Aitken Rowe
TESTING LABORATORIES

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Site Classification Report

CLIENT:	GREATER HUME COUNCIL – HOLBROOK, NSW
LOCATION:	LOT 78 JACOB WENKE DRIVE, WALLA WALLA, NSW
REGISTRATION No:	SC20-254
PROJECT DESCRIPTION:	PROPOSED RESIDENTIAL DWELLING
DATE REQUESTED:	17 SEPTEMBER 2020
DATE OF INVESTIGATION:	22 SEPTEMBER 2020
DATE REPORTED:	13 OCTOBER 2020

ARTL - NATA ACCREDITED LABORATORIES

FIELD INVESTIGATION

At your request, a subsurface exploration was performed at the above location to assess the nature of the underlying soils in order to classify the site in accordance with AS2870 - 2011 "Residential Slab and Footings". The following classification is derived from information gained in regard to the history of the site, the description of the natural material and the amount of swell and shrinkage the natural soils experience with variations of water content.

Our Geotechnical staff excavated one borehole (BH1 to 3.0m) using a powered drilling rig at the location shown in the attached sketch. Disturbed samples were taken at various depths to represent various strata. The soil and groundwater conditions in this borehole was assessed and the borehole was logged in the field. Visual descriptions of moisture, plasticity and strength were also noted. The soil samples were tested at our NATA accredited laboratory in Wagga Wagga. The borehole log with test results is attached to this report.

SITE CONDITIONS, CONCLUSIONS AND RECOMMENDATIONS

The site of the proposed construction is on the southern side of the road. The site is generally flat.

The borehole investigation revealed that the site is underlain by topsoil to 0.1m overlying low plasticity clayey silt to 0.3m which in turn is underlain by high plasticity clays, extending to the borehole termination depth at 3.0m in BH1. The moisture condition of the underlying material was generally greater than plastic limit throughout the profile at the time of the investigation. The underlying clays are considered "poorly drained" which may result in significant volume changes during the wet and dry climatic cycles. No groundwater or seepage was encountered during the drilling, however it should be noted that variations to the water table level could fluctuate with changes to the season, temperature and rainfall.

Based on available data, laboratory test results and estimated characteristic surface movements (y_s), the site shall be classified as **"Class "H1-D" Highly reactive deep drying"** in accordance with the Australian Standard AS 2870. We recommend that all the footings be designed in accordance with that Standard and shall be founded below **topsoil into natural ground.**

The footing shall be founded on the natural **orange brown clay at or below 0.35m** from the existing surface (refer borehole logs), for which an allowable bearing capacity of 100kPa may be adopted, provided proper drainage measures are incorporated in the design, during and after the construction. The slab panel, internal beams and load support thickening may be founded on the underlying clayey silt material, provided the topsoil is removed and the exposed subgrade is proof rolled to detect any soft or heaving areas. If such areas exist, they shall be excavated and replaced and compacted with granular select fill as required.

If any additional fill placement is required on site during the site preparation, it is highly recommended to remove the existing topsoil, fill and unsuitable material, if any, and place granular fill comprising mainly sand and well graded gravel, but caution shall be exercised not to select a 'raw' or non-plastic material that may induce erosion. Clay soils are subject to saturation and

shrink/swell problems. The fill shall be placed in accordance with Clause 6.4.1 & 6.4.2 of AS2870, or otherwise the site classification shall be reviewed.

The structural fill is to be prepared in such a way that it achieves 95% of Standard Maximum Dry Density in every 150mm thick compacted layer. The placed fill shall be certified by a relevant NATA accredited testing laboratory for which a safe allowable bearing pressure of 100kPa may be adopted, provided proper drainage measures are incorporated in the design, during and after the construction.

Per Tin Maung
Senior Geotechnical Engineer

GENERAL COMMENT

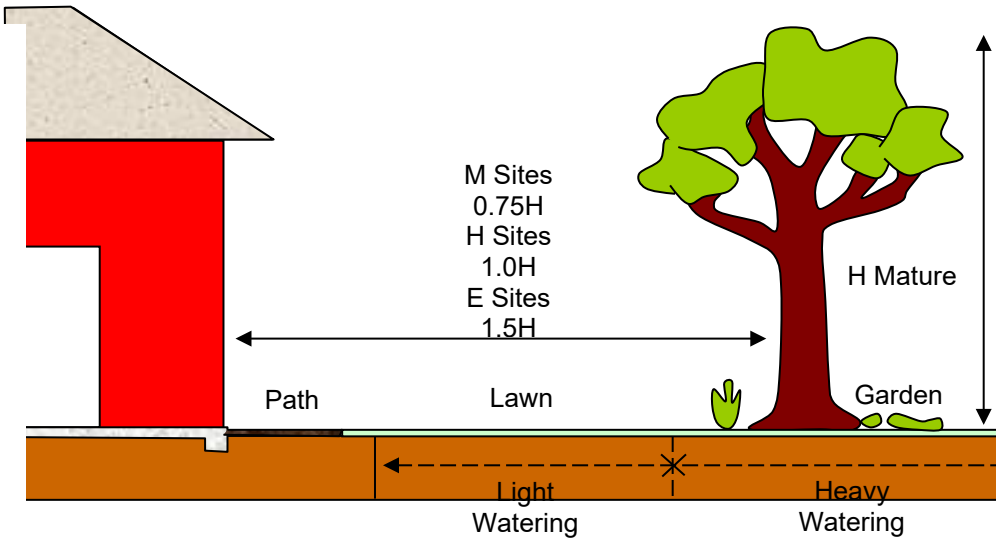
GARDENS AND TREES

Just as the building of a house changes the moisture conditions of the soil, so does the planting and establishment of a garden. The watering of the gardens increases moisture in the soil which can cause it to swell. Plants also draw moisture out of the soil, especially in long dry spells, causing the soil to shrink.

To avoid excessive moisture fluctuations around the home it is necessary to plan the garden so that only lightly watered areas such as lawns and small garden beds be located in close proximity to the house. Garden beds containing larger shrubs and trees should be kept well away from the building. Heavily watering of gardens near the house should be avoided, although uniform consistent watering of the gardens can be beneficial to prevent damage during long dry periods. Australian native plants generally require less water than exotic varieties. In any case, it is recommended to obtain information about the species to be planted in the garden prior to establishing the area.

If trees exist on site, it is highly recommended to site the proposed residential dwelling away from these trees at a distance equivalent to at least 75% (for Class M sites), 100% (for Class H sites) and 150% (for Class E sites) of the mature height of the tree. If the tree is to be removed, it is highly recommended to remove the entire tree including root system and allow the ground to achieve equilibrium moisture condition prior to construction. To assist with achieving equilibrium moisture content, the material used to backfill the removed tree site should be similar to the surrounding soil. If any trees are to be retained and the dwelling is to be built within the distance equivalent to 75% (for Class M sites), 100% (for Class H sites) and 150% (for Class E sites) of the mature height of the tree, then the footing system shall be designed for "**Class P – Problem site**" classification.

There are no recommendations within the standard for Class A and Class S sites for trees. To ensure that trees do not have a detrimental effect on the underlying materials of the dwelling it is recommended to take care when designing gardens for all soil classifications.



FOUNDATION EXCAVATION

The foundation excavation at times may expose soft or heaving areas at the base of the footing construction particularly if they are excavated after prolonged periods of rainfall. If such areas are encountered within the footing excavation, then such areas shall be excavated and treated before pouring the concrete. It is highly recommended to incorporate proper drainage measures around the perimeter of the building to ensure surface run-off does not ingress into the founding material.

RECOMMENDED FOUNDATION MATERIAL

Soil layer variations are common; we have therefore provided a description of the "Recommended foundation material" as a guide to the builder as to the correct foundation depths outside our test sites. In all cases the foundation soil chosen should have a similar consistency and strength to that recommended but need not be of the same type. The depth of the recommended foundation material may vary outside the test locations if the site is excavated or filled in any way after the date of our investigation. It is often difficult to distinguish fill from natural ground during investigation. If any significant variation from the borehole logs is noted during footing excavation i.e. 200mm or more, Aitken Rowe Testing Laboratories Pty Ltd should be consulted. Some allowances should be made for the removal of topsoil, organic matter, roots etc, which may be found in small, localised areas in the footing trenches. Also the effect of past and future trees should be considered in the selection of a design value for differential movement.

SITE ESTABLISHMENT

It is important to establish the site as soon as possible around the home as this will assist in stabilising the moisture content in the surrounding soil. The majority of soils expand (increase in volume) when wet, and shrink (decrease in volume) again when they dry out. The change in moisture and volume of soil can cause movement sufficient to damage the home. The more swelling and shrinkage the particular soil types on a site are likely to experience from changing moisture content, the more reactive that site will be.

By quickly completing the stormwater drainage and paving around the home the moisture content in the vicinity of the home can be partially stabilised. With careful planting of trees, shrubs and garden beds and well planned watering, the expected soil movement and risk of damage to the home can be minimised.

SITE DRAINAGE

When initially drawing a plan it is recommended to include the general layout of the site and garden areas. This enables the required levels to be established and ensures that adequate drainage is provided to all areas. This site drainage includes roof stormwater and ground water that may accumulate around the site and result in a change of soil conditions that could cause damage to the

building. Retaining walls generally require drainage provisions to be made around and behind the wall. These drains need to be co-ordinated with the total drainage system on the site. Paved areas also require adequate provision for stormwater runoff and should be graded to collection points that are both accessible for cleaning and connected to the stormwater system. All drains should be designed to prevent surface and subsurface water draining towards the house.

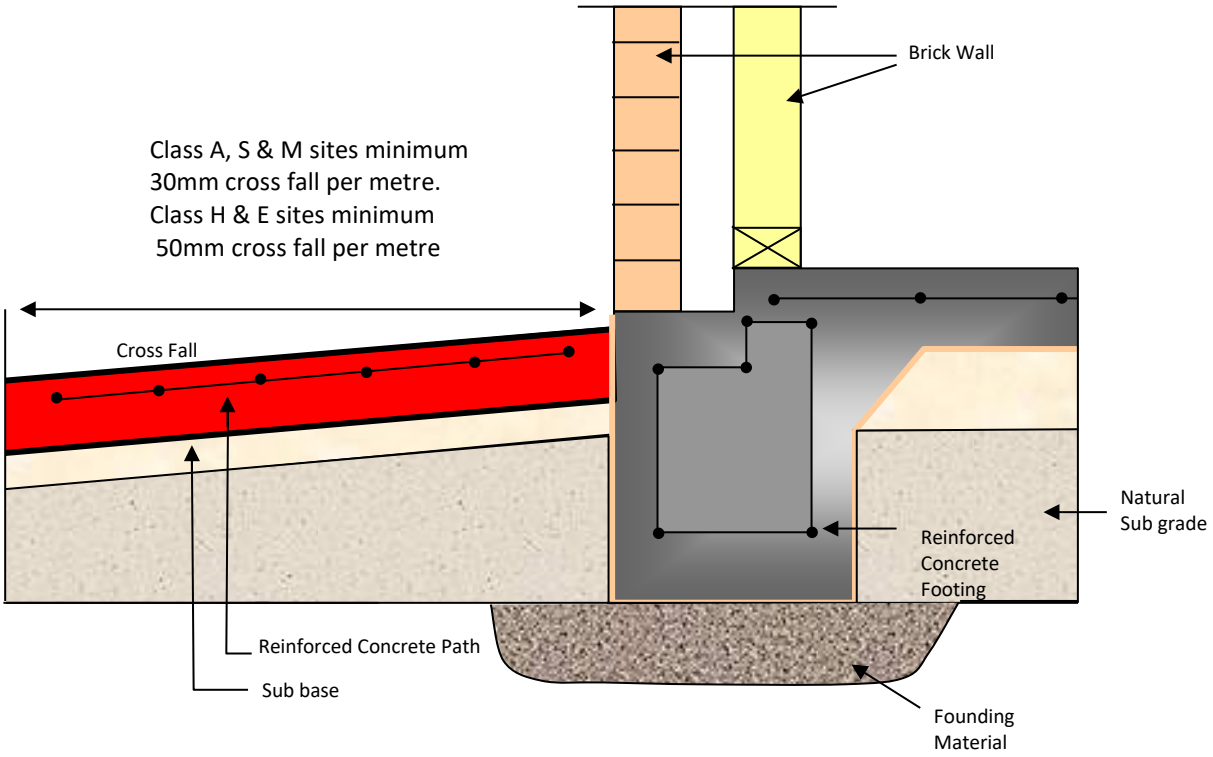
PAVING

The finished ground level (soil) around the home should be graded away from the house footing with a minimum fall of 50mm over the first metre. Any fill that has been placed during construction should also have the same fall and be well compacted.

Paving provides an excellent “buffer zone” around the house that assists in reducing fluctuations in the moisture conditions adjacent to the footings. If possible this paving should extend outwards from the building line a minimum of 900mm or more for highly reactive soils. It is essential that paving has the right crossfall for the expected reactivity (ground movement) of the site and all surface water is adequately drained. Care needs to be taken if laying pavements in the summer to ensure the crossfalls will not be reduced due to soils swelling in the winter.

If it is not possible to construct paving immediately, plastic sheeting with gravel spread on top provides a practical temporary alternative to protect the home until concrete paths can be placed.

For Class A, S, M sites, a minimum 30mm cross fall per metre is advised. For Class H and E sites, a minimum 50mm cross fall per metre is advised.



DEFINITIONS OF SITE CLASSES

A Most sand or rock sites with little or no ground movement from moisture changes.

S Slightly reactive clay sites with only slight ground movement from moisture changes.

M Moderately reactive clay or silt sites which can experience moderate ground movement from moisture changes.

M-D Moderately reactive clay or silt sites with deep moisture changes.

H1 Highly reactive clay sites, which can experience high ground movement from moisture changes.

H2 Highly reactive clay sites, which can experience high ground movement from moisture changes.

H1-D Highly reactive clay sites with deep moisture changes.

H2-D Highly reactive clay sites with deep moisture changes.

E Extremely reactive sites, which can experience extreme ground movement from moisture changes.

E-D Extremely reactive sites with deep moisture changes.

P Sites which include “uncontrolled” fill; soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites with large trees adjacent to the footings or sites which cannot be classified otherwise.

MAINTENANCE

As it is important for the homeowner to maintain the building, it is also important to maintain the site around the home. The primary objective of the site and house footing maintenance is to prevent the soil from becoming too wet or too dry. By keeping the moisture content of the soil under and adjacent to the footing reasonably constant, the potential for the soil to experience significant movement that may damage the building will be limited.

Good site establishment and management is a vital part of the maintenance and protection of the home. Careful planning and detailing of the site around the concrete footing will protect your investment in the home and provide a low maintenance concrete footing for many years.

ADDENDUM

LIMITS OF INVESTIGATION

The recommendations made in this report are based on the assumption that the test results are representative of the overall subsurface conditions. However, it should be noted that even under optimum circumstances, actual conditions in some parts of the building site may differ from those said to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal all that is hidden by earth, rock and time. Because the investigation procedure generally includes sampling from either one, two or three boreholes, it may not be possible to conclusively establish the presence or extent the condition of the underlying soil and rock over the whole block until site work commences for the construction.

The client should also be aware that our recommendations refer only to our test site locations and the ground level at the time of testing.

The recommendations in this report are based on the following: -

a) The information gained from our investigation.
b) The present "state of the art" in testing and design.
c) The building type and site treatment conveyed to us by the client.
d) Historical Information

Should the client or their agent have omitted to supply us with the correct relevant information, or make significant changes to the building type and/or building envelope, our report may not take responsibility for any consequences and we reserve the right to make an additional charge if more testing is necessary.

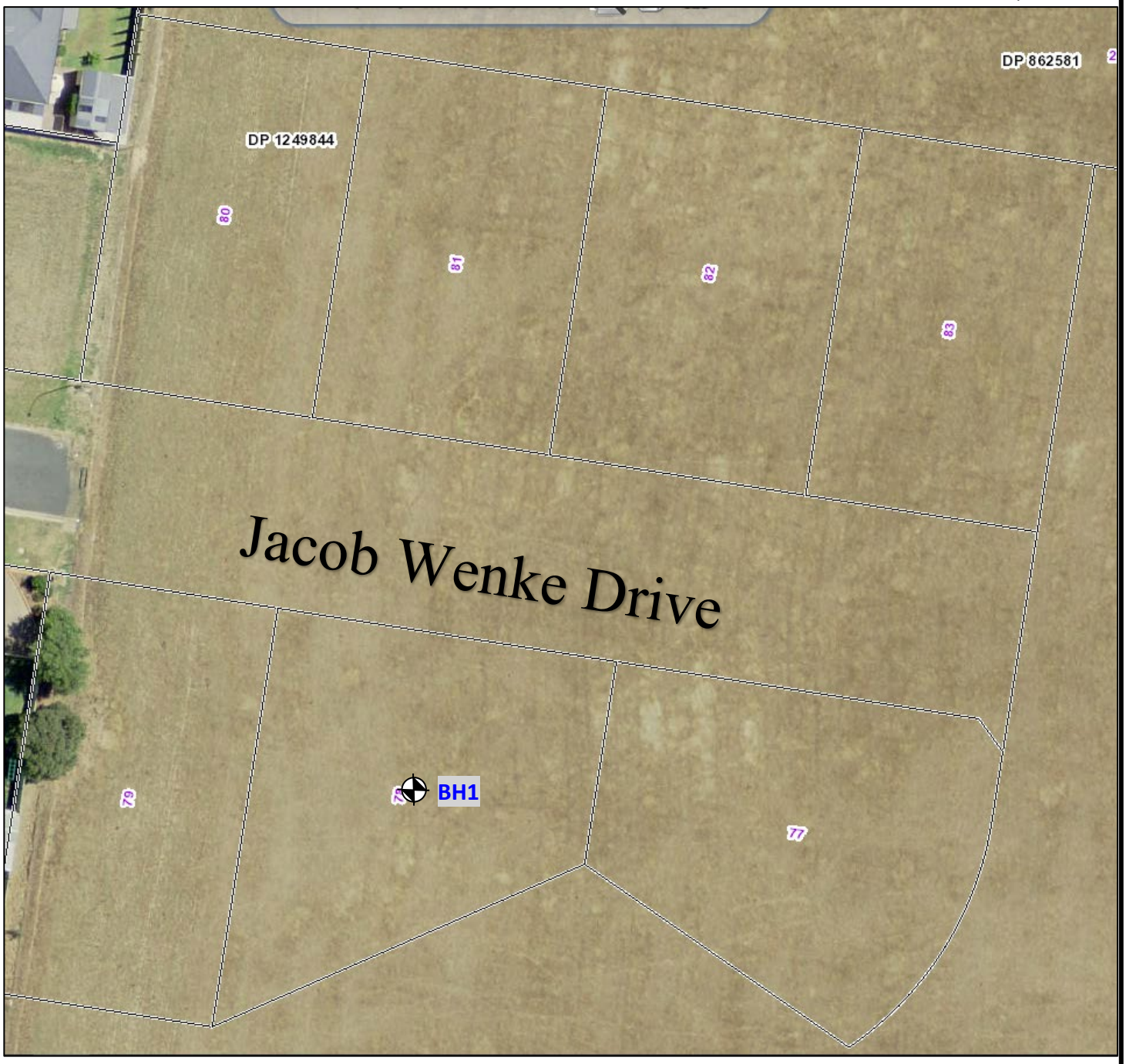
Not withstanding the recommendations made in this report, we also recommend that whenever footings are close to any excavations or easements, that consideration should be given to deepening the footings.

Unless otherwise stated in our commission, any dimensions or slope direction and magnitude should not be used for any building costing calculations and/or positioning. Any sketch supplied should be considered as only an approximate pictorial evidence of our work.

ADDITIONAL INFORMATION

Refer also to the CSIRO Information Sheet: - BTF18 “Foundation Maintenance and Footing Performance: A Home Owner’s Guide, which can be accessed through http://www.publish.csiro.au/pid/7076.htm.

SITE PLAN



NOT DRAWN TO SCALE

AITKEN ROWE TESTING LABORATORIES PTY LTD

Borehole No.: **1**
Sheet No.: 1 of 1

Ground Level: Existing
Method: Auger Drilling with TC Bit
Date: ***22/09/2020***

USCS Symbol	Description	Depth (m)	Moisture Condition	Consistency/ Rel. Density	Sample Type	Sample No.	Lab. Test L.S %	Remarks & Field Records
ML	TOPSOIL: SILT; low plasticity, trace sand brown		MC>PL	F.-St.				
ML	Clayey SILT; low plasticity, trace sand, orange brown							
CH	CLAY; high plasticity, trace sand, orange brown	0.5		VSt.	D	1A	13.5	
CH	CLAY; high plasticity, trace sand, yellow brown	1.0			D	1B	14.5	
		1.5						
		2.0			D	1C	15.5	Iss = 3.0
		2.5						
		3.0						
	End of Borehole (BH1) @ 3.0m	3.5						
		4.0						

Registration No.: SC20-254

Location: Lot 78 Jacob Wenke Drive, Walla Walla, NSW

Client: Greater Hume Council - Holbrook, NSW

Logged By: GDL

Scale: As shown

Dry on completion

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LOG SYMBOLS

LOG COLUMN	SYMBOLS	DEFINITION
Groundwater Record	▼	Standing water level. Time delay following completion of drilling may be shown.
	▶—	Groundwater seepage into borehole or excavation noted during drilling or excavation.
Samples	**D**	Small disturbed bag sample taken between the depths indicated by lines.
	B	Bulk disturbed sample taken between the depths indicated by lines.
	U	Undisturbed 50mm diameter tube sample taken between the depths indicated by lines
Field Tests	**N=17** **4, 7, 10**	Standard Penetration Test (S.P.T.) performed between depths indicated by lines. Individual figures show blows per 150mm penetration driven by SPT hammer.
	N_c **5** **7** **3**	Dynamic Cone Penetration Test performed between depths indicated by lines. Individual figures show blows per 100mm penetration for 60 degree solid cone driven by 9 Kg hammer.
Moisture Condition (Cohesive Soils) (Cohensionless Soils)	**MC>PL**	Moisture content estimated to be greater than plastic limit.
	MC=PL	Moisture content estimated to be approx. equal to plastic limit.
	MC<PL	Moisture content estimated to be less than plastic limit.
	D	DRY – runs freely through fingers.
	M	MOIST – does not run freely but no free water visible on soil surface.
	W	WET – free water visible on soil surface.
Consistency (Cohesive Soils)	**VS**	VERY SOFT – unconfined compressive strength less than 25kPa.
	S	SOFT – unconfined compressive strength 25-50 kPa.
	F	FIRM – unconfined compressive strength 50-100kPa.
	St.	STIFF – unconfined compressive strength 100-200kPa.
	VSt.	VERY STIFF – unconfined compressive strength 200 – 400kPa.
	H	HARD – unconfined compressive strength greater than 400kPa.
Relative Density (Cohensionless Soils)		**Description** / **Density Index Range % S.P.T.** / **'N' Value Range Blows/300mm**
	VL	VERY LOOSE / <15 / 0-4
	L	LOOSE / 15-35 / 4-10
	MD	MEDIUM DENSE / 35-65 / 10-30
	D	DENSE / 65-85 / 30-50
	VD	VERY DENSE / >85 / > 50
Hand Penetrometer Readings	**300** **250** **280**	Numbers indicate individual test results in kPa on representative undisturbed material unless noted otherwise.
Laboratory Test	**L.S. %**	Linear Shrinkage (As per RTA Method T113)
	M.C. %	Field Moisture Content (As per Australian Standard AS1289.2.1.1 or RTA Method T120)
	I_{ss}	Shrink-Swell Index (As per Australian Standard AS1289.7.1.1)
Remarks	**'V' bit**	Hardened steel 'V' shaped bit.
	'TC' bit	Tungsten Carbide wing bit.
	T^{60}	Penetration of auger string in mm under static load of rig rear axle without rotation of augers.