevelopmentWA will therefore provide sufficient groundwater for ongoing irrigation of the proposed public open space.

A Landscape Masterplan, currently being developed by Hassell for Development WA to support the PSP, will provide additional detail of irrigation demands and will focus on maximising water use efficiency through the application of best practice waterwise design principles.

4.2 Wastewater treatment and disposal

The study area is located in an area served by the Water Corporation's integrated sewerage scheme and will be connected to a reticulated sewerage network.

4.3 Water efficiency measures

To reduce the consumption of scheme water newly constructed houses will be recommended to meet the Water Corporation's Waterwise homes and gardens criteria. That is:

- All showerheads installed will be better than the minimum WELS 3 Star rating.
- All taps installed will be better than the minimum WELS 4 Star rating.
- All toilets will be dual flush and exceed the minimum WELS 4 Star rating.
- All water using appliances installed are rated WELS 4 Star or above.

Considerable savings can be achieved in potable water demand at the building scale by using alternative sources for non-potable demands such as toilets, washing machines and irrigation. The construction of new commercial and residential buildings provides the opportunity to integrate these systems during design and maximise the potential for efficient use of potable water and can be considered in more detail as part of sustainability initiatives during development of detailed design proposals for individual buildings.

5 SURFACE WATER AND GROUNDWATER MANAGEMENT

The water management plan for surface water and groundwater resources within the study area have been prepared based on guiding documents and site considerations (Section 2). These management measures address the design objectives (Section 3), including providing protection to the community and improving water quality.

5.1 Flood protection

The study area is not expected to be subject to flooding from the external area in a 1% AEP event. The on-site drainage system, road layout and earthworks design will ensure that lots are located at a minimum of 0.3 m above the 1% AEP flood level in the adjacent roads and drainage infrastructure, and 0.5m above basins with no overflow relief (DWER, 2017). The predicted 1% AEP top water level in the retained on-site basin is 20.38m AHD.

Advice from the Water Corporation indicates that the Bradford Street/Ron Stone Park compensation basin has no known issues of flooding.

5.2 Stormwater management

Measures to manage stormwater within the study area are outlined in the following sections and presented in Figure 6.

The key objectives for surface water management are:

- Protect infrastructure and assets from flooding and inundation.
- Protect receiving environments from the impacts of urban runoff.
- Provide opportunities for urban greening, cooling and habitat creation through the application of water sensitive urban design principles.

5.2.1 Frequent Events (1EY)

Development within the study area will retain at least the first 15 mm of rainfall within all private lots in accordance with the *Decision Process for Stormwater Management in WA* (DWER, 2017) and the City of Stirling's on-site stormwater drainage criteria.

Road reserves within the development will be designed applying water sensitive urban design principles to include passive watering of areas provided for trees and vegetation within road reserves. It is estimated that these design approaches will provide for on-site management of the first 5mm of runoff from road reserves with the remaining runoff generated by frequent events being managed on-site in existing and proposed drainage retention and detention areas.

5.2.2 Minor (20% AEP) and Major Events (1% AEP)

Runoff from the 20% AEP event throughout the study area will be contained within the road drainage network to ensure serviceability.

Stormwater management for the study area will incorporate the use of on-site retention as close to source as possible using underground infiltration systems that will capture runoff from impervious surfaces.

Where it is not possible to accommodate at-source retention of all events up to and including the 1% AEP event; stormwater flows will be collected and conveyed to the retained southern basin within the site, and the Bradford Street CB to the South.

Townhouse lots

Soakwells are required to be installed to townhouse lots for storage and infiltration of the first 15 mm of rainfall within all private lots in accordance with the *Decision Process for Stormwater Management in WA* (DWER, 2017) and the City of Stirling’s on-site stormwater drainage criteria.

Runoff from larger events will be directed to the road drainage network, ultimately discharging into new or existing basins within the site or to the Bradford St CB depending on the catchment.

Mixed use and public purpose - education lots

Each lot will be required to retain and infiltrate on site up to and including the 10% AEP event using:

- Underground infiltration systems
- roof gardens
- raingardens
- rainwater tanks
- or other in combination

Table 2 provides an assessment of the required volume and footprint areas of retention storages, assuming that 0.6m deep underground infiltration systems are used.

It is noted that, should containment cells be required to address contamination issues at individual mixed-use sites, the delivery of underground infiltration systems may be constrained and require consideration of alternative approaches to onsite stormwater management. Similarly, where there are retained buildings located within lots, careful consideration will be needed during design to ensure that stormwater management systems can be effectively integrated within the site. However, based on a preliminary review of potentially constrained sites it is considered unlikely that suitable storage areas cannot be accommodated.

Table 2: Mixed use and public purpose lot retention volumes and footprint areas

Site reference	Lot area (ha)	Retention volume (m ³)	Retention footprint (m ²)	Retention coverage (% of total lot area)
A	0.4797	282	470	10%
B	0.9603	565	941	10%
C	0.9630	611	1,018	11%
D	0.6702	394	657	10%
E	0.6227	366	610	10%
F	0.8029	550	917	11%
G	0.3090	182	303	10%
PP-E	1.6030	943	1,571	10%
PP-HS	1.8560	722	1,203	6%
Student village	1.0119	655	1,092	11%

5.2.3 Stormwater system modelling

Hydrological and hydraulic modelling has been completed to assess catchment flows and storages for the development. A summary of modelling procedures and parameters is provided in Appendix D.

Modelling results and the size of the respective stormwater systems are provided in Table 3 and presented in Figure 6. The predicted 1% AEP top water level in the on-site basin is 20.38m AHD.

Table 3: Modelling results

Location	20% AEP	Critical duration	1% AEP	Critical duration
POS swale volume (m ³)	31	3 hours	81	3 hours
Retained basin storage peak contained volume (m ³)	2	3 hours	384	6 hours
Underground peak contained storage volume (m ³)	444	varies	1,434	varies
Underground storage available capacity (m ³)	1,418			
Total on-site storage volume (m ³)	477	-	1,898	12 hour
Peak discharge flow from the study area (L/s)	0	-	74.3	12 hour

5.3 Groundwater management

The key objectives for groundwater management are:

- Protect infrastructure and assets from flooding and inundation by high seasonal groundwater levels, perching and/or soil moisture.
- Protect groundwater dependent ecosystems from the impacts of urban runoff.
- Manage and minimise changes in groundwater levels and groundwater quality following development.

The following planning measures are adopted to achieve the above objectives:

- Subsoil drainage and imported fill to ensure adequate separation to groundwater.
- Ensure infiltration of stormwater runoff, consistent with existing conditions.
- Use of bio-retention areas within raingardens, tree pits and swales to improve groundwater quality compared with the existing conditions.

5.3.1 Subsoil drainage

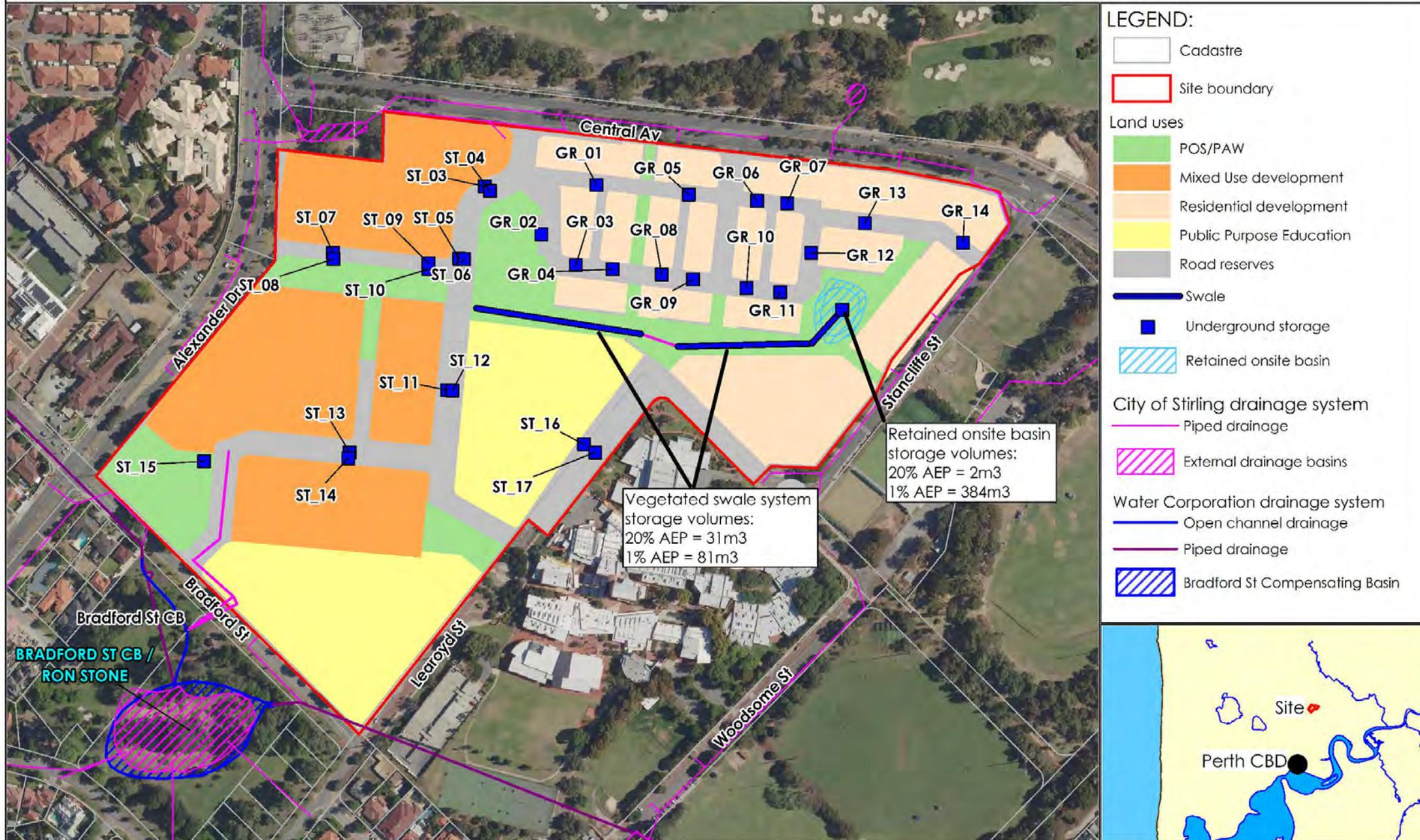
As discussed in Section 2.5, groundwater is present less than 3m below ground level in the northern portion of the study area.

Extensive use of subsoil drainage is not anticipated across the study area and will be limited to areas of shallow (<2m bgl) groundwater. Subsoil drains will be located as follows:

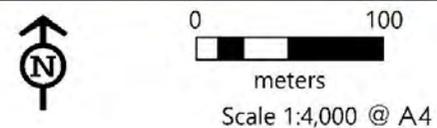
- In areas where subsoil is required, the subsoil drain will be located within the road reserve.
- Elsewhere, localised subsoil drains beneath drainage basins, and for retaining walls and roads will be considered during the construction phase to alleviate any problematic soil moisture.
 - Where these conditions are identified short length subsoil drains will be installed.

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Figure 6 - Stormwater management plan



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To be cost effective and free draining, subsoil drains will be connected to the nearest road drainage system, with water quality treatment provided downstream. The minimum separation criteria to stormwater infrastructure are provided in Table 3.

Table 4: Groundwater separation

Location	Specification	Comment
Soakwells	300 mm	From base of soakwell to MGL
Stormwater infiltration	300 mm	From invert of vegetated systems such as raingardens and swales to MGL

5.4 Water quality management

5.4.1 Biofiltration for Quality Treatment

Retention/infiltration of greater than the first 15mm of runoff will limit the mobilisation of pollutants to downstream environments. The retention and infiltration of runoff close to source through the various systems is supported by the existence of sandy soil and clearance to groundwater within the majority of the study area.

Road reserves within the development will be designed applying water sensitive urban design principles to include passive watering of areas provided for trees and vegetation within road reserves where possible. It is estimated that these design approaches will provide for management of the first 5mm of runoff from road reserves with the remaining runoff generated by frequent events being managed on-site in underground infiltration systems and the retained ephemeral basin.

The existing ephemeral basin (labelled basin 1 in Figure 4) is proposed for retention and will be fed via a linear swale system through the central public open space area as shown in Figure 6. The linear swale system and retained basin will be lined with phosphorus retentive soil and vegetated with nutrient retentive native vegetation to provide in stream biofiltration for stormwater flows and is designed to avoid creation of stagnant pools. The swale and basin will be maintained as ephemeral water features designed to empty within 96 hours of major storm events and are expected to be empty during typical mosquito and nuisance insect breeding seasons.

The detailed design of vegetated drainage system elements will be in accordance with *Adoption Guidelines for Stormwater Bio-filtration* (CRC, 2015). In addition to providing for stormwater quality management, these systems will also provide the opportunity to plant trees and mitigate urban heat impacts.

5.5 Management of disease vectors and nuisance insects

The key objectives for management of disease vectors and nuisance insects are:

- Limit the creation of new sites for breeding of nuisance insects.
- Prevent standing water in drainage infrastructure.
- Improve water quality throughout the development.

Most stormwater management systems proposed within the study area will be underground infiltration systems which do not pose a risk for mosquito and nuisance insect breeding.

Landscaped areas within the study area that will receive runoff for passive watering and to maintain soil moisture will drain by infiltration through sandy soil with relatively high infiltration rate minimising standing water times and therefore limiting the risk of mosquito and nuisance insect breeding in these areas.

As discussed in section 5.4 above, one of the existing waterbodies (southern basin) is proposed for retention and will be fed via a linear swale system through the central public open space area. The linear swale system and basin will be vegetated to provide in stream biofiltration for stormwater flows discharging into the system and will be designed to avoid creation of stagnant pools. The swale and basin will be maintained as ephemeral water features designed to empty within 96 hours of major storm events and are expected to be empty during typical mosquito and nuisance insect breeding seasons.

Physical, chemical, and biological control methods can be used to manage mosquito populations associated with the ephemeral swale system and basin, if required, in the unlikely event that the system contains water in the early part of the breeding season. Methods which may to be employed (and their order of priority) include:

- Improving water quality, minimising nutrient loads and thereby reducing potential for algal blooms and fish kills; and,
- Should Mosquitos and Chironomid Midges become a nuisance, pesticides (larvicides and/or adulticides) will be used as required to kill mosquito larvae in breeding sites.

6 IMPLEMENTATION

To achieve the water management objectives of this water management strategy in a manner consistent with the water management principles in draft *State Planning Policy 2.9 – Planning for Water* (WAPC, 2021), the water management strategies described in Sections 4 and 5 need to be delivered as part of future development.

It is noted that investigation of known contamination issues present within the study area are ongoing and are being conducted in accordance with the requirements of the Contaminated Sites Act 2003, under the review of an accredited Contaminated Sites Auditor (CSA), as described in the EAMS. Some investigative works cannot be completed until buildings are demolished, and these will be undertaken in a staged and orderly manner as redevelopment progresses. Remediation will be undertaken where required and will be independently reviewed by the CSA to ensure the site is fit for its intended uses.

6.1 Staging of development

It is noted that the implementation of the ECU Mount Lawley redevelopment will occur over a number of stages, with the timing and sequencing influenced by market conditions, demand, and other external factors.

The water management strategies presented in Sections 4 and 5 have been developed to facilitate delivery of the development in a staged manner with stormwater management provided in distributed underground storage cells that can be delivered with individual stages of development.

6.2 Management of Construction Activities

The Construction Management Plan will address sediment control and maintenance works during construction and will consider runoff flow paths during and following construction to ensure no surface water is allowed to leave the study area or enter constructed parts of the drainage system without adequate treatment to manage water quality.

6.3 Monitoring

No permanently inundated surface waterbodies are proposed within the site and therefore monitoring of surface water quality following development will not be required.

There are no sensitive groundwater receptors present within or in close proximity to the site and the land uses proposed by the PSP are considered a low risk to groundwater quality. Therefore, post-development groundwater monitoring is similarly not required.

6.4 Delivery

Key tasks, roles and responsibilities relating to delivery of urban water management objectives are outlined in Table 5.

Table 5: summary of roles and responsibilities

Task	Responsibility
Subdivision earthworks and construction of subdivision service infrastructure incl. erosion control, water, wastewater and drainage	Landowner/developer
Landscaping of public open spaces	Landowner/developer
Construction of residential and mixed use dwellings	Future lot owners
Landscaping of private lots	Future lot owners
Maintenance of subdivision drainage	Landowner/developer for 2 years until handover to City.
Maintenance of public open spaces	Landowner/developer for 2 summers until handover to City.
Dissemination of public information and public awareness campaigns	Landowner/developer to provide at settlement and as required.

6.5 Agreed Maintenance Arrangements

Subdivision drainage structures will require regular maintenance to ensure efficient operation. Table 6 outlines the proposed maintenance schedule.

More detailed ongoing maintenance requirements will be provided and agreed with the City of Stirling as required.

Table 6: Drainage infrastructure maintenance schedule

Maintenance task	Interval		
	Bi-Annually	Annually	As required
Sweep Roads (post-development)			✓ (Quarterly as a minimum)
Education of sediment and rubbish in manholes		✓	
Remove sediment and debris from vegetated swale system	✓		✓
Repair and replace mulch and vegetation in the vegetated swale system and retained basin			✓

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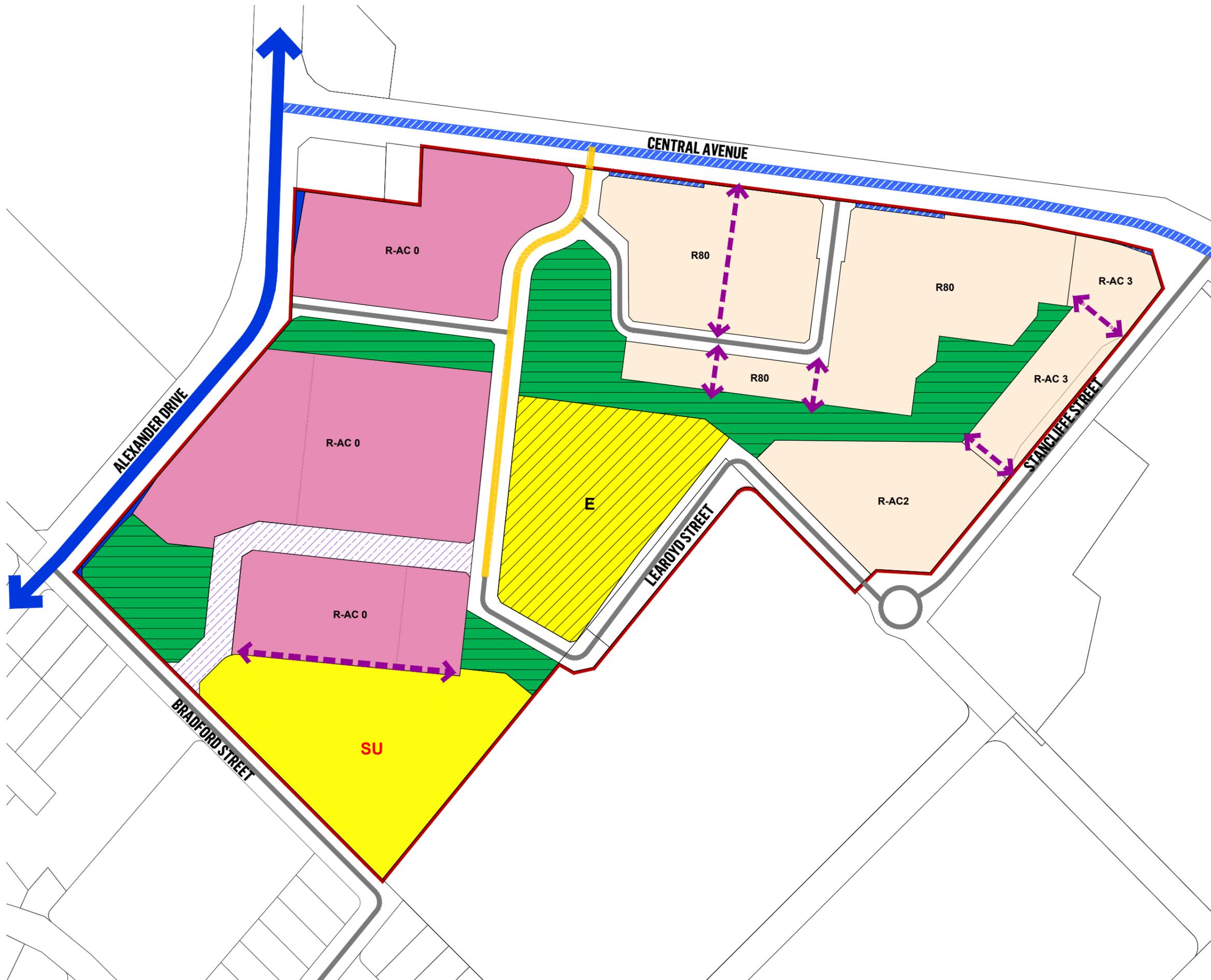
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Appendix A Precinct structure plan

LEGEND

- Precinct Structure Plan Area
- REGIONAL RESERVES**
- Other Regional Road
- SU** Public Purposes - Special Uses
- LOCAL RESERVES**
- Public Open Space
- E** Public Purpose - Education
- District Distributor Road
- ZONES**
- Mixed Use
- Residential
- OTHER**
- Neighbourhood Connector Road
- Access Street
- Pedestrian Priority Street
- ↔ Key Pedestrian Link



Precinct Structure Plan Map - Part 1 ECU Mount Lawley Precinct Structure Plan

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CLIENT

DevelopmentWA

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P0048633
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17.1

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20.11.2025
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Appendix B Geotechnical investigation



Douglas Partners

Geotechnics | Environment | Groundwater

Report on
Preliminary Geotechnical Investigation

Proposed Multi-Residential Development
Central Avenue, Mount Lawley, WA

Prepared for
DevelopmentWA

Project 216618.00
November 2022

Integrated Practical Solutions





Douglas Partners

Geotechnics | Environment | Groundwater

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		29 November 2022
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Report on Preliminary Geotechnical Investigation

Proposed Multi-Residential Development

Central Avenue, Mount Lawley, WA

1. Introduction

This report presents the results of a preliminary geotechnical investigation undertaken for a proposed multi-residential development at Central Avenue, Mount Lawley, WA. The investigation was commissioned in an email dated 12 August 2022 by Mariam Yaqub of DevelopmentWA and was undertaken in accordance with Douglas Partners' proposal P216618.00.P.001.Rev1 dated 27 July 2022.

It is understood that the proposed development of the site is likely to include both multi-storey apartment buildings and single storey residential buildings, with associated pavements and public open space.

This investigation was undertaken for due diligence purposes. Further investigation will be required across the site following demolition of existing buildings to allow investigation across areas of the site currently inaccessible for testing, as well as to complete targeted investigation once the development plans are confirmed.

The aim of the investigation was to assess the subsurface conditions beneath the site and provide preliminary comments on:

- the suitability of the site for the proposed development;
- site preparation, compaction and earthworks to allow the proposed development;
- areas of foundation risk and possible extent of unsuitable soils (in particular any areas associated with landfill materials);
- excavation conditions;
- the site classification in accordance with AS 2870-2011;
- an appropriate earthquake design factor for the site, in accordance with AS 1170.4-2007.
- parameters for the design of retaining structures and batter slopes;
- the suitability of the existing in situ materials for re-use as fill material;
- a design subgrade CBR based on field observations and limited laboratory testing;
- the permeability of the soils and suitability for on-site stormwater disposal;
- the depth to groundwater, if encountered; and
- assess the risk of acid sulfate soils based on a review of readily available desktop information.

The investigation included cone penetration tests (CPT) at 21 locations, the drilling of 33 boreholes, eight in situ infiltration tests and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations on the items listed above.

2. Site Description

The site is the existing Edith Cowan University (ECU) Mount Lawley campus and covers an irregular shaped area of approximately 18.3 ha. It is bordered by Central Avenue to the north, Alexander Drive to the west, Bradford Street to the south-west and Stancliffe Street and Learoyd Street to the south-east.

At the time of the investigation, most of the northern portion of the site comprised car parking areas, while the central and southern portions of the site comprised mostly two to five storey university buildings. The north-eastern part of the site comprised a student residential village, with buildings generally two to four storeys high.

Publicly available LiDAR data indicates that the site is relatively flat, with surface levels between approximately RL 23 m AHD and RL 24 m AHD across the northern and central part of the site, falling to between approximately RL 21 m AHD and RL 22 m AHD across the southern and eastern parts.

The Perth 1:50 000 Environmental Geology sheet indicates that shallow sub surface conditions beneath the site comprise Bassendean Sand. An area mapped as sand derived from Tamala Limestone is shown on the mapping, approximately 100 m to the south of the site.

Published acid sulfate soil risk mapping indicates the site is located within an area of “moderate to low risk of acid sulfate soils occurring within 3 m of natural surface”. The mapping also indicates an isolated area mapped as “high to moderate risk” located approximate 45 m southwest of the site.

In addition to the above, it is understood that a portion of the site (marked with pink hatches on Drawing 1, Appendix B) is classified as “Remediated for Restricted Use” under the Contaminated Sites Act 2003. With reference to Basic Summary of Records (available from www.dwer.wa.gov.au), it is understood the site was previously used as part of a sanitary landfill and is impacted with metals, hydrocarbons (polycyclic aromatic hydrocarbons) and asbestos. Previous investigations encountered sanitary waste up to 2.0 m thick and is covered with variable thickness of clean cover material. The site is subject to a Site Management Plan (SMP), which requires any disturbance or excavation below 0.3 m to be undertaken in accordance with the SMP.

3. Field Work Methods

Field work for the investigation was carried out between 27 September and 30 September 2022 and comprised:

- 21 cone penetration tests (locations 1 to 21).
- 33 boreholes (locations 22 to 53 and 50A).
- Perth sand penetrometer (PSP) tests adjacent to borehole locations.
- Eight in situ infiltration tests (locations 22, 25, 28, 32, 35, 42, 46 and 51).

The CPTs (and CPTu noted at the locations below) use a 36 mm diameter instrumented cone with a following 130 mm long friction sleeve attached to rods of the same diameter, pushed continuously at a rate of 20 mm/sec into the soil by hydraulic thrust from a truck rig. Strain gauges in the cone and sleeve

measure resistance to penetration and friction along the sleeve. This data is recorded on a computer and analysed to assess the type, properties and condition of the materials penetrated. The CPTs were pushed to termination depths of up to 19.5 m. Upon withdrawing the CPT probe, each test hole was dipped in an attempt to measure groundwater levels. Soil pore pressure was recorded at CPTu locations 1, 2, 6, 7, 9, 11, 13, 15, 16, 17, 18 and 19.

The boreholes were drilled using either an 8-tonne backhoe equipped with a 250 mm diameter power auger attachment, or a 110 mm diameter hand auger, to a maximum depth of 2.5 m. The boreholes were logged in accordance with AS1726-2017 by a geotechnical engineer from Douglas Partners. Soil samples were recovered from selected locations for subsequent laboratory testing.

Perth sand penetrometer (PSP) tests were carried out adjacent to the borehole locations in accordance with AS 1289.6.3.3 to assess the in-situ relative density of the shallow soils.

Infiltration testing was undertaken adjacent to Locations 22, 25, 28, 32, 35, 42, 46 and 51, using the falling head method, at depths of between 0.7 m and 1.2 m.

Test locations and associated surface elevations were measured using a differential GPS with a reported accuracy of 0.1 m.

4. Field Work Results

4.1 Ground Conditions

Detailed logs of the ground conditions and results of the field testing are presented in Appendix B, together with notes defining descriptive terms and classification methods, in Appendix A.

Ground conditions across the site generally comprised:

- **TOPSOIL / SAND SP-SM** - dark grey-brown sandy topsoil, with silt, 0.1 m thick at location 33.
- **FILL (SAND, Organic SAND, Gravelly SAND and Sandy GRAVEL) SP, SP-SM and GP-GM** - Generally sandy fill (or gravelly materials associated with pavement layers) which appears to generally be uncontrolled (apart from the pavement layers) from surface to depths between 0.3 m and 3.6 m, encountered at most test locations. A limited amount of foreign inclusions such as glass and brick fragments were observed at several locations, generally within the north eastern area shown as 'Classified Site' on Drawing 1, Appendix B (Location 41, 42, 43, 46, 49, 50A, 52), but also elsewhere (locations 26, 32, 53). An organic sandy fill layer was encountered from 0.15 m depth to 1.2 m depth at location 41.
- **SAND SP** - fine to medium grained sand, generally medium dense, increasing in density with depth. Some zones of loose to medium dense sand was encountered along the soil profile at some locations (2, 8, 10, 17, 18, 20), from depths of between ground surface and 2.7 m, extending to depths of between 1.8 m and 6.1 m. Layers of weakly cemented coffee rock were encountered or interpreted at some test locations (1, 21, 44).
- **Silty SAND SM, Clayey SAND SC and Sandy CLAY CL-CH** - various layers of Silty Sand, Clayey Sand and Sandy Clay often interbedded within layers of sand, and generally either medium dense

or very stiff to hard, encountered from depths between 10.2 m and 15 m, at most CPT locations excluding 2, 3 and 19.

4.2 Groundwater

Groundwater was observed within several boreholes and CPT holes between 27 and 30 September 2022. Groundwater was also interpreted from pore pressure data of the CPTu. Groundwater levels generally ranged between approximately RL19 m and 20.5 m AHD across the site, as shown in Table 1 below. The boreholes and CPT were immediately backfilled following sampling, which precluded longer-term monitoring of groundwater levels.

Table 1: Summary of Groundwater Levels (between 27 and 30 September 2022)

Location	Ground Surface Level ^[1] (m AHD)	Groundwater Depth (m)	Groundwater Level ^[2] (m AHD)
1	21.9	2.7	19.2
2	22.0	2.7	19.3
6	23.7	4.0	19.7
7	23.1	3.2	19.9
8	22.8	3.1	19.7
9	22.6	3.0	19.6
10	22.9	3.0	19.9
11	23.2	3.4	19.8
12	22.7	2.7	20.0
13	22.7	2.9	19.8
15	22.1	2.1	20.0
16	22.1	2.0	20.1
17	22.1	2.1	20.1
18	22.2	2.0	20.2
19	23.1	3.0	20.1

Location	Ground Surface Level ^[1] (m AHD)	Groundwater Depth (m)	Groundwater Level ^[2] (m AHD)
20	23.7	4.1	19.6
29	24.2	2.1 ^[3]	22.1 ^[3]
33	20.5	0.6	19.9
40	22.3	2.1	20.2
41	22.1	2.1	20.0
45	21.9	1.5	20.4
46	22.1	1.6	20.5
48	21.8	1.45	20.4
49	22.5	2.4	20.1

Notes for Table 1:

- [1]: Surface level measured using differential GPS.
- [2]: Groundwater Level = Surface Level – Groundwater Depth.
- [3] Water observation at Location 29 is inconsistent with surrounding observations, should be considered with caution.

It should be noted that groundwater levels are affected by climatic conditions and land usage and will therefore vary with time.

The Perth Groundwater Atlas (2004) indicates that the groundwater was at a level of between approximately RL 12 m AHD and RL 13 m AHD in May 2003 (end of summer, low seasonal level), i.e. approximately 8 m to 10 m below existing surface levels. The Perth Groundwater Atlas (1997) indicates that the groundwater was at a level of between approximately RL 20.5 m AHD and RL 22 m AHD in October 1997 (start of summer, high seasonal level), i.e. approximately 1 m to 2 m below existing surface levels.

4.3 Soil Permeability

Eight in-situ infiltration tests using a falling head method were carried out at depths of between 0.7 m to 1.2 m at locations 22, 25, 28, 32, 35, 42, 46 and 51. An estimated permeability value has been derived from the in situ test data using a formula based on a calculation by Hvorslev (1951). Results of the permeability analysis are summarised in Table 2.

Table 2: Summary of Permeability Analysis

Test Location	Depth (m)	Measured Permeability (m/day)	In situ Ground Conditions at Testing Depth
22	0.7	>20	FILL / SAND SP, trace silt, medium dense
25	0.9	2	FILL / SAND SP, trace silt, medium dense
28	1.0	>20	SAND SP, trace silt, medium dense (Bassendean Sand)
32	1.2	3	SAND SP, trace silt (Sand derived from Tamala Limestone)
35	1.0	>20	SAND SP, trace silt, dense (Bassendean Sand)
42	1.0	>20	SAND SP, trace silt, medium dense (Bassendean Sand)
46	0.85	10	FILL / SAND SP, trace silt and gravel, medium dense
51	0.8	>20	SAND SP, trace silt, very dense (Sand derived from Tamala Limestone)

5. Laboratory Testing

A geotechnical laboratory testing programme was carried out by a NATA registered laboratory and comprised the measurement of:

- the particle size distribution on twelve samples;
- the organic content on five samples;
- the modified maximum dry density (MMDD) and optimum moisture content (OMC) on five samples; and
- the California bearing ratio (CBR) of the five samples above.

The test report sheets are given in Appendix C and the results are summarised in Table 3 and 4.

Table 3: Results of Laboratory Testing for Soil Identification and Site Classification

Test Location	Depth (m)	Fines (%)	Sand (%)	Gravel (%)	OC (%)	Material
22	0.7	3	95	2	-	FILL / SAND SP, trace silt and gravel
25	0.9	5	84	11	0.6	FILL / SAND SP, trace silt and gravel

Test Location	Depth (m)	Fines (%)	Sand (%)	Gravel (%)	OC (%)	Material
27	0 – 0.7	5	95	0	-	FILL / SAND SP, trace silt
28	1.0	2	98	0	-	SAND SP, trace silt
29	0.8	3	95	2	1.1	SAND SP, trace silt and gravel
32	1.2	2	98	0	-	SAND SP, trace silt
34	0.5	4	82	14	-	FILL / SAND SP, trace silt and gravel
36	0.5	1	99	0	-	SAND SP, trace silt
37	0.9	3	96	1	-	SAND SP, trace silt and gravel
41	0.6 – 0.9	5	74	21	3.7	FILL / Organic SAND SP, with gravel, trace silt
45	1.4 – 1.5	-	-	-	2.0	SAND SP, trace silt
46	0.85	3	91	6	0.8	FILL / SAND SP, trace silt and gravel
52	0.6 – 1.0	7	76	17	-	FILL / SAND SP-SM, with gravel and silt

Notes: Fines = Finer than 75 µm.

Sand = Between 2.36 mm and 75 µm.

Gravel = Larger than 2.36 mm.

OC = Organic Content

Table 4: Summary of Laboratory Testing for Pavement Design Parameters

Test	Depth (m)	OMC (%)	MMDD (t/m ³)	CBR (%)	Material
27	0.5	14.0	1.72	16	FILL / SAND SP, trace silt
34	0.5	12.0	1.81	19	FILL / SAND SP, trace silt and gravel
36	0.5	12.0	1.69	15	SAND SP, trace silt
37	0.9	14.5	1.76	20	SAND SP, trace silt and gravel
52	0.6-1.0	14.5	1.92	25	FILL / SAND SP-SM, with gravel and silt

Notes: - OMC: optimum moisture content - MMDD: modified maximum dry density - CBR: California bearing ratio

6. Proposed Development

It is understood that the proposed development plan for the site is yet to be confirmed, however it is likely to include both multi-storey apartment and single storey residential buildings, with associated pavements and public open space.

7. Comments

7.1 Site Suitability

Results of the investigation indicate that the site is generally underlain by fill and sand as described in Section 4.1 above. Such ground conditions are generally considered suitable for a proposed multi-storey residential development, with consideration of the following constraints:

- The presence of fill across the majority of the site which should generally be considered as uncontrolled, owing to its variable compaction across the site and the absence of any QA/QC documentation about its placement;
- Some zones of loose to medium dense sand along the soil profile, encountered to depths of between 1.8 m and 6.1 m at several locations (2, 8, 10, 17, 18 and 20) and possibly occurring elsewhere across the site.

From a geotechnical standpoint, the land is physically capable of development, provided that the geotechnical constraints outlined above are taken into consideration, and the provisions outlined in the subsequent subsections of the report are incorporated in the development plans.

Detailed geotechnical investigation of the site is recommended during the design phases of the development. In particular, further testing will be required following demolition of the existing structures on-site and once building locations and types are known.

The possible impact of contamination and/or landfill gases associated with the former landfill area on the proposed development should be considered. It is understood that another environmental consultant is helping in this regard. This report is written exclusively from a geotechnical perspective, and guidance on environmental issues associated with the former landfill should be sought from this other consultant.

7.2 Site Classification

The shallow ground conditions beneath the site generally comprise uncontrolled fill overlying sand, as described in Section 4.

Based on the results of the investigation and in accordance with AS 2870-2011, a site classification 'Class P' applies to the site, owing to the presence of uncontrolled fill. Following suitable site preparation and assessment by a geotechnical engineer, it is anticipated that the site could generally be re-classified as 'Class A' in accordance with AS 2870-2011. Suitable site preparation includes treatment or excavation and replacement of the uncontrolled fill encountered across the site and suitable densification of any loose soils. Site preparation is further discussed in Section 7.4.

It should be noted that AS 2870-2011 is applicable to residential structures and “*other forms of construction including some light industrial, commercial and institutional buildings if they are similar to houses in size, loading and superstructure flexibility*”. The applicability of this standard should be considered for proposed buildings, although large multi-storey buildings will likely be outside the scope of the standard.

7.3 Soil Classification for Earthquake Design

Ground conditions encountered beneath the site generally comprise medium dense and denser sand overlying very stiff to hard clayey materials. An earthquake design soil sub-class of ‘Ce’ and a hazard factor (Z) of 0.09 are considered appropriate for this site in accordance with AS 1170.4-2007.

7.4 Site Preparation

Following demolition and prior to excavation for foundations and/or placement of filling, all existing structures, pavement layers, services, vegetation and topsoil should be removed from within proposed building and pavement envelopes and removed from site. Pavement layers could be stockpiled for possible re-use, subject to further assessment of their suitability for the proposed re-use.

The uncontrolled fill encountered across the site forms an unsuitable foundation material in its current conditions. It should be either be compacted in situ, or excavated, treated and replaced in a controlled manner, or excavated and removed, from all proposed building and pavement envelopes. The appropriate approach for individual structure will depend on the conditions and thickness of the existing fill and the type of proposed structures and should be assessed at design stage of the proposed development once further information about the proposed structures and their locations are known. The sand fraction of the uncontrolled fill is likely to be suitable for re-use as structural fill following screening of oversized and foreign particles, as discussed in Section 7.5. It is recommended that a geotechnical engineer supervises the treatment of the uncontrolled fill.

Following removal of existing structures, pavement, services, vegetation, topsoil, uncontrolled fill and any cut required prior to filling, it is recommended that the subgrade beneath proposed building and pavement envelopes be test rolled using a heavy (minimum of 14 t deadweight) vibrating smooth drum roller.

Any areas that show signs of excessive deformation during compaction should be continually compacted until deformation ceases. Alternatively, the poor-quality material giving rise to deformation could be excavated and replaced with controlled fill compacted to 95% modified maximum dry density. Care should be taken not to operate heavy vibrating plant immediately adjacent to existing buildings and services.

Appropriate compaction levels should be confirmed by a geotechnical engineer based on the development nature and settlement tolerances, prior to construction.

Owing to the variable depths (up to 6 m below existing levels) of zones of loose to medium sand encountered along the soil profile appropriate, care will be required during design and construction so that the proposed buildings are founded on soils of suitable density. Achieving suitable density for sand

beneath proposed footing systems might require excavation of the loose soils and replacement of the excavated sand in compacted layers. The requirement for and depth of excavation will depend on the type of buildings and their footing geometry. In addition, the base of all footing excavations will require compaction prior to footing construction, for instance using a vertical rammer or vibrating plate compactor, followed by geotechnical engineer assessment.

Alternatively, multi-storey buildings could be founded on piles if a shallow footing system that would include pad and strip footings or a raft is unsuitable. Further investigation and assessment should be undertaken once building specifics are known.

7.5 Re-use of Excavated Material

Based on the nature of the materials encountered during the investigation, it is anticipated that in situ natural sand excavated from the site should be generally geotechnically suitable for re-use as controlled fill material, provided it is free from organic matter, particles greater than 150 mm in size, and possible foreign items.

The uncontrolled fill encountered across the majority of the site mostly comprised sand (besides various foreign inclusions) and should generally be geotechnically suitable for re-use, provided it is free from organic matter and particles greater than 150 mm in size. Depending on the amount of oversized particles, screening or raking of the fill may be required.

Imported fill, if required, should comprise free draining cohesionless sand with less than 5% fines. This material should also be free from organic matter and particles greater than 150 mm in size. It is recommended that any sand fill be placed in layers, near its optimum moisture content with each layer compacted to achieve not less than 10 blows per 300 mm rod penetration when tested using a Perth sand penetrometer.

7.6 Excavations

7.6.1 Excavation Conditions

The encountered shallow ground conditions generally comprise sandy soils. Layers of weakly cemented coffee rock were encountered or inferred at some test locations but are not anticipated to significantly impact excavation. Therefore, conventional earthmoving equipment (such as large excavators) is anticipated to be suitable for excavations across the site.

7.6.2 Safe Batter Slopes

During construction, temporary batter slopes in excavations up to 3 m deep in sand should be no steeper than 1.5:1 (H:V) if not retained. This batter slope is valid provided that no surcharge loads (including live loads such as vehicles and machinery) apply within the slope height behind the crest. Any excavation that is adjacent to existing buildings (if any) should be supported, or the existing footings should be underpinned.

7.6.3 Retaining Structures

For retaining walls where the wall will be free to deflect, design may be based upon 'active' earth pressure coefficients (K_a), assuming a triangular earth pressure distribution. This would comprise any non-propped walls or laterally unrestrained walls (e.g. cantilever type walls). Where structures or services are near any crest, or if the retaining walls are laterally restrained by the structure are not free to deflect, retaining wall design should be based on 'at rest' earth pressure coefficients (K_0). Earth pressure parameters are given in Table 5 below. In addition to the soil pressure, wall design should also allow for external loads such as buildings, live loads and possible hydrostatic pressure.

Table 5: Soil Parameters for Retaining Wall Design

Soil Type	Soil Unit Weight Above Water Table γ (kN/m ³)	Drained Angle of Friction ϕ' (Degrees)	Undrained Shear Strength C_u (kPa)	Coefficient of Earth Pressure – Active K_a	Coefficient of Earth Pressure – at Rest K_0	Coefficient of Earth Pressure – Passive K_p
Sand – loose to medium dense	18	30	0	0.33	0.5	3
Sand – medium dense or denser, or controlled sand fill	20	32	0	0.31	0.47	3.2

7.7 Pavement Design Parameters

As noted in Section 4.1, the shallow soils across the site generally comprise sandy soils.

Based on field observations, limited laboratory testing and Douglas Partners' experience, a subgrade CBR of 12% is recommended for the design of flexible pavements founded on sand subgrade, provided that the subgrade is compacted to at least 95% modified dry density.

7.8 Stormwater Drainage and Permeability

Results of the permeability assessment in Section 4.3 indicate a field permeability value between 2 m/day and greater than 20 m/day for the sandy fill materials encountered across the site, with field permeability values between 3 m/day and greater than 20 m/day for the natural sandy soils across the site.

The lower bound values, in particular for the natural sand encountered at location 32 (permeability value of 3 m/day), appear below expectation for the encountered material, and therefore warrant further

assessment. Targeted assessment at proposed infiltration basin locations, if any proposed, is also recommended.

The fill materials encountered across the site are likely to be of variable composition and fines content. As such, the permeability of these materials is also likely to be varied, and drainage systems should preferably not be founded in these materials unless a lower bound value of soil permeability is assumed in their design, or other similar provisions are implemented (such as large infiltration systems, interconnection between infiltration systems, or other).

Observed ground conditions and permeability results indicate that on-site stormwater disposal using soakwells and sumps is generally feasible where ground conditions at the base of such systems comprise natural sand and there is a suitable clearance above groundwater.

Given that the sand at the site is generally medium dense near surface, a preliminary design permeability value of 5 m/day is suggested where sufficient clearance exists above groundwater, at this preliminary stage of the project. As discussed above, this value is greater than some results assessed during this preliminary investigation and therefore its suitability should be confirmed prior to using in any design, with further soil permeability assessments across the site and at specific locations of proposed infiltration systems.

The infiltration capability of sand often reduces over time due to silt build up at the base of soakwells and sumps, and therefore such systems should be regularly maintained.

7.9 Acid Sulfate Soils

The site is located in an area of “moderate to low risk of acid sulfate soils occurring within 3.0 m of natural soil surface”, which corresponds to the Bassendean Sand unit as depicted on the published geological mapping. The natural ground conditions encountered at the site are in broad agreement with the published mapping, consequently, the published level of risk appears to be appropriate.

With reference to Department of Water and Environmental Regulation (DWER) endorsed guidelines, investigation of acid sulfate soil in areas of moderate to low risk is recommended where any of the following works are proposed:

- Soil or sediment disturbance of greater than 100 m³ or more with excavation below the natural watertable;
- Lowering of the watertable, whether temporary or permanent (e.g. for groundwater abstraction, dewatering, installation of new drainage, or modification to existing drainage).

As such, the need to undertake an acid sulfate soil investigation should be reviewed following completion of detailed design once the excavation and dewatering requirements for site development are known.

8. References

AS 1170.4. (2007). *Structural Design Actions, Part 4: Earthquake Actions in Australia*. Reconfirmed 2018. Incorporating Amendments 1 & 2: Standards Australia.

AS 1289.6.3.3. (1997). *Methods for testing soils for engineering purposes - Soil strength and consolidation tests - Determination of the penetration resistance of a soil - Perth sand penetrometer test*. Reconfirmed 2013: Standards Australia.

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AS 2870. (2011). *Residential Slabs and Footings*. Standards Australia.

Department of Environment. (2004). *Perth Groundwater Atlas, Second Edition, Dec 2004*.

Hvorslev, M. J. (1951). *Time lag and soil permeability in groundwater observations*. US Army Corps of Engineers Waterways Experiment Observation Station, Bulletin 36, Vicksburg, Mississippi.

9. Limitations

Douglas Partners (DP) has prepared this report for this project at the ECU Mount Lawley Campus on Central Avenue in Mount Lawley, WA in accordance with DP's proposal dated 27 July 2022 and acceptance received from Mariam Yaqub dated 12 August 2022. The work was carried out under the existing geotechnical panel contract agreed with DevelopmentWA. This report is provided for the exclusive use of DevelopmentWA for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope of work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of fill of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such fill may contain contaminants and hazardous building materials.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners



Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;

- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.



Introduction

The Cone Penetration Test (CPT) is a sophisticated soil profiling test carried out in-situ. A special cone shaped probe is used which is connected to a digital data acquisition system. The cone and adjoining sleeve section contain a series of strain gauges and other transducers which continuously monitor and record various soil parameters as the cone penetrates the soils.

The soil parameters measured depend on the type of cone being used, however they always include the following basic measurements

- Cone tip resistance q_c
- Sleeve friction f_s
- Inclination (from vertical) i
- Depth below ground z

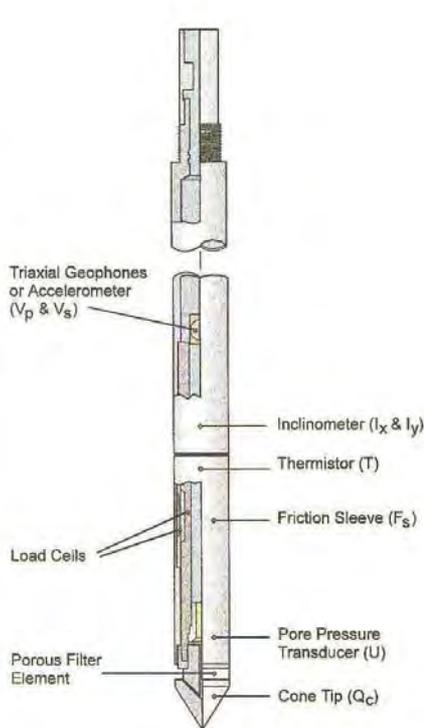


Figure 1: Cone Diagram

The inclinometer in the cone enables the verticality of the test to be confirmed and, if required, the vertical depth can be corrected.

The cone is thrust into the ground at a steady rate of about 20 mm/sec, usually using the hydraulic rams of a purpose built CPT rig, or a drilling rig. The testing is carried out in accordance with the Australian Standard AS1289 Test 6.5.1.



Figure 2: Purpose built CPT rig

The CPT can penetrate most soil types and is particularly suited to alluvial soils, being able to detect fine layering and strength variations. With sufficient thrust the cone can often penetrate a short distance into weathered rock. The cone will usually reach refusal in coarse filling, medium to coarse gravel and on very low strength or better rock. Tests have been successfully completed to more than 60 m.

Types of CPTs

Douglas Partners (and its subsidiary GroundTest) owns and operates the following types of CPT cones:

Type	Measures
Standard	Basic parameters (q_c , f_s , i & z)
Piezocone	Dynamic pore pressure (u) plus basic parameters. Dissipation tests estimate consolidation parameters
Conductivity	Bulk soil electrical conductivity (σ) plus basic parameters
Seismic	Shear wave velocity (V_s), compression wave velocity (V_p), plus basic parameters

Strata Interpretation

The CPT parameters can be used to infer the Soil Behaviour Type (SBT), based on normalised values of cone resistance (Q_t) and friction ratio (Fr). These are used in conjunction with soil classification charts, such as the one below (after Robertson 1990)

Cone Penetration Tests

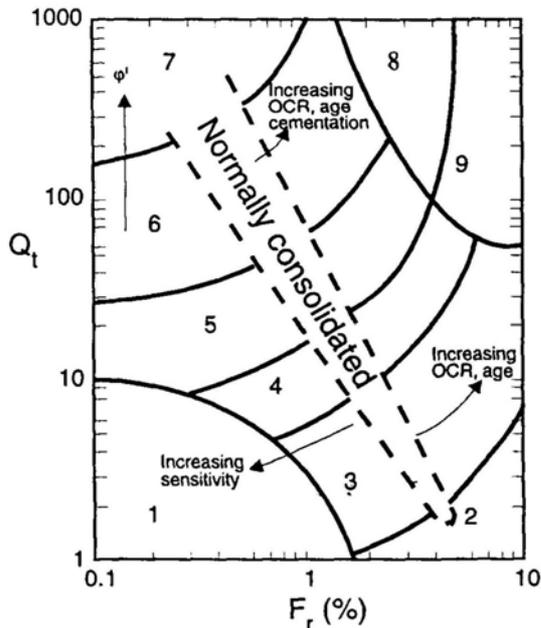


Figure 3: Soil Classification Chart

DP's in-house CPT software provides computer aided interpretation of soil strata, generating soil descriptions and strengths for each layer. The software can also produce plots of estimated soil parameters, including modulus, friction angle, relative density, shear strength and over consolidation ratio.

DP's CPT software helps our engineers quickly evaluate the critical soil layers and then focus on developing practical solutions for the client's project.

Engineering Applications

There are many uses for CPT data. The main applications are briefly introduced below:

Settlement

CPT provides a continuous profile of soil type and strength, providing an excellent basis for settlement analysis. Soil compressibility can be estimated from cone derived moduli, or known consolidation parameters for the critical layers (eg. from laboratory testing). Further, if pore pressure dissipation tests are undertaken using a piezocone, in-situ consolidation coefficients can be estimated to aid analysis.

Pile Capacity

The cone is, in effect, a small scale pile and, therefore, ideal for direct estimation of pile capacity. DP's in-house program ConePile can analyse most pile types and produces pile capacity versus depth plots. The analysis methods are based on proven static theory and empirical studies, taking account of scale effects, pile materials and method of installation. The results are expressed in limit state format, consistent with the Piling Code AS2159.

Dynamic or Earthquake Analysis

CPT and, in particular, Seismic CPT are suitable for dynamic foundation studies and earthquake response analyses, by profiling the low strain shear modulus G_0 . Techniques have also been developed relating CPT results to the risk of soil liquefaction.

Other Applications

Other applications of CPT include ground improvement monitoring (testing before and after works), salinity and contaminant plume mapping (conductivity cone), preloading studies and verification of strength gain.

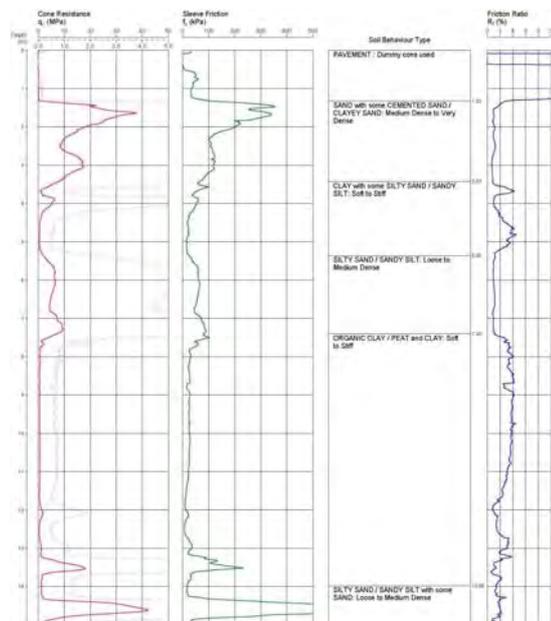


Figure 4: Sample Cone Plot



Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

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. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low

reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) 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 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is 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 test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:
4,6,7
N=13
- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:
15, 30/40 mm

Sampling Methods

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or 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 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). 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 Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	19 - 63
Medium gravel	6.7 - 19
Fine gravel	2.36 - 6.7
Coarse sand	0.6 - 2.36
Medium sand	0.21 - 0.6
Fine sand	0.075 - 0.21

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 - 30%	Clay with sand
Trace	0 - 15%	Clay with trace sand

In coarse grained soils (>65% coarse)

- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand with trace clay

In coarse grained soils (>65% coarse)

- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand with trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with 'Mix of Soil and Cobbles/Boulders' with the word order indicating the dominant first and the proportion of cobbles and boulders described together.

Soil Descriptions

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	St	50 - 100
Very stiff	VSt	100 - 200
Hard	H	>200
Friable	Fr	-

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;

- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) Non-cohesive and free-running.
- Moist (M) Soil feels cool, darkened in colour.
Soil tends to stick together.
Sand forms weak ball but breaks easily.
- Wet (W) Soil feels cool, darkened in colour.
Soil tends to stick together, free water forms when handling.

Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- 'Moist, dry of plastic limit' or 'w < PL' (i.e. hard and friable or powdery).
- 'Moist, near plastic limit' or 'w ≈ PL' (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- 'Moist, wet of plastic limit' or 'w > PL' (i.e. soils usually weakened and free water forms on the hands when handling).
- 'Wet' or 'w ≈ LL' (i.e. near the liquid limit).
- 'Wet' or 'w > LL' (i.e. wet of the liquid limit).

Symbols & Abbreviations

Douglas Partners



Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U ₅₀	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

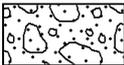
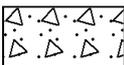
Other

fg	fragmented
bnd	band
qtz	quartz

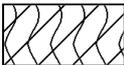
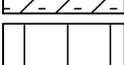
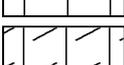
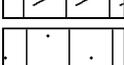
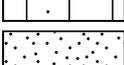
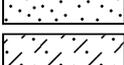
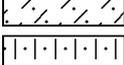
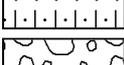
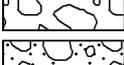
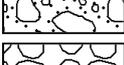
Symbols & Abbreviations

Graphic Symbols for Soil and Rock

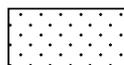
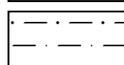
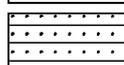
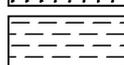
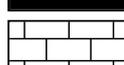
General

	Asphalt
	Road base
	Concrete
	Filling

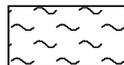
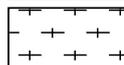
Soils

	Topsoil
	Peat
	Clay
	Silty clay
	Sandy clay
	Gravelly clay
	Shaly clay
	Silt
	Clayey silt
	Sandy silt
	Sand
	Clayey sand
	Silty sand
	Gravel
	Sandy gravel
	Cobbles, boulders
	Talus

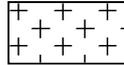
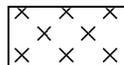
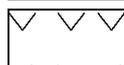
Sedimentary Rocks

	Boulder conglomerate
	Conglomerate
	Conglomeratic sandstone
	Sandstone
	Siltstone
	Laminite
	Mudstone, claystone, shale
	Coal
	Limestone

Metamorphic Rocks

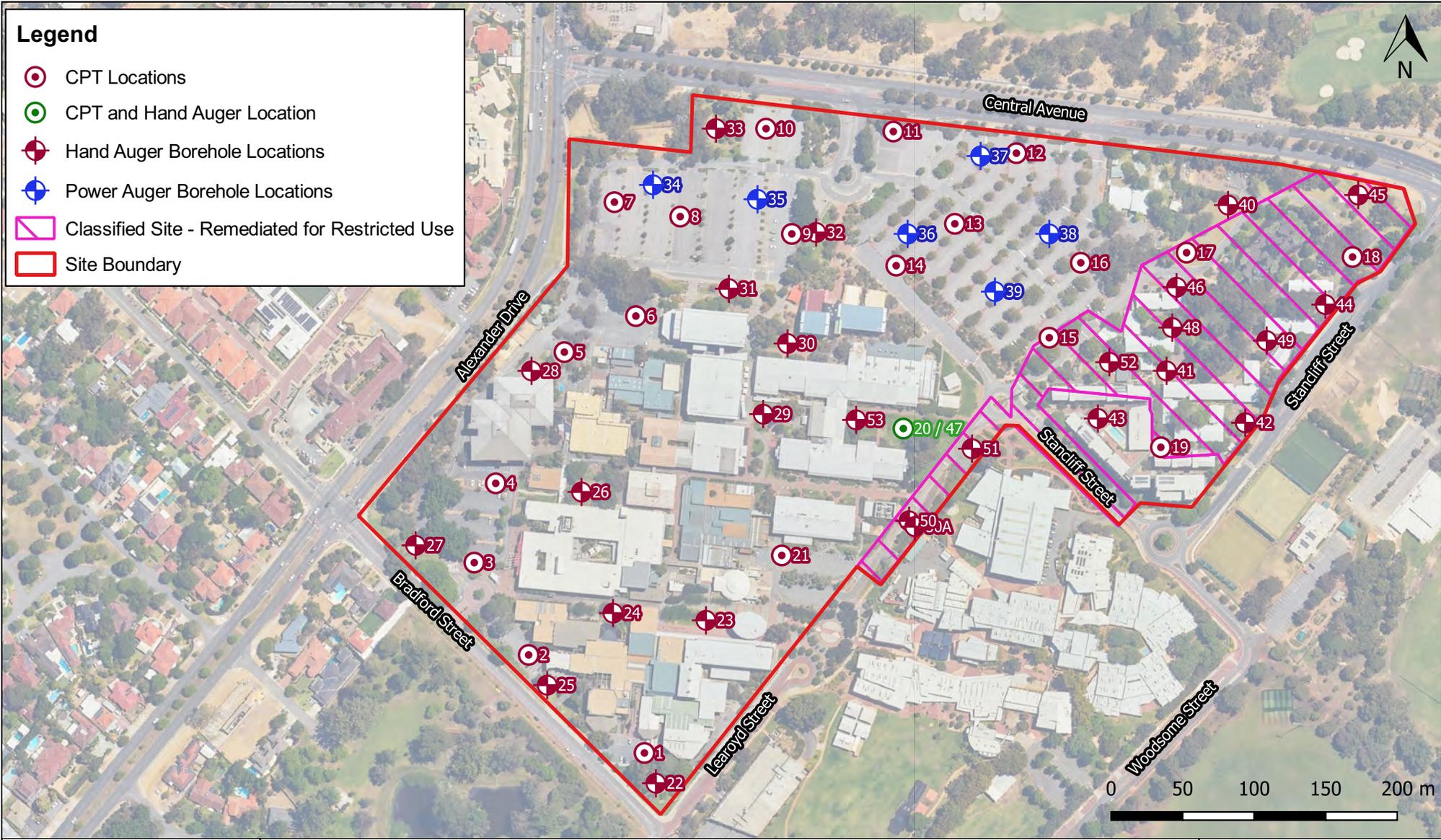
	Slate, phyllite, schist
	Gneiss
	Quartzite

Igneous Rocks

	Granite
	Dolerite, basalt, andesite
	Dacite, epidote
	Tuff, breccia
	Porphyry

Appendix B

Drawing 1
CPT Results
Borehole Logs



Test Locations
Proposed Multi-Residential Development
Central Avenue, Mount Lawley, WA

CLIENT: DevelopmentWA

PROJECT: 216618.00
 Drawing No: 1
 REV: 0
 DATE: 14/11/2022

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 21.9 m AHD*

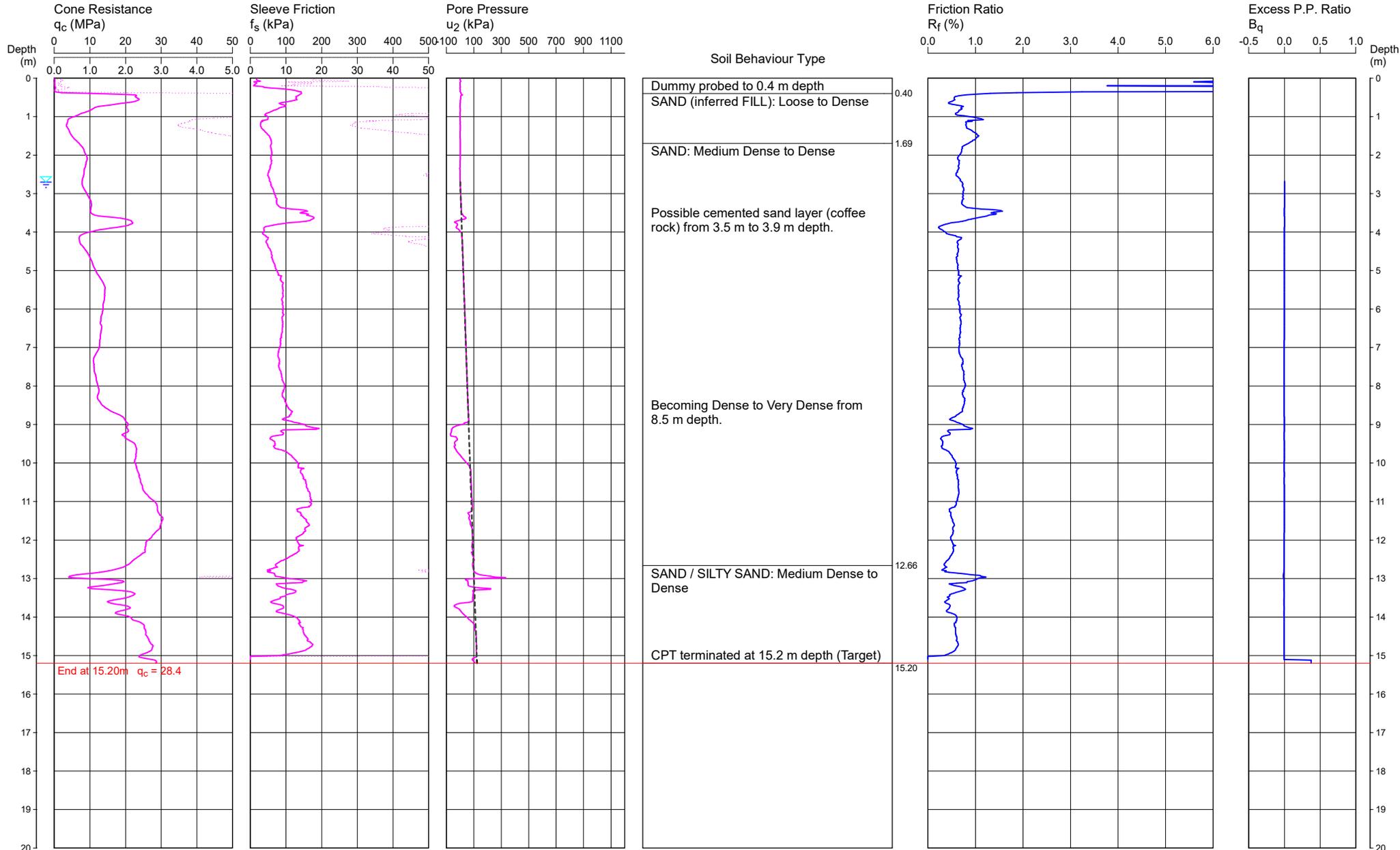
COORDINATES: 392938E 6467718N MGA94 50J

CPTU 01

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Groundwater assumed at 2.7 m depth

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 01.CP5
 Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
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Water depth after test: 2.70m depth (assumed)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.0 m AHD*

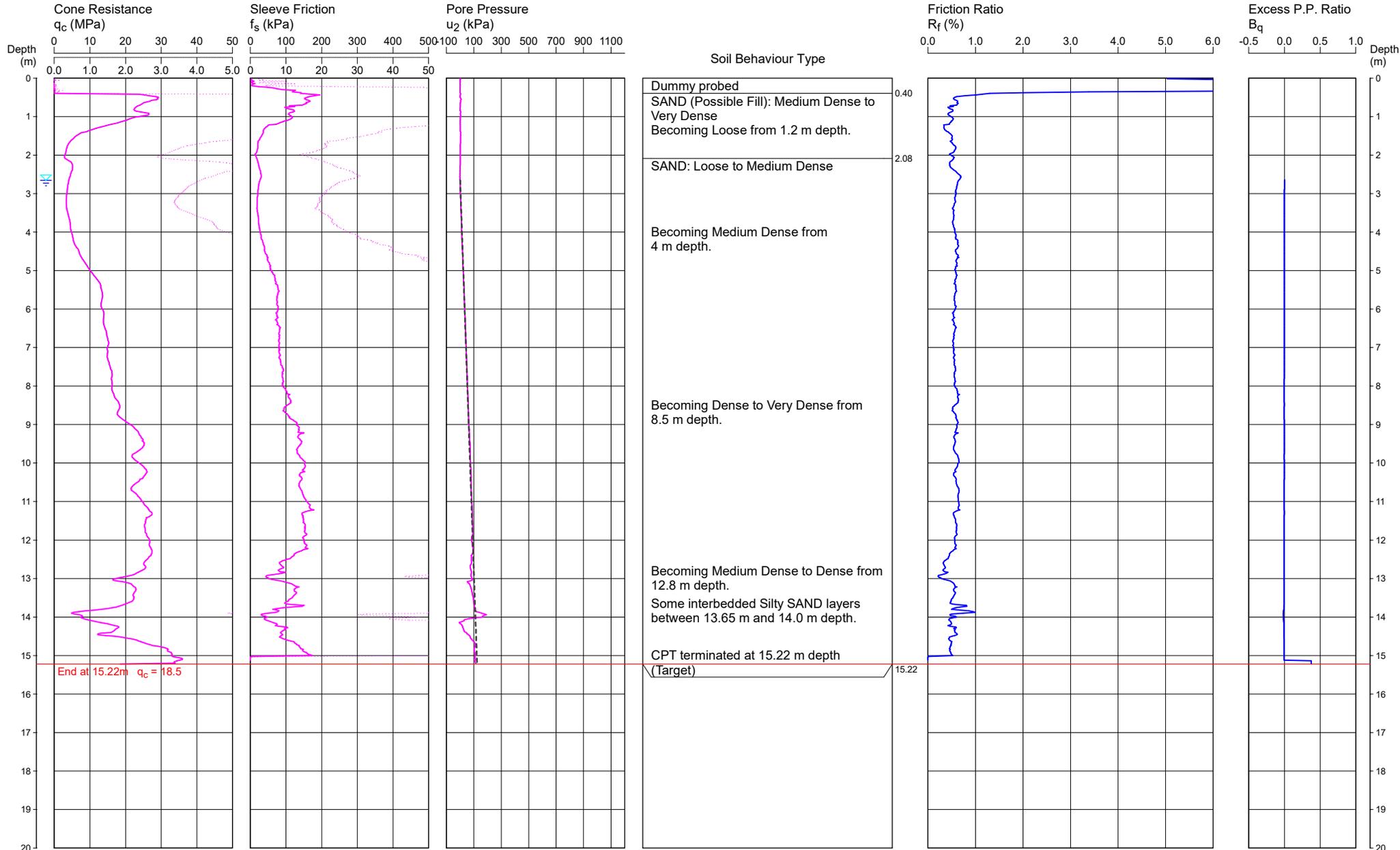
COORDINATES: 392857E 6467786N MGA94 50J

CPTU 02

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 2.66 m depth.

Water depth after test: 2.66m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 02.CP5
Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.8 m AHD*

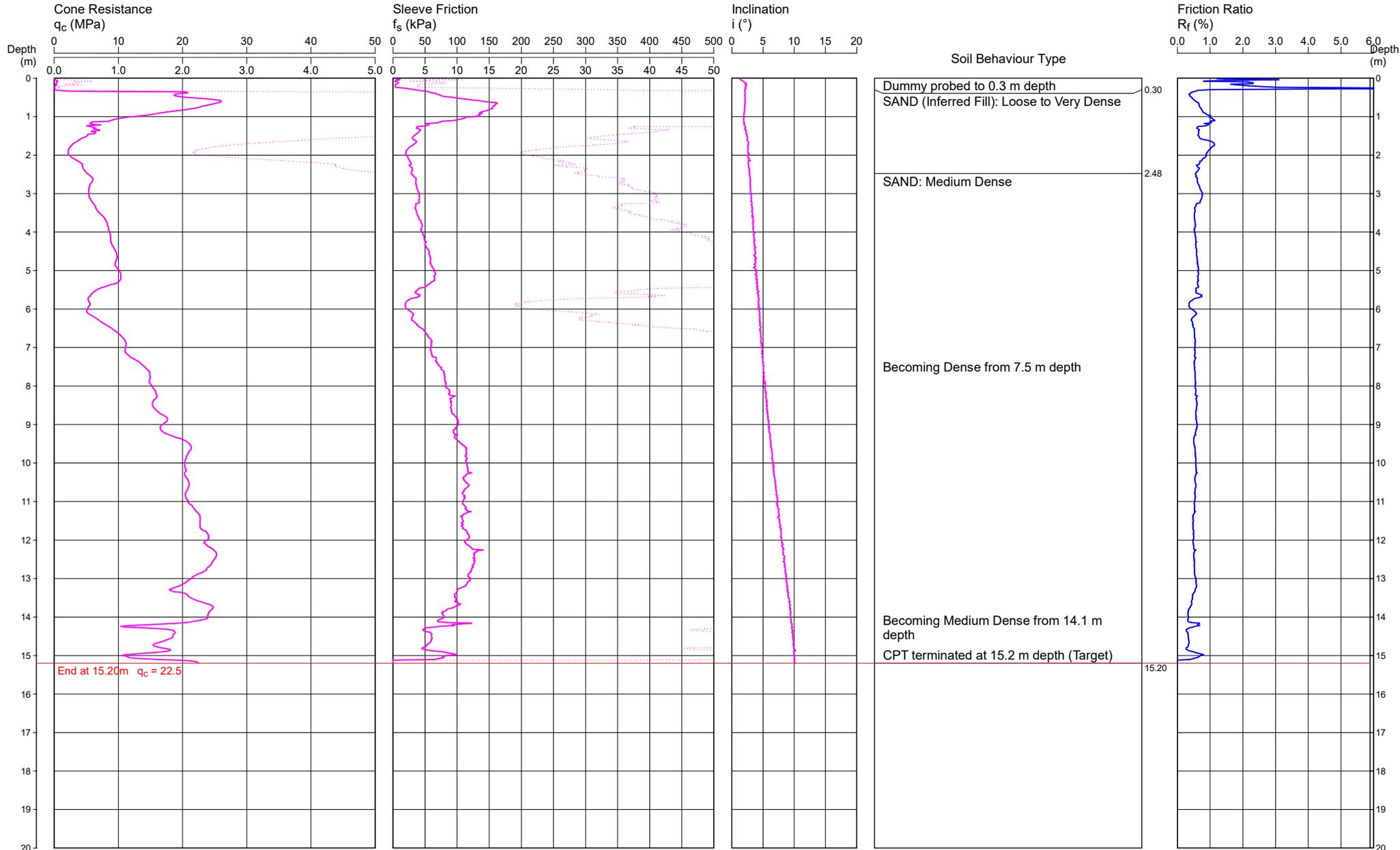
COORDINATES: 392819E 6467850N MGA94 50J

CPT 03

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Dry to 1.3 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 03.CP5
Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.7 m AHD*

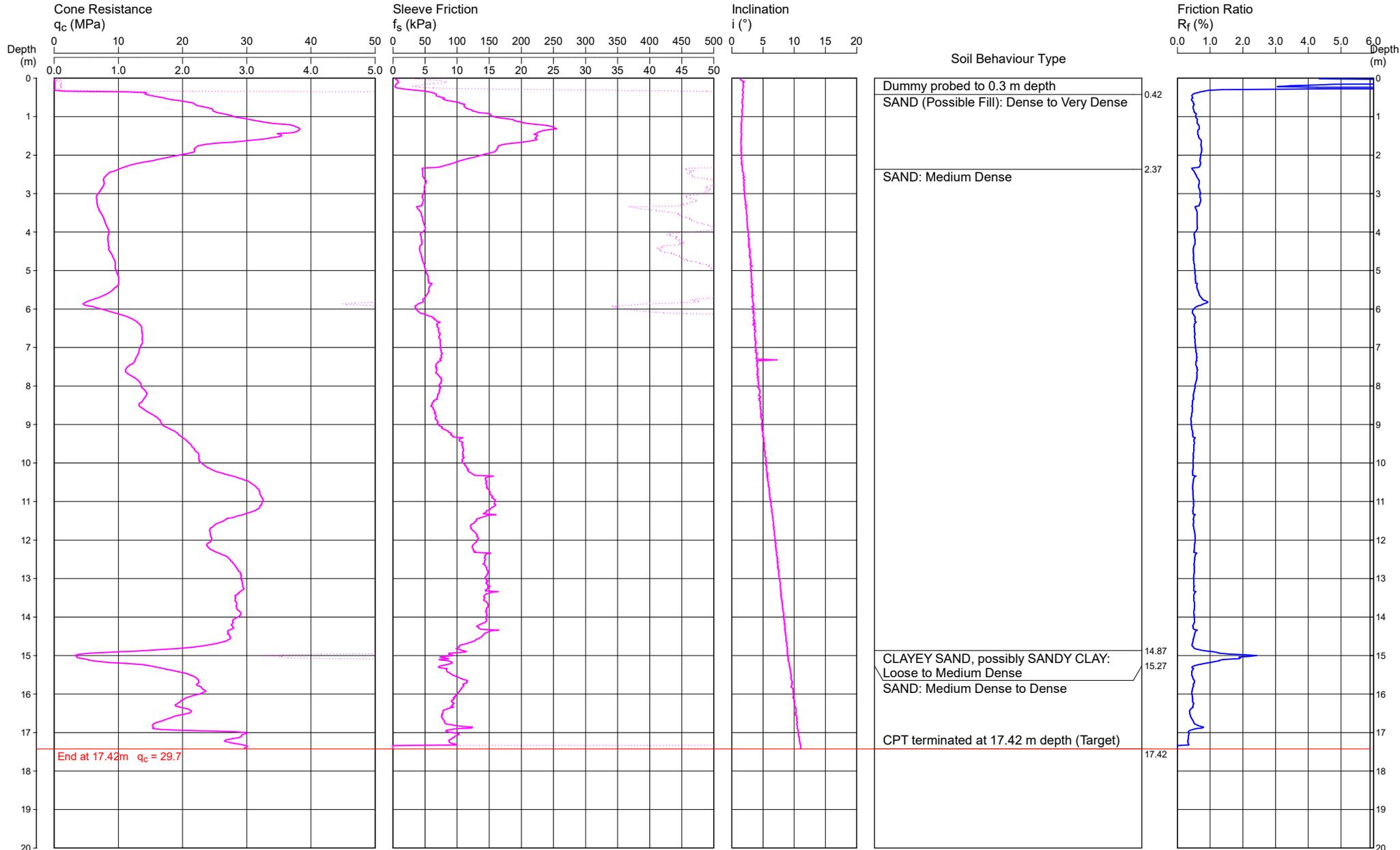
COORDINATES: 392834E 6467905N MGA94 50J

CPT 04

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Dry to 4 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 04.CP5
 Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 24.0 m AHD*

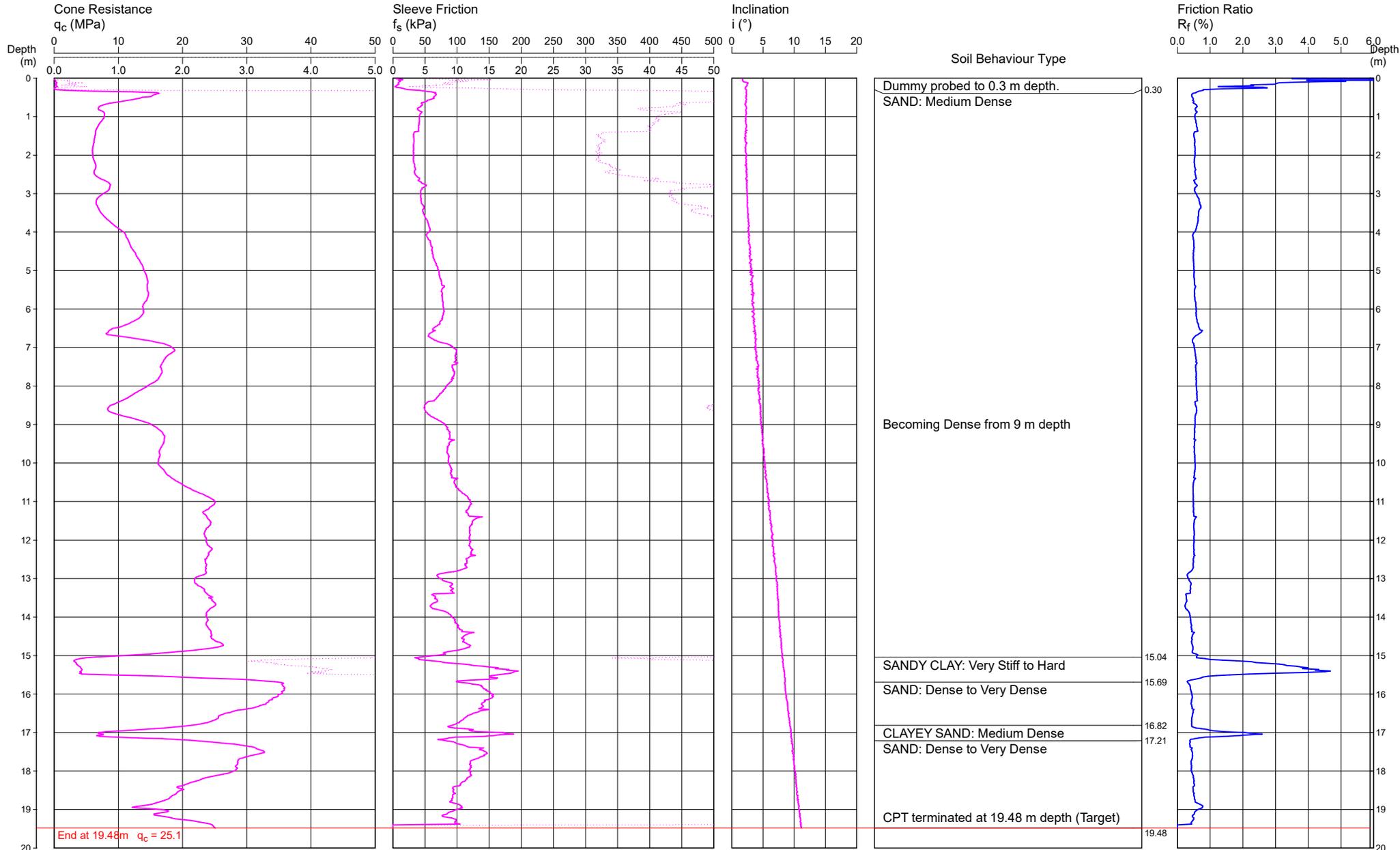
COORDINATES: 392882E 6467996N MGA94 50J

CPT 05

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Dry to 4.1 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 05.CP5
Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.7 m AHD*

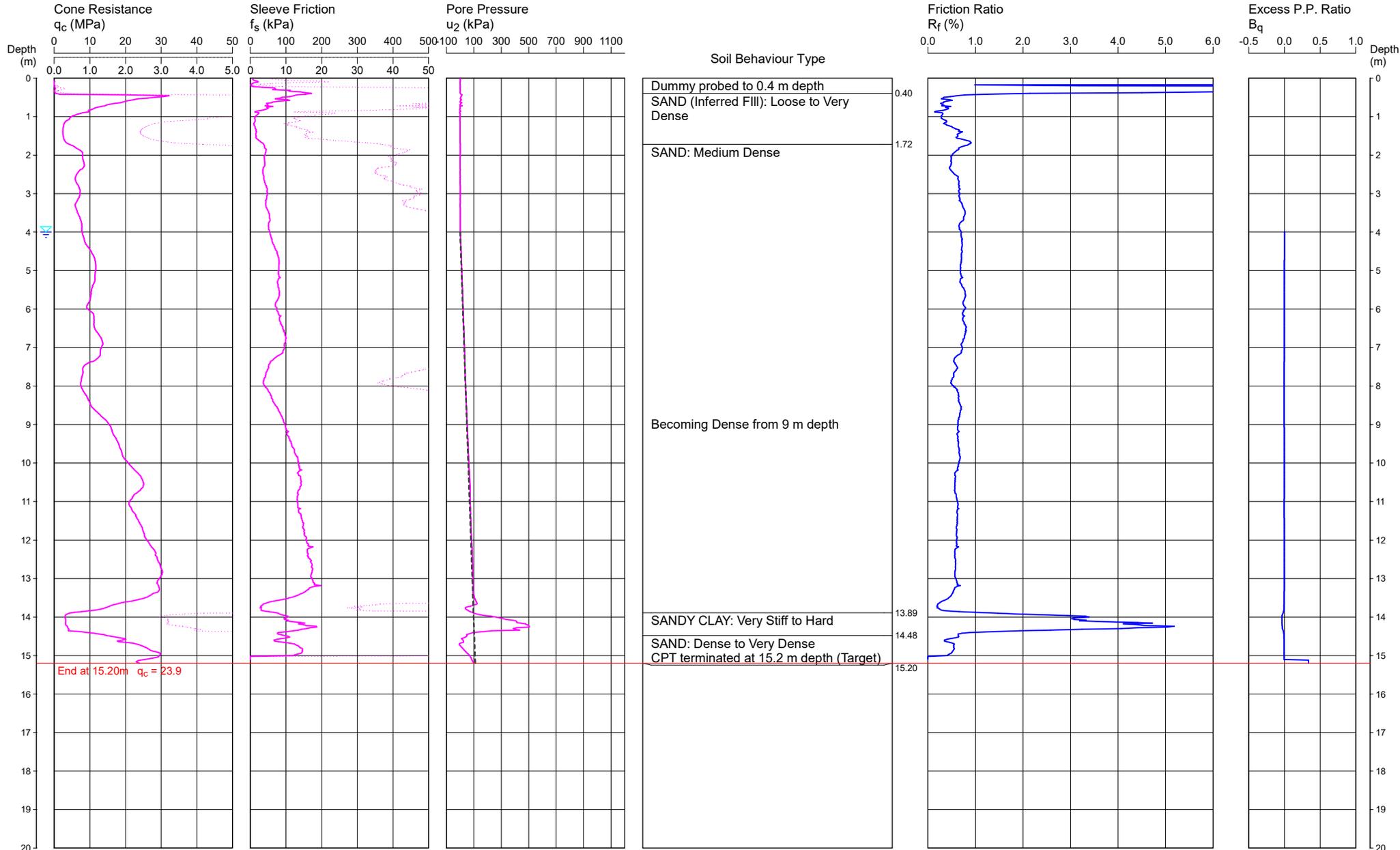
COORDINATES: 392932E 6468021N MGA94 50J

CPTU 06

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Groundwater assumed at 4 m depth.

Water depth after test: 4.00m depth (assumed)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 06.CP5
 Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.1 m AHD*

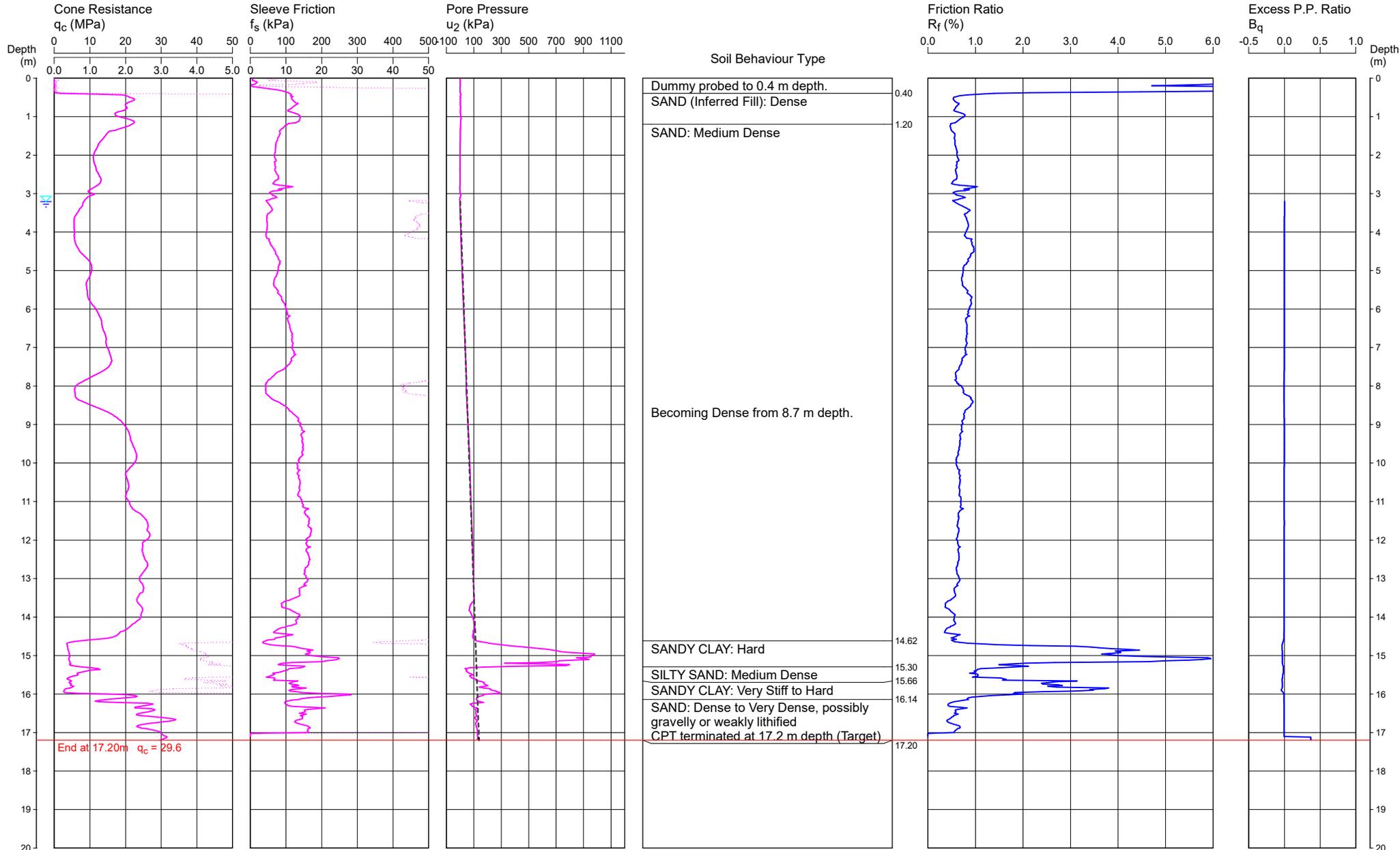
COORDINATES: 392917E 6468100N MGA94 50J

CPTU 07

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 3.21 m depth.

Water depth after test: 3.21m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 07.CP5
Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.8 m AHD*

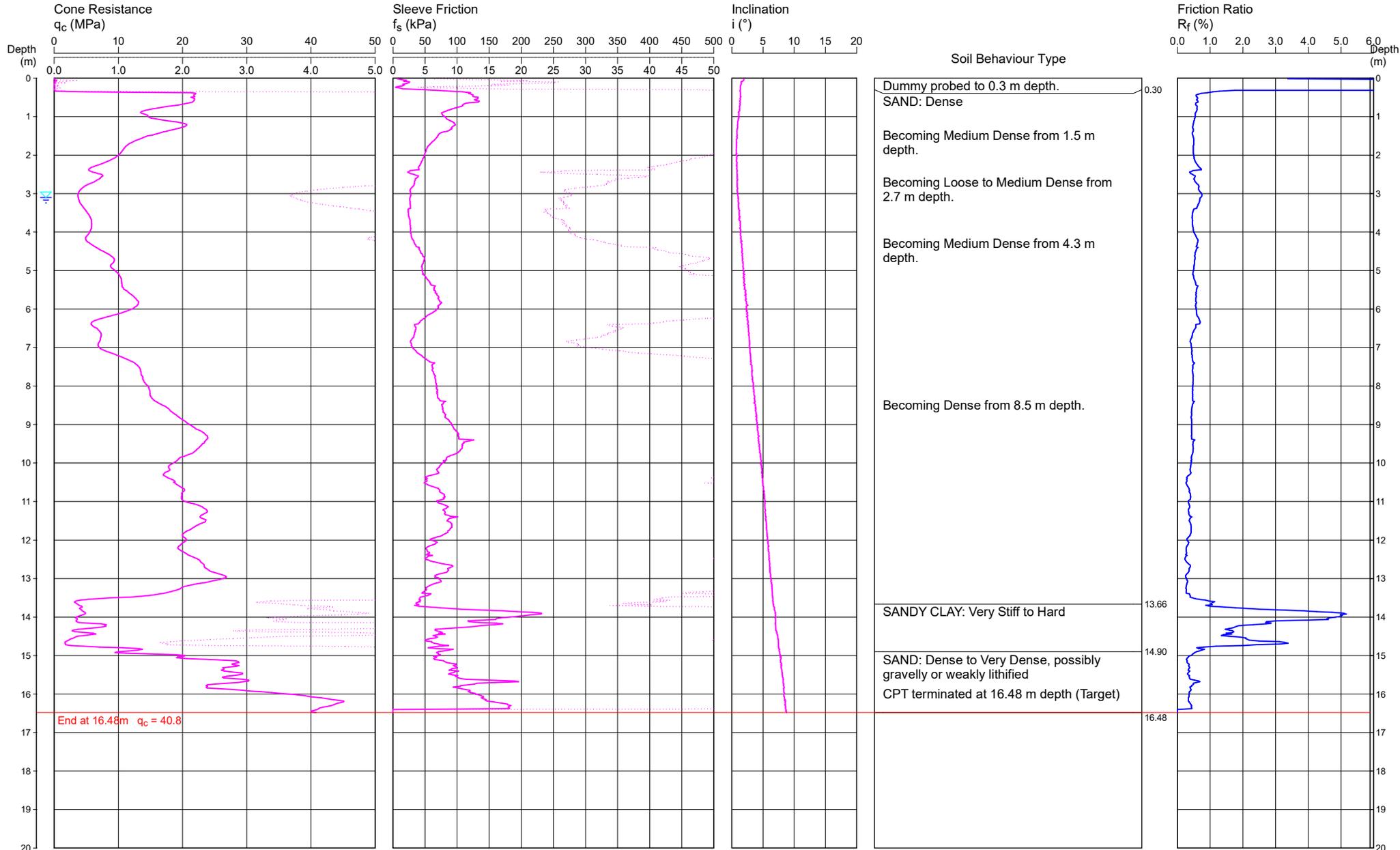
COORDINATES: 392963E 6468090N MGA94 50J

CPT 08

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 3.1 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 08.CP5
Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Water depth after test: 3.10m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.6 m AHD*

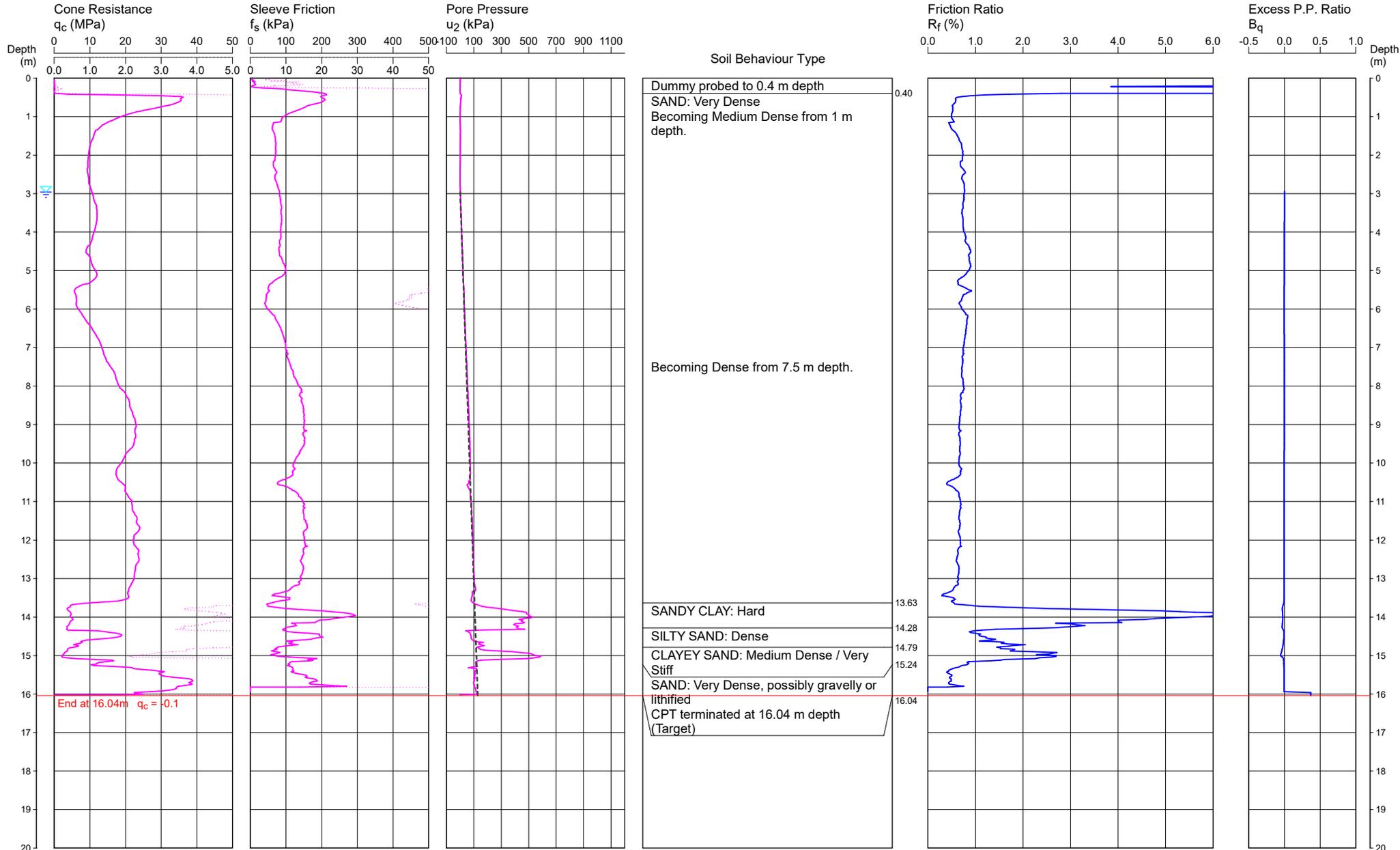
COORDINATES: 393041E 6468078N MGA94 50J

CPTU 09

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater assumed at 2.96 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 09.CP5
Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
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Water depth after test: 2.96m depth (assumed)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.9 m AHD*

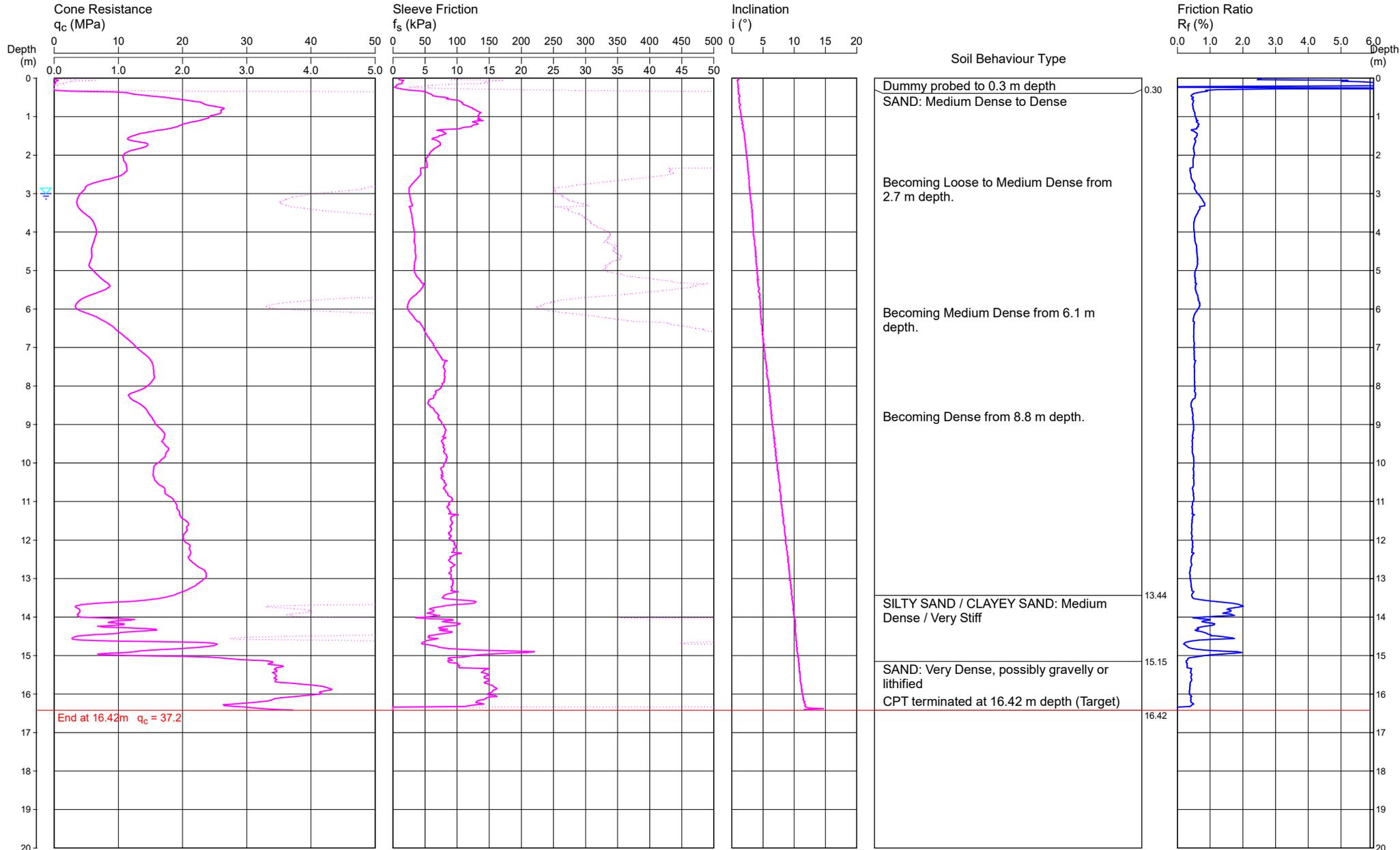
COORDINATES: 393023E 6468151N MGA94 50J

CPT 10

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 3 m depth.

Water depth after test: 3.00m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 10.CP5
Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.2 m AHD*

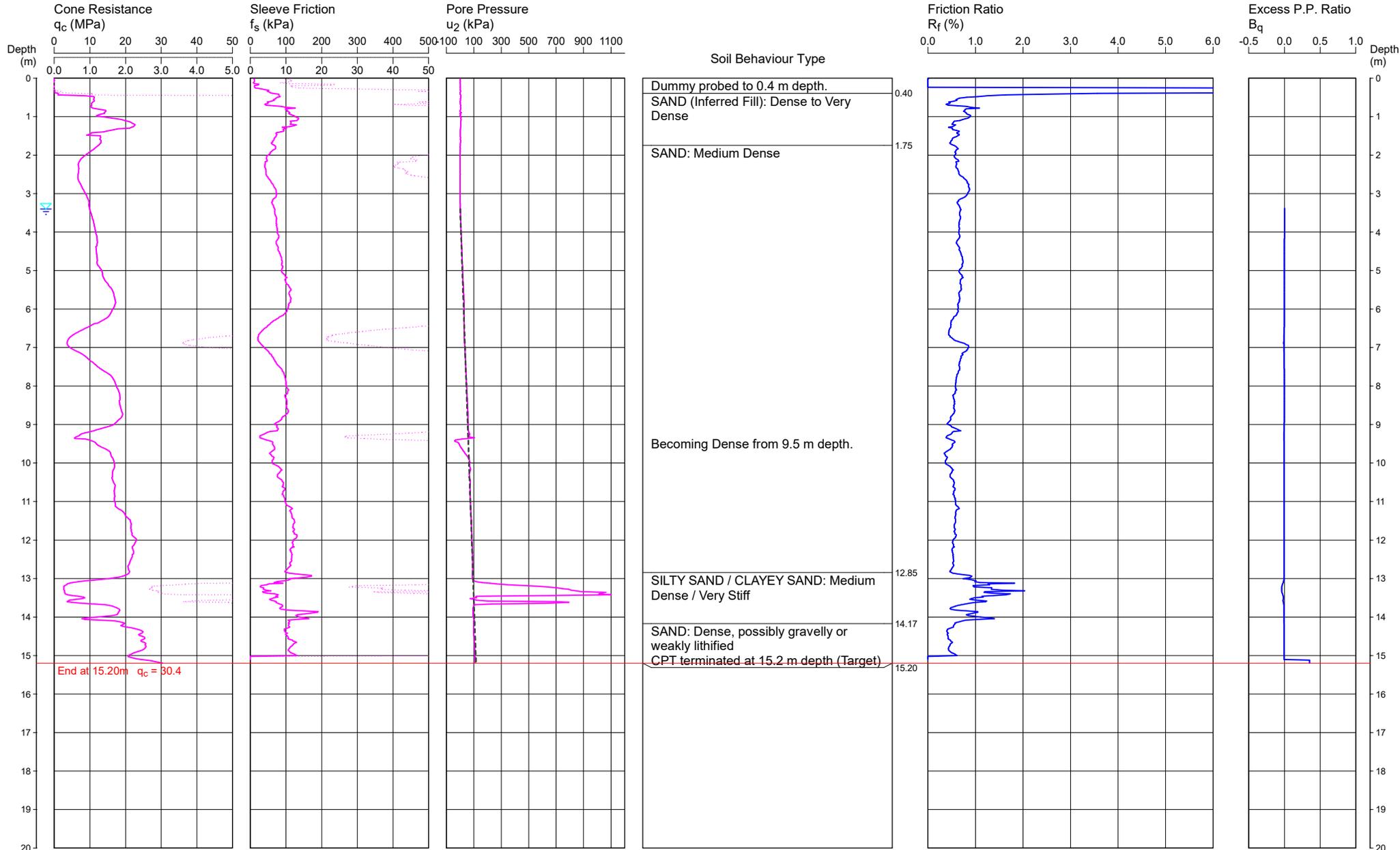
COORDINATES: 393112E 6468149N MGA94 50J

CPTU 11

Page 1 of 1

DATE 30/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater assumed at to 3.4 m depth.

Water depth after test: 3.40m depth (assumed)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 11.CP5
Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.7 m AHD*

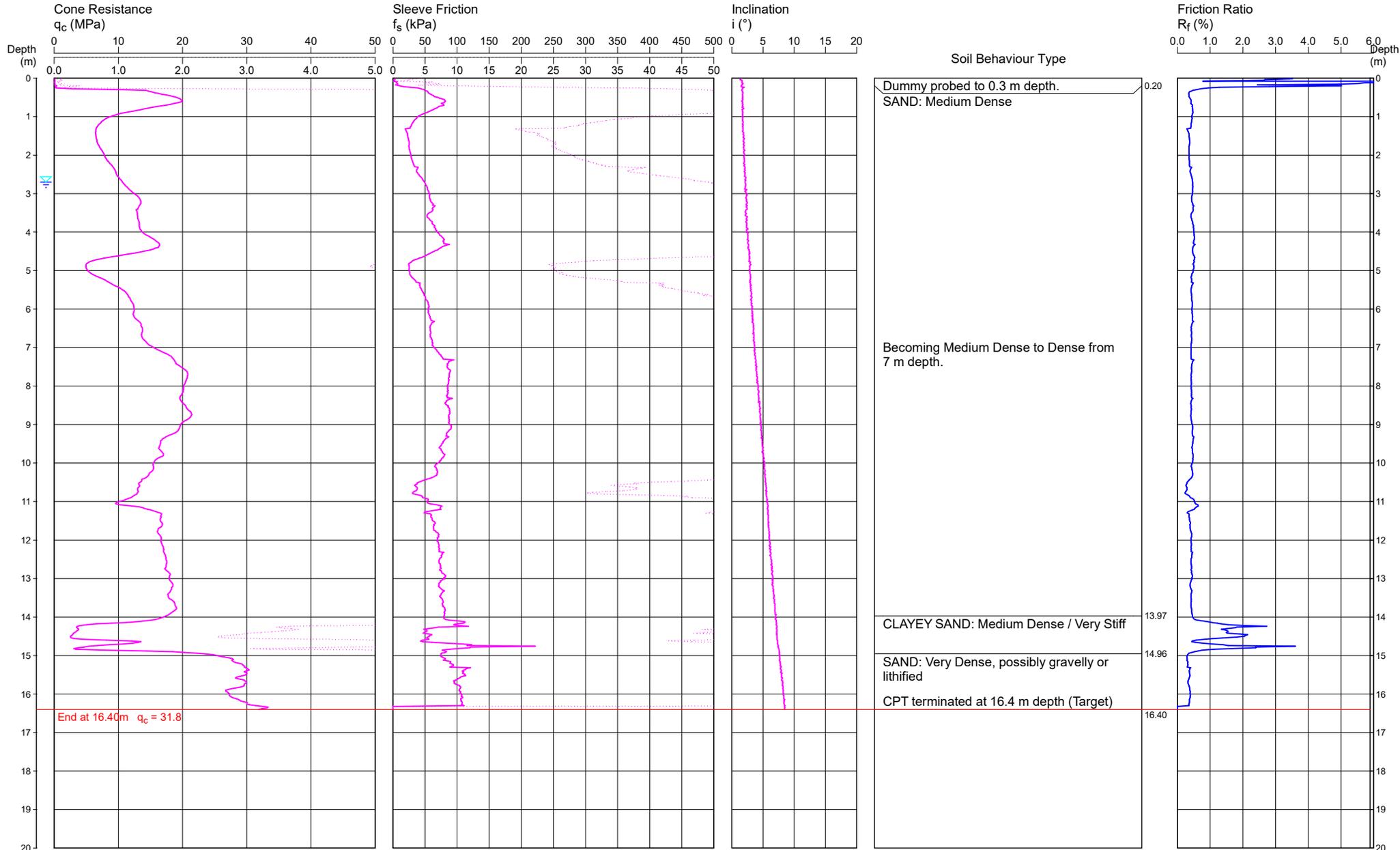
COORDINATES: 393198E 6468134N MGA94 50J

CPT 12

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 2.7 m depth.

Water depth after test: 2.70m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 12.CP5
Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.7 m AHD*

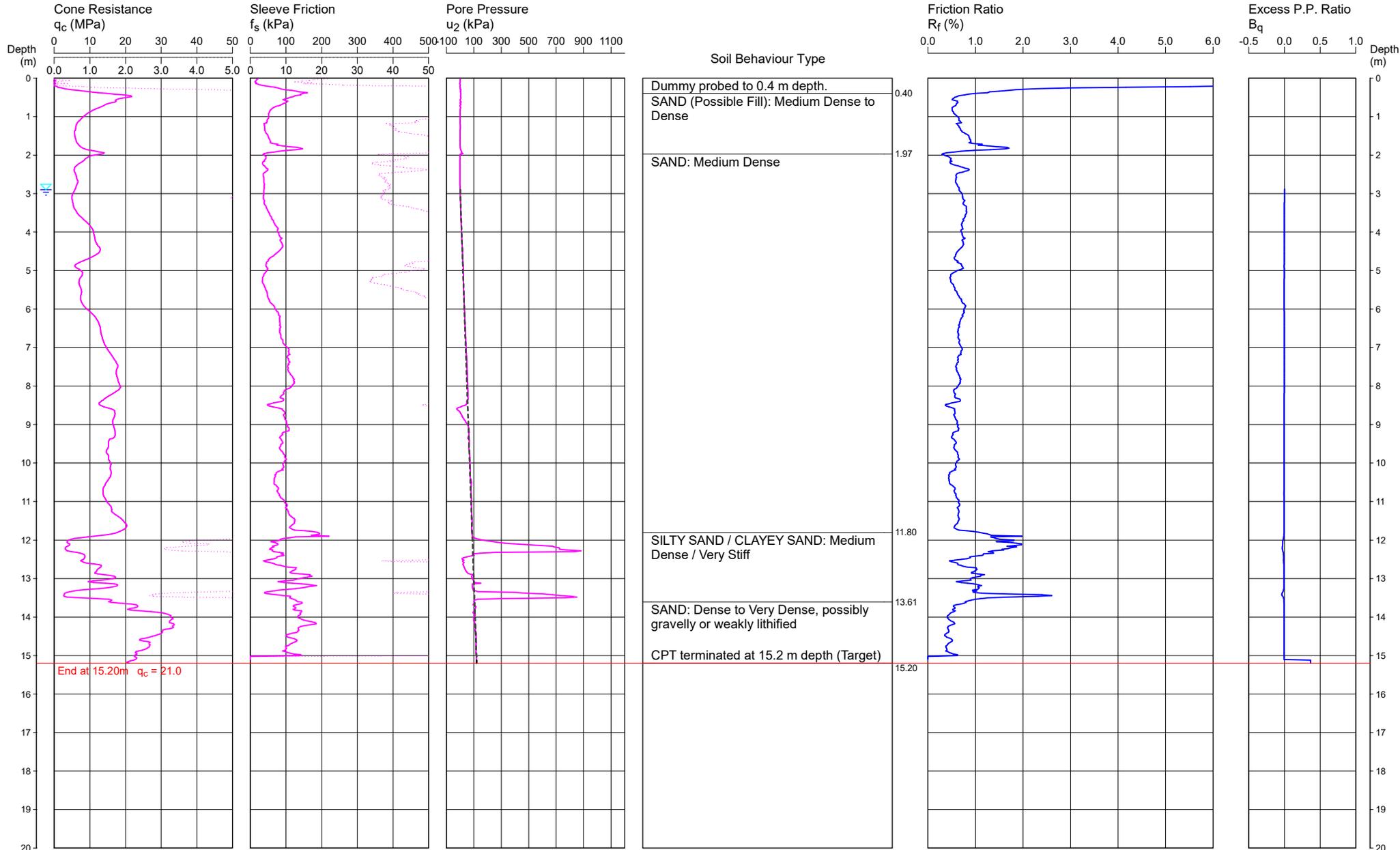
COORDINATES: 393155E 6468085N MGA94 50J

CPTU 13

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Groundwater assumed at 2.9 m depth.

Water depth after test: 2.90m depth (assumed)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 13.CP5
 Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.9 m AHD*

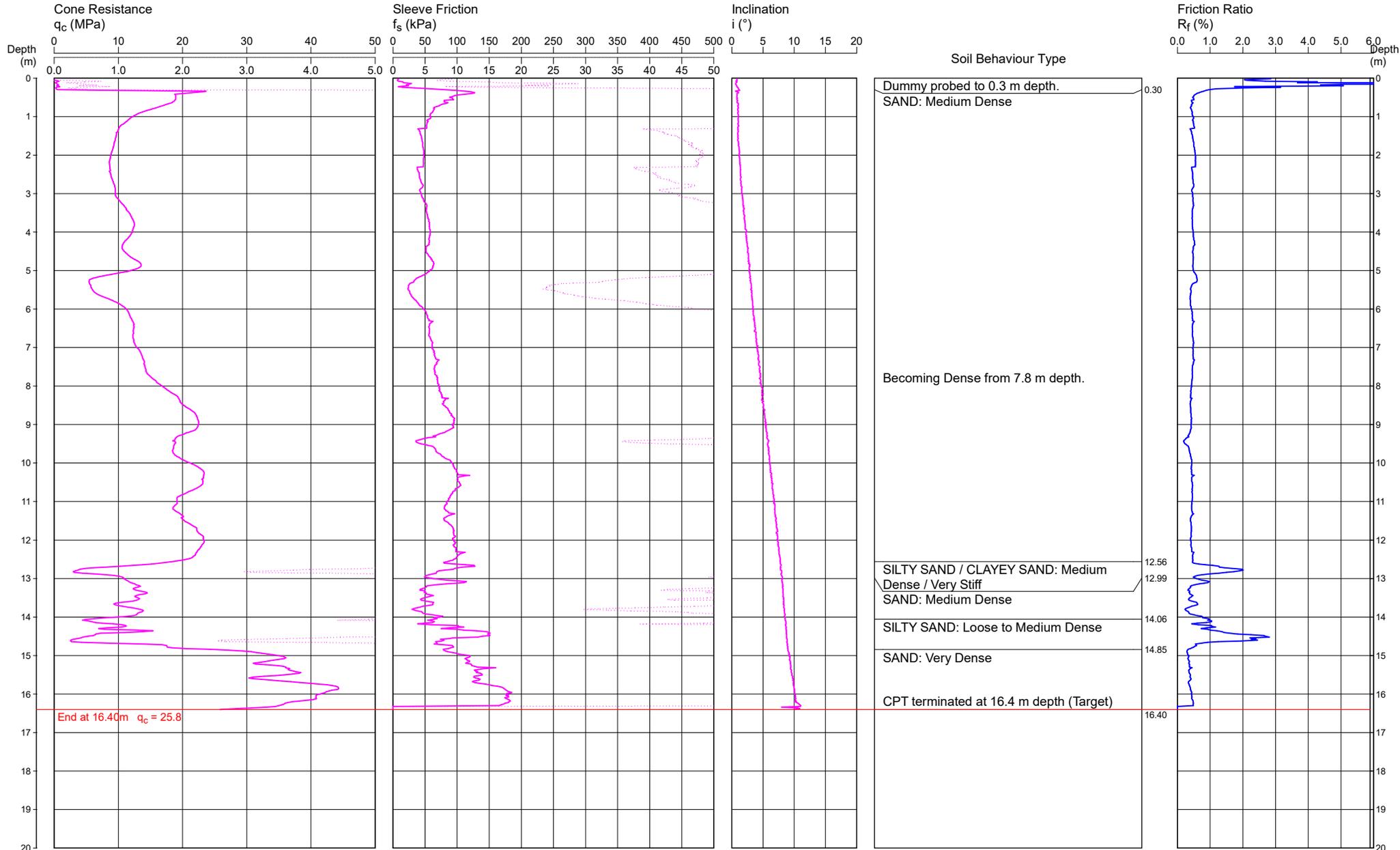
COORDINATES: 393114E 6468056N MGA94 50J

CPT 14

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Dry to 2.1 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 14.CP5
Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.1 m AHD*

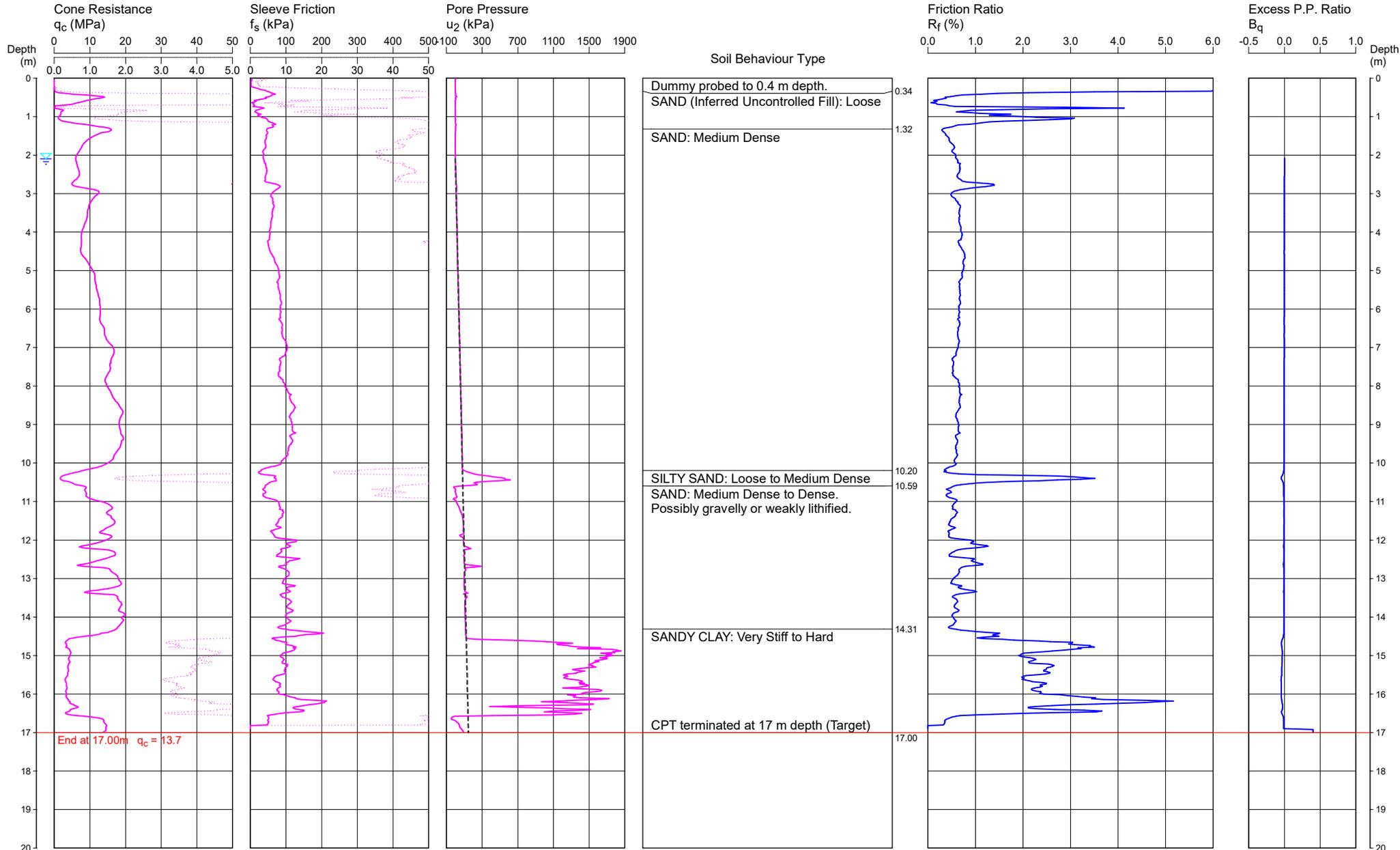
COORDINATES: 393221E 6468006N MGA94 50J

CPTU 15

Page 1 of 1

DATE 30/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Groundwater assumed at 2.1 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 15.CP5
Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Water depth after test: 2.10m depth (assumed)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.1 m AHD*

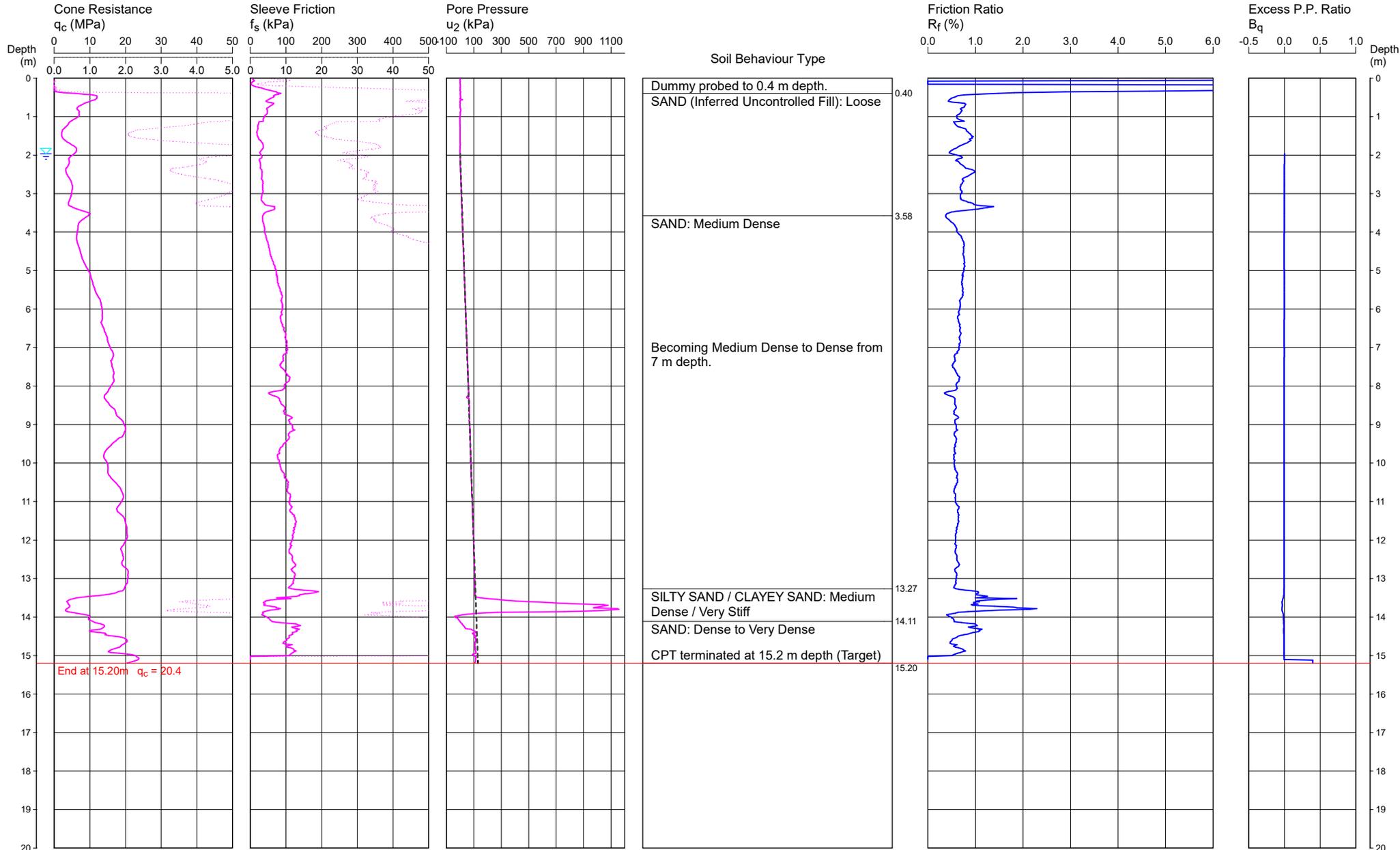
COORDINATES: 393243E 6468058N MGA94 50J

CPTU 16

Page 1 of 1

DATE 30/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Groundwater measured at 1.97 m depth.

Water depth after test: 1.97m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 16.CP5
 Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.2 m AHD*

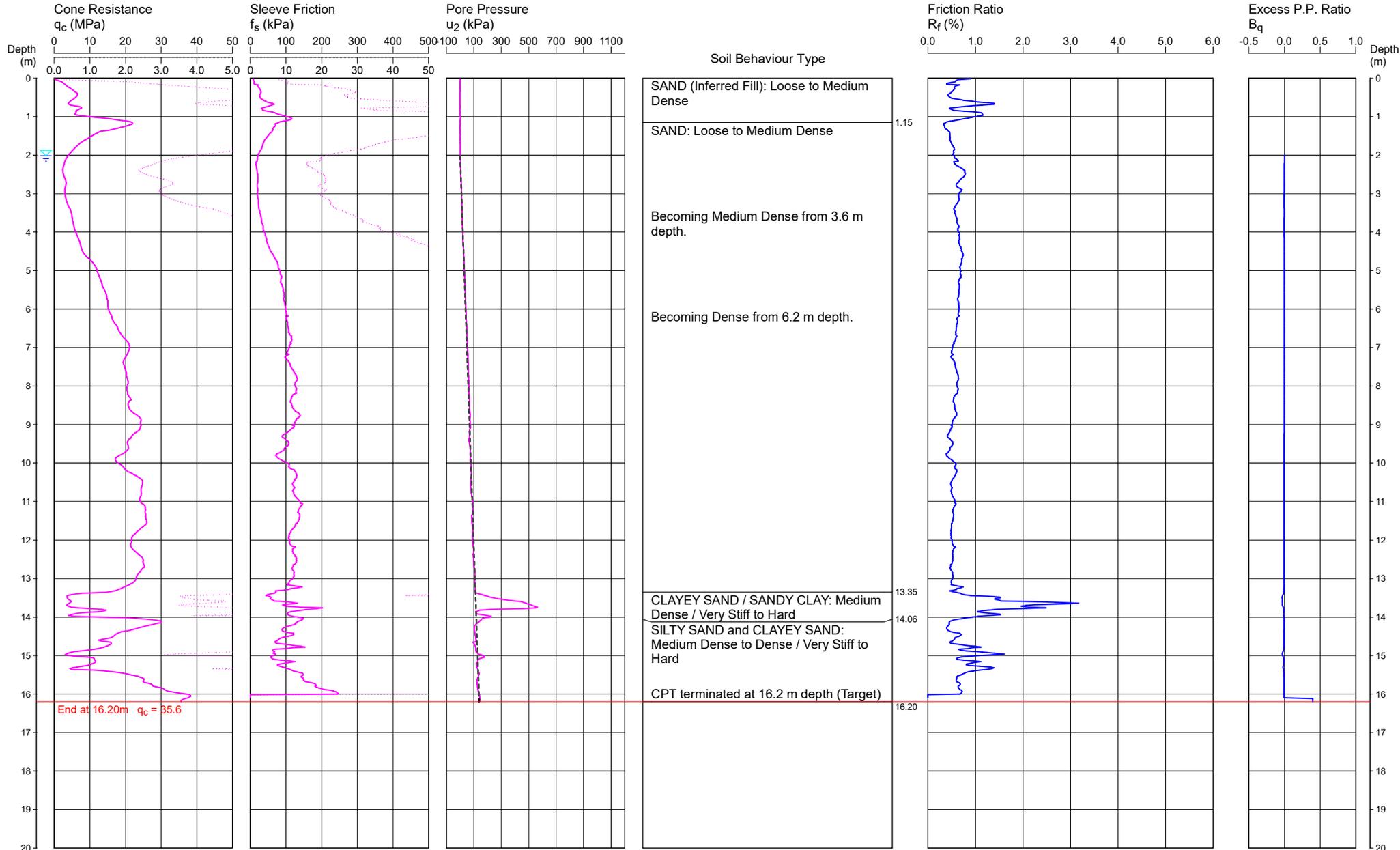
COORDINATES: 393317E 6468065N MGA94 50J

CPTU 17

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 2.02 m depth.

Water depth after test: 2.02m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 17.CP5
Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.2 m AHD*

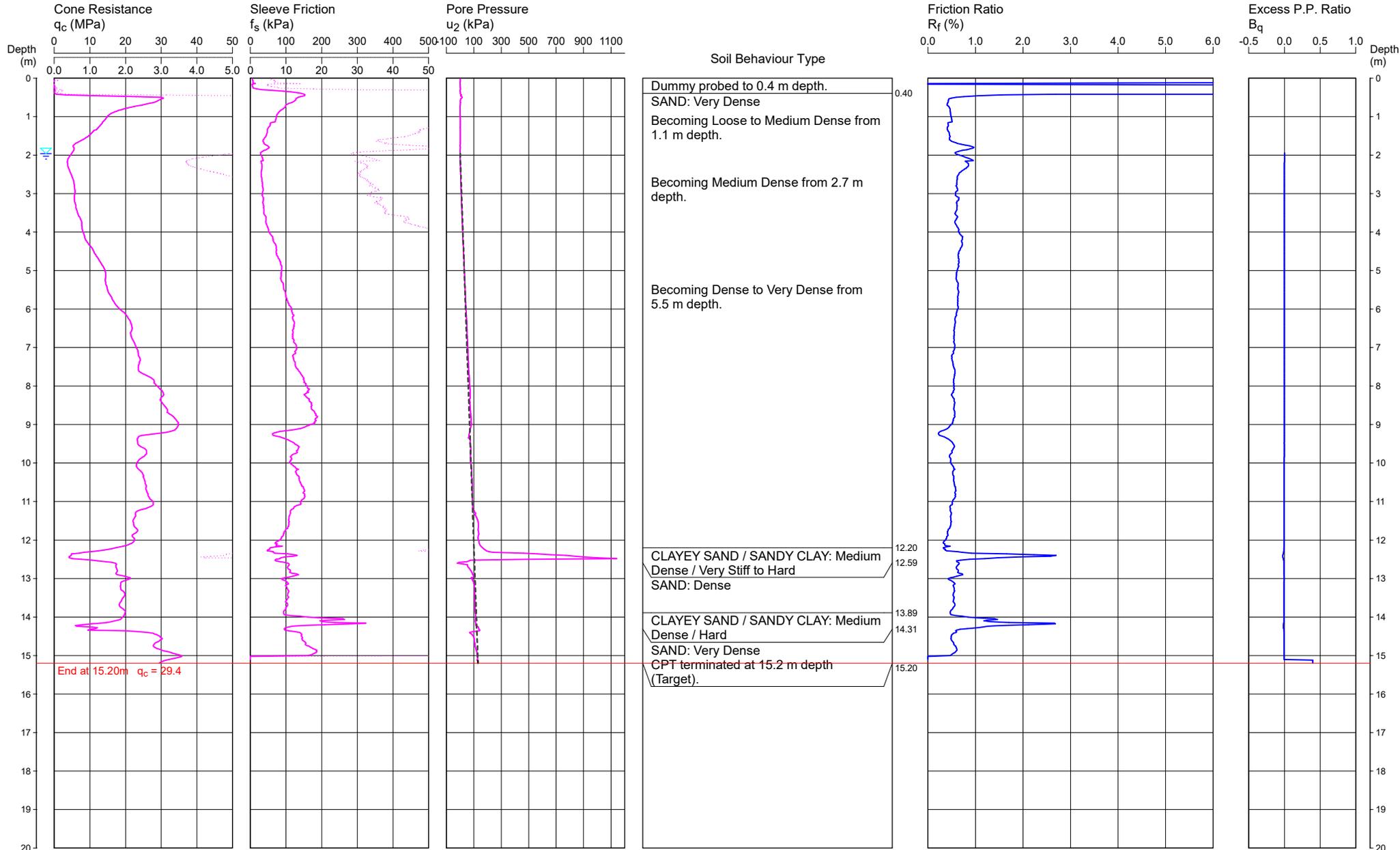
COORDINATES: 393433E 6468062N MGA94 50J

CPTU 18

Page 1 of 1

DATE 30/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 1.96 m depth.

Water depth after test: 1.96m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 18.CP5
Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.1 m AHD*

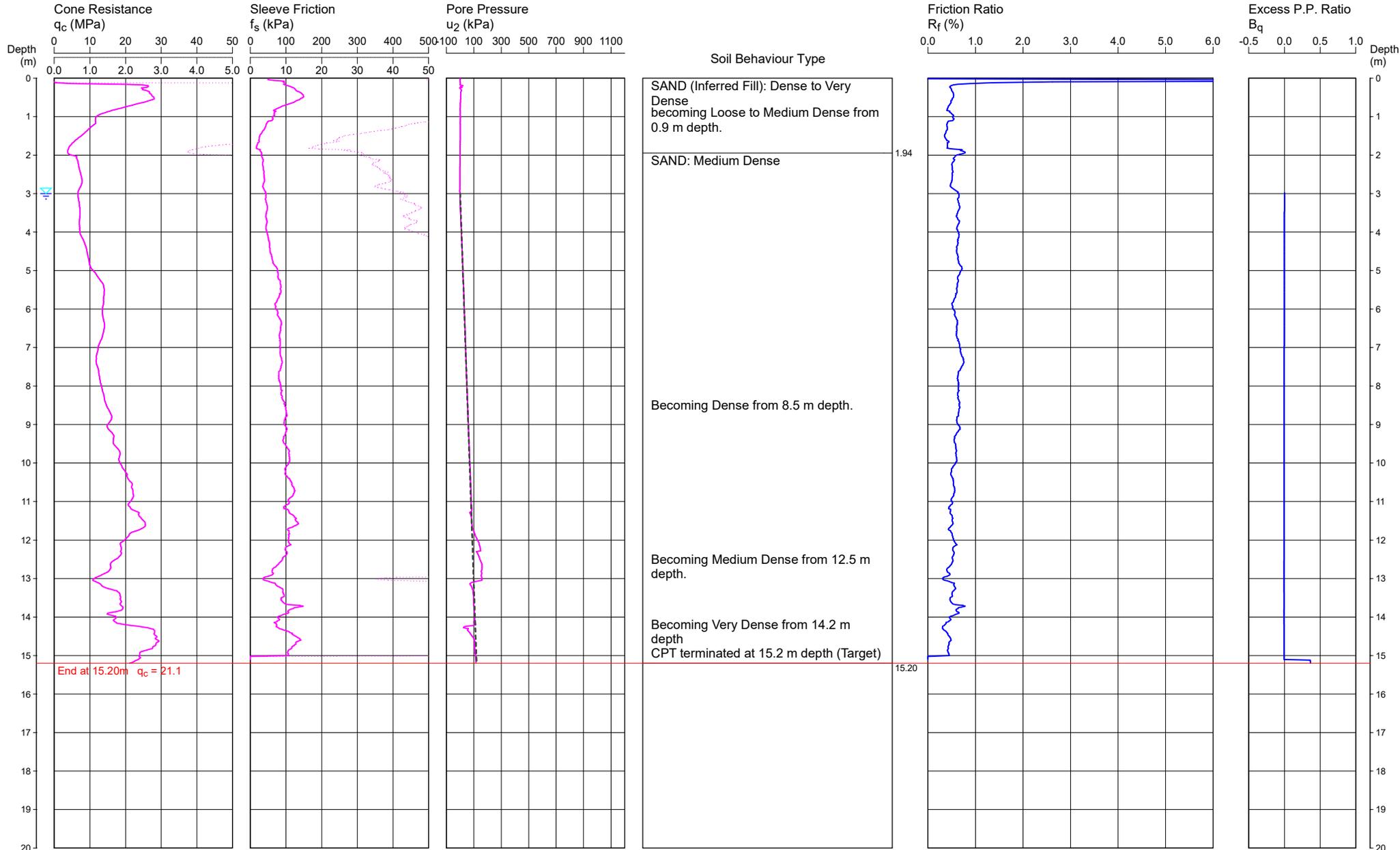
COORDINATES: 393299E 6467930N MGA94 50J

CPTU 19

Page 1 of 1

DATE 30/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Groundwater measured at 3 m depth.

Water depth after test: 3.00m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 19.CP5
Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.7 m AHD*

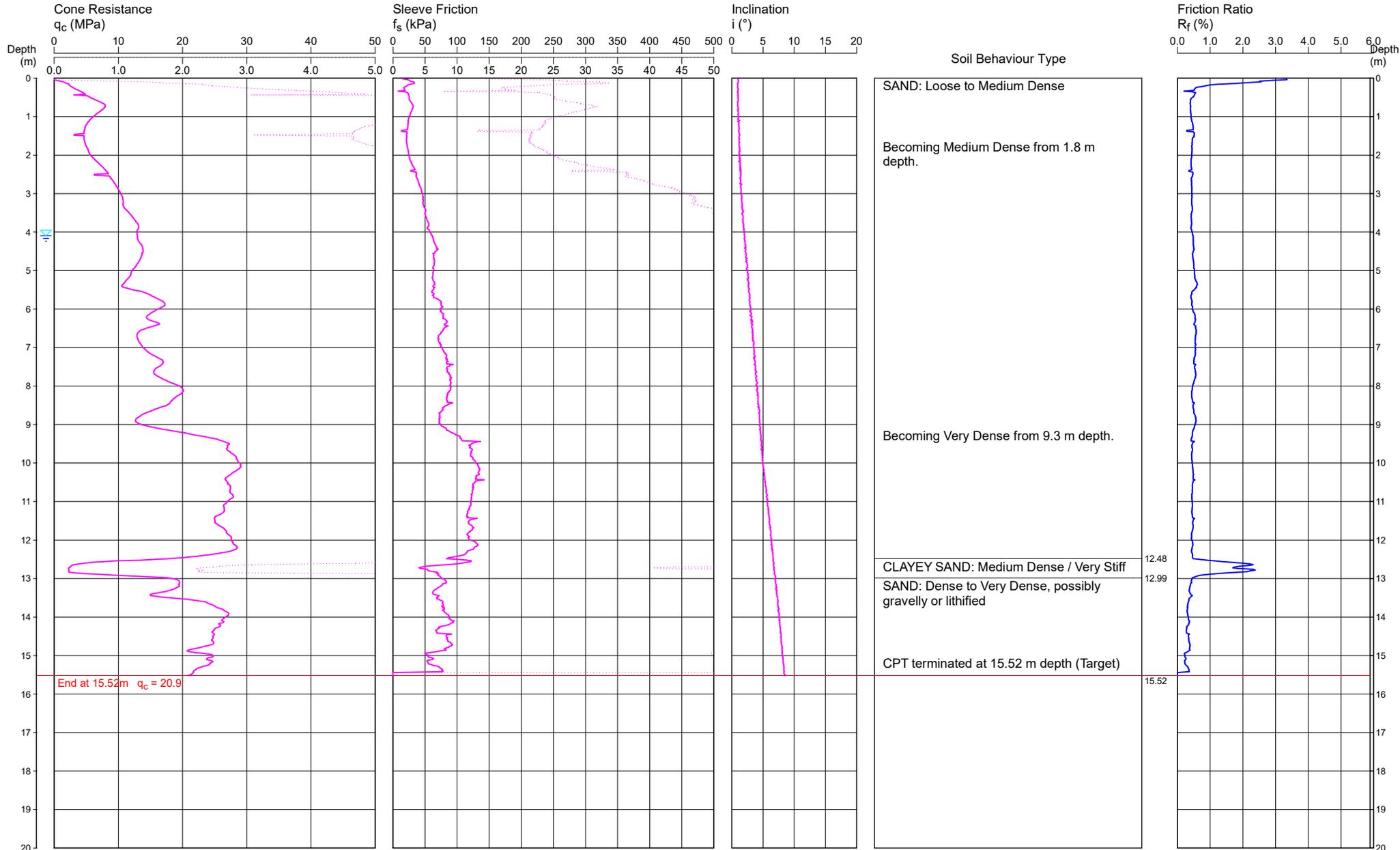
COORDINATES: 393119E 6467943N MGA94 50J

CPT 20

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 4.1 m depth.

Water depth after test: 4.10m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 20.CP5
Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.8 m AHD*

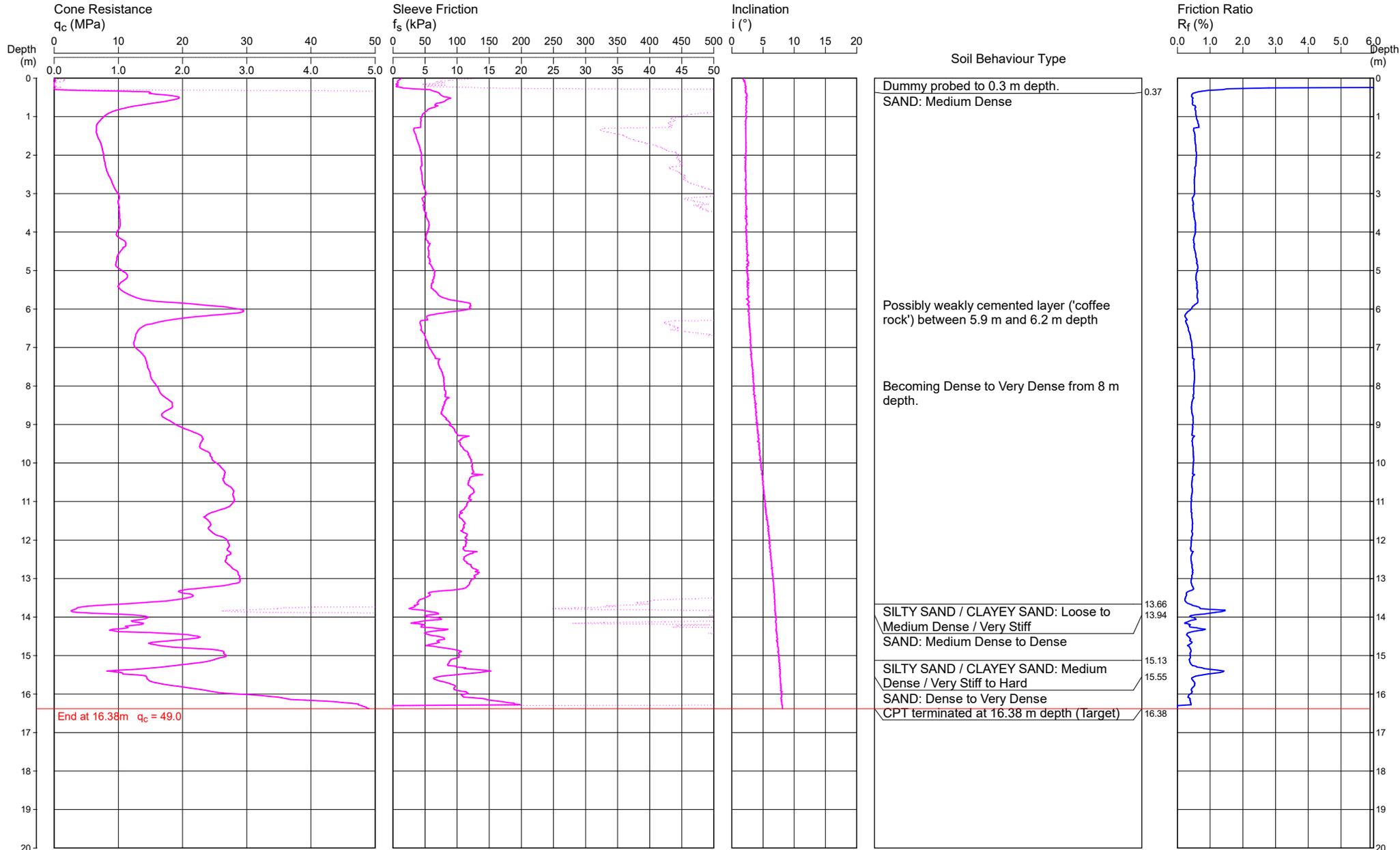
COORDINATES: 393034E 6467855N MGA94 50J

CPT 21

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Dry to 3.2 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 21.CP5
 Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
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BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.0 m AHD*
EASTING: 392946
NORTHING: 6467697
DIP/AZIMUTH: 90°/--

BORE No: 22
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)									
				Type	Depth	Sample	Results & Comments		5	10	15	20						
20		FILL/SAND SP: fine to medium grained, dark grey-brown, trace silt and gravel, moist, medium dense, fill. - becoming grey-brown from 0.1 m depth.	[Cross-hatch pattern]															
21	1	- becoming dark grey-brown and yellow-brown from 1.4 m depth.	[Cross-hatch pattern]															
21	1.8	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	[Dotted pattern]															
21	2.3	Bore discontinued at 2.3m (Hard digging, refusal on tree roots)																



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.3 m AHD*
EASTING: 392981
NORTHING: 6467810
DIP/AZIMUTH: 90°/--

BORE No: 23
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
23 22 21	0.3	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace gravel, moist, dense, fill.	[Cross-hatched pattern]						
	0.45	FILL/Gravelly SAND SP-SM: fine to medium grained, pale yellow-brown, fine to coarse sized, with silt, moist, very dense, fill. Gravel is crushed limestone.							
	1	FILL/SAND SP-SM: fine to medium grained, grey-brown, yellow-brown, grey and dark grey, with silt, moist, very dense, fill.							
	1.7	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	[Dotted pattern]						
2 21	2.3	Bore discontinued at 2.3m (Collapsing conditions)							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.3 m AHD*
EASTING: 392916
NORTHING: 6467815
DIP/AZIMUTH: 90°/--

BORE No: 24
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
23	0	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist, loose, fill. - becoming grey-brown, trace gravel from 0.1 m depth.	[Cross-hatch pattern]						
22	1								
21	1.7	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand. - becoming pale brown and brown from 2.1 m depth.	[Dotted pattern]						
	2								
	2.5	Bore discontinued at 2.5m (Target depth)							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.2 m AHD*
EASTING: 392870
NORTHING: 6467765
DIP/AZIMUTH: 90°/--

BORE No: 25
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
22		FILL/SAND SP: fine to medium grained, dark grey-brown, trace silt and gravel, moist, medium dense, fill. - becoming grey-brown from 0.1 m depth.												
	1	- becoming grey from 1.1 m depth.		D	0.9									
21	1.3	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.												
	2	- becoming pale brown from 2.0 m depth.												
20	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.2 m AHD*
EASTING: 392894
NORTHING: 6467899
DIP/AZIMUTH: 90°/--

BORE No: 26
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
23		FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace gravel, moist, dense to very dense, fill. Glass pieces observed in fill. - becoming grey-brown from 0.1 m depth.	[Cross-hatch pattern]						
	0.9	- with gravel from 0.65 m depth.							
	1.1	SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist.	[Dotted pattern]						
	1.4	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	[Dotted pattern]						
21	2.5	Bore discontinued at 2.5m (Target depth)							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.4 m AHD*
EASTING: 392778
NORTHING: 6467862
DIP/AZIMUTH: 90°/--

BORE No: 27
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
23	0.0	FILL/SAND SP: fine to medium grained, dark grey-brown, trace silt, moist, medium dense, fill. - becoming orange-brown, trace gravel from 0.1 m depth.	[Cross-hatched pattern]	B	0.0				5	10	15	20
	0.8	SAND SP: fine to medium grained, dark grey, trace silt, moist, medium dense. Bassendean Sand. - becoming grey from 0.9 m depth. - becoming pale grey from 1.1 m depth.										
22	1		[Dotted pattern]									
21	2.5	Bore discontinued at 2.5m (Target depth)										



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 24.3 m AHD*
EASTING: 392859
NORTHING: 6467983
DIP/AZIMUTH: 90°/--

BORE No: 28
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
24.3	0.55	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown and pale yellow-brown, fine to medium grained, with silt, moist, very dense, fill.												
	0.8	FILL/SAND SP-SM: fine to medium grained, grey-brown, with silt, trace gravel, moist, dense, fill.												
	1.0	SAND SP: fine to medium grained, grey, trace silt, moist, medium dense. Bassendean Sand. - becoming pale grey from 0.9 m depth.		D	1.0									
	2.3	- becoming pale yellow-brown from 2.3 m depth.												
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 24.2 m AHD*
EASTING: 393021
NORTHING: 6467953
DIP/AZIMUTH: 90°/--

BORE No: 29
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
24		FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace gravel, moist, medium dense, fill. - becoming grey-brown from 0.1 m depth.							
0.7		SAND SP: fine to medium grained, dark grey-brown, trace silt and gravel, moist, medium dense. Sand derived from Tamala Limestone. - becoming yellow-brown, no gravel and dense from 0.85 m depth.		D	0.8				
1									
2.5		Bore discontinued at 2.5m (Target depth)							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater observed at 2.1 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.6 m AHD*
EASTING: 393038
NORTHING: 6468002
DIP/AZIMUTH: 90°/--

BORE No: 30
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.45	FILL/SAND SP-SM: fine to medium grained, grey-brown, with silt, trace gravel, moist, dense, fill.	X										
	1	SAND SP: fine to medium grained, yellow-brown, trace silt, moist, dense. Sand derived from Tamala Limestone.	.										
	2.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.0 m AHD*
EASTING: 392997
NORTHING: 6468040
DIP/AZIMUTH: 90°/--

BORE No: 31
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.45	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown and grey, fine to medium grained, with silt, moist, very dense, fill.	[Cross-hatch pattern]										
	0.55	SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist.	[Dotted pattern]										
	1	SAND SP: fine to medium grained, yellow-brown, trace silt, moist, medium dense to dense. Sand derived from Tamala Limestone.	[Dotted pattern]										
	2.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.1 m AHD*
EASTING: 393058
NORTHING: 6468079
DIP/AZIMUTH: 90°/--

BORE No: 32
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
23.1	0.8	FILL/SAND SP-SM: fine to medium grained, grey-brown, with silt, trace gravel, moist, dense, fill. Glass pieces observed in fill.							
23.1	1.1	SAND SP: fine to medium grained, grey, trace silt, moist, dense. Bassendean Sand.							
23.1	1.1	SAND SP: fine to medium grained, yellow-brown, trace silt, moist. Sand derived from Tamala Limestone.		D	1.2				
23.1	2.5	Bore discontinued at 2.5m (Target depth)							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

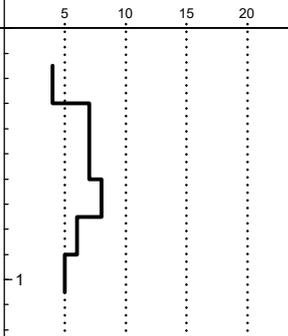
SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 20.5 m AHD*
EASTING: 392988
NORTHING: 6468151
DIP/AZIMUTH: 90°/--

BORE No: 33
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.1	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist, topsoil. SAND SP: fine to medium grained, grey, trace silt, moist to wet, medium dense to dense. Bassendean Sand. - becoming brown from 1.0 m depth.						 27-09-22					
	1.3	Bore discontinued at 1.3m (Collapsing conditions)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater observed at 0.6 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.0 m AHD*
EASTING: 392944
NORTHING: 6468112
DIP/AZIMUTH: 90°/--

BORE No: 34
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
20	0.03	ASPHALT: black, 7 mm nominal aggregate.												
	0.18	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown, fine to medium grained, with silt, moist, fill. FILL/SAND SP: fine to medium grained, bands of grey-brown, yellow-brown and dark brown, trace silt and gravel, moist, dense to very dense, fill.		B	0.5									
21	1.3	SAND SP: fine to medium grained, dark grey-brown, trace silt, moist. Bassendean Sand. - becoming pale grey from 1.5 m depth.												
22	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:** None

TYPE OF BORING: 250 mm diameter power auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PLD	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.7 m AHD*
EASTING: 393017
NORTHING: 6468102
DIP/AZIMUTH: 90°/--

BORE No: 35
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.03	ASPHALT: black, 7 mm nominal aggregate.	▬											
	0.13	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, pale grey, fine to medium grained, with silt, moist, fill.	▨											
	0.26	FILL/Gravelly SAND SP-SM: fine to medium grained, grey-brown, fine to coarse sized, with silt, moist, fill.	▩											
	0.7	FILL/SAND SP: fine to medium grained, bands of grey-brown, dark grey-brown and yellow-brown, trace silt and gravel, moist, dense to very dense, fill.	▧											
	1	SAND SP: fine to medium grained, grey, trace silt, moist, dense. Bassendean Sand.	▦	D	1.0									
		- becoming pale grey from 1.5 m depth.												
	2	- becoming pale brown from 2.0 m depth.												
		- becoming brown, weakly cemented from 2.2 m depth.												
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:** None

TYPE OF BORING: 250 mm diameter power auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PLD	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.8 m AHD*
EASTING: 393122
NORTHING: 6468078
DIP/AZIMUTH: 90°/--

BORE No: 36
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.02	ASPHALT: black, 7 mm nominal aggregate.	[Cross-hatch pattern]											
	0.2	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown and grey, fine to medium grained, with silt, moist, fill.	[Cross-hatch pattern]											
	0.4	FILL/SAND SP: fine to medium grained, bands of dark grey-brown, pale grey, yellow-brown and orange-brown, trace silt, moist, dense, fill.	[Dotted pattern]											
	1	SAND SP: fine to medium grained, pale grey, trace silt, moist, medium dense. Bassendean Sand. - becoming pale brown from 1.0 m depth. - becoming brown from 1.5 m depth.	[Dotted pattern]	B	0.5									
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:** None

TYPE OF BORING: 250 mm diameter power auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.9 m AHD*
EASTING: 393173
NORTHING: 6468132
DIP/AZIMUTH: 90°/--

BORE No: 37
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.03	ASPHALT: black, 7 mm nominal aggregate.	▨											
	0.2	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown and pale grey, fine to medium grained, with silt, moist, fill.	▩											
	0.34													
		FILL/SAND SP: fine to medium grained, dark grey-brown and grey-brown, trace silt and gravel, moist, dense, fill.	▩											
	0.8	SAND SP: fine to medium grained, pale grey, trace silt, moist, dense. Possibly fill.	▩											
	0.9	SAND SP: fine to medium grained, pale yellow-brown, trace silt, moist, medium dense. Sand derived from Tamala Limestone.	▩	B	0.9									
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:** None
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PLD	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.4 m AHD*
EASTING: 393221
NORTHING: 6468078
DIP/AZIMUTH: 90°/--

BORE No: 38
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.03	ASPHALT: black, 7 mm nominal aggregate.	▨											
	0.2	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown and grey, fine to medium grained, with silt, moist, fill.	▩											
		FILL/SAND SP-SM: fine to medium grained, bands of grey-brown, dark grey-brown and yellow-brown, with silt, dry to moist, dense, fill.	▩											
	0.9	SAND SP: fine to medium grained, pale grey, trace silt, dry to moist, dense. Bassendean Sand.	▩											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:** None

TYPE OF BORING: 250 mm diameter power auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.3 m AHD*
EASTING: 393183
NORTHING: 6468038
DIP/AZIMUTH: 90°/--

BORE No: 39
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)									
				Type	Depth	Sample	Results & Comments		5	10	15	20						
	0.03	ASPHALT: black, 7 mm nominal aggregate.	[Cross-hatched pattern]															
	0.19	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown and grey, fine to medium grained, with silt, moist, fill. - becoming brown and yellow-brown from 0.09 m depth.	[Cross-hatched pattern]															
	0.23																	
	0.53	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist, fill.	[Dotted pattern]															
	1	FILL/SAND SP: fine to medium grained, yellow-brown, trace silt and gravel, dry to moist, dense, fill. SAND SP: fine to medium grained, pale grey, trace silt, dry to moist, dense. Bassendean Sand.																
	2.5	Bore discontinued at 2.5m (Target depth)																



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:** None
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.
REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PLD	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.3 m AHD*
EASTING: 393346
NORTHING: 6468098
DIP/AZIMUTH: 90°/--

BORE No: 40
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
21	0.15	FILL/SAND SP-SM: fine to medium grained, grey-brown, with silt, trace gravel, moist, fill.	[Cross-hatch pattern]										
		FILL/SAND SP: fine to medium grained, yellow-brown, trace silt and gravel, moist, medium dense, fill.											
	0.6	- becoming dark brown, with gravel from 0.5 m depth.											
	0.75	SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist, medium dense.	[Dotted pattern]										
	1	SAND SP: fine to medium grained, grey, trace silt, moist, medium dense. Bassendean Sand. - becoming pale grey from 1.0 m depth.											
1.7	SAND SP-SM: fine to medium grained, brown, with silt, moist. Bassendean Sand.												
2.5	Bore discontinued at 2.5m (Target depth)												



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater observed at 2.1 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.1 m AHD*
EASTING: 393303
NORTHING: 6467983
DIP/AZIMUTH: 90°/--

BORE No: 41
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
22.1	0.15	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace gravel, trace rootlets, moist, fill. FILL/ORGANIC SAND SP: fine to medium grained, brown, trace silt and gravel, moist, medium dense, fill. Pieces of brick, tile and glass observed in fill. - becoming dark grey-brown, with gravel and dense from 0.35 m depth.											
				B	0.6								
					0.9								
21	1.2	SAND SP: fine to medium grained, grey, trace silt, moist. Bassendean Sand.											
20	2							▼ 28-09-22					
	2.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater observed at 2.1 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.1 m AHD*
EASTING: 393358
NORTHING: 6467947
DIP/AZIMUTH: 90°/--

BORE No: 42
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
23	0.8	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace gravel, moist, medium dense, fill. Glass pieces, plastic waste observed in fill. - becoming grey-brown from 0.4 m depth.												
21	1.0	SAND SP: fine to medium grained, pale grey, trace silt, moist, medium dense. Bassendean Sand.		D	1.0									
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.9 m AHD*
EASTING: 393255
NORTHING: 6467950
DIP/AZIMUTH: 90°/--

BORE No: 43
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	22.1	FILL/SAND SP-SM: fine to medium grained, yellow-brown, with silt, trace gravel, moist, very dense. Brick pieces observed in fill. - with gravel from 0.2 m depth. - becoming grey-brown from 0.35 m depth.											
	21.1	- becoming yellow-brown from 1.0 m depth.											
	20.5	- becoming dark grey-brown and brown from 1.5 m depth.											
	20.2	- becoming yellow-brown from 1.8 m depth.											
	20.3	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.											
	20.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.7 m AHD*
EASTING: 393414
NORTHING: 6468029
DIP/AZIMUTH: 90°/--

BORE No: 44
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.3	FILL/SAND SP-SM: fine to medium grained, grey and grey-brown, with silt, trace gravel, moist, dense, fill.	[Cross-hatch pattern]										
		SAND SP: fine to medium grained, pale grey, trace silt, moist, medium dense. Bassendean Sand.	[Dotted pattern]										
	2.2	- becoming pale brown from 2.1 m depth.											
	2.5	SAND SP-SM: fine to medium grained, brown, with silt, moist, weakly cemented. Bassendean Sand.	[Dotted pattern]										
	2.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 21.9 m AHD*
EASTING: 393437
NORTHING: 6468105
DIP/AZIMUTH: 90°/--

BORE No: 45
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.1	FILL/SAND SP-SM: fine to medium grained, grey-brown and dark grey-brown, with silt, trace gravel, trace rootlets, moist, fill.	[Cross-hatch pattern]										
	0.7	FILL/SAND SP: fine to medium grained, dark grey-brown, trace silt and gravel, moist, medium dense, fill. - becoming grey, no gravel and trace pockets of Silty SAND SM from 0.4 m depth.	[Cross-hatch pattern]										
	1.0	SAND SP: fine to medium grained, grey, trace silt, moist. Bassendean Sand.	[Dotted pattern]										
	1.4	- with pockets of dark grey-brown sand from 1.4 m depth.		D	1.4								
	1.5				1.5								
	1.7	Bore discontinued at 1.7m (Collapsing conditions)						28-09-22					



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater observed at 1.5 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.1 m AHD*
EASTING: 393310
NORTHING: 6468041
DIP/AZIMUTH: 90°/--

BORE No: 46
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
22		FILL/SAND SP: fine to medium grained, grey-brown, trace silt and gravel, trace rootlets, moist, medium dense, fill. Pieces of glass, basalt, tile and brick observed in fill.		D	0.85				1				
21	1								1				
21	1.4	SAND SP: fine to medium grained, grey, trace silt, moist. Bassendean Sand.						▼ 28-09-22					
20	2												
20	2.3	Bore discontinued at 2.3m (Collapsing conditions)											



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater observed at 1.6 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.7 m AHD*
EASTING: 393119
NORTHING: 6467943
DIP/AZIMUTH: 90°/--

BORE No: 47
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
	0.5	FILL/SAND SP-SM: fine to medium grained, brown, grey and dark grey-brown, with silt, trace gravel, moist, dense, fill.	[Cross-hatched pattern]						5 10 15 20
	2.0	SAND SP: fine to medium grained, yellow-brown, trace silt, moist, medium dense to dense. Sand derived from Tamala Limestone.	[Dotted pattern]						5 10 15 20
	2.5	Bore discontinued at 2.5m (Target depth)							5 10 15 20



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 21.8 m AHD*
EASTING: 393307
NORTHING: 6468013
DIP/AZIMUTH: 90°/--

BORE No: 48
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.1	FILL/SAND SP-SM: fine to medium grained, grey-brown, with silt, trace gravel, moist, fill. FILL/SAND SP: fine to medium grained, dark grey-brown, trace silt and gravel, moist, medium dense, fill. - becoming grey-brown from 0.3 m depth.											
	1.35	SAND SP: fine to medium grained, grey, trace silt and gravel, moist. Possibly fill. - becoming wet from 1.45 m depth.						▼ 28-09-22					
	2.2	Bore discontinued at 2.2m (Collapsing conditions)											



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater observed at 1.45 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.5 m AHD*
EASTING: 393373
NORTHING: 6468004
DIP/AZIMUTH: 90°/--

BORE No: 49
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
	0.1	FILL/SAND SP-SM: fine to medium grained, grey-brown, with silt, trace gravel, moist, fill. Tile pieces observed in fill. FILL/SAND SP: fine to medium grained, dark grey-brown and brown, trace silt and gravel, moist, medium dense, fill.							5	10	15	20
	1.35	SAND SP: fine to medium grained, grey, trace silt, moist. Bassendean Sand.										
	2.5	Bore discontinued at 2.5m (Target depth)						▼ 28-09-22				



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater observed at 2.4 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 26.7 m AHD*
EASTING: 393127
NORTHING: 6467875
DIP/AZIMUTH: 90°/--

BORE No: 50A
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.1	FILL/SAND SP-SM: fine to medium grained, grey-brown, with silt, trace gravel, trace rootlets, moist, fill.	[Cross-hatched pattern]	D	0.3								
	0.5	FILL/SAND SP: fine to medium grained, grey-brown and brown, trace silt and gravel, trace pockets of Silty SAND SM, moist, medium dense, fill. Glass pieces observed in fill. SAND SP: fine to medium grained, yellow-brown, trace silt, moist, medium dense. Sand derived from Tamala Limestone.	[Dotted pattern]										
	2.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 24.2 m AHD*
EASTING: 393167
NORTHING: 6467929
DIP/AZIMUTH: 90°/--

BORE No: 51
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
24	0.13	FILL/TOPSOIL: SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace rootlets, moist, fill.												
	0.6	FILL/SAND SP: fine to medium grained, yellow-brown and brown, trace silt and gravel, trace rootlets, moist, medium dense, fill. - becoming yellow-brown from 0.3 m depth.												
	0.8	SAND SP: fine to medium grained, yellow-brown, trace silt, moist, very dense. Sand derived from Tamala Limestone.		D	0.8									
	1													
	2													
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.5 m AHD*
EASTING: 393263
NORTHING: 6467989
DIP/AZIMUTH: 90°/--

BORE No: 52
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.15	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace gravel, trace rootlets, moist, fill.												
	0.5	FILL/SAND SP: fine to medium grained, grey-brown, trace silt and gravel, moist, medium dense, fill.												
	0.6	FILL/SAND SP-SM: fine to medium grained, brown, with silt, trace gravel, moist, medium dense to dense, fill. Pieces of tile, brick and ceramic observed in fill.		B	0.6									
	1.0				1.0									
	1.4	Bore discontinued at 1.4m (Hard digging)												



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 24.0 m AHD*
EASTING: 393086
NORTHING: 6467949
DIP/AZIMUTH: 90°/--

BORE No: 53
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
24	0.1	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace gravel, trace rootlets, moist, fill.	[Cross-hatch pattern]		0.3		No PSP was undertaken at this location due to risk of intersection with underground services.					
	0.55	FILL/SAND SP: fine to medium grained, brown, trace silt and gravel, trace rootlets to 0.15 m depth, moist, fill. Brick pieces observed at 0.5 m depth.	[Cross-hatch pattern]									
	1	SAND SP: fine to medium grained, yellow-brown, trace silt, moist. Bassendean Sand.	[Dotted pattern]									
-1												
-2												
-2	2.5	Bore discontinued at 2.5m (Target depth)										



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. PSP not undertaken due to high risk of intersecting services. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

Appendix C

Laboratory Test Results



SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - ASTM D2974-14 (Test Method C)

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15569-15579_1_ORG
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15569-15579
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	Various - See Below	Date Tested:	12/10/2022

TEST RESULTS - Organic Content

Sampling Method:

Sampled by Client, Tested as Received

Testing Completed By:

WGLS-LC

Furnace Temperature (°C):

440

Sample Number	Sample Identification	Ash Content (%)	Organic Content (%)
WG22.15569	BH25, 0.9m	99.4	0.6
WG22.15572	BH29, 0.8m	98.9	1.1
WG22.15577	BH41, 0.6-0.9m	96.3	3.7
WG22.15578	BH45, 1.4-1.5m	98.0	2.0
WG22.15579	BH46, 0.85m	99.2	0.8

Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 13/October/2022



Accreditation No. 20599

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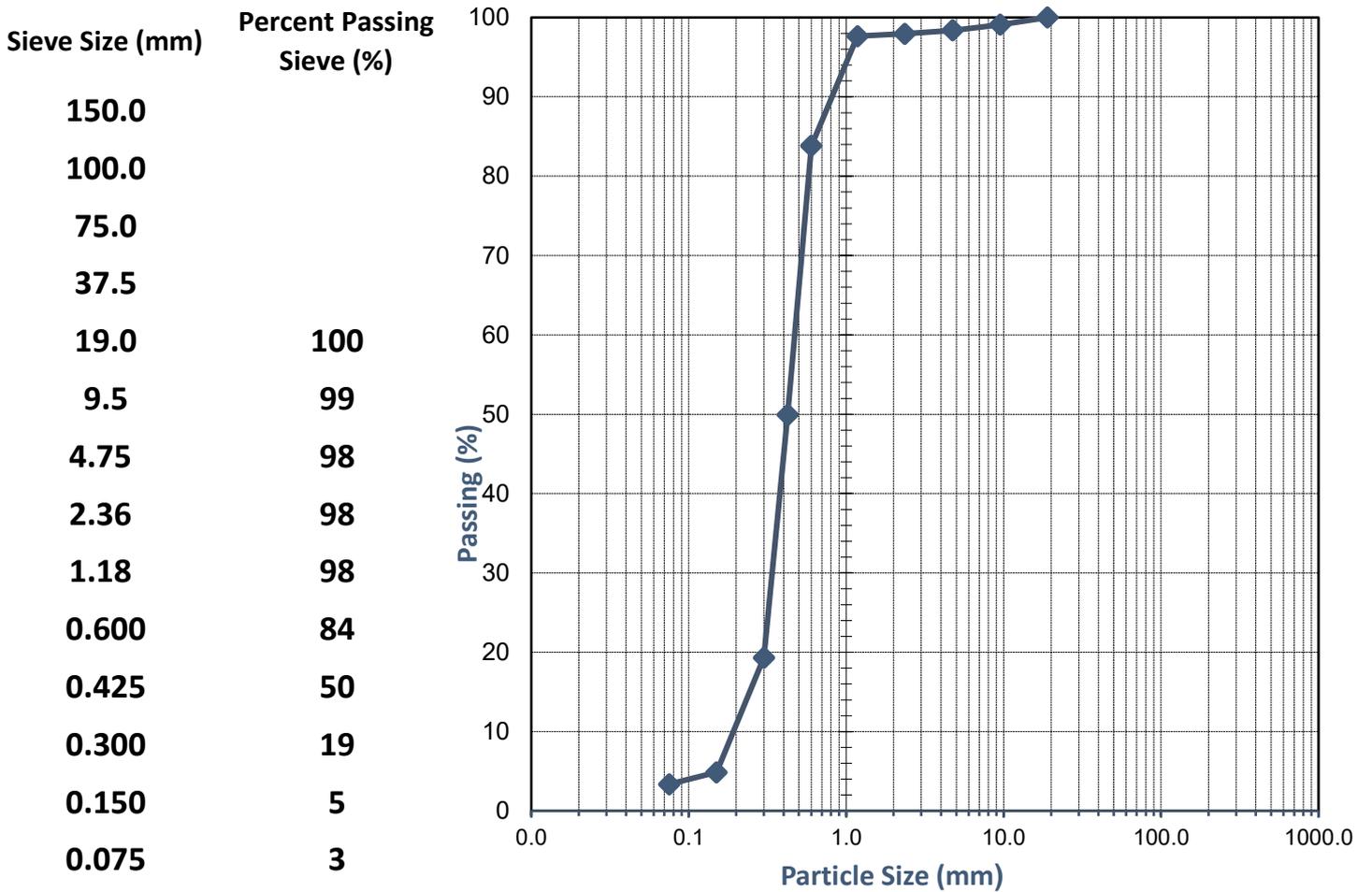
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15568_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15568
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH22, 0.7m	Date Tested:	13/10 - 14/10/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 14/October/2022



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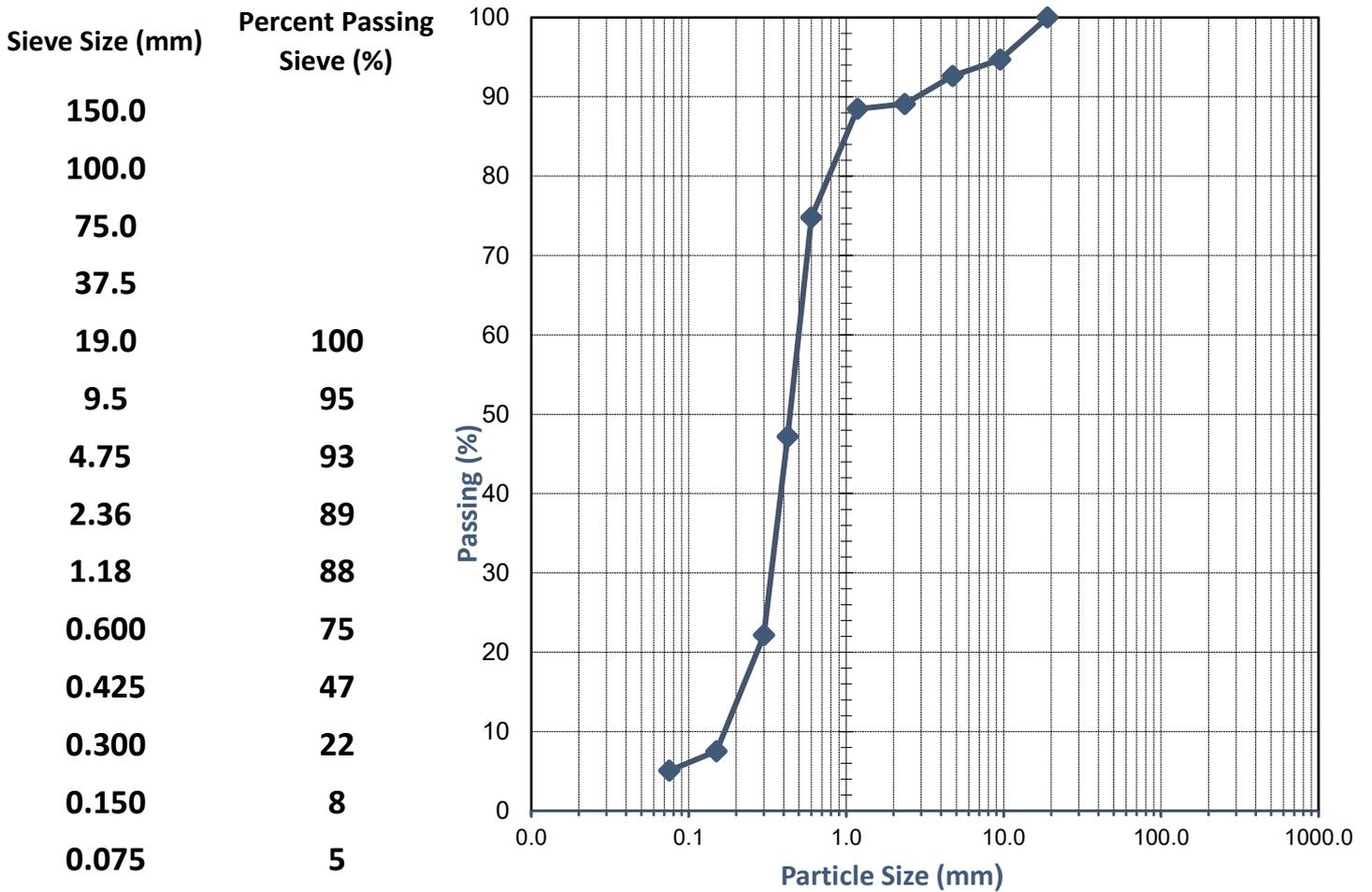
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15569_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15569
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH25, 0.9m	Date Tested:	13/10 - 14/10/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 14/October/2022



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SOIL | AGGREGATE | CONCRETE | CRUSHING

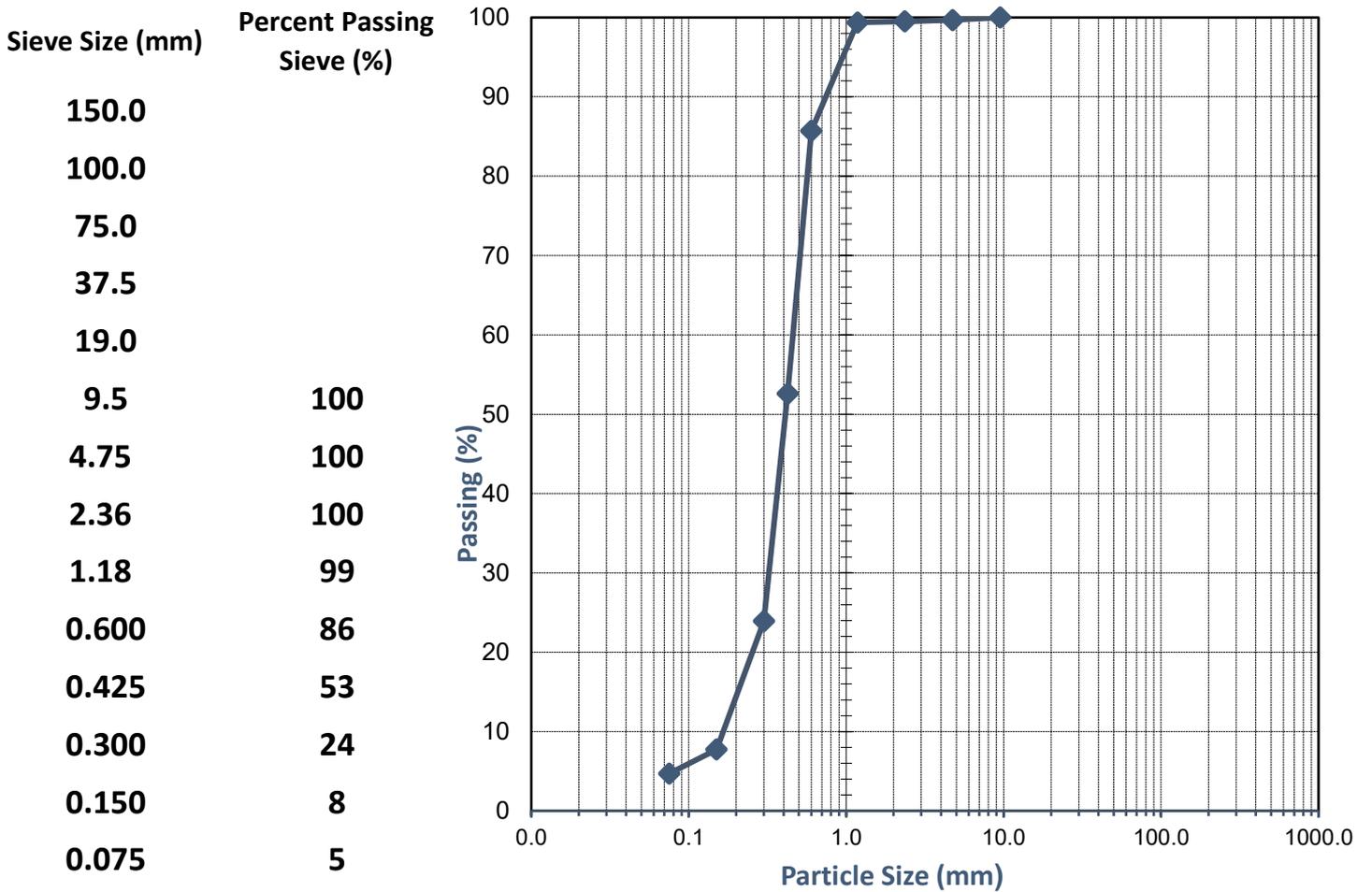
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15570_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15570
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH27, 0-0.7m	Date Tested:	13/10 - 14/10/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Natasha Bielawski

Date: 14/October/2022



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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15570_1_MMDD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15570
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH27, 0-0.7m	Date Tested:	12/10/2022

TEST RESULTS - Modified Maximum Dry Density

Sampling Method:

Sampled by Client, Tested as Received

Sample Curing Time:

2 HRS

Method used to Determine Liquid Limit:

Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%):

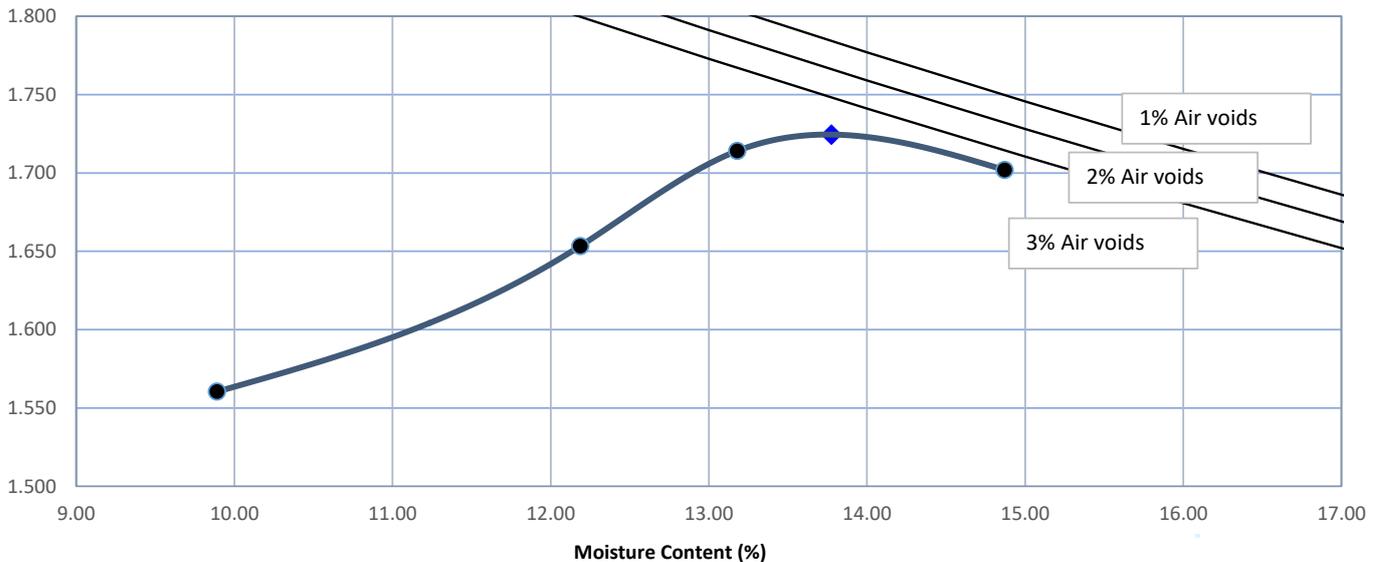
0

Material + 37.5mm (%)

-

Moisture Content (%)	9.9	12.2	13.2	14.9	
Dry Density (t/m ³)	1.560	1.653	1.714	1.702	

Dry Density (t/m³)



Modified Maximum Dry Density (t/m³)

1.72

Optimum Moisture Content (%)

14.0

Comments: The above air void lines are derived from a calculated apparent particle density of 2.397 t/m³

Approved Signatory:

Name: Cody O'Neill

Date: 13/October/2022



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TEST REPORT - AS 1289.6.1.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15570_1_SCBR
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15570
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH27, 0-0.7m	Date Tested:	12/10 - 17/10/22

TEST RESULTS - CALIFORNIA BEARING RATIO

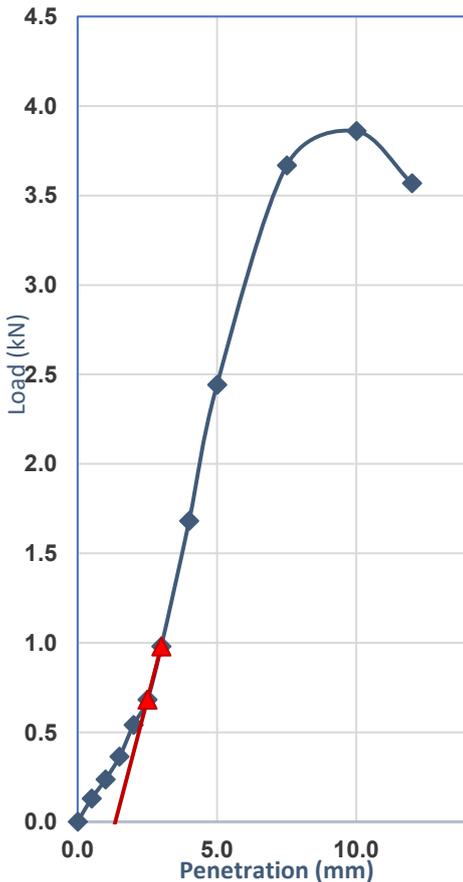
Sample Description:

Sand

Sampling Method:

Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details

Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	2.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m ³)	1.72	Optimum Moisture (%)	14.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction

Dry Density (t/m ³)	1.63	Moisture Content (%)	14.3
Density Ratio (%)	94.5	Moisture Ratio (%)	103.5

Specimen Conditions After Soak

Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m ³)	1.63	Dry Density Ratio (%)	94.5
Moisture Content (%)	17.0	Moisture Ratio (%)	123.0

Specimen Conditions After Test

Top 30mm Moisture (%)	14.4	Remaining Depth (%)	15.0
-----------------------	------	---------------------	------

Correction applied to Penetration: 1.4mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 16%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 18-October-2022



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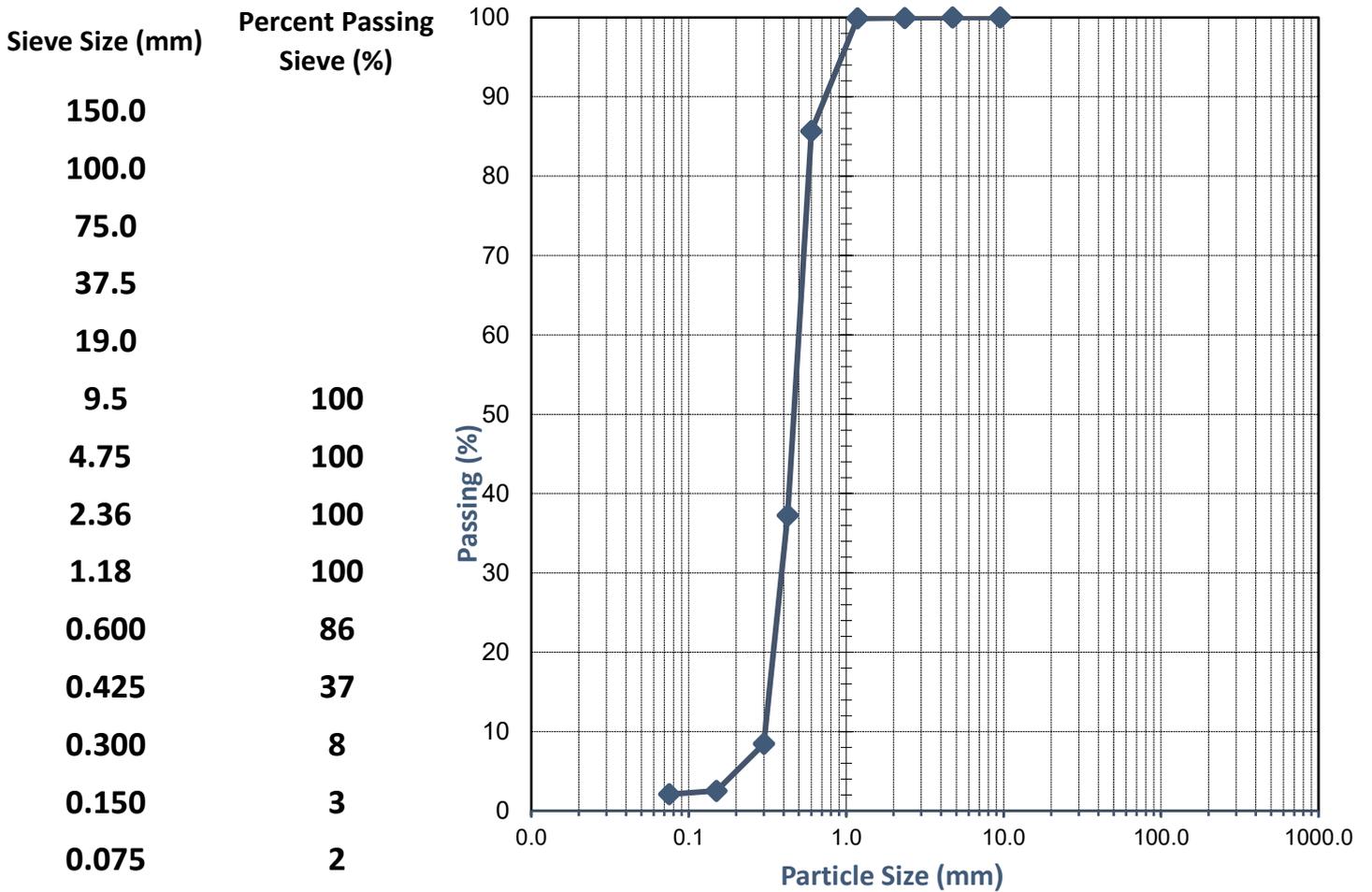
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15571_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15571
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH28, 1.0m	Date Tested:	13/10 - 14/10/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 14/October/2022



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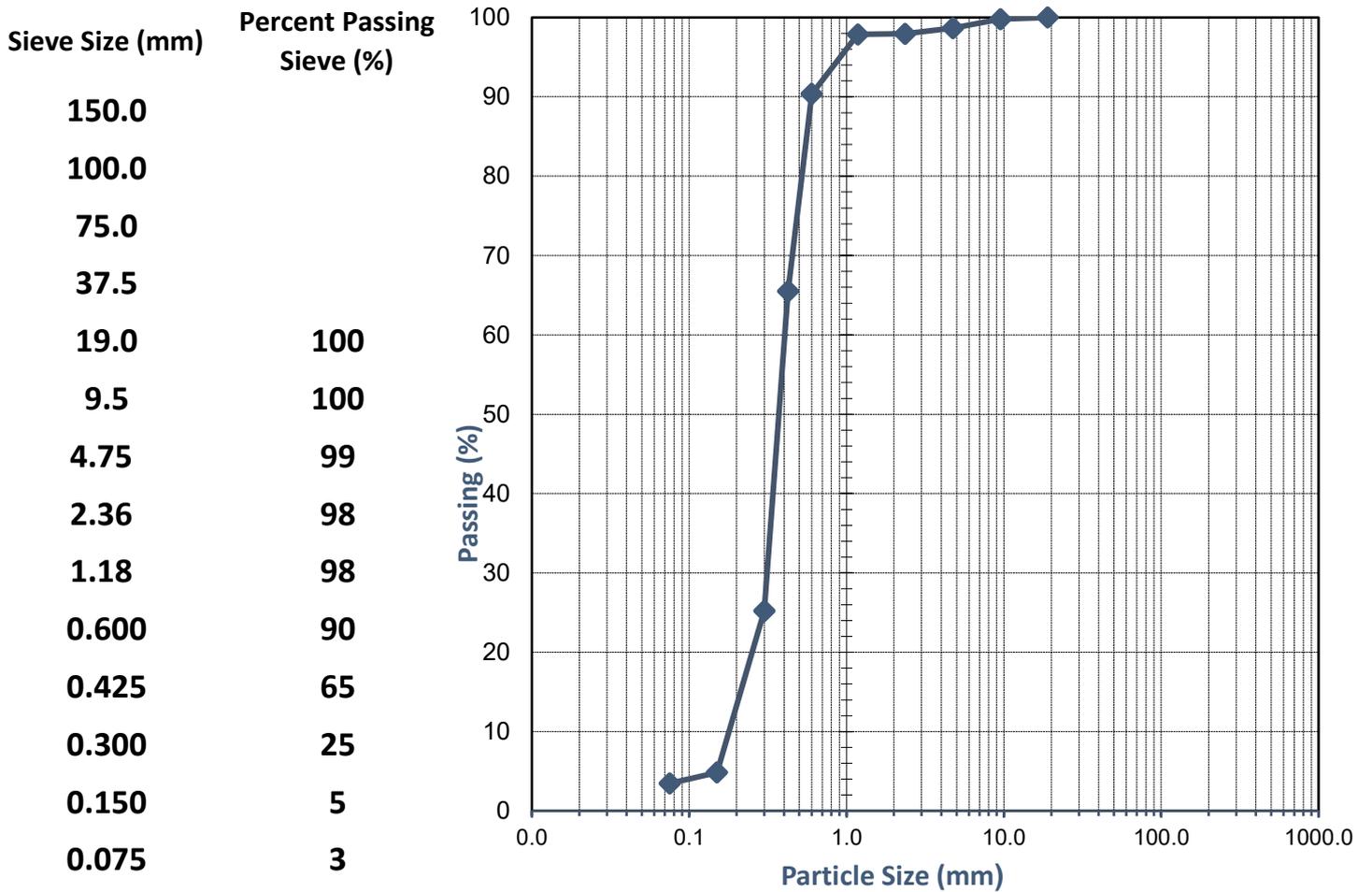
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15572_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15572
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH29, 0.8m	Date Tested:	13/10 - 14/10/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 14/October/2022



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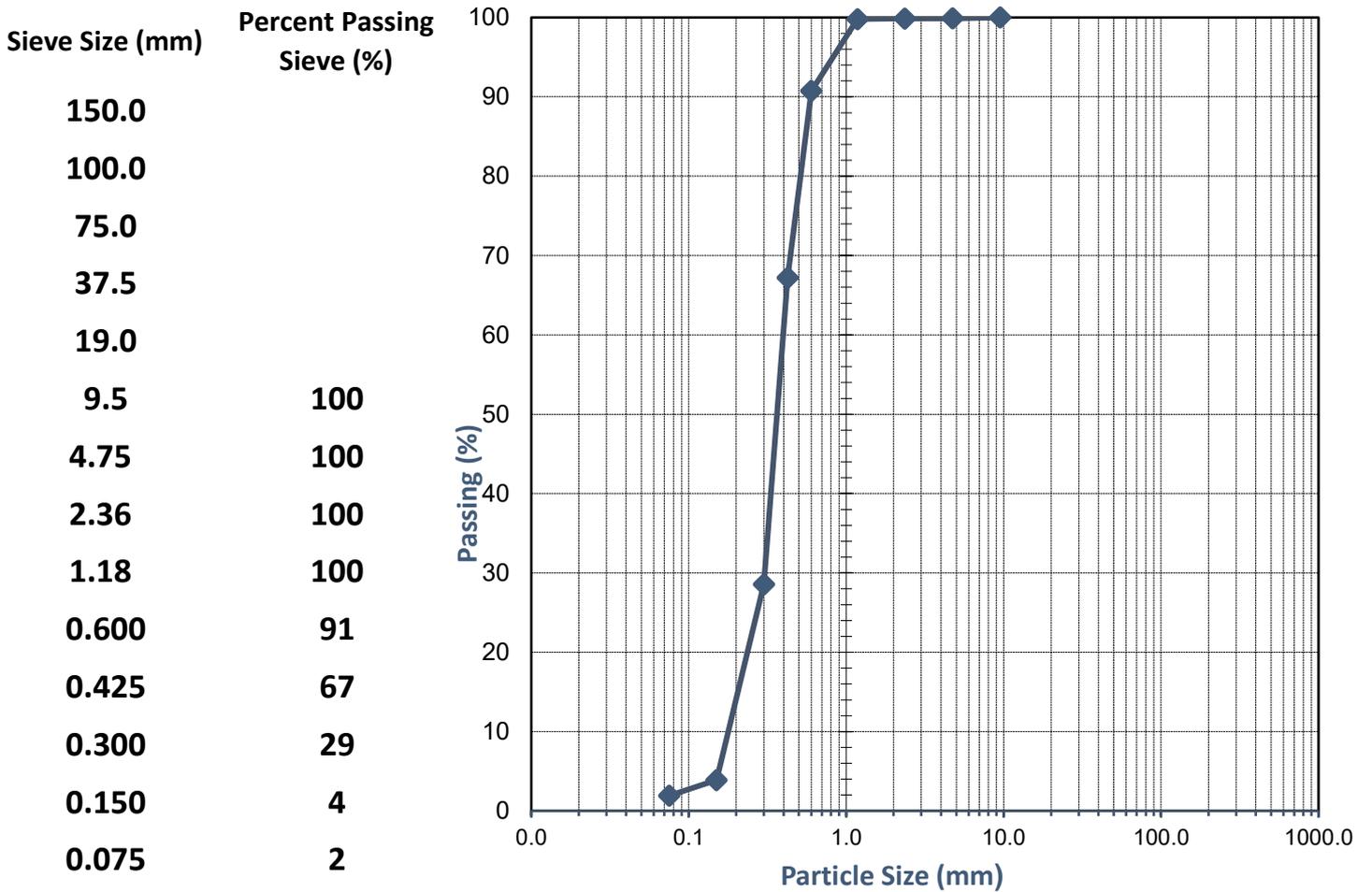
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15573_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15573
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH32, 1.2m	Date Tested:	13/10 - 14/10/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 14/October/2022



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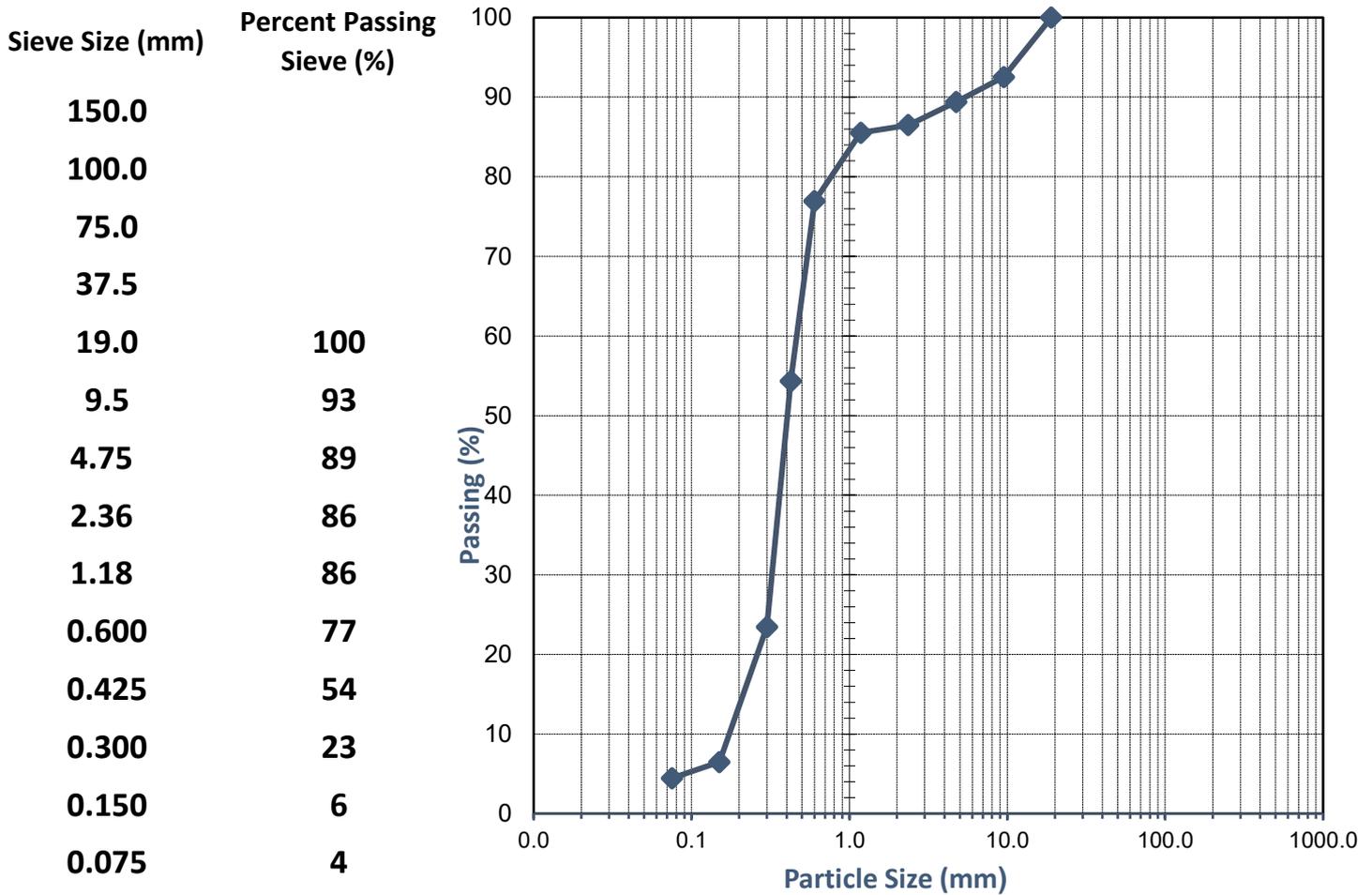
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15574_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15574
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH34, 0.5m	Date Tested:	13/10 - 14/10/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 14/October/2022



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TEST REPORT - AS 1289.5.2.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15574_1_MMDD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15574
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH34, 0.5m	Date Tested:	12/10/2022

TEST RESULTS - Modified Maximum Dry Density

Sampling Method:

Sampled by Client, Tested as Received

Sample Curing Time:

2 hrs

Method used to Determine Liquid Limit:

Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%):

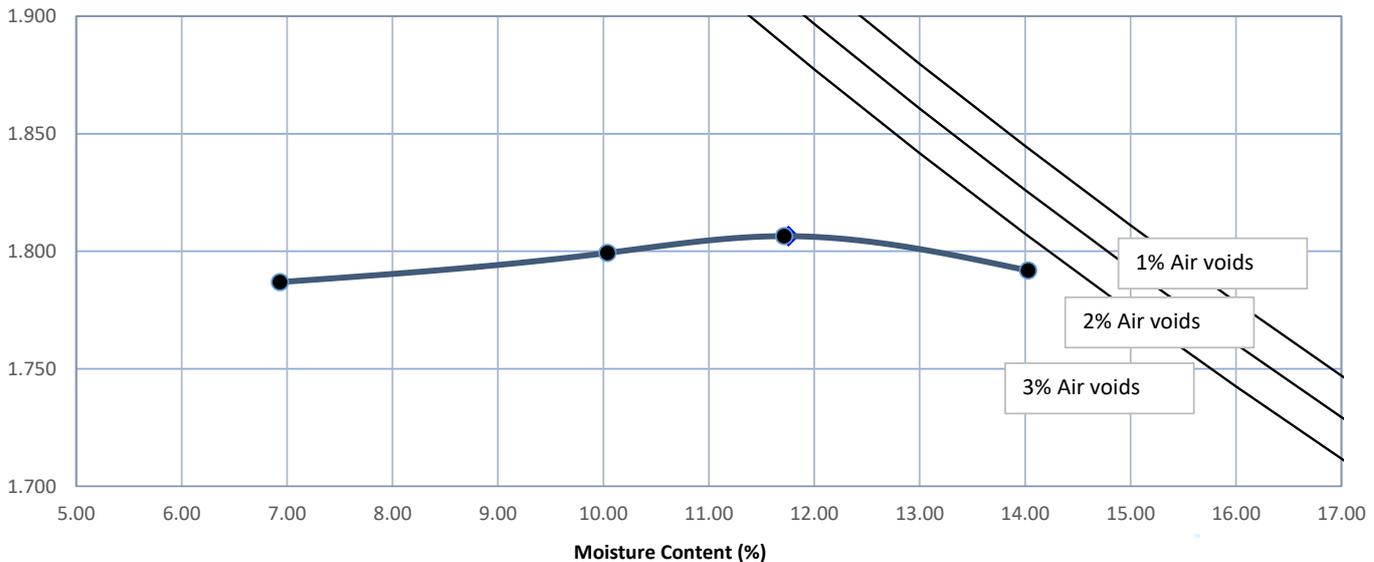
0

Material + 37.5mm (%)

-

Moisture Content (%)	6.9	10.0	11.7	14.0	
Dry Density (t/m ³)	1.787	1.799	1.806	1.792	

Dry Density (t/m³)



Modified Maximum Dry Density (t/m³)

1.81

Optimum Moisture Content (%)

12.0

Comments: The above air void lines are derived from a calculated apparent particle density of 2.521 t/m³

Approved Signatory:

Name: Cody O'Neill

Date: 13/October/2022



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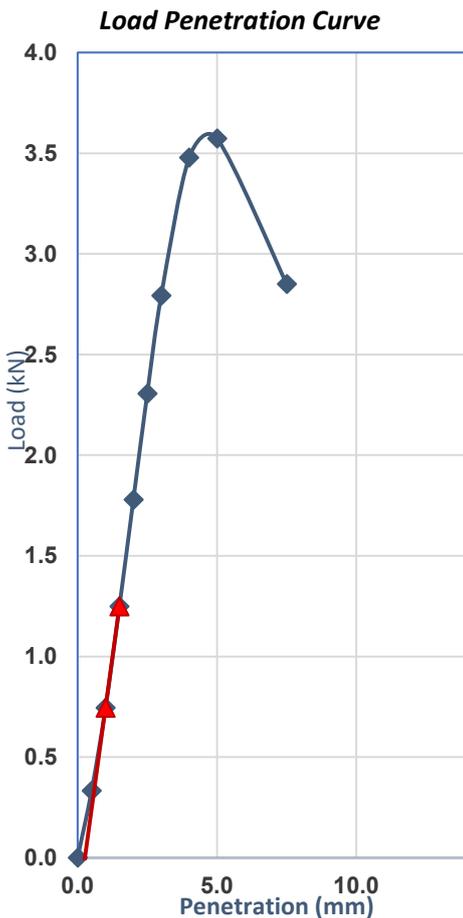
SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15574_1_SCBR
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15574
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH34, 0.5m	Date Tested:	12/10 - 17/10/22

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand, trace Gravel
 Sampling Method: Sampled by Client, Tested as Received



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	2.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m ³)	1.81	Optimum Moisture (%)	12.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m ³)	1.73	Moisture Content (%)	12.2
Density Ratio (%)	95.5	Moisture Ratio (%)	103.0

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m ³)	1.73	Dry Density Ratio (%)	95.5
Moisture Content (%)	14.2	Moisture Ratio (%)	120.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	12.3	Remaining Depth (%)	13.6

Correction applied to Penetration: 0.3mm
 Determined at a Penetration of: 2.5mm
 California Bearing Ratio (CBR): 19%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 18-October-2022



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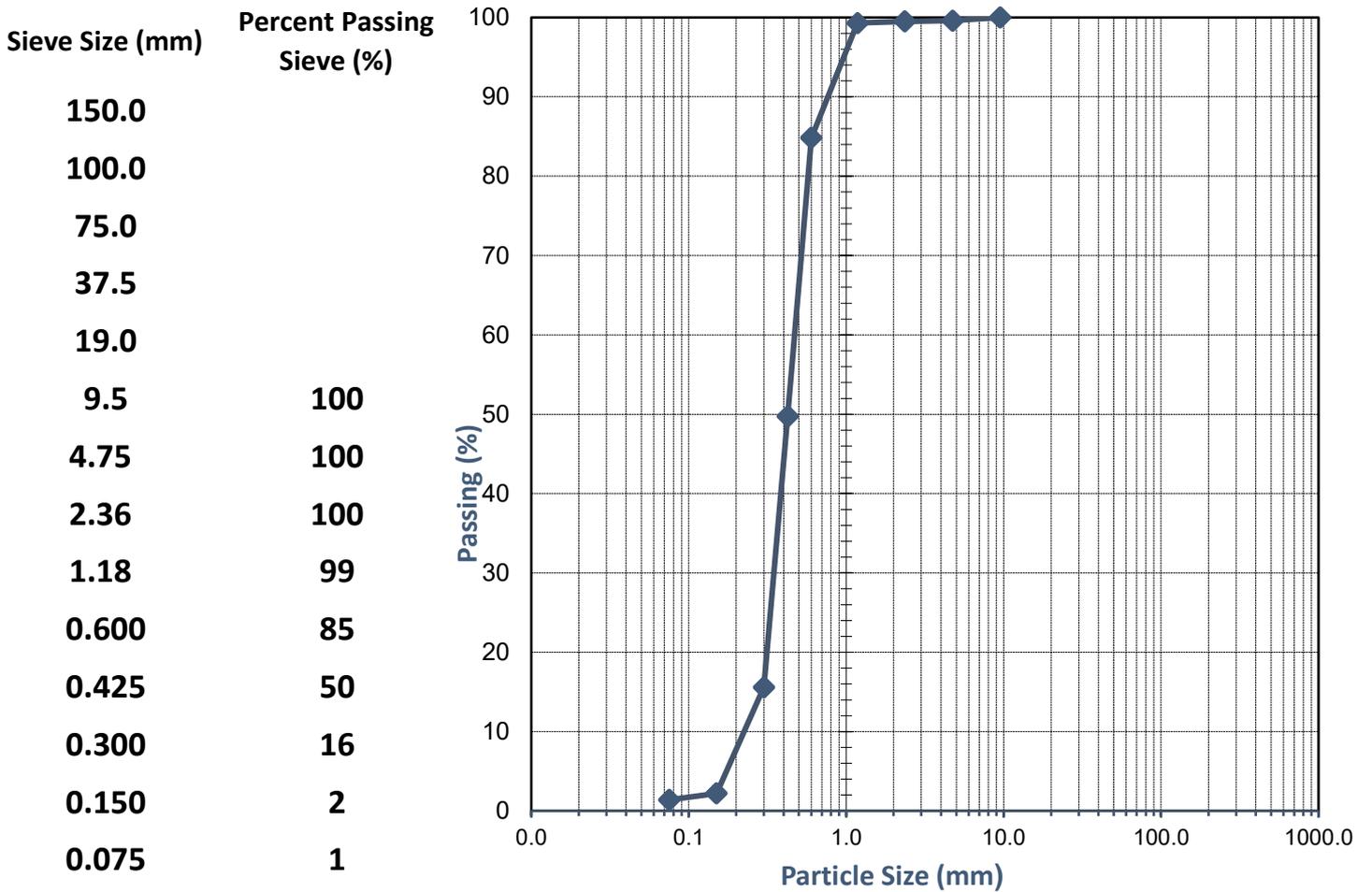
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15575_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15575
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH36, 0.5m	Date Tested:	12/10 - 13/10/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 13/October/2022



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TEST REPORT - AS 1289.5.2.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15575_1_MMDD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15575
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH36, 0.5m	Date Tested:	12/10/2022

TEST RESULTS - Modified Maximum Dry Density

Sampling Method:

Sampled by Client, Tested as Received

Sample Curing Time:

2 hrs

Method used to Determine Liquid Limit:

Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%):

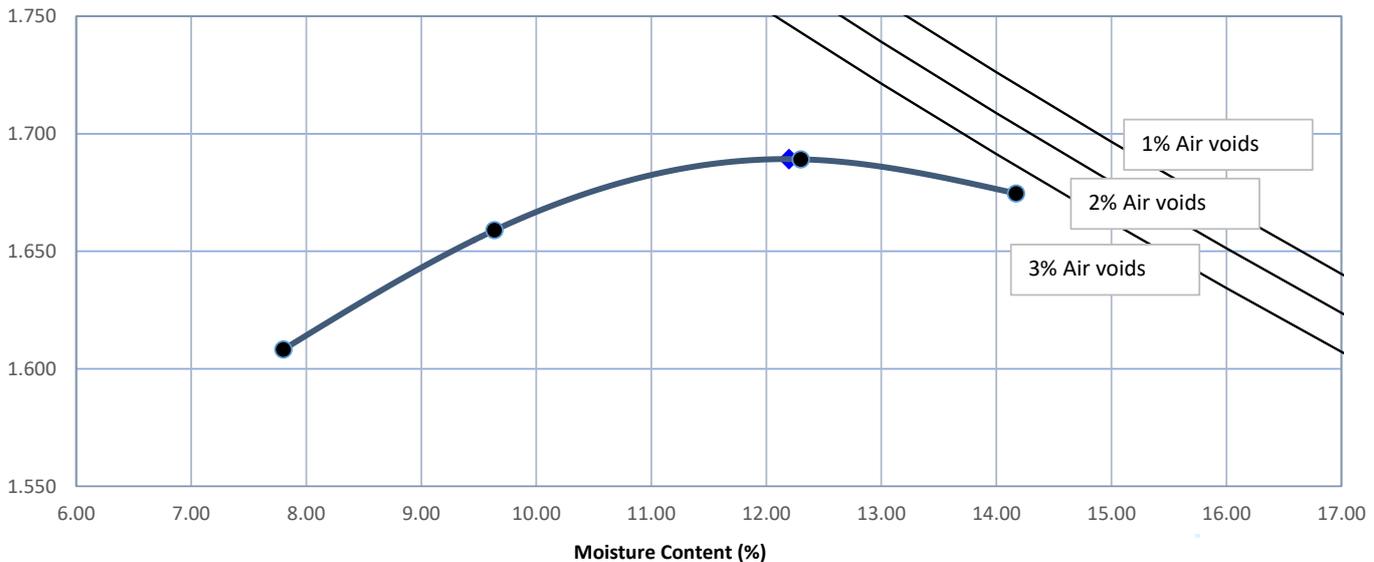
0

Material + 37.5mm (%)

-

Moisture Content (%)	7.8	9.6	12.3	14.2	
Dry Density (t/m ³)	1.608	1.659	1.689	1.675	

Dry Density (t/m³)



Modified Maximum Dry Density (t/m³)

1.69

Optimum Moisture Content (%)

12.0

Comments: The above air void lines are derived from a calculated apparent particle density of 2.307 t/m³

Approved Signatory:

Name: Cody O'Neill

Date: 13/October/2022



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TEST REPORT - AS 1289.6.1.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15575_1_SCBR
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15575
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH36, 0.5m	Date Tested:	12/10 - 17/10/22

TEST RESULTS - CALIFORNIA BEARING RATIO

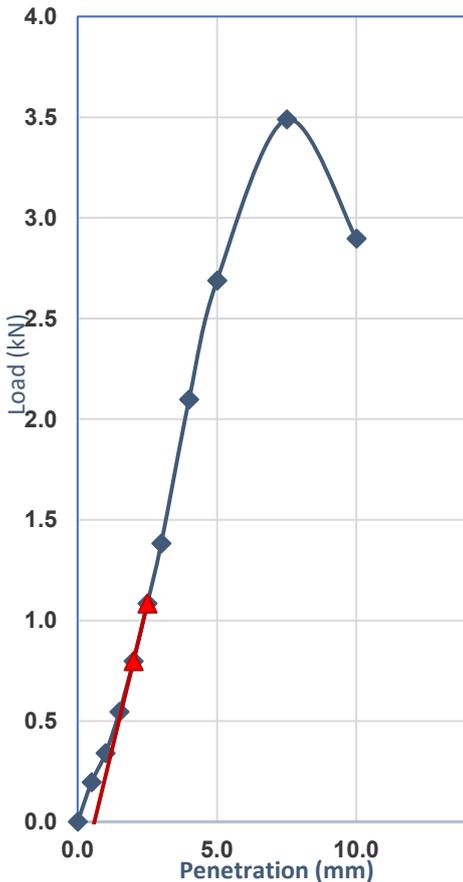
Sample Description:

Sand

Sampling Method:

Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details

Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	2.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m ³)	1.69	Optimum Moisture (%)	12.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction

Dry Density (t/m ³)	1.60	Moisture Content (%)	11.8
Density Ratio (%)	95.0	Moisture Ratio (%)	97.0

Specimen Conditions After Soak

Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m ³)	1.60	Dry Density Ratio (%)	95.0
Moisture Content (%)	14.2	Moisture Ratio (%)	116.5

Specimen Conditions After Test

Top 30mm Moisture (%)	12.7	Remaining Depth (%)	13.8
-----------------------	------	---------------------	------

Correction applied to Penetration: 0.6mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 15%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 18-October-2022



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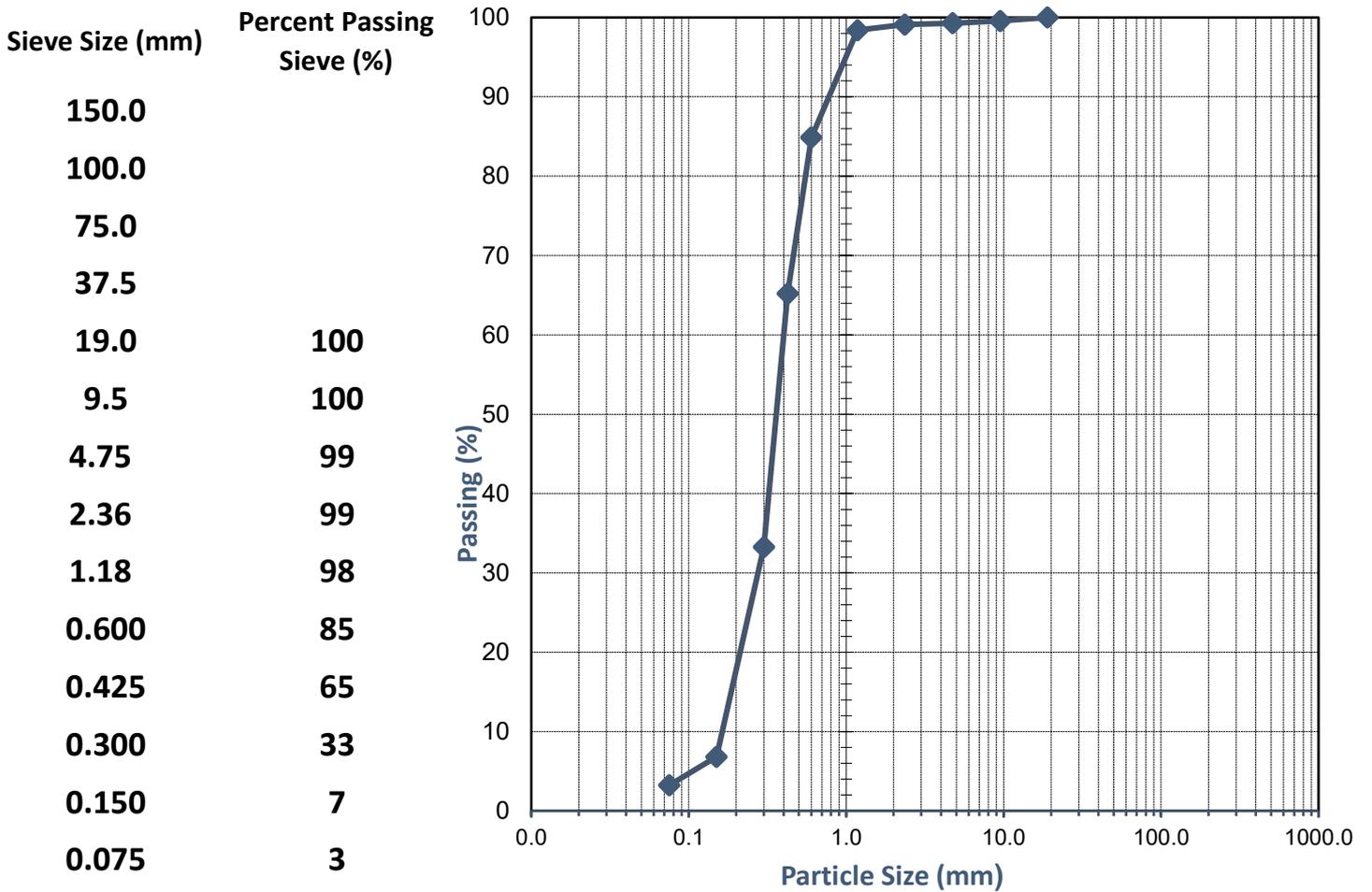
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15576_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15576
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH37, 0.9m	Date Tested:	13/10 - 14/10/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 14/October/2022



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TEST REPORT - AS 1289.5.2.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15576_1_MMDD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15576
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH37, 0.9m	Date Tested:	12/10/2022

TEST RESULTS - Modified Maximum Dry Density

Sampling Method:

Sampled by Client, Tested as Received

Sample Curing Time:

2 hrs

Method used to Determine Liquid Limit:

Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%):

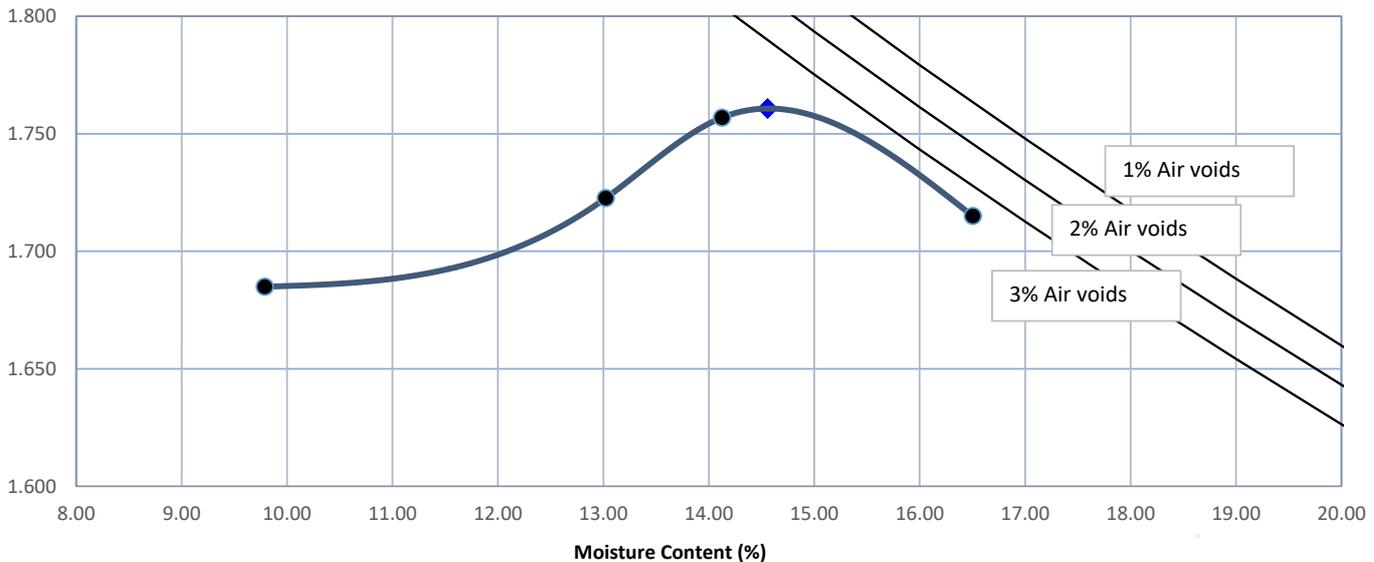
0

Material + 37.5mm (%)

-

Moisture Content (%)	9.8	13.0	14.1	16.5	
Dry Density (t/m ³)	1.685	1.723	1.757	1.715	

Dry Density (t/m³)



Modified Maximum Dry Density (t/m³)

1.76

Optimum Moisture Content (%)

14.5

Comments: The above air void lines are derived from a calculated apparent particle density of 2.523 t/m³

Approved Signatory:

Name: Cody O'Neill

Date: 13/October/2022



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TEST REPORT - AS 1289.6.1.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15576_1_SCBR
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15576
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH37, 0.9m	Date Tested:	12/10 - 17/10/22

TEST RESULTS - CALIFORNIA BEARING RATIO

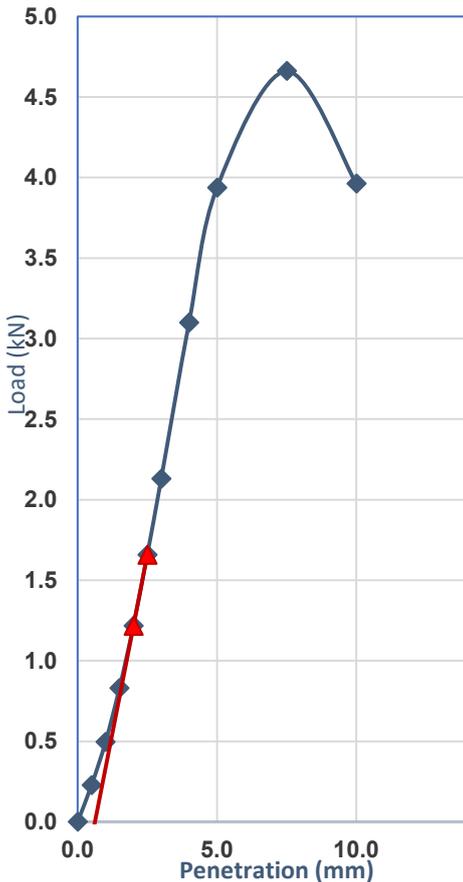
Sample Description:

Sand

Sampling Method:

Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details

Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	2.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m ³)	1.76	Optimum Moisture (%)	14.5
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction

Dry Density (t/m ³)	1.67	Moisture Content (%)	14.2
Density Ratio (%)	95.0	Moisture Ratio (%)	97.5

Specimen Conditions After Soak

Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m ³)	1.67	Dry Density Ratio (%)	95.0
Moisture Content (%)	14.8	Moisture Ratio (%)	101.0

Specimen Conditions After Test

Top 30mm Moisture (%)	13.7	Remaining Depth (%)	14.5
-----------------------	------	---------------------	------

Correction applied to Penetration: 0.6mm

Determined at a Penetration of: 5.0mm

California Bearing Ratio (CBR): 20%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 18-October-2022



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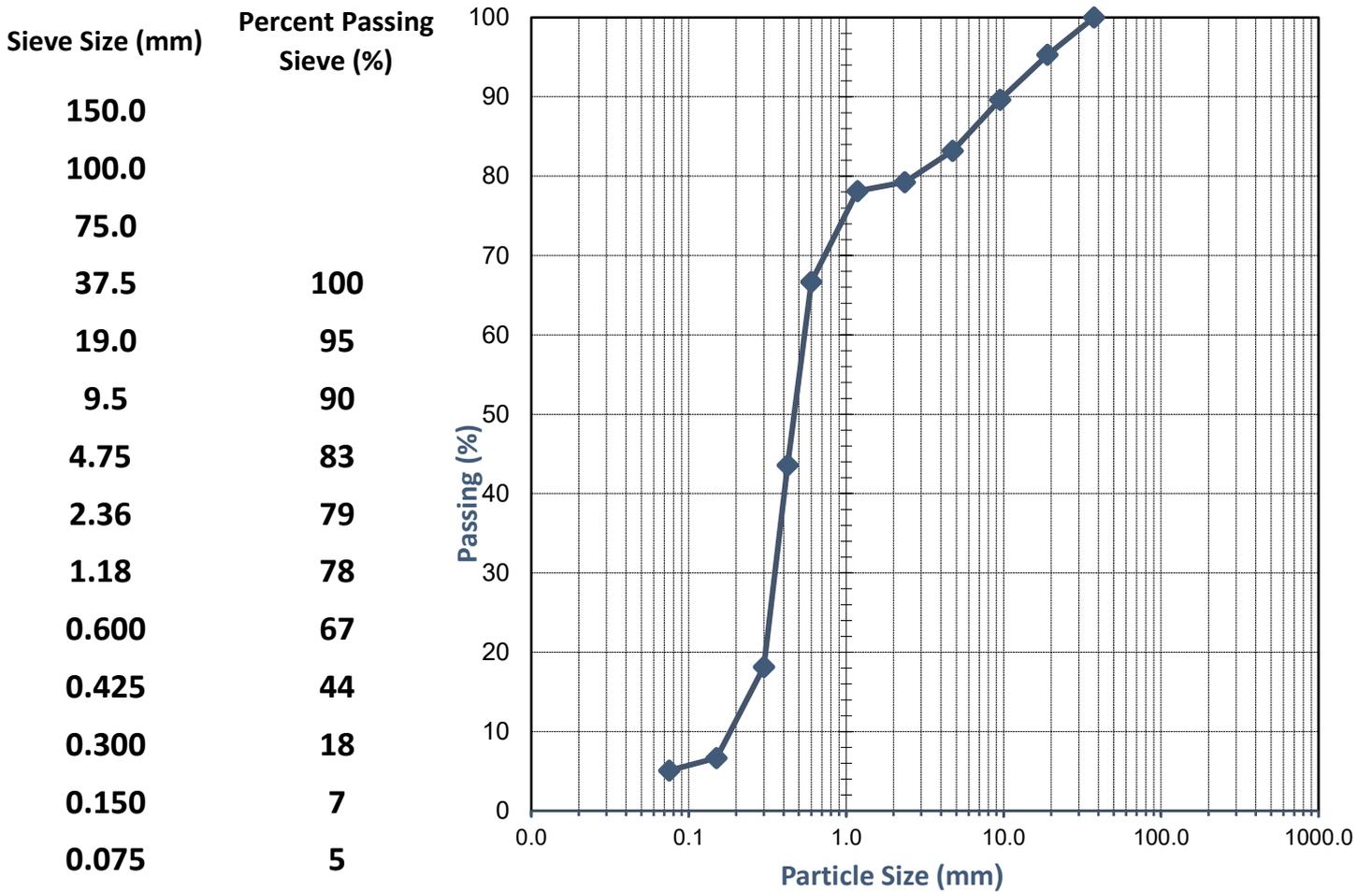
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15577_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15577
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH41, 0.6-0.9m	Date Tested:	13/10 - 14/10/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 14/October/2022



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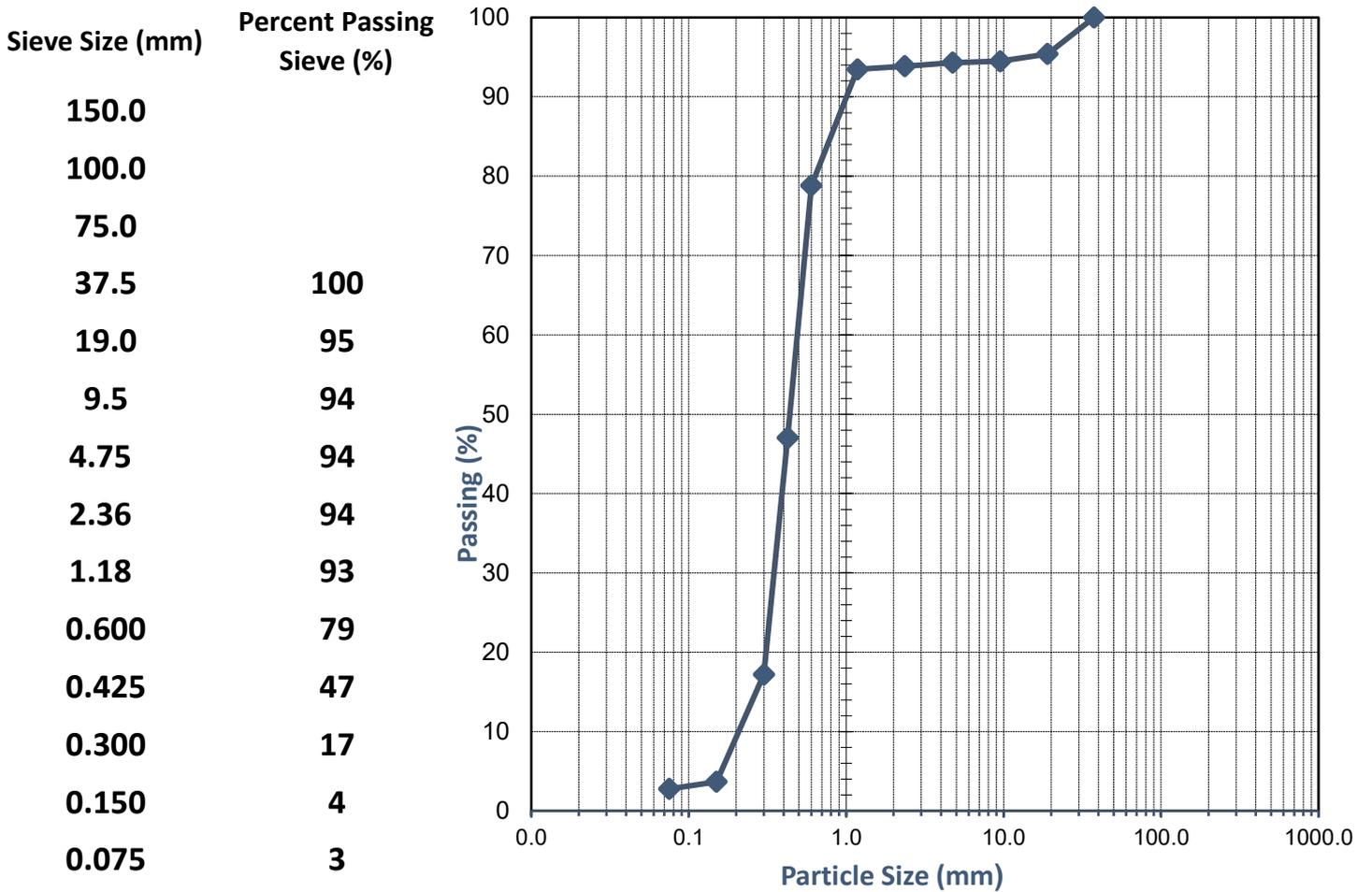
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15579_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15579
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH46, 0.85m	Date Tested:	13/10 - 14/10/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 14/October/2022



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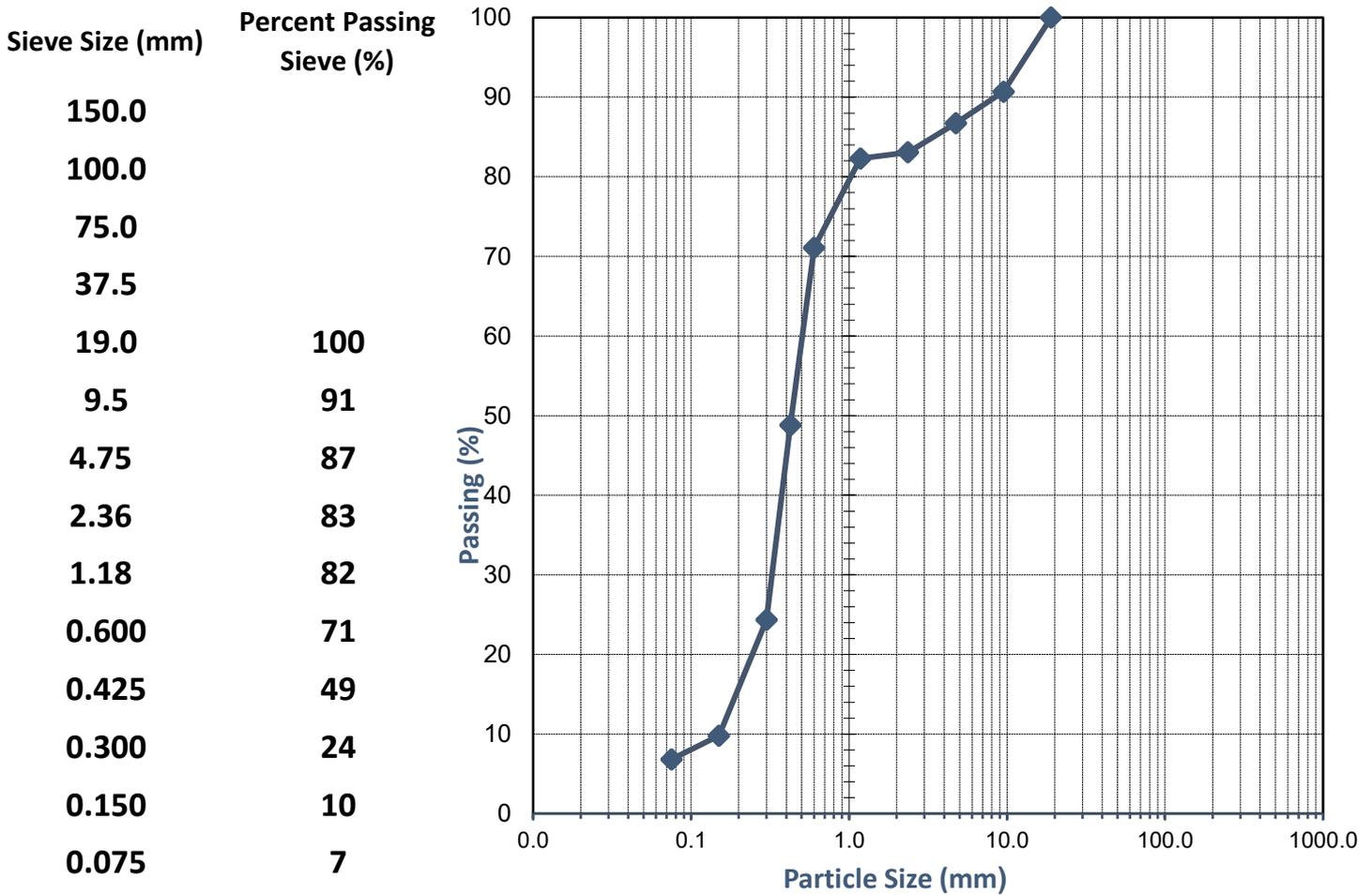
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15580_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15580
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH52, 0.6-1.0m	Date Tested:	13/10 - 14/10/2022

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Cody O'Neill

Date: 14/October/2022



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SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15580_1_MMDD
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15580
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH52, 0.6-1.0m	Date Tested:	12/10/2022

TEST RESULTS - Modified Maximum Dry Density

Sampling Method:

Sampled by Client, Tested as Received

Sample Curing Time:

2 hrs

Method used to Determine Liquid Limit:

Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%):

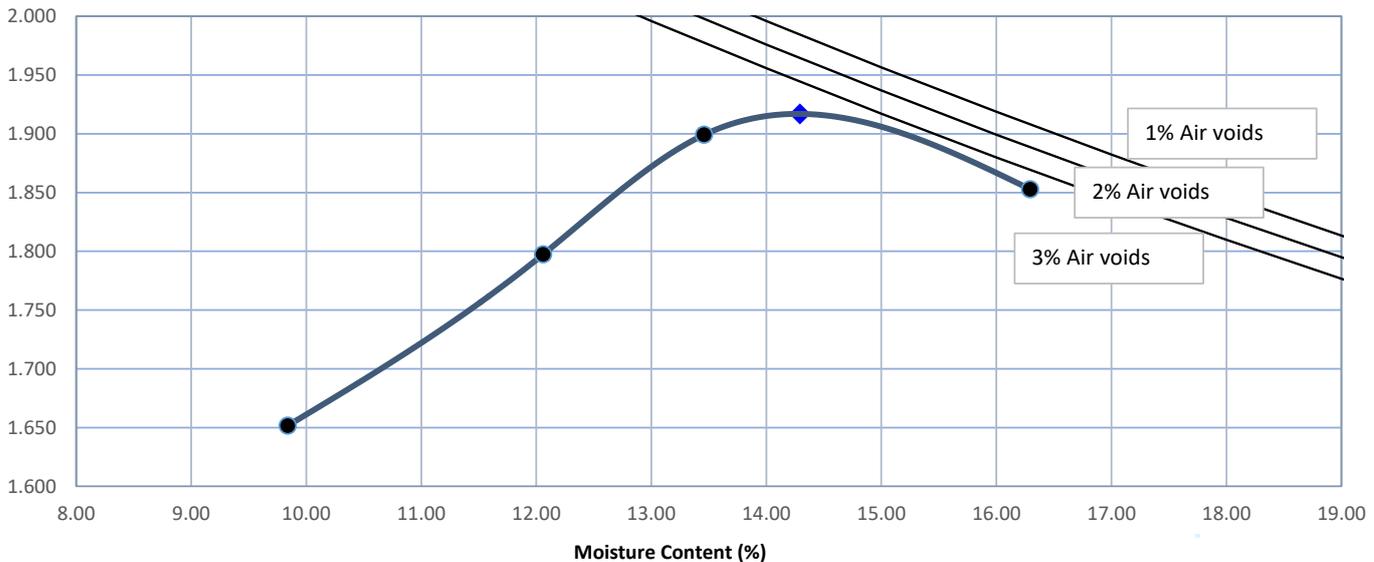
1

Material + 37.5mm (%)

-

Moisture Content (%)	9.8	12.1	13.5	16.3	
Dry Density (t/m ³)	1.652	1.797	1.899	1.853	

Dry Density (t/m³)



Modified Maximum Dry Density (t/m³)

1.92

Optimum Moisture Content (%)

14.5

Comments: The above air void lines are derived from a calculated apparent particle density of 2.809 t/m³

Approved Signatory:

Name: Cody O'Neill

Date: 13/October/2022



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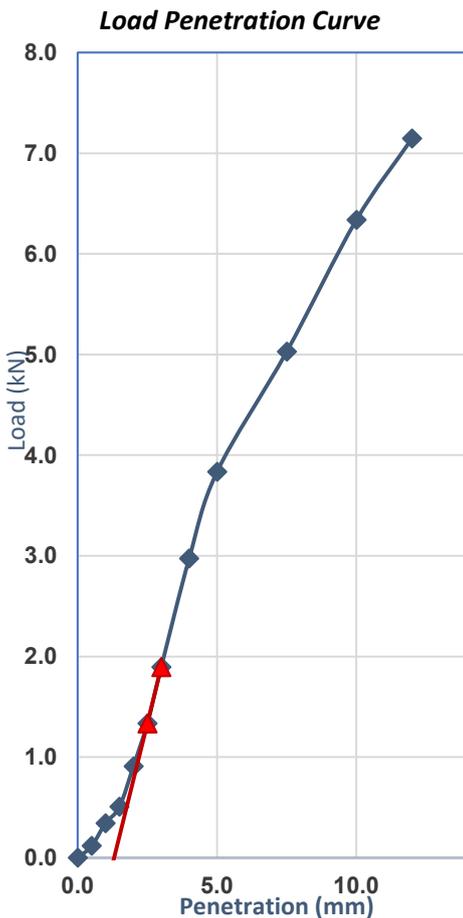
SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.6.1.1

Client:	Development WA	Ticket No.	S7666
Client Address:	-	Report No.	WG22.15580_1_SCBR
Project:	Proposed Multi-Residential Development	Sample No.	WG22.15580
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	Not Specified
Sample Identification:	BH52, 0.6-1.0m	Date Tested:	12/10 - 17/10/22

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand, trace Gravel
 Sampling Method: Sampled by Client, Tested as Received



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	2.0
% Retained 19.0mm	1	Excluded/Replaced	Excluded
Maximum Dry Density (t/m ³)	1.92	Optimum Moisture (%)	14.5
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m ³)	1.82	Moisture Content (%)	13.8
Density Ratio (%)	95.0	Moisture Ratio (%)	96.5

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m ³)	1.82	Dry Density Ratio (%)	95.0
Moisture Content (%)	16.9	Moisture Ratio (%)	118.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	16.2	Remaining Depth (%)	16.2

Correction applied to Penetration: 1.3mm
 Determined at a Penetration of: 5.0mm
 California Bearing Ratio (CBR): 25%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 18-October-2022



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Report on
Preliminary Geotechnical Investigation

Proposed Multi-Residential Development
Central Avenue, Mount Lawley, WA

Prepared for
DevelopmentWA

Project 216618.01
September 2023

Integrated Practical Solutions



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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		5 September 2023
Reviewer	 	5 September 2023

Douglas Partners acknowledges Australia's First Peoples as the Traditional Owners of the Land and Sea on which we operate. We pay our respects to Elders past and present and to all Aboriginal and Torres Strait Islander peoples across the many communities in which we live, visit and work. We recognise and respect their ongoing cultural and spiritual connection to Country.



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- Appendix E: ASS Results Summary and Laboratory Reports

Report on Preliminary Geotechnical Investigation

Proposed Multi-Residential Development

Central Avenue, Mount Lawley, WA

1. Introduction

This report presents the results of a preliminary geotechnical investigation undertaken for a proposed multi-residential development at Central Avenue, Mount Lawley, WA. The investigation was commissioned in a letter of award dated 30 May 2023 from Ivy Kim of DevelopmentWA and was undertaken in accordance with Douglas Partners' proposal P216618.01.P.001.Rev0 dated 16 May 2023.

It is understood that the proposed development of the site is likely to include both multi-storey apartment buildings and single storey residential buildings, with associated pavements and public open space.

Douglas Partners undertook an initial preliminary investigation across the site in September 2022, which encountered some uncontrolled fill and loose to medium dense sand at several locations across the site.

The purpose of this additional investigation is to assess the subsurface conditions at a greater testing frequency than the preliminary September 2022 geotechnical investigation and to provide further comments on:

- The suitability of the site for the proposed development;
- Site preparation, compaction and earthworks to allow the proposed development;
- Areas of foundation risk and possible extent of unsuitable soils (in particular any areas associated with landfill materials);
- Excavation conditions;
- The site classification in accordance with the requirements of AS 2870-2011;
- Appropriate earthquake design factor for the site, in accordance with AS 1170.4-2007.
- Parameters for the design of retaining structures and batter slopes.
- The suitability of the existing in situ materials for re-use as fill material;
- A design subgrade CBR, and modulus of subgrade reaction based on field observations and limited laboratory testing;
- The permeability of the soils and suitability for on-site stormwater disposal;
- The depth to groundwater, if encountered; and
- Assess the presence of acid sulfate soils.

The investigation included cone penetration tests with pore pressure measurement (CPTu) at 28 locations, the drilling of 49 boreholes, 17 in situ infiltration tests and laboratory testing of selected samples. The details of the field work are presented in this report, together with comments and recommendations on the items listed above.

2. Site Description

The site comprises the existing Edith Cowan University (ECU) Mount Lawley campus and covers an irregular shaped area of approximately 18.3 ha. It is bordered by Central Avenue to the north, Alexander Drive to the west, Bradford Street to the south-west and Stancliffe Street and Learoyd Street to the south-east.

At the time of the investigation, most of the northern portion of the site comprised car parking areas, while the central and southern portions of the site comprised mostly two to five storey university buildings. The north-eastern part of the site comprised a student residential village, with buildings generally two to four storeys high.

Publicly available LiDAR data indicates that the site is relatively flat, with surface levels between approximately RL 23 m AHD and RL 24 m AHD across the northern and central part of the site, falling to between approximately RL 21 m AHD and RL 22 m AHD across the southern and eastern parts.

The Perth 1:50 000 Environmental Geology sheet indicates that shallow sub surface conditions beneath the site comprise Bassendean Sand. An area mapped as sand derived from Tamala Limestone is shown on the mapping, approximately 100 m to the south of the site.

Published acid sulfate soil risk mapping indicates the site is located within an area of “moderate to low risk of acid sulfate soils occurring within 3 m of natural surface” but high to moderate risk of acid sulfate soils beyond 3 m of natural soil surface”. The mapping also indicates isolated areas mapped as “high to moderate risk” located approximate 45 m southwest and 300 m northwest of the site.

In addition to the above, it is understood that a portion of the site (marked with pink hatches on Drawing 1, Appendix B) is classified as “Remediated for Restricted Use” under the Contaminated Sites Act 2003. With reference to the Basic Summary of Records (available from www.dwer.wa.gov.au), it is understood the site was previously used as part of a sanitary landfill and is impacted with metals, hydrocarbons (polycyclic aromatic hydrocarbons) and asbestos. Previous investigations encountered sanitary waste up to 2.0 m thick and is covered with variable thickness of clean cover material. The site is subject to a Site Management Plan (SMP), which requires any disturbance or excavation below 0.3 m to be undertaken in accordance with the SMP.

3. Field Work Methods

Field work for the investigation was carried out between 19 June and 29 June 2023 and comprised:

- 28 cone penetration tests with pore pressure measurement (CPTu, locations 101 to 128).
- 49 boreholes (locations 129 to 177).
- Perth sand penetrometer (PSP) tests adjacent to borehole locations.
- 17 in situ infiltration tests (locations 138, 142, 155, 157, 158, 160, 161, 162, 164, 168, 169, 170, 172, 174, 175, 176 and 177).

The CPTu's use a 36 mm diameter instrumented cone with a following 130 mm long friction sleeve attached to rods of the same diameter, pushed continuously at a rate of 20 mm/sec into the soil by

hydraulic thrust from a truck rig. Strain gauges in the cone and sleeve measure resistance to penetration, friction along the sleeve, and water pore pressure during penetration. This data is recorded on a computer and analysed to assess the type, properties and condition of the materials penetrated. The CPTu's were pushed to termination depths of up to 19.5 m. Upon withdrawing the CPTu probe, each test hole was dipped in an attempt to measure groundwater levels.

The boreholes were drilled using either an 8-tonne backhoe equipped with a 250 mm diameter power auger attachment, or a 110 mm diameter hand auger, to a maximum depth of 2.5 m. The boreholes were logged in accordance with AS 1726-2017 by a geotechnical engineer from Douglas Partners. Soil samples were recovered from selected locations for subsequent laboratory testing.

Perth sand penetrometer (PSP) tests were carried out adjacent to the borehole locations in accordance with AS 1289.6.3.3 to assess the in-situ relative density of the shallow soils.

Infiltration testing was undertaken adjacent to Locations 138, 142, 155, 157, 158, 160, 161, 162, 164, 168, 169, 170, 172, 174, 175, 176 and 177, using the falling head method, at depths of between 0.7 m and 1.2 m.

Test locations and associated surface elevations were measured using a differential GPS with a reported accuracy of 0.1 m.

4. Field Work Results

4.1 Ground Conditions

Logs of the ground conditions and results of the field testing are presented in Appendix B, and should be read together with the notes defining descriptive terms and classification methods, in Appendix A. Drawing 3 in Appendix B shows the locations, depths and levels of the encountered uncontrolled fill and/or loose sand discussed in the following paragraphs.

Ground conditions encountered during both the current and previous investigations across the site generally comprised:

- **FILL (SAND, Organic SAND, Gravelly SAND and Sandy GRAVEL) SP, SP-SM and GP-GM** - Generally sandy fill (and granular pavement layers) which appears to generally be uncontrolled (apart from the pavement layers) from surface to depths of between 0.2 m and 2.3 m, encountered at most test locations. A limited amount of foreign inclusions such as glass, scrap metal, plastic, tile, concrete and brick fragments were observed at several locations, generally within the north eastern area shown as 'Classified Site' on Drawing 1, Appendix B (locations 41, 42, 43, 46, 49, 50A, 52, 163, 164, 165 and 167), but also elsewhere (locations 26, 32, 53, 132, 143, 144, 150, 153, 171, 172 and 173). An organic sandy fill layer was encountered from surface depth to 1.2 m and 1.0 m depth at locations 163 and 164 respectively, and from depths between 0.15 m and 1.8 m to 1.2 m and 2.1 m depth at locations 41 and 136. The CPT and PSP results indicate that the fill is variably compacted, between loose to very dense. Loose zones up to 2.1 m depth were encountered at several locations. The fill encountered at the site should be considered uncontrolled.

- **SAND SP** - fine to medium grained sand, generally medium dense, increasing in density with depth. Some zones of loose to medium dense sand were encountered at most locations, from depths of between 0.3 m and 2.7 m, extending to depths of between 1.9 m and 6.1 m. Layers of weakly cemented coffee rock were encountered or interpreted at some test locations (1, 21, 44, 110, 119, 120, 128, 165, 169 and 177).
- **Silty SAND SM, Clayey SAND SC and Sandy CLAY CL-CH** - various layers of Silty Sand, Clayey Sand and Sandy Clay often interbedded within layers of sand, and generally either medium dense or very stiff to hard, encountered from depths between 10.2 m and 15 m, at most CPT locations excluding 2, 3 and 19.

4.2 Groundwater

Groundwater was observed within several boreholes and CPT holes between 19 and 29 June 2023. Groundwater was also interpreted from pore pressure data of the CPTu. Groundwater levels generally ranged between approximately RL 18.4 m AHD and RL 19.7 m AHD across the site, as shown in Table 1 below. Groundwater contours based on data collected during this and the previous investigation have been provided in Drawing 3, Appendix B. The boreholes and CPT were immediately backfilled following sampling, which precluded longer-term monitoring of groundwater levels.

Table 1: Summary of Groundwater Levels (between 19 and 29 June 2023)

Location	Ground Surface Level ^[1] (m AHD)	Groundwater Depth (m)	Groundwater Level ^[2] (m AHD)
101	21.7	2.8	18.9
102	23.3	4.4	18.9
103	21.9	3.5	18.4
104	23.1	4.2	18.9
105	23.8	5.0	18.8
106	23.6	4.6	19.0
107	23.1	4.0	19.1
108	23.1	4.0	19.1
109	22.5	3.3	19.2
110	22.7	3.3	19.4
111	22.5	3.0	19.5
112	22.6	3.3	19.3
113	22.8	3.5	19.3
114	22.8	3.8	19.0
115	22.3	3.1	19.2
116	22.3	3.0	19.3

Location	Ground Surface Level ^[1] (m AHD)	Groundwater Depth (m)	Groundwater Level ^[2] (m AHD)
117	22.4	3.0	19.4
118	21.9	2.4	19.5
119	22.1	2.6	19.5
120	22.8	3.1	19.7
121	21.8	2.1	19.7
122	23.6	4.8	18.8
123	23.7	4.5	19.2
124	23.3	4.2	19.1
125	24.0	5.0	19.0
126	24.0	4.8	19.2
127	23.7	4.7	19.0
128	22.6	3.6	19.0
165	21.4	1.85	19.6
167	21.3	1.8	19.5

Notes for Table 1: [1]: Surface level measured using differential GPS.
 [2]: Groundwater Level = Surface Level – Groundwater Depth.

It should be noted that groundwater levels are affected by climatic conditions and land usage and will therefore vary with time.

The Perth Groundwater Atlas (2004) indicates that the groundwater was at a level of between approximately RL 12 m AHD and RL 13 m AHD in May 2003 (end of summer, low seasonal level), i.e. approximately 8 m to 10 m below existing surface levels. The Perth Groundwater Atlas (1997), indicates that the estimated maximum groundwater level was approximately between RL 20.5 m AHD and RL 22 m AHD, i.e. approximately 1 m to 2 m below existing surface levels.

4.3 Soil Permeability

In-situ infiltration tests using a falling head method were carried out at depths of between 0.7 m to 1.2 m at 17 locations (138, 142, 155, 157, 158, 160 to 162, 164, 168 to 170, 172, 174 to 177). Estimated permeability values were derived from the in situ test data using a formula based on a calculation by Hvorslev (1951). Results of the permeability analysis are summarised in Table 2.

Table 2: Summary of Permeability Analysis

Test Location	Depth (m)	Measured Permeability (m/day)	In situ Ground Conditions at Testing Depth
138	0.7	3	FILL / SAND SP, trace silt and gravel, dense to very dense
142	1.2	>20	SAND SP, trace silt, dense (Sand derived from Tamala Limestone)
155	1.1	>20	SAND SP, trace silt, dense (Bassendean Sand)
157	1.0	>20	SAND SP, trace silt, medium dense (Sand derived from Tamala Limestone)
158	1.1	>20	FILL / SAND SP, trace silt and gravel, medium dense
160	1.0	>20	SAND SP, trace silt, medium dense (Sand derived from Tamala Limestone)
161	1.0	>20	SAND SP, trace silt, dense (Bassendean Sand)
162	1.0	9	SAND SP, trace silt (Bassendean Sand)
164	1.1	6	SAND SP, trace silt (Bassendean Sand)
168	1.0	>20	SAND SP, trace silt, medium dense (Bassendean Sand)
169	1.0	11	SAND SP, trace silt, medium dense (Bassendean Sand)
170	1.0	6	FILL / SAND SP, trace silt and gravel, dense to very dense
172	1.0	>20	FILL / SAND SP, trace silt and gravel, medium dense
174	1.0	>20	SAND SP, trace silt, medium dense (Bassendean Sand)
175	1.0	>20	SAND SP, trace silt (Sand derived from Tamala Limestone)
176	1.0	14	SAND SP, trace silt, dense (Bassendean Sand)
177	1.0	>20	SAND SP, trace silt, medium dense to dense (Bassendean Sand)

5. Laboratory Testing

5.1 Geotechnical Laboratory Testing

A geotechnical laboratory testing programme was carried out by a NATA registered laboratory and comprised:

- the particle size distribution on fourteen samples;
- the organic content on ten samples;
- the modified maximum dry density (MMDD) and optimum moisture content (OMC) on five samples; and
- the California bearing ratio (CBR) of the five samples above. The CBR value was assessed after a 4-day soaking period, compacted at 95% MMDD, with a 4.5 kg surcharge.

The test report sheets are given in Appendix C and the results are summarised in Tables 3 and 4.

Table 3: Results of Laboratory Testing for Soil Identification

Test Location	Depth (m)	Fines (%)	Sand (%)	Gravel (%)	OC (%)	Material
135	0.5	0	97	3	-	SAND SP, trace silt
136	0.5	2	97	1	-	FILL / SAND SP, trace silt and gravel
136	2.0	-	-	-	3.2	FILL / Organic SAND SP-SM, with silt
138	0.7	3	92	5	-	FILL / SAND SP, trace silt and gravel
140	0.3	-	-	-	0.6	FILL / SAND SP, trace silt
144	0.5	4	91	5		FILL / SAND SP, trace silt and gravel
153	0.5	5	83	12	1.2	FILL / SAND SP, trace silt and gravel
155	0.5	3	95	2	0.6	FILL / SAND SP, trace silt and gravel
162	1.0	2	98	0	-	FILL / SAND SP, trace silt
163	1.0	5	83	12	4.1	FILL / Organic SAND SP, trace silt and gravel
164	0.5	7	71	22	6.7	FILL / Organic SAND SP-SM, with silt and gravel
164	1.1	3	95	2	-	SAND SP, trace silt

Test Location	Depth (m)	Fines (%)	Sand (%)	Gravel (%)	OC (%)	Material
166	1.0	-	-	-	0.7	FILL / SAND SP, trace silt
170	1.0	2	92	6	1.3	FILL / SAND SP, trace silt and gravel
174	1.0	2	98	0	-	SAND SP, trace silt
175	1.1	2	98	0	-	SAND SP, trace silt
176	0.3	-	-	-	1.4	FILL / SAND SP, trace silt
176	1.0	2	95	3	-	SAND SP, trace silt

Notes: Fines = Finer than 75 μ m.

Sand = Between 2.36 mm and 75 μ m.

Gravel = Larger than 2.36 mm.

OC = Organic Content.

Table 4: Summary of Laboratory Testing for Pavement Design Parameters

Test	Depth (m)	OMC (%)	MMDD (t/m ³)	CBR (%)	Material
135	0.5	15.5	1.71	13	SAND SP, trace silt
136	0.5	13.0	1.72	16	FILL / SAND SP, trace silt and gravel
144	0.5	9.0	1.77	15	FILL / SAND SP, trace silt and gravel
153	0.5	11.5	1.87	18	FILL / SAND SP, trace silt and gravel
155	0.5	14.0	1.77	20	FILL / SAND SP, trace silt and gravel

Notes: - OMC: optimum moisture content - MMDD: modified maximum dry density - CBR: California bearing ratio

5.2 Acid Sulfate Soil Laboratory Testing

Acid sulfate soil screening tests were undertaken on all soil samples retrieved from test locations 157, 161, 162, 164, 168, 169, 174 and 175, by MPL Laboratories Pty Ltd (MPL). The screening tests comprised measurement of pH of the soil in water (pH_F) and the pH of the soil after oxidation with a 30% solution of hydrogen peroxide (pH_{FOX}). The results of these tests provide an indication of the presence of actual and potential acid sulfate soils and should be considered as qualitative only.

Following the review of the screening test results, selected soil samples were submitted to MPL Laboratories to undergo the Chromium suite of testing. This laboratory test quantifies the existing acidity and potential acidity derived from sulfide oxidation which is reported as a net acidity. Soil samples were selected for laboratory analysis with due consideration of the following:

- Screening results, with particular focus on the lowest reported pH_F or pH_{FOX} within a soil stratum at each test location;
- Reported reaction strength; and
- Visual identification of the soils encountered.

If the net acidity, calculated from the results of the titratable actual acidity (TAA) and the chromium reducible sulfur (S_{CR}) is greater than the appropriate action criterion for the amount of disturbance, it is considered that acid sulfate soils are present and excavations within this material would require specific management. In this regard, the most conservative action criterion of 0.03% S has been adopted for the assessment. The acid sulfate soil laboratory results are presented in Appendix E, together with the laboratory reports and associated chain-of-custody reports.

With reference to the summary of acid sulfate soil results presented in Table E-1 in Appendix E, the following comments are made:

- The results for pH_F are not indicative of actual acid sulfate soils conditions at the sampling locations to a depth of up to 2.5 m;
- The results for pH_{FOX} are not indicative of potential acid sulfate soils conditions at the sampling locations to a depth of up to 2.5 m; and
- Calculated net acidity values using S_{CR} , excluding acid neutralising capacity, were below the adopted action criterion of 0.03% S for all samples submitted for analysis.

6. Proposed Development

It is understood that the exact development plans for the site are yet to be confirmed, however it is likely to include both multi-storey apartment and single storey residential buildings, with associated pavements and public open space.

7. Comments

7.1 Site Suitability

Results of the investigation indicate that the site is generally underlain by fill and sand as described in Section 4.1 above. The following geotechnical constraints were identified:

- The presence of fill across the majority of the site which should generally be considered as uncontrolled, owing to its variable compaction and deleterious inclusions, and the absence of any QA/QC documentation regarding its placement.
- The uncontrolled fill across the site is considered to be an unsuitable foundation material for the proposed development in its current condition. Treatment measures for the uncontrolled fill are presented in Sections 7.4 and 7.5 and include either over-excavation, screening and replacement, or possible in situ compaction. Following demolition of the existing buildings across the site, further investigation at detailed design stage is suggested, which would include a combination of

test pits and CPT, which will assist in providing further direction on the appropriate treatment measures. The required site preparation measures will also be influenced by the type of proposed structure at that location.

- Organic sand fill (also considered as uncontrolled fill) was encountered at some locations (41, 136, 163 and 164) and forms an unsuitable foundation material and will require over-excavation and replacement. This material is unsuitable for re-use as structural fill following over-excavation in its current condition. Preliminary comments on the re-use potential of this organic sand fill, following its blending with clean sand, are presented in Section 7.5. Alternatively, this organic sand fill could be excavated and removed from site.
- Some zones of loose to medium dense sand, encountered to depths of between 1.3 m and 6.1 m at several locations and possibly occurring elsewhere across the site. Drawing 3, Appendix B, shows the depth and level of the base of uncontrolled fill and/or loose sand (where proven). Zones of loose to medium dense sand deeper than 2 m following site preparation are unlikely to impact low-rise residential development. Locations where there are impacts on multi-storey buildings are shown on Drawing 2, Appendix B.
- Groundwater was measured at depths of between 1.8 m and 5.0 m during the investigation in June 2023, and may impact excavations required during the earthworks for the over-excavation and remediation of areas of uncontrolled fill and loose sand. The groundwater level may also impact basement excavations, if proposed for the multi-storey structures, and excavations for service trenches.

From a geotechnical standpoint, the land is physically capable of development, provided that the geotechnical constraints outlined above are taken into consideration, and the provisions outlined in the subsequent subsections of the report are incorporated in the development plans.

Detailed geotechnical investigation of the site is recommended during the design phases of the development. In particular, further testing is recommended following demolition of the existing structures on-site and once building locations and types are known.

The possible impact of contamination and/or landfill gases associated with the former landfill area and of the uncontrolled fill encountered across the site on the proposed development should be considered. It is understood that an environmental consultant has been engaged to provide advice on these matters. This report is written exclusively from a geotechnical perspective, and guidance on environmental issues associated with the former landfill and the uncontrolled fill encountered across the entire site, should be sought from this other consultant.

7.2 Site Classification

The shallow ground conditions beneath the site generally comprise uncontrolled fill overlying sand, as described in Section 4.

Based on the results of the investigation and in accordance with AS 2870-2011, a site classification 'Class P' generally applies to the site, owing to the presence of uncontrolled fill and loose sand. Following suitable site preparation and assessment by a geotechnical engineer, it is anticipated that the site could generally be re-classified as 'Class A' in accordance with AS 2870-2011. Suitable site preparation includes treatment or excavation and replacement of the uncontrolled fill encountered

across the site and suitable densification of existing loose soils within the depth of influence of the proposed buildings. Site preparation is further discussed in Section 7.4.

Drawing 2, Appendix B, presents the test locations which are currently classified as 'Class P', other test locations which could be re-classified as 'Class A' following standard site preparation measures, as well as locations which may require some more onerous site preparation to achieve a 'Class A' site classification. More onerous site preparation may include over-excavation of loose soils, and replacement in a controlled manner.

It should be noted that AS 2870-2011 is applicable to residential structures and *"other forms of construction including some light industrial, commercial and institutional buildings if they are similar to houses in size, loading and superstructure flexibility"*. The applicability of this standard should be considered for proposed buildings, although large multi-storey buildings will likely be outside the scope of the standard.

7.3 Soil Classification for Earthquake Design

The ground conditions encountered beneath the site generally comprise medium dense and denser sand, with some isolated zones of loose to medium dense sand, overlying very stiff to hard clayey materials from depths between 10.2 m and 15 m. An earthquake design soil sub-class of 'Ce' and a hazard factor (Z) of 0.09 are considered appropriate for this site in accordance with AS 1170.4-2007.

7.4 Site Preparation

Following demolition and prior to excavation for foundations and/or placement of fill, all existing structures, pavement layers, services, vegetation and topsoil should be removed from the development area and removed from site. Pavement layers could be stockpiled for possible re-use, subject to further assessment of their suitability for the proposed re-use.

The uncontrolled fill encountered across the site forms an unsuitable foundation material in its current condition. It should either be compacted in situ, or excavated, treated and replaced in a controlled manner, or excavated and removed from all proposed building and pavement envelopes. The appropriate approach for individual structures will depend on the conditions and thickness of the existing fill and the type of proposed structures and should be assessed at design stage of the proposed development once further information about the proposed structures and their locations are known. The sand fraction of the uncontrolled fill (excluding the organic sand fill) is likely to be suitable for re-use as structural fill following screening of oversized and foreign particles where required, as discussed in Section 7.5. The organic sand fill is unsuitable for re-use in its current condition and will require blending (and possible screening), as discussed in Section 7.5, prior to any possible re-use. It is recommended that a geotechnical engineer supervises the excavation and treatment of the uncontrolled fill.

Drawing 2, Appendix B, presents test locations where standard site preparation measures are likely to be suitable (i.e. stripping of vegetation and topsoil and suitable test rolling).

Following removal of existing structures, pavement, services, vegetation, topsoil, uncontrolled fill and any cut required prior to filling, it is recommended that the subgrade beneath proposed building and

pavement envelopes be test rolled using a heavy (minimum of 14 t deadweight) vibrating smooth drum roller.

Any areas that show signs of excessive deformation during compaction should be continually compacted until deformation ceases. Alternatively, the poor-quality material giving rise to deformation could be excavated and replaced with controlled fill compacted to 95% modified maximum dry density. Care should be taken not to operate heavy vibrating plant immediately adjacent to existing buildings and services.

Appropriate compaction levels should be confirmed by a geotechnical engineer based on the development nature and settlement tolerances, prior to construction.

Owing to the variable depths (up to 6 m below existing levels) of zones of loose to medium sand, appropriate care will be required during design and construction so that the proposed buildings are founded on soils of suitable density. Achieving suitable density for sand beneath proposed footing systems might require excavation of the loose soils and replacement of the excavated sand in compacted layers. The requirement for and depth of excavation will depend on the type of buildings and their footing geometry. In addition, the base of all footing excavations will require compaction prior to footing construction, for instance using a vertical rammer or vibrating plate compactor, followed by geotechnical engineer assessment.

For standard low-rise residential development (residential homes up to two storeys), a raft of suitably compacted soils to a depth of about 2 m is generally considered suitable for such development.

Alternatively, multi-storey buildings could be founded on piles if a shallow footing system that would include pad and strip footings or a raft is unsuitable. Further investigation and assessment should be undertaken following demolition and once building specifics are known.

7.5 Re-use of Excavated Material

Based on the nature of the materials encountered during the investigation, it is anticipated that in situ natural sand excavated from the site should be generally geotechnically suitable for re-use as structural fill material, provided it is free from organic matter, particles greater than 150 mm in size, and possible foreign items.

The uncontrolled fill encountered across the majority of the site (excluding the organic sand fill) mostly comprised sand (besides various foreign inclusions) and should generally be geotechnically suitable for re-use, provided it is free from organic matter and particles greater than 150 mm in size. Depending on the amount of oversized particles, screening or raking of the fill may be required.

Organic sand fill, such as encountered at locations 136, 163 and 164, and likely elsewhere on site, is unsuitable for re-use as structural fill in its current condition. This organic sand fill will be required to be blended with clean sand fill at a preliminary blend ratio of 3:1 (clean sand : organic sand) prior to re-use (following any screening requirements, depending on the presence of oversized particles). Blended fill is likely to be of a lower soil permeability compared to clean sand, so adverse implications on site drainage should be taken into account, if such material is to be re-used as structural fill, particularly in areas of shallow fill.

Imported fill, if required, should comprise free draining cohesionless sand with less than 5% fines. This material should also be free from organic matter and particles greater than 150 mm in size. It is recommended that any sand fill be placed in layers, near its optimum moisture content with each layer compacted to achieve not less than 10 blows per 300 mm rod penetration when tested using a Perth sand penetrometer.

7.6 Excavations

7.6.1 Excavation Conditions

The encountered shallow ground conditions generally comprise sandy soils. Layers of weakly cemented coffee rock were encountered or inferred at some test locations but are not anticipated to significantly impact excavation. Therefore, conventional earthmoving equipment (such as large excavators) is anticipated to be suitable for excavations across the site.

Owing to the shallow groundwater encountered across the site (contours of encountered groundwater are shown on Drawing 3, Appendix B), excavations may require some dewatering. At this stage, dewatering using spears is considered likely to be suitable. It is recommended that significant excavation work is scheduled during the summer, where possible, to assist dewatering efforts.

7.6.2 Safe Batter Slopes

During construction, temporary batter slopes in excavations up to 3 m deep in sand should be no steeper than 1.5:1 (H:V) if not retained. This batter slope is valid provided that no surcharge loads (including live loads such as vehicles and machinery) apply within the slope height behind the crest. Any excavation that is adjacent to existing buildings (if any) should be supported, or the existing footings should be underpinned.

7.6.3 Retaining Structures

For retaining walls where the wall will be free to deflect, design may be based upon 'active' earth pressure coefficients (K_a), assuming a triangular earth pressure distribution. This would comprise any non-propped walls or laterally unrestrained walls (e.g. cantilever type walls). Where structures or services are near any crest, or if the retaining walls are laterally restrained by the structure are not free to deflect, retaining wall design should be based on 'at rest' earth pressure coefficients (K_0). Earth pressure parameters are given in Table 5 below. In addition to the soil pressure, wall design should also allow for external loads such as buildings, live loads and possible hydrostatic pressure.

Table 5: Soil Parameters for Retaining Wall Design

Soil Type	Soil Unit Weight Above Water Table γ (kN/m ³)	Drained Angle of Friction Φ' (Degrees)	Undrained Shear Strength C_u (kPa)	Coefficient of Earth Pressure – Active K_a	Coefficient of Earth Pressure – at Rest K_0	Coefficient of Earth Pressure – Passive K_p
Sand – loose to medium dense	18	30	0	0.33	0.5	3
Sand – medium dense or denser, or controlled sand fill	20	32	0	0.31	0.47	3.2

7.7 Pavement Design Parameters

As noted in Section 4.1, the shallow soils across the site generally comprise sandy soils.

Based on field observations, limited laboratory testing and Douglas Partners' experience, a subgrade CBR of 12% is recommended for the design of flexible pavements founded on sand subgrade, provided that the subgrade is compacted to at least 95% modified dry density.

A modulus of subgrade reaction of 55 kPa/mm is recommended for the sand subgrade for rigid pavement design, based on the abovementioned CBR value of 12%. It should be noted that this value only applies to wheel loads, as modulus of subgrade reaction is a function of the size of the loaded area. Therefore, a site-specific assessment should be undertaken if moduli of subgrade reaction are required for larger loaded areas (e.g. design of pads).

7.8 Stormwater Drainage and Permeability

Results of the permeability assessment in Section 4.3 indicate field permeability values of between 3 m/day and greater than 20 m/day for the sandy fill materials encountered across the site, and field permeability values of between 6 m/day and greater than 20 m/day for the natural sandy soils across the site.

The fill materials encountered across the site are likely to be of variable composition and fines content. As such, the permeability of these materials is also likely to be varied, and drainage systems should preferably not be founded in these materials unless a lower bound value of soil permeability is assumed in their design, or other similar provisions are implemented (such as large infiltration systems, interconnection between infiltration systems, or other).

Observed ground conditions and permeability results indicate that on-site stormwater disposal using soakwells and sumps is generally feasible where ground conditions at the base of such systems comprise natural sand and there is a suitable clearance above groundwater.

Given that the sand at the site is generally loose to medium dense near surface, a preliminary design permeability value of 5 m/day is suggested where sufficient clearance exists above groundwater, at this preliminary stage of the project. Targeted assessment at proposed infiltration basin locations, if any proposed, is also recommended.

The infiltration capability of sand often reduces over time due to silt build up at the base of soakwells and sumps, and therefore such systems should be regularly maintained.

7.9 Acid Sulfate Soils

Based on the results of soil sampling and analysis, acid sulfate soil in excess of adopted action criterion were not encountered to a depth of 2.5 m at test locations 157, 161, 162, 164, 168, 169, 174 and 175. As such, the risk of acid sulfate soil to a depth of 2.5 m is considered to be low, which is in broad agreement with the published risk mapping.

With reference to Department of Water and Environmental Regulation (DWER) endorsed guidelines, investigation of acid sulfate soil in areas of moderate to low risk is recommended where any of the following works are proposed:

- Earthworks extending to beyond 3 m below the natural soil surface;
- Soil or sediment disturbance of greater than 100 m³ or more with excavation below the natural water table;
- Lowering of the water table, whether temporary or permanent (e.g. for groundwater abstraction, dewatering, installation of new drainage, or modification to existing drainage).

As such, the need to undertake an acid sulfate soil investigation should be reviewed following completion of detailed design once the excavation and dewatering requirements for site development are known.

8. References

AS 1170.4. (2007). *Structural Design Actions, Part 4: Earthquake Actions in Australia*. Reconfirmed 2018. Incorporating Amendments 1 & 2: Standards Australia.

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AS 1289.6.3.3. (1997). *Methods for testing soils for engineering purposes - Soil strength and consolidation tests - Determination of the penetration resistance of a soil - Perth sand penetrometer test*. Reconfirmed 2013: Standards Australia.

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Department of Environment. (2004). *Perth Groundwater Atlas, Second Edition, Dec 2004*.

Hvorslev, M. J. (1951). *Time lag and soil permeability in groundwater observations*. US Army Corps of Engineers Waterways Experiment Observation Station, Bulletin 36, Vicksburg, Mississippi.

9. Limitations

Douglas Partners (DP) has prepared this report for this project at the ECU Mount Lawley Campus on Central Avenue in Mount Lawley, WA in accordance with DP's proposal dated 16 May 2023 and acceptance received from Ivy Kim dated 30 May 2023. The work was carried out under the existing geotechnical panel contract agreed with DevelopmentWA. This report is provided for the exclusive use of DevelopmentWA for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope of work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of fill of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such fill may contain contaminants and hazardous building materials.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners



Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;

- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.



Introduction

The Cone Penetration Test (CPT) is a sophisticated soil profiling test carried out in-situ. A special cone shaped probe is used which is connected to a digital data acquisition system. The cone and adjoining sleeve section contain a series of strain gauges and other transducers which continuously monitor and record various soil parameters as the cone penetrates the soils.

The soil parameters measured depend on the type of cone being used, however they always include the following basic measurements

- Cone tip resistance q_c
- Sleeve friction f_s
- Inclination (from vertical) i
- Depth below ground z

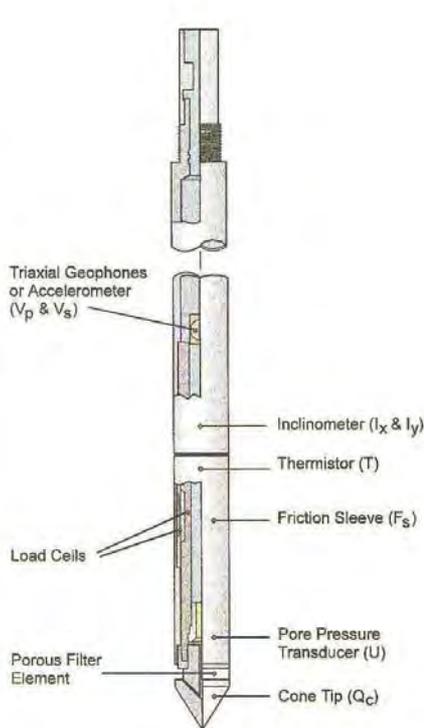


Figure 1: Cone Diagram

The inclinometer in the cone enables the verticality of the test to be confirmed and, if required, the vertical depth can be corrected.

The cone is thrust into the ground at a steady rate of about 20 mm/sec, usually using the hydraulic rams of a purpose built CPT rig, or a drilling rig. The testing is carried out in accordance with the Australian Standard AS1289 Test 6.5.1.



Figure 2: Purpose built CPT rig

The CPT can penetrate most soil types and is particularly suited to alluvial soils, being able to detect fine layering and strength variations. With sufficient thrust the cone can often penetrate a short distance into weathered rock. The cone will usually reach refusal in coarse filling, medium to coarse gravel and on very low strength or better rock. Tests have been successfully completed to more than 60 m.

Types of CPTs

Douglas Partners (and its subsidiary GroundTest) owns and operates the following types of CPT cones:

Type	Measures
Standard	Basic parameters (q_c , f_s , i & z)
Piezocone	Dynamic pore pressure (u) plus basic parameters. Dissipation tests estimate consolidation parameters
Conductivity	Bulk soil electrical conductivity (σ) plus basic parameters
Seismic	Shear wave velocity (V_s), compression wave velocity (V_p), plus basic parameters

Strata Interpretation

The CPT parameters can be used to infer the Soil Behaviour Type (SBT), based on normalised values of cone resistance (Q_t) and friction ratio (F_r). These are used in conjunction with soil classification charts, such as the one below (after Robertson 1990)

Cone Penetration Tests

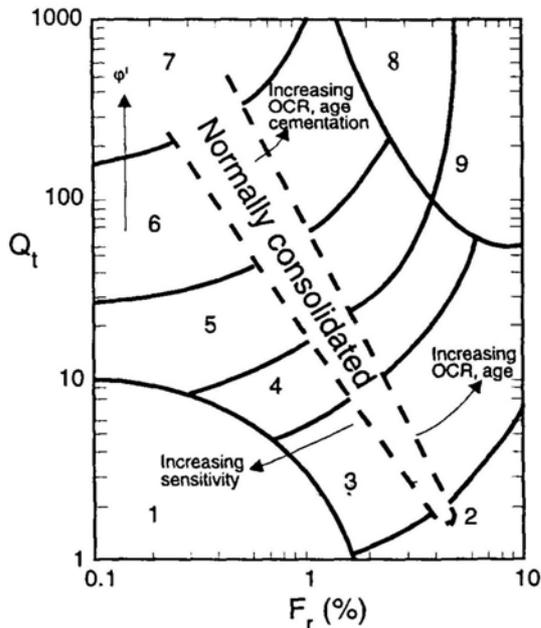


Figure 3: Soil Classification Chart

DP's in-house CPT software provides computer aided interpretation of soil strata, generating soil descriptions and strengths for each layer. The software can also produce plots of estimated soil parameters, including modulus, friction angle, relative density, shear strength and over consolidation ratio.

DP's CPT software helps our engineers quickly evaluate the critical soil layers and then focus on developing practical solutions for the client's project.

Engineering Applications

There are many uses for CPT data. The main applications are briefly introduced below:

Settlement

CPT provides a continuous profile of soil type and strength, providing an excellent basis for settlement analysis. Soil compressibility can be estimated from cone derived moduli, or known consolidation parameters for the critical layers (eg. from laboratory testing). Further, if pore pressure dissipation tests are undertaken using a piezocone, in-situ consolidation coefficients can be estimated to aid analysis.

Pile Capacity

The cone is, in effect, a small scale pile and, therefore, ideal for direct estimation of pile capacity. DP's in-house program ConePile can analyse most pile types and produces pile capacity versus depth plots. The analysis methods are based on proven static theory and empirical studies, taking account of scale effects, pile materials and method of installation. The results are expressed in limit state format, consistent with the Piling Code AS2159.

Dynamic or Earthquake Analysis

CPT and, in particular, Seismic CPT are suitable for dynamic foundation studies and earthquake response analyses, by profiling the low strain shear modulus G_0 . Techniques have also been developed relating CPT results to the risk of soil liquefaction.

Other Applications

Other applications of CPT include ground improvement monitoring (testing before and after works), salinity and contaminant plume mapping (conductivity cone), preloading studies and verification of strength gain.

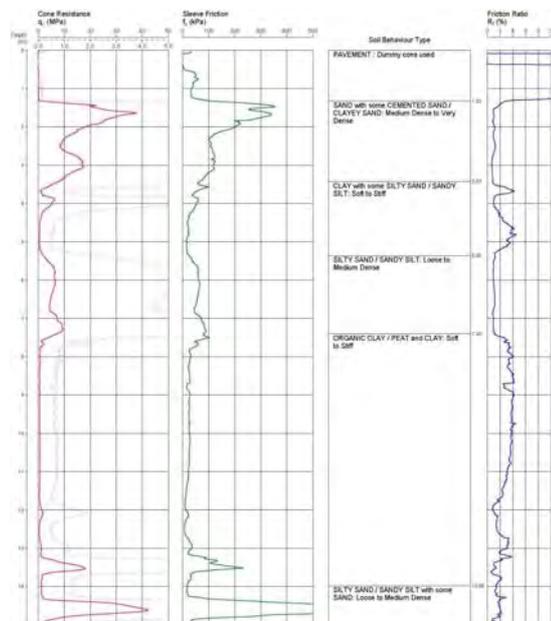


Figure 4: Sample Cone Plot



Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

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. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low

reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) 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 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is 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 test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:
4,6,7
N=13
- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:
15, 30/40 mm

Sampling Methods

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or 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 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). 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 Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

The soil group symbol classifications are given as follows based on two major soil divisions:

- Coarse-grained soils
- Fine-grained soils

Major Divisions				Description		
				Group Symbol*	Typical Name	
COARSE-GRAINED SOILS	More than 65% by dry mass, (excluding that larger than 63 mm) is greater than 0.075 mm	GRAVEL	More than 50% of coarse grains are greater than 2.36 mm	GW	Well graded gravels and gravel-sand mixtures, little or no fines.	
				GP	Poorly graded gravels and gravel-sand mixtures, little or no fines.	
				GM	Silty gravels, gravel-sand-silt mixtures.	
				GC	Clay gravels, gravel-sand-clay mixtures.	
		SAND	More than 50% of coarse grains are less than 2.36 mm	SW	Well graded sands and gravelly sands, little or no fines.	
				SP	Poorly graded sands and gravelly sands, little or no fines.	
				SM	Silty sand, sand-silt mixtures.	
				SC	Clayey sands, sand-clay mixtures.	
				GRAVELLY SOILS		
				SANDY SOILS		

* For coarse grained soils where the fines content is between 5% and 12%, the soil shall be given a dual classification eg GP-GM.

FINE-GRAINED SOILS	More than 35% by dry mass, (excluding that larger than 63 mm) is less than 0.075 mm	Liquid Limit less than 35%	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity
		35% <LL< 50%	CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
		Liquid Limit greater than 50%	OH	Organic clays of medium to high plasticity.
			Pt	Peat muck and other highly organic soils.



Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	19 - 63
Medium gravel	6.7 - 19
Fine gravel	2.36 - 6.7
Coarse sand	0.6 - 2.36
Medium sand	0.21 - 0.6
Fine sand	0.075 - 0.21

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 - 30%	Clay with sand
Trace	0 - 15%	Clay, trace sand

In coarse grained soils (>65% coarse)

- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand, trace clay

In coarse grained soils (>65% coarse)

- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand, trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with 'Mix of Soil and Cobbles/Boulders' with the word order indicating the dominant first and the proportion of cobbles and boulders described together.



Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	St	50 - 100
Very stiff	VSt	100 - 200
Hard	H	>200
Friable	Fr	-

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;
- Estuarine soil – deposited in coastal estuaries;

- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) Non-cohesive and free-running.
- Moist (M) Soil feels cool, darkened in colour.
Soil tends to stick together.
Sand forms weak ball but breaks easily.
- Wet (W) Soil feels cool, darkened in colour.
Soil tends to stick together, free water forms when handling.

Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- 'Moist, dry of plastic limit' or 'w <PL' (i.e. hard and friable or powdery).
- 'Moist, near plastic limit' or 'w ≈ PL (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- 'Moist, wet of plastic limit' or 'w >PL' (i.e. soils usually weakened and free water forms on the hands when handling).
- 'Wet' or 'w ≈LL' (i.e. near the liquid limit).
- 'Wet' or 'w >LL' (i.e. wet of the liquid limit).

Symbols & Abbreviations

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Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U ₅₀	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

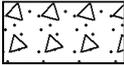
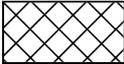
Other

fg	fragmented
bnd	band
qtz	quartz

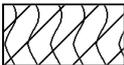
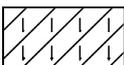
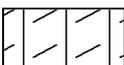
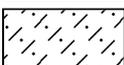
Symbols & Abbreviations

Graphic Symbols for Soil and Rock

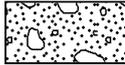
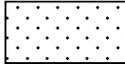
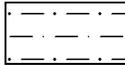
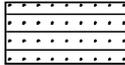
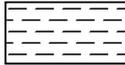
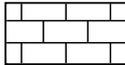
General

	Asphalt
	Road base
	Concrete
	Filling

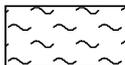
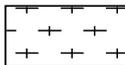
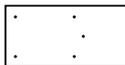
Soils

	Topsoil
	Peat
	Clay
	Silty clay
	Sandy clay
	Gravelly clay
	Shaly clay
	Silt
	Clayey silt
	Sandy silt
	Sand
	Clayey sand
	Silty sand
	Gravel
	Sandy gravel
	Cobbles, boulders
	Talus

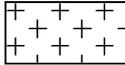
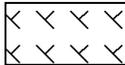
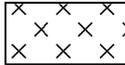
Sedimentary Rocks

	Boulder conglomerate
	Conglomerate
	Conglomeratic sandstone
	Sandstone
	Siltstone
	Laminite
	Mudstone, claystone, shale
	Coal
	Limestone

Metamorphic Rocks

	Slate, phyllite, schist
	Gneiss
	Quartzite

Igneous Rocks

	Granite
	Dolerite, basalt, andesite
	Dacite, epidote
	Tuff, breccia
	Porphyry

Appendix B

Drawings
CPT Logs (Current Investigation)
Borehole Logs (Current Investigation)

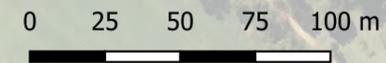
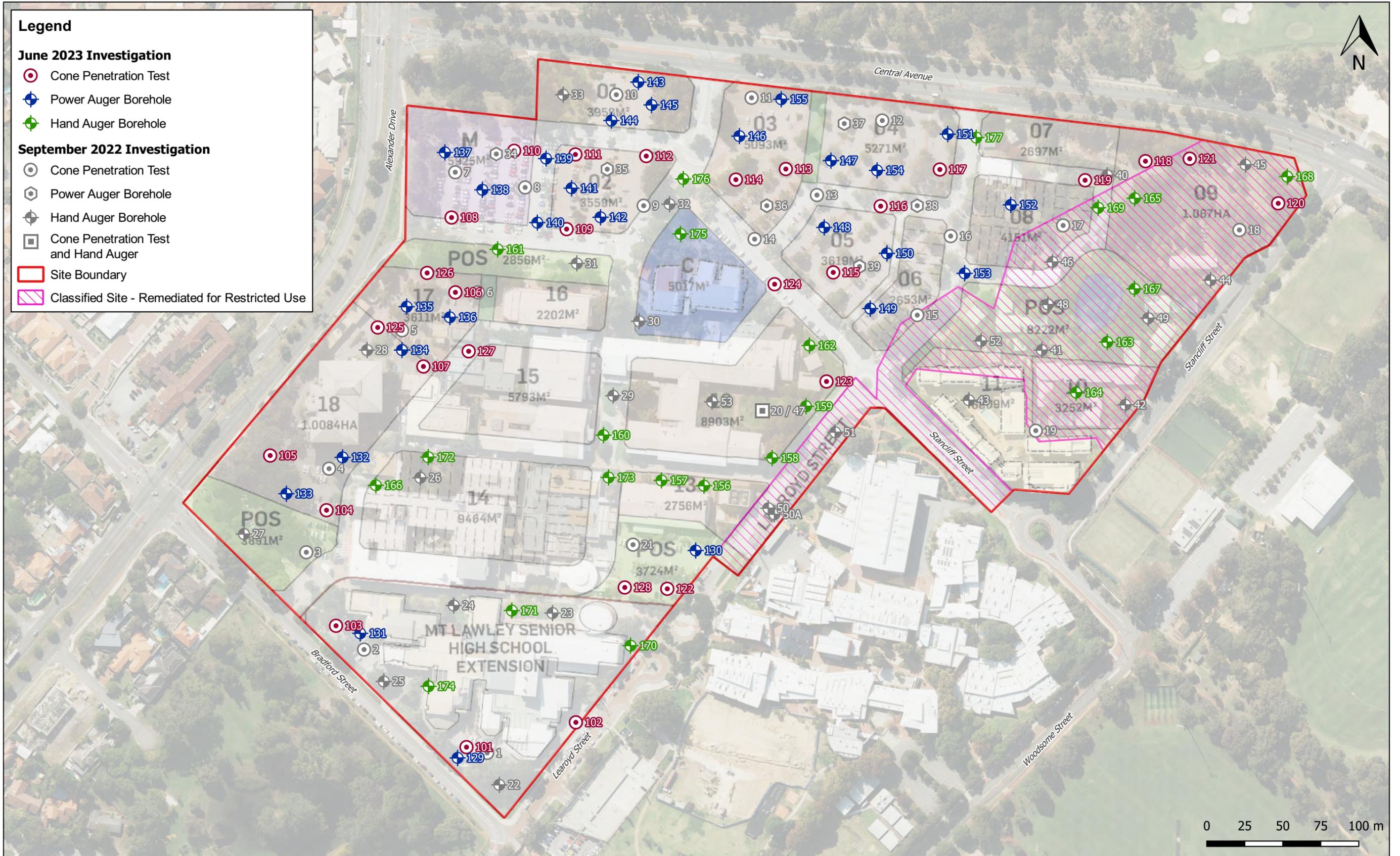
Legend

June 2023 Investigation

-  Cone Penetration Test
-  Power Auger Borehole
-  Hand Auger Borehole

September 2022 Investigation

-  Cone Penetration Test
-  Power Auger Borehole
-  Hand Auger Borehole
-  Cone Penetration Test and Hand Auger
-  Site Boundary
-  Classified Site - Remediated for Restricted Use



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Test Locations
 Proposed Multi-Residential Development
 Central Avenue, Mount Lawley, WA
 CLIENT: DevelopmentWA

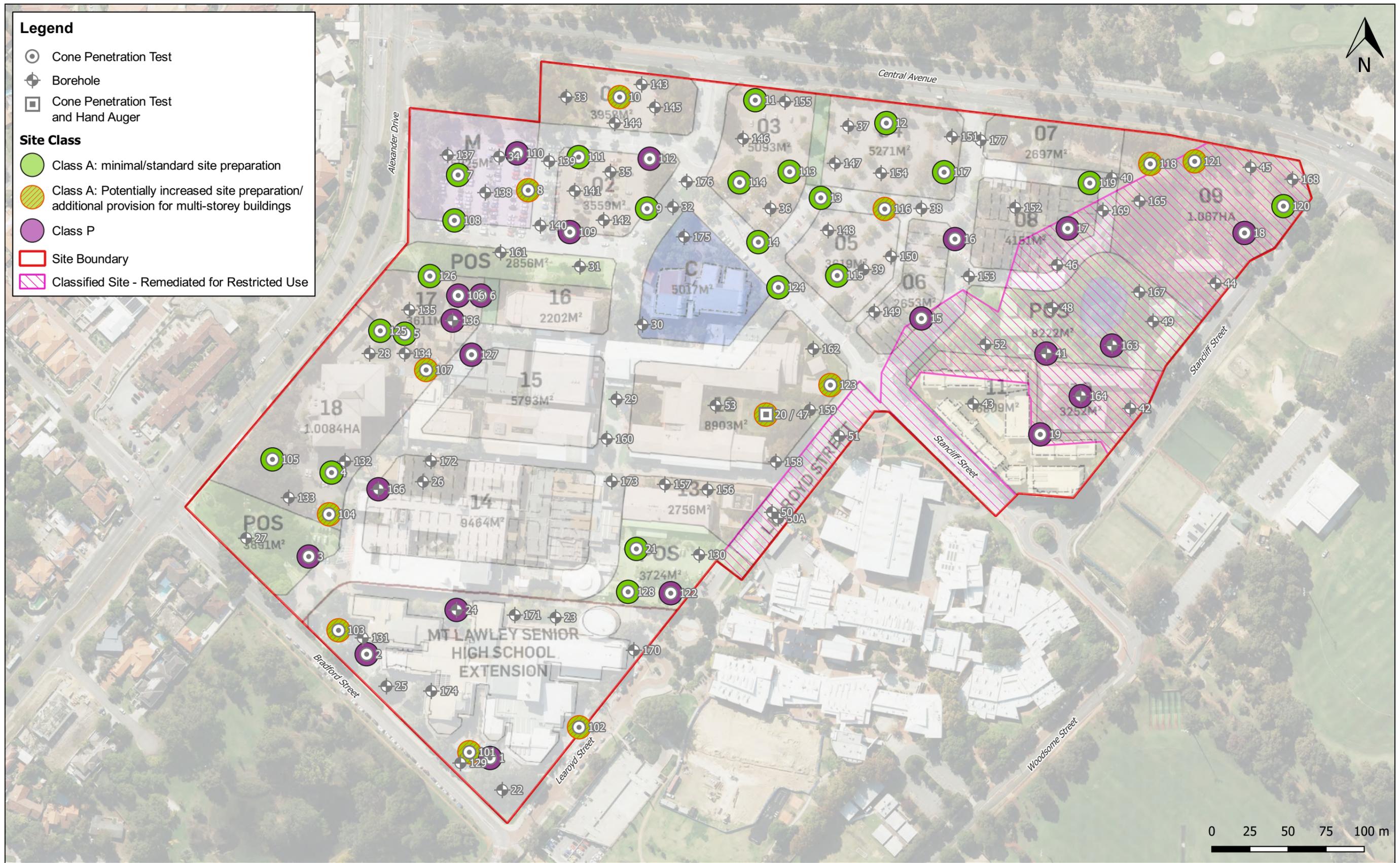
PROJECT: 216618.01
 Drawing No: 1
 REV: 0
 DATE: 8/8/2023

Legend

-  Cone Penetration Test
-  Borehole
-  Cone Penetration Test and Hand Auger

Site Class

-  Class A: minimal/standard site preparation
-  Class A: Potentially increased site preparation/ additional provision for multi-storey buildings
-  Class P
-  Site Boundary
-  Classified Site - Remediated for Restricted Use




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Site Classification
Proposed Multi-Residential Development
Central Avenue, Mount Lawley, WA

CLIENT: DevelopmentWA

PROJECT: 216618.01
 Drawing No: 2
 REV: 0
 DATE: 8/8/2023

Legend

June 2023 Investigation

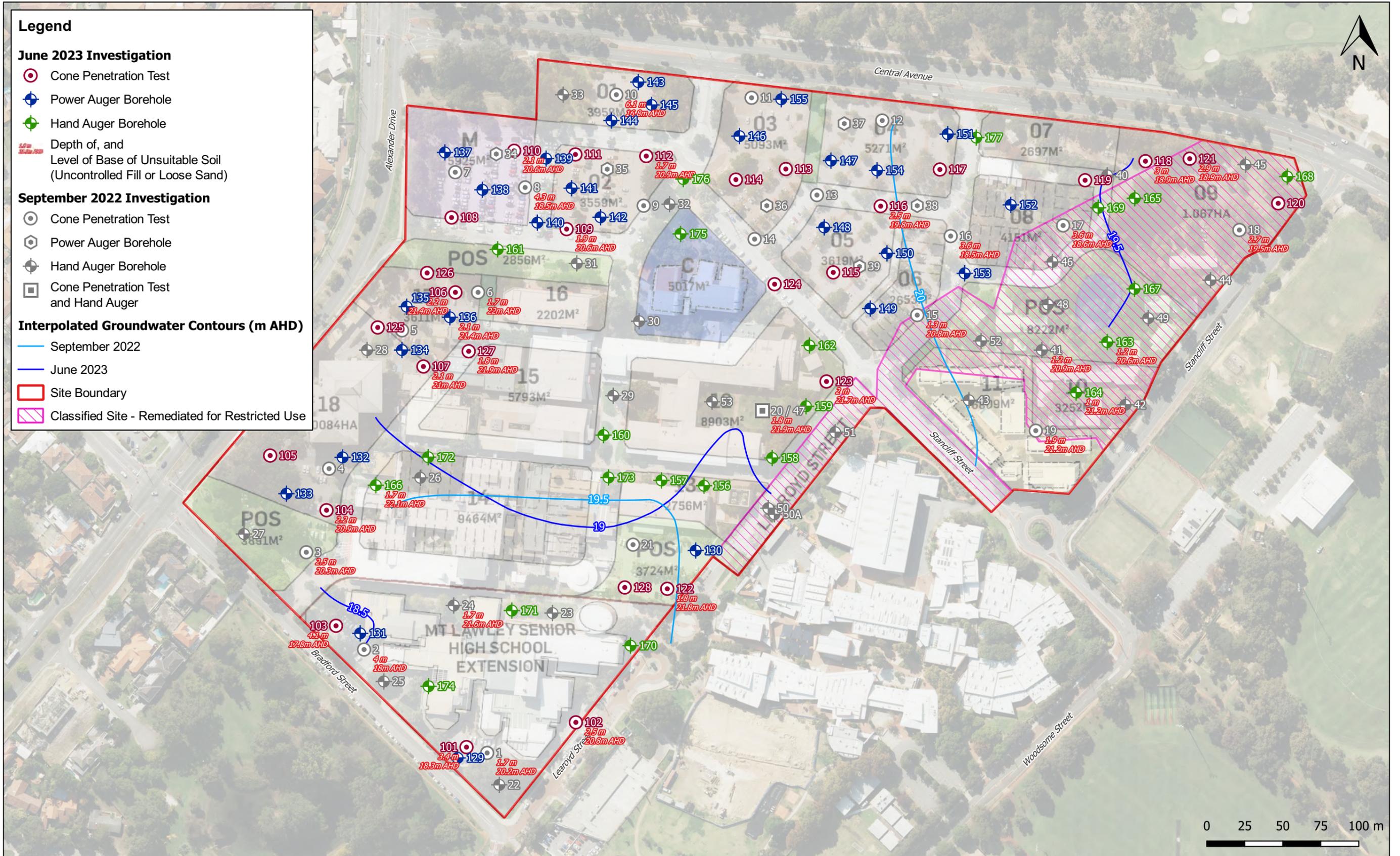
- Cone Penetration Test
- Power Auger Borehole
- Hand Auger Borehole
- Depth of, and Level of Base of Unsuitable Soil (Uncontrolled Fill or Loose Sand)

September 2022 Investigation

- Cone Penetration Test
- Power Auger Borehole
- Hand Auger Borehole
- Cone Penetration Test and Hand Auger

Interpolated Groundwater Contours (m AHD)

- September 2022
- June 2023
- Site Boundary
- Classified Site - Remediated for Restricted Use



Depth and Level of Unsuitable Soils (where proven) and Interpolated Groundwater Level Contours
Proposed Multi-Residential Development
Central Avenue, Mount Lawley, WA

CLIENT: DevelopmentWA



PROJECT: 216618.01
 Drawing No: 3
 REV: 0
 DATE: 8/8/2023

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 21.7 m AHD*

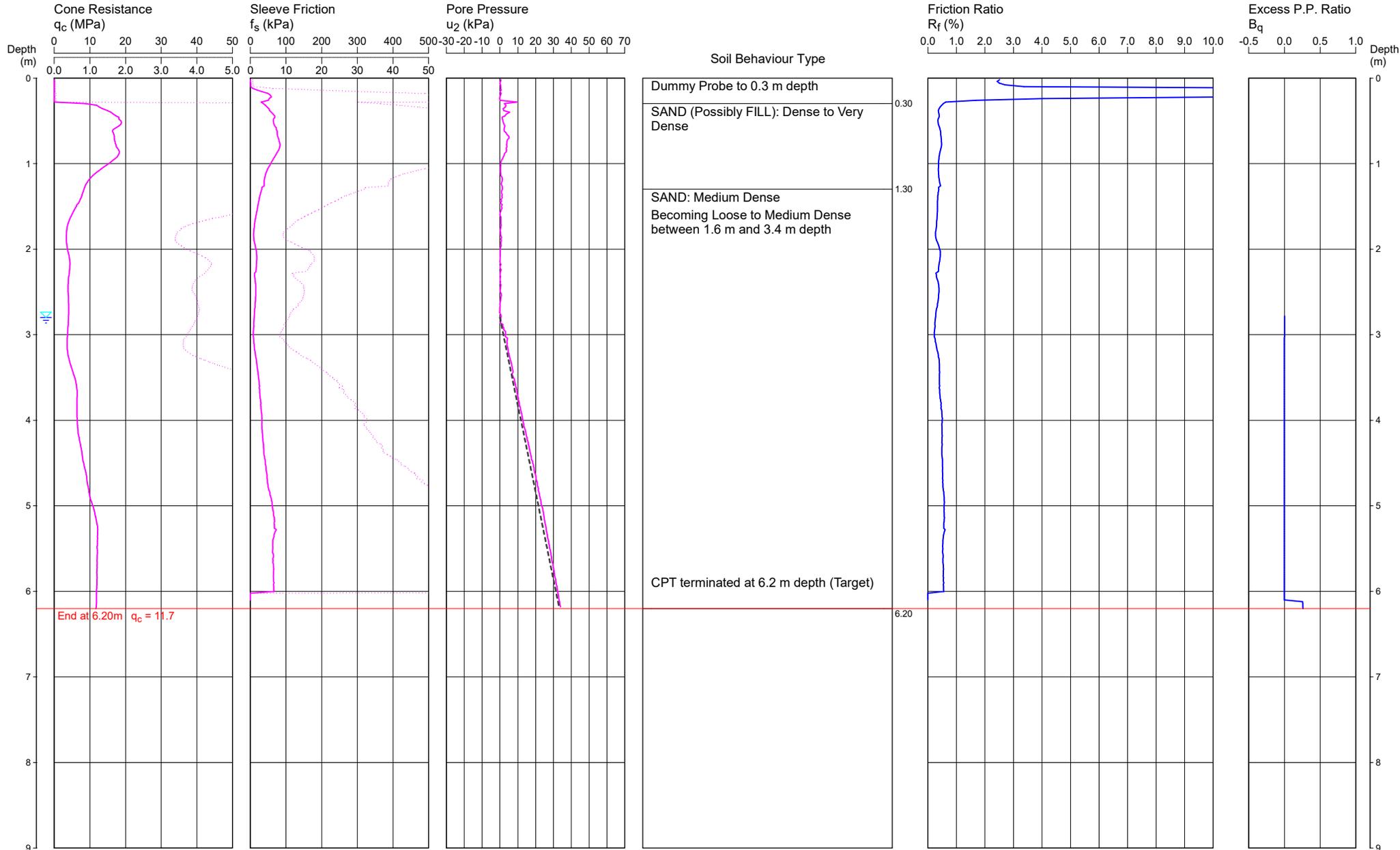
COORDINATES: 392924E 6467722N MGA94 50J

CPTU 101

Page 1 of 1

DATE 22/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

Water depth after test: 2.80m depth (measured)

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 101.CP5
 Cone ID: Probedrill Type: EC46

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.3 m AHD*

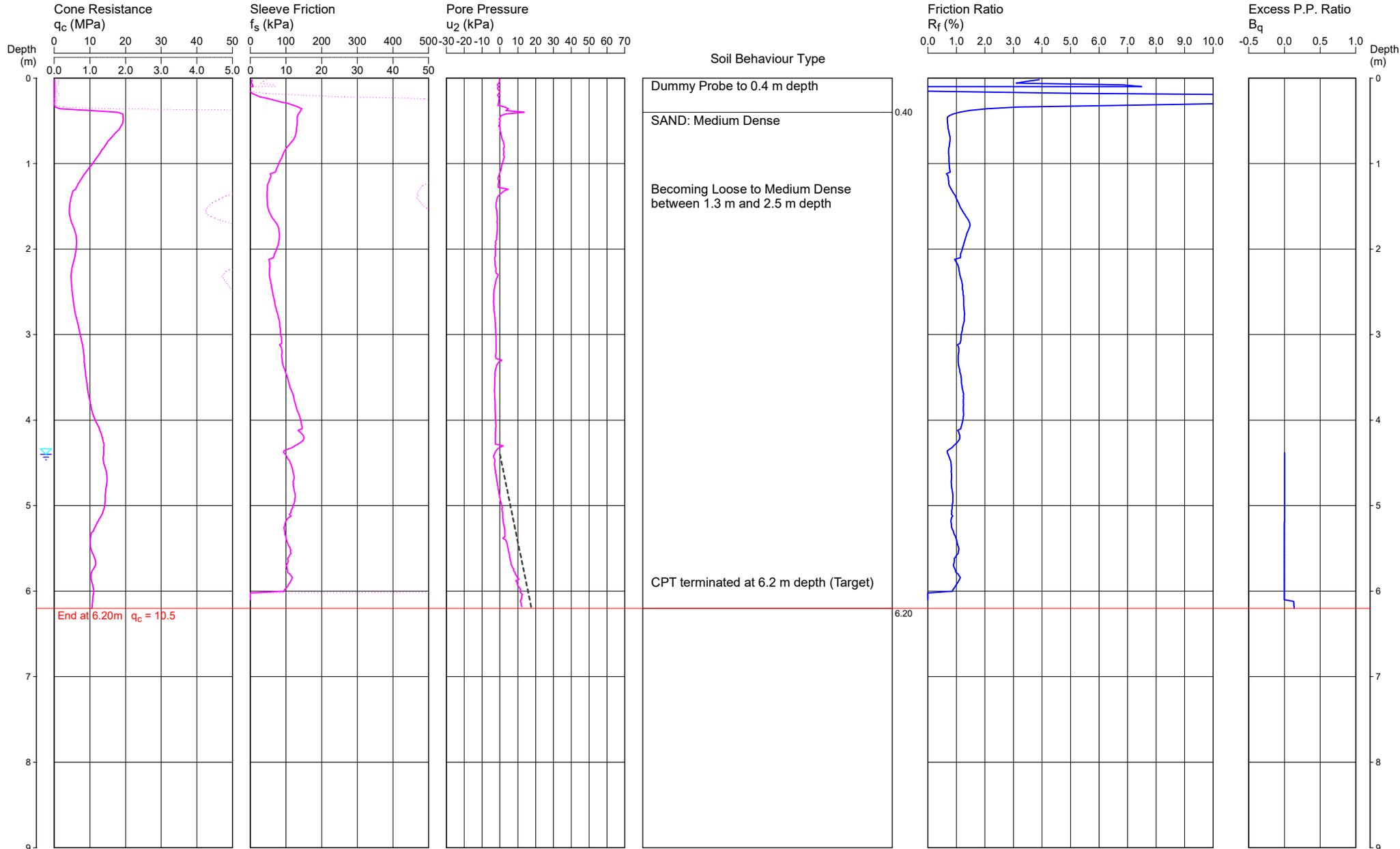
COORDINATES: 392996E 6467738N MGA94 50J

CPTU 102

Page 1 of 1

DATE 21/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 102.CP5
 Cone ID: Probedrill Type: EC10

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd

Water depth after test: 4.40m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 21.9 m AHD*

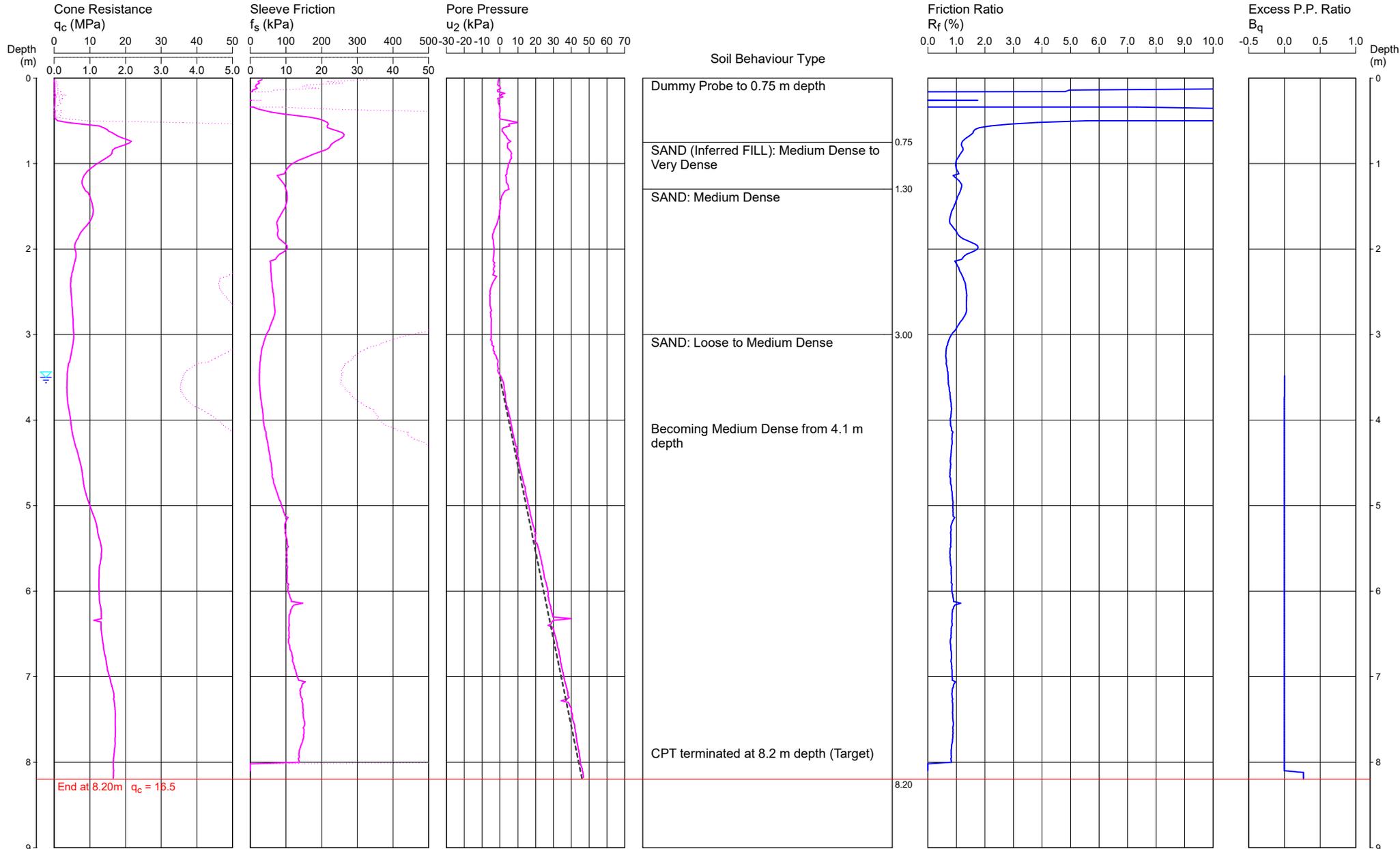
COORDINATES: 392839E 6467802N MGA94 50J

CPTU 103

Page 1 of 1

DATE 21/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 103.CP5
Cone ID: Probedrill Type: EC10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Water depth after test: 3.50m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.1 m AHD*

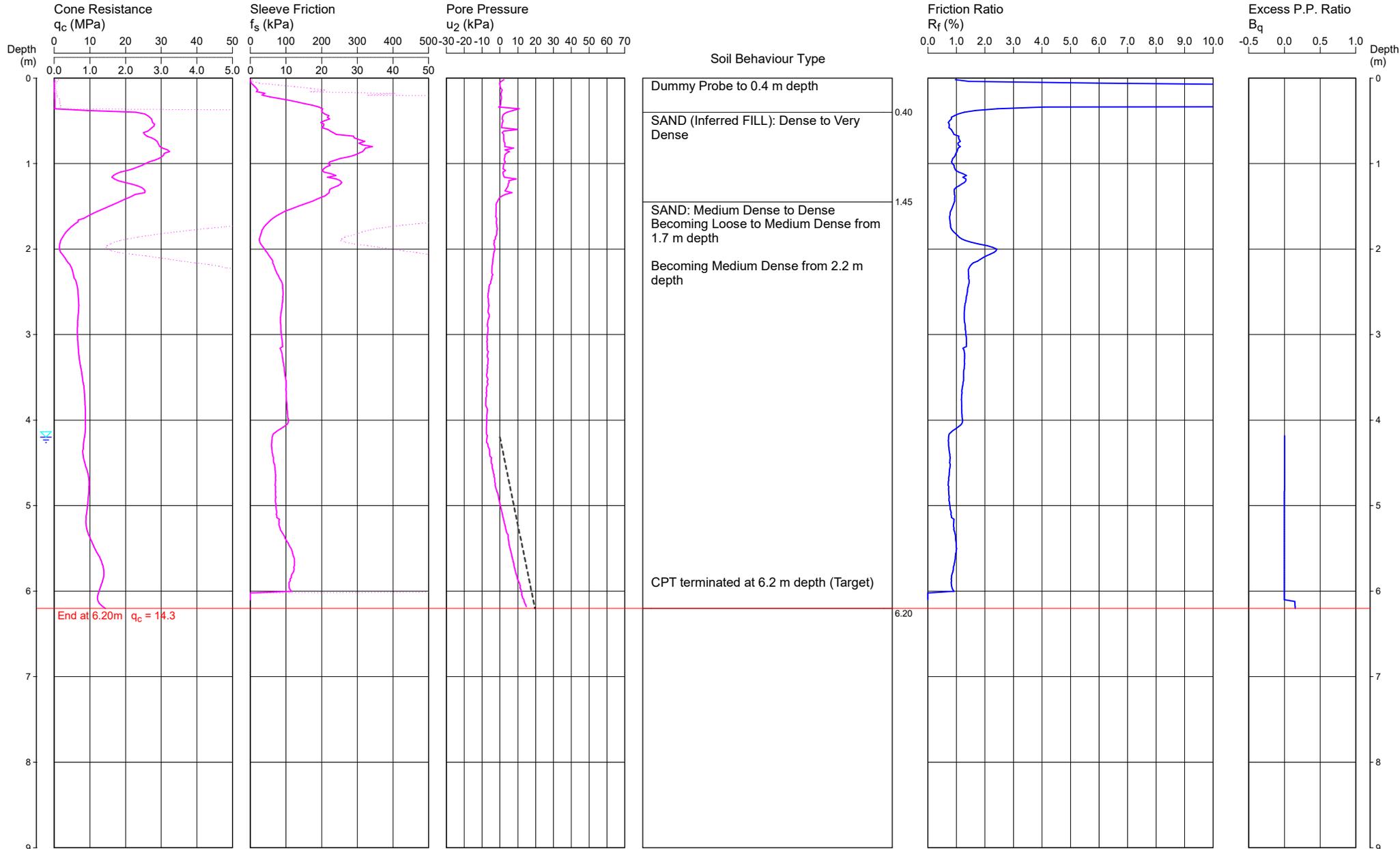
COORDINATES: 392832E 6467878N MGA94 50J

CPTU 104

Page 1 of 1

DATE 21/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 104.CP5
Cone ID: Probedrill Type: EC10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Water depth after test: 4.20m depth (assumed)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.8 m AHD*

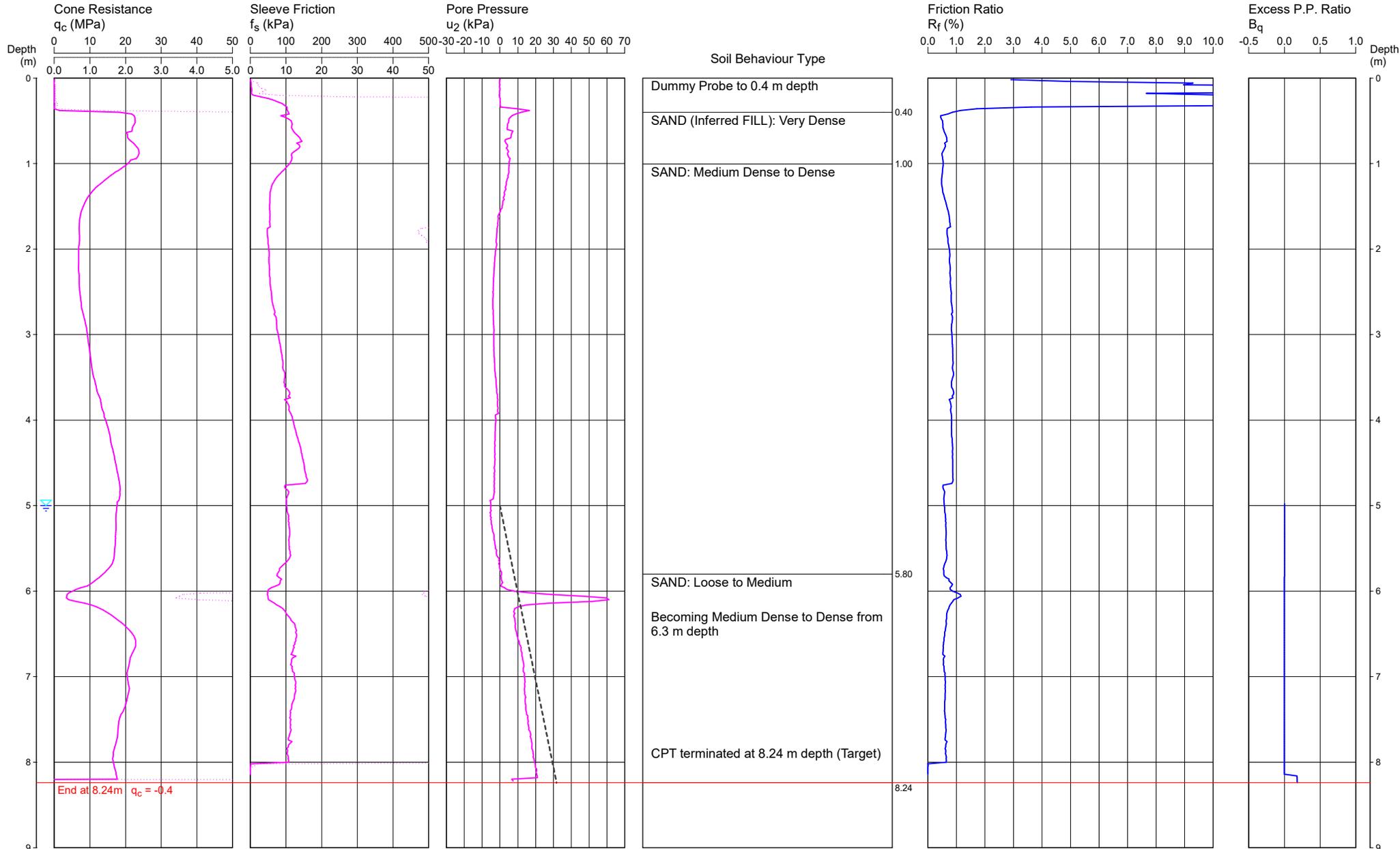
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CPTU 105

Page 1 of 1

DATE 22/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 105.CP5
 Cone ID: Probedrill Type: EC46

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd

Water depth after test: 5.00m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.6 m AHD*

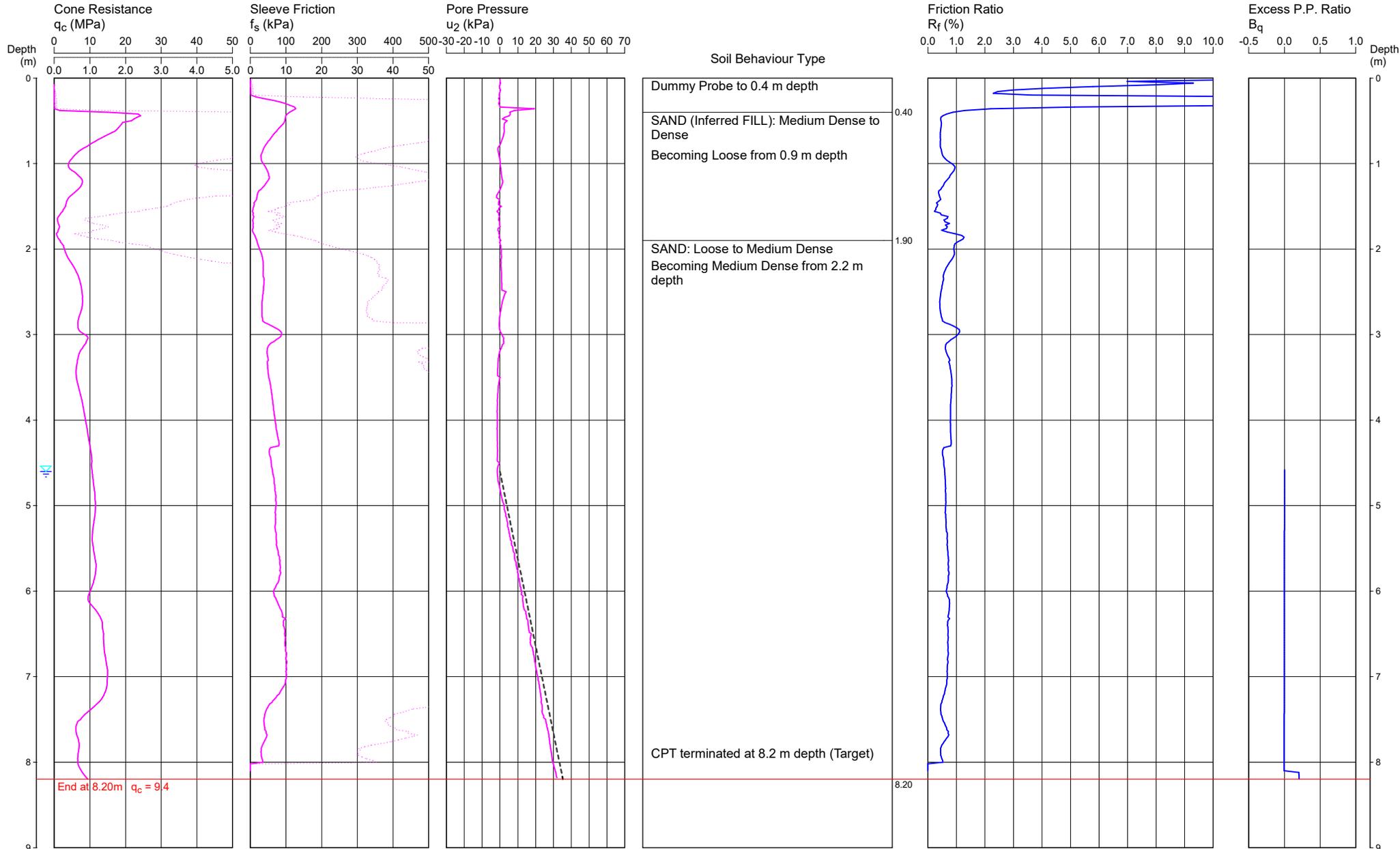
COORDINATES: 392917E 6468021N MGA94 50J

CPTU 106

Page 1 of 1

DATE 22/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 106.CP5
 Cone ID: Probedrill Type: EC46

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd

Water depth after test: 4.60m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.1 m AHD*

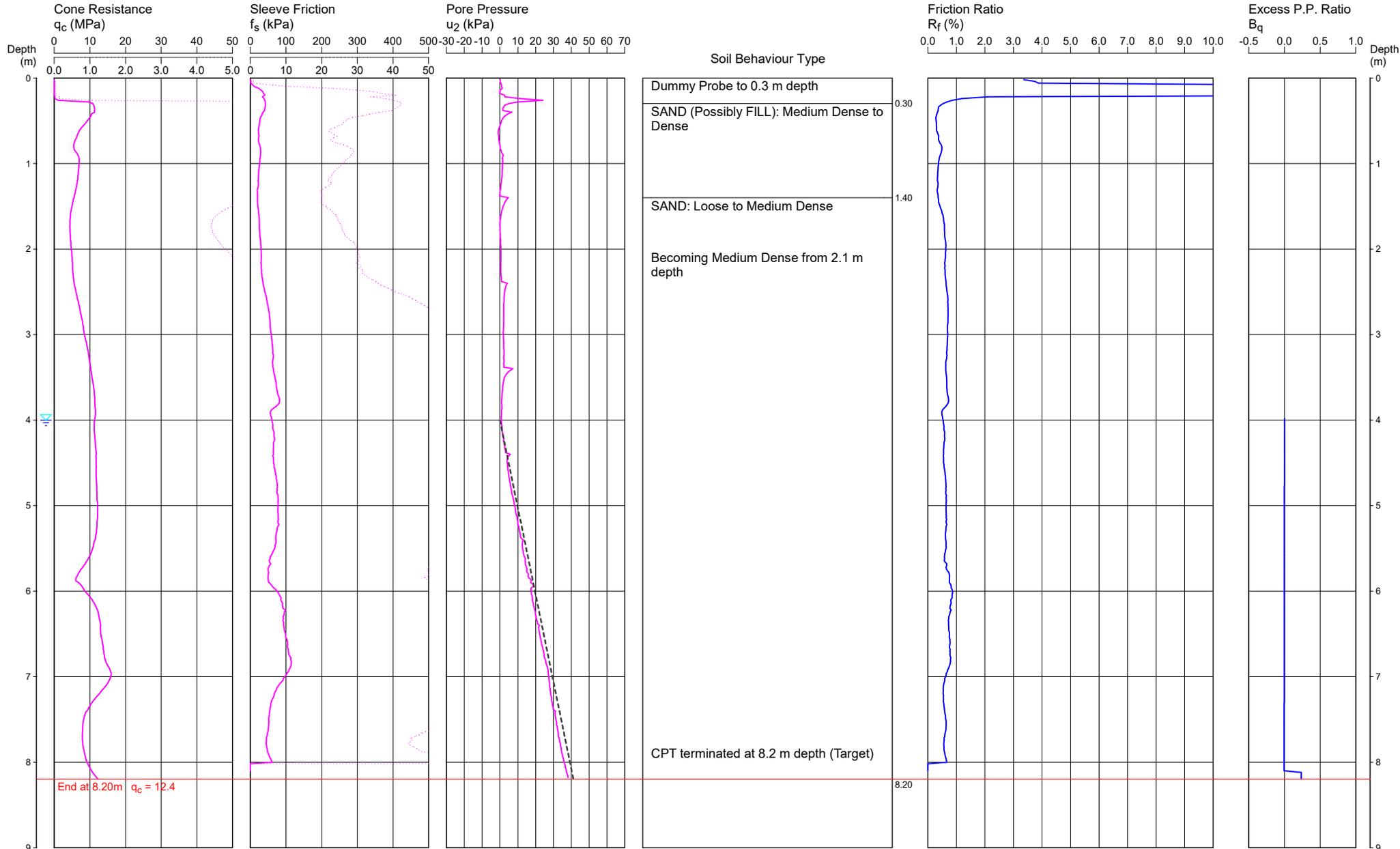
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CPTU 107

Page 1 of 1

DATE 22/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 107.CP5
 Cone ID: Probedrill Type: EC46

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd

Water depth after test: 4.00m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.1 m AHD*

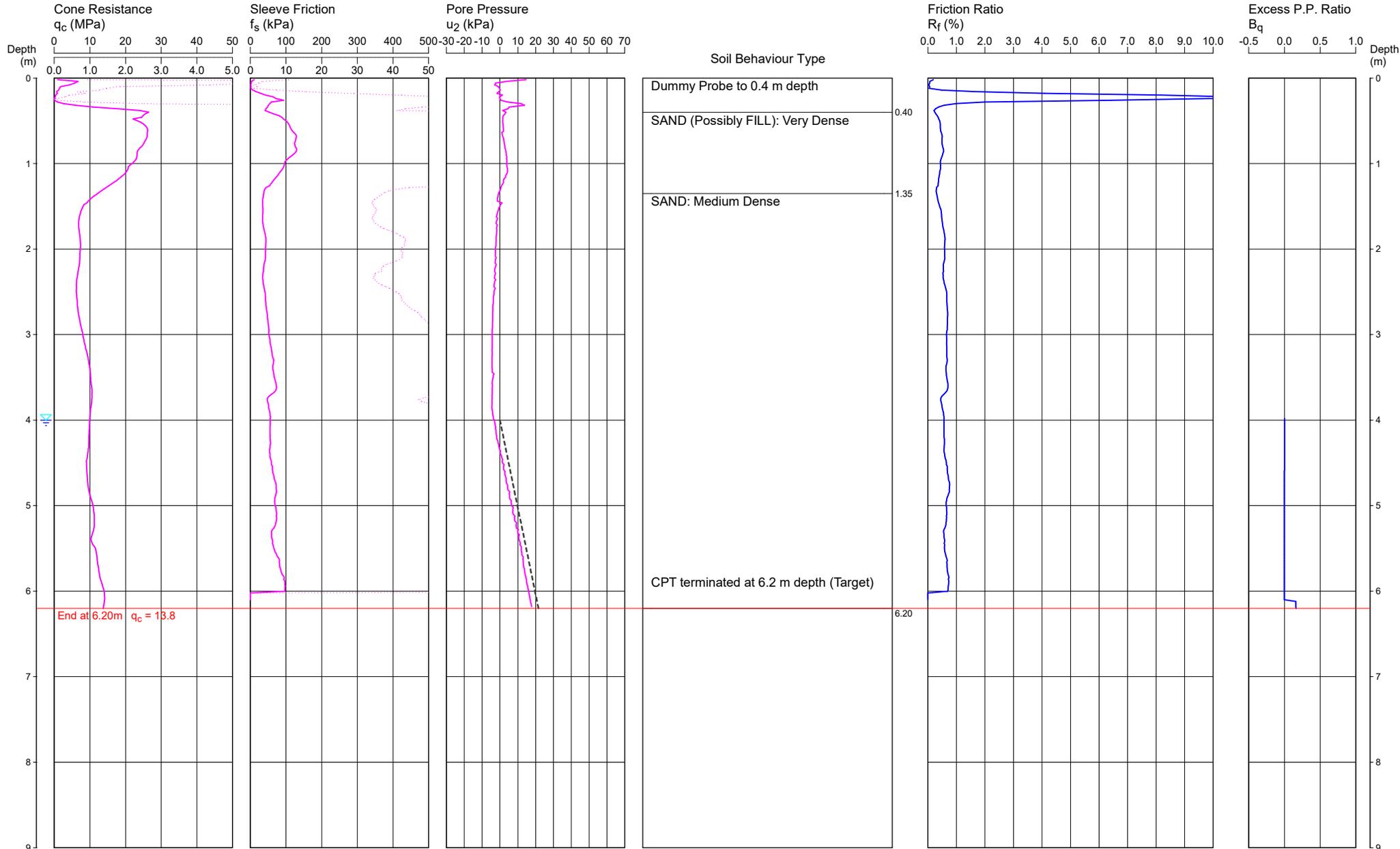
COORDINATES: 392915E 6468070N MGA94 50J

CPTU 108

Page 1 of 1

DATE 22/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 108.CP5
 Cone ID: Probedrill Type: EC46

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd

Water depth after test: 4.00m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.5 m AHD*

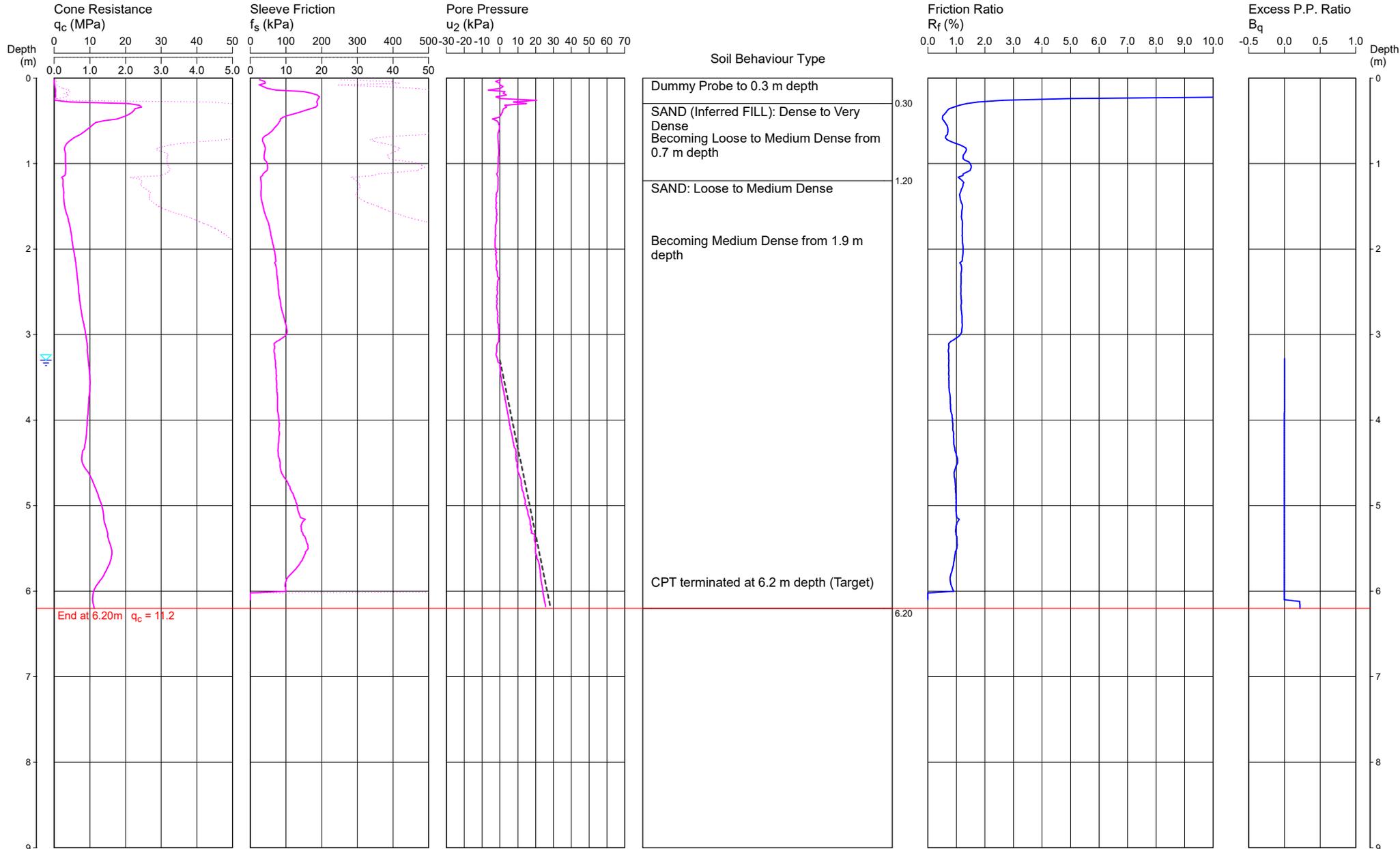
COORDINATES: 392990E 6468063N MGA94 50J

CPTU 109

Page 1 of 1

DATE 21/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 109.CP5
Cone ID: Probedrill Type: EC10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Water depth after test: 3.30m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.7 m AHD*

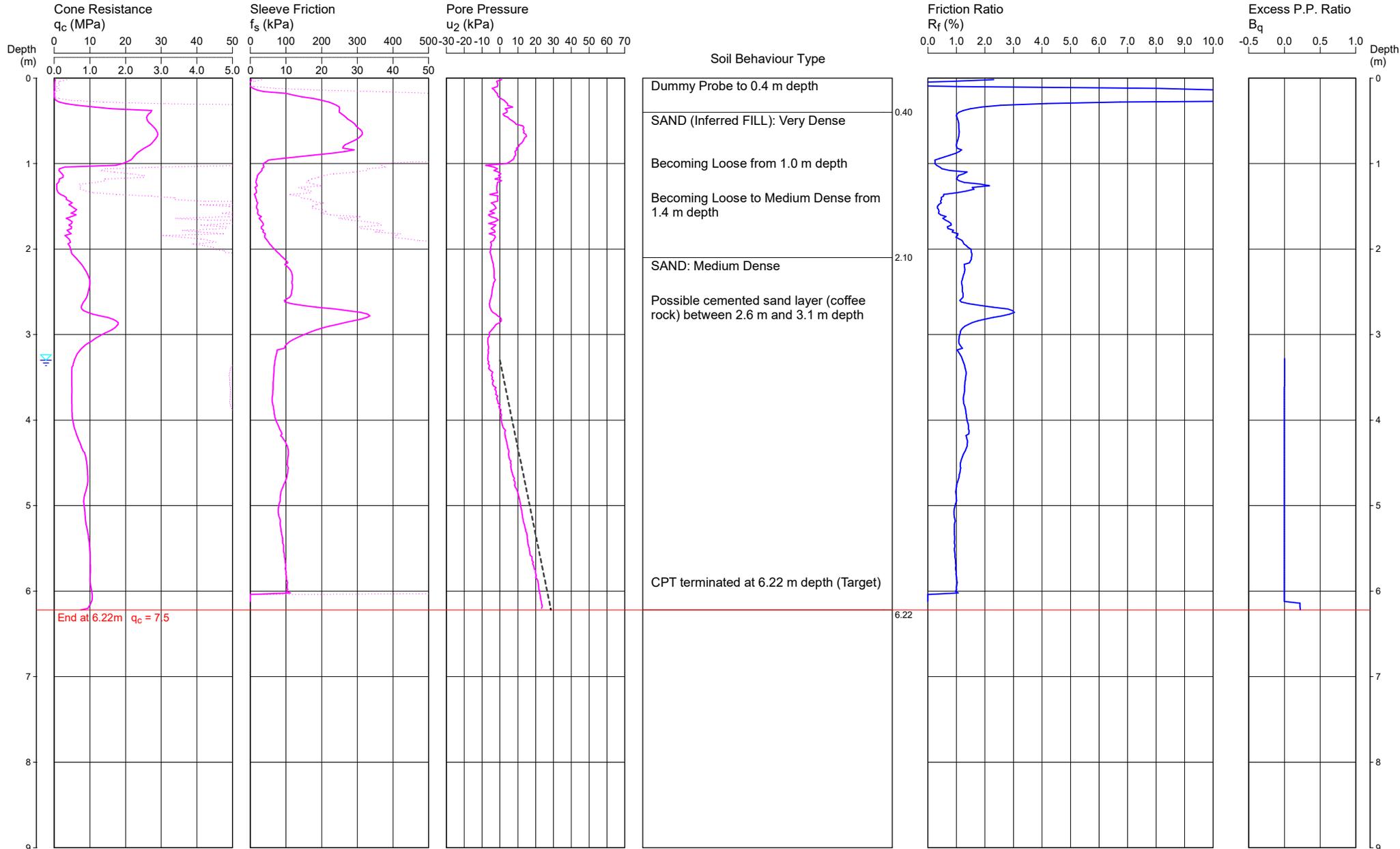
COORDINATES: 392956E 6468114N MGA94 50J

CPTU 110

Page 1 of 1

DATE 21/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 110.CP5
 Cone ID: Probedrill Type: EC10

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd

Water depth after test: 3.30m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.5 m AHD*

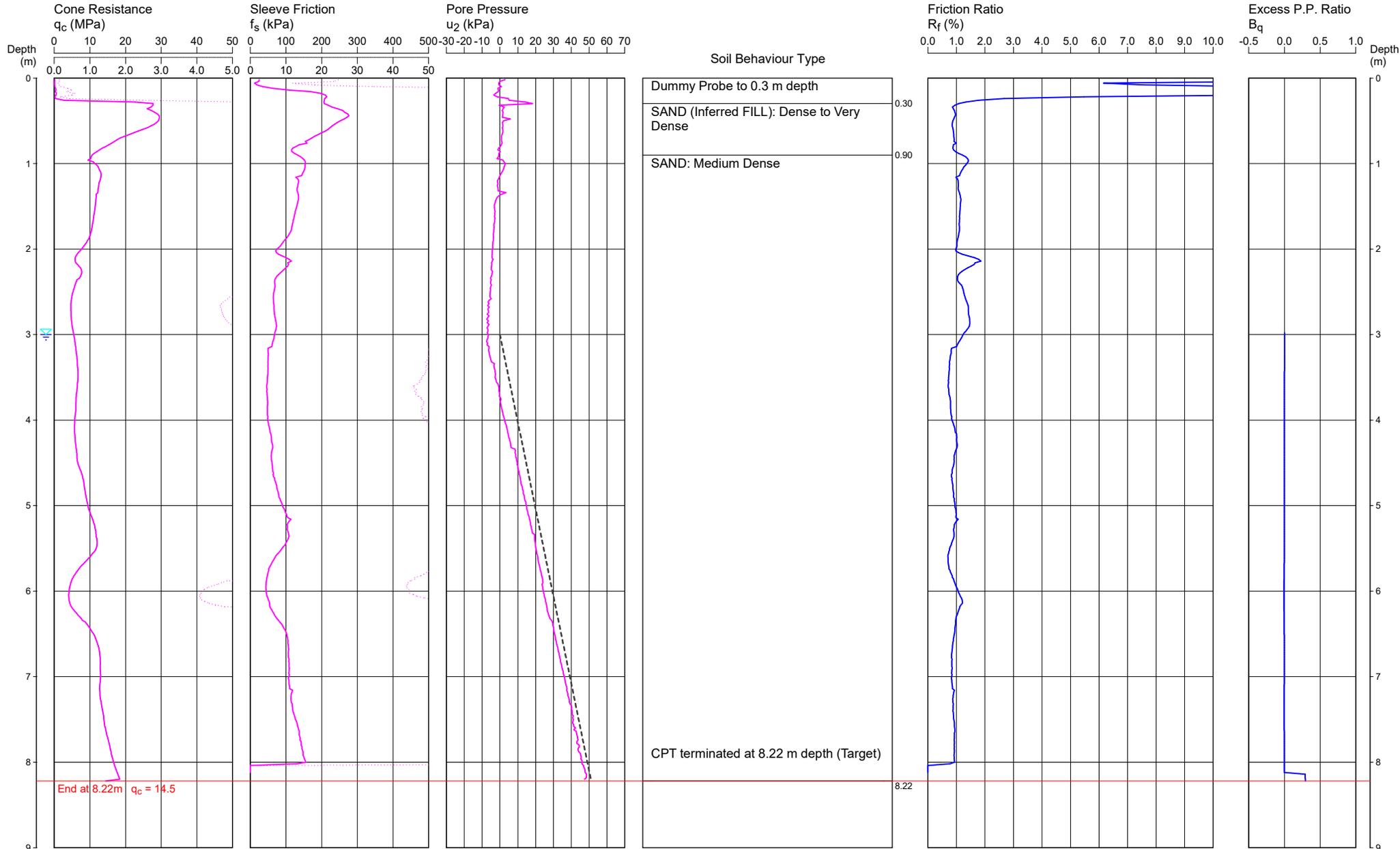
COORDINATES: 392996E 6468112N MGA94 50J

CPTU 111

Page 1 of 1

DATE 21/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 111.CP5
 Cone ID: Probedrill Type: EC10

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd

Water depth after test: 3.00m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.6 m AHD*

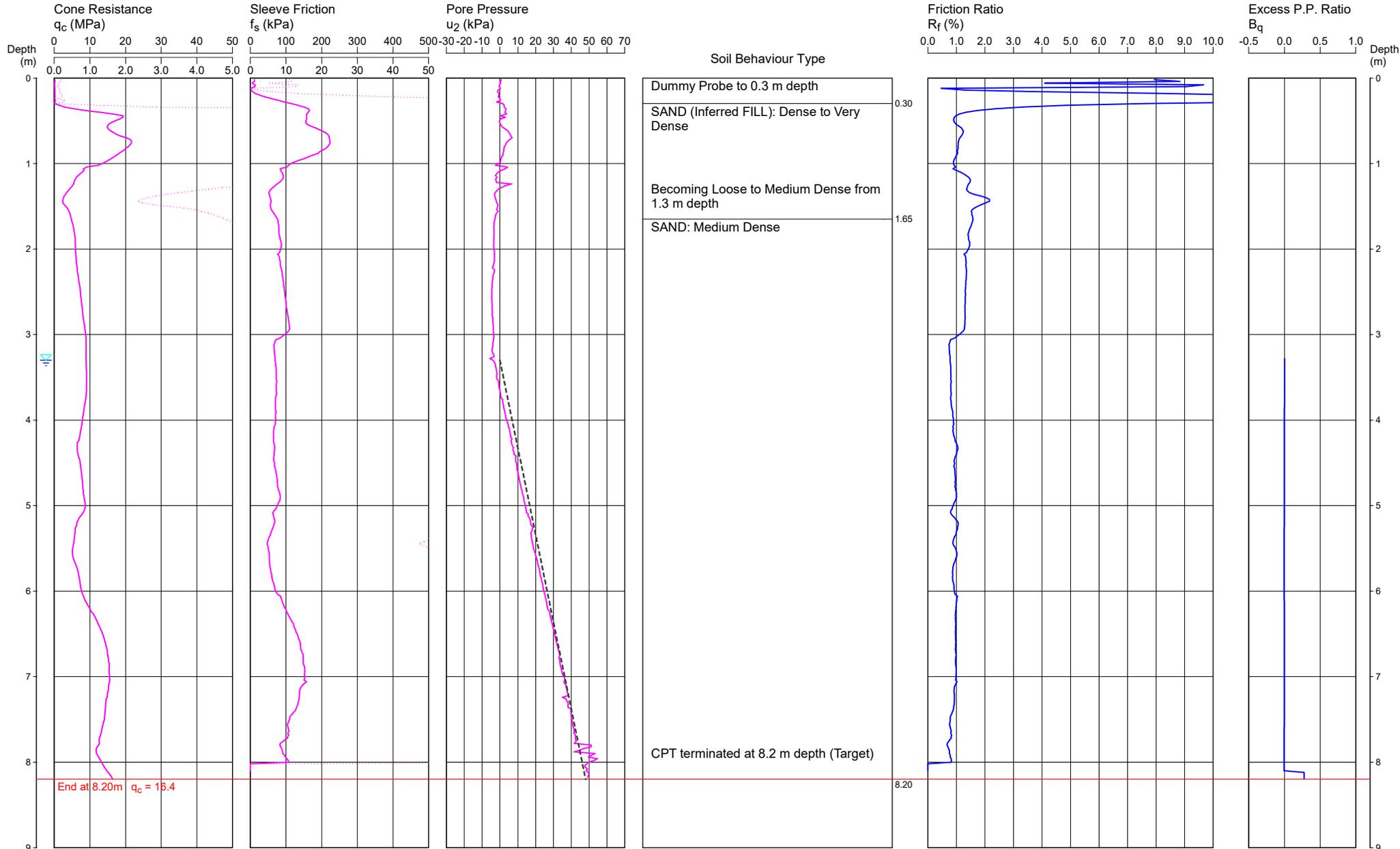
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CPTU 112

Page 1 of 1

DATE 21/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 112.CP5
Cone ID: Probedrill Type: EC10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Water depth after test: 3.30m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.8 m AHD*

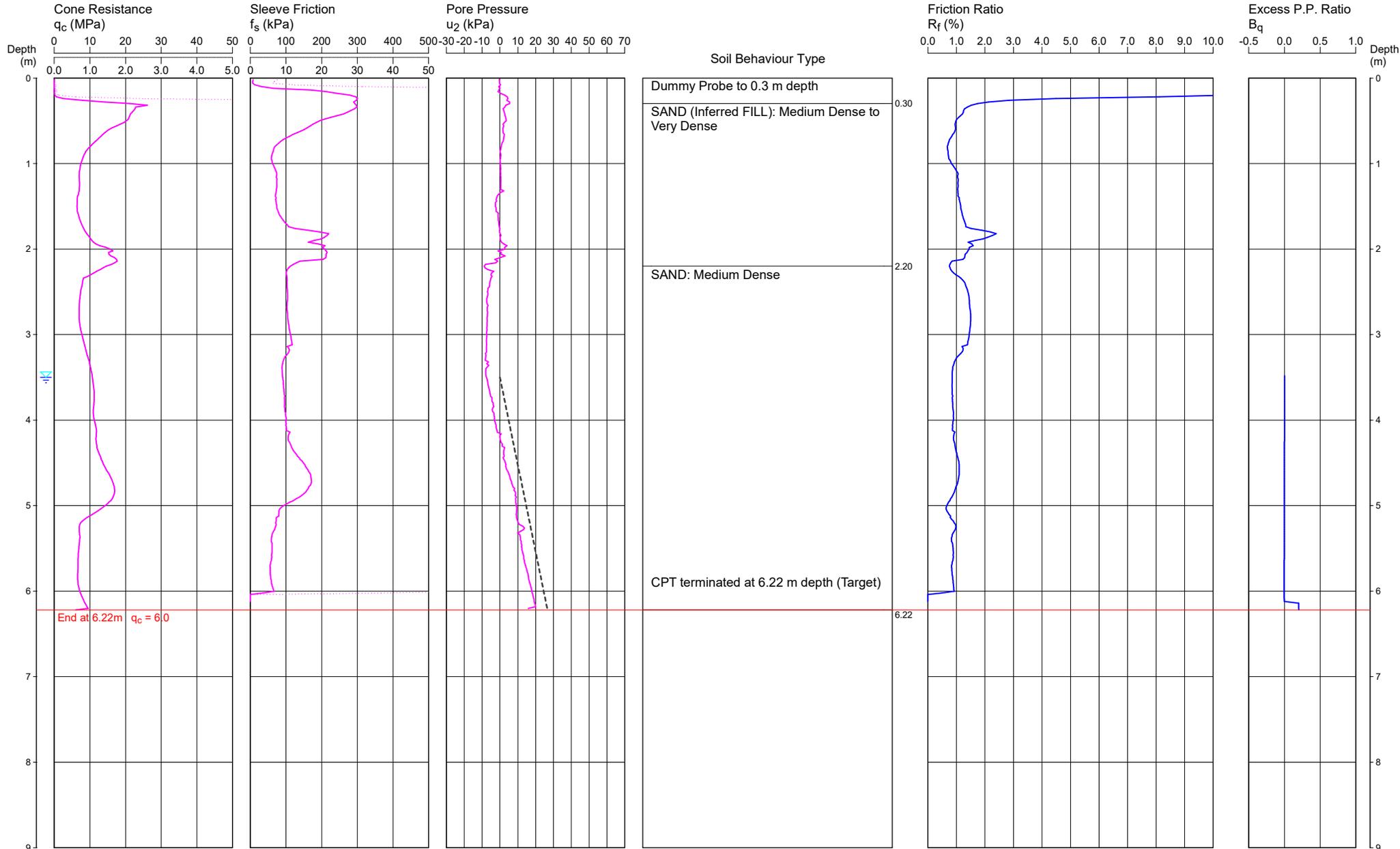
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CPTU 113

Page 1 of 1

DATE 21/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

Water depth after test: 3.50m depth (measured)

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 113.CP5
Cone ID: Probedrill Type: EC10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.8 m AHD*

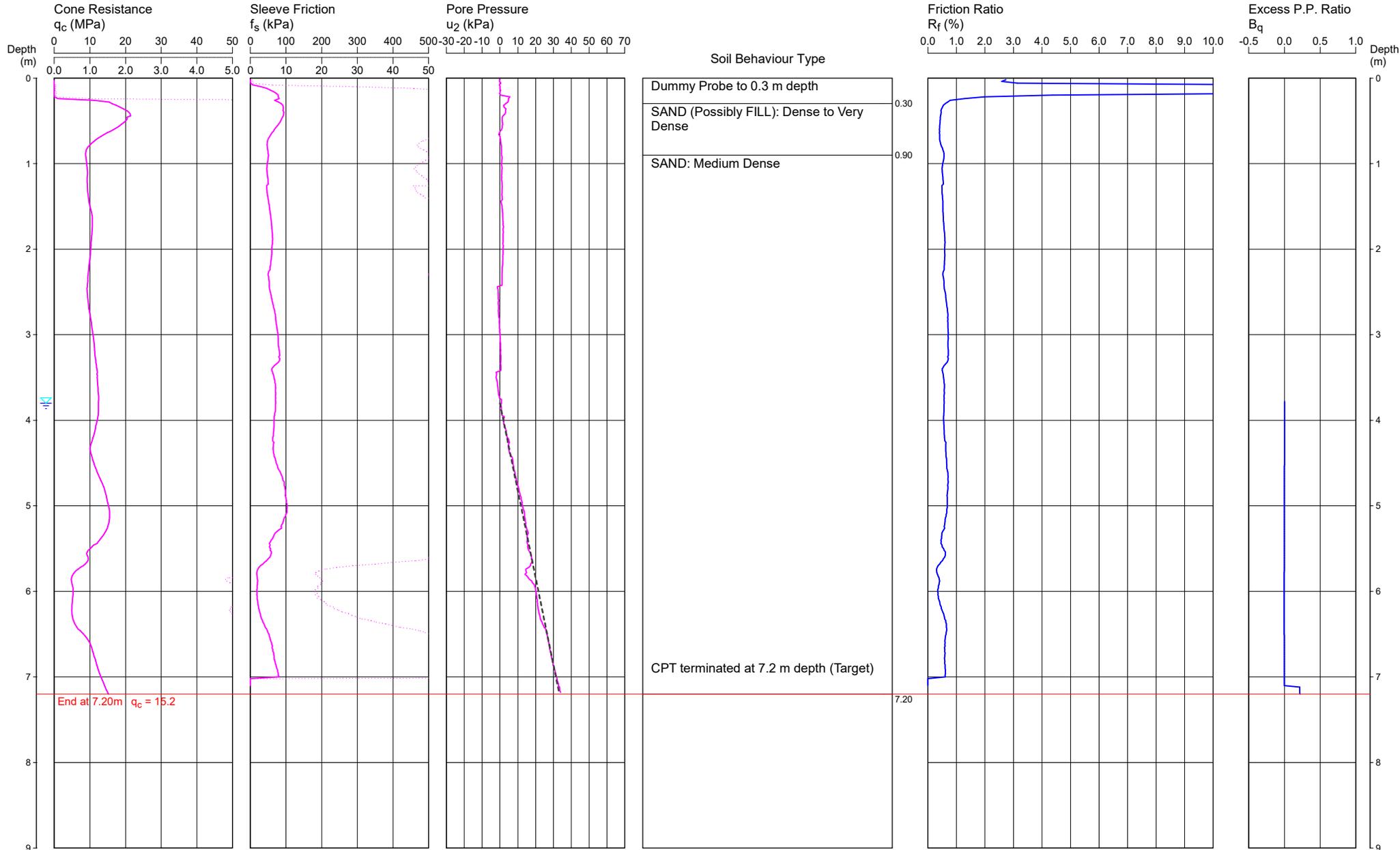
COORDINATES: 393102E 6468095N MGA94 50J

CPTU 114

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DATE 22/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 114.CP5
Cone ID: Probedrill Type: EC46

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Water depth after test: 3.80m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.3 m AHD*

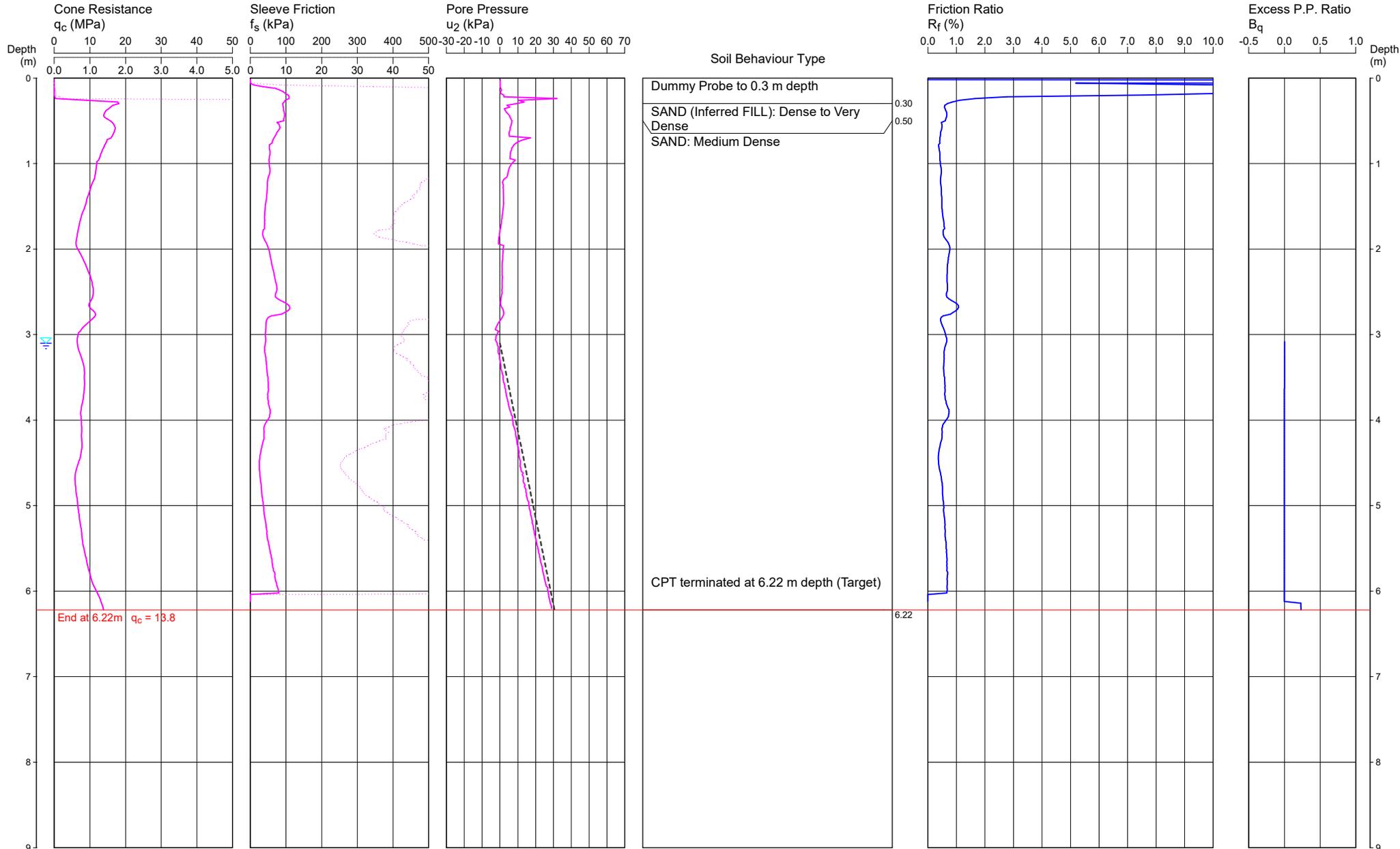
COORDINATES: 393166E 6468034N MGA94 50J

CPTU 115

Page 1 of 1

DATE 22/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

Water depth after test: 3.10m depth (measured)

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 115.CP5
Cone ID: Probedrill Type: EC46

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.3 m AHD*

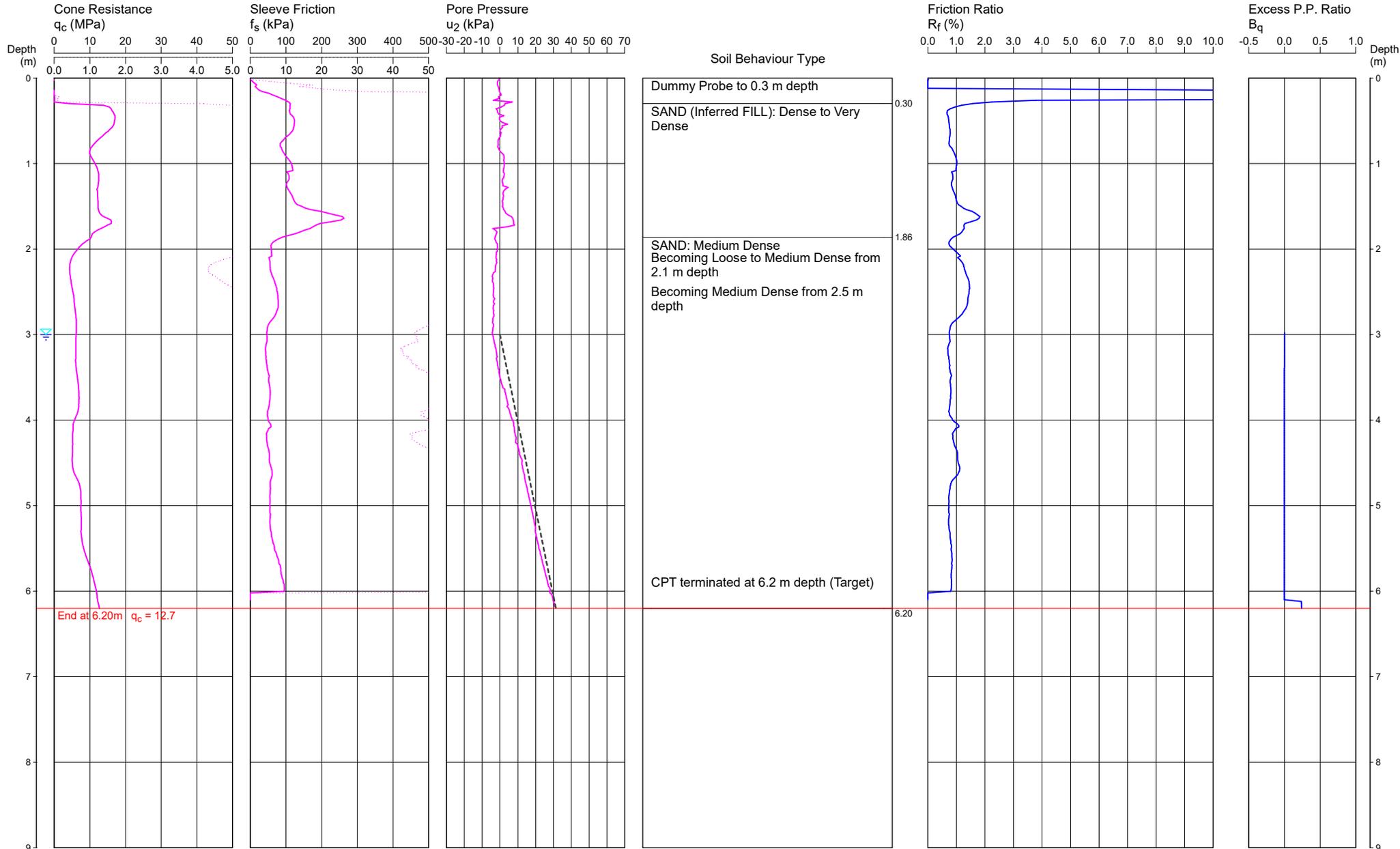
COORDINATES: 393197E 6468078N MGA94 50J

CPTU 116

Page 1 of 1

DATE 21/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

Water depth after test: 3.00m depth (measured)

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 116.CP5
Cone ID: Probedrill Type: EC10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.4 m AHD*

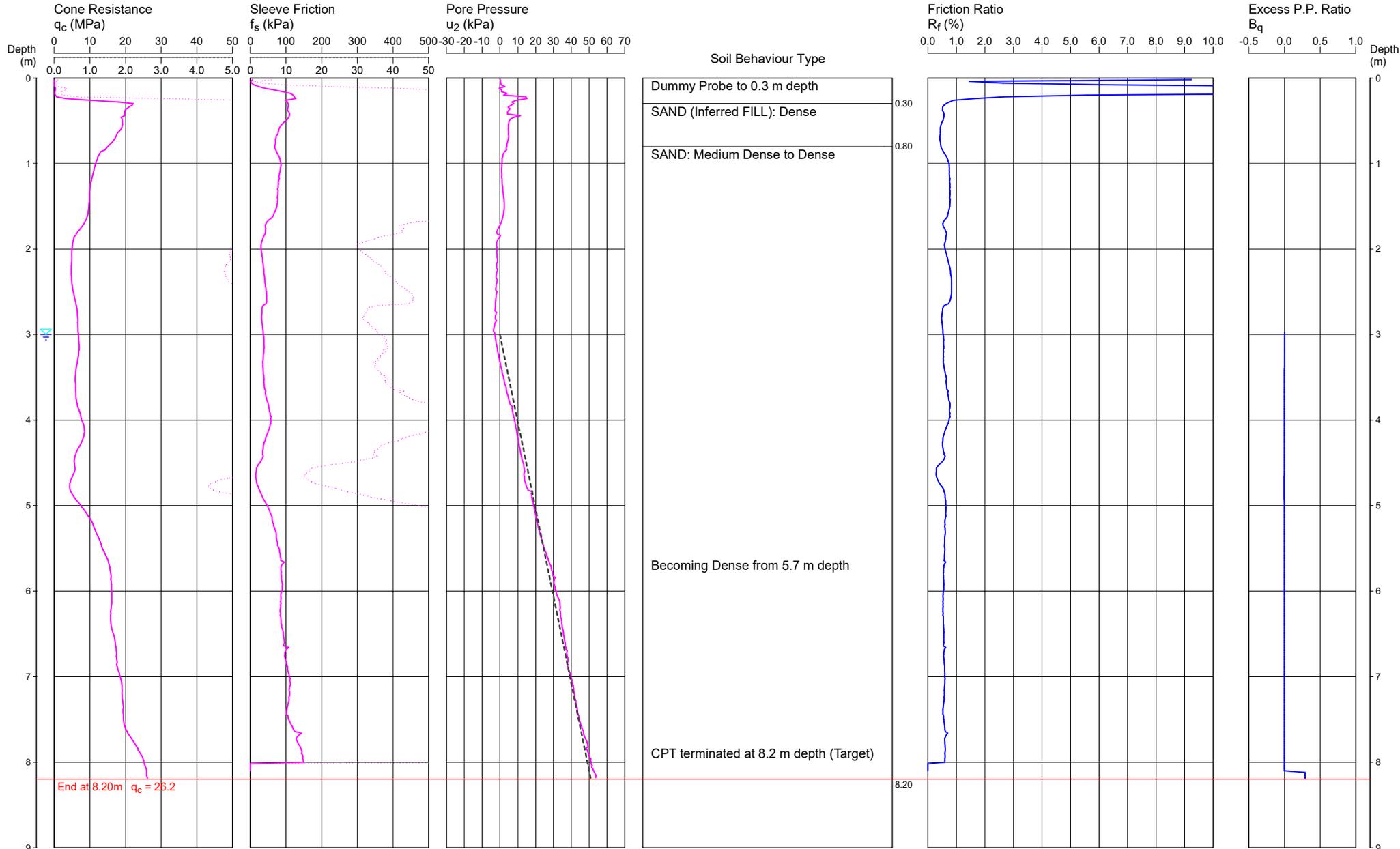
COORDINATES: 393236E 6468102N MGA94 50J

CPTU 117

Page 1 of 1

DATE 22/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 117.CP5
Cone ID: Probedrill Type: EC46

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Water depth after test: 3.00m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 21.9 m AHD*

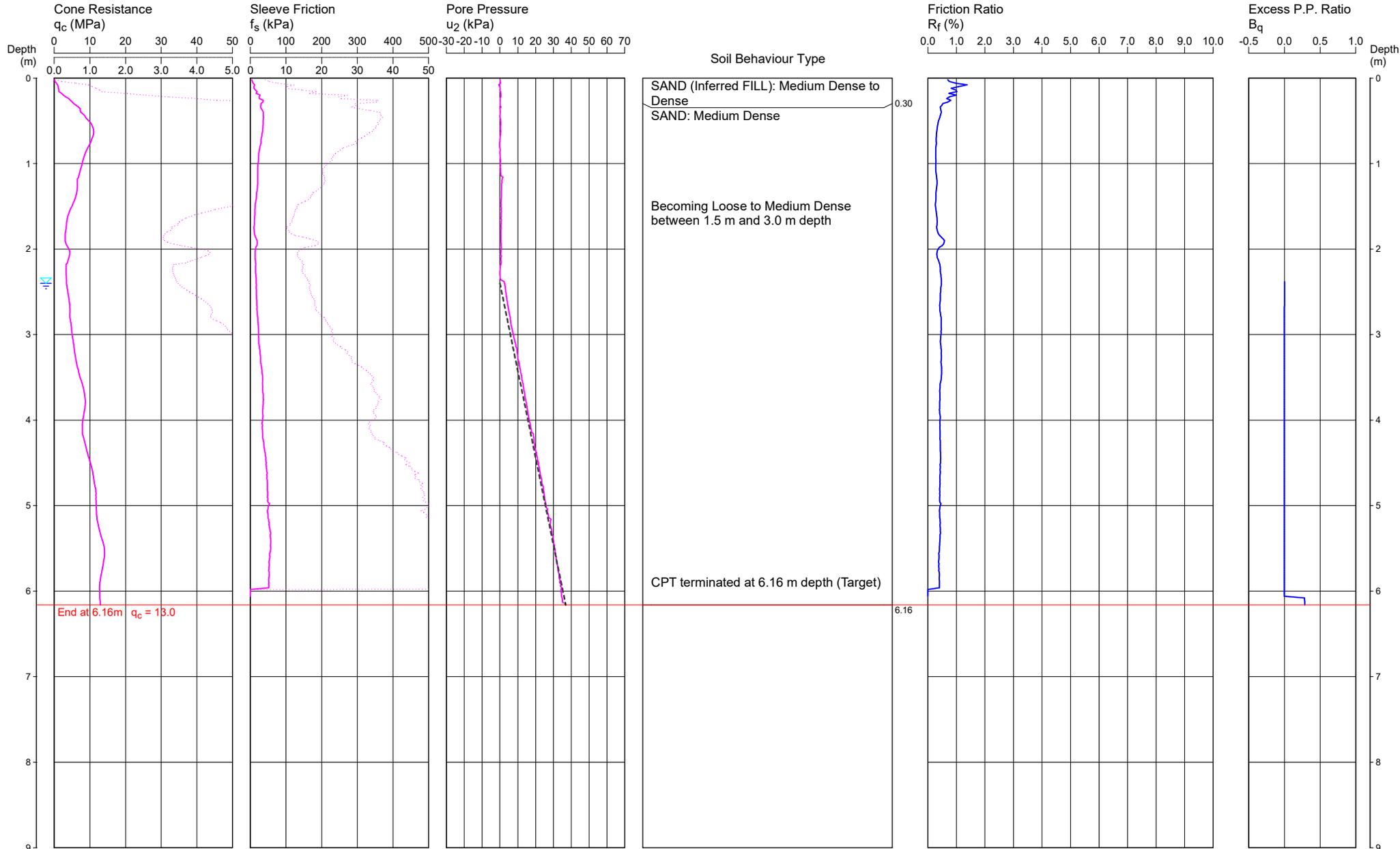
COORDINATES: 393371E 6468107N MGA94 50J

CPTU 118

Page 1 of 1

DATE 23/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 118.CP5
Cone ID: Probedrill Type: EC33

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Water depth after test: 2.40m depth (assumed)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.1 m AHD*

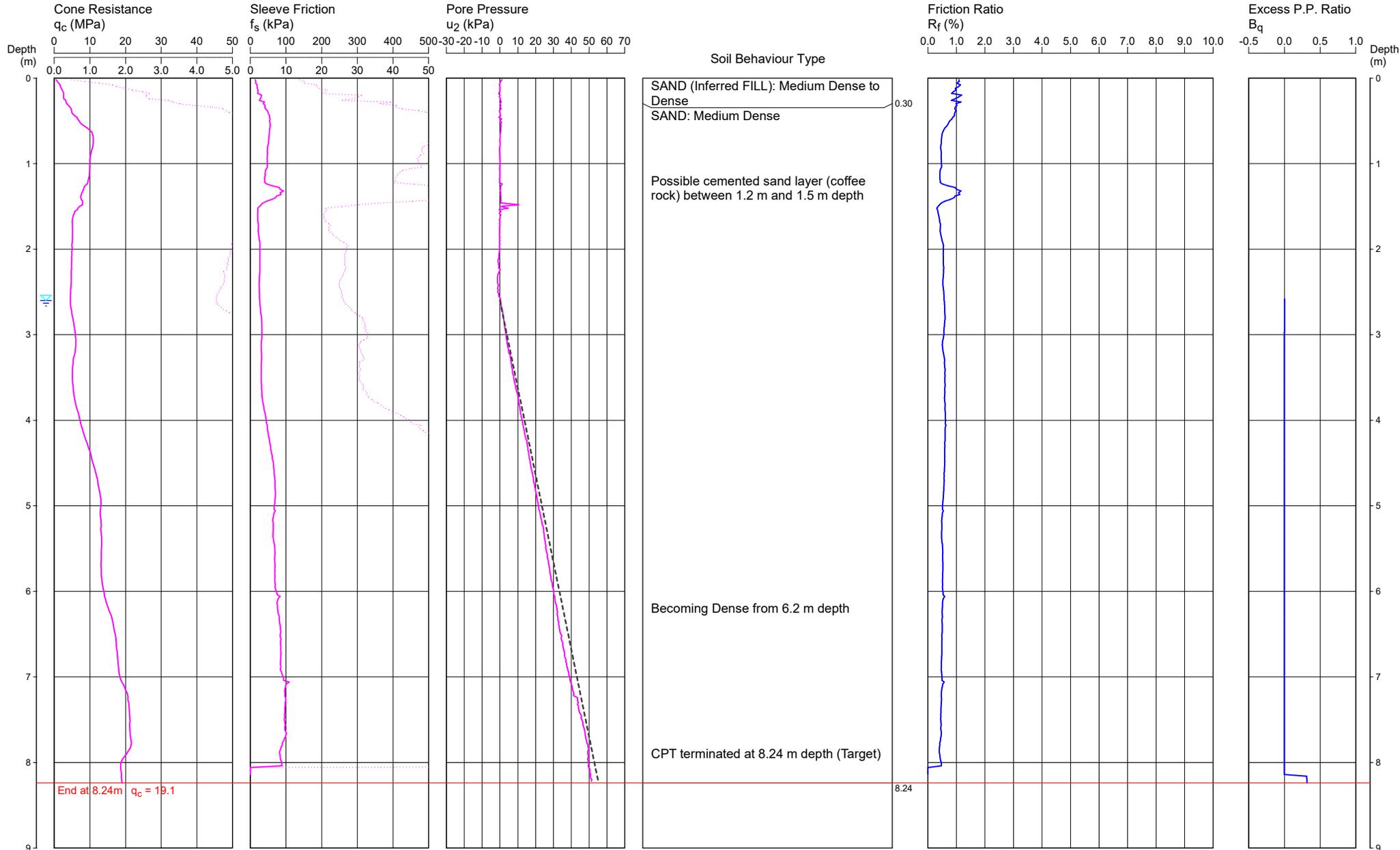
COORDINATES: 393331E 6468095N MGA94 50J

CPTU 119

Page 1 of 1

DATE 23/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 119.CP5
Cone ID: Probedrill Type: EC33

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.8 m AHD*

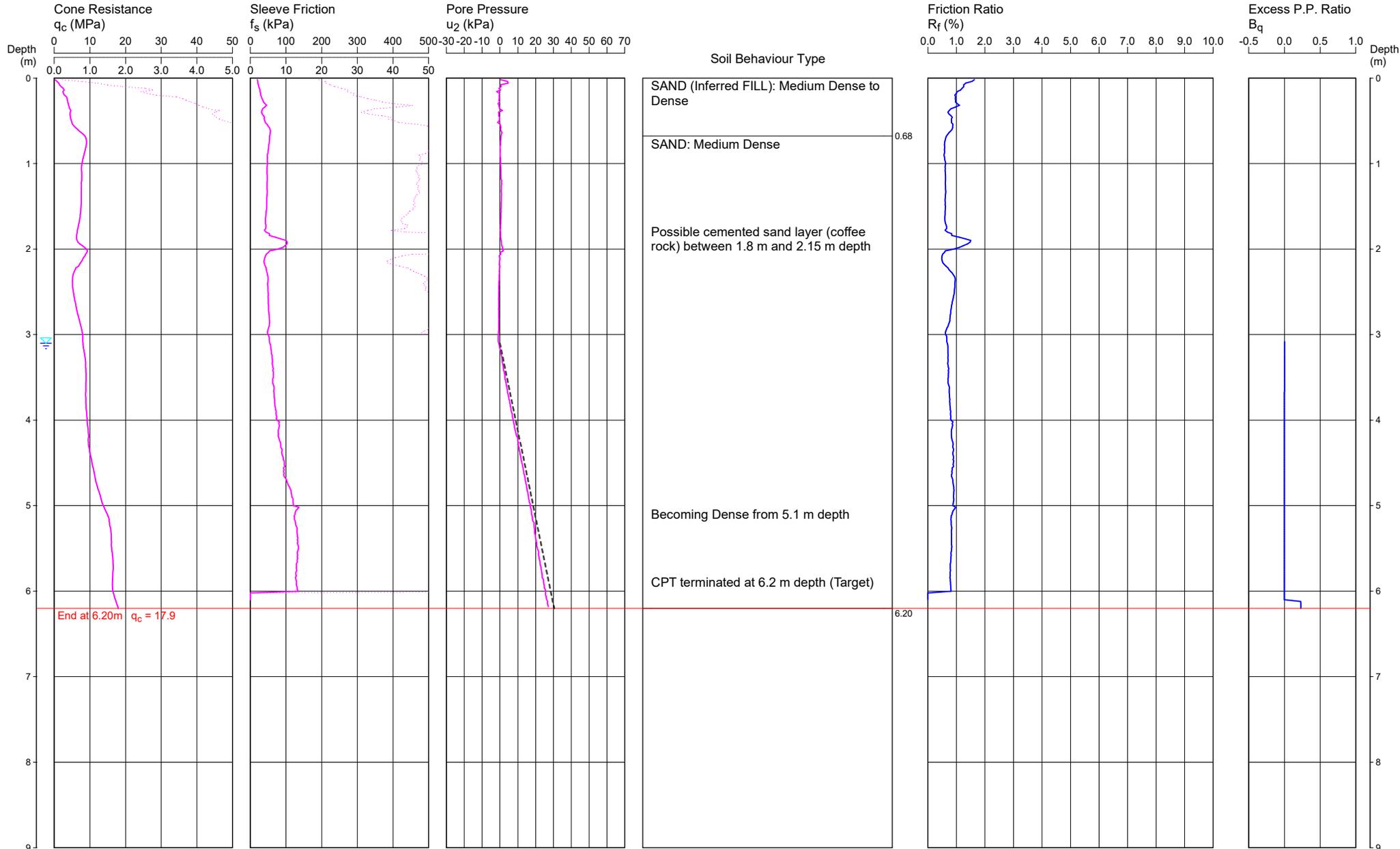
COORDINATES: 393459E 6468080N MGA94 50J

CPTU 120

Page 1 of 1

DATE 23/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 120.CP5
Cone ID: Probedrill Type: EC33

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Water depth after test: 3.10m depth (assumed)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 21.8 m AHD*

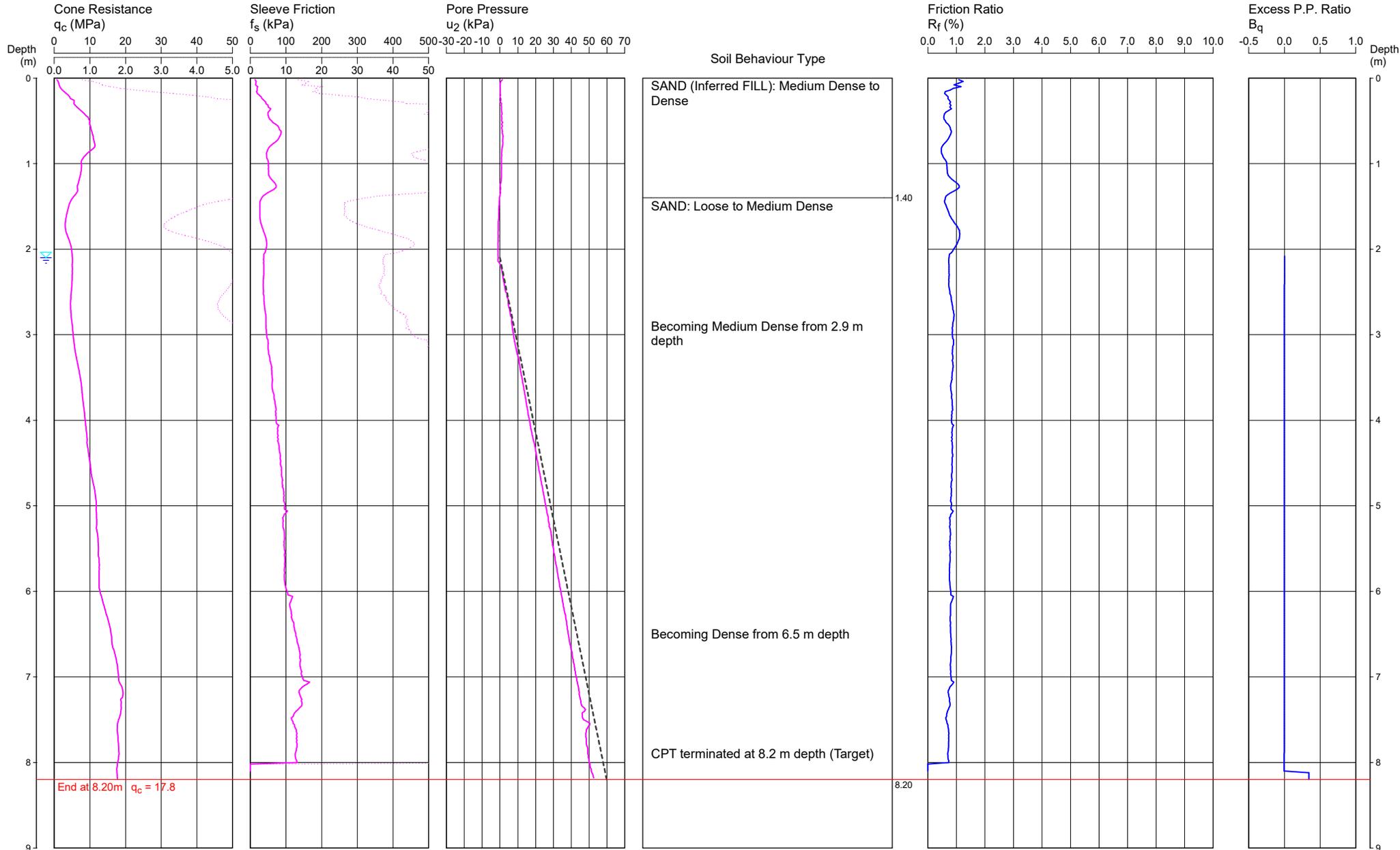
COORDINATES: 393400E 6468109N MGA94 50J

CPTU 121

Page 1 of 1

DATE 23/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 121.CP5
Cone ID: Probedrill Type: EC33

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Water depth after test: 2.10m depth (assumed)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.6 m AHD*

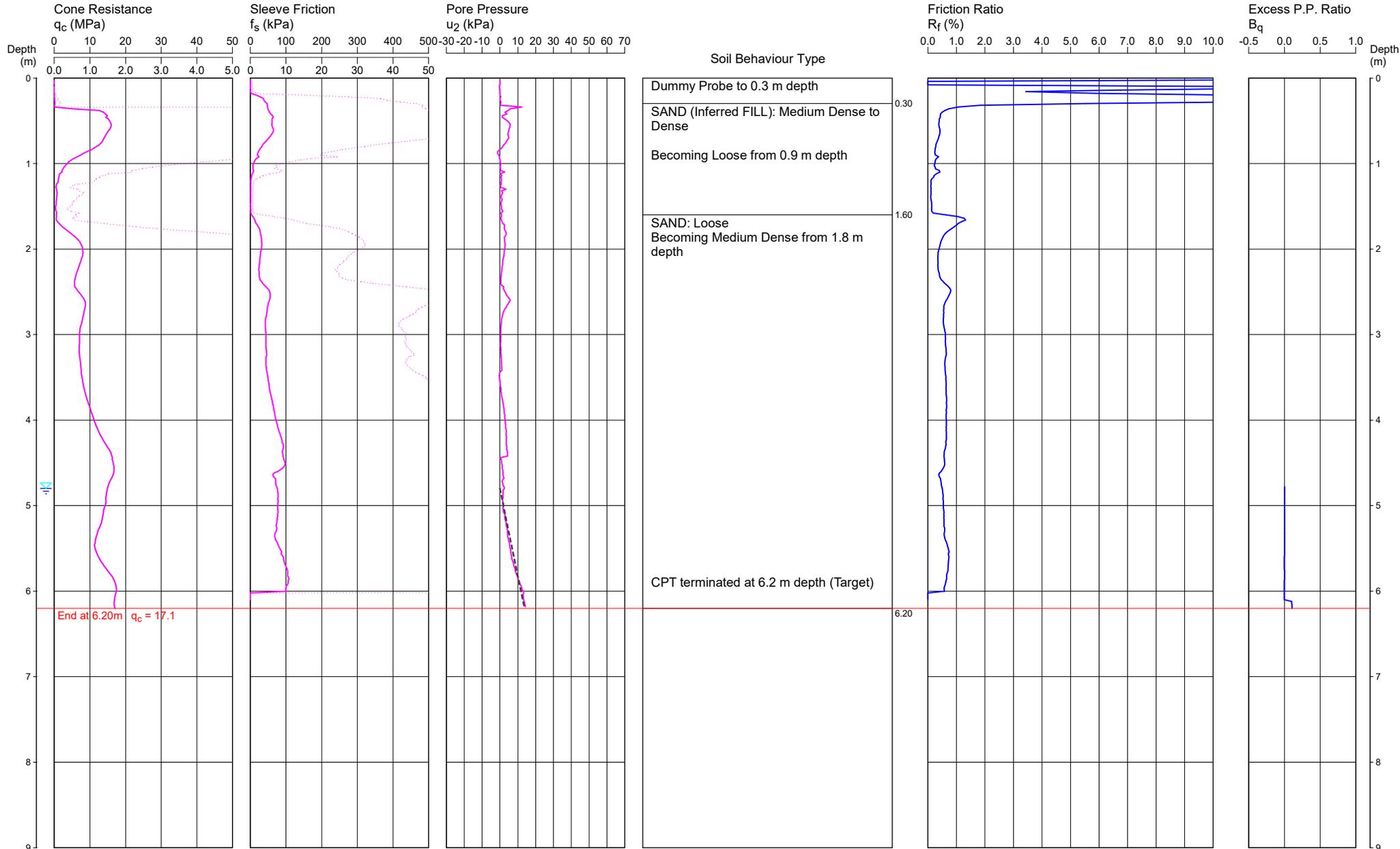
COORDINATES: 393057E 6467826N MGA94 50J

CPTU 122

Page 1 of 1

DATE 22/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 122.CP5
 Cone ID: Probedrill Type: EC46

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd

Water depth after test: 4.80m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.7 m AHD*

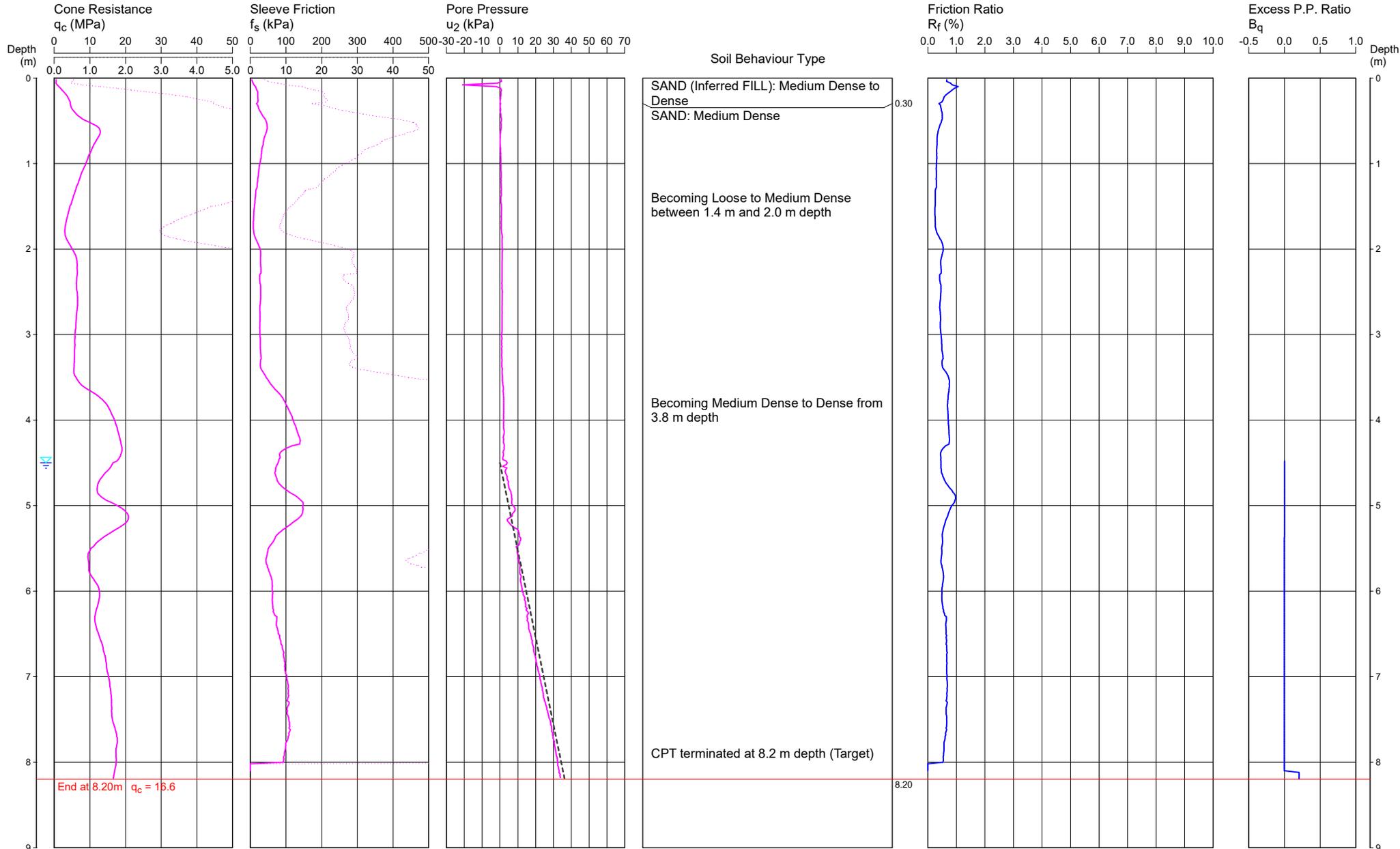
COORDINATES: 393161E 6467962N MGA94 50J

CPTU 123

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DATE 22/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 123.CP5
Cone ID: Probedrill Type: EC46

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.3 m AHD*

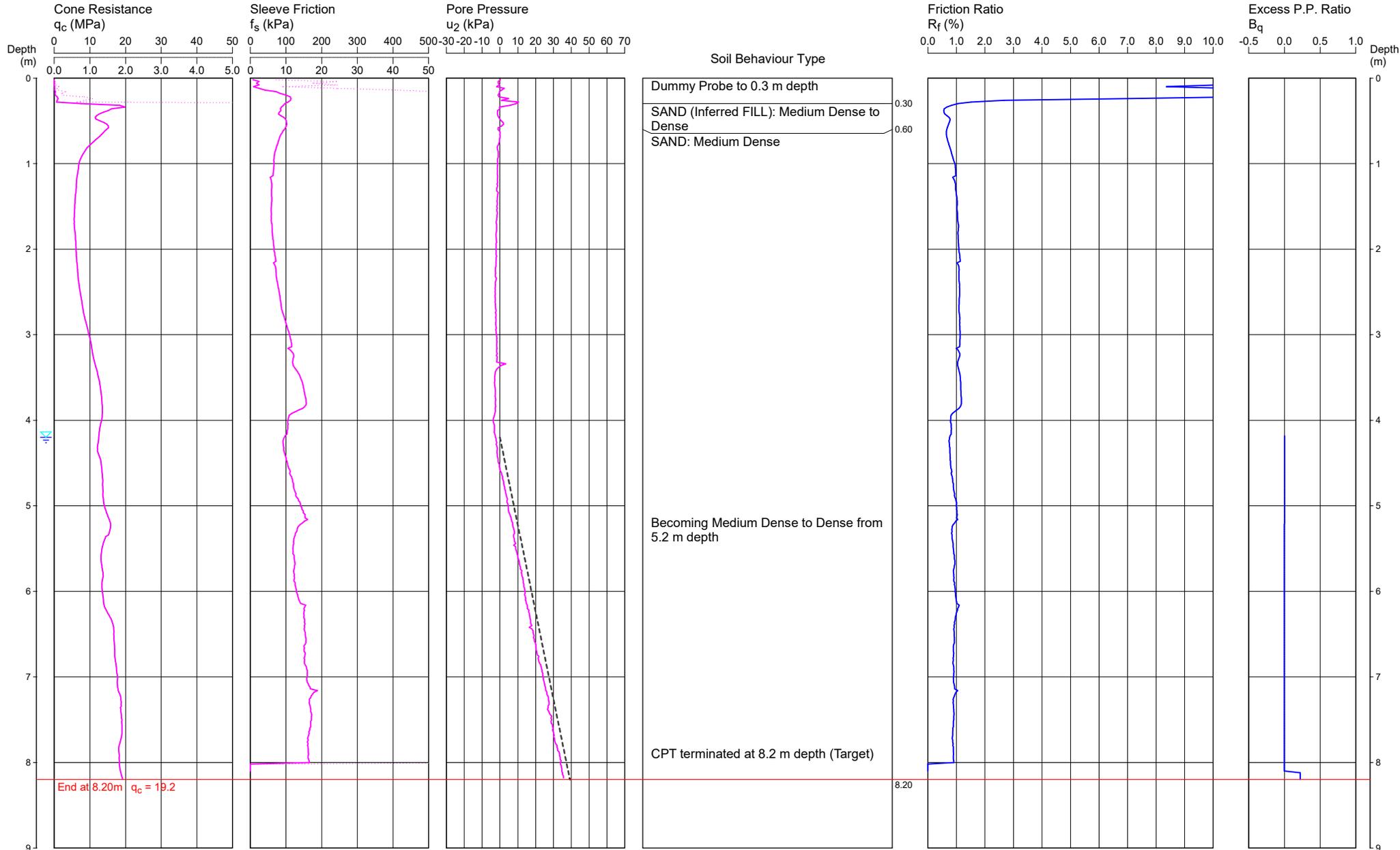
COORDINATES: 393127E 6468026N MGA94 50J

CPTU 124

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DATE 21/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 124.CP5
 Cone ID: Probedrill Type: EC10

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd

Water depth after test: 4.20m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 24.0 m AHD*

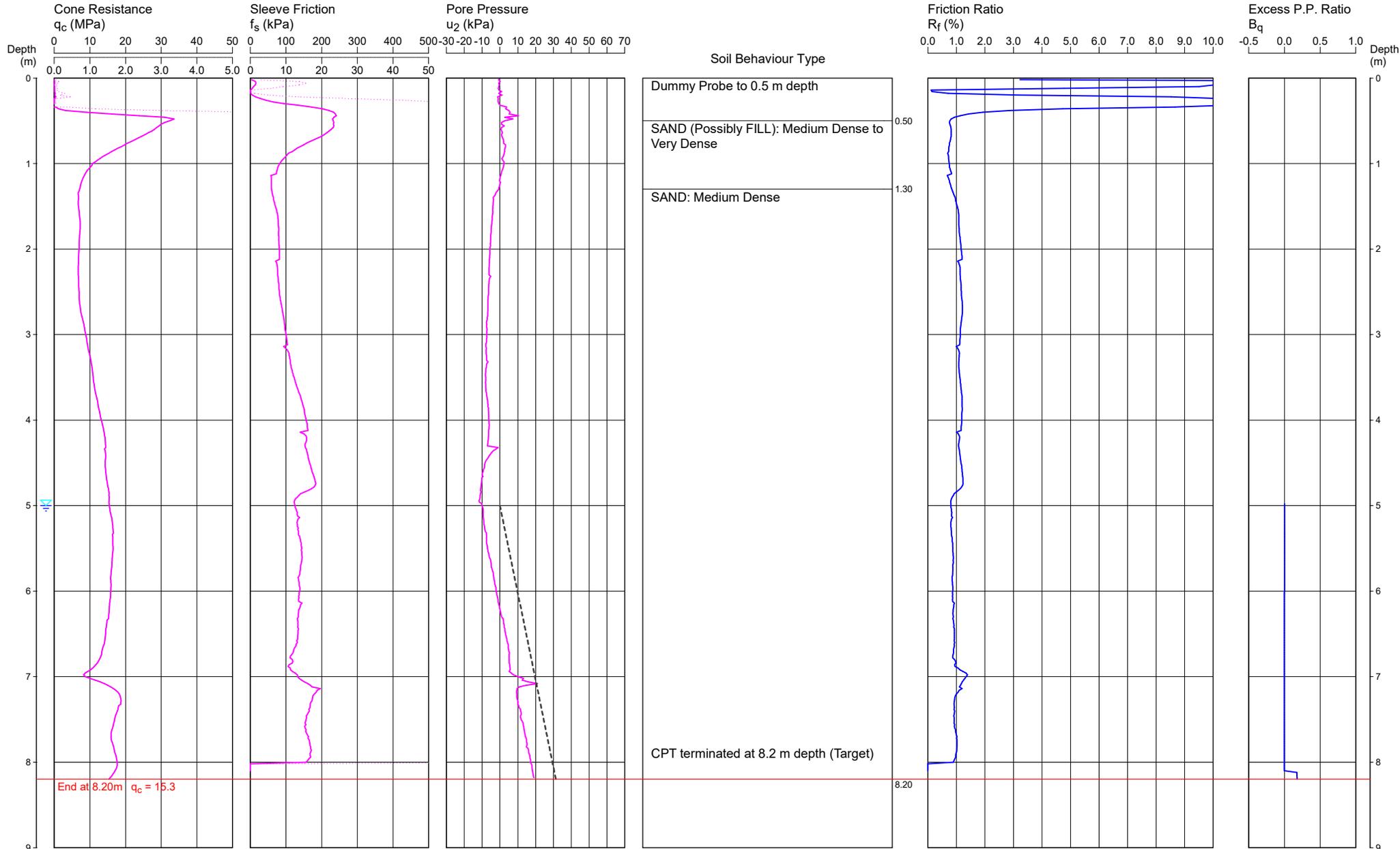
COORDINATES: 392866E 6467998N MGA94 50J

CPTU 125

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DATE 21/06/2023

PROJECT No: 216618.01



End at 8.20m $q_c = 15.3$

Dummy Probe to 0.5 m depth

SAND (Possibly FILL): Medium Dense to Very Dense

SAND: Medium Dense

CPT terminated at 8.2 m depth (Target)

REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 125.CP5
Cone ID: Probedrill Type: EC10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Water depth after test: 5.00m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 24.0 m AHD*

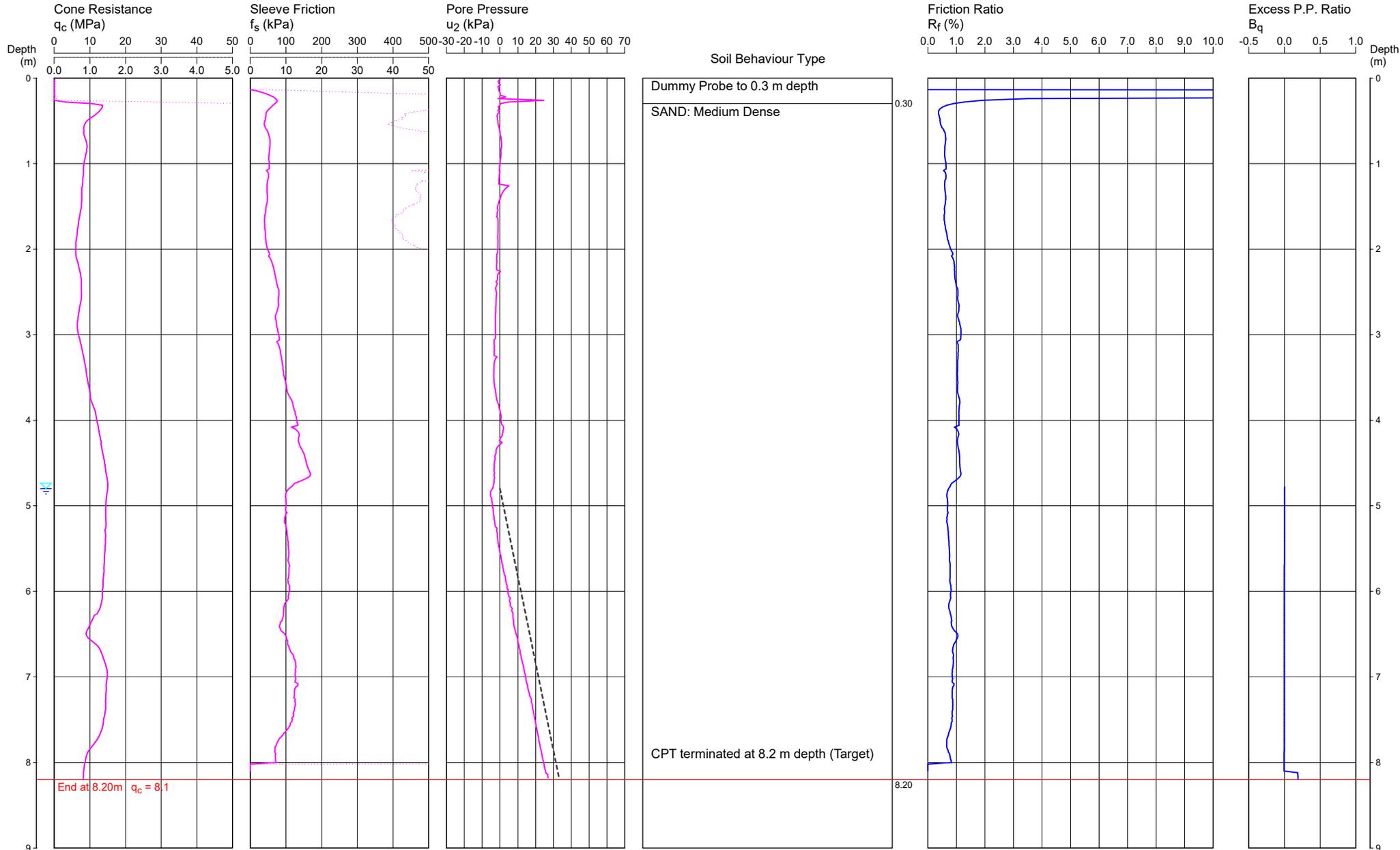
COORDINATES: 392898E 6468034N MGA94 50J

CPTU 126

Page 1 of 1

DATE 21/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 126.CP5
Cone ID: Probedrill Type: EC10

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Water depth after test: 4.80m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.7 m AHD*

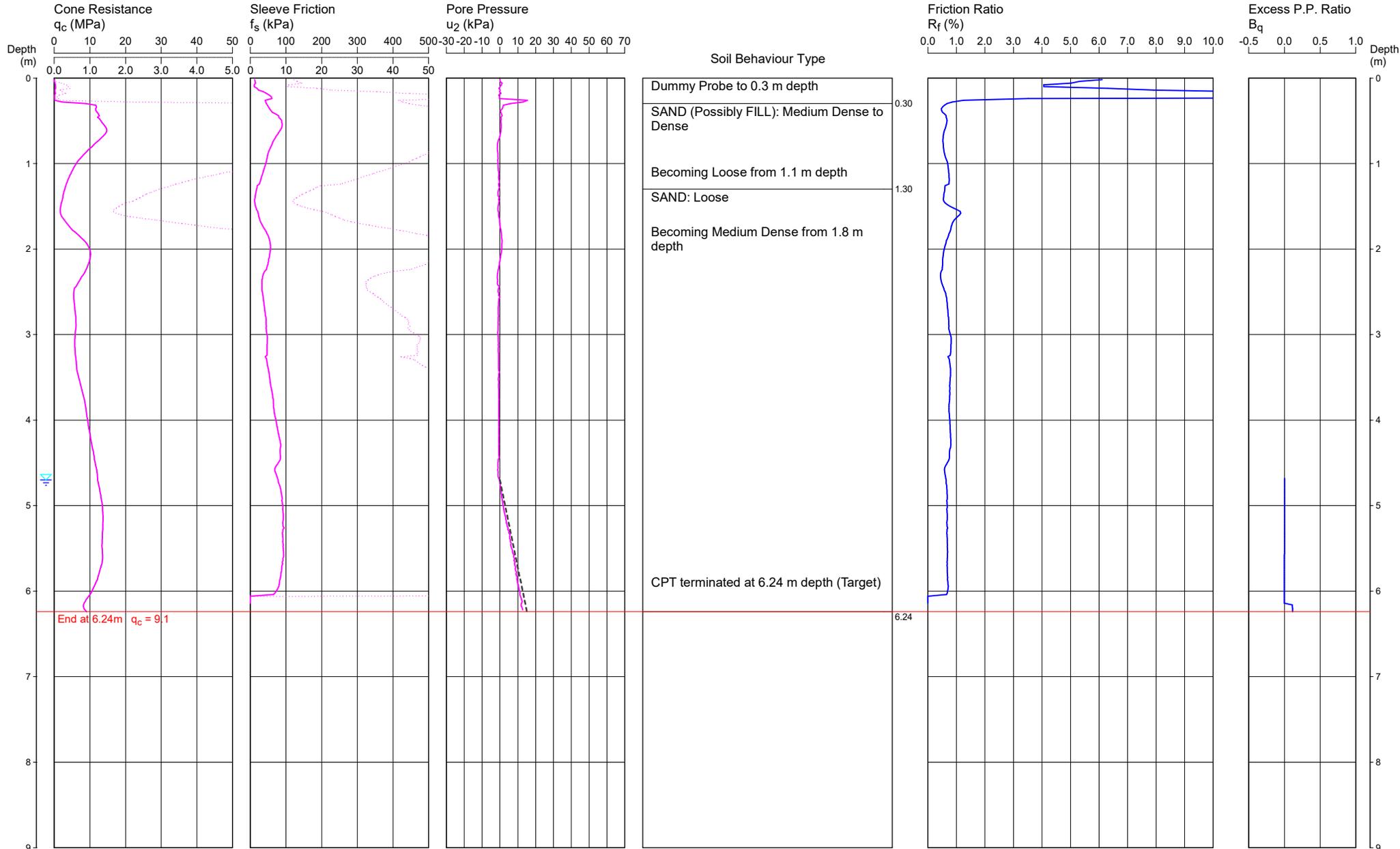
COORDINATES: 392926E 6467982N MGA94 50J

CPTU 127

Page 1 of 1

DATE 22/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

Water depth after test: 4.70m depth (measured)

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 127.CP5
 Cone ID: Probedrill Type: EC46

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.6 m AHD*

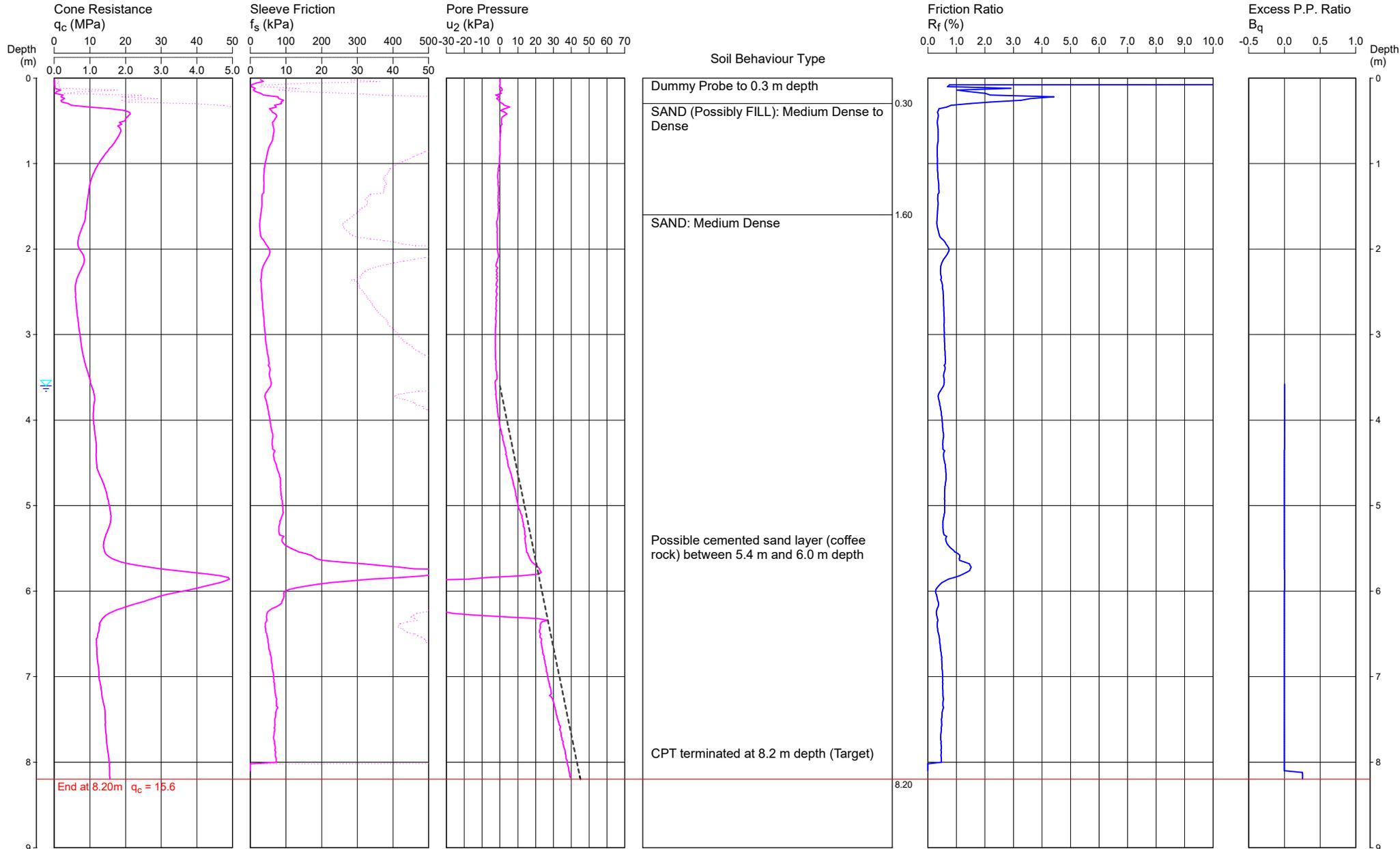
COORDINATES: 393029E 6467827N MGA94 50J

CPTU 128

Page 1 of 1

DATE 22/06/2023

PROJECT No: 216618.01



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.

File: C:\Users\Gary.Gao\Desktop\CPT\DP\216618.01 - CPTU 128.CP5
Cone ID: Probedrill Type: EC46

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

Water depth after test: 3.60m depth (measured)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 21.6 m AHD*
EASTING: 392919
NORTHING: 6467715
DIP/AZIMUTH: 90°/--

BORE No: 129
PROJECT No: 216618.01
DATE: 27/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.02	ASPHALT: black, 7 mm sized nominal aggregate.	[Cross-hatched pattern]											
	0.18	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey and yellow-brown, fine to medium grained, with silt, moist, fill. Gravel is crushed rock.	[Cross-hatched pattern]											
	0.75	FILL/SAND SP: fine to medium grained, bands of grey, grey-brown and dark grey, trace gravel to 0.38 m depth, trace silt, moist, dense to very dense, fill. SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	[Dotted pattern]											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 24.2 m AHD*
EASTING: 393075
NORTHING: 6467851
DIP/AZIMUTH: 90°/--

BORE No: 130
PROJECT No: 216618.01
DATE: 29/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.05	ASPHALT: black, 7 mm sized nominal aggregate.	[Asphalt symbol]											
	0.25	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to medium grained, pale yellow, fine to medium grained, with silt, moist, fill. Gravel is crushed limestone.	[Gravel symbol]	B	0.25									
	0.5	FILL/SAND SP: fine to medium grained, dark grey, trace gravel and silt, moist, fill. - becoming grey and dark grey from 0.35 m depth.	[Sand SP symbol]		0.5									
	1	SAND SP: fine to medium grained, pale yellow, trace silt, dense. Sand derived from Tamala Limestone. - becoming yellow-brown from 0.7 m depth.	[Sand SP symbol]											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.0 m AHD*
EASTING: 392854
NORTHING: 6467797
DIP/AZIMUTH: 90°/--

BORE No: 131
PROJECT No: 216618.01
DATE: 27/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
22.02	0.02	ASPHALT: black, 7 mm sized nominal aggregate.	▨						
22.15	0.15	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey, fine to medium grained, with silt, moist, fill. Gravel is crushed rock.	▩		0.15				
22.35	0.35				0.35				
		FILL/SUB-BASE: Gravelly SAND SP-SM: fine to medium grained, grey, yellow-brown and grey-brown, with silt, trace pieces of tile, moist, fill.							
		FILL/SAND SP: fine to medium grained, brown, trace gravel and silt, moist, medium dense to dense, fill.							
22.1	1.2	SAND SP: fine to medium grained, grey, trace silt, moist. Bassendean Sand. - becoming pale grey from 1.4 m depth.	●						
22.2	2.2	SAND SP-SM: fine to medium grained, dark brown, with silt, trace pockets of weakly cemented Silty SAND SM, moist. Bassendean Sand.	●						
22.5	2.5	Bore discontinued at 2.5m (Target depth)							



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.7 m AHD*
EASTING: 392843
NORTHING: 6467912
DIP/AZIMUTH: 90°/--

BORE No: 132
PROJECT No: 216618.01
DATE: 27/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
0.015		ASPHALT: black, 7 mm sized nominal aggregate.	AS											
0.175		FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to medium grained, grey-brown, fine to medium grained, with silt, moist, fill. Gravel is crushed rock.	G											
		FILL/SAND SP: fine to medium grained, yellow-brown, trace gravel and silt, moist, medium dense to dense, fill.	S	B	0.5									
		- becoming brown, trace pockets of pale grey SAND from 1.2 m depth.												
		- becoming grey-brown and brown from 1.6 m depth.												
		- with pockets of crushed rock from 1.8 m depth.												
		- tile pieces observed at 2.0 m depth.		D	2.0									
2.3		SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	S											
2.5		Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole to 1.8 m and 110 mm diameter hand auger borehole to 2.5 m depth

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.4 m AHD*
EASTING: 392806
NORTHING: 6467889
DIP/AZIMUTH: 90°/--

BORE No: 133
PROJECT No: 216618.01
DATE: 27/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.02	ASPHALT: black, 7 mm sized nominal aggregate.	▨											
	0.155	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, blue-grey, fine to medium grained, with silt, fill. Gravel is crushed rock.	▩											
		FILL/SAND SP: fine to medium grained, yellow-brown and pale yellow-brown, trace silt, moist, dense to very dense, fill. - becoming brown from 0.48 m depth.	▩											
	1.3	SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist. Bassendean Sand.	▩											
	1.4	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	▩											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.5 m AHD*
EASTING: 392882
NORTHING: 6467983
DIP/AZIMUTH: 90°/--

BORE No: 134
PROJECT No: 216618.01
DATE: 27/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.02	ASPHALT: black, 7 mm sized nominal aggregate.												
	0.2	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown, fine to medium grained, with silt, moist, fill.												
		FILL/SAND SP: fine to medium grained, grey-brown, trace silt, moist, medium dense to dense, fill. - becoming yellow-brown from 0.25 m depth. - becoming pale grey from 0.6 m depth. - becoming dark grey and grey from 0.8 m depth.												
	1.1	SAND SP: fine to medium grained, grey, trace silt, moist, medium dense. Bassendean Sand. - becoming pale grey from 1.3 m depth.												
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.7 m AHD*
EASTING: 392885
NORTHING: 6468012
DIP/AZIMUTH: 90°/--

BORE No: 135
PROJECT No: 216618.01
DATE: 27/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.015	ASPHALT: black, 7 mm sized nominal aggregate.	AS											
	0.22	FILL/BASECOURSE: Gravelly SAND SP-SM: fine to coarse sized, grey-brown, fine to medium grained, with silt, moist, fill.	FS											
		SAND SP: fine to medium grained, dark grey, trace silt, moist, medium dense to dense. Bassendean Sand. - becoming pale grey from 0.32 m depth.	S	B	0.5									
		- becoming pale brown and brown from 2.3 m depth.												
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.5 m AHD*
EASTING: 392913
NORTHING: 6468005
DIP/AZIMUTH: 90°/--

BORE No: 136
PROJECT No: 216618.01
DATE: 29/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
0.015		ASPHALT: black, 7 mm sized nominal aggregate.	AS											
0.18		FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown, fine to medium grained, with silt, moist, fill.	G											
		FILL/SAND SP: fine to medium grained, yellow-brown, trace silt and gravel, moist, medium dense, fill.	B	0.5										
	1	- becoming grey-brown from 1.0 m depth.												
	1.5	- becoming dark grey from 1.5 m depth.												
	1.8	FILL/ORGANIC SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist, fill. Pieces of glass and tile observed in fill.	D	2.0										
	2.1	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	S											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.2 m AHD*
EASTING: 392910
NORTHING: 6468113
DIP/AZIMUTH: 90°/--

BORE No: 137
PROJECT No: 216618.01
DATE: 27/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.08	ASPHALT: black, 7 mm sized nominal aggregate.												
	0.15	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown, fine to medium grained, with silt, moist, fill. Gravel is crushed rock.												
		FILL/SAND SP: fine to medium grained, yellow-brown, trace silt, moist, very dense, fill. - becoming grey-brown, trace silt from 0.38 m depth.												
	1.5	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.												
	2.2	Bore discontinued at 2.2m (Collapsing conditions)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.9 m AHD*
EASTING: 392935
NORTHING: 6468088
DIP/AZIMUTH: 90°/--

BORE No: 138
PROJECT No: 216618.01
DATE: 27/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
22.9	0.02	ASPHALT: black, 7 mm sized nominal aggregate.	[Cross-hatch pattern]											
	0.26	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, pale grey, fine to medium grained, with silt, moist, fill. Gravel is crushed rock.	[Cross-hatch pattern]											
		FILL/SAND SP: fine to medium grained, grey, trace gravel and silt, dry to moist, dense to very dense, fill.	[Cross-hatch pattern]	D	0.7									
	1.2	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	[Dotted pattern]											
		- becoming brown from 2.3 m depth.	[Dotted pattern]											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PLD	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.6 m AHD*
EASTING: 392977
NORTHING: 6468109
DIP/AZIMUTH: 90°/--

BORE No: 139
PROJECT No: 216618.01
DATE: 27/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.02	ASPHALT: black, 7 mm sized nominal aggregate.	ASPH											
	0.2	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, pale grey, fine to medium grained, with silt, moist, fill. Gravel is crushed rock.	GRAVEL											
	0.35	FILL/SAND SP: fine to medium grained, dark grey-brown and dark brown, trace silt, moist, fill. - becoming brown and yellow, trace limestone gravel from 0.35 m depth. - a piece of limestone cobble observed at 0.7 m depth.	SAND SP											
	1.0	SAND SP: fine to medium grained, grey, trace silt, moist, dense. Bassendean Sand. - becoming pale grey from 1.1 m depth.	SAND SP											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PLD	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.6 m AHD*
EASTING: 392971
NORTHING: 6468067
DIP/AZIMUTH: 90°/--

BORE No: 140
PROJECT No: 216618.01
DATE: 27/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.04	ASPHALT: black, 7 mm sized nominal aggregate.	[Asphalt Pattern]											
	0.18	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, blue-grey, fine to medium grained, with silt, moist, fill.	[Cross-hatch Pattern]	B	0.3									
	0.55	FILL/SAND SP: fine to medium grained, dark grey-brown and dark brown, trace gravel and silt, moist, fill. SAND SP: fine to medium grained, pale grey, trace silt, moist, very dense. Bassendean Sand.	[Dotted Pattern]											
		- becoming pale brown from 1.6 m depth.												
		- becoming brown from 1.9 m depth.												
		- trace pockets of SAND SP-SM from 2.2 m depth.												
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PLD	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.5 m AHD*
EASTING: 392994
NORTHING: 6468090
DIP/AZIMUTH: 90°/--

BORE No: 141
PROJECT No: 216618.01
DATE: 28/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.03	ASPHALT: black, 7 mm sized nominal aggregate.	[Symbol]											
	0.2	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown, fine to medium grained, with silt, moist, fill.	[Symbol]											
	0.55	FILL/SAND SP: fine to medium grained, bands of dark grey, dark grey-brown and yellow-brown, trace gravel and silt, moist, dense, fill. - becoming grey from 0.55 m depth.	[Symbol]											
	1.0	SAND SP: fine to medium grained, grey, trace silt, moist. Bassendean Sand. - becoming pale grey from 1.2 m depth.	[Symbol]	D	1.5									
	2.5	- becoming dark brown, trace pockets of SAND SP-SM from 2.4 m depth. Bore discontinued at 2.5m (Target depth)	[Symbol]											



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.7 m AHD*
EASTING: 393013
NORTHING: 6468070
DIP/AZIMUTH: 90°/--

BORE No: 142
PROJECT No: 216618.01
DATE: 28/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.02	ASPHALT: black, 7 mm sized nominal aggregate.	AS											
	0.11	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey, fine to medium grained, with silt, moist, fill.	GB											
	0.6	FILL/SAND SP: fine to medium grained, grey-brown, with gravel, trace silt, moist, fill. - becoming grey, trace gravel from 0.38 m depth. - becoming yellow-brown between 0.55 m to 0.6 m depth.	FS											
	1.1	SAND SP: fine to medium grained, pale grey, trace silt, moist, dense. Possibly fill.	SS	D	1.2									
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.0 m AHD*
EASTING: 393037
NORTHING: 6468159
DIP/AZIMUTH: 90°/--

BORE No: 143
PROJECT No: 216618.01
DATE: 28/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
20	0.05	ASPHALT: black, 7 mm sized nominal aggregate.	b. s.										
	0.14	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown, fine to medium grained, with silt, moist, fill.	x										
		FILL/SAND SP: fine to medium grained, bands of yellow-brown, brown and grey-brown, trace silt, moist, dense to very dense, fill. Pieces of broken glass and tile observed in fill. - becoming dark grey-brown and dark grey, trace gravel from 0.45 m depth.	x										
21	1.8	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	.										
21	2.5	Bore discontinued at 2.5m (Target depth)											



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.7 m AHD*
EASTING: 393020
NORTHING: 6468134
DIP/AZIMUTH: 90°/--

BORE No: 144
PROJECT No: 216618.01
DATE: 28/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.06	ASPHALT: black, 7 mm sized nominal aggregate.	[ASPHALT]											
	0.14	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey, fine to medium grained, with silt, moist, fill.	[GRAVEL]											
	0.5	FILL/SAND SP: fine to medium grained, yellow-brown, trace gravel and silt, moist, fill. Pieces of glass bottle observed in fill. - becoming grey-brown from 0.17 m depth. - becoming dark grey and dark grey-brown from 0.6 m depth.	[SAND SP]	B	0.5									
	1.5	SAND SP: fine to medium grained, grey, trace silt, moist. Bassendean Sand. - becoming pale grey from 1.8 m depth.	[SAND SP]											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.8 m AHD*
EASTING: 393046
NORTHING: 6468144
DIP/AZIMUTH: 90°/--

BORE No: 145
PROJECT No: 216618.01
DATE: 29/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
0.04	0.13	ASPHALT: black, 7 mm sized nominal aggregate. FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey and grey-brown, fine to medium grained, with silt, moist, fill. FILL/SAND SP: fine to medium grained, yellow-brown, trace gravel and silt, moist, dense to very dense, fill. - becoming grey-brown from 0.22 m depth. - becoming grey-brown and dark grey from 0.45 m depth.											
1.9	2.5	SAND SP: fine to medium grained, grey, trace silt, moist. Bassendean Sand. Bore discontinued at 2.5m (Target depth)											



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.2 m AHD*
EASTING: 393104
NORTHING: 6468124
DIP/AZIMUTH: 90°/--

BORE No: 146
PROJECT No: 216618.01
DATE: 28/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.04	ASPHALT: black, 7 mm sized nominal aggregate.	[Asphalt Pattern]											
	0.28	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to medium grained, pale yellow, fine to medium grained, with silt, moist, fill. Gravel is crushed limestone. FILL/SAND SP: fine to medium grained, dark grey, trace gravel and silt, moist, fill. - piece of limestone cobble observed at 0.65 m depth.	[Gravel Pattern]											
	1.0	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	[Sand Pattern]											
	2.0	SAND SP: fine to medium grained, brown, trace silt, moist. Possibly sand derived from Tamala Limestone.	[Sand Pattern]											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.7 m AHD*
EASTING: 393164
NORTHING: 6468108
DIP/AZIMUTH: 90°/--

BORE No: 147
PROJECT No: 216618.01
DATE: 29/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.04	ASPHALT: black, 7 mm sized nominal aggregate.	[Asphalt symbol]											
	0.2	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, pale grey, fine to medium grained, with silt, moist, fill. Gravel is crushed rock. - becoming grey-brown from 0.12 m depth.	[Gravel symbol]											
	0.5	FILL/SAND SP: fine to medium grained, bands of grey, pale grey and grey-brown, trace gravel and silt, moist, fill. SAND SP: fine to medium grained, pale grey, trace silt, moist, very dense. Bassendean Sand.	[Sand SP symbol]											
	1													
	2													
	2.5	- becoming dark brown, trace pockets of SAND SP-SM from 2.1 m depth. Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.6 m AHD*
EASTING: 393160
NORTHING: 6468064
DIP/AZIMUTH: 90°/--

BORE No: 148
PROJECT No: 216618.01
DATE: 28/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
0.02		ASPHALT: black, 7 mm sized nominal aggregate.	S											
0.17		FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown, fine to medium grained, with silt, moist, fill. Gravel is crushed rock.	G											
0.55		FILL/SAND SP: fine to medium grained, grey, trace gravel and silt, moist, very dense, fill. SAND SP: fine to medium grained, pale grey, trace silt, moist, very dense. Bassendean Sand.	S											
1.0		- becoming pale brown from 1.0 m depth.												
1.3		SAND SP: fine to medium grained, yellow-brown, trace silt, moist. Possibly sand derived from Tamala Limestone.	S											
2.0		- becoming pale brown from 2.1 m depth.		D	2.0									
2.5		Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.1 m AHD*
EASTING: 393190
NORTHING: 6468010
DIP/AZIMUTH: 90°/--

BORE No: 149
PROJECT No: 216618.01
DATE: 28/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
22.04	0.04	ASPHALT: black, 7 mm sized nominal aggregate.	b											
22.14	0.14	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, pale grey, fine to medium grained, with silt, moist, fill.	b											
		FILL/SAND SP: fine to medium grained, grey-brown, trace gravel and silt, moist, medium dense, fill. - becoming dark grey-brown from 0.4 m depth. - becoming pale yellow-brown, trace bands of grey-brown from 0.8 m depth.	b											
	1.3	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	b											
	2.5	Bore discontinued at 2.5m (Target depth)												

RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)



BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.2 m AHD*
EASTING: 393201
NORTHING: 6468047
DIP/AZIMUTH: 90°/--

BORE No: 150
PROJECT No: 216618.01
DATE: 28/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.03	ASPHALT: black, 7 mm sized nominal aggregate.	[Symbol]											
	0.2	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown, fine to medium grained, with silt, moist, fill. - becoming yellow-brown from 0.125 m depth.	[Symbol]											
	0.65	FILL/SAND SP: fine to medium grained, grey-brown, trace gravel and silt, moist, medium dense, fill. Scrap metal observed in fill. - becoming pale yellow-brown from 0.26 m depth. - becoming grey-brown and dark grey from 0.37 m depth.	[Symbol]											
	1	SAND SP: fine to medium grained, pale grey, trace silt, moist, medium dense. Bassendean Sand.	[Symbol]											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.5 m AHD*
EASTING: 393241
NORTHING: 6468125
DIP/AZIMUTH: 90°/--

BORE No: 151
PROJECT No: 216618.01
DATE: 28/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.03	ASPHALT: black, 7 mm sized nominal aggregate.	[Symbol]											
	0.135	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown, fine to medium grained, with silt, moist, fill.	[Symbol]	B	0.2									
	0.5	FILL/SAND SP: fine to medium grained, grey and grey-brown, trace gravel and silt, moist, medium dense, fill. SAND SP: fine to medium grained, pale grey, trace silt, moist, medium dense. Bassendean Sand. - becoming dark brown, trace pockets of Silty SAND SM from 1.7 m depth. - becoming pale brown from 2.0 m depth.	[Symbol]		0.5									
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.0 m AHD*
EASTING: 393252
NORTHING: 6468034
DIP/AZIMUTH: 90°/--

BORE No: 153
PROJECT No: 216618.01
DATE: 28/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
22.02	0.02	ASPHALT: black, 7 mm sized nominal aggregate.	S											
22.14	0.14	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown, fine to medium grained, with silt, moist, fill.	S											
		FILL/SAND SP: fine to medium grained, dark grey-brown, trace bands of yellow-brown, trace gravel and silt, moist, dense to very dense, fill. Pieces of tile, glass and brick observed in fill. - plastic wrap observed at 0.25 m depth. - piece of cobble observed at 0.35 m depth.	S	B	0.5									
22.15	1.5	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	S											
22.20	2.0	- becoming pale brown from 2.0 m depth.	S											
22.25	2.5	- becoming dark brown, trace pockets of SAND SP-SM from 2.4 m depth. Bore discontinued at 2.5m (Target depth)	S											



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.5 m AHD*
EASTING: 393195
NORTHING: 6468101
DIP/AZIMUTH: 90°/--

BORE No: 154
PROJECT No: 216618.01
DATE: 29/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.04	ASPHALT: black, 7 mm sized nominal aggregate.	[Asphalt symbol]											
	0.19	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown, fine to medium grained, with silt, moist, fill.	[Gravel symbol]											
	0.45	FILL/SAND SP: fine to medium grained, dark grey, trace gravel and silt, moist, fill. - becoming grey from 0.35 m depth.	[Sand SP symbol]											
		SAND SP: fine to medium grained, pale grey, trace silt, moist, medium dense. Bassendean Sand.	[Sand SP symbol]											
		- becoming dark brown and trace pockets of SAND SP-SM from 2.1 m depth. - becoming pale brown from 2.3 m depth.	[Sand SP symbol]											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.2 m AHD*
EASTING: 393132
NORTHING: 6468148
DIP/AZIMUTH: 90°/--

BORE No: 155
PROJECT No: 216618.01
DATE: 28/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.03	ASPHALT: black, 7 mm sized nominal aggregate.	[Asphalt Pattern]											
	0.18	FILL/BASECOURSE: Sandy GRAVEL GP-GM: fine to coarse sized, pale grey, fine to medium grained, with silt, fill. Gravel is crushed limestone.	[Gravel Pattern]											
	0.37	FILL/SAND SP-SM: fine to medium grained, dark grey-brown and grey-brown, with gravel and silt, moist, fill.	[Sand Pattern]	B	0.5									
	0.7	FILL/SAND SP: fine to medium grained, grey-brown, trace gravel and silt, moist, dense to very dense, fill. - becoming grey from 0.45 m depth.	[Sand Pattern]											
	1	SAND SP: fine to medium grained, grey, trace silt, moist, dense. Bassendean Sand. - becoming pale grey from 1.1 m depth.	[Sand Pattern]	D	1.1									
	2	- becoming pale brown from 1.9 m depth.												
	2.1	- becoming brown from 2.2 m depth.												
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:**
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.6 m AHD*
EASTING: 393081
NORTHING: 6467894
DIP/AZIMUTH: 90°/--

BORE No: 156
PROJECT No: 216618.01
DATE: 23/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.3	FILL/SAND SP: fine to medium grained, grey-brown and grey, trace silt, moist, medium dense, fill.	[Cross-hatch pattern]											
	0.3 - 2.5	SAND SP: fine to medium grained, yellow-brown, trace silt, moist, medium dense. Possibly sand derived from Tamala Limestone. - becoming pale yellow-brown from 1.2 m depth.	[Dotted pattern]											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.6 m AHD*
EASTING: 393053
NORTHING: 6467897
DIP/AZIMUTH: 90°/--

BORE No: 157
PROJECT No: 216618.01
DATE: 23/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.25	FILL/SAND SP: fine to medium grained, grey-brown, trace gravel and silt, moist, medium dense, fill.	XXXX										
	0.5	SAND SP: fine to medium grained, yellow-brown, trace silt, moist, medium dense. Possibly sand derived from Tamala Limestone.	.....	E	0.5								
	1.0		.....	D E	1.0								
	1.5		.....	E	1.5								
	2.0	- becoming pale yellow-brown from 2.0 m depth.	.....	E	2.0								
	2.5	Bore discontinued at 2.5m (Target depth)		E	2.5								



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.6 m AHD*
EASTING: 393126
NORTHING: 6467912
DIP/AZIMUTH: 90°/--

BORE No: 158
PROJECT No: 216618.01
DATE: 26/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
		FILL/SAND SP: fine to medium grained, grey, trace gravel and silt, moist, medium dense, fill. - becoming brown and yellow-brown from 0.1 m depth.											
		- becoming grey-brown and brown from 0.8 m depth.											
		- becoming grey-brown and yellow-brown from 1.2 m depth.											
	2.0	SAND SP: fine to medium grained, pale yellow-brown, trace silt, moist. Possibly sand derived from Tamala Limestone.		D	1.1								
	2.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.9 m AHD*
EASTING: 393148
NORTHING: 6467946
DIP/AZIMUTH: 90°/--

BORE No: 159
PROJECT No: 216618.01
DATE: 26/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
	0.7	FILL/SAND SP: fine to medium grained, dark grey, trace gravel and silt, moist, dense to very dense, fill.	[Cross-hatched pattern]	D	0.4				5 10 15 20
	1	SAND SP: fine to medium grained, yellow-brown, trace silt, moist, very dense. Possibly sand derived from Tamala Limestone.	[Dotted pattern]						
	2	- becoming pale brown from 1.9 m depth.	[Dotted pattern]						
	2.5	Bore discontinued at 2.5m (Target depth)							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.6 m AHD*
EASTING: 393015
NORTHING: 6467927
DIP/AZIMUTH: 90°/--

BORE No: 160
PROJECT No: 216618.01
DATE: 23/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.4	FILL/SAND SP: fine to medium grained, grey-brown, trace silt, trace gravel to 0.2 m depth, moist, medium dense, fill.	[Cross-hatch pattern]										
	0.4	SAND SP: fine to medium grained, brown, trace silt, moist, medium dense. Possibly sand derived from Tamala Limestone.	[Dotted pattern]	D	1.0								
		- becoming yellow-brown from 1.6 m depth.											
		- becoming pale yellow-brown from 2.0 m depth.											
	2.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.1 m AHD*
EASTING: 392945
NORTHING: 6468049
DIP/AZIMUTH: 90°/--

BORE No: 161
PROJECT No: 216618.01
DATE: 22/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
23	0.1	FILL/TOPSOIL: SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace rootlets, moist, fill.	[Cross-hatched pattern]										
	0.35	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, pale yellow, fine to medium grained, with silt, moist, very dense, fill. Gravel is crushed limestone.											
	0.85	FILL/SAND SP: fine to medium grained, grey, trace gravel and silt, moist, dense to very dense, fill.	[Cross-hatched pattern]	E	0.5								
	1	SAND SP: fine to medium grained, dark grey, trace silt, moist, dense. Bassendean Sand. - becoming pale grey from 1.1 m depth.	[Dotted pattern]	D	1.0								
22	1.5	- becoming pale brown from 1.7 m depth.	[Dotted pattern]	E	1.5								
	2.0	SAND SP-SM: fine to medium grained, brown, with silt, moist. Bassendean Sand.	[Dotted pattern]	E	2.0								
	2.5	Bore discontinued at 2.5m (Target depth)	[Dotted pattern]	E	2.5								



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.7 m AHD*
EASTING: 393150
NORTHING: 6467986
DIP/AZIMUTH: 90°/--

BORE No: 162
PROJECT No: 216618.01
DATE: 22/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
		FILL/SAND SP: fine to medium grained, dark grey, trace gravel and silt, moist, medium dense, fill.	[Cross-hatch pattern]	E	0.5									
		- becoming pale grey and no gravel from 0.7 m depth.		D	1.0									
	1.1	SAND SP: fine to medium grained, dark grey, trace silt, moist. Bassendean Sand.	[Dotted pattern]	E	1.5									
		- becoming pale grey from 1.2 m depth.		E	2.0									
	2.5	Bore discontinued at 2.5m (Target depth)		E	2.5									



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.
REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)



BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 21.8 m AHD*
EASTING: 393346
NORTHING: 6467988
DIP/AZIMUTH: 90°/--

BORE No: 163
PROJECT No: 216618.01
DATE: 23/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
	1.2	FILL/ORGANIC SAND SP: fine to medium grained, dark grey and grey-brown, trace gravel and silt, moist, medium dense, fill. Scrap metal, pieces of glass and brick observed in fill.	[Cross-hatched pattern]	D	1.0			[Penetration curve showing ~10 blows]				
	2.0	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	[Dotted pattern]									
	2.5	Bore discontinued at 2.5m (Target depth)										



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.2 m AHD*
EASTING: 393326
NORTHING: 6467955
DIP/AZIMUTH: 90°/--

BORE No: 164
PROJECT No: 216618.01
DATE: 23/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
22		FILL/ORGANIC SAND SP-SM: fine to medium grained, dark grey, with gravel and silt, moist, dense to very dense, fill. Pieces of tile, glass and brick observed in fill.		D	0.5				
1	1.0	SAND SP: fine to medium grained, grey, trace silt, moist. Bassendean Sand.		E	1.0				
		- becoming pale grey from 1.4 m depth.		E	1.1				
				E	1.5				
				E	2.0				
	2.5	Bore discontinued at 2.5m (Target depth)		E	2.5				



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 21.4 m AHD*
EASTING: 393364
NORTHING: 6468083
DIP/AZIMUTH: 90°/--

BORE No: 165
PROJECT No: 216618.01
DATE: 23/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
21 20 19	0.5	FILL/SAND SP: fine to medium grained, grey, trace silt, moist, medium dense, fill. Plastic wrap observed at 0.5 m depth.	[Cross-hatch pattern]										
		SAND SP: fine to medium grained, pale grey, trace silt, moist, medium dense. Bassendean Sand.	[Dotted pattern]										
	1.3	- becoming dark grey from 1.2 m depth.											
	1.5	Cemented Silty SAND SM: fine to medium grained, dark brown, moist, weakly cemented. Coffee Rock.	[Vertical line pattern]										
		SAND SP: fine to medium grained, brown, trace silt, moist. Bassendean Sand. - becoming pale brown from 1.65 m depth.	[Dotted pattern]										
	2.1	Bore discontinued at 2.1m (Collapsing conditions)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater encountered at 1.85 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)



BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 21.3 m AHD*
EASTING: 393364
NORTHING: 6468023
DIP/AZIMUTH: 90°/--

BORE No: 167
PROJECT No: 216618.01
DATE: 23/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
21	0.7	FILL/SAND SP: fine to medium grained, dark grey, trace gravel and silt, moist, medium dense, fill. Tile pieces observed in fill.							5 10 15 20
19	2.2	SAND SP: fine to medium grained, pale grey, trace silt, moist, medium dense to dense. Bassendean Sand. - becoming grey from 1.7 m depth.						1 2	
19	2.2	Bore discontinued at 2.2m (Collapsing conditions)							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater encountered at 1.8 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.6 m AHD*
EASTING: 393464
NORTHING: 6468097
DIP/AZIMUTH: 90°/--

BORE No: 168
PROJECT No: 216618.01
DATE: 23/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
22 21 20	0.7	FILL/SAND SP: fine to medium grained, grey-brown, trace gravel and silt, moist, medium dense, fill. - becoming grey and grey-brown from 0.3 m depth.	[Cross-hatch pattern]	E	0.5			5 10 15 20	
	1.8	SAND SP: fine to medium grained, pale grey, trace silt, moist, medium dense. Bassendean Sand. - becoming grey from 1.6 m depth.	[Dotted pattern]	D E	1.0 1.5			5 10 15 20	
	2.1	SAND SP-SM: fine to medium grained, dark brown, with silt, trace pockets of weakly cemented Silty SAND SM, moist. Bassendean Sand.	[Dotted pattern]	E	2.0			5 10 15 20	
	2.5	SAND SP: fine to medium grained, pale brown, trace silt, moist. Bassendean Sand.	[Dotted pattern]	E	2.5			5 10 15 20	
		2.5	Bore discontinued at 2.5m (Target depth)		E	2.5			5 10 15 20



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 21.8 m AHD*
EASTING: 393340
NORTHING: 6468077
DIP/AZIMUTH: 90°/--

BORE No: 169
PROJECT No: 216618.01
DATE: 23/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.1	FILL/TOPSOIL: SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist, fill.	[Cross-hatch pattern]										
		FILL/SAND SP: fine to medium grained, yellow-brown, trace silt, moist, medium dense, fill. - becoming dark grey, trace gravel from 0.2 m depth.		D	0.3								
			E	0.5									
	0.8	SAND SP: fine to medium grained, grey, trace silt, moist, medium dense. Bassendean Sand.	[Dotted pattern]	D	1.0								
		- becoming pale grey from 1.3 m depth.		E	1.5								
	1.7	Cemented Silty SAND SM: fine to medium grained, brown and dark brown, moist, weakly cemented. Coffee Rock.		E	2.0								
	2.0	SAND SP: fine to medium grained, pale brown, trace silt, moist. Bassendean Sand.	[Dotted pattern]	E	2.5								
	2.5	Bore discontinued at 2.5m (Target depth)		E									



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 24.3 m AHD*
EASTING: 393032
NORTHING: 6467789
DIP/AZIMUTH: 90°/--

BORE No: 170
PROJECT No: 216618.01
DATE: 26/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
24	0.2	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace rootlets and gravel, moist, fill.	[Cross-hatched pattern]	D	1.0			Water					
	1	FILL/SAND SP: fine to medium grained, grey-brown, trace gravel and silt, moist, dense to very dense, fill.											
23	1	- becoming grey-brown and grey from 1.2 m depth.											
22	1.5	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	[Dotted pattern]										
21	2												
20	2.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.1 m AHD*
EASTING: 392954
NORTHING: 6467812
DIP/AZIMUTH: 90°/--

BORE No: 171
PROJECT No: 216618.01
DATE: 26/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
23		FILL/SAND SP: fine to medium grained, bands of brown, yellow-brown and grey-brown, trace gravel and silt, moist, medium dense, fill.												
	1	- with gravel between 0.9 m and 1.2 m depth.												
		- becoming pale grey and grey-brown from 1.3 m depth.												
	1.9	- brick pieces observed at 1.8 m depth.												
2		SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.												
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.3 m AHD*
EASTING: 392899
NORTHING: 6467913
DIP/AZIMUTH: 90°/--

BORE No: 172
PROJECT No: 216618.01
DATE: 26/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
23	0.0	FILL/SAND SP: fine to medium grained, bands of grey, grey-brown, pale yellow and yellow-brown, trace gravel and silt, moist, medium dense, fill. Pieces of tile and brick observed in fill.		D	1.0				<div style="display: flex; justify-content: space-around; width: 100%;"> 5101520 </div>
22	1.3	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand. - becoming pale brown from 1.8 m depth. - becoming brown from 2.0 m depth.							
21	2.5	Bore discontinued at 2.5m (Target depth)							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)



BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 21.4 m AHD*
EASTING: 392899
NORTHING: 6467762
DIP/AZIMUTH: 90°/--

BORE No: 174
PROJECT No: 216618.01
DATE: 23/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
21 20 19	0.5	FILL/SAND SP: fine to medium grained, grey and grey-brown, trace gravel and silt, moist, medium dense, fill.	[Cross-hatch pattern]	E	0.5				
	1.0	SAND SP: fine to medium grained, pale grey, trace silt, moist, medium dense. Bassendean Sand.	[Dotted pattern]	D E	1.0				
	1.6	- becoming grey-brown from 1.5 m depth.	[Dotted pattern]	E	1.5				
	2.0	SAND SP: fine to medium grained, brown, trace silt, trace pockets of weakly cemented SAND SP-SM, moist. Sand derived from Tamala Limestone.	[Dotted pattern]	E	2.0				
	2.5	- becoming pale brown from 2.0 m depth. - becoming pale yellow-brown from 2.2 m depth.	[Dotted pattern]	E	2.5				
	2.5	Bore discontinued at 2.5m (Target depth)							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.3 m AHD*
EASTING: 393065
NORTHING: 6468059
DIP/AZIMUTH: 90°/--

BORE No: 175
PROJECT No: 216618.01
DATE: 22/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
23 22 21	0.1	FILL/TOPSOIL: SAND SP: fine to medium grained, grey, trace silt and rootlets, moist, fill. FILL/SAND SP: fine to medium grained, grey-brown, trace gravel and silt, moist, medium dense to dense, fill.	[Cross-hatched pattern]	E	0.5								
	0.7	SAND SP: fine to medium grained, grey, trace silt, moist, dense. Possibly fill.	[Dotted pattern]	E	1.0								
	1.0	SAND SP: fine to medium grained, yellow-brown, trace silt, moist. Possibly sand derived from Tamala Limestone.	[Dotted pattern]	D	1.1								
				E	1.5								
				E	2.0								
		2.5	Bore discontinued at 2.5m (Target depth)		E	2.5							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.1 m AHD*
EASTING: 393067
NORTHING: 6468096
DIP/AZIMUTH: 90°/--

BORE No: 176
PROJECT No: 216618.01
DATE: 22/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
23	0.1	FILL/TOPSOIL: SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist, fill.	[Cross-hatched pattern]	D	0.3								
		FILL/SAND SP: fine to medium grained, dark grey, trace gravel, silt and tree roots, moist, medium dense, fill.											
22	0.8	SAND SP: fine to medium grained, grey, trace silt, moist, dense. Bassendean Sand.	[Dotted pattern]	D	1.0								
1		- becoming brown from 1.6 m depth.											
2		- becoming pale brown from 2.0 m depth.											
21	2.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.6 m AHD*
EASTING: 393260
NORTHING: 6468123
DIP/AZIMUTH: 90°/--

BORE No: 177
PROJECT No: 216618.01
DATE: 22/6/2023
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
	0.6	FILL/SAND SP: fine to medium grained, dark grey, trace gravel and silt, moist, medium dense, fill.	[Cross-hatched pattern]						
	1.0	SAND SP: fine to medium grained, grey, trace silt, moist, medium dense to dense. Bassendean Sand. - becoming pale grey from 0.8 m depth.	[Dotted pattern]	D	1.0				[Penetration curve graph]
	1.9 2.0	Cemented Silty SAND SM: fine to medium grained, dark brown, moist, weakly cemented. Coffee rock. Bore discontinued at 2.0m (Hard digging, refusal on coffee rock)	[Horizontal lines pattern]						



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:**
TYPE OF BORING: 110 mm diameter hand auger borehole
WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level surveyed using a differential GPS with a reported accuracy of +/- 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

Appendix C

CPT Logs (Previous Investigation)
Borehole Logs (Previous Investigation)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 21.9 m AHD*

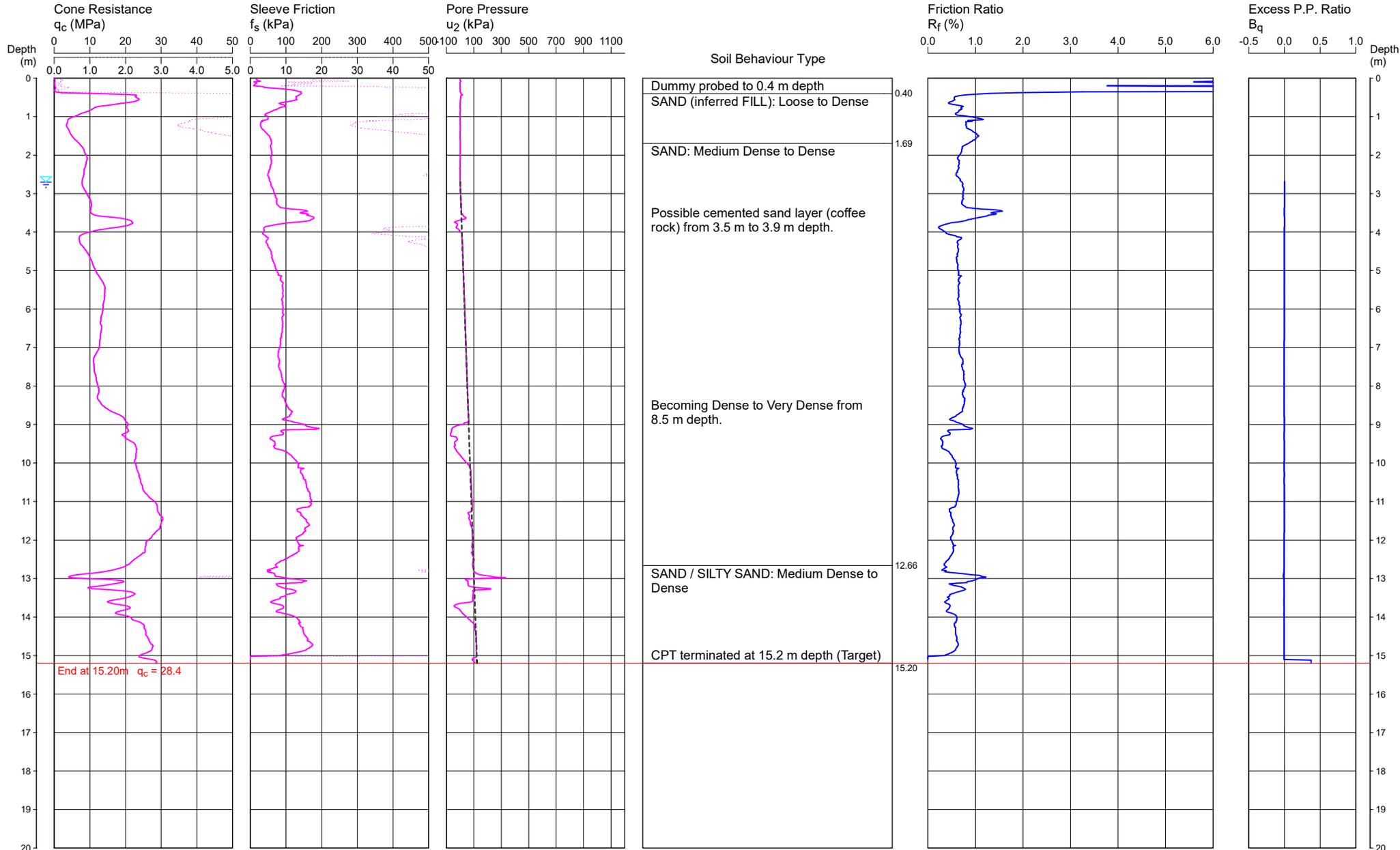
COORDINATES: 392938E 6467718N MGA94 50J

CPTU 01

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Groundwater assumed at 2.7 m depth

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 01.CP5
 Cone ID: Probedrill Type: ECF21GM

Water depth after test: 2.70m depth (assumed)

ConePlot Version 5.9.2
 © 2003 Douglas Partners Pty Ltd



CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.0 m AHD*

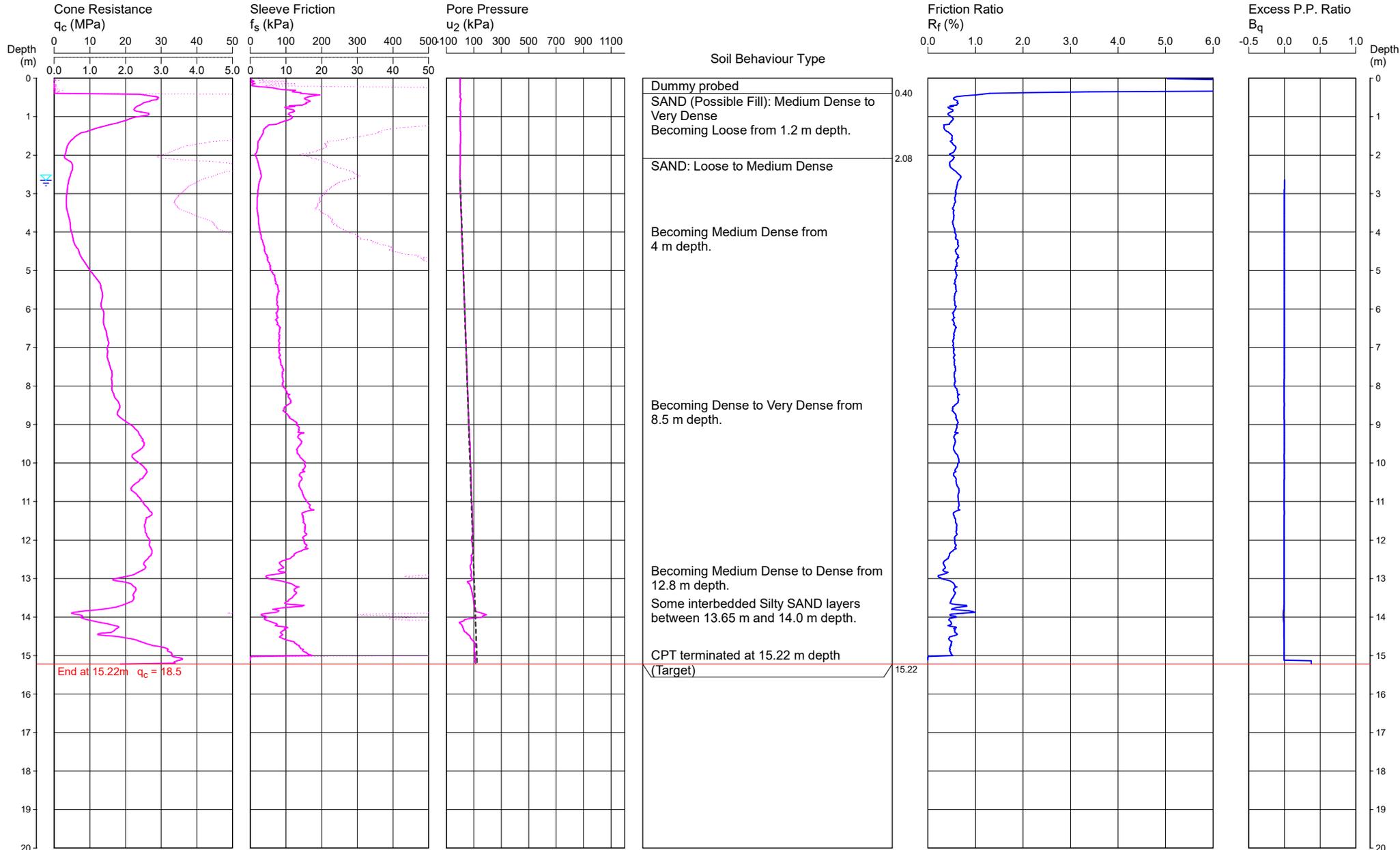
COORDINATES: 392857E 6467786N MGA94 50J

CPTU 02

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 2.66 m depth.

Water depth after test: 2.66m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 02.CP5
Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.8 m AHD*

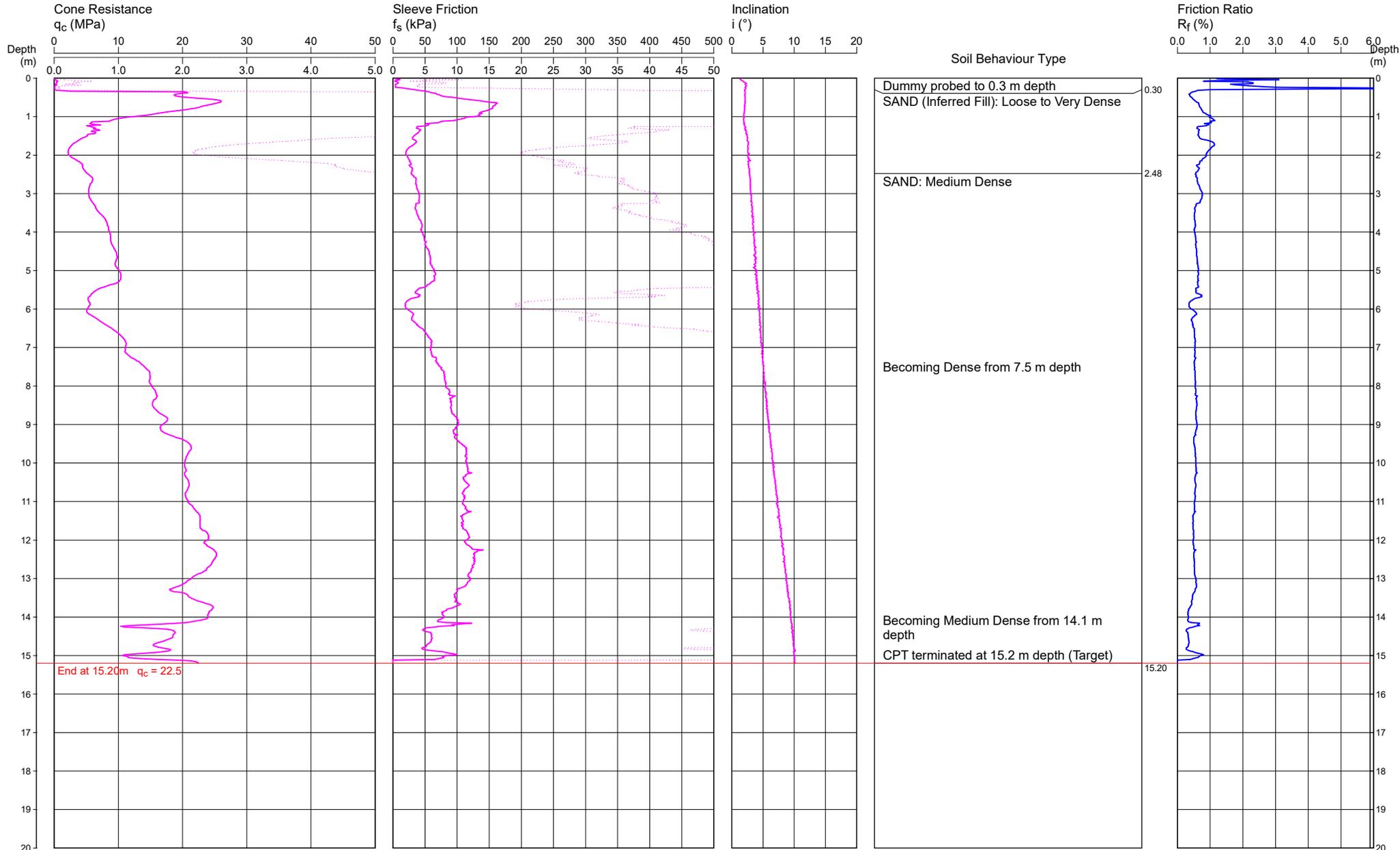
COORDINATES: 392819E 6467850N MGA94 50J

CPT 03

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Dry to 1.3 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 03.CP5
Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
© 2003 Douglas Partners Pty Ltd

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.7 m AHD*

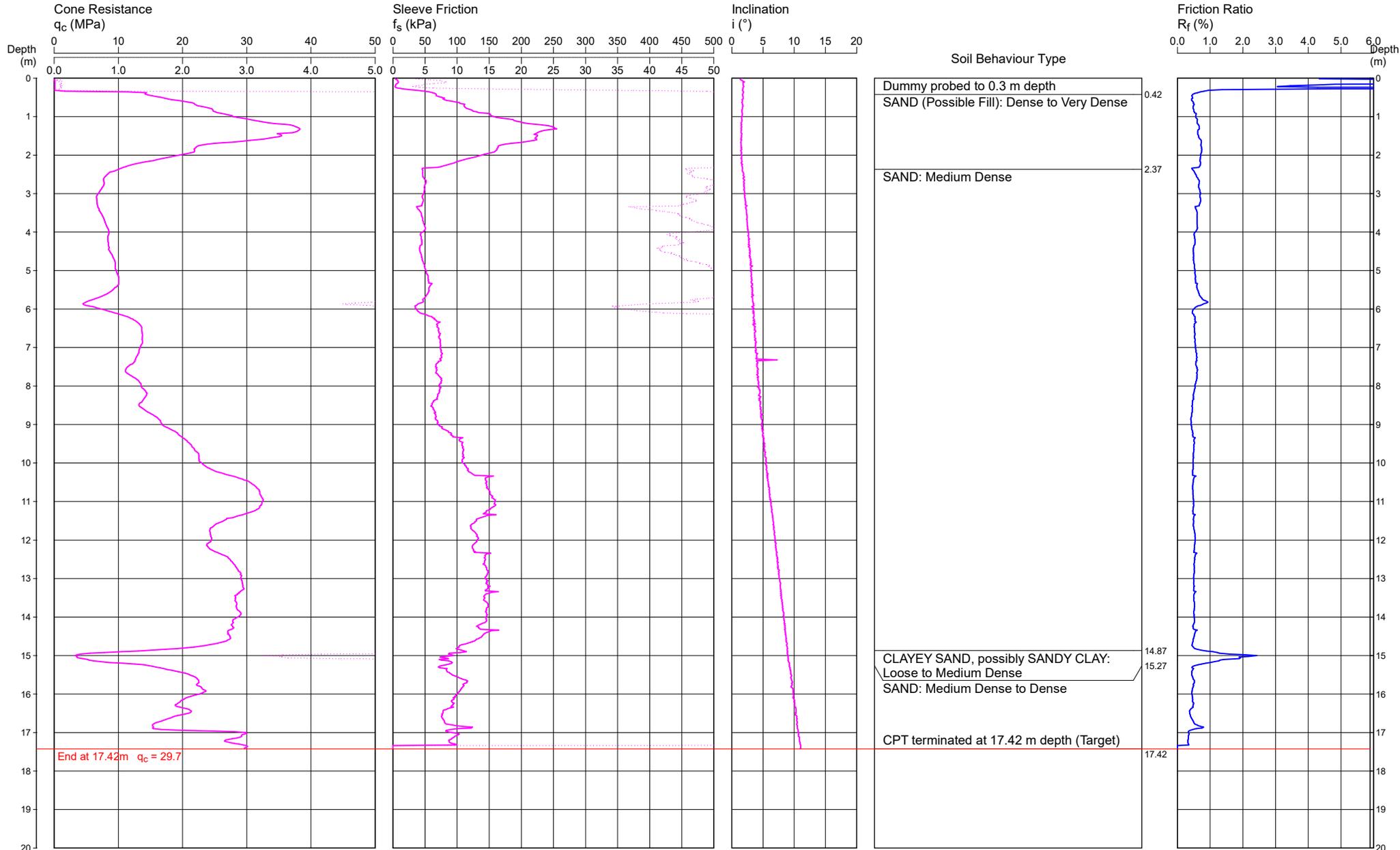
COORDINATES: 392834E 6467905N MGA94 50J

CPT 04

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Dry to 4 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 04.CP5
 Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 24.0 m AHD*

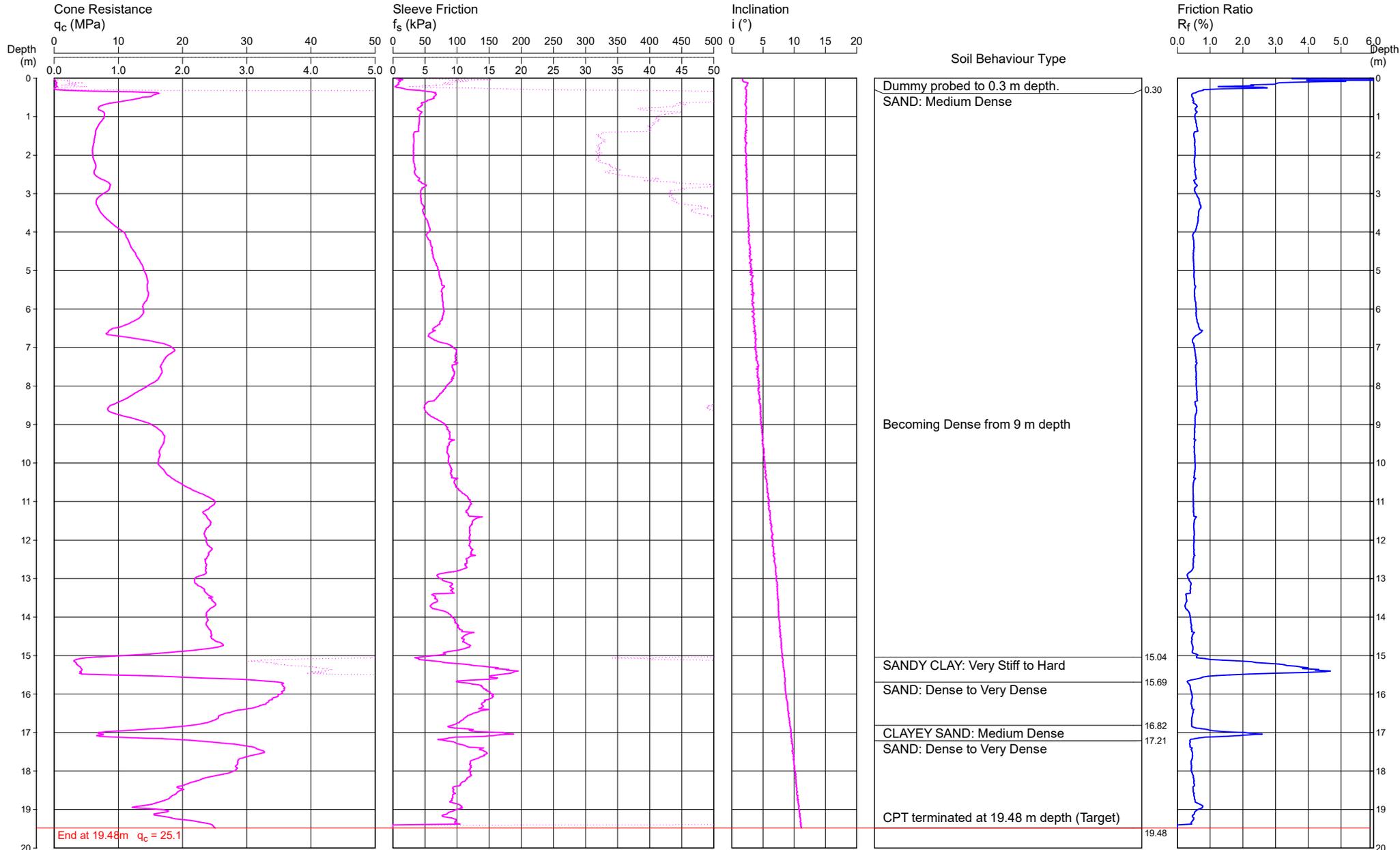
COORDINATES: 392882E 6467996N MGA94 50J

CPT 05

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Dry to 4.1 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 05.CP5
 Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.7 m AHD*

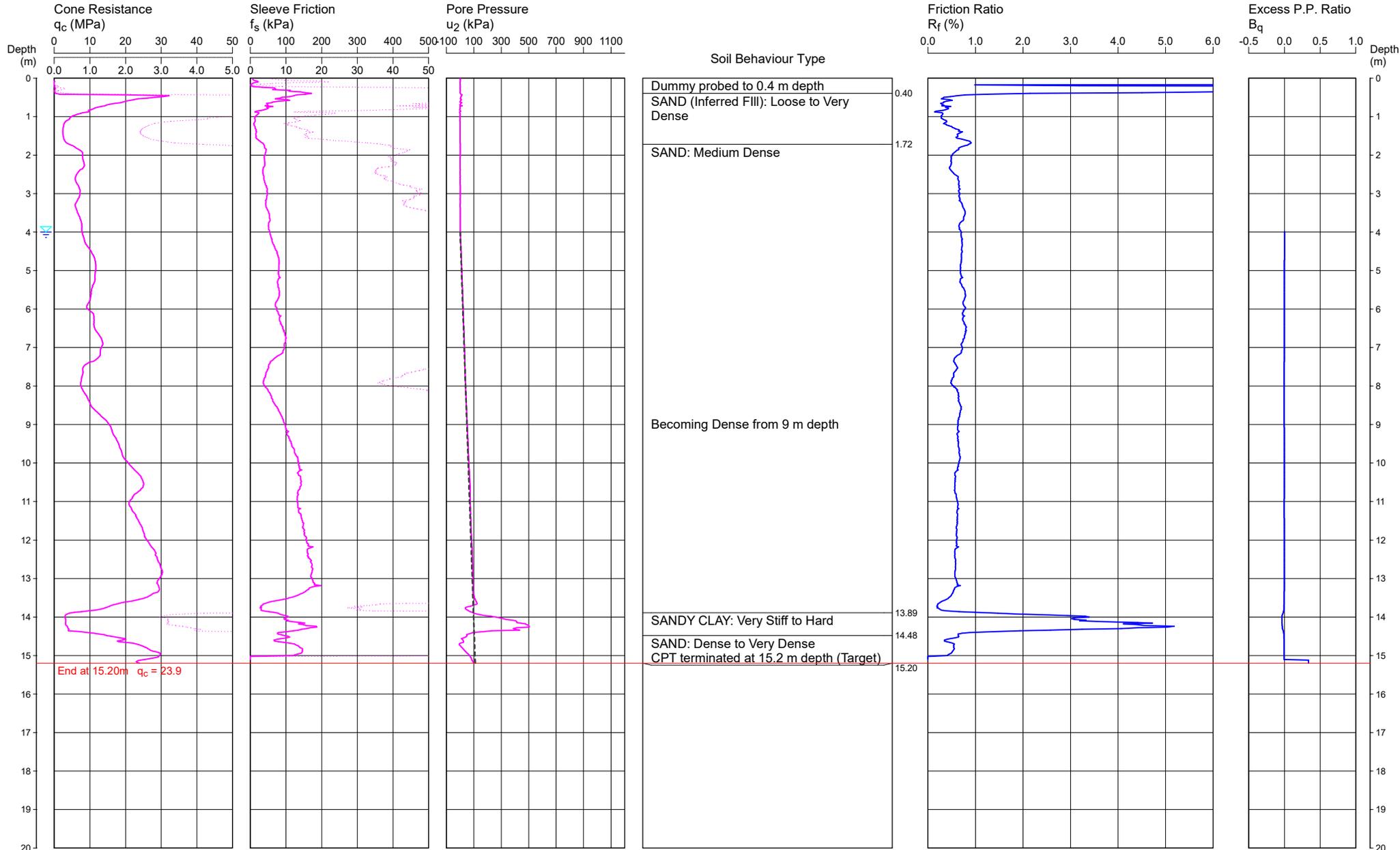
COORDINATES: 392932E 6468021N MGA94 50J

CPTU 06

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Groundwater assumed at 4 m depth.

Water depth after test: 4.00m depth (assumed)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 06.CP5
 Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.1 m AHD*

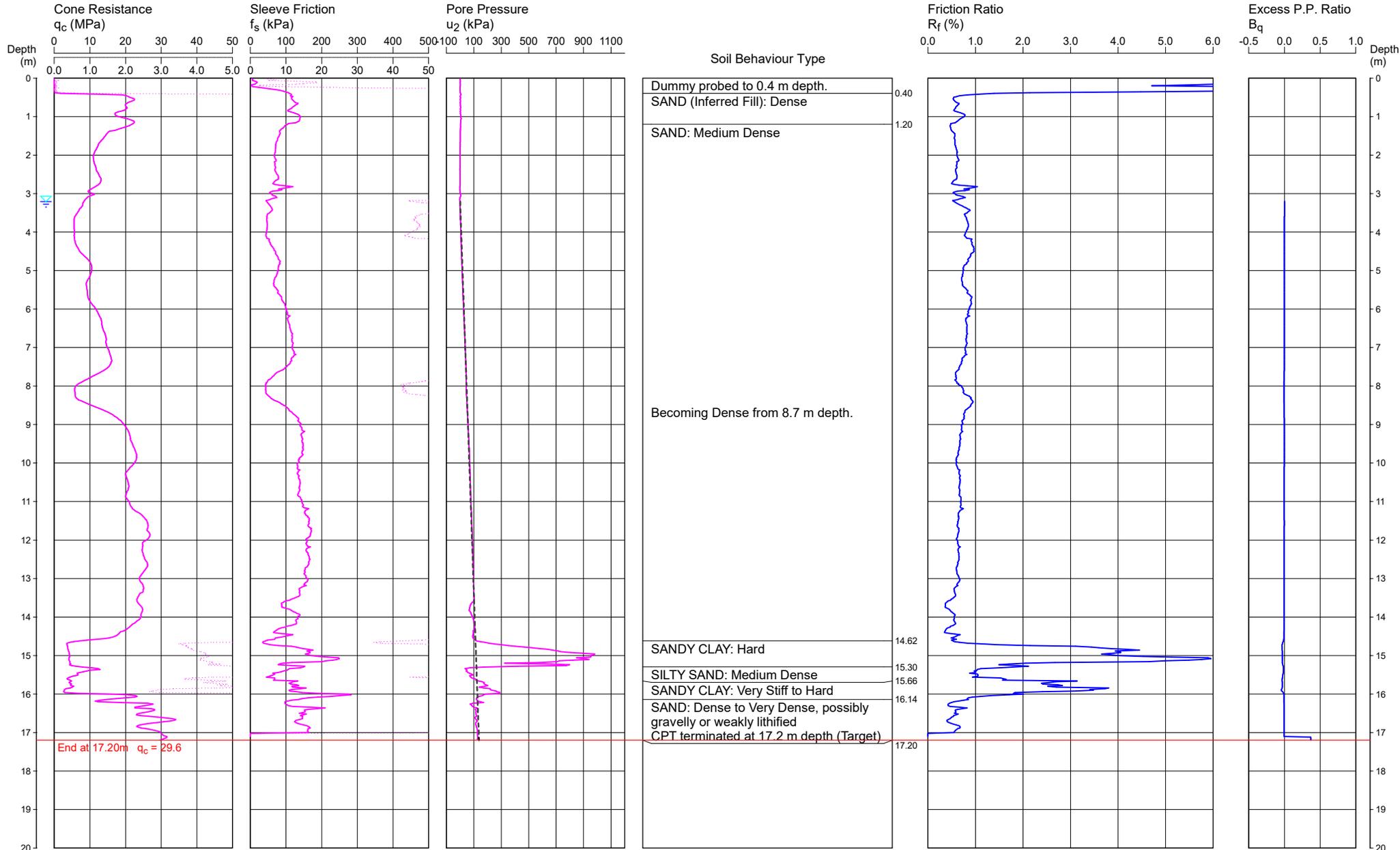
COORDINATES: 392917E 6468100N MGA94 50J

CPTU 07

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 3.21 m depth.

Water depth after test: 3.21m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 07.CP5
Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.8 m AHD*

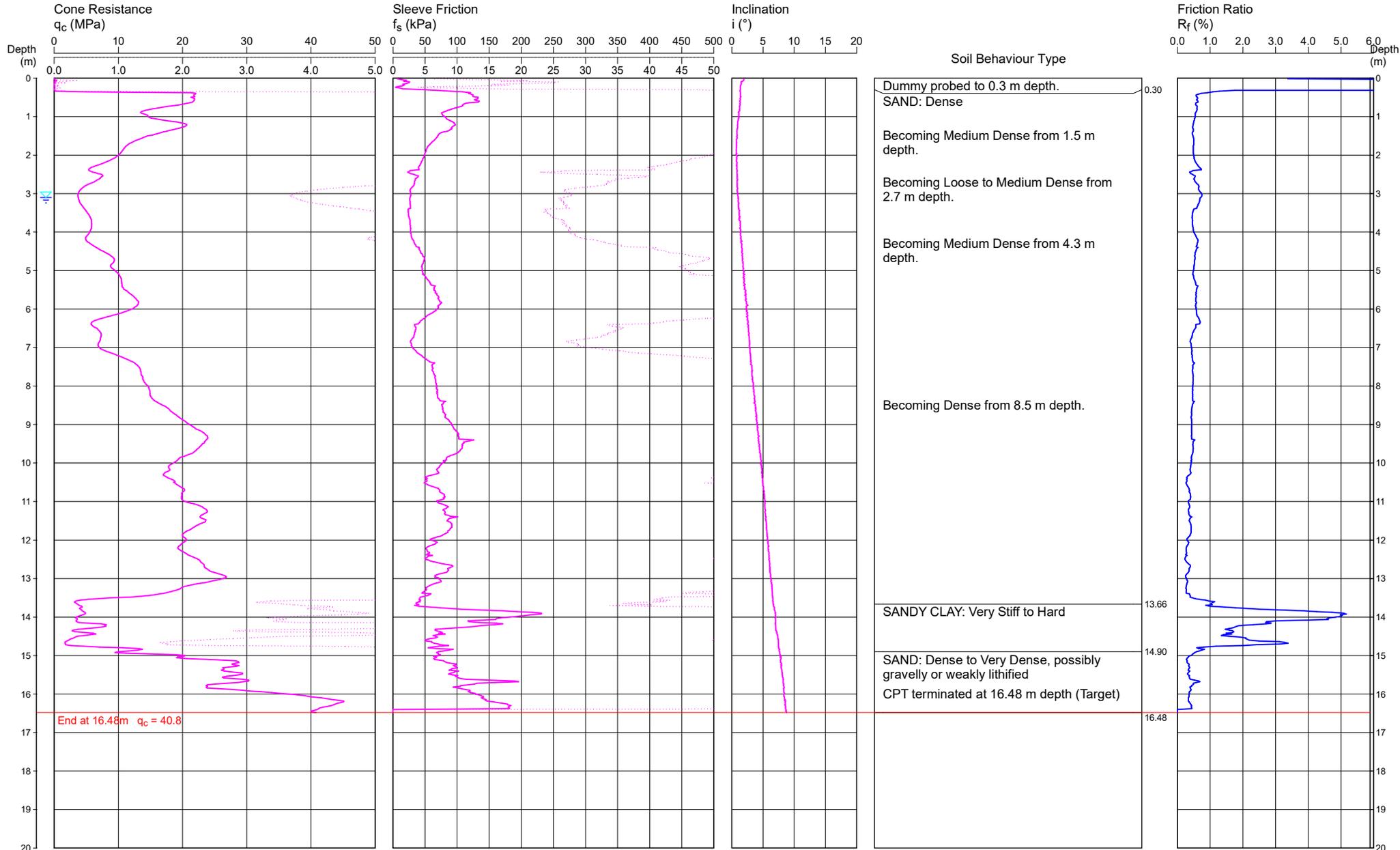
COORDINATES: 392963E 6468090N MGA94 50J

CPT 08

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 3.1 m depth.

Water depth after test: 3.10m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 08.CP5
Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.6 m AHD*

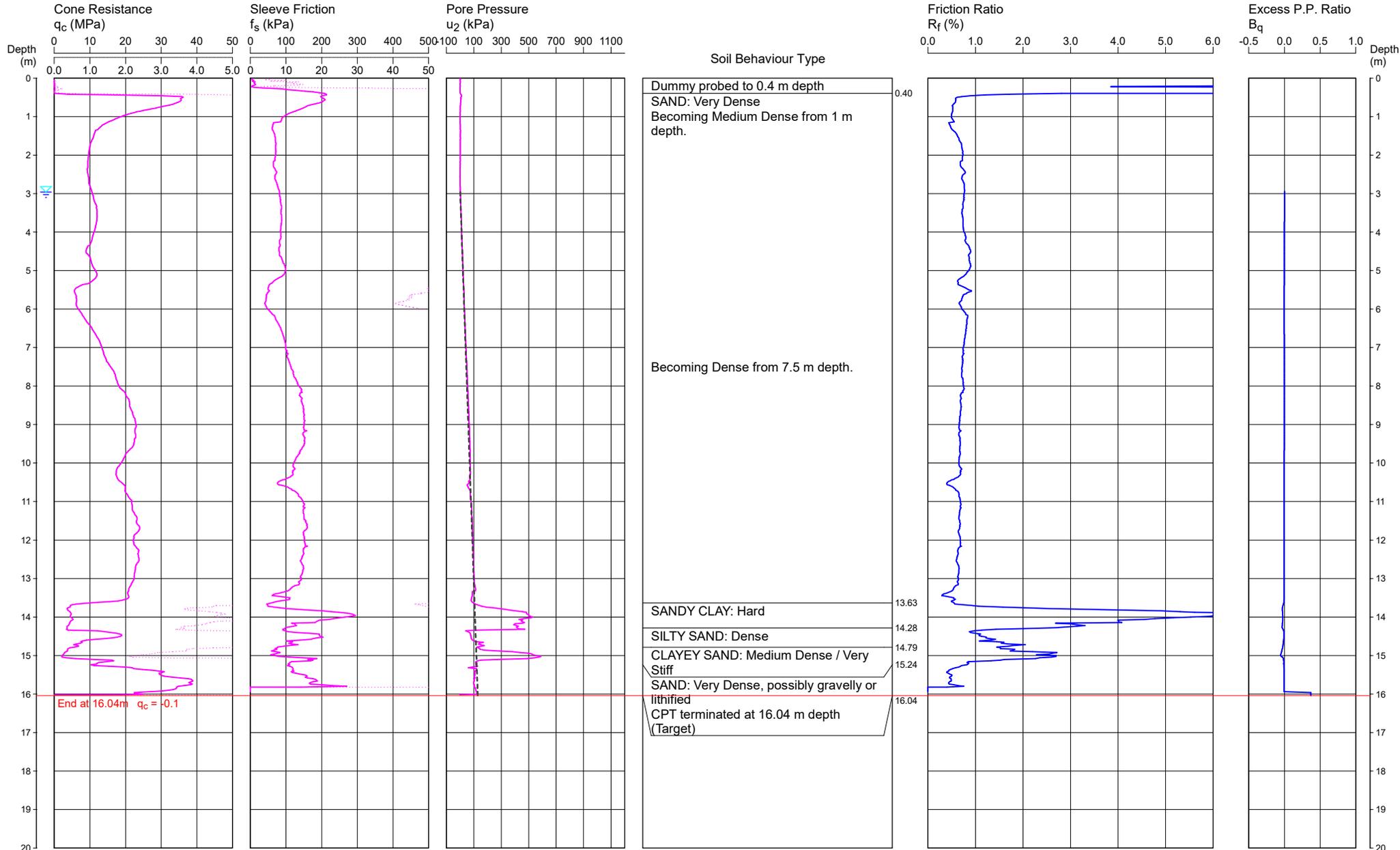
COORDINATES: 393041E 6468078N MGA94 50J

CPTU 09

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater assumed at 2.96 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 09.CP5
Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
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Water depth after test: 2.96m depth (assumed)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.9 m AHD*

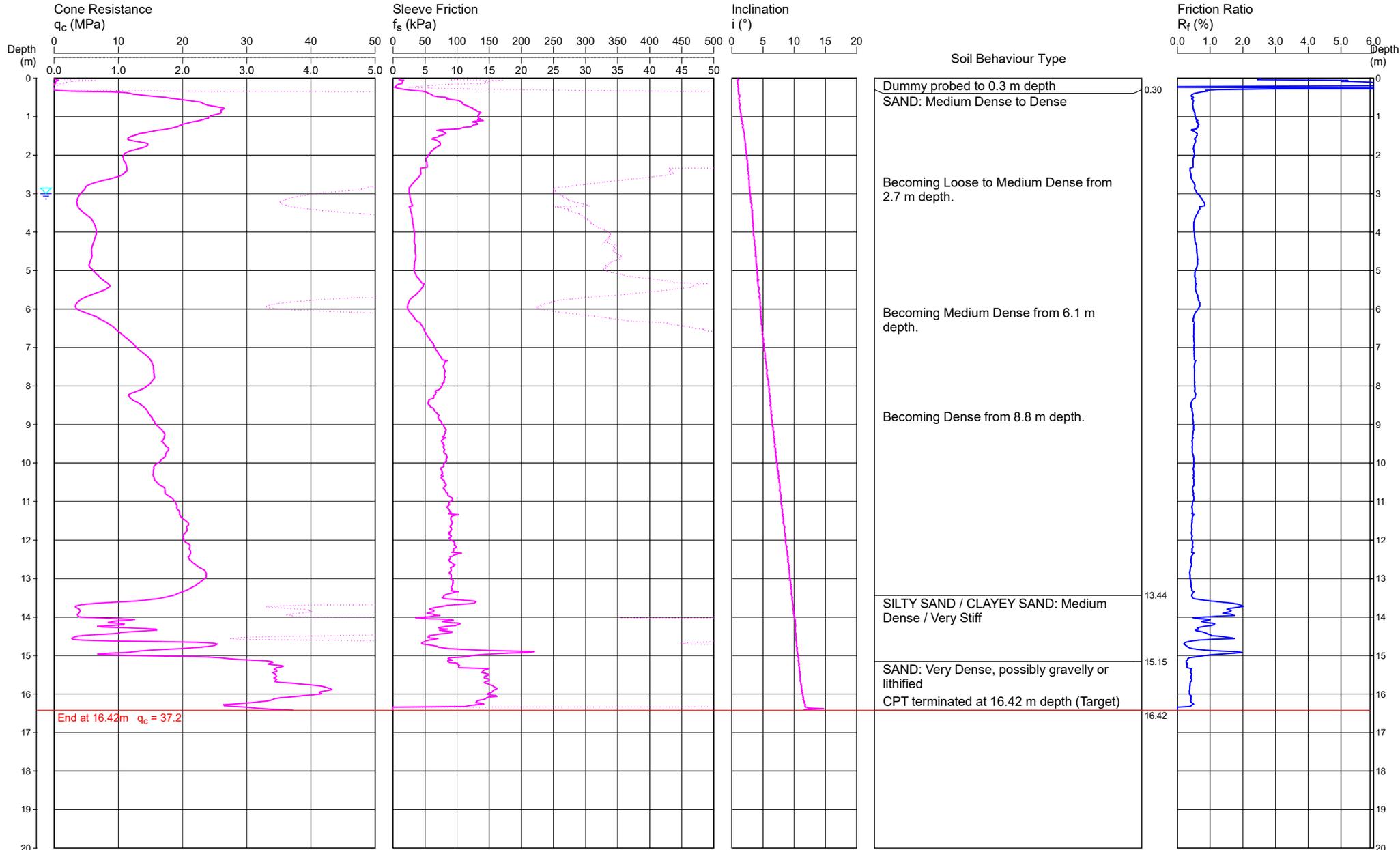
COORDINATES: 393023E 6468151N MGA94 50J

CPT 10

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 3 m depth.

Water depth after test: 3.00m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 10.CP5
Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.2 m AHD*

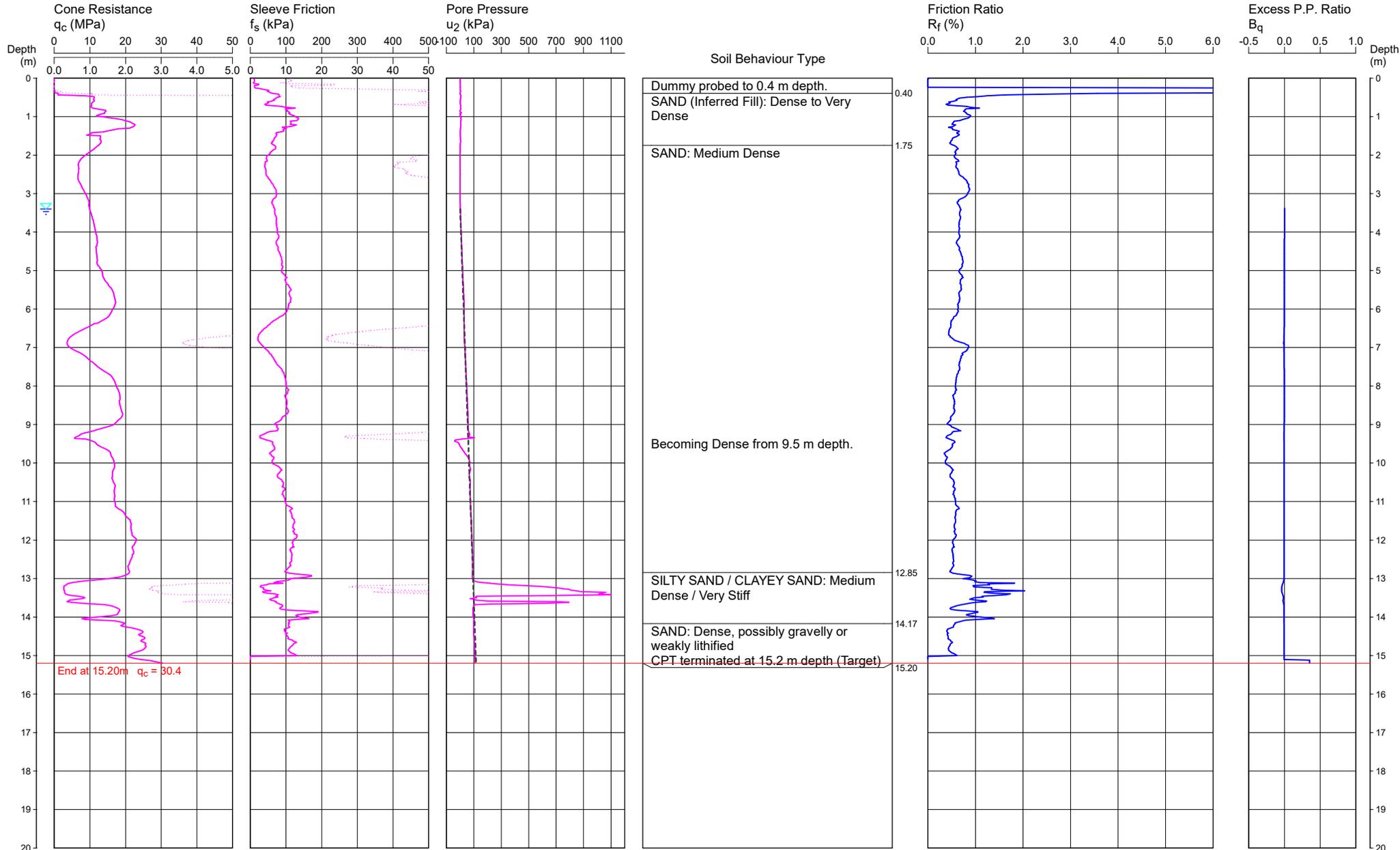
COORDINATES: 393112E 6468149N MGA94 50J

CPTU 11

Page 1 of 1

DATE 30/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Groundwater assumed at to 3.4 m depth.

Water depth after test: 3.40m depth (assumed)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 11.CP5
 Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.7 m AHD*

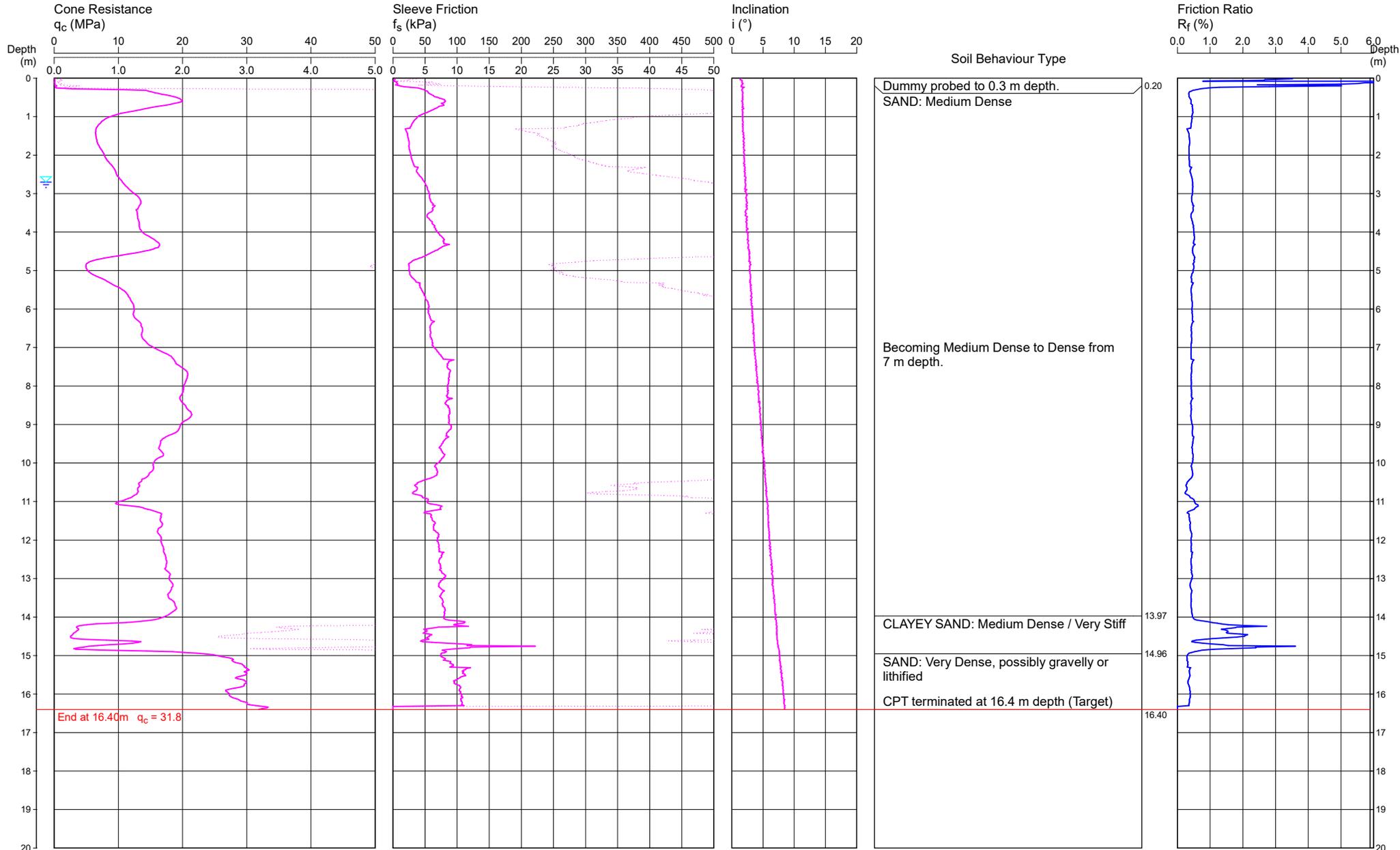
COORDINATES: 393198E 6468134N MGA94 50J

CPT 12

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 2.7 m depth.

Water depth after test: 2.70m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 12.CP5
Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.7 m AHD*

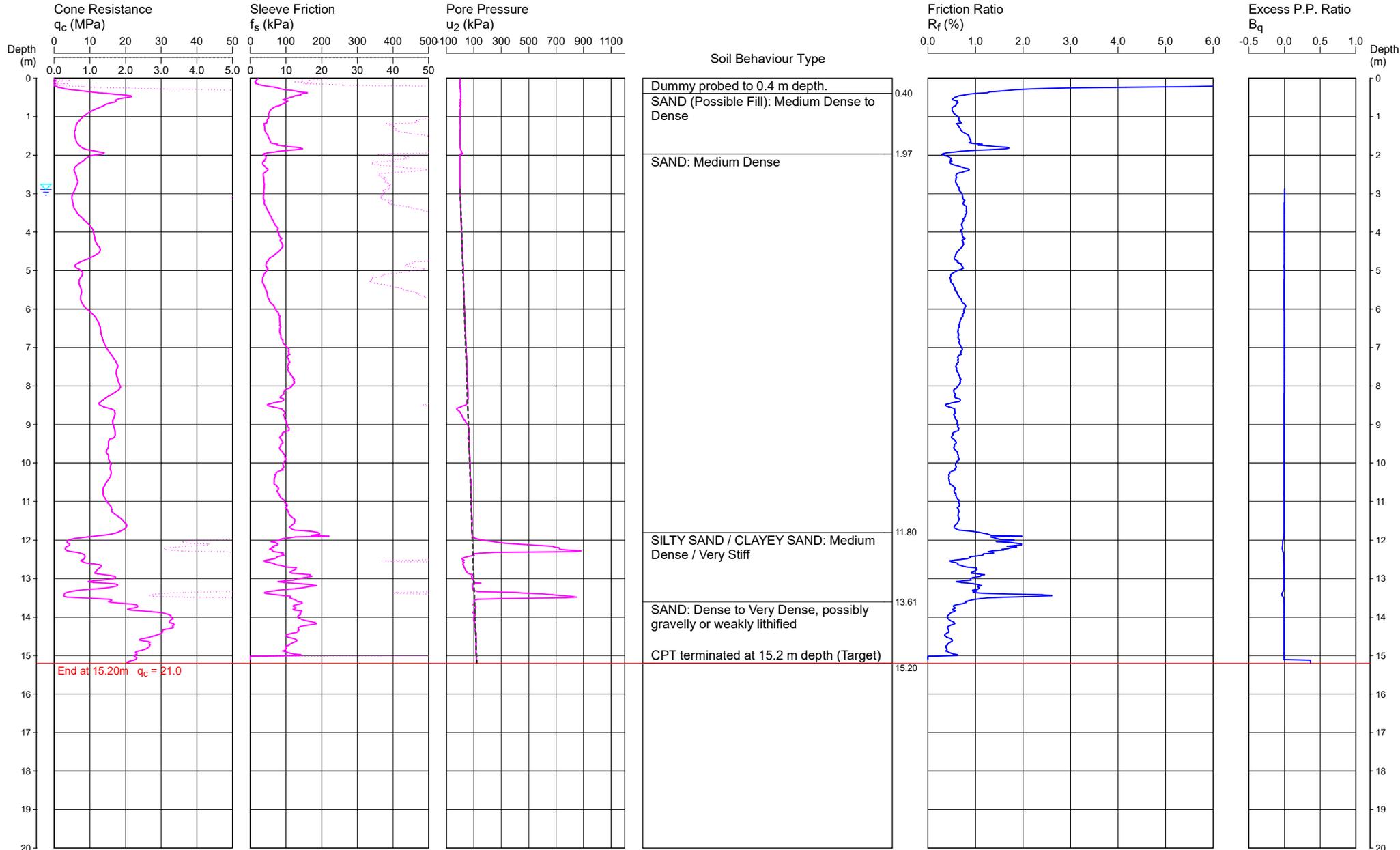
COORDINATES: 393155E 6468085N MGA94 50J

CPTU 13

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater assumed at 2.9 m depth.

Water depth after test: 2.90m depth (assumed)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 13.CP5
Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.9 m AHD*

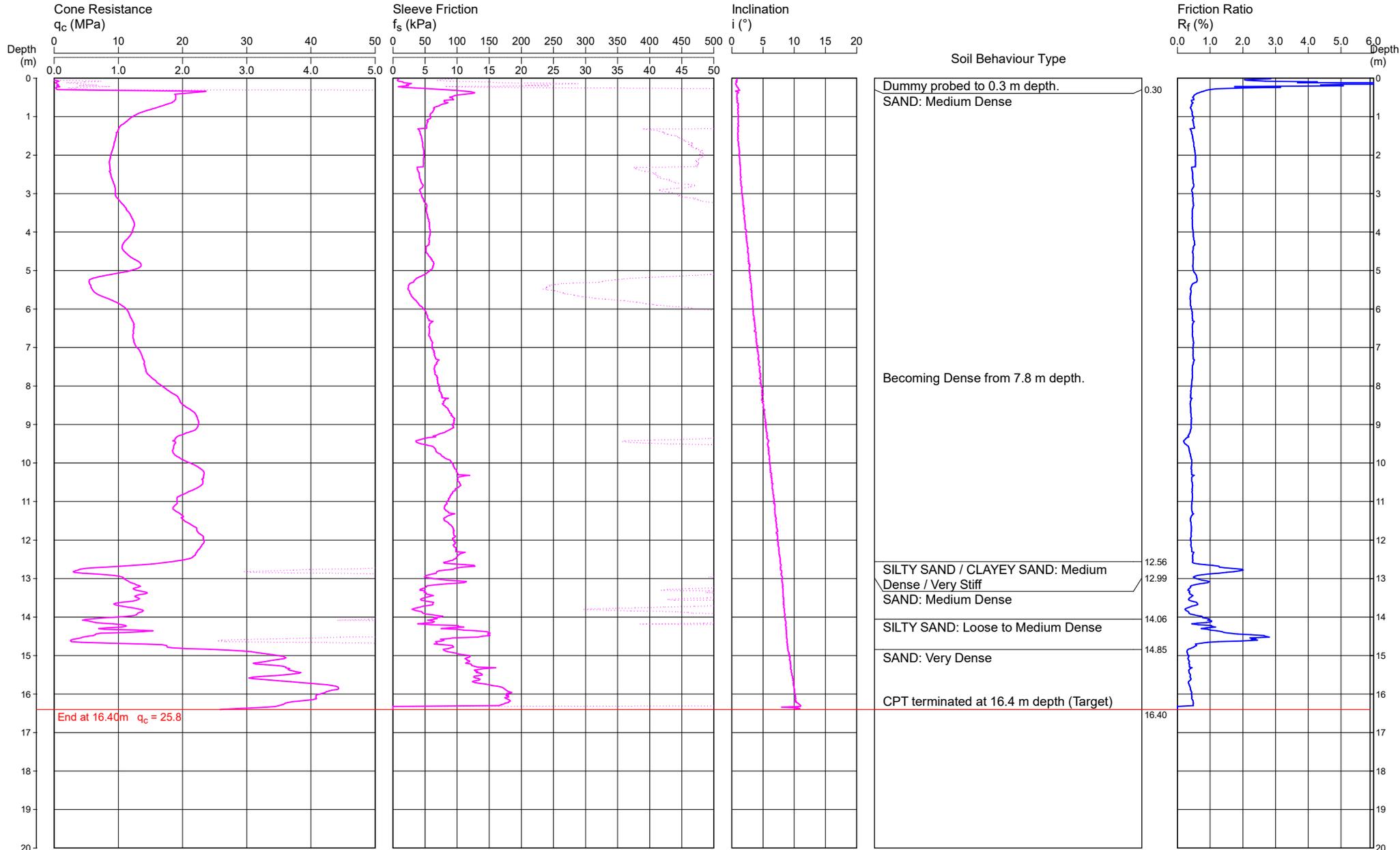
COORDINATES: 393114E 6468056N MGA94 50J

CPT 14

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Dry to 2.1 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 14.CP5
Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.1 m AHD*

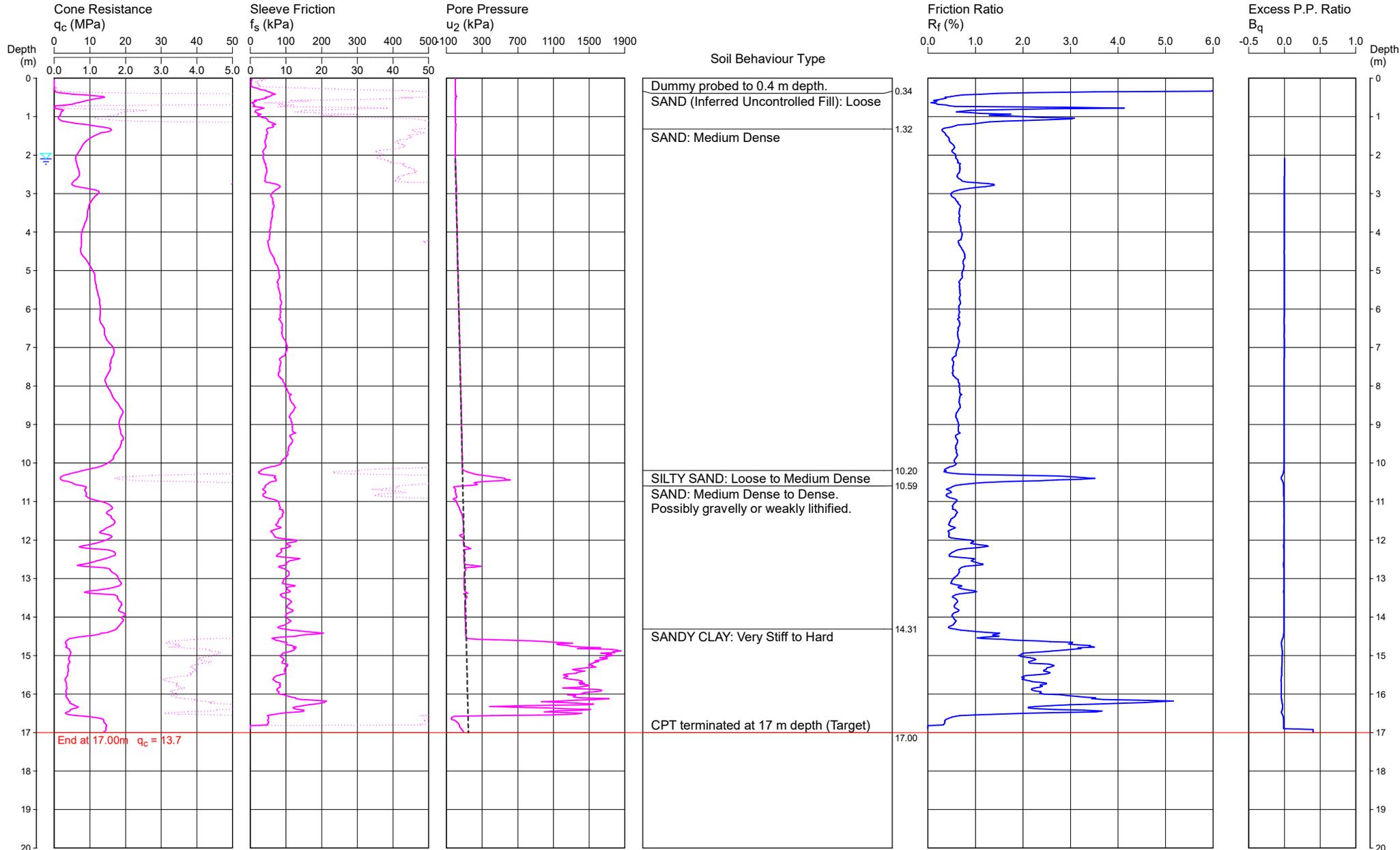
COORDINATES: 393221E 6468006N MGA94 50J

CPTU 15

Page 1 of 1

DATE 30/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Groundwater assumed at 2.1 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 15.CP5
 Cone ID: Probedrill Type: ECF21GM

ConePlot Version 5.9.2
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Water depth after test: 2.10m depth (assumed)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.1 m AHD*

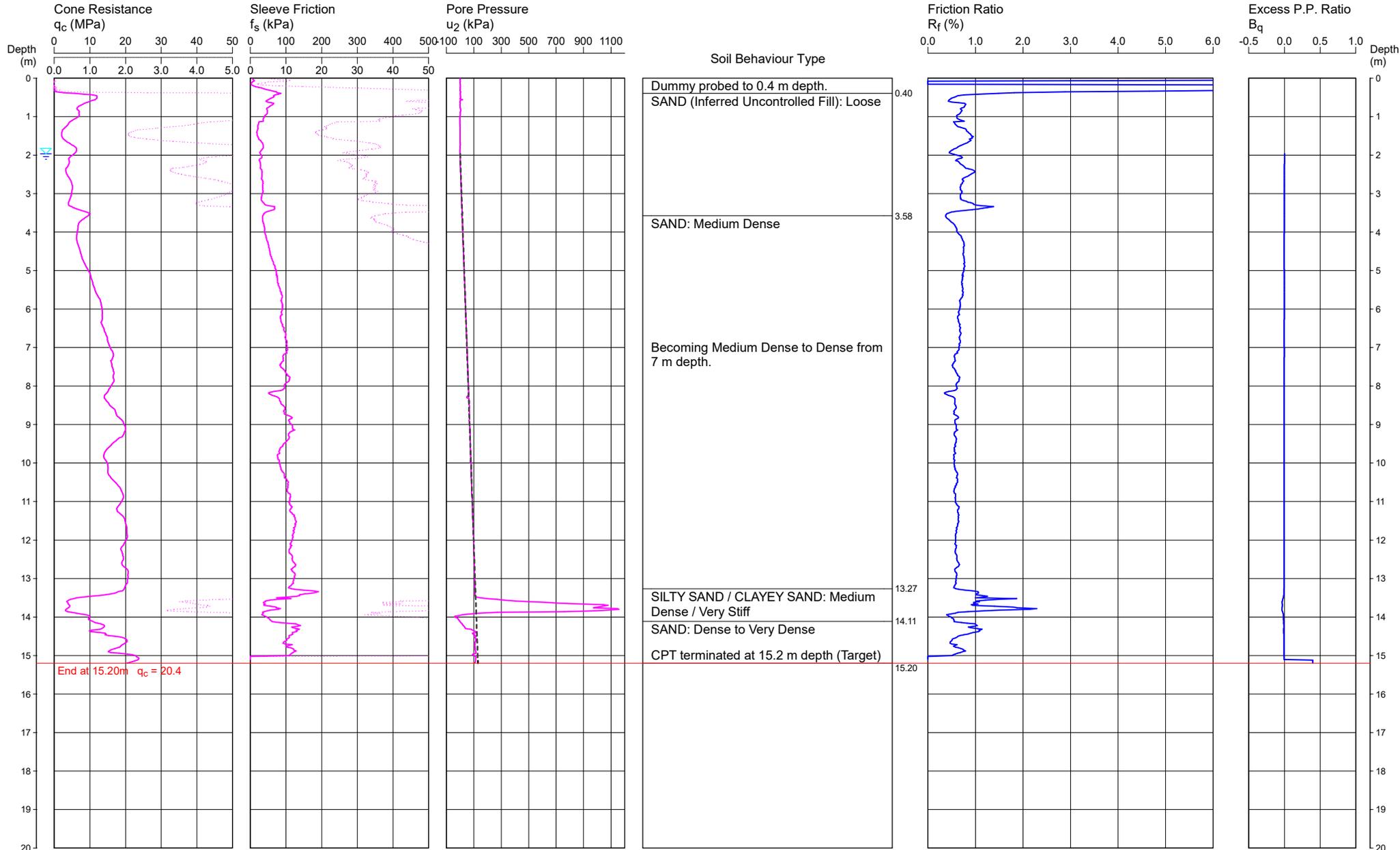
COORDINATES: 393243E 6468058N MGA94 50J

CPTU 16

Page 1 of 1

DATE 30/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 1.97 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 16.CP5
Cone ID: Probedrill Type: ECF21GM

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Water depth after test: 1.97m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.2 m AHD*

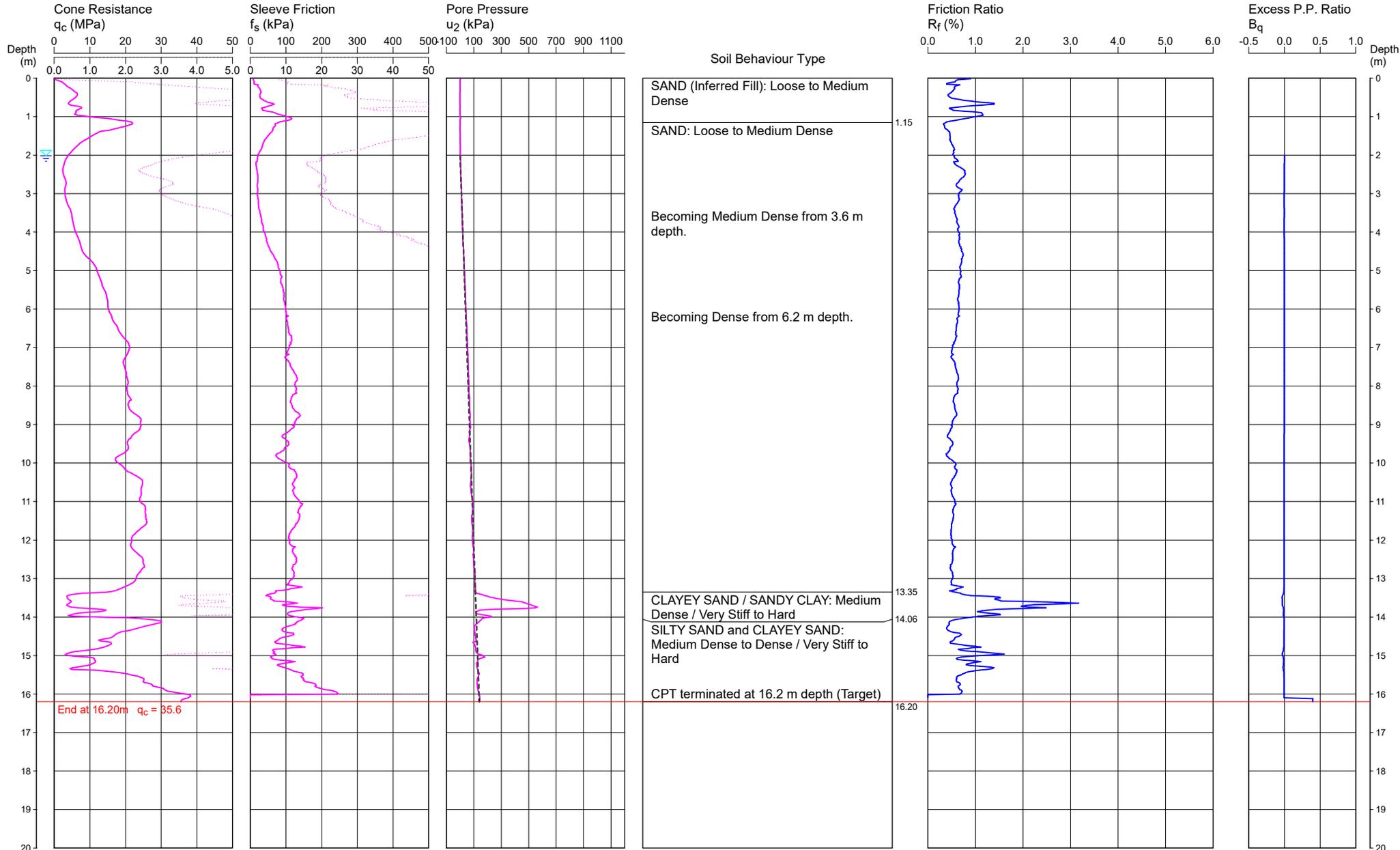
COORDINATES: 393317E 6468065N MGA94 50J

CPTU 17

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 2.02 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 17.CP5
Cone ID: Probedrill Type: ECF21GM

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Water depth after test: 2.02m depth (measured)

CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.2 m AHD*

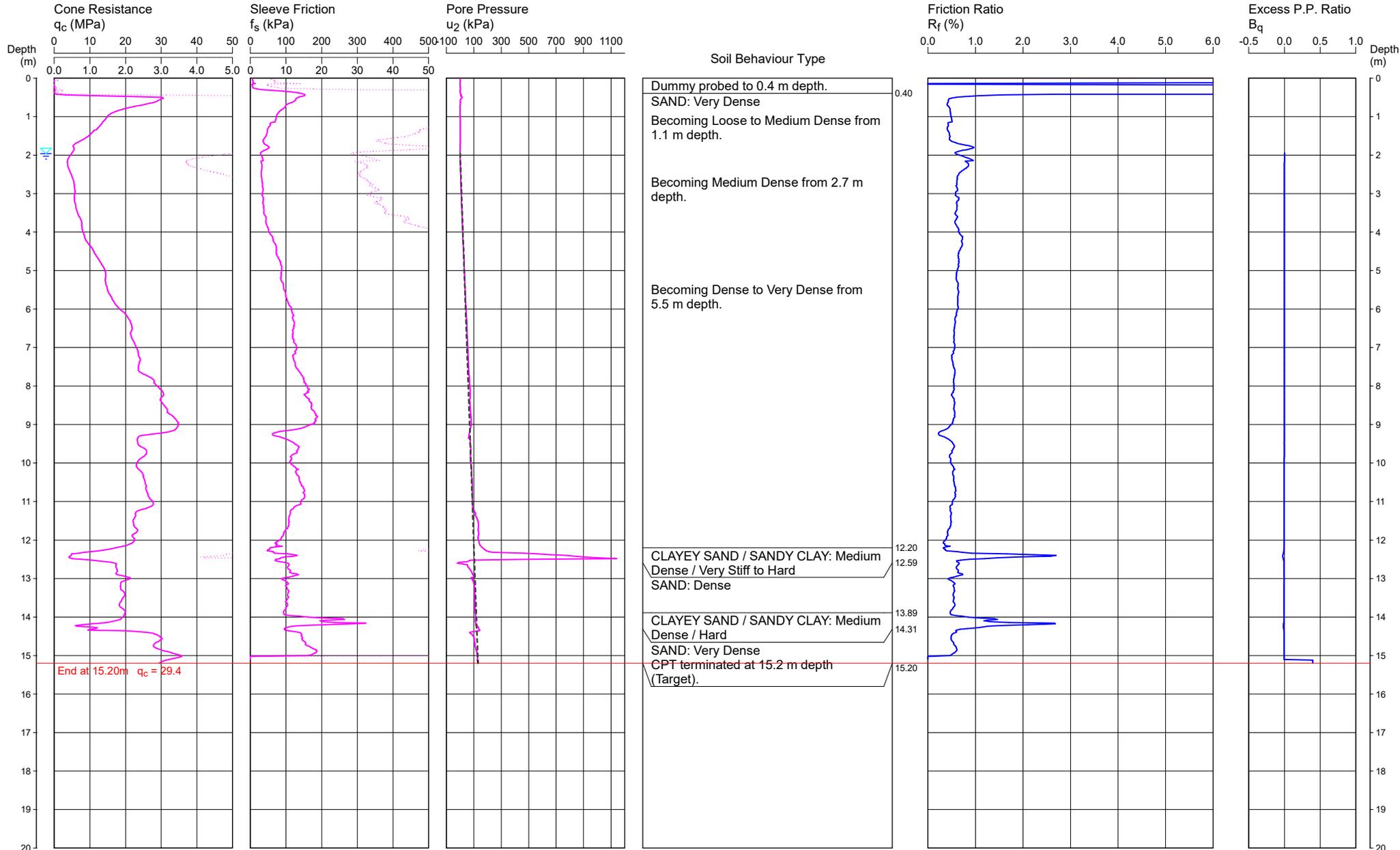
COORDINATES: 393433E 6468062N MGA94 50J

CPTU 18

Page 1 of 1

DATE 30/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 1.96 m depth.

Water depth after test: 1.96m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 18.CP5
Cone ID: Probedrill Type: ECF21GM

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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.1 m AHD*

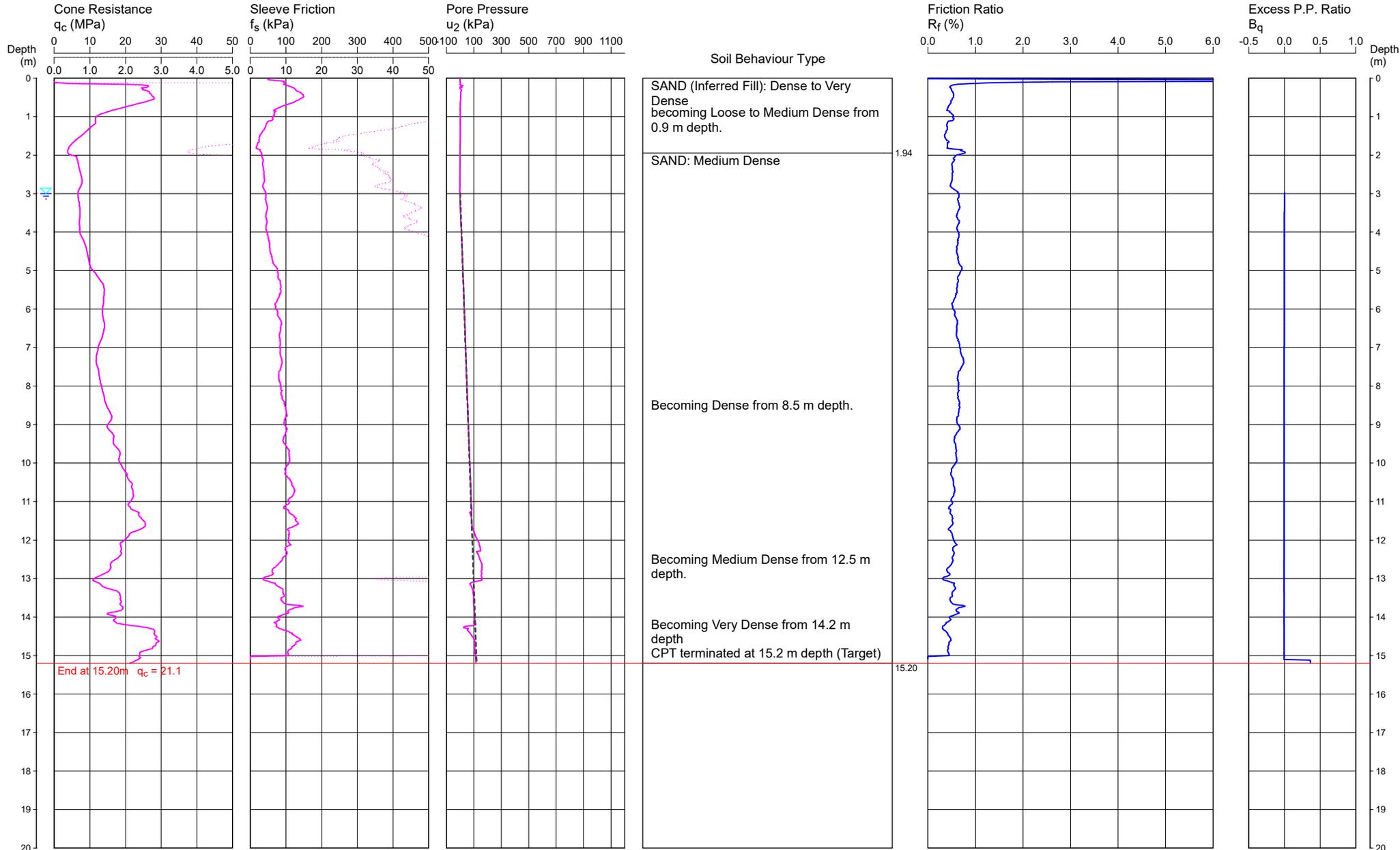
COORDINATES: 393299E 6467930N MGA94 50J

CPTU 19

Page 1 of 1

DATE 30/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 3 m depth.

Water depth after test: 3.00m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPTU 19.CP5
Cone ID: Probedrill Type: ECF21GM

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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 23.7 m AHD*

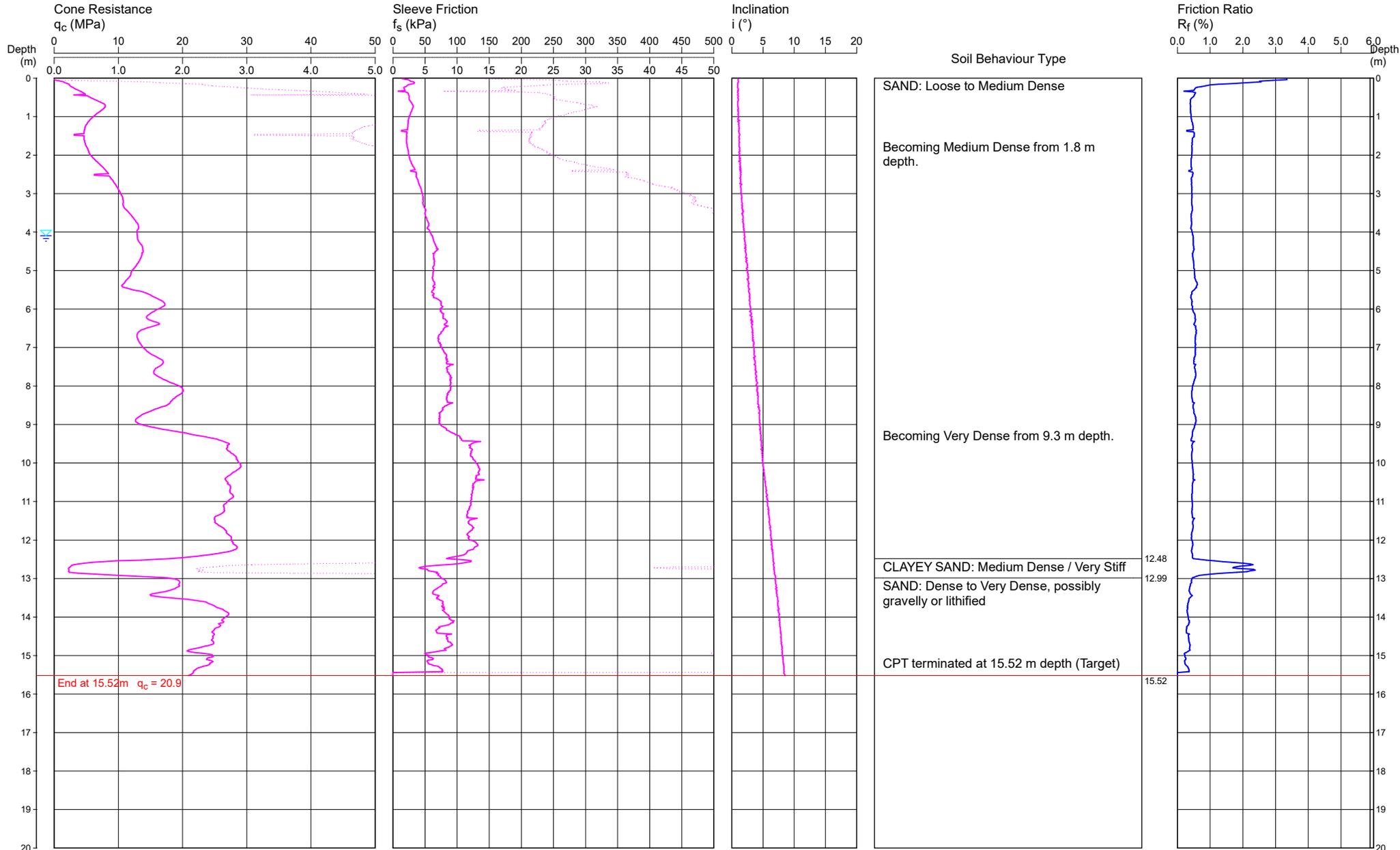
COORDINATES: 393119E 6467943N MGA94 50J

CPT 20

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m.
Groundwater measured at 4.1 m depth.

Water depth after test: 4.10m depth (measured)

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 20.CP5
Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
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CONE PENETRATION TEST

CLIENT: DevelopmentWA

PROJECT: Proposed Multi-Residential Development

LOCATION: Central Avenue, Mount Lawley, WA

REDUCED LEVEL: 22.8 m AHD*

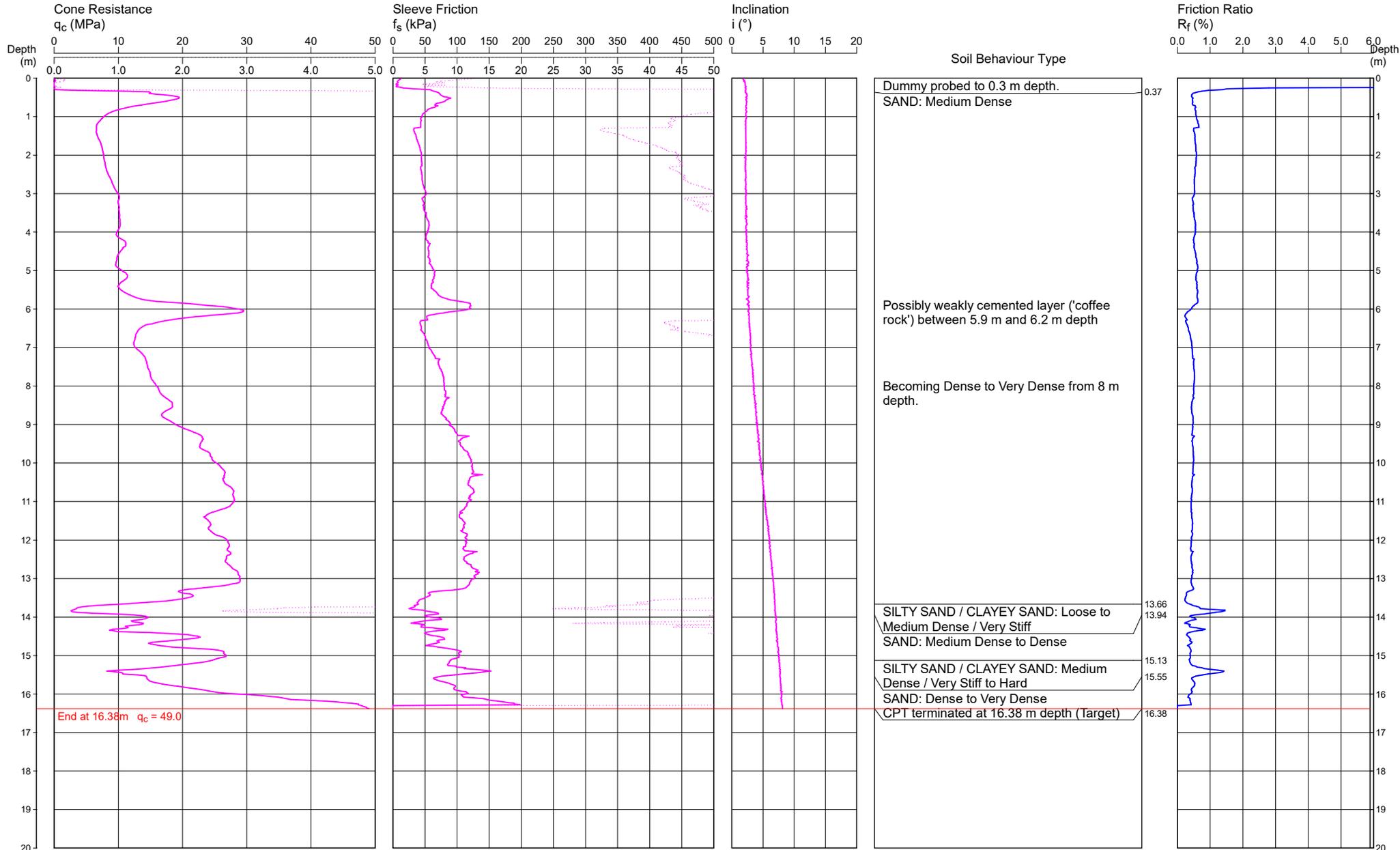
COORDINATES: 393034E 6467855N MGA94 50J

CPT 21

Page 1 of 1

DATE 29/09/2022

PROJECT No: 216618.00



REMARKS: *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Dry to 3.2 m depth.

File: P:\216618.00 - MT LAWLEY, ECU - Central Avenue\4.0 Field Work\CPT\DP\216618 - CPT 21.CP5
 Cone ID: Probedrill Type: EC16

ConePlot Version 5.9.2
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BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.0 m AHD*
EASTING: 392946
NORTHING: 6467697
DIP/AZIMUTH: 90°/--

BORE No: 22
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)									
				Type	Depth	Sample	Results & Comments		5	10	15	20						
20		FILL/SAND SP: fine to medium grained, dark grey-brown, trace silt and gravel, moist, medium dense, fill. - becoming grey-brown from 0.1 m depth.	[Cross-hatch pattern]															
21	1	- becoming dark grey-brown and yellow-brown from 1.4 m depth.	[Cross-hatch pattern]															
21	1.8	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	[Dotted pattern]															
21	2.3	Bore discontinued at 2.3m (Hard digging, refusal on tree roots)																



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.3 m AHD*
EASTING: 392981
NORTHING: 6467810
DIP/AZIMUTH: 90°/--

BORE No: 23
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
23	0.3	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace gravel, moist, dense, fill.	[Cross-hatched pattern]						[Penetrometer graph showing blow counts vs depth]
	0.45	FILL/Gravelly SAND SP-SM: fine to medium grained, pale yellow-brown, fine to coarse sized, with silt, moist, very dense, fill. Gravel is crushed limestone.							
	1	FILL/SAND SP-SM: fine to medium grained, grey-brown, yellow-brown, grey and dark grey, with silt, moist, very dense, fill.							
2	1.7	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	[Dotted pattern]						
21	2.3	Bore discontinued at 2.3m (Collapsing conditions)							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.3 m AHD*
EASTING: 392916
NORTHING: 6467815
DIP/AZIMUTH: 90°/--

BORE No: 24
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
23 22 21	0 1 2 2.5	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist, loose, fill. - becoming grey-brown, trace gravel from 0.1 m depth.							
		SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand. - becoming pale brown and brown from 2.1 m depth.							
		Bore discontinued at 2.5m (Target depth)							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.2 m AHD*
EASTING: 392870
NORTHING: 6467765
DIP/AZIMUTH: 90°/--

BORE No: 25
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
22		FILL/SAND SP: fine to medium grained, dark grey-brown, trace silt and gravel, moist, medium dense, fill. - becoming grey-brown from 0.1 m depth.		D	0.9									
21	1	- becoming grey from 1.1 m depth.												
20	1.3	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.												
19	2	- becoming pale brown from 2.0 m depth.												
18	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.2 m AHD*
EASTING: 392894
NORTHING: 6467899
DIP/AZIMUTH: 90°/--

BORE No: 26
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
	0.0 - 0.9	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace gravel, moist, dense to very dense, fill. Glass pieces observed in fill. - becoming grey-brown from 0.1 m depth. - with gravel from 0.65 m depth.	[Cross-hatched pattern]						5 10 15 20
	0.9 - 1.1	SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist.	[Dotted pattern]						
	1.1 - 1.4	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.	[Dotted pattern]						
	1.4 - 2.5	SAND SP: fine to medium grained, pale yellow-brown, trace silt, moist. Sand derived from Tamala Limestone.	[Dotted pattern]						
	2.5	Bore discontinued at 2.5m (Target depth)							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.4 m AHD*
EASTING: 392778
NORTHING: 6467862
DIP/AZIMUTH: 90°/--

BORE No: 27
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
23	0.0	FILL/SAND SP: fine to medium grained, dark grey-brown, trace silt, moist, medium dense, fill. - becoming orange-brown, trace gravel from 0.1 m depth.	[Cross-hatched pattern]	B	0.0								
	0.8	SAND SP: fine to medium grained, dark grey, trace silt, moist, medium dense. Bassendean Sand. - becoming grey from 0.9 m depth. - becoming pale grey from 1.1 m depth.											
21	2.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 24.3 m AHD*
EASTING: 392859
NORTHING: 6467983
DIP/AZIMUTH: 90°/--

BORE No: 28
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
24.3	0.55	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown and pale yellow-brown, fine to medium grained, with silt, moist, very dense, fill.												
	0.8	FILL/SAND SP-SM: fine to medium grained, grey-brown, with silt, trace gravel, moist, dense, fill.												
	1.0	SAND SP: fine to medium grained, grey, trace silt, moist, medium dense. Bassendean Sand. - becoming pale grey from 0.9 m depth.		D	1.0									
	2.3	- becoming pale yellow-brown from 2.3 m depth.												
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 24.2 m AHD*
EASTING: 393021
NORTHING: 6467953
DIP/AZIMUTH: 90°/--

BORE No: 29
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
24		FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace gravel, moist, medium dense, fill. - becoming grey-brown from 0.1 m depth.							
0.7		SAND SP: fine to medium grained, dark grey-brown, trace silt and gravel, moist, medium dense. Sand derived from Tamala Limestone. - becoming yellow-brown, no gravel and dense from 0.85 m depth.		D	0.8				
1									
2.5		Bore discontinued at 2.5m (Target depth)							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater observed at 2.1 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)



BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.6 m AHD*
EASTING: 393038
NORTHING: 6468002
DIP/AZIMUTH: 90°/--

BORE No: 30
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.45	FILL/SAND SP-SM: fine to medium grained, grey-brown, with silt, trace gravel, moist, dense, fill.											
	1	SAND SP: fine to medium grained, yellow-brown, trace silt, moist, dense. Sand derived from Tamala Limestone.											
	2.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.0 m AHD*
EASTING: 392997
NORTHING: 6468040
DIP/AZIMUTH: 90°/--

BORE No: 31
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.45	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown and grey, fine to medium grained, with silt, moist, very dense, fill.											
	0.55	SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist.											
	1	SAND SP: fine to medium grained, yellow-brown, trace silt, moist, medium dense to dense. Sand derived from Tamala Limestone.											
	2.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.1 m AHD*
EASTING: 393058
NORTHING: 6468079
DIP/AZIMUTH: 90°/--

BORE No: 32
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
23	0.8	FILL/SAND SP-SM: fine to medium grained, grey-brown, with silt, trace gravel, moist, dense, fill. Glass pieces observed in fill.							
22	1.1	SAND SP: fine to medium grained, grey, trace silt, moist, dense. Bassendean Sand.							
21	1.2	SAND SP: fine to medium grained, yellow-brown, trace silt, moist. Sand derived from Tamala Limestone.		D	1.2				
20	2.5	Bore discontinued at 2.5m (Target depth)							



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

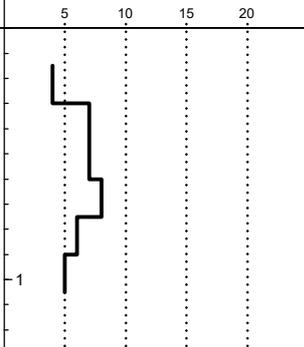
SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 20.5 m AHD*
EASTING: 392988
NORTHING: 6468151
DIP/AZIMUTH: 90°/--

BORE No: 33
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.1	TOPSOIL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist, topsoil. SAND SP: fine to medium grained, grey, trace silt, moist to wet, medium dense to dense. Bassendean Sand. - becoming brown from 1.0 m depth.						 27-09-22					
	1.3	Bore discontinued at 1.3m (Collapsing conditions)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater observed at 0.6 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.0 m AHD*
EASTING: 392944
NORTHING: 6468112
DIP/AZIMUTH: 90°/--

BORE No: 34
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
20	0.03	ASPHALT: black, 7 mm nominal aggregate.												
	0.18	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown, fine to medium grained, with silt, moist, fill. FILL/SAND SP: fine to medium grained, bands of grey-brown, yellow-brown and dark brown, trace silt and gravel, moist, dense to very dense, fill.		B	0.5									
	1.3	SAND SP: fine to medium grained, dark grey-brown, trace silt, moist. Bassendean Sand. - becoming pale grey from 1.5 m depth.												
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:** None

TYPE OF BORING: 250 mm diameter power auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PLD	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.7 m AHD*
EASTING: 393017
NORTHING: 6468102
DIP/AZIMUTH: 90°/--

BORE No: 35
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.03	ASPHALT: black, 7 mm nominal aggregate.	▬											
	0.13	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, pale grey, fine to medium grained, with silt, moist, fill.	▨											
	0.26	FILL/Gravelly SAND SP-SM: fine to medium grained, grey-brown, fine to coarse sized, with silt, moist, fill.	▩											
	0.7	FILL/SAND SP: fine to medium grained, bands of grey-brown, dark grey-brown and yellow-brown, trace silt and gravel, moist, dense to very dense, fill.	▧											
	1.0	SAND SP: fine to medium grained, grey, trace silt, moist, dense. Bassendean Sand.	▦	D	1.0									
	1.5	- becoming pale grey from 1.5 m depth.												
	2.0	- becoming pale brown from 2.0 m depth.												
	2.2	- becoming brown, weakly cemented from 2.2 m depth.												
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:** None
TYPE OF BORING: 250 mm diameter power auger borehole
WATER OBSERVATIONS: No free groundwater observed.
REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PLD	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)



BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.8 m AHD*
EASTING: 393122
NORTHING: 6468078
DIP/AZIMUTH: 90°/--

BORE No: 36
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.02	ASPHALT: black, 7 mm nominal aggregate.	[Cross-hatch pattern]											
	0.2	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown and grey, fine to medium grained, with silt, moist, fill.	[Cross-hatch pattern]											
	0.4	FILL/SAND SP: fine to medium grained, bands of dark grey-brown, pale grey, yellow-brown and orange-brown, trace silt, moist, dense, fill.	[Dotted pattern]											
	1	SAND SP: fine to medium grained, pale grey, trace silt, moist, medium dense. Bassendean Sand. - becoming pale brown from 1.0 m depth. - becoming brown from 1.5 m depth.	[Dotted pattern]	B	0.5									
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:** None

TYPE OF BORING: 250 mm diameter power auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.9 m AHD*
EASTING: 393173
NORTHING: 6468132
DIP/AZIMUTH: 90°/--

BORE No: 37
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.03	ASPHALT: black, 7 mm nominal aggregate.	▨											
	0.2	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown and pale grey, fine to medium grained, with silt, moist, fill.	▩											
	0.34	FILL/SAND SP: fine to medium grained, dark grey-brown and grey-brown, trace silt and gravel, moist, dense, fill.	▧											
	0.8	SAND SP: fine to medium grained, pale grey, trace silt, moist, dense. Possibly fill.	▦											
22	1	SAND SP: fine to medium grained, pale yellow-brown, trace silt, moist, medium dense. Sand derived from Tamala Limestone.	▤	B	0.9									
21	2													
20	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:** None

TYPE OF BORING: 250 mm diameter power auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PLD	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.4 m AHD*
EASTING: 393221
NORTHING: 6468078
DIP/AZIMUTH: 90°/--

BORE No: 38
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.03	ASPHALT: black, 7 mm nominal aggregate.	▨											
	0.2	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown and grey, fine to medium grained, with silt, moist, fill.	▩											
		FILL/SAND SP-SM: fine to medium grained, bands of grey-brown, dark grey-brown and yellow-brown, with silt, dry to moist, dense, fill.	▩											
	0.9	SAND SP: fine to medium grained, pale grey, trace silt, dry to moist, dense. Bassendean Sand.	▩											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:** None

TYPE OF BORING: 250 mm diameter power auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.3 m AHD*
EASTING: 393183
NORTHING: 6468038
DIP/AZIMUTH: 90°/--

BORE No: 39
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.03	ASPHALT: black, 7 mm nominal aggregate.	▨											
	0.19	FILL/Sandy GRAVEL GP-GM: fine to coarse sized, grey-brown and grey, fine to medium grained, with silt, moist, fill. - becoming brown and yellow-brown from 0.09 m depth.	▨											
	0.23													
	0.53	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist, fill.	▨											
		FILL/SAND SP: fine to medium grained, yellow-brown, trace silt and gravel, dry to moist, dense, fill.	▨											
	1	SAND SP: fine to medium grained, pale grey, trace silt, dry to moist, dense. Bassendean Sand.	▨											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: 8 tonne backhoe **DRILLER:** ANH Contracting **LOGGED:** GG **CASING:** None

TYPE OF BORING: 250 mm diameter power auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PLD	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)



BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.3 m AHD*
EASTING: 393346
NORTHING: 6468098
DIP/AZIMUTH: 90°/--

BORE No: 40
PROJECT No: 216618.00
DATE: 27/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
21	0.15	FILL/SAND SP-SM: fine to medium grained, grey-brown, with silt, trace gravel, moist, fill.	[Cross-hatch pattern]										
		FILL/SAND SP: fine to medium grained, yellow-brown, trace silt and gravel, moist, medium dense, fill.											
	0.6	- becoming dark brown, with gravel from 0.5 m depth.											
	0.75	SAND SP-SM: fine to medium grained, dark grey-brown, with silt, moist, medium dense.	[Dotted pattern]										
	1	SAND SP: fine to medium grained, grey, trace silt, moist, medium dense. Bassendean Sand. - becoming pale grey from 1.0 m depth.											
1.7	SAND SP-SM: fine to medium grained, brown, with silt, moist. Bassendean Sand.												
2.5	Bore discontinued at 2.5m (Target depth)												



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater observed at 2.1 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.1 m AHD*
EASTING: 393358
NORTHING: 6467947
DIP/AZIMUTH: 90°/--

BORE No: 42
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
23	0.8	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace gravel, moist, medium dense, fill. Glass pieces, plastic waste observed in fill. - becoming grey-brown from 0.4 m depth.												
21	1.0	SAND SP: fine to medium grained, pale grey, trace silt, moist, medium dense. Bassendean Sand.		D	1.0									
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.9 m AHD*
EASTING: 393255
NORTHING: 6467950
DIP/AZIMUTH: 90°/--

BORE No: 43
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	22.1	FILL/SAND SP-SM: fine to medium grained, yellow-brown, with silt, trace gravel, moist, very dense. Brick pieces observed in fill. - with gravel from 0.2 m depth. - becoming grey-brown from 0.35 m depth.											
	21.1	- becoming yellow-brown from 1.0 m depth.											
	20.5	- becoming dark grey-brown and brown from 1.5 m depth.											
	20.2	- becoming yellow-brown from 1.8 m depth.											
	20.3	SAND SP: fine to medium grained, pale grey, trace silt, moist. Bassendean Sand.											
	20.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.7 m AHD*
EASTING: 393414
NORTHING: 6468029
DIP/AZIMUTH: 90°/--

BORE No: 44
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.3	FILL/SAND SP-SM: fine to medium grained, grey and grey-brown, with silt, trace gravel, moist, dense, fill.	[Cross-hatch pattern]										
		SAND SP: fine to medium grained, pale grey, trace silt, moist, medium dense. Bassendean Sand.	[Dotted pattern]										
	2.2	- becoming pale brown from 2.1 m depth.											
	2.5	SAND SP-SM: fine to medium grained, brown, with silt, moist, weakly cemented. Bassendean Sand.	[Dotted pattern]										
	2.5	Bore discontinued at 2.5m (Target depth)											



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 21.9 m AHD*
EASTING: 393437
NORTHING: 6468105
DIP/AZIMUTH: 90°/--

BORE No: 45
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.1	FILL/SAND SP-SM: fine to medium grained, grey-brown and dark grey-brown, with silt, trace gravel, trace rootlets, moist, fill.	[Cross-hatched pattern]										
	0.7	FILL/SAND SP: fine to medium grained, dark grey-brown, trace silt and gravel, moist, medium dense, fill. - becoming grey, no gravel and trace pockets of Silty SAND SM from 0.4 m depth.											
	1	SAND SP: fine to medium grained, grey, trace silt, moist. Bassendean Sand.	[Dotted pattern]										
	1.4	- with pockets of dark grey-brown sand from 1.4 m depth.		D	1.4								
	1.5				1.5								
	1.7	Bore discontinued at 1.7m (Collapsing conditions)						28-09-22					
	2												



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater observed at 1.5 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.1 m AHD*
EASTING: 393310
NORTHING: 6468041
DIP/AZIMUTH: 90°/--

BORE No: 46
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
22		FILL/SAND SP: fine to medium grained, grey-brown, trace silt and gravel, trace rootlets, moist, medium dense, fill. Pieces of glass, basalt, tile and brick observed in fill.		D	0.85				1			
21	1								1			
21	1.4	SAND SP: fine to medium grained, grey, trace silt, moist. Bassendean Sand.						28-09-22	2			
20	2								2			
20	2.3	Bore discontinued at 2.3m (Collapsing conditions)										



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater observed at 1.6 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 23.7 m AHD*
EASTING: 393119
NORTHING: 6467943
DIP/AZIMUTH: 90°/--

BORE No: 47
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
	0.5	FILL/SAND SP-SM: fine to medium grained, brown, grey and dark grey-brown, with silt, trace gravel, moist, dense, fill.							5 10 15 20
	2.5	SAND SP: fine to medium grained, yellow-brown, trace silt, moist, medium dense to dense. Sand derived from Tamala Limestone.							5 10 15 20
	2.5	Bore discontinued at 2.5m (Target depth)							5 10 15 20



RIG: hand auger **DRILLER:** GG **LOGGED:** GG **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 21.8 m AHD*
EASTING: 393307
NORTHING: 6468013
DIP/AZIMUTH: 90°/--

BORE No: 48
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)				
				Type	Depth	Sample	Results & Comments		5	10	15	20	
	0.1	FILL/SAND SP-SM: fine to medium grained, grey-brown, with silt, trace gravel, moist, fill. FILL/SAND SP: fine to medium grained, dark grey-brown, trace silt and gravel, moist, medium dense, fill. - becoming grey-brown from 0.3 m depth.	[Cross-hatched pattern]										
	1.35	SAND SP: fine to medium grained, grey, trace silt and gravel, moist. Possibly fill. - becoming wet from 1.45 m depth.	[Dotted pattern]					▼ 28-09-22					
	2.2	Bore discontinued at 2.2m (Collapsing conditions)											



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: Groundwater observed at 1.45 m depth.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 26.7 m AHD*
EASTING: 393127
NORTHING: 6467875
DIP/AZIMUTH: 90°/--

BORE No: 50A
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.1	FILL/SAND SP-SM: fine to medium grained, grey-brown, with silt, trace gravel, trace rootlets, moist, fill.	[Cross-hatched pattern]											
	0.5	FILL/SAND SP: fine to medium grained, grey-brown and brown, trace silt and gravel, trace pockets of Silty SAND SM, moist, medium dense, fill. Glass pieces observed in fill.	[Cross-hatched pattern]		0.3									
	2.0	SAND SP: fine to medium grained, yellow-brown, trace silt, moist, medium dense. Sand derived from Tamala Limestone.	[Dotted pattern]											
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 24.2 m AHD*
EASTING: 393167
NORTHING: 6467929
DIP/AZIMUTH: 90°/--

BORE No: 51
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
24	0.13	FILL/TOPSOIL: SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace rootlets, moist, fill.												
	0.6	FILL/SAND SP: fine to medium grained, yellow-brown and brown, trace silt and gravel, trace rootlets, moist, medium dense, fill. - becoming yellow-brown from 0.3 m depth.												
	0.8	SAND SP: fine to medium grained, yellow-brown, trace silt, moist, very dense. Sand derived from Tamala Limestone.		D	0.8									
	1													
	2													
	2.5	Bore discontinued at 2.5m (Target depth)												



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 22.5 m AHD*
EASTING: 393263
NORTHING: 6467989
DIP/AZIMUTH: 90°/--

BORE No: 52
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)					
				Type	Depth	Sample	Results & Comments		5	10	15	20		
	0.15	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace gravel, trace rootlets, moist, fill.												
	0.5	FILL/SAND SP: fine to medium grained, grey-brown, trace silt and gravel, moist, medium dense, fill.												
	0.6	FILL/SAND SP-SM: fine to medium grained, brown, with silt, trace gravel, moist, medium dense to dense, fill. Pieces of tile, brick and ceramic observed in fill.		B	0.6									
	1.0				1.0									
	1.4	Bore discontinued at 1.4m (Hard digging)												



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: DevelopmentWA
PROJECT: Proposed Multi-Residential Development
LOCATION: Central Avenue, Mount Lawley, WA

SURFACE LEVEL: 24.0 m AHD*
EASTING: 393086
NORTHING: 6467949
DIP/AZIMUTH: 90°/--

BORE No: 53
PROJECT No: 216618.00
DATE: 28/9/2022
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
24	0.1	FILL/SAND SP-SM: fine to medium grained, dark grey-brown, with silt, trace gravel, trace rootlets, moist, fill.	[Cross-hatch pattern]		0.3		No PSP was undertaken at this location due to risk of intersection with underground services.					
	0.55	FILL/SAND SP: fine to medium grained, brown, trace silt and gravel, trace rootlets to 0.15 m depth, moist, fill. Brick pieces observed at 0.5 m depth.	[Cross-hatch pattern]									
	1	SAND SP: fine to medium grained, yellow-brown, trace silt, moist. Bassendean Sand.	[Dotted pattern]									
24	2											
	2.5	Bore discontinued at 2.5m (Target depth)										



RIG: hand auger **DRILLER:** AA **LOGGED:** AA **CASING:** None

TYPE OF BORING: 110 mm diameter hand auger borehole

WATER OBSERVATIONS: No free groundwater observed.

REMARKS: Location coordinates are in MGA94 Zone 50 J. *Surface level measured using a differential GPS with a reported accuracy of 0.1 m. PSP not undertaken due to high risk of intersecting services. Sand Penetrometer AS1289.6.3.3
 Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

Appendix D

Geotechnical Laboratory Test Certificates



SOIL | AGGREGATE | CONCRETE | CRUSHING

TEST REPORT - AS 1289.5.2.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10358_1_MMDD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10358
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH135, 0.5m	Date Tested:	7/07/2023

TEST RESULTS - Modified Maximum Dry Density

Sampling Method:

Sampled by Client, Tested as Received

Sample Curing Time (Hours):

2

Method used to Determine Liquid Limit:

Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%):

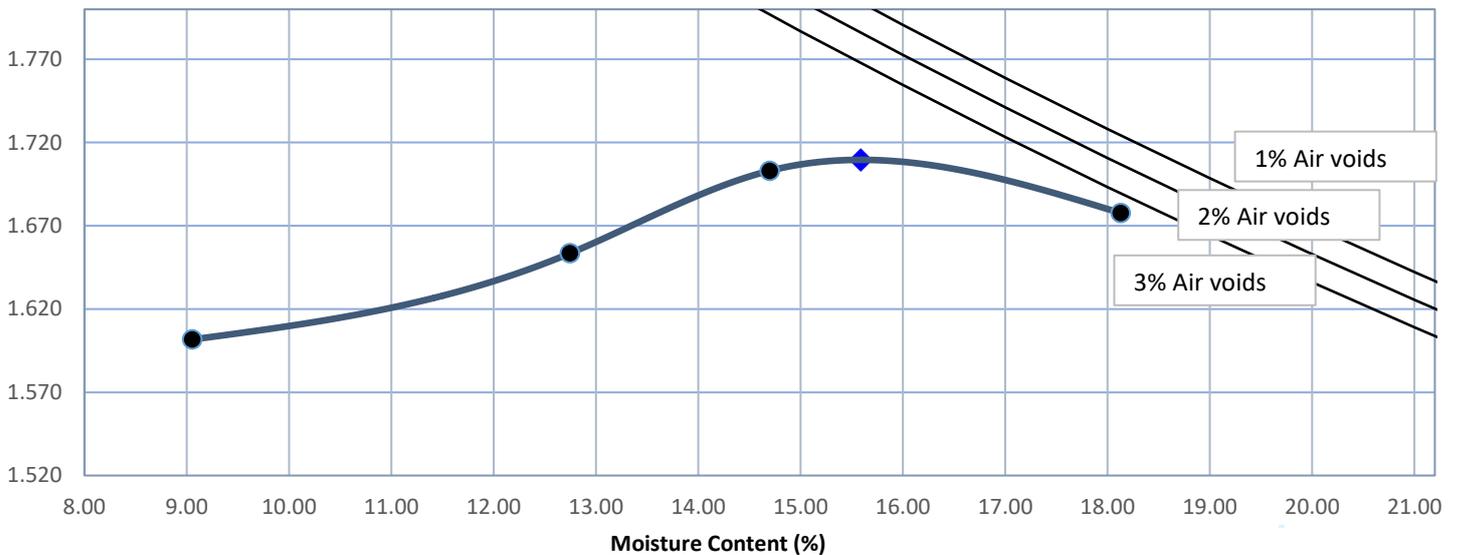
0

Material + 37.5mm (%):

-

Moisture Content (%)	9.1	12.7	14.7	18.1	
Dry Density (t/m³)	1.602	1.653	1.703	1.678	

Dry Density (t/m³)



Modified Maximum Dry Density (t/m³)

1.71

Optimum Moisture Content (%)

15.5

Comments: The above air void lines are derived from a calculated apparent particle density of 2.545 t/m³

Approved Signatory:

Name: Madhav Basnet

Date: 10/July/2023



Accreditation No. 20599
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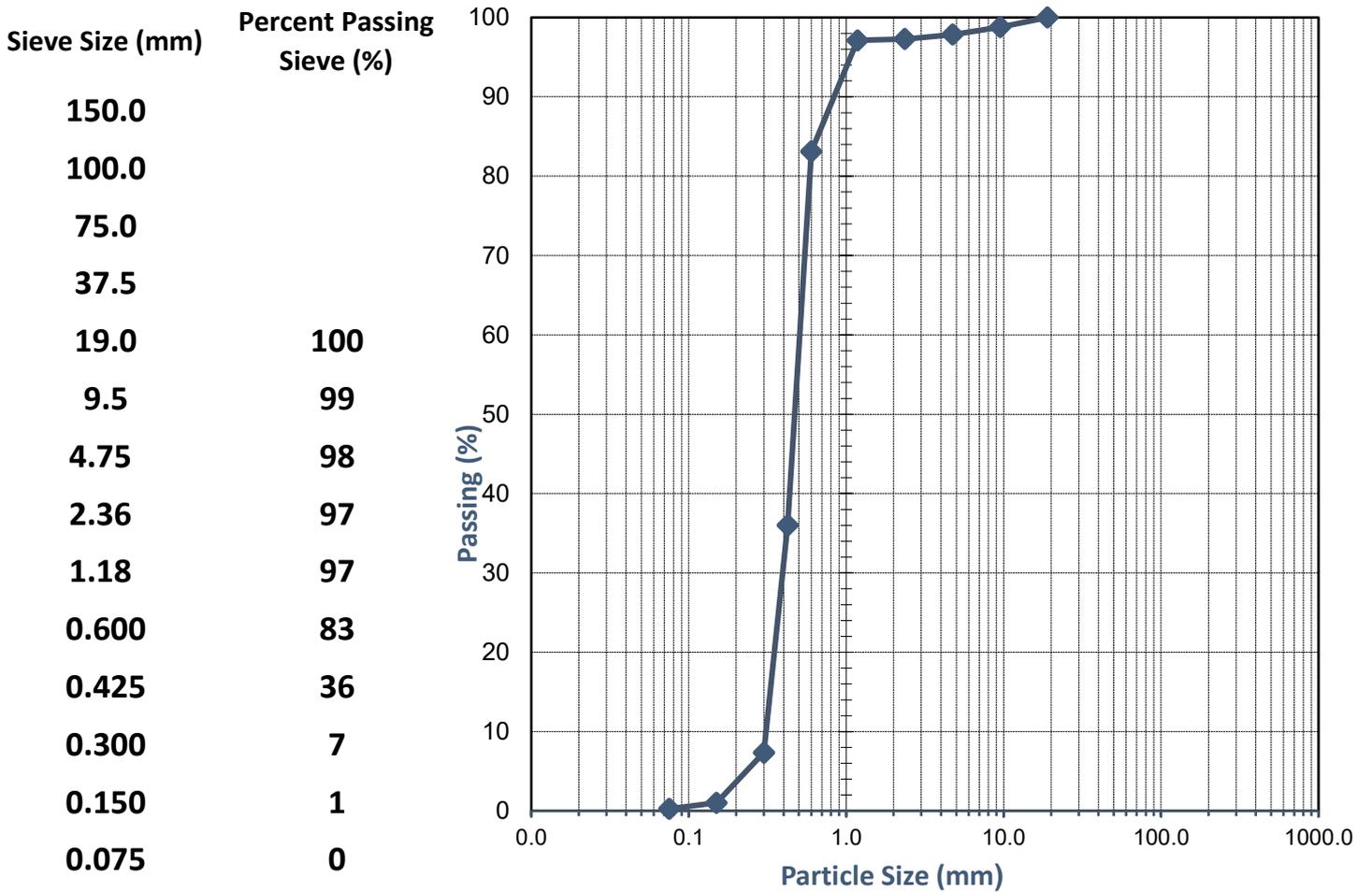
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10358_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10358
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH135, 0.5m	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Madhav Basnet

Date: 11-July-2023



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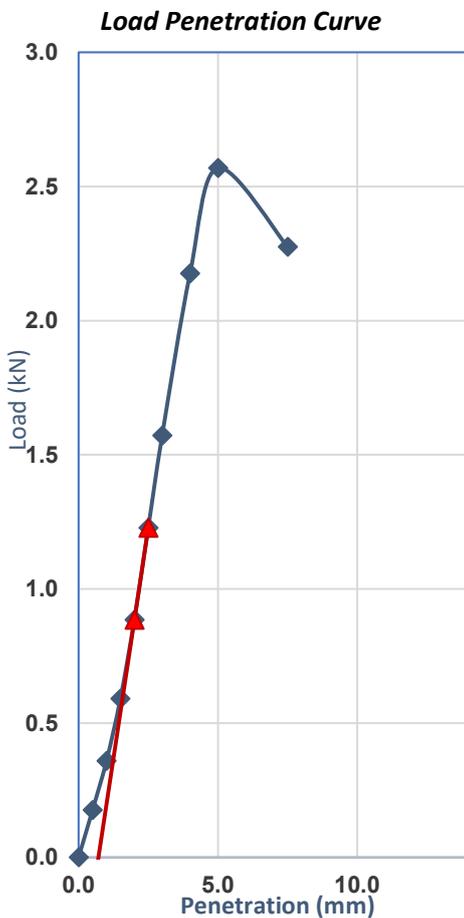
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TEST REPORT - AS 1289.6.1.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10358_1_SCBR
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10358
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH135, 0.5m	Date Tested:	07/07 - 14/07/2023

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand, trace Gravel
 Sampling Method: Sampled by Client, Tested as Received



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	2.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m ³)	1.71	Optimum Moisture (%)	15.5
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m ³)	1.63	Moisture Content (%)	15.5
Density Ratio (%)	95.0	Moisture Ratio (%)	99.5

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m ³)	1.63	Dry Density Ratio (%)	95.0
Moisture Content (%)	15.6	Moisture Ratio (%)	100.0

Specimen Conditions After Test			
Top 30mm Moisture (%)	13.1	Remaining Depth (%)	15.0

Correction applied to Penetration: 0.7mm
 Determined at a Penetration of: 2.5mm
 California Bearing Ratio (CBR): 13%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 17-July-2023



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TEST REPORT - AS 1289.5.2.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10359_1_MMDD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10359
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH136, 0.5m	Date Tested:	7/07/2023

TEST RESULTS - Modified Maximum Dry Density

Sampling Method:

Sampled by Client, Tested as Received

Sample Curing Time (Hours):

2

Method used to Determine Liquid Limit:

Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%):

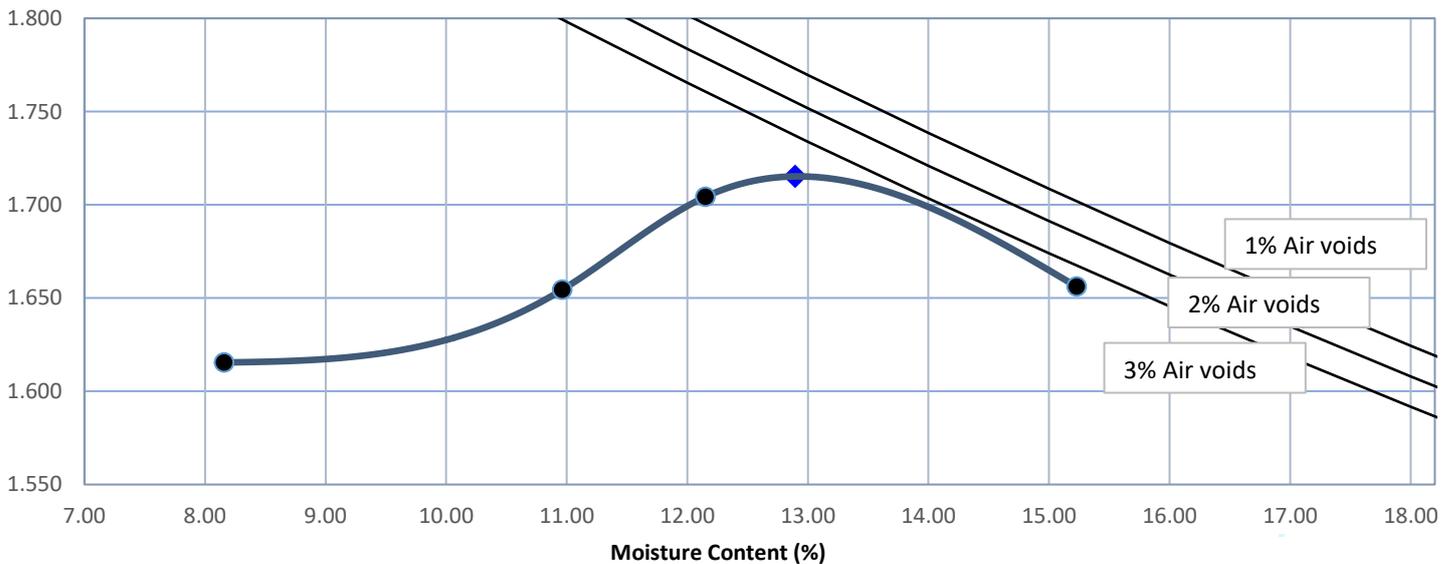
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Material + 37.5mm (%):

-

Moisture Content (%)	8.2	11.0	12.2	15.2	
Dry Density (t/m³)	1.615	1.654	1.704	1.656	

Dry Density (t/m³)



Modified Maximum Dry Density (t/m³)

1.72

Optimum Moisture Content (%)

13.0

Comments: The above air void lines are derived from a calculated apparent particle density of 2.329 t/m³

Approved Signatory:

Name: Madhav Basnet

Date: 10/July/2023



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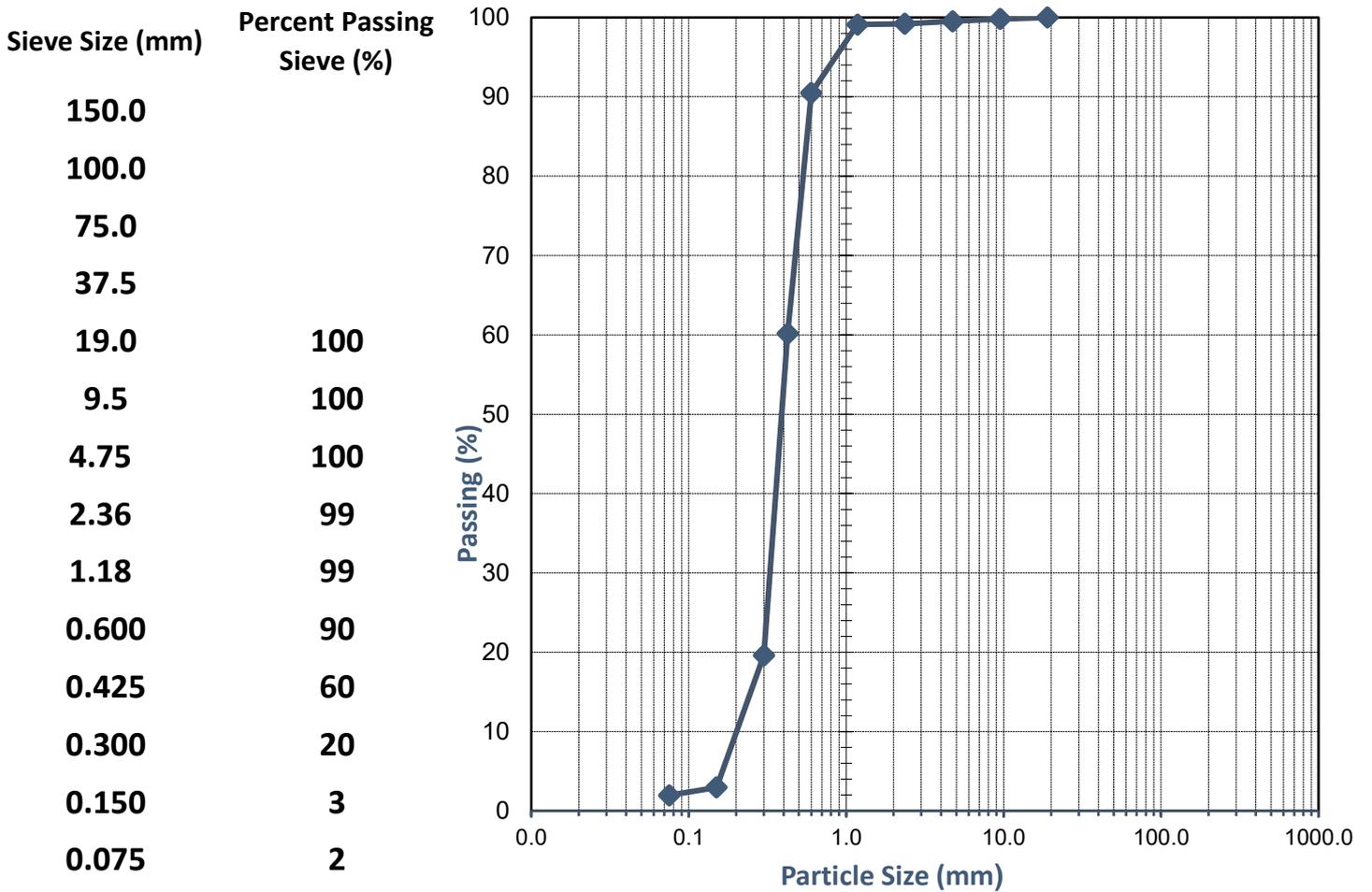
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10359_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10359
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH136, 0.5m	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Madhav Basnet

Date: 11-July-2023



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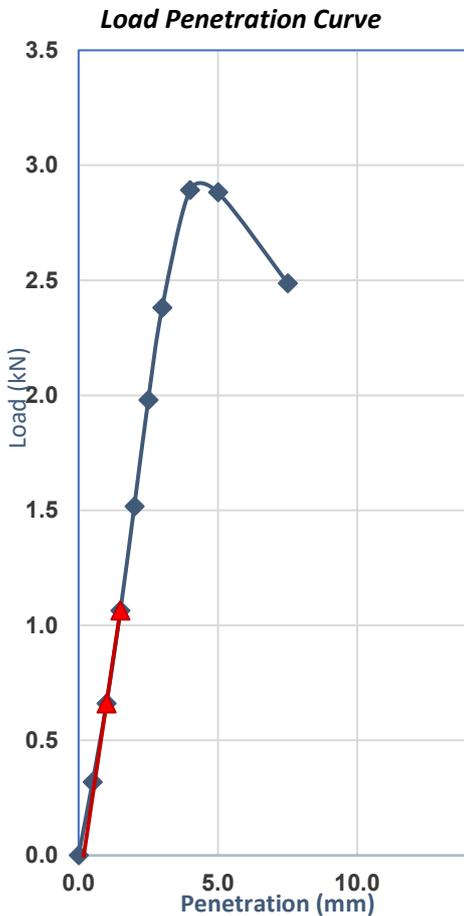
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TEST REPORT - AS 1289.6.1.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10359_1_SCBR
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10359
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH136, 0.5m	Date Tested:	07/07 - 14/07/2023

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand, trace Gravel
Sampling Method: Sampled by Client, Tested as Received



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	2.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m ³)	1.72	Optimum Moisture (%)	13.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m ³)	1.63	Moisture Content (%)	13.2
Density Ratio (%)	95.0	Moisture Ratio (%)	102.0

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m ³)	1.63	Dry Density Ratio (%)	95.0
Moisture Content (%)	15.6	Moisture Ratio (%)	120.5

Specimen Conditions After Test			
Top 30mm Moisture (%)	12.9	Remaining Depth (%)	15.1

Correction applied to Penetration: 0.2mm
Determined at a Penetration of: 2.5mm
California Bearing Ratio (CBR): 16%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 17-July-2023



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TEST REPORT - ASTM D2974-14 (Test Method C)

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10360-10372_1_ORG
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10360-10372
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	Various - see below	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Organic Content

Sampling Method:

Sampled by Client, Tested as Received

Testing Completed By:

WGLS-LC

Furnace Temperature (°C):

440

Sample Number	Sample Identification	Ash Content (%)	Organic Content (%)
WG23.10360	BH136, 2.0m	96.8	3.2
WG23.10362	BH140, 0.3m	99.4	0.6
WG23.10364	BH153, 0.5m	98.8	1.2
WG23.10365	BH155, 0.5m	99.4	0.6
WG23.10367	BH163, 1.0m	95.9	4.1
WG23.10368	BH164, 0.5m	93.3	6.7
WG23.10370	BH166, 1.0m	99.3	0.7
WG23.10371	BH169, 0.3m	97.9	2.1
WG23.10372	BH170, 1.0m	98.7	1.3

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 11/July/2023



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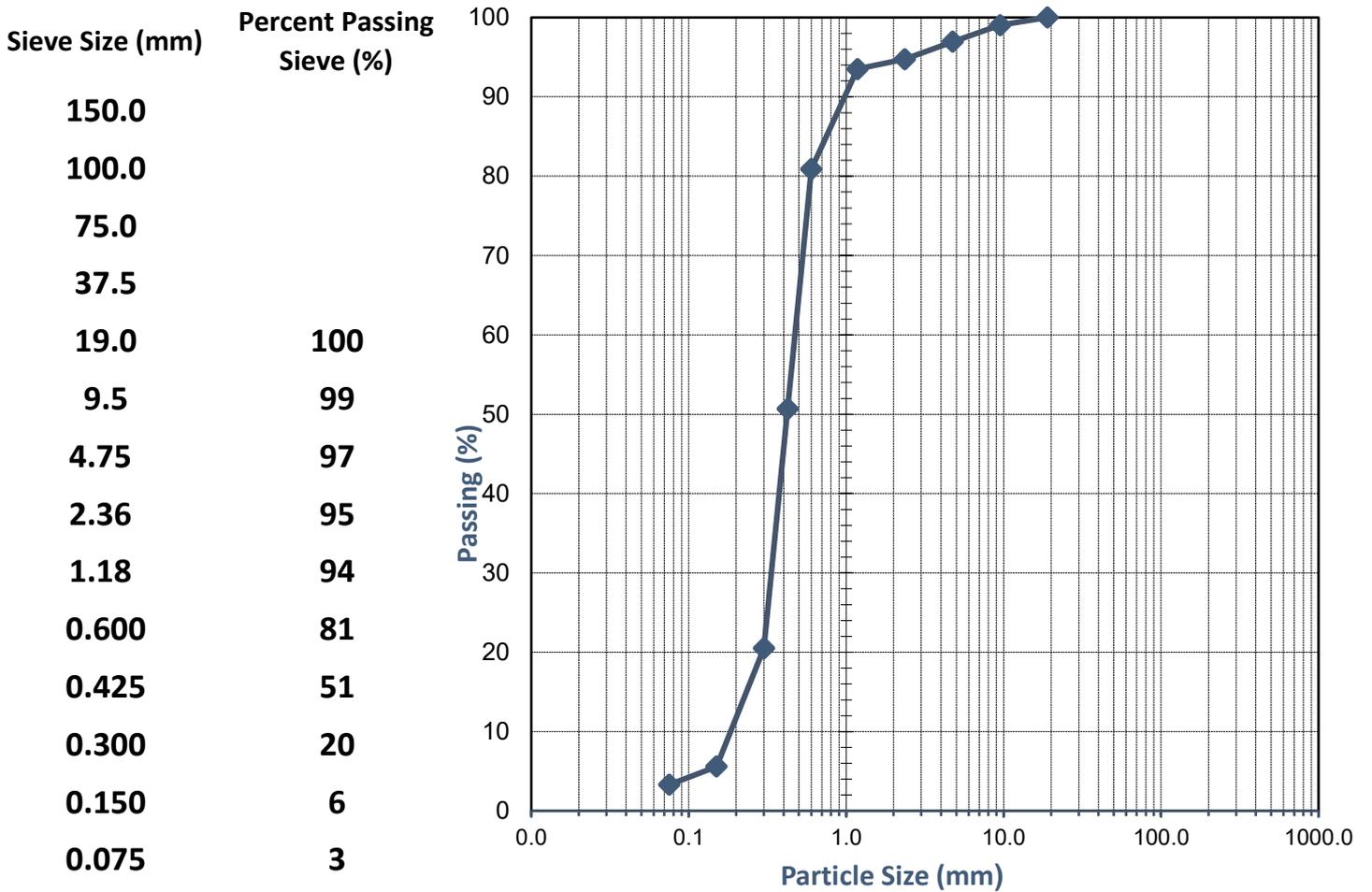
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10361_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10361
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH138, 0.7m	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Madhav Basnet

Date: 11-July-2023



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TEST REPORT - AS 1289.5.2.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10363_1_MMDD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10363
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH144, 0.5m	Date Tested:	7-07-2023

TEST RESULTS - Modified Maximum Dry Density

Sampling Method:

Sampled by Client, Tested as Received

Sample Curing Time (Hours):

2

Method used to Determine Liquid Limit:

Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%):

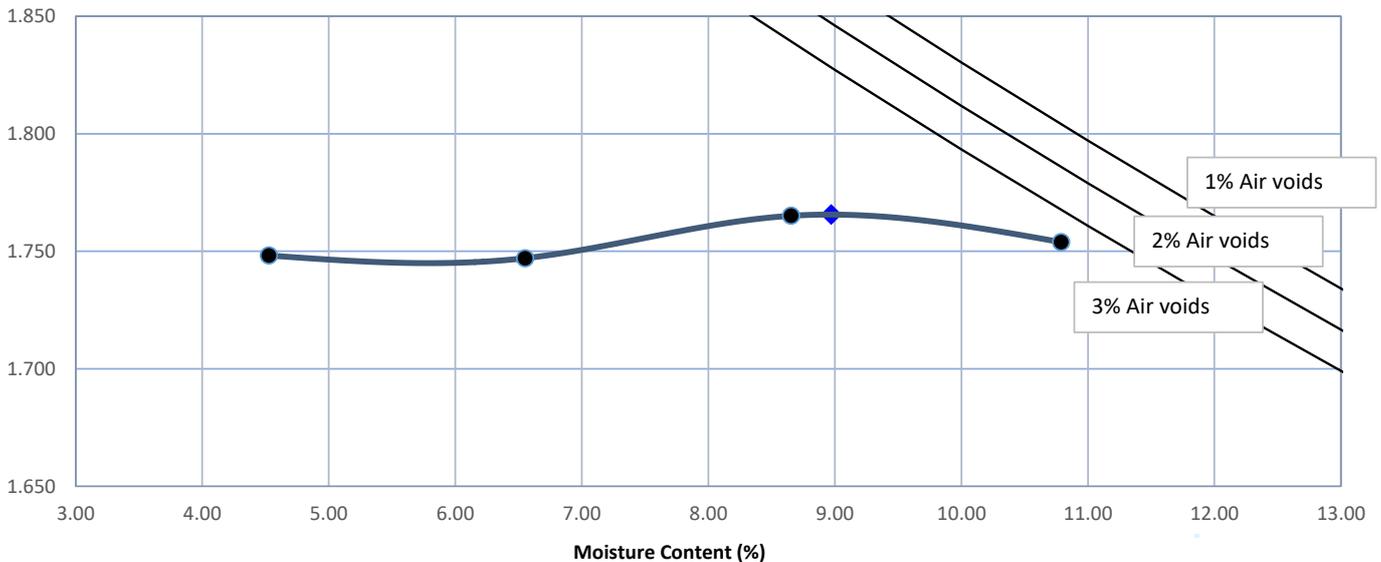
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Material + 37.5mm (%):

-

Moisture Content (%)	4.5	6.6	8.7	10.8	
Dry Density (t/m³)	1.748	1.747	1.765	1.754	

Dry Density (t/m³)



Modified Maximum Dry Density (t/m³)

1.77

Optimum Moisture Content (%)

9.0

Comments: The above air void lines are derived from a calculated apparent particle density of 2.268 t/m³

Approved Signatory:

Name: Brooke Elliott

Date: 10-July-2023



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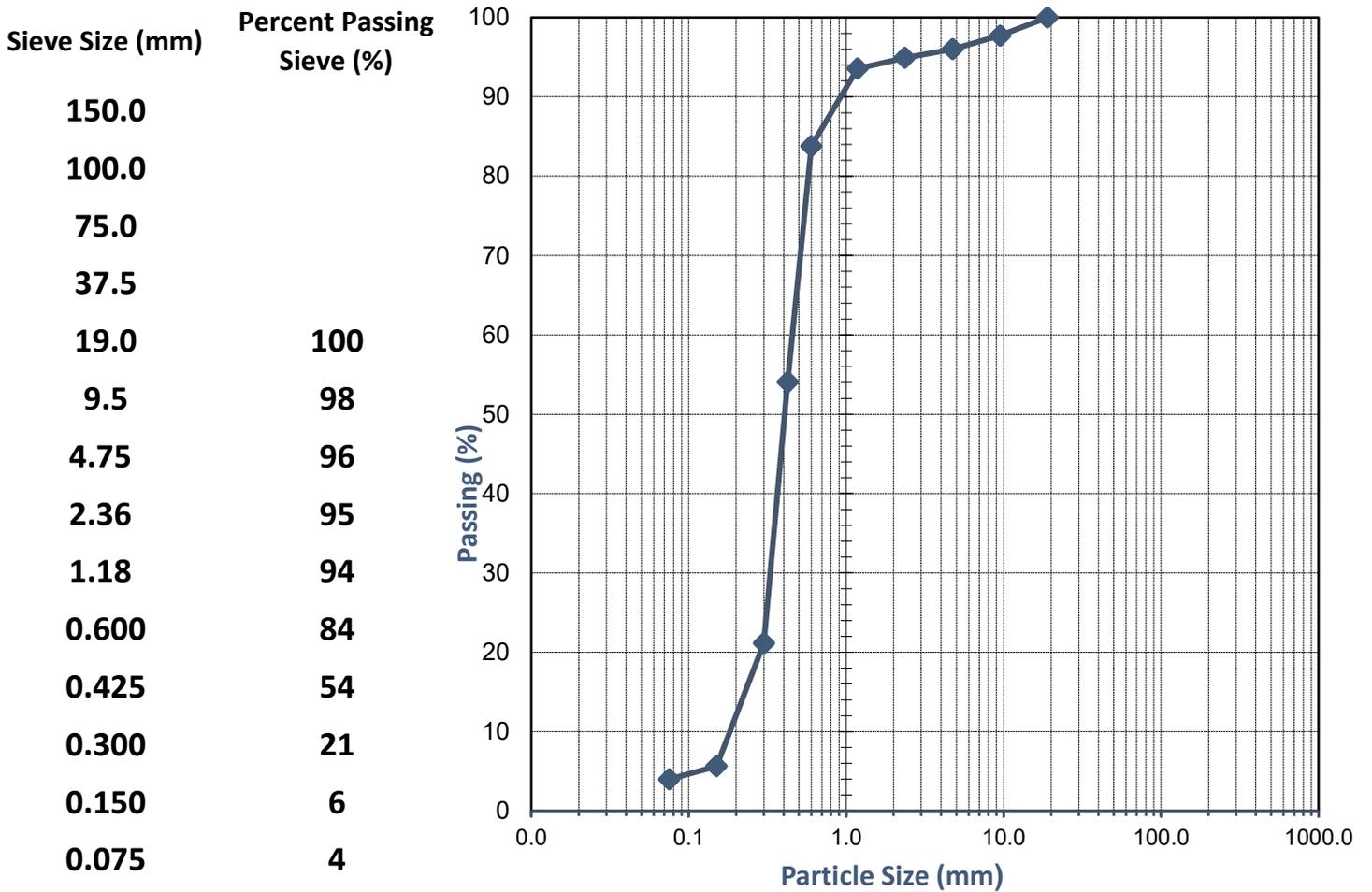
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10363_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10363
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH144, 0.5m	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Madhav Basnet

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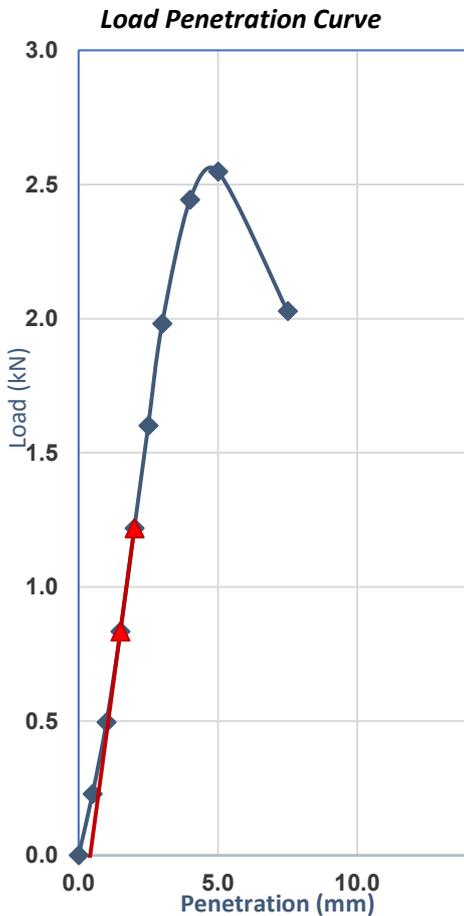
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TEST REPORT - AS 1289.6.1.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10363_1_SCBR
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10363
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH144, 0.5m	Date Tested:	07/07 - 14/07/2023

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand, trace Gravel
Sampling Method: Sampled by Client, Tested as Received



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	2.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m ³)	1.77	Optimum Moisture (%)	9.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m ³)	1.68	Moisture Content (%)	9.1
Density Ratio (%)	95.0	Moisture Ratio (%)	101.0

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m ³)	1.68	Dry Density Ratio (%)	95.0
Moisture Content (%)	16.4	Moisture Ratio (%)	182.5

Specimen Conditions After Test			
Top 30mm Moisture (%)	13.2	Remaining Depth (%)	15.8

Correction applied to Penetration: 0.4mm
Determined at a Penetration of: 2.5mm
California Bearing Ratio (CBR): 15%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 17-July-2023



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TEST REPORT - AS 1289.5.2.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10364_1_MMDD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10364
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH153, 0.5m	Date Tested:	7-07-2023

TEST RESULTS - Modified Maximum Dry Density

Sampling Method:

Sampled by Client, Tested as Received

Sample Curing Time (Hours):

2

Method used to Determine Liquid Limit:

Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%):

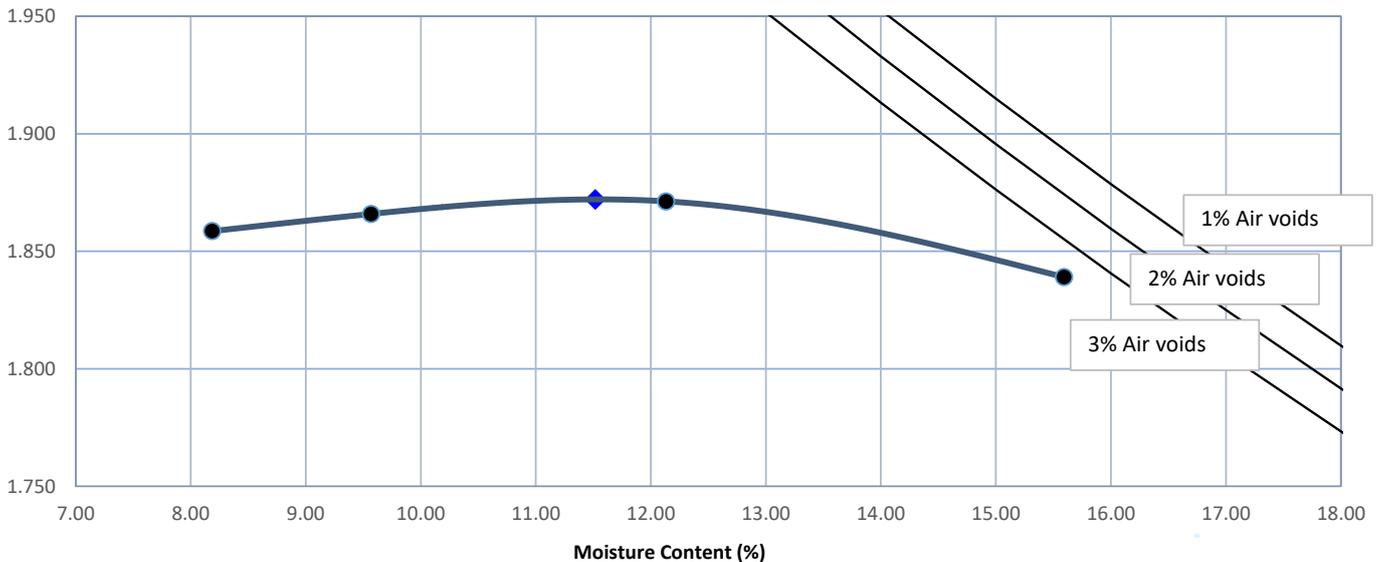
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Material + 37.5mm (%):

-

Moisture Content (%)	8.2	9.6	12.1	15.6	
Dry Density (t/m³)	1.859	1.866	1.871	1.839	

Dry Density (t/m³)



Modified Maximum Dry Density (t/m³)

1.87

Optimum Moisture Content (%)

11.5

Comments: The above air void lines are derived from a calculated apparent particle density of 2.725 t/m³

Approved Signatory:

Name: Brooke Elliott

Date: 10-July-2023



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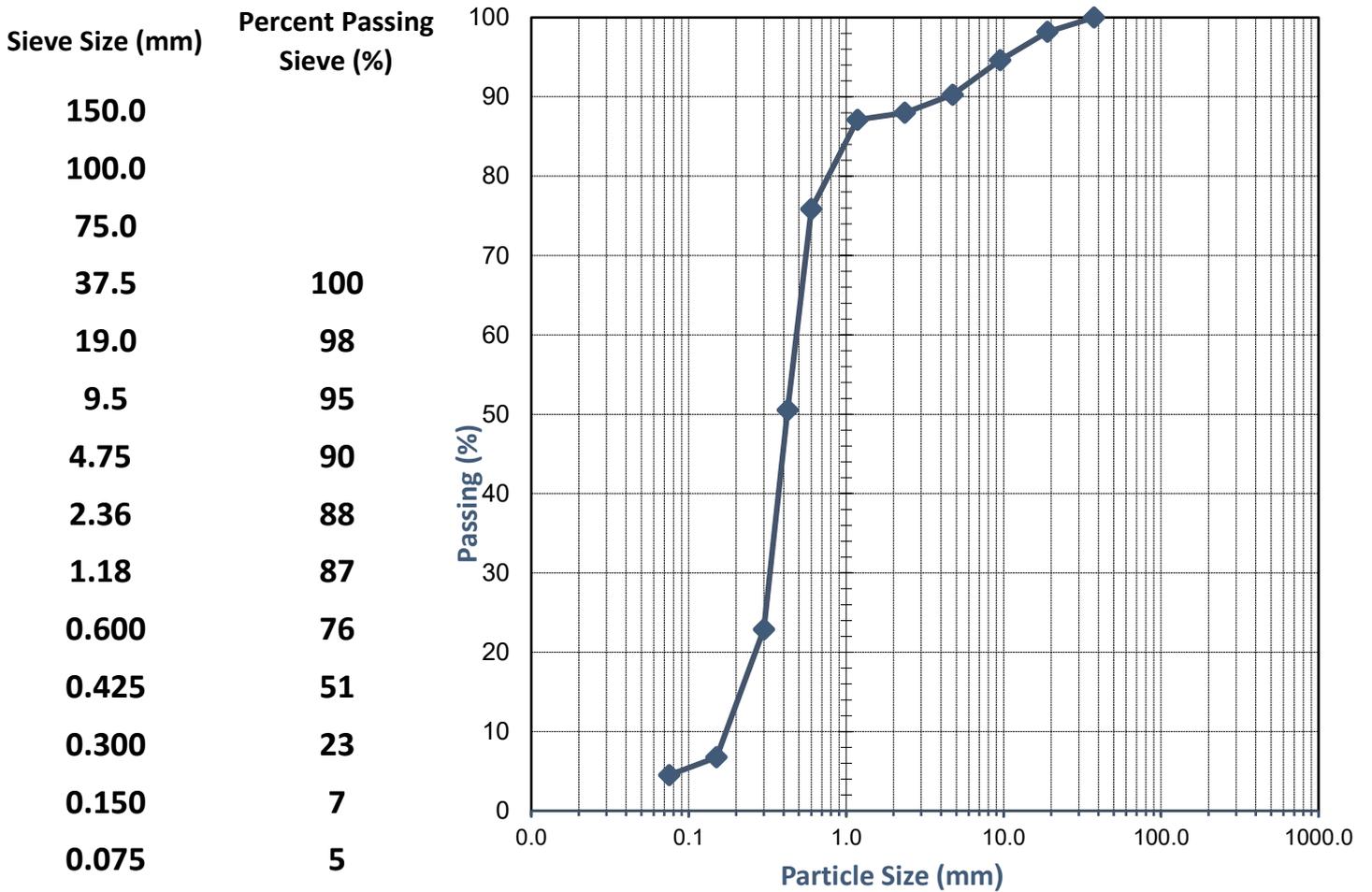
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10364_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10364
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH153, 0.5m	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Brooke Elliott

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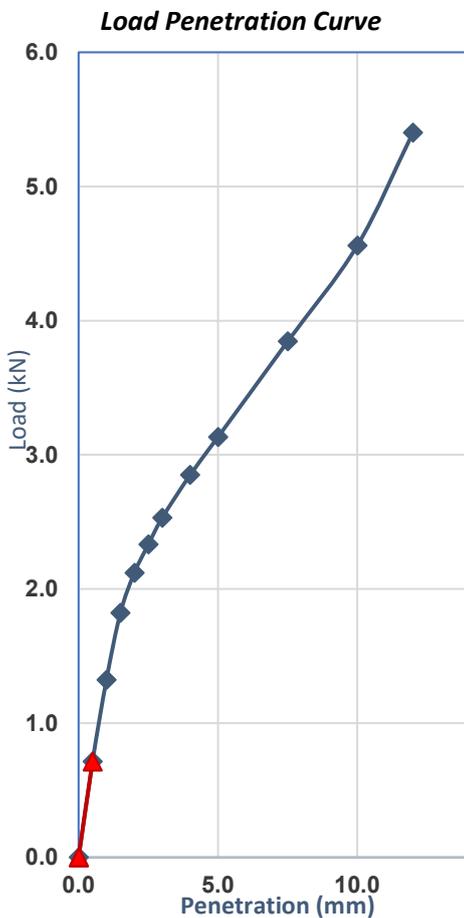
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TEST REPORT - AS 1289.6.1.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10364_1_SCBR
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10364
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH153, 0.5m	Date Tested:	07/07 - 14/07/2023

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand, trace Gravel
Sampling Method: Sampled by Client, Tested as Received



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	2.0
% Retained 19.0mm	1	Excluded/Replaced	Excluded
Maximum Dry Density (t/m ³)	1.87	Optimum Moisture (%)	11.5
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m ³)	1.77	Moisture Content (%)	11.7
Density Ratio (%)	94.5	Moisture Ratio (%)	101.5

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m ³)	1.77	Dry Density Ratio (%)	94.5
Moisture Content (%)	13.5	Moisture Ratio (%)	117.5

Specimen Conditions After Test			
Top 30mm Moisture (%)	12.8	Remaining Depth (%)	12.6

Correction applied to Penetration: 0mm
Determined at a Penetration of: 2.5mm
California Bearing Ratio (CBR): 18%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 17-July-2023



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TEST REPORT - AS 1289.5.2.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10365_1_MMDD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10365
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH155, 0.5m	Date Tested:	7-07-2023

TEST RESULTS - Modified Maximum Dry Density

Sampling Method:

Sampled by Client, Tested as Received

Sample Curing Time (Hours):

2

Method used to Determine Liquid Limit:

Visual / Tactile Assessment by Competent Technician

Material + 19.0mm (%):

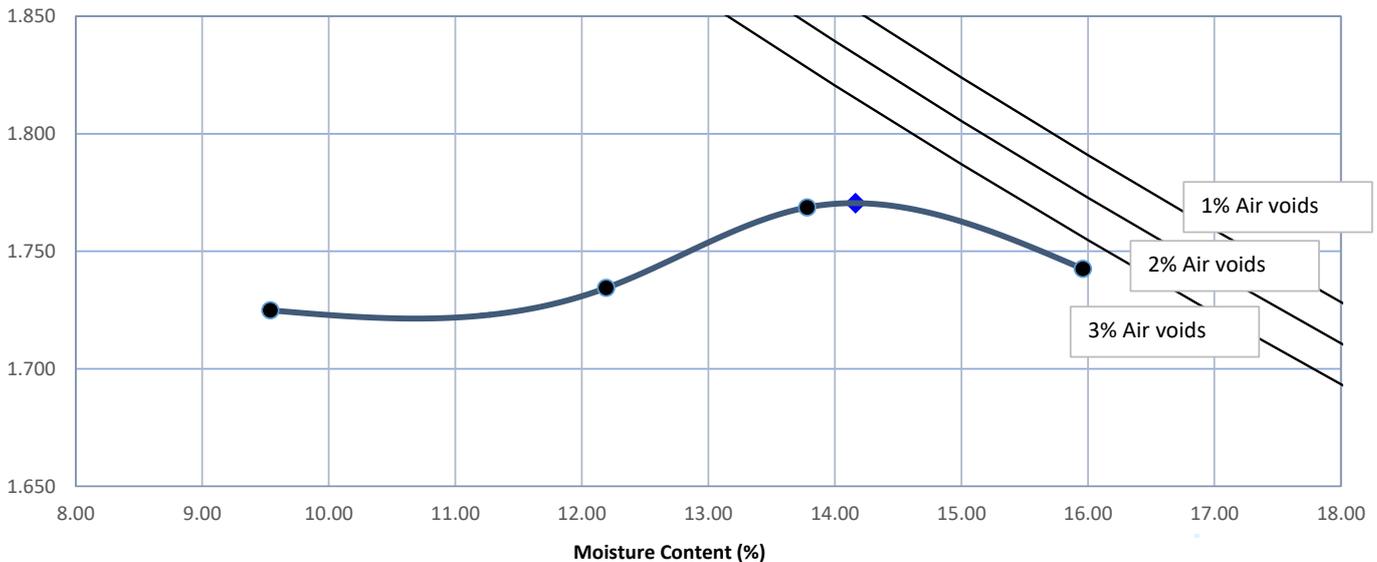
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Material + 37.5mm (%):

-

Moisture Content (%)	9.5	12.2	13.8	16.0	
Dry Density (t/m³)	1.725	1.734	1.769	1.742	

Dry Density (t/m³)



Modified Maximum Dry Density (t/m³)

1.77

Optimum Moisture Content (%)

14.0

Comments: The above air void lines are derived from a calculated apparent particle density of 2.546 t/m³

Approved Signatory:

Name: Brooke Elliott

Date: 10-July-2023



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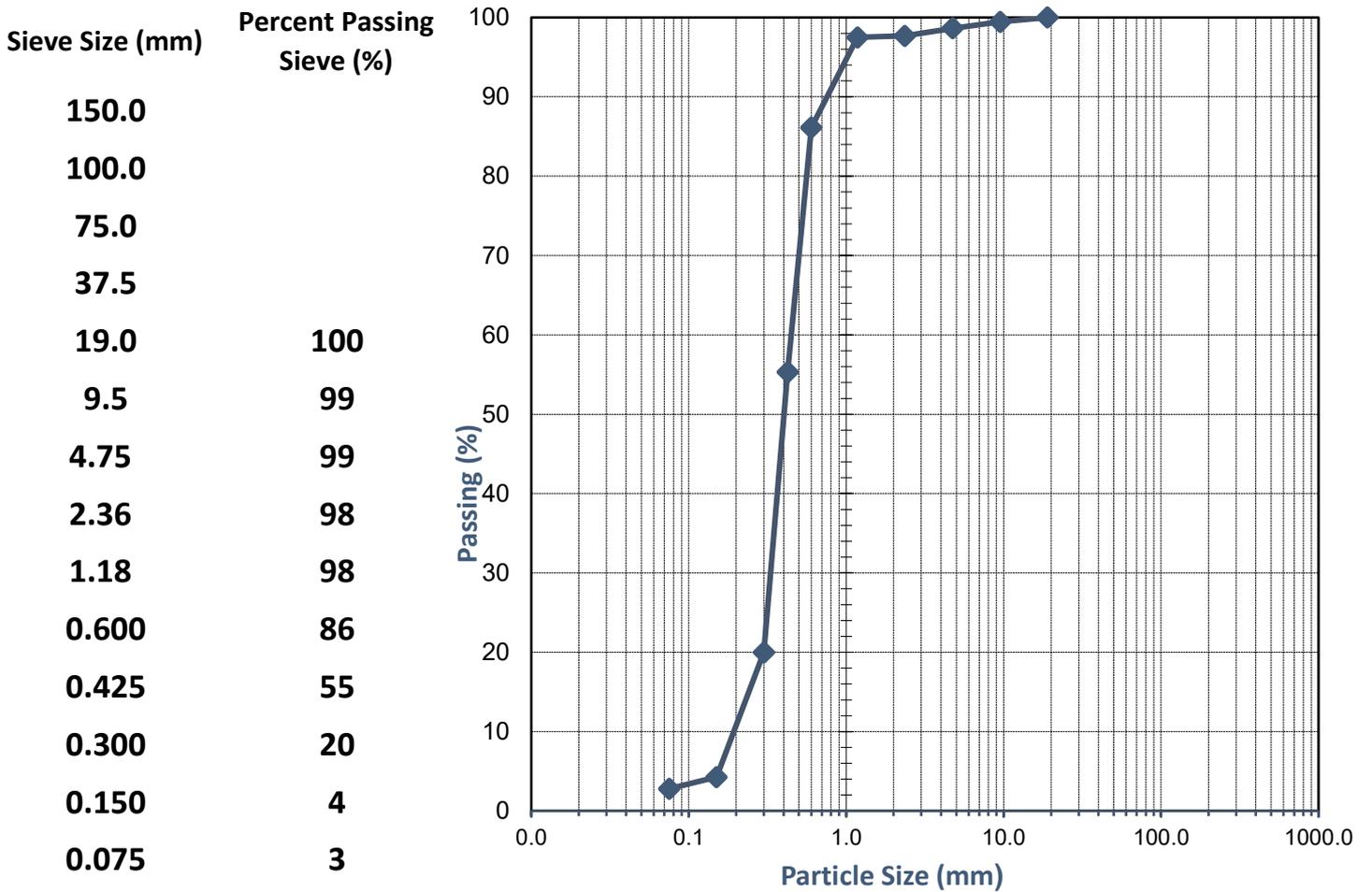
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10365_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10365
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH155, 0.5m	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Brooke Elliott

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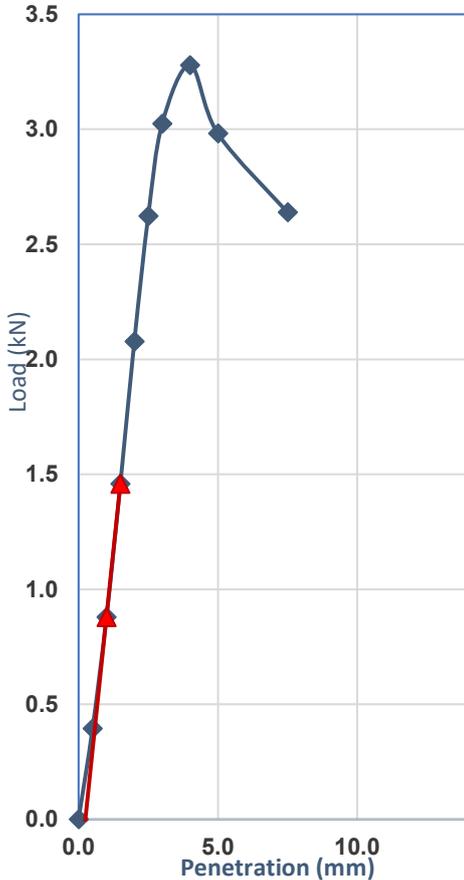
TEST REPORT - AS 1289.6.1.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10365_1_SCBR
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10365
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH155, 0.5m	Date Tested:	07/07 - 14/07/2023

TEST RESULTS - CALIFORNIA BEARING RATIO

Sample Description: Sand, trace Gravel
 Sampling Method: Sampled by Client, Tested as Received

Load Penetration Curve



Compaction Details			
Compaction Method	AS 1289.5.2.1	Hammer Type	Modified
Plasticity Determined by	Estimated	Curing Time (Hours)	2.0
% Retained 19.0mm	0	Excluded/Replaced	Excluded
Maximum Dry Density (t/m ³)	1.77	Optimum Moisture (%)	14.0
Target Dry Density Ratio (%)	95	Target Moisture Ratio (%)	100

Specimen Conditions At Compaction			
Dry Density (t/m ³)	1.68	Moisture Content (%)	14.2
Density Ratio (%)	95.0	Moisture Ratio (%)	100.0

Specimen Conditions After Soak			
Soaked or Unsoaked	Soaked	Soaking Period (days)	4
Surcharges Applied (kg)	4.50	Measured Swell (%)	0.0
Dry Density (t/m ³)	1.68	Dry Density Ratio (%)	95.0
Moisture Content (%)	15.1	Moisture Ratio (%)	106.5

Specimen Conditions After Test			
Top 30mm Moisture (%)	13.4	Remaining Depth (%)	13.7

Correction applied to Penetration: 0.2mm
 Determined at a Penetration of: 2.5mm
 California Bearing Ratio (CBR): 20%

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 17-July-2023



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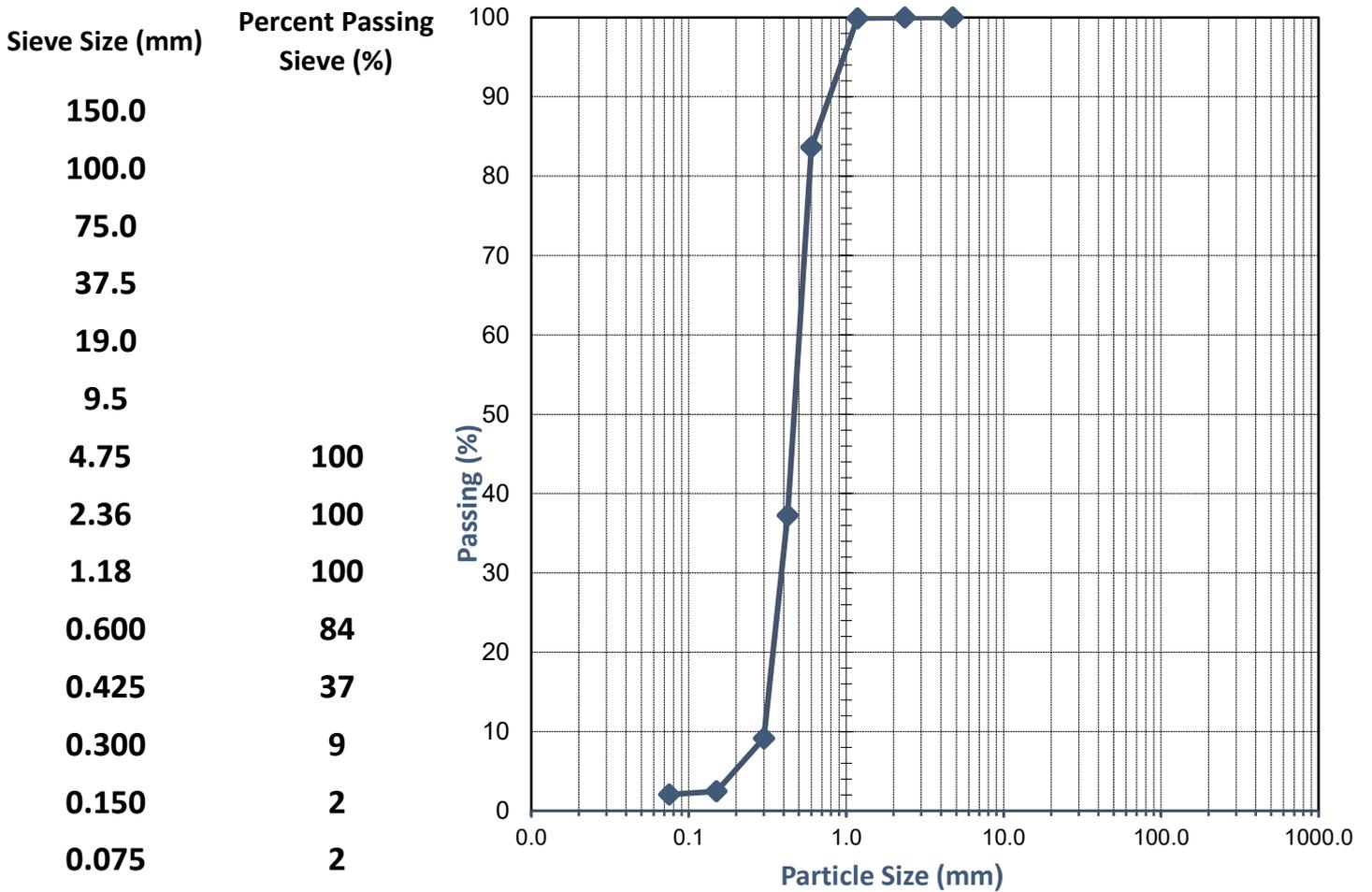
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10366_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10366
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH162, 1.0m	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Madhav Basnet

Date: 11-July-2023



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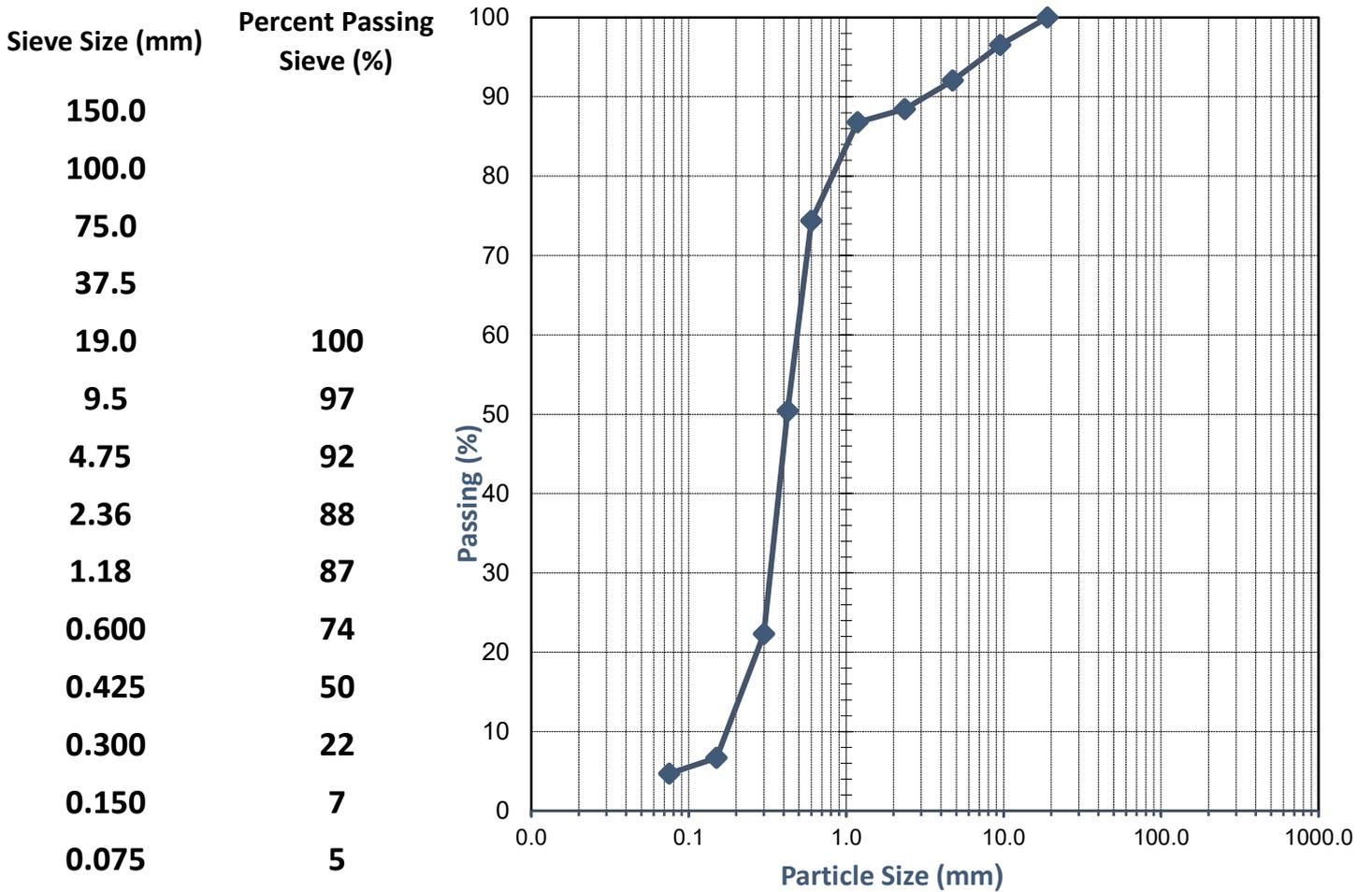
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10367_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10367
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH163, 1.0m	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 10/July/2023



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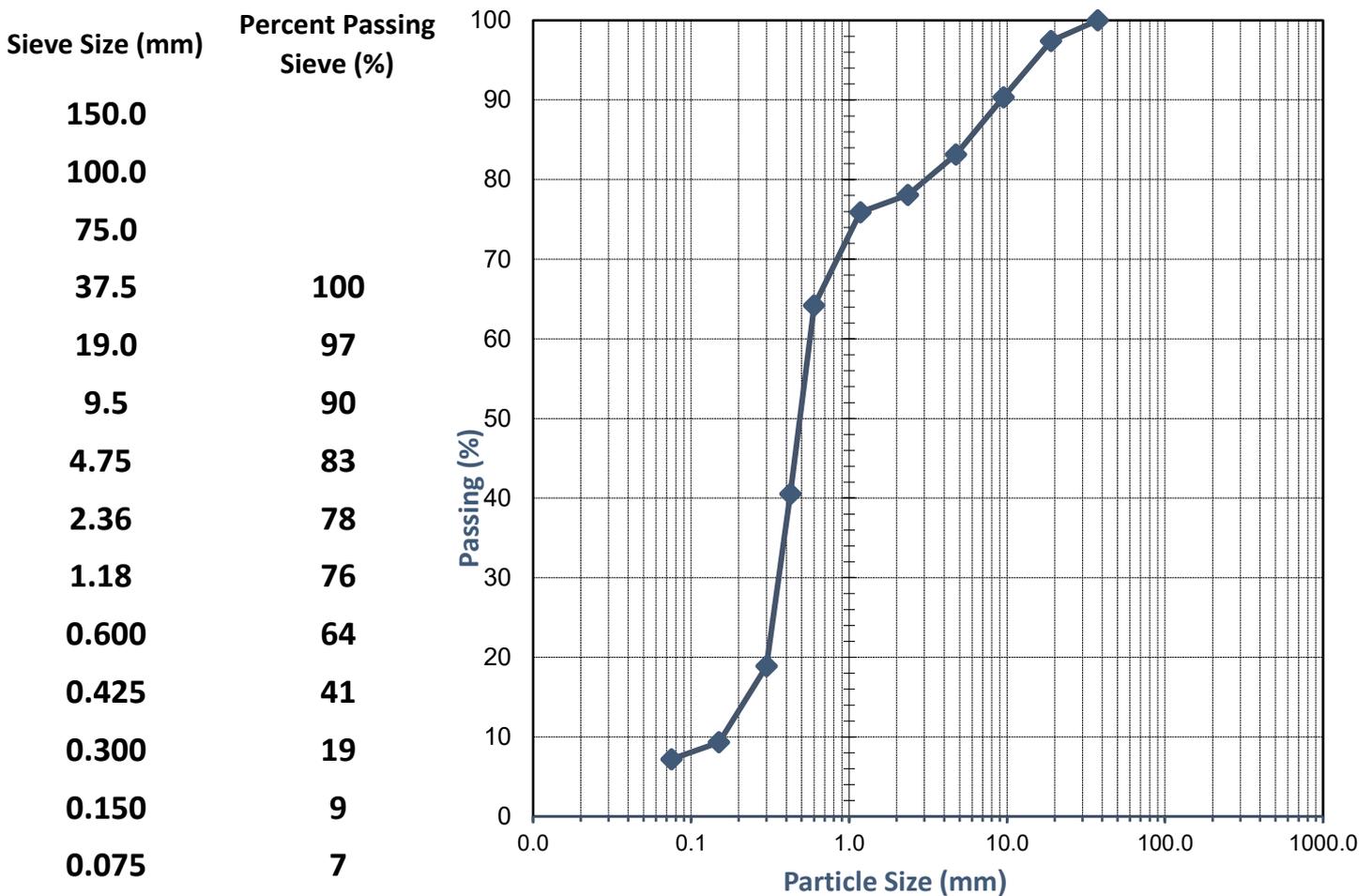
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10368_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10368
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH164, 0.5m	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 10/July/2023



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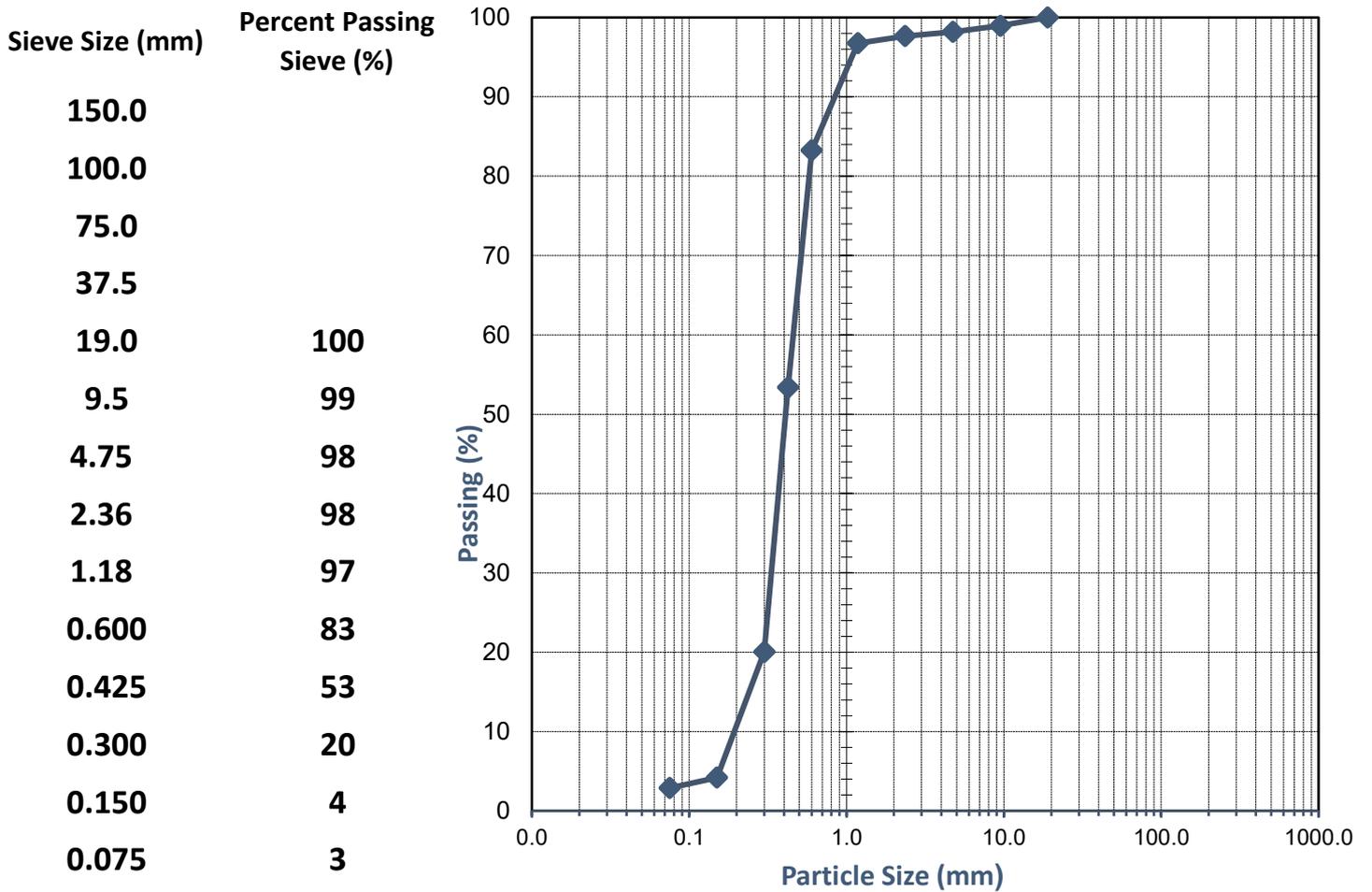
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10369_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10369
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH164, 1.1m	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 10/July/2023



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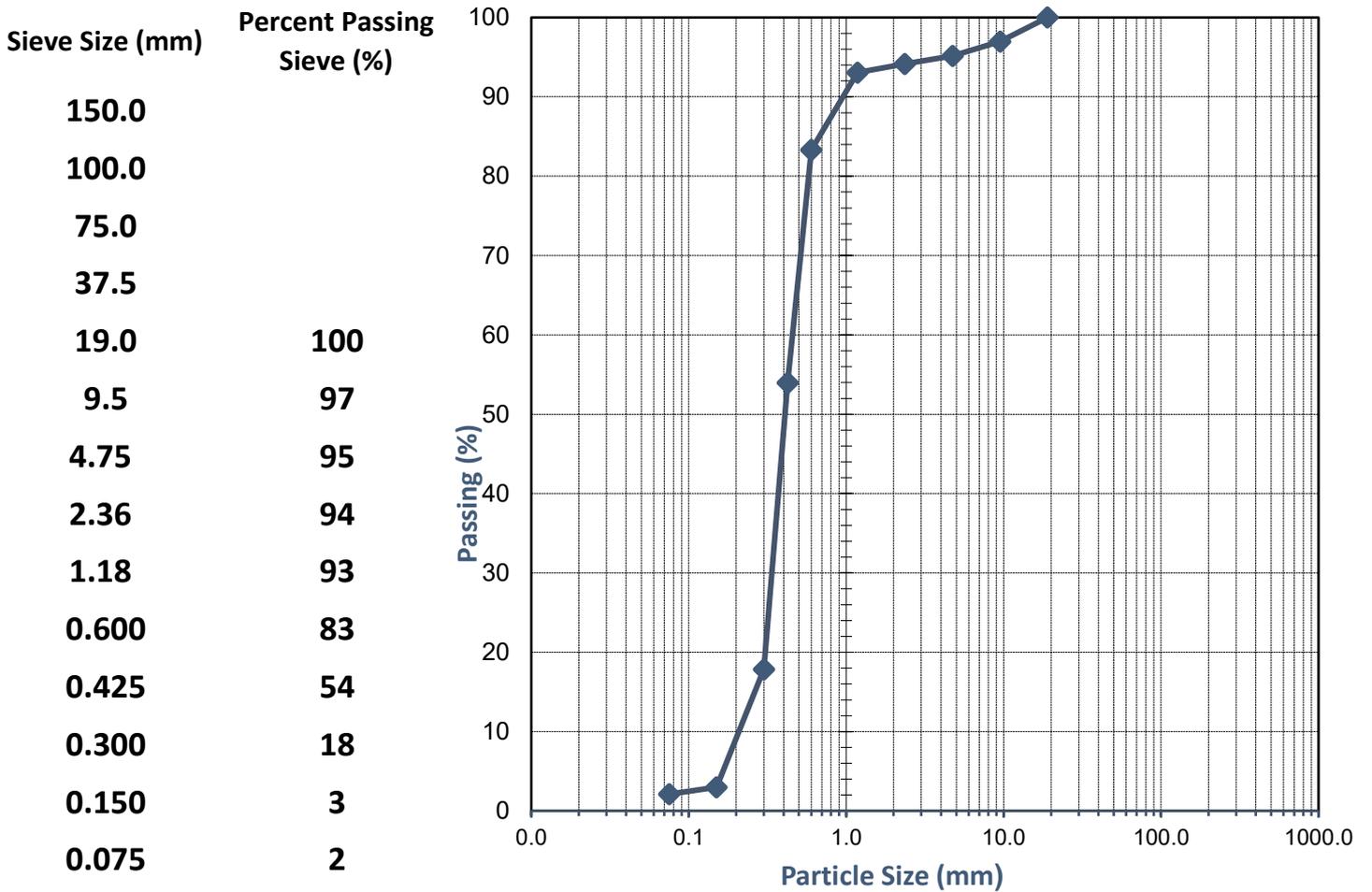
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10372_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10372
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH170, 1.0m	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 10/July/2023



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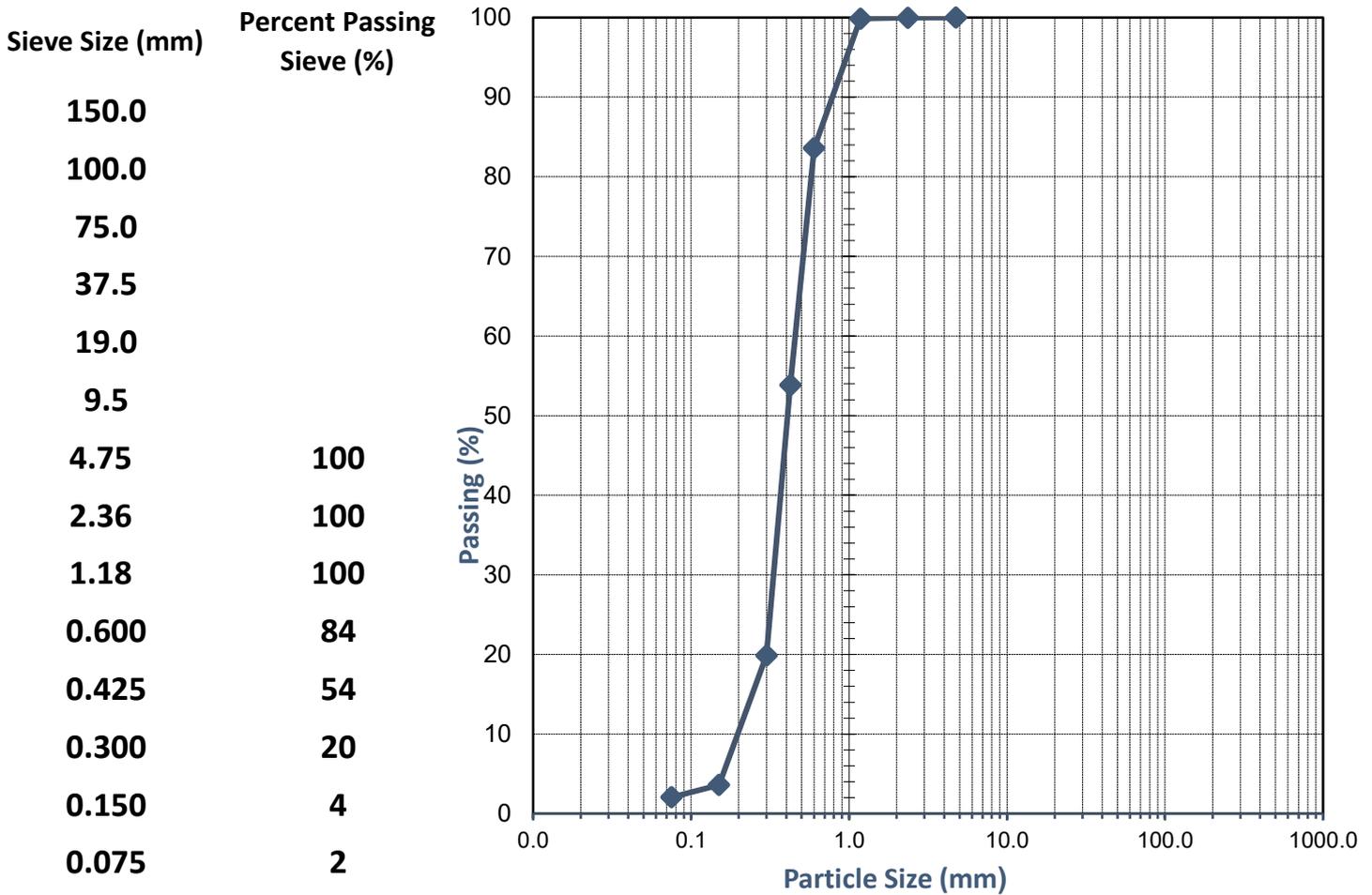
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10373_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10373
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH174, 1.0m	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 10/July/2023



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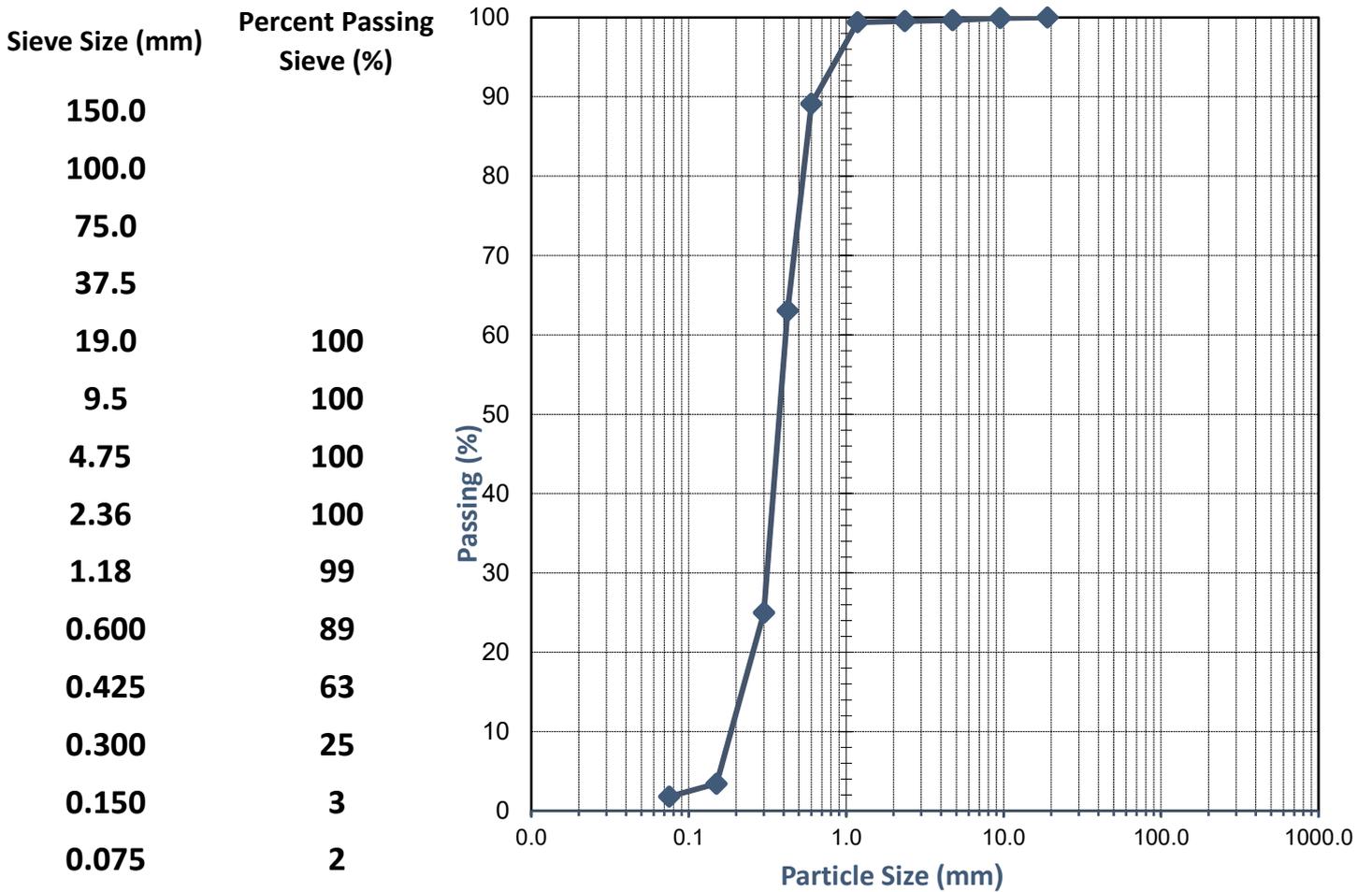
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10374_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10374
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH175, 1.1m	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 10/July/2023



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TEST REPORT - ASTM D2974-14 (Test Method C)

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10375_1_ORG
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10375
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	Various - see below	Date Tested:	7/07/2023

TEST RESULTS - Organic Content

Sampling Method:

Sampled by Client, Tested as Received

Testing Completed By:

WGLS-LC

Furnace Temperature (°C):

440

Sample Number	Sample Identification	Ash Content (%)	Organic Content (%)
WG23.10375	BH176, 0.3m	98.6	1.4

Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 10/July/2023



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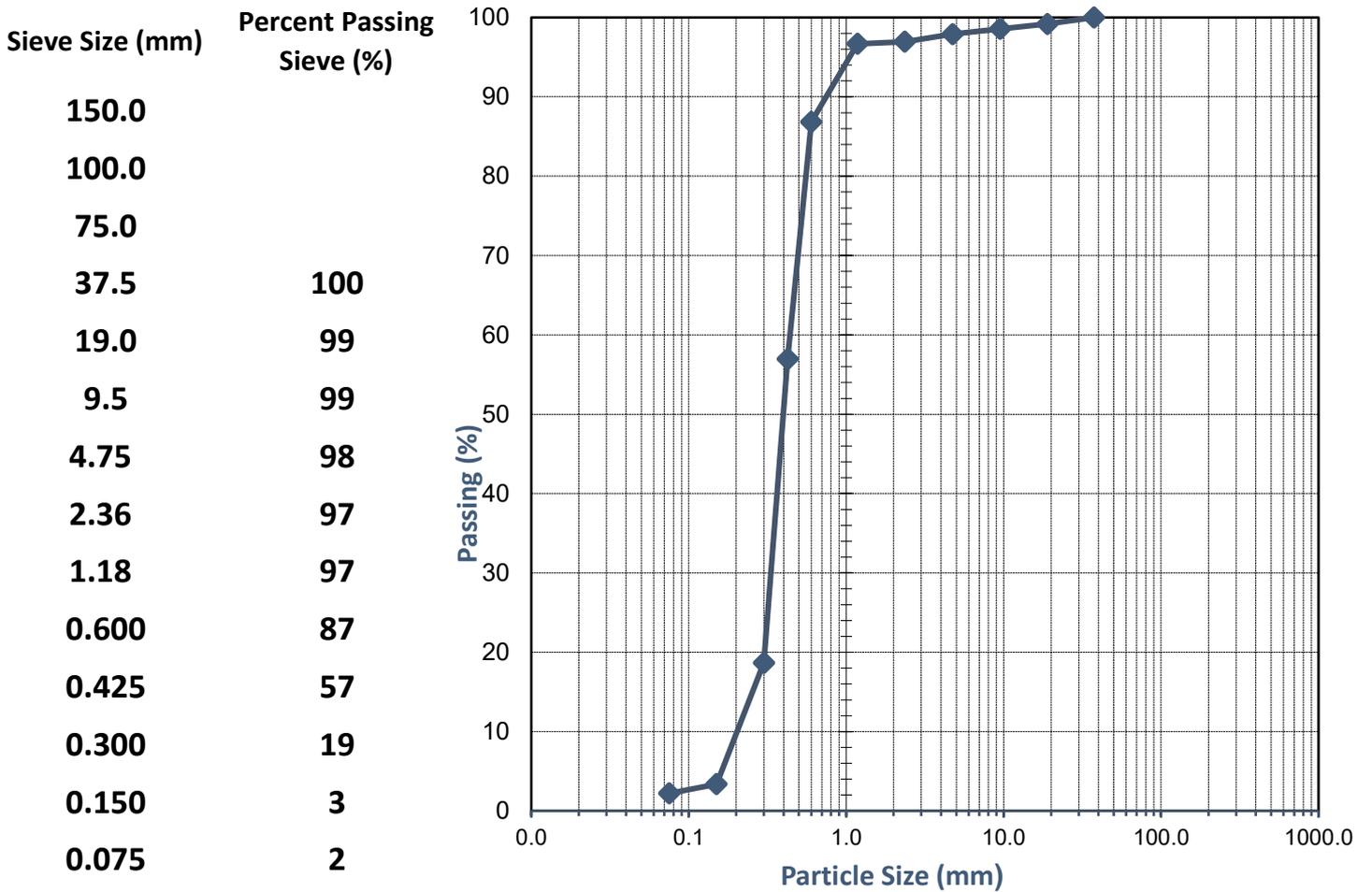
TEST REPORT - AS 1289.3.6.1

Client:	Development WA	Ticket No.	S10271
Client Address:	-	Report No.	WG23.10376_1_PSD
Project:	Proposed Multi-Residential Development	Sample No.	WG23.10376
Location:	Central Avenue, Mount Lawley, WA	Date Sampled:	21/06 - 29/06/2023
Sample Identification:	BH176, 1.0m	Date Tested:	07/07 - 10/07/2023

TEST RESULTS - Particle Size Distribution of Soil

Sampling Method:

Sampled by Client, Tested as Received



Comments:

Approved Signatory:

Name: Brooke Elliott

Date: 10/July/2023



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Appendix E

ASS Results Summary and Laboratory Reports

Table E-1: Summary of Screening and Chromium Suite Results

Test Location	Depth (m)	Soil Description					Chromium Suite of Testing					
			pHF	pHFOX	Reaction ² Strength	Δ pH ³	pH _{KCl}	TAA ⁴ (%S)	S _{CR} ⁵ (%S)	S _{NAS} ⁶ (%S)	ANC _{BT} ⁷ (%S)	Net ⁸ Acidity (%S)
Assessment Criteria			<4	<3	-	-	-	-	-	-	-	<0.03
BH 157	0.5	SAND: yellow-brown, trace silt.	8.3	6.1	Medium	2.2	8.4	<0.010	<0.0050	NT	0.24	<0.0050
BH 157	1.0	SAND: yellow-brown, trace silt.	8.2	5.8	Low	2.4	-	-	-	-	-	-
BH 157	1.5	SAND: yellow-brown, trace silt.	8.2	6.1	Low	2.1	-	-	-	-	-	-
BH 157	2.0	SAND: pale yellow-brown, trace silt.	8.1	5.6	Low	2.5	6.4	<0.010	<0.0050	NT	NT	<0.0050
BH 157	2.5	SAND: pale yellow-brown, trace silt.	8.0	5.8	Low	2.2	-	-	-	-	-	-
BH 161	0.5	FILL/SAND: grey, trace gravel, silt.	8.6	6.0	Medium	2.6	-	-	-	-	-	-
BH 161	1.0	SAND: dark grey, trace silt.	7.6	5.1	Medium	2.5	7.2	<0.010	<0.0050	NT	0.22	<0.0050
BH 161	1.5	SAND: pale grey, trace silt.	8.7	5.9	Low	2.8	-	-	-	-	-	-
BH 161	2.0	SAND: brown, trace silt.	6.8	5.5	Low	1.3	-	-	-	-	-	-
BH 161	2.5	SAND: brown, trace silt.	6.2	4.7	Low	1.5	6.1	<0.010	<0.0050	NT	NT	0.0081
BH 162	0.5	FILL/SAND: dark grey, trace gravel, silt.	7.2	4.3	Medium	2.9	6.6	<0.010	<0.0050	NT	0.22	<0.0050
BH 162	1.0	FILL/SAND: pale grey, trace silt.	7.1	5.2	Low	1.9	-	-	-	-	-	-
BH 162	1.5	SAND: dark grey, trace silt.	7.1	4.9	Low	2.2	6.3	<0.010	<0.0050	NT	NT	<0.0050
BH 162	2.0	SAND: pale grey, trace silt.	6.7	5.0	Low	1.7	-	-	-	-	-	-
BH 162	2.5	SAND: pale grey, trace silt.	6.7	5.1	Low	1.6	-	-	-	-	-	-
BH164	0.5	FILL/ORGANIC SAND: dark grey, with gravel, silt.	7.4	4.9	Medium	2.5	7.6	<0.010	<0.0050	NT	0.48	<0.0050
BH164	1.0	SAND: grey, trace silt.	7.4	5.3	Medium	2.1	-	-	-	-	-	-
BH164	1.5	SAND: pale grey, trace silt.	7.7	5.8	Low	1.9	-	-	-	-	-	-
BH164	2.0	SAND: pale grey, trace silt.	7.7	5.5	Low	2.2	6.4	<0.010	<0.0050	NT	NT	<0.0050
BH164	2.5	SAND: pale grey, trace silt.	7.7	5.6	Low	2.1	-	-	-	-	-	-
BH168	0.5	FILL/SAND: grey, trace gravel, silt.	7.1	4.8	Medium	2.3	6.8	<0.010	<0.0050	NT	0.22	<0.0050
BH168	1.0	SAND: pale grey, trace silt.	7.2	5.5	Low	1.7	-	-	-	-	-	-
BH168	1.5	SAND: pale grey, trace silt.	7.9	5.1	Low	2.8	-	-	-	-	-	-
BH168	2.0	SAND: dark brown, trace silt.	7.4	5.5	Low	1.9	6.7	<0.010	<0.0050	NT	0.21	<0.0050
BH168	2.5	SAND: pale brown, trace silt.	7.4	6.0	Low	1.4	-	-	-	-	-	-
BH169	0.5	FILL/SAND: dark grey, trace gravel, silt.	8.2	6.3	Medium	1.9	9.3	<0.010	<0.0050	NT	0.64	<0.0050
BH169	1.0	SAND: grey, trace silt.	7.6	5.3	Low	2.3	-	-	-	-	-	-
BH169	1.5	SAND: pale grey, trace silt.	7.7	5.5	Low	2.2	-	-	-	-	-	-
BH169	2.0	SAND: pale brown, trace silt.	7.4	6.1	Low	1.3	-	-	-	-	-	-
BH169	2.5	SAND: pale brown, trace silt.	7.3	5.9	Low	1.4	7.0	<0.010	<0.0050	NT	0.19	<0.0050
BH 174	0.5	SAND: pale grey, trace silt.	7.7	5.3	Medium	2.4	-	-	-	-	-	-
BH 174	1.0	SAND: pale grey, trace silt.	8.2	5.2	Medium	3.0	6.9	<0.010	<0.0050	NT	0.19	<0.0050
BH 174	1.5	SAND: grey-brown, trace silt.	7.5	5.6	Low	1.9	-	-	-	-	-	-
BH 174	2.0	SAND: pale brown, trace silt.	7.5	5.4	Low	2.1	6.8	<0.010	<0.0050	NT	0.19	<0.0050
BH 174	2.5	SAND: yellow-brown, trace silt.	7.6	5.6	Low	2.0	-	-	-	-	-	-
BH 175	0.5	FILL/SAND: grey-brown, trace gravel, silt.	8.4	6.8	Medium	1.6	8.3	<0.010	<0.0050	NT	0.24	<0.0050
BH 175	1.0	SAND: grey, trace silt.	5.4	4.4	Low	1.0	-	-	-	-	-	-
BH 175	1.5	SAND: yellow-brown, trace silt.	6.2	4.7	Low	1.5	-	-	-	-	-	-
BH 175	2.0	SAND: yellow-brown, trace silt.	6.8	5.5	Medium	1.3	7.7	<0.010	<0.0050	NT	0.20	<0.0050
BH 175	2.5	SAND: yellow-brown, trace silt.	7.1	5.6	Low	1.5	-	-	-	-	-	-

- Note:
- Screening Tests undertaken by MPL Laboratories
 - Low – indicates no or slight effervescence in hydrogen peroxide, Medium – indicates moderate effervescence in hydrogen peroxide, Moderate – indicates moderate effervescence in hydrogen peroxide, High – indicates high effervescence in hydrogen peroxide, Extreme – indicates vigorous effervescence in hydrogen peroxide
 - Δ pH – pHF - pHFOX
 - TAA – titratable actual acidity
 - SCR – chromium reducible sulphur
 - SNASS – retained acidity (reported for pH_{KCl} < 4.5)
 - ANC – acid neutralising capacity (reported for pH_{KCl} > 6.5)
 - Net Acidity = TAA + Scr + NASS. (It should be noted that ANC is excluded as per WA Guidelines)
 - NT Not Tested
- 0.03** Exceedance of criteria.

Sample Receipt Advice PEG0842

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Attention	Rob Shapland

Sample Login Details

Your Reference	216618.01 - Proposed Multi-Residential Development
Envirolab Reference	PEG0842
Date Sample Received	14/07/2023
Date Instructions Received	14/07/2023
Date Final Results Expected	21/07/2023

Sample Condition

Samples received in appropriate condition for analysis	See Comments
Number of Samples	40 Soil
Turnaround Time	5 Days
Temperatures / Cooling Methods	0.0°C On Ice

Additional Info

Sample storage - waters are routinely disposed at approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Where no sampling date has been supplied for some or all samples, the date of sample receipt has been used as the associated sampling date. The sampling dates are used to assess compliance to recommended Technical Holding Times.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

Please direct any queries to:

Heram Halim

Phone 08 9317 2505
Fax 08 9317 4163
Email hhalim@mpl.com.au

Meredith Conroy

Phone 08 9317 2505
Fax 08 9317 4163
Email mconroy@mpl.com.au

Analysis underway, details on the following page

Sample Receipt Advice PEG0842

Holding Time Comments

The below samples have been received outside of Technical Holding Time (THT), however, the analysis has proceeded as requested, analytical results may be impacted.

BH157,0.5m 0.50m	pH F, pH FOX
BH157,1.0m 1.00m	pH F, pH FOX
BH157,1.5m 1.50m	pH F, pH FOX
BH157,2.0m 2.00m	pH F, pH FOX
BH157,2.5m 2.50m	pH F, pH FOX
BH161,0.5m 0.50m	pH F, pH FOX
BH161,1.0m 1.00m	pH F, pH FOX
BH161,1.5m 1.50m	pH F, pH FOX
BH161,2.0m 2.00m	pH F, pH FOX
BH161,2.5m 2.50m	pH F, pH FOX
BH162,0.5m 0.50m	pH F, pH FOX
BH162,1.0m 1.00m	pH F, pH FOX
BH162,1.5m 1.50m	pH F, pH FOX
BH162,2.0m 2.00m	pH F, pH FOX
BH162,2.5m 2.50m	pH F, pH FOX
BH164,0.5m 0.50m	pH F, pH FOX
BH164,1.0m 1.00m	pH F, pH FOX
BH164,1.5m 1.50m	pH F, pH FOX
BH164,2.0m 2.00m	pH F, pH FOX
BH164,2.5m 2.50m	pH F, pH FOX
BH168,0.5m 0.50m	pH F, pH FOX
BH168,1.0m 1.00m	pH F, pH FOX
BH168,1.5m 1.50m	pH F, pH FOX
BH168,2.0m 2.00m	pH F, pH FOX
BH168,2.5m 2.50m	pH F, pH FOX
BH169,0.5m 0.50m	pH F, pH FOX
BH169,1.0m 1.00m	pH F, pH FOX
BH169,1.5m 1.50m	pH F, pH FOX

Sample Receipt Advice PEG0842

Holding Time Comments

The below samples have been received outside of Technical Holding Time (THT), however, the analysis has proceeded as requested, analytical results may be impacted.

BH169,2.0m 2.00m	pH F, pH FOX
BH169,2.5m 2.50m	pH F, pH FOX
BH174,0.5m 0.50m	pH F, pH FOX
BH174,1.0m 1.00m	pH F, pH FOX
BH174,1.5m 1.50m	pH F, pH FOX
BH174,2.0m 2.00m	pH F, pH FOX
BH174,2.5m 2.50m	pH F, pH FOX
BH175,0.5m 0.50m	pH F, pH FOX
BH175,1.0m 1.00m	pH F, pH FOX
BH175,1.5m 1.50m	pH F, pH FOX
BH175,2.0m 2.00m	pH F, pH FOX
BH175,2.5m 2.50m	pH F, pH FOX

Analysis Grid

The • indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

	ASS Field
PEG0842-01 Soil | 23/06/2023 BH157,0.5m | 0.5m	•
PEG0842-02 Soil | 23/06/2023 BH157,1.0m | 1m	•
PEG0842-03 Soil | 23/06/2023 BH157,1.5m | 1.5m	•
PEG0842-04 Soil | 23/06/2023 BH157,2.0m | 2m	•
PEG0842-05 Soil | 23/06/2023 BH157,2.5m | 2.5m	•

Sample Receipt Advice PEG0842

Analysis Grid *(Cont.)*

	ASS Field
PEG0842-06 Soil | 23/06/2023 BH161,0.5m | 0.5m	•
PEG0842-07 Soil | 23/06/2023 BH161,1.0m | 1m	•
PEG0842-08 Soil | 23/06/2023 BH161,1.5m | 1.5m	•
PEG0842-09 Soil | 23/06/2023 BH161,2.0m | 2m	•
PEG0842-10 Soil | 23/06/2023 BH161,2.5m | 2.5m	•
PEG0842-11 Soil | 23/06/2023 BH162,0.5m | 0.5m	•
PEG0842-12 Soil | 23/06/2023 BH162,1.0m | 1m	•
PEG0842-13 Soil | 23/06/2023 BH162,1.5m | 1.5m	•
PEG0842-14 Soil | 23/06/2023 BH162,2.0m | 2m	•
PEG0842-15 Soil | 23/06/2023 BH162,2.5m | 2.5m	•
PEG0842-16 Soil | 23/06/2023 BH164,0.5m | 0.5m	•
PEG0842-17 Soil | 23/06/2023 BH164,1.0m | 1m	•
PEG0842-18 Soil | 23/06/2023 BH164,1.5m | 1.5m	•
PEG0842-19 Soil | 23/06/2023 BH164,2.0m | 2m	•
PEG0842-20 Soil | 23/06/2023 BH164,2.5m | 2.5m	•
PEG0842-21 Soil | 23/06/2023 BH168,0.5m | 0.5m	•

Sample Receipt Advice PEG0842

Analysis Grid *(Cont.)*

	ASS Field
PEG0842-22 Soil | 23/06/2023 BH168,1.0m | 1m	•
PEG0842-23 Soil | 23/06/2023 BH168,1.5m | 1.5m	•
PEG0842-24 Soil | 23/06/2023 BH168,2.0m | 2m	•
PEG0842-25 Soil | 23/06/2023 BH168,2.5m | 2.5m	•
PEG0842-26 Soil | 23/06/2023 BH169,0.5m | 0.5m	•
PEG0842-27 Soil | 23/06/2023 BH169,1.0m | 1m	•
PEG0842-28 Soil | 23/06/2023 BH169,1.5m | 1.5m	•
PEG0842-29 Soil | 23/06/2023 BH169,2.0m | 2m	•
PEG0842-30 Soil | 23/06/2023 BH169,2.5m | 2.5m	•
PEG0842-31 Soil | 23/06/2023 BH174,0.5m | 0.5m	•
PEG0842-32 Soil | 23/06/2023 BH174,1.0m | 1m	•
PEG0842-33 Soil | 23/06/2023 BH174,1.5m | 1.5m	•
PEG0842-34 Soil | 23/06/2023 BH174,2.0m | 2m	•
PEG0842-35 Soil | 23/06/2023 BH174,2.5m | 2.5m	•
PEG0842-36 Soil | 23/06/2023 BH175,0.5m | 0.5m	•
PEG0842-37 Soil | 23/06/2023 BH175,1.0m | 1m	•

Sample Receipt Advice PEG0842

Analysis Grid (Cont.)

	ASS Field
PEG0842-38 Soil | 23/06/2023 BH175,1.5m | 1.5m	•
PEG0842-39 Soil | 23/06/2023 BH175,2.0m | 2m	•
PEG0842-40 Soil | 23/06/2023 BH175,2.5m | 2.5m	•

Suite Details

Suite Name	Suite Analyses
ASS Field | Soil	pH F, pH FOX, Reaction Rate

Certificate of Analysis PEG0842

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Contact	Rob Shapland
Address	36 O'Malley St, OSBORNE PARK, WA, 6017

Sample Details

Your Reference	216618.01 - Proposed Multi-Residential Development
Number of Samples	40 Soil
Date Samples Received	14/07/2023
Date Samples Registered	14/07/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	21/07/2023
Date of Issue	17/07/2023

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Authorisation Details

Results Approved By	Stacey Hawkins, ASS/AMD Supervisor
Laboratory Manager	Michael Kubiak

Certificate of Analysis PEG0842

Samples in this Report

Envirolab ID	Sample ID	Depth	Matrix	Date Sampled	Date Received
PEG0842-01	BH157,0.5m	0.50	Soil	23/06/2023	14/07/2023
PEG0842-02	BH157,1.0m	1.00	Soil	23/06/2023	14/07/2023
PEG0842-03	BH157,1.5m	1.50	Soil	23/06/2023	14/07/2023
PEG0842-04	BH157,2.0m	2.00	Soil	23/06/2023	14/07/2023
PEG0842-05	BH157,2.5m	2.50	Soil	23/06/2023	14/07/2023
PEG0842-06	BH161,0.5m	0.50	Soil	23/06/2023	14/07/2023
PEG0842-07	BH161,1.0m	1.00	Soil	23/06/2023	14/07/2023
PEG0842-08	BH161,1.5m	1.50	Soil	23/06/2023	14/07/2023
PEG0842-09	BH161,2.0m	2.00	Soil	23/06/2023	14/07/2023
PEG0842-10	BH161,2.5m	2.50	Soil	23/06/2023	14/07/2023
PEG0842-11	BH162,0.5m	0.50	Soil	23/06/2023	14/07/2023
PEG0842-12	BH162,1.0m	1.00	Soil	23/06/2023	14/07/2023
PEG0842-13	BH162,1.5m	1.50	Soil	23/06/2023	14/07/2023
PEG0842-14	BH162,2.0m	2.00	Soil	23/06/2023	14/07/2023
PEG0842-15	BH162,2.5m	2.50	Soil	23/06/2023	14/07/2023
PEG0842-16	BH164,0.5m	0.50	Soil	23/06/2023	14/07/2023
PEG0842-17	BH164,1.0m	1.00	Soil	23/06/2023	14/07/2023
PEG0842-18	BH164,1.5m	1.50	Soil	23/06/2023	14/07/2023
PEG0842-19	BH164,2.0m	2.00	Soil	23/06/2023	14/07/2023
PEG0842-20	BH164,2.5m	2.50	Soil	23/06/2023	14/07/2023
PEG0842-21	BH168,0.5m	0.50	Soil	23/06/2023	14/07/2023
PEG0842-22	BH168,1.0m	1.00	Soil	23/06/2023	14/07/2023
PEG0842-23	BH168,1.5m	1.50	Soil	23/06/2023	14/07/2023
PEG0842-24	BH168,2.0m	2.00	Soil	23/06/2023	14/07/2023
PEG0842-25	BH168,2.5m	2.50	Soil	23/06/2023	14/07/2023
PEG0842-26	BH169,0.5m	0.50	Soil	23/06/2023	14/07/2023
PEG0842-27	BH169,1.0m	1.00	Soil	23/06/2023	14/07/2023
PEG0842-28	BH169,1.5m	1.50	Soil	23/06/2023	14/07/2023
PEG0842-29	BH169,2.0m	2.00	Soil	23/06/2023	14/07/2023
PEG0842-30	BH169,2.5m	2.50	Soil	23/06/2023	14/07/2023
PEG0842-31	BH174,0.5m	0.50	Soil	23/06/2023	14/07/2023
PEG0842-32	BH174,1.0m	1.00	Soil	23/06/2023	14/07/2023
PEG0842-33	BH174,1.5m	1.50	Soil	23/06/2023	14/07/2023
PEG0842-34	BH174,2.0m	2.00	Soil	23/06/2023	14/07/2023
PEG0842-35	BH174,2.5m	2.50	Soil	23/06/2023	14/07/2023

Certificate of Analysis PEG0842

Samples in this Report

Envirolab ID	Sample ID	Depth	Matrix	Date Sampled	Date Received
PEG0842-36	BH175,0.5m	0.50	Soil	23/06/2023	14/07/2023
PEG0842-37	BH175,1.0m	1.00	Soil	23/06/2023	14/07/2023
PEG0842-38	BH175,1.5m	1.50	Soil	23/06/2023	14/07/2023
PEG0842-39	BH175,2.0m	2.00	Soil	23/06/2023	14/07/2023
PEG0842-40	BH175,2.5m	2.50	Soil	23/06/2023	14/07/2023

Certificate of Analysis PEG0842

Acid Sulfate Soils (Soil)

Envirolab ID	Units	PQL	PEG0842-01	PEG0842-02	PEG0842-03	PEG0842-04	PEG0842-05
Your Reference			BH157,0.5m	BH157,1.0m	BH157,1.5m	BH157,2.0m	BH157,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		8.3 [1]	8.2 [1]	8.2 [1]	8.1 [1]	8.0 [1]
pHFOX (field peroxide test)*	pH units		6.1 [1]	5.8 [1]	6.1 [1]	5.6 [1]	5.8 [1]
Reaction Rate*	-		Medium [1]	Low [1]	Low [1]	Low [1]	Low [1]

Envirolab ID	Units	PQL	PEG0842-06	PEG0842-07	PEG0842-08	PEG0842-09	PEG0842-10
Your Reference			BH161,0.5m	BH161,1.0m	BH161,1.5m	BH161,2.0m	BH161,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		8.6 [1]	7.6 [1]	8.7 [1]	6.8 [1]	6.2 [1]
pHFOX (field peroxide test)*	pH units		6.0 [1]	5.1 [1]	5.9 [1]	5.5 [1]	4.7 [1]
Reaction Rate*	-		Medium [1]	Medium [1]	Low [1]	Low [1]	Low [1]

Envirolab ID	Units	PQL	PEG0842-11	PEG0842-12	PEG0842-13	PEG0842-14	PEG0842-15
Your Reference			BH162,0.5m	BH162,1.0m	BH162,1.5m	BH162,2.0m	BH162,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		7.2 [1]	7.1 [1]	7.1 [1]	6.7 [1]	6.7 [1]
pHFOX (field peroxide test)*	pH units		4.3 [1]	5.2 [1]	4.9 [1]	5.0 [1]	5.1 [1]
Reaction Rate*	-		Medium [1]	Low [1]	Low [1]	Low [1]	Low [1]

Envirolab ID	Units	PQL	PEG0842-16	PEG0842-17	PEG0842-18	PEG0842-19	PEG0842-20
Your Reference			BH164,0.5m	BH164,1.0m	BH164,1.5m	BH164,2.0m	BH164,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		7.4 [1]	7.4 [1]	7.7 [1]	7.7 [1]	7.7 [1]
pHFOX (field peroxide test)*	pH units		4.9 [1]	5.3 [1]	5.8 [1]	5.5 [1]	5.6 [1]
Reaction Rate*	-		Medium [1]	Medium [1]	Low [1]	Low [1]	Low [1]

Envirolab ID	Units	PQL	PEG0842-21	PEG0842-22	PEG0842-23	PEG0842-24	PEG0842-25
Your Reference			BH168,0.5m	BH168,1.0m	BH168,1.5m	BH168,2.0m	BH168,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		7.1 [1]	7.2 [1]	7.9 [1]	7.4 [1]	7.4 [1]
pHFOX (field peroxide test)*	pH units		4.8 [1]	5.5 [1]	5.1 [1]	5.5 [1]	6.0 [1]
Reaction Rate*	-		Medium [1]	Low [1]	Low [1]	Low [1]	Low [1]

Envirolab ID	Units	PQL	PEG0842-26	PEG0842-27	PEG0842-28	PEG0842-29	PEG0842-30
Your Reference			BH169,0.5m	BH169,1.0m	BH169,1.5m	BH169,2.0m	BH169,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		8.2 [1]	7.6 [1]	7.7 [1]	7.4 [1]	7.3 [1]
pHFOX (field peroxide test)*	pH units		6.3 [1]	5.3 [1]	5.5 [1]	6.1 [1]	5.9 [1]
Reaction Rate*	-		Medium [1]	Low [1]	Low [1]	Low [1]	Low [1]

Envirolab ID	Units	PQL	PEG0842-31	PEG0842-32	PEG0842-33	PEG0842-34	PEG0842-35
Your Reference			BH174,0.5m	BH174,1.0m	BH174,1.5m	BH174,2.0m	BH174,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		7.7 [1]	8.2 [1]	7.5 [1]	7.5 [1]	7.6 [1]
pHFOX (field peroxide test)*	pH units		5.3 [1]	5.2 [1]	5.6 [1]	5.4 [1]	5.6 [1]

Certificate of Analysis PEG0842

Acid Sulfate Soils (Soil)

Envirolab ID	Units	PQL	PEG0842-31	PEG0842-32	PEG0842-33	PEG0842-34	PEG0842-35
Your Reference			BH174,0.5m	BH174,1.0m	BH174,1.5m	BH174,2.0m	BH174,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
Reaction Rate*	-		Medium [1]	Medium [1]	Low [1]	Low [1]	Low [1]

Envirolab ID	Units	PQL	PEG0842-36	PEG0842-37	PEG0842-38	PEG0842-39	PEG0842-40
Your Reference			BH175,0.5m	BH175,1.0m	BH175,1.5m	BH175,2.0m	BH175,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		8.4 [1]	5.4 [1]	6.2 [1]	6.8 [1]	7.1 [1]
pHFOX (field peroxide test)*	pH units		6.8 [1]	4.4 [1]	4.7 [1]	5.5 [1]	5.6 [1]
Reaction Rate*	-		Medium [1]	Low [1]	Low [1]	Medium [1]	Low [1]

Certificate of Analysis PEG0842

Result Comments

Identifier	Description
[1]	Though samples were not received within 24 hours following collection, they were received by the lab either frozen/dried, which prolongs holding time.

Certificate of Analysis PEG0842

Method Summary

Method ID	Methodology Summary
INORG-063	pH- measured using pH meter and electrode. Solids are oxidised with Hydrogen Peroxide or extracted with water. To ensure accurate results these tests are recommended to be done in the field as pH may change with time thus these results may not be representative of true field conditions. There is no documented official holding time, we have assigned an arbitrary 180 days to frozen samples.

Certificate of Analysis PEG0842

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Certificate of Analysis PEG0842

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary PEG0842

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Your Reference	216618.01 - Proposed Multi-Residential Development
Date Issued	17/07/2023

Recommended Holding Time Compliance

Recommended holding time exceedances exist - See detailed list below

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	Yes	No Outliers
Surrogates / Extracted Internal Standards	Yes	No Outliers
QC Frequency	Yes	No Outliers

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PEG0842

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
pH F | Soil	1-40	23/06/2023	14/07/2023	17/07/2023	No
pH FOX | Soil	1-40	23/06/2023	14/07/2023	17/07/2023	No
Reaction Rate | Soil	1-40	23/06/2023	14/07/2023	17/07/2023	Yes

Quality Control PEG0842

INORG-063 | Acid Sulfate Soils (Soil) | Batch BEG1598

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %
				PEG0842-01 Samp | QC | RPD %	PEG0842-11 Samp | QC | RPD %	
pHF (field pH test)	pH units			8.3 | 8.9 | 7.22 [1]	7.2 | 7.1 | 0.843 [1]	100
pHFOX (field peroxide test)	pH units			6.1 | 6.1 | 0.492 [1]	4.3 | 4.3 | 0.467 [1]	100
Reaction Rate	-			Medium | Medium | [NA] [1]	Medium | Medium | [NA] [1]	[NA]

Analyte	Units	PQL	Blank	DUP3	DUP4	LCS %
				PEG0842-21 Samp | QC | RPD %	PEG0842-31 Samp | QC | RPD %	
pHF (field pH test)	pH units			7.1 | 7.1 | 0.563 [1]	7.7 | 7.6 | 1.05 [1]	100
pHFOX (field peroxide test)	pH units			4.8 | 4.6 | 4.03 [1]	5.3 | 5.1 | 3.84 [1]	100
Reaction Rate	-			Medium | Medium | [NA] [1]	Medium | Medium | [NA] [1]	[NA]

QC Comments

Identifier	Description
[1]	Though samples were not received within 24 hours following collection, they were received by the lab either frozen/dried, which prolongs holding time.

Meredith Conroy

From: Venkat Vallurapalli <Venkat.Vallurapalli@douglaspartners.com.au>
Sent: Tuesday, 25 July 2023 9:49 AM
To: Stacey Hawkins
Cc: Rob Shapland; MPL Laboratory
Subject: MPL Ref:PEG0842- Additional Testing
Attachments: PE251179.pdf

CAUTION: This email originated from outside of the organisation. Do not act on instructions, click links or open attachments unless you recognise the sender and know the content is authentic and safe.

Hi Stacey

Hi Stacey

Please find attached PO to carry out Chromium suite of testing on the following sample IDs held under MPL work order PEG0842 (DP ref: 216618.01):

Test Location	Depth
BH 157	0.5
BH 157	2.0
BH 161	1.0
BH 161	2.5
BH 162	0.5
BH 162	1.5
BH164	0.5
BH164	2.0
BH168	0.5
BH168	2.0
BH169	0.5
BH169	2.5
BH 174	1.0
BH 174	2.0
BH 175	0.5
BH 175	2.0

Regards,

Venkat Vallurapalli | Environmental Engineer
Douglas Partners Pty Ltd | ABN 75 053 980 117 | www.douglaspartners.com.au

Work Amendment Advice PEG0842

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Attention	Rob Shapland

Sample Login Details

Your Reference	216618.01 - Proposed Multi-Residential Development
Envirolab Reference	PEG0842
Date Sample Received	14/07/2023
Date Instructions Received	25/07/2023
Date Interim Results Expected	01/08/2023
Date Final Results Expected	03/08/2023

Sample Condition

Samples received in appropriate condition for analysis	See Comments
Number of Samples	40 Soil
Turnaround Time	7 Days
Temperatures / Cooling Methods	0.0°C On Ice

Additional Info

Sample storage - waters are routinely disposed at approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Where no sampling date has been supplied for some or all samples, the date of sample receipt has been used as the associated sampling date. The sampling dates are used to assess compliance to recommended Technical Holding Times.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

Please direct any queries to:

Heram Halim

Phone 08 9317 2505
Fax 08 9317 4163
Email hhalim@mpl.com.au

Meredith Conroy

Phone 08 9317 2505
Fax 08 9317 4163
Email mconroy@mpl.com.au

Analysis underway, details on the following page

Work Amendment Advice PEG0842

Analysis Grid

The • indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

	SCr Suite	ASS Field
PEG0842-01 Soil | 23/06/2023 BH157,0.5m | 0.5m	•	•
PEG0842-02 Soil | 23/06/2023 BH157,1.0m | 1m		•
PEG0842-03 Soil | 23/06/2023 BH157,1.5m | 1.5m		•
PEG0842-04 Soil | 23/06/2023 BH157,2.0m | 2m	•	•
PEG0842-05 Soil | 23/06/2023 BH157,2.5m | 2.5m		•
PEG0842-06 Soil | 23/06/2023 BH161,0.5m | 0.5m		•
PEG0842-07 Soil | 23/06/2023 BH161,1.0m | 1m	•	•
PEG0842-08 Soil | 23/06/2023 BH161,1.5m | 1.5m		•
PEG0842-09 Soil | 23/06/2023 BH161,2.0m | 2m		•
PEG0842-10 Soil | 23/06/2023 BH161,2.5m | 2.5m	•	•
PEG0842-11 Soil | 23/06/2023 BH162,0.5m | 0.5m	•	•
PEG0842-12 Soil | 23/06/2023 BH162,1.0m | 1m		•
PEG0842-13 Soil | 23/06/2023 BH162,1.5m | 1.5m	•	•
PEG0842-14 Soil | 23/06/2023 BH162,2.0m | 2m		•
PEG0842-15 Soil | 23/06/2023 BH162,2.5m | 2.5m		•
PEG0842-16 Soil | 23/06/2023 BH164,0.5m | 0.5m	•	•

Work Amendment Advice PEG0842

Analysis Grid *(Cont.)*

	SCR Suite	ASS Field
PEG0842-17 Soil | 23/06/2023 BH164,1.0m | 1m		•
PEG0842-18 Soil | 23/06/2023 BH164,1.5m | 1.5m		•
PEG0842-19 Soil | 23/06/2023 BH164,2.0m | 2m	•	•
PEG0842-20 Soil | 23/06/2023 BH164,2.5m | 2.5m		•
PEG0842-21 Soil | 23/06/2023 BH168,0.5m | 0.5m	•	•
PEG0842-22 Soil | 23/06/2023 BH168,1.0m | 1m		•
PEG0842-23 Soil | 23/06/2023 BH168,1.5m | 1.5m		•
PEG0842-24 Soil | 23/06/2023 BH168,2.0m | 2m	•	•
PEG0842-25 Soil | 23/06/2023 BH168,2.5m | 2.5m		•
PEG0842-26 Soil | 23/06/2023 BH169,0.5m | 0.5m	•	•
PEG0842-27 Soil | 23/06/2023 BH169,1.0m | 1m		•
PEG0842-28 Soil | 23/06/2023 BH169,1.5m | 1.5m		•
PEG0842-29 Soil | 23/06/2023 BH169,2.0m | 2m		•
PEG0842-30 Soil | 23/06/2023 BH169,2.5m | 2.5m	•	•
PEG0842-31 Soil | 23/06/2023 BH174,0.5m | 0.5m		•
PEG0842-32 Soil | 23/06/2023 BH174,1.0m | 1m	•	•

Work Amendment Advice PEG0842

Analysis Grid (Cont.)

	SCR Suite	ASS Field
PEG0842-33 Soil | 23/06/2023 BH174,1.5m | 1.5m		•
PEG0842-34 Soil | 23/06/2023 BH174,2.0m | 2m	•	•
PEG0842-35 Soil | 23/06/2023 BH174,2.5m | 2.5m		•
PEG0842-36 Soil | 23/06/2023 BH175,0.5m | 0.5m	•	•
PEG0842-37 Soil | 23/06/2023 BH175,1.0m | 1m		•
PEG0842-38 Soil | 23/06/2023 BH175,1.5m | 1.5m		•
PEG0842-39 Soil | 23/06/2023 BH175,2.0m | 2m	•	•
PEG0842-40 Soil | 23/06/2023 BH175,2.5m | 2.5m		•

Suite Details

Suite Name	Suite Analyses
SCR Suite | Soil	a-ANCBT, a-CRS, ANCBT, a-Net Acidity, a-Net Acidity w/out ANCE, a-SNAS, Chromium Reducible Sulfur, Fineness Factor, Liming rate, Liming rate without ANCE, pH kcl, s-ANCBT, SHCl, SKCl, SNAS, s-Net Acidity, s-Net Acidity w/out ANCE, s-SNAS, s-TAA, TAA
ASS Field | Soil	pH F, pH FOX, Reaction Rate

Work Order Amendment History

Revision	Reason for Amendment
R-01	Additional analysis requested by client. 25/07/23



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Certificate of Analysis PEG0842

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Contact	Rob Shapland
Address	36 O'Malley St, OSBORNE PARK, WA, 6017

Sample Details

Your Reference	216618.01 - Proposed Multi-Residential Development
Number of Samples	40 Soil
Date Instructions Received	25/07/2023
Date Samples Registered	14/07/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date Results Requested by	03/08/2023
Date of Reissue	28/07/2023 - This report supercedes previous report, see amendment history for details

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Authorisation Details

Results Approved By	Stacey Hawkins, ASS/AMD Supervisor
Laboratory Manager	Michael Kubiak

Certificate of Analysis PEG0842

Report Amendment History

Revision	Reason for Amendment
R-01	Additional analysis requested by client. 25/07/23

Certificate of Analysis PEG0842

Samples in this Report

Envirolab ID	Sample ID	Depth	Matrix	Date Sampled	Date Received
PEG0842-01	BH157,0.5m	0.50	Soil	23/06/2023	25/07/2023
PEG0842-02	BH157,1.0m	1.00	Soil	23/06/2023	25/07/2023
PEG0842-03	BH157,1.5m	1.50	Soil	23/06/2023	25/07/2023
PEG0842-04	BH157,2.0m	2.00	Soil	23/06/2023	25/07/2023
PEG0842-05	BH157,2.5m	2.50	Soil	23/06/2023	25/07/2023
PEG0842-06	BH161,0.5m	0.50	Soil	23/06/2023	25/07/2023
PEG0842-07	BH161,1.0m	1.00	Soil	23/06/2023	25/07/2023
PEG0842-08	BH161,1.5m	1.50	Soil	23/06/2023	25/07/2023
PEG0842-09	BH161,2.0m	2.00	Soil	23/06/2023	25/07/2023
PEG0842-10	BH161,2.5m	2.50	Soil	23/06/2023	25/07/2023
PEG0842-11	BH162,0.5m	0.50	Soil	23/06/2023	25/07/2023
PEG0842-12	BH162,1.0m	1.00	Soil	23/06/2023	25/07/2023
PEG0842-13	BH162,1.5m	1.50	Soil	23/06/2023	25/07/2023
PEG0842-14	BH162,2.0m	2.00	Soil	23/06/2023	25/07/2023
PEG0842-15	BH162,2.5m	2.50	Soil	23/06/2023	25/07/2023
PEG0842-16	BH164,0.5m	0.50	Soil	23/06/2023	25/07/2023
PEG0842-17	BH164,1.0m	1.00	Soil	23/06/2023	25/07/2023
PEG0842-18	BH164,1.5m	1.50	Soil	23/06/2023	25/07/2023
PEG0842-19	BH164,2.0m	2.00	Soil	23/06/2023	25/07/2023
PEG0842-20	BH164,2.5m	2.50	Soil	23/06/2023	25/07/2023
PEG0842-21	BH168,0.5m	0.50	Soil	23/06/2023	25/07/2023
PEG0842-22	BH168,1.0m	1.00	Soil	23/06/2023	25/07/2023
PEG0842-23	BH168,1.5m	1.50	Soil	23/06/2023	25/07/2023
PEG0842-24	BH168,2.0m	2.00	Soil	23/06/2023	25/07/2023
PEG0842-25	BH168,2.5m	2.50	Soil	23/06/2023	25/07/2023
PEG0842-26	BH169,0.5m	0.50	Soil	23/06/2023	25/07/2023
PEG0842-27	BH169,1.0m	1.00	Soil	23/06/2023	25/07/2023
PEG0842-28	BH169,1.5m	1.50	Soil	23/06/2023	25/07/2023
PEG0842-29	BH169,2.0m	2.00	Soil	23/06/2023	25/07/2023
PEG0842-30	BH169,2.5m	2.50	Soil	23/06/2023	25/07/2023
PEG0842-31	BH174,0.5m	0.50	Soil	23/06/2023	25/07/2023
PEG0842-32	BH174,1.0m	1.00	Soil	23/06/2023	25/07/2023
PEG0842-33	BH174,1.5m	1.50	Soil	23/06/2023	25/07/2023
PEG0842-34	BH174,2.0m	2.00	Soil	23/06/2023	25/07/2023
PEG0842-35	BH174,2.5m	2.50	Soil	23/06/2023	25/07/2023

Certificate of Analysis PEG0842

Samples in this Report

Envirolab ID	Sample ID	Depth	Matrix	Date Sampled	Date Received
PEG0842-36	BH175,0.5m	0.50	Soil	23/06/2023	25/07/2023
PEG0842-37	BH175,1.0m	1.00	Soil	23/06/2023	25/07/2023
PEG0842-38	BH175,1.5m	1.50	Soil	23/06/2023	25/07/2023
PEG0842-39	BH175,2.0m	2.00	Soil	23/06/2023	25/07/2023
PEG0842-40	BH175,2.5m	2.50	Soil	23/06/2023	25/07/2023

Certificate of Analysis PEG0842

Acid Sulfate Soils (Soil)

Envirolab ID	Units	PQL	PEG0842-01	PEG0842-02	PEG0842-03	PEG0842-04	PEG0842-05
Your Reference			BH157,0.5m	BH157,1.0m	BH157,1.5m	BH157,2.0m	BH157,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		8.3 [1]	8.2 [1]	8.2 [1]	8.1 [1]	8.0 [1]
pHFOX (field peroxide test)*	pH units		6.1 [1]	5.8 [1]	6.1 [1]	5.6 [1]	5.8 [1]
Reaction Rate*	-		Medium [1]	Low [1]	Low [1]	Low [1]	Low [1]

Envirolab ID	Units	PQL	PEG0842-06	PEG0842-07	PEG0842-08	PEG0842-09	PEG0842-10
Your Reference			BH161,0.5m	BH161,1.0m	BH161,1.5m	BH161,2.0m	BH161,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		8.6 [1]	7.6 [1]	8.7 [1]	6.8 [1]	6.2 [1]
pHFOX (field peroxide test)*	pH units		6.0 [1]	5.1 [1]	5.9 [1]	5.5 [1]	4.7 [1]
Reaction Rate*	-		Medium [1]	Medium [1]	Low [1]	Low [1]	Low [1]

Envirolab ID	Units	PQL	PEG0842-11	PEG0842-12	PEG0842-13	PEG0842-14	PEG0842-15
Your Reference			BH162,0.5m	BH162,1.0m	BH162,1.5m	BH162,2.0m	BH162,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		7.2 [1]	7.1 [1]	7.1 [1]	6.7 [1]	6.7 [1]
pHFOX (field peroxide test)*	pH units		4.3 [1]	5.2 [1]	4.9 [1]	5.0 [1]	5.1 [1]
Reaction Rate*	-		Medium [1]	Low [1]	Low [1]	Low [1]	Low [1]

Envirolab ID	Units	PQL	PEG0842-16	PEG0842-17	PEG0842-18	PEG0842-19	PEG0842-20
Your Reference			BH164,0.5m	BH164,1.0m	BH164,1.5m	BH164,2.0m	BH164,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		7.4 [1]	7.4 [1]	7.7 [1]	7.7 [1]	7.7 [1]
pHFOX (field peroxide test)*	pH units		4.9 [1]	5.3 [1]	5.8 [1]	5.5 [1]	5.6 [1]
Reaction Rate*	-		Medium [1]	Medium [1]	Low [1]	Low [1]	Low [1]

Envirolab ID	Units	PQL	PEG0842-21	PEG0842-22	PEG0842-23	PEG0842-24	PEG0842-25
Your Reference			BH168,0.5m	BH168,1.0m	BH168,1.5m	BH168,2.0m	BH168,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		7.1 [1]	7.2 [1]	7.9 [1]	7.4 [1]	7.4 [1]
pHFOX (field peroxide test)*	pH units		4.8 [1]	5.5 [1]	5.1 [1]	5.5 [1]	6.0 [1]
Reaction Rate*	-		Medium [1]	Low [1]	Low [1]	Low [1]	Low [1]

Envirolab ID	Units	PQL	PEG0842-26	PEG0842-27	PEG0842-28	PEG0842-29	PEG0842-30
Your Reference			BH169,0.5m	BH169,1.0m	BH169,1.5m	BH169,2.0m	BH169,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		8.2 [1]	7.6 [1]	7.7 [1]	7.4 [1]	7.3 [1]
pHFOX (field peroxide test)*	pH units		6.3 [1]	5.3 [1]	5.5 [1]	6.1 [1]	5.9 [1]
Reaction Rate*	-		Medium [1]	Low [1]	Low [1]	Low [1]	Low [1]

Envirolab ID	Units	PQL	PEG0842-31	PEG0842-32	PEG0842-33	PEG0842-34	PEG0842-35
Your Reference			BH174,0.5m	BH174,1.0m	BH174,1.5m	BH174,2.0m	BH174,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		7.7 [1]	8.2 [1]	7.5 [1]	7.5 [1]	7.6 [1]
pHFOX (field peroxide test)*	pH units		5.3 [1]	5.2 [1]	5.6 [1]	5.4 [1]	5.6 [1]

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Acid Sulfate Soils (Soil)

Envirolab ID	Units	PQL	PEG0842-31	PEG0842-32	PEG0842-33	PEG0842-34	PEG0842-35
Your Reference			BH174,0.5m	BH174,1.0m	BH174,1.5m	BH174,2.0m	BH174,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
Reaction Rate*	-		Medium [1]	Medium [1]	Low [1]	Low [1]	Low [1]

Envirolab ID	Units	PQL	PEG0842-36	PEG0842-37	PEG0842-38	PEG0842-39	PEG0842-40
Your Reference			BH175,0.5m	BH175,1.0m	BH175,1.5m	BH175,2.0m	BH175,2.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	1.00	1.50	2.00	2.50
pHF (field pH test)*	pH units		8.4 [1]	5.4 [1]	6.2 [1]	6.8 [1]	7.1 [1]
pHFOX (field peroxide test)*	pH units		6.8 [1]	4.4 [1]	4.7 [1]	5.5 [1]	5.6 [1]
Reaction Rate*	-		Medium [1]	Low [1]	Low [1]	Medium [1]	Low [1]

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Chromium Reducible Sulfur Suite (Soil)

Envirolab ID	Units	PQL	PEG0842-01	PEG0842-04	PEG0842-07	PEG0842-10	PEG0842-11
Your Reference			BH157,0.5m	BH157,2.0m	BH161,1.0m	BH161,2.5m	BH162,0.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	2.00	1.00	2.50	0.50
pH KCl	pH units		8.4	6.4	7.2	6.1	6.6
TAA	moles H+/t	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
s-TAA	% w/w S	0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Chromium Reducible Sulfur	% w/w	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
a-Chromium Reducible Sulfur	moles H+/t	3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SHCl	% w/w S	0.0050	NT	NT	NT	NT	NT
SKCl	% w/w S	0.0050	NT	NT	NT	NT	NT
SNAS	% w/w S	0.0050	NT	NT	NT	NT	NT
a-SNAS	moles H+/t	5.0	NT	NT	NT	NT	NT
s-SNAS	% w/w S	0.010	NT	NT	NT	NT	NT
Fineness Factor	-	1.5	1.5	1.5	1.5	1.5	1.5
ANCBT	% CaCO3	0.010	0.75	NT	0.70	NT	0.70
a-ANCBT	moles H+/t	5.0	150	NT	140	NT	140
s-ANCBT	% w/w S	0.010	0.24	NT	0.22	NT	0.22
s-Net Acidity	% w/w S	0.0050	<0.0050	<0.0050	<0.0050	0.0081	<0.0050
a-Net Acidity	moles H+/t	5.0	<5.0	<5.0	<5.0	5.1	<5.0
Liming rate	kg CaCO3/t	0.75	<0.75	<0.75	<0.75	<0.75	<0.75
s-Net Acidity without ANCE	% w/w S	0.0050	<0.0050	<0.0050	<0.0050	0.0081	<0.0050
a-Net Acidity without ANCE	moles H+/t	5.0	<5.0	<5.0	<5.0	5.1	<5.0
Liming rate without ANCE	kg CaCO3/t	0.75	<0.75	<0.75	<0.75	<0.75	<0.75

Envirolab ID	Units	PQL	PEG0842-13	PEG0842-16	PEG0842-19	PEG0842-21	PEG0842-24
Your Reference			BH162,1.5m	BH164,0.5m	BH164,2.0m	BH168,0.5m	BH168,2.0m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			1.50	0.50	2.00	0.50	2.00
pH KCl	pH units		6.3	7.6	6.4	6.8	6.7
TAA	moles H+/t	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
s-TAA	% w/w S	0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Chromium Reducible Sulfur	% w/w	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
a-Chromium Reducible Sulfur	moles H+/t	3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SHCl	% w/w S	0.0050	NT	NT	NT	NT	NT
SKCl	% w/w S	0.0050	NT	NT	NT	NT	NT
SNAS	% w/w S	0.0050	NT	NT	NT	NT	NT
a-SNAS	moles H+/t	5.0	NT	NT	NT	NT	NT
s-SNAS	% w/w S	0.010	NT	NT	NT	NT	NT
Fineness Factor	-	1.5	1.5	1.5	1.5	1.5	1.5
ANCBT	% CaCO3	0.010	NT	1.5	NT	0.68	0.65
a-ANCBT	moles H+/t	5.0	NT	300	NT	140	130
s-ANCBT	% w/w S	0.010	NT	0.48	NT	0.22	0.21
s-Net Acidity	% w/w S	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
a-Net Acidity	moles H+/t	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Liming rate	kg CaCO3/t	0.75	<0.75	<0.75	<0.75	<0.75	<0.75
s-Net Acidity without ANCE	% w/w S	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
a-Net Acidity without ANCE	moles H+/t	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Liming rate without ANCE	kg CaCO3/t	0.75	<0.75	<0.75	<0.75	<0.75	<0.75

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Chromium Reducible Sulfur Suite (Soil)

Envirolab ID	Units	PQL	PEG0842-26	PEG0842-30	PEG0842-32	PEG0842-34	PEG0842-36
Your Reference			BH169,0.5m	BH169,2.5m	BH174,1.0m	BH174,2.0m	BH175,0.5m
Date Sampled			23/06/2023	23/06/2023	23/06/2023	23/06/2023	23/06/2023
Depth			0.50	2.50	1.00	2.00	0.50
pH KCl	pH units		9.3	7.0	6.9	6.8	8.3
TAA	moles H+/t	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
s-TAA	% w/w S	0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Chromium Reducible Sulfur	% w/w	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
a-Chromium Reducible Sulfur	moles H+/t	3.0	<3.0	<3.0	<3.0	<3.0	<3.0
SHCl	% w/w S	0.0050	NT	NT	NT	NT	NT
SKCl	% w/w S	0.0050	NT	NT	NT	NT	NT
SNAS	% w/w S	0.0050	NT	NT	NT	NT	NT
a-SNAS	moles H+/t	5.0	NT	NT	NT	NT	NT
s-SNAS	% w/w S	0.010	NT	NT	NT	NT	NT
Fineness Factor	-	1.5	1.5	1.5	1.5	1.5	1.5
ANCBT	% CaCO3	0.010	2.0	0.60	0.60	0.60	0.75
a-ANCBT	moles H+/t	5.0	400	120	120	120	150
s-ANCBT	% w/w S	0.010	0.64	0.19	0.19	0.19	0.24
s-Net Acidity	% w/w S	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
a-Net Acidity	moles H+/t	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Liming rate	kg CaCO3/t	0.75	<0.75	<0.75	<0.75	<0.75	<0.75
s-Net Acidity without ANCE	% w/w S	0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
a-Net Acidity without ANCE	moles H+/t	5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Liming rate without ANCE	kg CaCO3/t	0.75	<0.75	<0.75	<0.75	<0.75	<0.75

Envirolab ID	Units	PQL	PEG0842-39
Your Reference			BH175,2.0m
Date Sampled			23/06/2023
Depth			2.00
pH KCl	pH units		7.7
TAA	moles H+/t	5.0	<5.0
s-TAA	% w/w S	0.010	<0.010
Chromium Reducible Sulfur	% w/w	0.0050	<0.0050
a-Chromium Reducible Sulfur	moles H+/t	3.0	<3.0
SHCl	% w/w S	0.0050	NT
SKCl	% w/w S	0.0050	NT
SNAS	% w/w S	0.0050	NT
a-SNAS	moles H+/t	5.0	NT
s-SNAS	% w/w S	0.010	NT
Fineness Factor	-	1.5	1.5
ANCBT	% CaCO3	0.010	0.63
a-ANCBT	moles H+/t	5.0	130
s-ANCBT	% w/w S	0.010	0.20
s-Net Acidity	% w/w S	0.0050	<0.0050
a-Net Acidity	moles H+/t	5.0	<5.0
Liming rate	kg CaCO3/t	0.75	<0.75
s-Net Acidity without ANCE	% w/w S	0.0050	<0.0050
a-Net Acidity without ANCE	moles H+/t	5.0	<5.0
Liming rate without ANCE	kg CaCO3/t	0.75	<0.75

Certificate of Analysis PEG0842

Result Comments

Identifier	Description
[1]	Though samples were not received within 24 hours following collection, they were received by the lab either frozen/dried, which prolongs holding time.

Certificate of Analysis PEG0842

Method Summary

Method ID	Methodology Summary
INORG-063	pH- measured using pH meter and electrode. Solids are oxidised with Hydrogen Peroxide or extracted with water. To ensure accurate results these tests are recommended to be done in the field as pH may change with time thus these results may not be representative of true field conditions. There is no documented official holding time, we have assigned an arbitrary 180 days to frozen samples.
INORG-068	Determination of Chromium Suite analysis - a sample is analysed by traditional titration method as well as ICP-OES analysis. There is no documented official holding time, we have assigned an arbitrary 180 days to frozen samples.

Certificate of Analysis PEG0842

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Certificate of Analysis PEG0842

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Data Quality Assessment Summary PEG0842

Client Details

Client	Douglas Partners Pty Ltd (Perth)
Your Reference	216618.01 - Proposed Multi-Residential Development
Date Issued	28/07/2023

Recommended Holding Time Compliance

Recommended holding time exceedances exist - See detailed list below

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	Yes	No Outliers
Surrogates / Extracted Internal Standards	Yes	No Outliers
QC Frequency	Yes	No Outliers

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Data Quality Assessment Summary PEG0842

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
pH F | Soil	1-40	23/06/2023	14/07/2023	17/07/2023	No
pH FOX | Soil	1-40	23/06/2023	14/07/2023	17/07/2023	No
Reaction Rate | Soil	1-40	23/06/2023	14/07/2023	17/07/2023	Yes
CRS Suite | Soil	1, 4, 7, 10-11, 13, 16, 19, 21, 24, 26, 30, 32, 34, 36, 39	23/06/2023	25/07/2023	25/07/2023	Yes

Quality Control PEG0842

INORG-063 | Acid Sulfate Soils (Soil) | Batch BEG1598

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %
				PEG0842-01 Samp | QC | RPD %	PEG0842-11 Samp | QC | RPD %	
pHF (field pH test)	pH units			8.3 | 8.9 | 7.22 [1]	7.2 | 7.1 | 0.843 [1]	100
pHFOX (field peroxide test)	pH units			6.1 | 6.1 | 0.492 [1]	4.3 | 4.3 | 0.467 [1]	100
Reaction Rate	-			Medium | Medium | [NA] [1]	Medium | Medium | [NA] [1]	[NA]

Analyte	Units	PQL	Blank	DUP3	DUP4	LCS %
				PEG0842-21 Samp | QC | RPD %	PEG0842-31 Samp | QC | RPD %	
pHF (field pH test)	pH units			7.1 | 7.1 | 0.563 [1]	7.7 | 7.6 | 1.05 [1]	100
pHFOX (field peroxide test)	pH units			4.8 | 4.6 | 4.03 [1]	5.3 | 5.1 | 3.84 [1]	100
Reaction Rate	-			Medium | Medium | [NA] [1]	Medium | Medium | [NA] [1]	[NA]

INORG-068 | Chromium Reducible Sulfur Suite (Soil) | Batch BEG2688

Analyte	Units	PQL	Blank	DUP1	DUP2	LCS %
				PEG0842-01 Samp | QC | RPD %	PEG0842-21 Samp | QC | RPD %	
pH KCl	pH units		NT	8.36 | 8.43 | 0.834	6.79 | 6.79 | 0.00	96.7
TAA	moles H+/t	5.0	<5.0	<5.0 | <5.0 | [NA]	<5.0 | <5.0 | [NA]	101
s-TAA	% w/w S	0.010	<0.010	<0.010 | <0.010 | [NA]	<0.010 | <0.010 | [NA]	[NA]
Chromium Reducible Sulfur	% w/w	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	<0.0050 | <0.0050 | [NA]	104
a-Chromium Reducible Sulfur	moles H+/t	3.0	<3.0	<3.0 | <3.0 | [NA]	<3.0 | <3.0 | [NA]	[NA]
SHCl	% w/w S	0.0050	<0.0050	NT | NT | [NA]	NT | NT | [NA]	[NA]
SKCl	% w/w S	0.0050	<0.0050	NT | NT | [NA]	NT | NT | [NA]	[NA]
SNAS	% w/w S	0.0050	<0.0050	NT | NT | [NA]	NT | NT | [NA]	[NA]
a-SNAS	moles H+/t	5.0	<5.0	NT | NT | [NA]	NT | NT | [NA]	[NA]
s-SNAS	% w/w S	0.010	<0.010	NT | NT | [NA]	NT | NT | [NA]	[NA]
Fineness Factor	-	1.5	NT	1.50 | 1.50 | 0.00	1.50 | 1.50 | 0.00	[NA]
ANCBT	% CaCO3	0.010	<0.010	0.751 | 0.701 | 6.90	0.676 | 0.676 | 0.00	NT
a-ANCBT	moles H+/t	5.0	<5.0	150 | 140 | 6.90	135 | 135 | 0.00	[NA]
s-ANCBT	% w/w S	0.010	<0.010	0.241 | 0.225 | 6.90	0.217 | 0.217 | 0.00	[NA]
s-Net Acidity	% w/w S	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	<0.0050 | <0.0050 | [NA]	[NA]
a-Net Acidity	moles H+/t	5.0	<5.0	<5.0 | <5.0 | [NA]	<5.0 | <5.0 | [NA]	[NA]
Liming rate	kg CaCO3/t	0.75	<0.75	<0.75 | <0.75 | [NA]	<0.75 | <0.75 | [NA]	[NA]
s-Net Acidity without ANCE	% w/w S	0.0050	<0.0050	<0.0050 | <0.0050 | [NA]	<0.0050 | <0.0050 | [NA]	[NA]
a-Net Acidity without ANCE	moles H+/t	5.0	<5.0	<5.0 | <5.0 | [NA]	<5.0 | <5.0 | [NA]	[NA]
Liming rate without ANCE	kg CaCO3/t	0.75	<0.75	<0.75 | <0.75 | [NA]	<0.75 | <0.75 | [NA]	[NA]

QC Comments

Identifier	Description
[1]	Though samples were not received within 24 hours following collection, they were received by the lab either frozen/dried, which prolongs holding time.

Appendix C Monitoring data

m below Top Of Collar (bTOC)					
Date	ECU01	ECU02	ECU04	ECU05	ECU06
22-Aug-23	3.515	2.255	5.235	3.495	3.925
05-Sep-23	3.475	2.120	5.110	3.495	3.945
04-Oct-23	3.655	2.255	5.200	3.660	4.105
08-Nov-23	3.815	2.465	5.415	3.840	4.240
05-Dec-23	4.020	2.662	5.602	4.055	4.468
16-Jan-24	4.358	3.023	5.937	4.391	4.785
12-Feb-24	4.570	3.233	6.153	4.599	5.000
04-Mar-24	4.713	3.372	6.289	4.724	5.130
05-Apr-24	4.879	3.540	6.443	4.881	5.284
08-May-24	5.003	3.570	6.608	5.023	5.395
13-Jun-24	4.693	3.340	6.275	4.579	5.055
05-Jul-24	4.534	3.310	6.183	4.537	4.987
12-Aug-24	4.100	2.789	5.729	4.072	4.510
02-Sep-24	3.925	2.574	5.528	3.923	4.350
09-Oct-24	3.879	2.509	5.497	3.960	4.350
06-Nov-24	4.030	2.651	5.611	4.092	4.483
04-Dec-24	4.181	2.804	5.761	4.246	4.570
14-Jan-25	4.483	3.129	6.043	4.541	4.902

m below ground level					
TOC	-0.08	-0.08	-0.07	-0.1	-0.08
Date	ECU01	ECU02	ECU04	ECU05	ECU06
22-Aug-23	3.595	2.335	5.305	3.595	4.005
05-Sep-23	3.555	2.200	5.180	3.595	4.025
04-Oct-23	3.735	2.335	5.270	3.760	4.185
08-Nov-23	3.895	2.545	5.485	3.940	4.320
05-Dec-23	4.100	2.742	5.672	4.155	4.548
16-Jan-24	4.438	3.103	6.007	4.491	4.865
12-Feb-24	4.650	3.313	6.223	4.699	5.080
04-Mar-24	4.793	3.452	6.359	4.824	5.210
05-Apr-24	4.959	3.620	6.513	4.981	5.364
08-May-24	5.083	3.650	6.678	5.123	5.475
13-Jun-24	4.773	3.420	6.345	4.679	5.135
05-Jul-24	4.614	3.390	6.253	4.637	5.067
12-Aug-24	4.180	2.869	5.799	4.172	4.590
02-Sep-24	4.005	2.654	5.598	4.023	4.430
09-Oct-24	3.959	2.589	5.567	4.060	4.430
06-Nov-24	4.110	2.731	5.681	4.192	4.563
04-Dec-24	4.181	2.804	5.761	4.246	4.570
14-Jan-25	4.563	3.209	6.113	4.641	4.982

mAHD					
GL (mAHD)	23.288	22.311	25.073	22.614	23.199
Date	ECU01	ECU02	ECU04	ECU05	ECU06
22-Aug-23	19.693	19.976	19.768	19.019	19.194
05-Sep-23	19.733	20.111	19.893	19.019	19.174
04-Oct-23	19.553	19.976	19.803	18.854	19.014
08-Nov-23	19.393	19.766	19.588	18.674	18.879
05-Dec-23	19.188	19.569	19.401	18.459	18.651
16-Jan-24	18.850	19.208	19.066	18.123	18.334
12-Feb-24	18.638	18.998	18.850	17.915	18.119
04-Mar-24	18.495	18.859	18.714	17.790	17.989
05-Apr-24	18.329	18.691	18.560	17.633	17.835
08-May-24	18.205	18.661	18.395	17.491	17.724
13-Jun-24	18.515	18.891	18.728	17.935	18.064
05-Jul-24	18.674	18.921	18.820	17.977	18.132
12-Aug-24	19.108	19.442	19.274	18.442	18.609
02-Sep-24	19.283	19.657	19.475	18.591	18.769
09-Oct-24	19.329	19.722	19.506	18.554	18.769
06-Nov-24	19.178	19.580	19.392	18.422	18.636
04-Dec-24	19.107	19.507	19.312	18.368	18.629
14-Jan-25	18.725	19.102	18.960	17.973	18.217
	Peak event				

Parameter	Appearance	Colour	Temp.	pH	EC (C)	ORP	DO	Ammonia-N	Nitrate-N	Nitrite-N	NOx-N	Total Kjeldahl Nitrogen	Total Nitrogen	Total Phosphorus	Filterable Reactive Phosphorus (Phosphate as P)		
Units			(°C)		(µS/cm)	(mV)	(%)	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		
ANZECC freshwater lowland rivers, and slightly modified level				6.5-8.0			80-120	0.08	-	-	0.15	-	1.2	0.065	0.04		
22 Aug 2023	ECU01	N.Turbid/F.Turbid	Brown/Grey	17.8	6.29	431.5	-110.4	8.9	0.12	< 0.01	< 0.01	< 0.01	6.5	6.5	6	0.01	
	ECU02	F.Turbid	Grey	18	6.21	2956	-65	16.6	0.08	0.05	< 0.01	0.05	11	11	0.39	< 0.01	
	ECU04	F.Turbid	Grey	21.6	7.38	1513	-1.5	19.3	< 0.02	0.73	0.02	0.75	3.1	3.8	1	0.37	
	ECU05	F.Turbid	Grey/Brown	20.1	6.27	350.9	-54.6	8.3	0.19	< 0.01	< 0.01	< 0.01	3	3	0.38	< 0.01	
	ECU06	F.Turbid	Grey/Brown	20.1	6.36	1636	-173.2	9.5	0.06	< 0.01	< 0.01	< 0.01	6.5	6.5	0.48	< 0.01	
	Z1	Duplicate of ECU06							0.06	< 0.01	< 0.01	< 0.01	6.6	6.6	1.5	< 0.01	
	Z2	Blank							< 0.02	< 0.01	< 0.01	< 0.01	< 0.2	< 0.2	< 0.01	< 0.01	
8 Nov 2023	ECU01	Turbid	Grey	16.1	6.2	123.7	-109.6	20.1	0.054	< 0.0050	< 0.0050	< 0.0050	3.7	3.7	3	0.063	
	ECU02	Turbid	Grey	18.8	6.26	2047	-109.6	12.4	0.029	0.16	0.011	0.17	13	14	0.22	< 0.0050	
	ECU04	Turbid	Grey	21.6	7.28	1227	35.1	20.6	0.016	0.14	< 0.0050	0.15	2.3	2.4	0.86	0.34	
	ECU05	Turbid	Grey	19.5	6.13	369.3	-45.9	9.2	0.14	< 0.0050	< 0.0050	< 0.0050	2.1	2.1	0.87	< 0.0050	
	ECU06	Turbid	Chocolate Brown	20.6	6.23	1832	-40.1	8.4	0.041	< 0.0050	< 0.0050	< 0.0050	7.8	7.8	1.7	< 0.0050	
	Z1	Duplicate															
	Z2	Blank							< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.10	< 0.10	< 0.050	< 0.0050	
12 Feb 2024	ECU01	Turbid	Brownish	16.2	6.23	967	-78.7	49.2	0.51	0.011	< 0.0050	0.014	3.9	3.9	1.5	0.014	
	ECU02	Turbid	Grey	20.6	6.21	1776	-40.1	31.7	0.062	0.007	0.0054	0.012	7.5	7.6	0.093	< 0.0050	
	ECU04	Turbid	Brownish	20.9	6.81	771	46.6	53.8	0.027	0.0068	< 0.0050	0.0091	3.2	3.2	0.77	0.18	
	ECU05	S.Turbid	Brownish	18.9	6.38	292	18.6	37	0.18	< 0.050	< 0.050	0.054	4.8	4.9	0.15	< 0.0050	
	ECU06	Turbid	Brown	20.4	6.17	1351	-8.7	26.1	0.07	0.021	< 0.0050	0.025	15	15	1.9	< 0.0050	
	Z1	Duplicate of ECU06							0.061	0.012	< 0.0050	0.014	13	13	1.4	0.0054	
	Z2	Blank							0.022	0.013	< 0.0050	0.016	< 0.10	< 0.10	< 0.050	< 0.0050	
8 May 2024	ECU01	Turbid	Brown	19.8	8.95	1564	5.6	29	0.18	< 0.0050	< 0.0050	< 0.0050	3.5	3.5	1.3	0.032	
	ECU02	Turbid	White	22.3	6.17	1954	86	32.1	0.072	< 0.0050	< 0.0050	< 0.0050	4.4	4.4	0.057	< 0.0050	
	ECU04	Turbid	Brown	22.9	6.66	771	177.8	30.9	0.066	0.0093	< 0.0050	0.0093	2.8	2.9	0.6	0.099	
	ECU05	Turbid	White	20.8	6.32	520	102.4	37	0.12	< 0.0050	< 0.0050	< 0.0050	5.4	5.4	0.14	< 0.0050	
	ECU06	Turbid	Brown	22.2	6.22	716	89	50.4	0.07	< 0.0050	< 0.0050	< 0.0050	9.7	9.7	0.48	< 0.0050	
	Z1	Duplicate of ECU02							0.073	< 0.0050	< 0.0050	< 0.0050	5.6	5.6	< 0.050	< 0.0050	
	Z2	Trip Blank							< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.11	0.11	< 0.050	< 0.0050	
12 Aug 2024	ECU01	Turbid	Grey	19.3	6.52	437.7	-152	50.1	0.1	< 0.0050	< 0.0050	< 0.0050	2.4	2.4	1.1	0.044	
	ECU02	Turbid	Grey/White	19.4	6.48	1922	-147.3	46.5	0.072	0.042	< 0.0050	0.042	5.3	5.3	0.088	< 0.0050	
	ECU04	Turbid	Brown	22	7.12	1155	-72.2	54.1	0.021	0.0088	< 0.0050	0.0088	1.6	1.6	0.54	0.26	
	ECU05	Turbid	Brown/Grey	20.4	6.36	406.8	-83.6	53.6	0.11	< 0.0050	< 0.0050	< 0.0050	4.6	4.6	0.08	0.0059	
	ECU06	Turbid	Brown	20.7	6.22	1318	-59.4	48.4	0.063	0.013	< 0.0050	0.013	5.7	5.7	0.49	< 0.0050	
	Z1	Duplicate of ECU05							0.15	0.0062	< 0.0050	0.0062	4.3	4.3	0.073	< 0.0050	
	Z2	Trip Blank							< 0.0050	0.0068	< 0.0050	0.0068	< 0.10	< 0.10	< 0.050	< 0.0050	
6 Nov 2024	ECU01	S.Turbid	Grey	15	6.75	103	-171	17.7	0.064	0.0052	< 0.0050	0.0055	1.7	1.7	0.72	0.026	
	ECU02	Turbid	Brown	16.7	6.32	1555	-149	99.5	0.041	0.051	< 0.0050	0.056	5.4	5.5	0.090	< 0.0050	
	ECU04	Turbid	Brown	19.7	7.22	1288	80.7	14.6	0.016	0.064	< 0.0050	0.064	1.5	1.6	0.53	0.33	
	ECU05	Turbid	Brown	17.6	6.3	341	3.4	25.6	0.12	0.0059	< 0.0050	0.0055	4.1	4.1	0.084	< 0.0050	
	ECU06	Turbid	Brown	18.6	6.05	1365	37	50.5	0.078	0.023	< 0.0050	0.025	6.5	6.5	1.0	< 0.0050	
	Z1	Duplicate of ECU05							0.12	0.12	< 0.0050	0.12	4.0	4.2	< 0.050	< 0.0050	
	Z2	Trip Blank							< 0.0050	0.055	< 0.0050	0.055	< 0.10	0.13	< 0.050	< 0.0050	

Indicates exceedance of ANZECC guideline

Table 1
Surface Water Analytical Results

Analyte		Polycyclic Aromatic Hydrocarbons															
		Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j,k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthracene	Benzo(g,h,i)perylene	
Units		µg/L															
LOR		0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
Assessment Criteria	FWG 95% DGV ²	16	NE	NE	NE	2	0.4	1.4	NE	NE	NE	NE	0.2	NE	NE	NE	NE
	NPUG ¹	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0.1	NE	NE	NE	NE
Sample ID	Sample Date																
SW1	20/06/2023	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01
SW2	20/06/2023	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01
SW3	20/06/2023	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.01

References:

1. Department of Water and Environmental Regulation (DWER) (2021) Assessment and Management of Contaminated Sites
2. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia (ANZG, 2018)

Abbreviations

FWG 95% DGV - Fresh Water Guidelines 95% Default Guideline Values
 NPUG - Not Potable Uses of Groundwater Guidelines
 SW - Surface Water
 NE - None Established

Table 1
Surface Water Analytical Results

Analyte		Dissolved Heavy Metals									Inorganics									
		Aluminium*	Arsenic	Cadmium	Chromium	Copper	Lead	Manganese	Nickel	Zinc	pH	Electrical Conductivity	Total Dissolved Solids	Dissolved Oxygen	Chloride	Calcium	Magnesium	Potassium	Sodium	Hardness as CaCO3
Units		µg/L									pH units	µS/cm	mg/L							
LOR		10	1	0.1	1	1	1	1	1	1		2	5	0.1	1	0.5	0.5	0.5	0.5	3
Assessment Criteria	FWG 95% DGV ²	0.8 / 55	0.8	0.2	3.3	1.4	3.4	NE	11	8	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	NPUG ¹	200	100	20	50	1000	100	5000	200	3000	NE	NE	NE	NE	250	NE	NE	NE	NE	NE
Sample ID	Sample Date																			
SW1	20/06/2023	<10	<1	<0.1	<1	<1	<1	35	<1	4.7	6.8	870	520	9.3	190	20	25	7.7	110	150
SW2	20/06/2023	<10	<1	<0.1	<1	<1	<1	38	<1	2.8	6.8	860	510	9.3	190	20	24	7.8	110	150
SW3	20/06/2023	<10	<1	<0.1	1	<1	<1	3.4	<1	66	6.4	31	18	10	5.2	1.1	<0.5	0.51	3.9	4.7

References:

1. Department of Water and Environmental Regulation (DWER) (2021) Assessment and Management of Contaminated Sites
2. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia (ANZG, 2018)

Abbreviations

FWG 95% DGV - Fresh Water Guidelines 95% Default Guideline Values

NPUG - Not Potable Uses of Groundwater Guidelines

SW - Surface Water

NE - None Established

* Aluminium criteria based on pH >6.5 (55ug/L) and pH <6.5 (0.8) for FWG 95% DGV

Appendix D Drainage Modelling

This appendix summarises the hydrologic and hydraulic modelling undertaken for this study.

Drainage system modelling was guided by the following key design criteria:

Townhouse lots

- Soakwells will be provided to townhouse lots for storage and infiltration of the first 15 mm of rainfall

'Mixed use' and 'public purpose – education' lots

- Each lot will be required to retain and infiltrate on site up to and including the 10% AEP event

Model construction and parameterisation

A 1-dimensional InfoWorks ICM model was constructed of the study area to assist in the design of the drainage system, provide sizing information for onsite drainage systems, and to demonstrate compliance with discharge criteria into the Water Corporations drainage system.

In order to determine the requirements for minor (20% AEP) and major (1% AEP) rainfall event storage and infiltration, the hydrological and hydraulic model InfoWorks ICM was utilised, applying ensemble design rainfall analysis consistent with the procedures recommended by Australian Rainfall and Runoff (ARR2019).

Drainage network and subcatchment delineation

The drainage network consists of mainly piped drainage. The southern portion of the study area discharges into the Water Corporations drainage system at Ron Stone Park via existing pipes beneath Bradford Street. The northern portion of the study area mainly discharges to a proposed vegetated swale within linear public open space providing treatment prior to discharge into on-site drainage basins.

The study area is represented by 24 subcatchments, consistent with the existing and proposed drainage system layout.

Rainfall

Rainfall for design events were developed using *Australian Rainfall and Runoff* (ARR2019) and BoM (2016) IFD ensemble methodology resulting in an ensemble of 10 rainfall simulation events for each design storm. Ensembles were generated for 1EY, 20%, 10%, and 1% AEP events of 30min, 1hr, 3hr, 6hr, 12hr, and 24hr durations.

Runoff parameterisation

ARR2019 provides spatially distributed recommendations for initial and continuing loss rates for application in pervious areas of rural catchments. For this study area, the recommended rates are:

- Initial loss – 37 mm
- Continuing loss – 2.9 mm/hr

Consistent with the recommendations of ARR2019, modelling of the study area includes three different surface types:

Effective Impervious Areas (EIA): These are Impervious areas that are directly connected to a modelled part of the drainage system, eg areas draining into pipes or direct into modelled storages. These areas are modelled with 2mm initial loss and zero continuing loss.

Indirectly Connected Areas (ICA): This includes a mix of pervious and impervious areas that are not directly connected to the drainage system – eg: public open spaces, residential lots with soakwells or footpaths in road reserves that drain to adjacent pervious areas). These areas are modelled with initial losses consistent with on-site drainage requirements and 2.9mm/hour continuing loss consistent with site conditions and the recommendations of ARR2019.

Rural pervious areas: This surface type is reserved for undeveloped rural or conservation land areas and is therefore not used in modelling.

Subcatchments have been parameterised applying these rates and a summary of parameters applied in this study is presented in Table 7.

Table 8 provides the breakdown of surface types applied to land uses in modelling.

Drainage basin infiltration rates

Geotechnical investigations were completed in 2022 and 2023 including permeability testing (Appendix C). A preliminary design permeability of 5 m/day was suggested where sufficient clearance exists above groundwater and has been assumed in modelling for the bulk of the study area, including proposed underground infiltration cells.

However, for on-site basins, where reduced clearance from groundwater has been identified, a reduced rate of 2.5m/day has been adopted for the southern basin and 0m/day has been adopted for the existing northern basin which is permanently inundated.

Model results

The InfoWorks ICM model was used to assess discharge flows and storage volumes for the 20%, and 1% AEPs storm events.

A summary of modelling results and the size of the respective stormwater systems are provided in Table 9 and presented in Figure 6. Table 10 provides a detailed breakdown of retained volumes in individual underground infiltration sites identified in Figure 6.

The modelled peak discharge flows to the Water Corporation's system in Ron Stone Park, and storage volumes in on site swales and basins are provided in Table 9. The predicted 1% AEP top water level in the retained onsite basin is 20.38m AHD.

Table 7: Summary of model parameters

Parameter	Unit	
Catchment roughness (Manning's N)		
Effective impervious areas (EIA)	-	0.025
Indirectly connected areas (ICA)	-	0.030
Hydraulic roughness (Manning's N)		
Vegetated open swales/drains	-	0.040
Culverts and piped drainage	-	0.015
Initial Loss		
Effective impervious areas (EIA)	mm	2
Indirectly connected areas (ICA) – POS, road reserves & small single residential lots	mm	15
Indirectly connected areas (ICA) – large mixed-use lots & education/school sites	mm	86
Continuing loss		
Effective impervious areas (EIA)	mm/hr	0
Indirectly connected areas (ICA)	mm/hr	2.9
Infiltration rates		
Retained onsite basin (south)	m/day	2.5

Table 8: Post development modelling parameters

Land use	EIA	ICA	Pervious	Comments
Lots		100%	-	ICA includes all hardstand areas draining to on-site retention/detention systems
Roads	70%	30%	-	ICA includes verges only (including footpaths)
POS		100%	-	

Table 9: Modelling results summary

Location	20% AEP	Critical duration	1% AEP	Critical duration
POS swale volume (m ³)	31	3 hours	81	3 hours
Retained basin storage peak contained volume (m ³)	2	3 hours	384	6 hours
Underground peak contained storage volume (m ³)	444	varies	1,434	varies
Underground storage available capacity (m ³)	1,418			
Total on-site storage volume (m ³)	477	-	1,898	12 hour
Peak discharge flow from the study area (L/s)	0	-	74.3	12 hour

Table 10: Modelling results – underground storage volumes

Location	Infiltration footprint (m2)	Available capacity (m3)	Peak storage volume		
			20% AEP	10% AEP	1% AEP
Stormtrap storage					
ST_03	67	40	8	14	41
ST_04	67	40	8	14	41
ST_05	33	20	8	11	19
ST_06	17	10	4	6	10
ST_07	17	10	2	4	11
ST_08	17	10	2	4	11
ST_09	8	5	0	1	3
ST_10	8	5	0	1	3
ST_11	50	30	0	3	30
ST_12	75	45	19	26	46
ST_13	58	35	11	16	36
ST_14	58	35	11	16	36
ST_15	57	85	68	86	87
ST_16	280	210	34	71	211
ST_17	280	210	71	94	211
Subtotal		790	249	368	794
Graf storage					
GR_01	136	45	6	12	45
GR_02	30	10	4	6	11
GR_03	30	10	8	10	11
GR_04	58	19	11	17	20
GR_05	124	82	34	57	84
GR_06	45	30	14	20	31
GR_07	45	30	11	17	31
GR_08	58	19	11	16	20
GR_09	48	16	16	17	17
GR_10	52	17	9	14	18
GR_11	45	15	7	11	16
GR_12	106	70	15	25	70
GR_13	213	211	29	71	212
GR_14	55	54	21	34	55
Subtotal		628	196	328	640
Total (m³)		1,418	444	697	1,434



Client: DevelopmentWA

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				Copies	Date
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