REPORT TO

HEALTH INFRASTRUCTURE

ON

GEOTECHNICAL INVESTIGATION

FOR

PROPOSED EUROBODALLA REGIONAL HOSPITAL EARLY WORKS

AT

LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Date: 9 December 2022

Ref: 33942LT3rpt

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ATTACHMENTS

1 INTRODUCTION

This report presents the results of geotechnical investigations for the proposed Eurobodalla Regional Hospital (ERH) early works at Lot 2 DP1281576, Princes Highway, Moruya, NSW. The location of the site is shown in Figure 1. The assessment was commissioned by Health Infrastructure and was carried out in accordance with the Health Infrastructure Consultancy Agreement (Contract No. HI21018, dated 22 March 2021) and instruction on 23 November 2022 from Mr Matthew Curnow of RP Infrastructure for preparation of a separate early works report.

We have been supplied with the following information pertaining to the proposed early works:

- Early Works – Civil & Stormwater drawings prepared by Meinhardt Bonacci (Ref. 13086-01C, Drawing Nos. ERH-HI-CV-DWG-DD-01-PW-0501, ERH-HI-CV-DWG-DD-01-PW-0502, ERH-HI-CV-DWG-DD-01-PW-0504, ERH-HI-CV-DWG-DD-01-PW-0507, ERH-HI-CV-DWG-DD-01-PW-0510, ERH-HI-CV-DWG-DD-01-PW-0521 and ERH-HI-CV-DWG-DD-01-PW-0530, Revisions A and B [Drawings 0521 and 0530 only], dated 30 November 2022 and 6 December 2022 respectively),

Based on these drawings we understand that the early works for the proposed ERH will comprise the formation of access roads and three sediment basins. To achieve the proposed levels for the roads and basins excavation to depths of generally less than about 2m will be required. On the downstream end of the basins the drawings indicate that some filling is required to form small embankments.

This geotechnical assessment was carried out in conjunction with environmental assessments by our environmental division, JK Environments (JKE). Reference should be made to the separate reports by JKE, Project Ref: E33942PL, for the results of the early works environmental site assessment.

2 INVESTIGATION PROCEDURE

The following is a description of the site investigation completed for the main hospital works. No additional investigation has been completed for the proposed early works.

The fieldwork for the investigation of the main hospital site comprised the drilling of thirty-eight boreholes (BH1 to BH38 inclusive) to depths ranging from 1.85m (BH26) to 21.5m (BH4) below existing surface levels. The boreholes were drilled using our track-mounted JK308 drilling rig. All boreholes were initially advanced through the soils and upper weathered bedrock using spiral auger drilling techniques and a Tungsten Carbide (TC) bit. Nine boreholes (BH3, BH4, BH6, BH7, BH16, BH20, BH24, BH30 and BH35) were then extended to the final depths by rotary diamond coring techniques, using an NMLC triple tube core barrel and water flush.

Prior to commencement of the fieldwork, the investigation locations were electromagnetically scanned by a specialist subcontractor so that borehole locations could be located clear of buried services. The services scan was also completed by referencing the 'Dial Before You Dig' plans.

The borehole locations, as shown on the attached Figure 2, and the surface reduced levels were obtained using a Sokkia SHC5000 differential GPS unit. The height datum is Australian Height Datum.

The strength of the cohesive soils was assessed from Standard Penetration Test (SPT) 'N' values, augmented by hand penetrometer tests carried out on cohesive samples recovered by the SPT split tube sampler or disturbed lump samples recovered from the auger. The strength of the bedrock in the augered portion was assessed from observation of the drilling resistance using the TC drill bit attached to the augers, tactile examination of rock cuttings, and correlation with the results of subsequent laboratory moisture content tests. It should be noted that strengths assessed in this way are approximate and variances of at least one strength order should not be unexpected.

For the cored portion of the bedrock, the recovered core was returned to our laboratory for photographing and Point Load Strength Index (Is_{50}) testing. Using established correlations, the Unconfined Compressive Strength (UCS) of the bedrock was then calculated from the Is_{50} results. These Point Load Strength test results are summarised in the attached Table E and on the borehole logs.

Selected soil samples were also returned to Soil Test Services Pty Ltd (STS) and Envirolab Services Pty Ltd, both NATA accredited laboratories. STS completed moisture content, Atterberg limits, shrink-swell index, particle size distribution and CBR testing and the results of these tests are provided in the attached STS Tables A, B, C and D. Soil aggression testing was completed by Envirolab Services Pty Ltd and the results are provided in the attached Certificate of Analysis No. 268115.

Groundwater observations were recorded in all boreholes during and on completion of auger drilling. Standpipe piezometers were installed in BH1, BH18 and BH27 to allow for longer-term groundwater monitoring. Data loggers were installed within BH1 and BH18 to provide a continuous assessment of groundwater levels over time. A return site visit was carried out on 8 December 2021 to retrieve the data loggers and download the groundwater results. We note that due to the recording interval of the loggers monitoring of groundwater levels terminated on 15 October 2021 however this still provided about 6 months of data.

Our geotechnical engineer, Mr Warren Smith, was present on a full-time basis during the fieldwork, to nominate testing and sampling and prepare the borehole logs. The borehole logs, which include field test results and groundwater observations, are attached, together with a set of explanatory notes which describe the investigation techniques, and their limitations and define the logging terms and symbols used.

3 SITE OBSERVATIONS

3.1 Site History

From a review of historical imagery and maps, the site has been in use as grazing farmland since European settlement and there are no indications of extensive development previously occurring on the site.

3.2 Site Description

The following site description is from our latest site visit in June 2022. No return visits have been made in preparation of this early works report to confirm any changes to site conditions or conditions adjoining the site. If site conditions are known to have changed, or there are particular areas of the site which are critical to the early works, then a further site visit should be undertaken.

The site is located within undulating regional topography associated with the relatively narrow coastal 'plain' bounded by the Great Dividing Range to the west and the Pacific Ocean to the east. This topography is defined by hills generally sloping at between 3° and 10° flattening towards floodplains surrounding creeks which intersect the area. Local reliefs extend up to 100m above sea level however are generally 60m or less.

The site comprises an irregularly shaped, battle-axe lot with an approximate area of 22 ha (54.4 acres). Surface levels across the site are predominantly defined by the slopes of a hill which peaks at RL60m adjacent to the south-eastern corner of the site and which slopes down to the north-west towards a floodplain adjacent to the western site boundary. The southern half of the site primarily comprises the backslope of the hill which slopes down at approximately 7° to 11° to the north-west towards an overland flow path and the floodplains further west. Levels within the northern half are predominantly formed by a spur of the main hill with a peak at about RL22m located towards the north-eastern corner. Surface levels slope down to the north and west from the crest of this spur at approximately 3° to 4° and to the south at approximately 7°. This spur is an interfluve for the overland flow path at the toe of the main hill slope in the southern half of the site and another flow path originating from a concrete stormwater outlet at the end of Caswell Street adjacent to the northern site boundary.

The site is currently in use as pasture and is predominantly dominated by grasses with isolated mature trees. However, the south-eastern corner comprises a remnant of grassy woodland comprising mature trees generally spaced at about 15m to 20m. Trees typically appear to be *Eucalyptus spp.* and *Angophora floribunda.* Within this woodland area are significant outcrops of granite which were generally assessed as high strength and slightly weathered to fresh. The granite outcrops comprised large boulders with some larger exposures close to the ground surface. The granite exhibited signs of spheroidal weathering typical of granitic formations including sub-rounded edges and open sub-vertical joints. Joints generally appear to strike in a southerly direction. A few isolated exposures of granite cobbles and boulders were observed on the south-western flank of the spur. In addition to these exposures of granite, approximately mid-slope near the southern boundary an isolated outcrop of diorite was observed. The diorite was assessed as high to very high strength and slightly weathered.

Within the two main overland flow paths there are several small embankment dams with downstream earthen embankments generally 1m to 1.5m high. Along and adjacent to the flow paths and in the relatively level area adjacent to the western boundary, the ground surface was marshy with water ponding in localised depressions.

West of the site is open pasture with surface levels across the boundaries similar. These farms are relatively level being located within a floodplain. To the east and south-east of the site are properties with grassy

woodland and surface levels following the contours of the hill. North and adjacent to the eastern boundary of the 'handle' of the site are residential properties which comprise single-storey houses primarily of fibro or brick construction.

The site has short frontages with Princes Highway, Albert Street and Braemar Place to the south-west, north and north-west respectively. Princes Highway comprises an asphalt paved, two lane single carriageway which appears to be in good condition upon cursory inspection. Albert Street and Braemar Place both comprise asphalt paved, residential streets which appear to be in good condition. Surface levels at the southern end of Braemar Place have been raised 2m by an embankment which slopes down at about 20°.

4 SUBSURFACE CONDITIONS

The Ulladulla 1:250,000 Metallogenic Series Sheet SI 56-13 indicates that the site is underlain by Moruya Granodiorite comprising *"biotite granite, adamellite, granodiorite, granite, diorite, gabbro"*. From a review of the Australian Stratigraphic Units Database the designation of this unit as Moruya Granodiorite has been replaced by Moruya Tonalite within the Moruya Suite. The aforementioned rock types in the Moruya Tonalite formation are all plutonic igneous rocks.

The Moruya 1:25,000 Quaternary Geology Sheet indicates that most of the site is underlain by bedrock of the Moruya Supersuite. However, along and adjacent to the creek line adjacent to the western site boundary Quaternary alluvial and colluvial fan soils are mapped. These soils comprise *"fluvial sand, silt, gravel, clay"*.

The boreholes encountered a generalised profile comprising topsoil and residual clay overlying shallow weathered granite bedrock. The bedrock is generally moderately to deeply weathered with bedrock of low or higher strength encountered at depths ranging from 1.8m to 20.15m. Some of the more pertinent subsurface observations are discussed below, however for specific details reference should be made to the attached borehole logs and graphical borehole summaries (Figures 3 to 6).

Topsoil

Topsoil, typically comprising a silty sandy clay, was encountered at the surface in all boreholes and extended to depths typically ranging from 0.1m to 0.2m, although within the gullies the topsoil was found to be locally deeper and up to 0.5m in BH29. The topsoil contained inclusions of roots and root fibres.

Residual Soils

Residual clays were encountered below the topsoil in all boreholes. The residual clays predominantly comprise silty sandy clay with some silty clay and silty gravelly clay encountered. The residual clays were typically of very stiff or hard strength, although there were occasional locations where they were assessed as either firm to stiff or stiff. The residual clays ranged from low to high plasticity. Fine grained quartz gravel was encountered throughout the residual clays on the site.

Granite Bedrock

Weathered granite was encountered at depths ranging from 0.3m to 1.4m below existing surface levels, although it was generally encountered at depths shallower than 1m. The granite comprised a moderately deep to deep extremely weathered profile. We note that granitic rock masses typically undergo a spheroidal weathering process whereby weathering occurs preferentially along intersecting joints in the upper portion of the rock mass which gradually causes 'rounding' of the upper rock and separation of this material from the underlying less-weathered bedrock. In this regard, the bands of low to moderate resistance encountered within the otherwise extremely weathered profile are inferred to be less weathered core stones.

Granite bedrock of low or higher strength was encountered below depths ranging from 1.6m (BH19) to 20.15m (BH4), correlating with levels of RL18.4m and RL-3m, though generally below 5m. Typically, the bedrock below the extremely weathered profile was of high to very high strength. The fresh granite was typically of very high strength.

Within the cored portions of the granite, defects primarily comprise joints inclined at 20° and 90° from the horizontal with most joints steeper than 45°. Joints were primarily iron stained with some containing extremely weathered infill. Extremely weathered seams were encountered in some of the core and ranged from 20mm to 100mm thick.

Groundwater

All boreholes, except BH2 and BH34, were dry during and on completion of drilling. In BH2, minor seepage was observed at a depth of 1.5m during drilling (which is at the surface of the weathered granite), however on completion of augering BH2 was 'dry'. Standing water was measured within BH34 at a depth of 4.2m (approximately RL3.6m) upon completion of augering. The standpipe piezometers were dipped before leaving site however no groundwater was measured. Following retrieval of the data loggers the groundwater levels were plotted against rainfall for BH1 and BH18 however no groundwater was encountered within BH27. The plots of groundwater levels and rainfall vs time are presented as Figures 7 and 8.

The groundwater level in BH1 was generally about RL2.6m however elevated readings up to RL4.6m were recorded following rainfall. The monitoring indicates that the groundwater level in BH18 is generally about RL13.2m however levels spiked up to about RL15.2m following heavy rainfall. The groundwater in both piezometers was within the extremely weathered granite.

We anticipate that the water level in BH1 represents the surface of the groundwater table connected to the adjoining creek to the west of the proposed hospital. The water level in BH18 was not constant but fluctuated with seasonal variations and we anticipate the groundwater encountered represents seepage flows through the extremely weathered granite down towards the west.

5 LABORATORY TESTING

The results of the moisture content tests correlate well with our field assessment of rock strength.

The Atterberg Limits testing completed on the residual clay indicate they ranged from low to high plasticity. The moisture contents of the clays were predominantly below their respective plastic limits. The Linear Shrinkage and shrink-swell index test results generally indicate a moderate to high potential for shrink-swell movements with changes in moisture content in the residual soils tested.

The particle size distribution curves correlated well with our field logging assessment of the residual clay and extremely weathered granite.

The four-day soaked CBR tests on the residual soils returned values ranging from 2.5% to 13%. The in-situ moisture content of the clays is typically 'wet' of their respective Standard Optimum Moisture Content (SOMC), with the exception of BH34 which was 0.8% 'dry' of its SOMC. During soaking, only the samples from BH1, BH37 and BH104 swelled by 0.5% and 1.0% respectively indicating the clays are reactive with respect to variations in moisture content.

The four-day soaked CBR test on the extremely weathered granite in BH105 returned a value of 20%. The in-situ moisture content of the granite was 4.2% 'dry' of its SOMC.

The following table provides a summary of the laboratory test results completed. Reference should be made to the attached Tables A, B, C and D for further details

Table 1 – Summary Table of Laboratory Test Results

Borehole Number	Sample Depth	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Soaked CBR (%)	Shrink-Swell Index (%/pF)
1	0.2-0.5	18.2					5	
2	0.5-0.95	8.7	20	17	3	0.5		
3	0.75-0.9	12.1	35	15	20	10		
3	0.3-0.8	15.1						1.57
5	0.5-0.6	19.4	66	21	45	16		
6	0.5-0.8	23.8	65	25	40	16.5		
8	0.5-0.7	13.9	66	20	46	14		
9	2.7-3.15	14.3						
10	0.5-0.95	12.7	49	22	27	12		
10	0.3-0.7	19.5						1.85
11	0.5-0.6	18.5	70	22	48	16.5		
11	0.2-0.6	16.7					5	
13	0.5-0.7	16.7	53	15	38	14		
13	0.2-0.6	14.4					9	
19	0.5-0.6	5.9	32	16	16	8		
19	2.0-2.2	5.1						
21	0.2-0.5	13.5						0.8
22	1.5-1.8	7.6						
26	0.5-0.95	13.1	31	14	17	7.5		

Borehole Number	Sample Depth	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Soaked CBR (%)	Shrink-Swell Index (%/pF)
26	0.2-1.2	12.8					4	
26	0.3-0.7	24.3						1.09
31	0.5-0.95	13.9	34	13	21	10		
31	0.3-0.5	13.3						0.32
34	0.5-0.95	11.0	33	12	21	10		
34	0.2-1.0	15.3					2.5	
35	1.5-1.95	8.2						
37	0.6-1.0	14.7	55	19	36	12.5		
37	0.2-1.0	10.4					13	
37	0.3-0.55	23.7						2.2
104	0.6-1.0	12.0	40	17	23	9	7	
105	0.4-1.0	7.9	40	18	22	8.5	20	

The following table summarises the soil aggression tests.

Table 2 – Summary table of Aggression Test Results

Borehole Number	Sample Depth	Sample Type	Soil pH (pH units)	Soil Chloride (mg/kg)	Soil Sulphate (mg/kg)	Resistivity (ohm cm)
7	1.5-1.95	EW Granite	5.8	53	10	13,000
9	0.5-0.8	Residual Silty Sandy Clay	6.1	22	10	34,000
13	1.5-1.7	EW Granite	5.8	94	32	9,600
14	2.7-3.0	EW Granite	6.1	46	26	14,000
15	1.5-1.8	EW Granite	5.7	180	43	5,200
18	0.5-0.6	EW Granite	5.8	40	10	18,000
20	0.5-0.6	Residual Silty Sandy Clay	5.9	10	<10	32,000
21	0.6-0.7	EW Granite	5.2	20	110	12,000
24	5.0-5.5	DW Granite	7.3	56	<10	16,000
27	1.5-1.95	EW Granite	6.0	35	10	19,000
35	0.5-0.95	EW Granite	5.8	44	<10	17,000
36	0.5-0.95	Residual Gravelly Sandy Clay	5.4	60	120	7,400

Based on these results, the soils and weathered granite would be classified as having a 'Mild' exposure classification for concrete piles and a 'Non-aggressive' exposure classification for steel piles in accordance with Table 6.4.2(C) and 6.5.2(C) of AS2159-2009 'Piling – Design and Installation.

6 COMMENTS AND RECOMMENDATIONS

6.1 Geotechnical Issues

From a geotechnical perspective, we consider the site will be suitable for the proposed scale of early works proposed. The main geotechnical issues relating to these early works will be as follows:

- The temporary sediment basins will primarily be constructed by excavating into the natural hillslopes although at the downstream ends of the basins, low-height embankments are required. To avoid the need for constructing embankments, which will require placement of engineered fill, consideration should be given to constructing the basins by excavation only.
- If excavation for the proposed access roads and basins encounter high strength granite bedrock then this will produce hard rock excavation conditions. Excavation through such material will be slow and abrasive for excavation equipment. Specialised rock excavation equipment will be required.
- There are existing overland flows which will need to be either diverted or controlled during construction and in the long term. The localised existing earth dams will potentially contain softened soils which will require more extensive earthworks operations during construction.
- The residual soils are reactive (i.e. they will exhibit shrink-swell movements with changes in moisture content), they may also be dispersive, although no testing has been undertaken to check the soils for their dispersive nature. As such any structures will need to consider the reactive potential of these soils and their dispersivity. Further geotechnical sampling and laboratory testing is recommended to assess the suitability of the existing site soils for use in water retaining embankments used as part of sediment basin construction.

6.2 Sediment Basins

We understand that the proposed sediment basins are temporary structures for the construction phase only. Should consideration be given to these basins being permanent structures then additional geotechnical investigations and further advice to the following recommendations will be required.

The civil drawings have nominated the sediment basins to be constructed with batters of 1 Vertical (V) in 4 Horizontal (H). A minimum crest width of 0.5m has been nominated for the embankment portions of the sediment basin. To avoid the need for completing engineered earthworks to construct the embankments, consideration should be given to designing the basins to be 'in cut' only.

Should embankments be required, then the embankments will need to be appropriately designed by the civil engineers or embankment designer. The design must include earthworks and compaction recommendations, material types, and assessment of embankment stability. Further geotechnical sampling and laboratory testing will be required in order for the geotechnical engineers to provide specific advice in regards to the suitability of existing site won materials for embankment construction.

6.2.1 Excavation

All excavations should be carried out with reference to the latest version of *'Excavation Work – Code of Practice'* by SafeWork NSW.

The following comments and recommendations in regard to excavation are on the basis that excavation for the proposed access roads extend to maximum depths of about 3m.

Based on the encountered subsurface conditions, excavation is expected to be predominantly through soils and extremely weathered granite. Excavation of the soils and any extremely weathered granite should be achievable using conventional earthmoving equipment, such as the buckets of hydraulic excavators.

Excavation of granite bedrock or large core stones of low or higher strength will require rock excavation techniques such as rock saws, rock grinders and/or hydraulic impact hammers attached to large excavators. The granite bedrock will be abrasive to excavation equipment and as such excavation costs will be high. Due to the distance from the site boundaries to adjacent structures we do not consider that quantitative vibration monitoring will be required where hydraulic impact hammers are used.

Based on the results of the monitoring we do not consider that the proposed excavations will encounter the groundwater table however groundwater seepage will likely occur at the soil/rock interface or through joints and defects within the rock, particularly during or immediately following periods of wet weather. Seepage is most likely to occur in and around the overland flow paths and around areas of the existing small embankment dams. We expect that any seepage encountered will be controllable using conventional sump and pump techniques.

Excavated spoil for off-site disposal will need to be suitably classified for waste disposal purposes. Reference should be made to the preliminary environmental report prepared by JK Environments.

6.3 Access Roads

The following recommendations are provided for construction of the access roads only.

6.3.1 Excavation Conditions

Reference should be made to Section 6.2.1 for comments and recommendations regarding excavations which are also applicable to the proposed access roads.

6.3.2 Temporary Batter Slopes for Access Roads

We anticipate that sufficient space will be available for forming temporary batters for road excavations less than 3m deep. Temporary batters formed through residual clays and the extremely weathered granite may be formed no steeper than 1 Vertical (V) in 1 Horizontal (H), subject to inspection by a geotechnical engineer. Steeper temporary batters may be feasible if better quality bedrock is exposed in the excavation and the

geotechnical engineers can assess this at the time. All temporary excavations should be inspected by the geotechnical engineers at not greater than 1.5m depth intervals and if there is any concern about the stability of excavations. The geotechnical engineers can provide specific advice during excavation. Geotechnical inspection of excavations is essential to identify any adverse defects present and to provide advice on stabilisation measures where required.

Surcharge loads such as construction traffic, site sheds etc. should be no closer than 2H from the crest of any temporary batter, where H is the vertical height of the batter. Surface drainage should not be allowed to flow over the crest of temporary batters, and should be directed and discharged in a manner which avoids concentrated flows and erosion. Granitic materials can be particularly susceptible to erosion and careful attention to surface drainage and surface protection of works to reduce the adverse effects of erosion is recommended.

6.3.3 Permanent Batter Slopes for Access Roads

Permanent batter slopes will likely be suitable for transitioning between existing and proposed surface levels around the access roads. The formation of permanent batters will be dependent on the height of the cut and the materials exposed. As a guide we suggest the following general recommendations;

- Permanent batters through the residual soils and all bedrock up to and including very low strength should be battered at not steeper than 1 Vertical (V) in 3 Horizontal (H).
- Permanent batters through low or higher strength bedrock should be battered at not steeper than 1V in 1H, although steeper permanent batters may also be feasible subject to specific inspection and mapping by the geotechnical engineers.

Any permanent batters will need to be fully protected from erosion, in the long term, by a suitable and approved erosion protection measure. Suitable measures would include revegetation or shotcrete. Where revegetation is being proposed, consideration should be given to flattening the permanent batters even further than recommended above to assist with initial vegetation and topsoil establishment, to reduce the risk of topsoil washing from the face during heavy rainfall, and to provide for ease of maintenance. Erosion protection may not be required if batters will be located within undercroft areas, subject to approval from the geotechnical engineers.

6.3.4 Earthworks for Access Roads

Earthworks recommendations in this report should be read in conjunction with AS3798-2007: '*Guidelines on Earthworks for Commercial and Residential Developments*' which should also be adopted.

Based on the supplied cut and fill plans, site earthworks for access roads will result in filling along portions of the access roads. In this regard, the following subgrade preparation is recommended.

- Strip off the existing, grass, topsoil and root-affected material. The root balls of any trees or shrubs should also be fully removed. Stripped materials will not be suitable for re-use as engineered fill and should be stockpiled separately. Such materials may be suitable for re-use within landscaped areas.
- Following stripping, the exposed subgrade should be proof rolled with 8 passes of a minimum 10 tonne smooth drum roller to detect any soft or heaving areas. The proof rolling should be carried out in the presence of a geotechnical engineer or experienced earthworks technician. The subgrade should be well graded to promote runoff and reduce the risk of water ponding on the surface. If the subgrade becomes wet it may become untrafficable.
- Any areas of heaving subgrade should be locally removed to a competent base and replaced with engineered fill. Additional removal of unsuitable or water-softened soils is likely to be encountered in and around the existing small dams and gullies on the site. Specific subgrade improvement may be required and this is best determined in consultation with the geotechnical engineers at the time of construction.
- Engineered fill for the roads should preferably comprise a good quality granular material with a particle size not greater than about 75mm. From a geotechnical perspective, crushed or weathered granite excavated from the site or nearby sites would likely be a suitable engineered fill material. However, depending on the excavation techniques adopted the granitic bedrock of high strength may require crushing prior to re-use as engineered fill to achieve a maximum particle size not exceeding 75mm. All granular engineered fill should be compacted in horizontal layers with a maximum 300mm loose thickness to at least 98% of Standard Maximum Dry Density (SMDD).
- From a geotechnical perspective, the existing residual clays may also be used as engineered fill, provided they are compacted to between 98% and 102% of Standard Maximum Dry Density (SMDD) and to within ±2% of Standard Optimum Moisture Content (SOMC). If the residual clay soils are to be adopted for use as an engineered fill the following needs to be carefully considered.

  (i) Where clays have moisture contents greater than the plastic limit they will require drying out prior to their use as engineered fill, and

  (ii) Where reactive clays are used as an engineered fill, they will undergo greater shrink swell movements with changes in moisture content than the in-situ reactive clays. Therefore, consideration needs to be given to the effect that greater shrink-swell movements will have on the performance of structures founded above.
- All earthworks for support of structures, including placement of engineered fill, should be carried out to Level 1 requirements in accordance with AS3798-2007 'Guidelines on Earthworks for Commercial and Residential Developments'. Density testing should be regularly carried out on all engineered fill. Regular density testing in accordance with Level 1 requirements of AS3798-2007 are recommended.
- To reduce the risk of deterioration of the subgrade during construction, the subgrade should have continuous falls to appropriate discharge points.

6.3.5 Pavement Design

Following completion of bulk earthworks for the access roads, we anticipate that the subgrade for the access roads will predominantly comprise residual soils and/or extremely weathered bedrock with some areas of engineered fill. The subgrade will need to be prepared in accordance with the requirements of Section 6.3.3 above. A design CBR of 2% should be adopted for the residual clays whilst a design CBR value of 10% may be adopted for the extremely weathered granite.

The early works drawings indicate that the proposed pavement profile for the access roads will comprise a 150mm thick layer of uniformly sized 50mm gravel. JK Geotechnics has not completed any analysis to assess the suitability of this pavement profile, however we anticipate that, particularly in areas where the subgrade comprises residual clay that some deformation will occur during the construction period. We assume that any deformation that occurs, eg. rutting, during construction will be rectified by the contractor to ensure access is maintained.

Design and construction of the permanent access roads should be completed in accordance with the recommendations in our report for the main hospital works dated 25 November 2022, Ref: 33942LTrpt4.

7 GENERAL COMMENTS

The recommendations presented in this report include specific issues to be addressed during the construction phase of the project. As an example, special treatment of soft spots may be required as a result of their discovery during proof-rolling, etc. In the event that any of the construction phase recommendations presented in this report are not implemented, the general recommendations may become inapplicable and JK Geotechnics accept no responsibility whatsoever for the performance of the structure where recommendations are not implemented in full and properly tested, inspected and documented.

The long-term successful performance of pavements is dependent on the satisfactory completion of the earthworks. In order to achieve this, the quality assurance program should not be limited to routine compaction density testing only. Other critical factors associated with the earthworks may include subgrade preparation, selection of fill materials, control of moisture content and drainage, etc. The satisfactory control and assessment of these items may require judgment from an experienced engineer. Such judgment often cannot be made by a technician who may not have formal engineering qualifications and experience. In order to identify potential problems, we recommend that a pre-construction meeting be held so that all parties involved understand the earthworks requirements and potential difficulties. This meeting should clearly define the lines of communication and responsibility.

This report provides advice on geotechnical aspects for the proposed civil and structural design. As part of the documentation stage of this project, Contract Documents and Specifications may be prepared based on our report. However, there may be design features we are not aware of or have not commented on for a variety of reasons. The designers should satisfy themselves that all the necessary advice has been obtained. If required, we could be commissioned to review the geotechnical aspects of contract documents to confirm the intent of our recommendations has been correctly implemented.

A waste classification is required for any soil and/or bedrock excavated from the site prior to offsite disposal. Subject to the appropriate testing, material can be classified as Virgin Excavated Natural Material (VENM), Excavated Natural Material (ENM), General Solid, Restricted Solid or Hazardous Waste. Analysis can take up to seven to ten working days to complete, therefore, an adequate allowance should be included in the construction program unless testing is completed prior to construction. If contamination is encountered, then substantial further testing (and associated delays) could be expected. We strongly recommend that this requirement is addressed prior to the commencement of excavation on site.

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SOIL TEST SERVICES

ABN 43 002 145 173

TABLE A

MOISTURE CONTENT, ATTERBERG LIMIT AND LINEAR SHRINKAGE TEST REPORT

Client:	JK Geotechnics	**Ref No:**	33942LT
Project:	Proposed Eurobodalla Health Service	**Report:**	A
Location:	Lot 6 DP1212271, Princes Highway, Moruya, NSW	**Report Date:**	14/05/2021
		Page 1 of 1	

AS 1289	TEST METHOD	2.1.1	3.1.2	3.2.1	3.3.1	3.4.1
BOREHOLE NUMBER	DEPTH m	MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX %	LINEAR SHRINKAGE %
2	0.50 - 0.95	8.7	20	17	3	0.5 **
3	0.75 - 0.90	12.1	35	15	20	10.0
5	0.50 - 0.60	19.4	66	21	45	16.0 *
6	0.50 - 0.80	23.8	65	25	40	16.5
8	0.50 - 0.70	13.9	66	20	46	14.0 *
9	2.70 - 3.15	14.3	-	-	-	-
10	0.50 - 0.95	12.7	49	22	27	12.0 *
11	0.50 - 0.60	18.5	70	22	48	16.5
13	0.50 - 0.70	16.7	53	15	38	14.0 *
19	0.50 - 0.60	5.9	32	16	16	8.0
19	2.00 - 2.20	5.1	-	-	-	-
22	1.50 - 1.80	7.6	-	-	-	-
26	0.50 - 0.95	13.1	31	14	17	7.5
31	0.50 - 0.95	13.9	34	13	21	10.0
34	0.50 - 0.95	11.0	33	12	21	10.0
35	1.50 - 1.95	8.2	-	-	-	-
37	0.60 - 1.00	14.7	55	19	36	12.5

Notes:

- The test sample for liquid and plastic limit was air-dried & dry-sieved
- The linear shrinkage mould was 125mm
- Refer to appropriate notes for soil descriptions
- Date of receipt of sample: 28/04/2021.
- Sampled and supplied by client. Samples tested as received.
- * Denotes the Linear Shrinkage curled.
- ** Denotes the Linear Shrinkage cracked.

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14/05/2021

Authorised Signature / Date
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SOIL TEST SERVICES
ABN 43 002 145 173

TABLE B
FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

Client: JK Geotechnics
Project: Proposed Eurobodalla Health Service
Location: Lot 6 DP1212271, Princes Highway, Moruya, NSW

Ref No: 33942LT
Report: B
Report Date: 12/05/2021
Page 1 of 1

BOREHOLE NUMBER		BH 1	BH 11	BH 13	BH 26	BH 34	BH 37
DEPTH (m)		0.20 - 0.50	0.20 - 0.60	0.20 - 0.60	0.20 - 1.20	0.20 - 1.00	0.20 - 1.00
Surcharge (kg)		9.0	9.0	9.0	9.0	9.0	9.0
Maximum Dry Density (t/m^3)		1.77 STD	1.86 STD	1.95 STD	1.90 STD	1.85 STD	2.00 STD
Optimum Moisture Content (%)		15.9	14.1	11.1	12.6	16.1	8.9
Moulded Dry Density (t/m^3)		1.74	1.82	1.91	1.87	1.82	1.95
Sample Density Ratio (%)		98	98	98	98	98	98
Sample Moisture Ratio (%)		98	106	101	101	99	115
Moisture Contents							
Insitu (%)		18.2	16.7	14.4	12.8	15.3	10.4
Moulded (%)		15.5	14.9	11.2	12.8	15.9	10.3
After soaking and							
After Test, Top 30mm(%)		21.0	18.1	12.9	17.6	12.0	21.6
Remaining Depth (%)		17.3	16.0	11.6	14.9	11.7	15.0
Material Retained on 19mm Sieve (%)		0	0	0	0	0	0
Swell (%)		0.5	0.0	0.0	0.0	0.0	1.0
C.B.R. value:	@2.5mm penetration	5	5	9			
	@5.0mm penetration				4.0	2.5	13

NOTES: Sampled and supplied by client. Samples tested as received.

- Refer to appropriate Borehole logs for soil descriptions
- Test Methods : AS 1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 28/04/2021.

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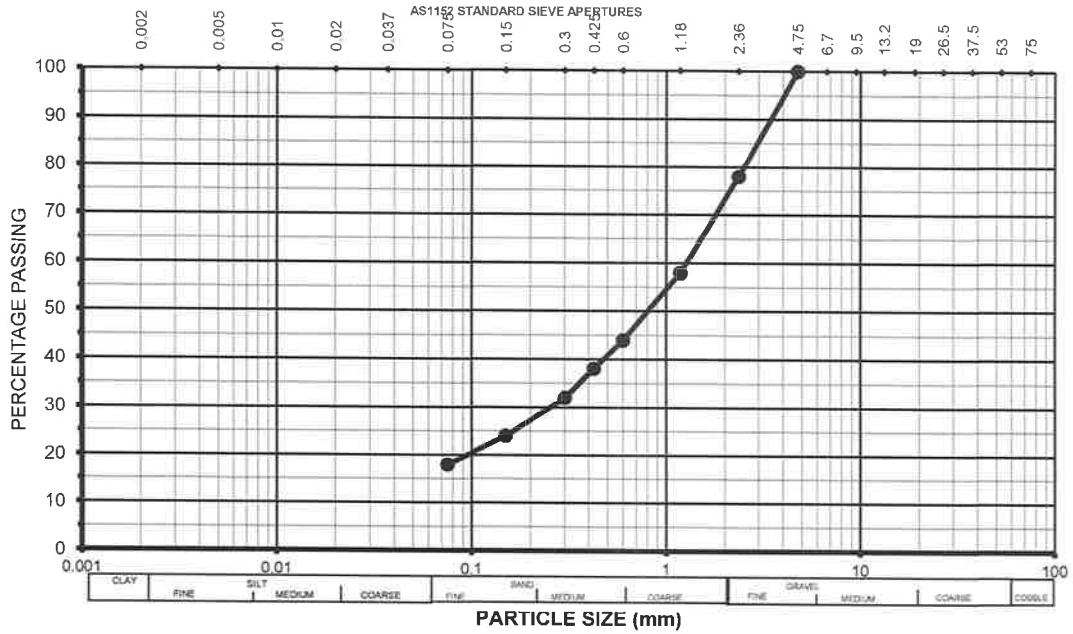
SOIL TEST SERVICES
ABN 43 002 145 173

TABLE C
PARTICLE SIZE DISTRIBUTION TEST REPORT

Client: JK Geotechnics
Project: Proposed Eurobodalla Health Service
Location: Lot 6 DP1212271, Princes Highway, Moruya, NSW

Ref No: 33942LT
Report No: C
Report Date: 13/05/2021
Page 1 of 6



Borehole Number: 12
Depth (m): 0.50 - 0.95

SIEVE ANALYSIS RESULTS

SIEVE SIZE	% PASSING
4.75 mm	100
2.36 mm	78
1.18 mm	58
600 µm	44
425 µm	38
300 µm	32
150 µm	24
75 µm	18

Test Method: AS1289.3.6.1 & 3.6.3 Dry Sieve (washed)

- **Notes:** Sampled and supplied by client. Sample tested as received.
- Please refer to appropriate notes for soil descriptions
- Date of receipt of sample: 28/04/2021.

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SOIL TEST SERVICES
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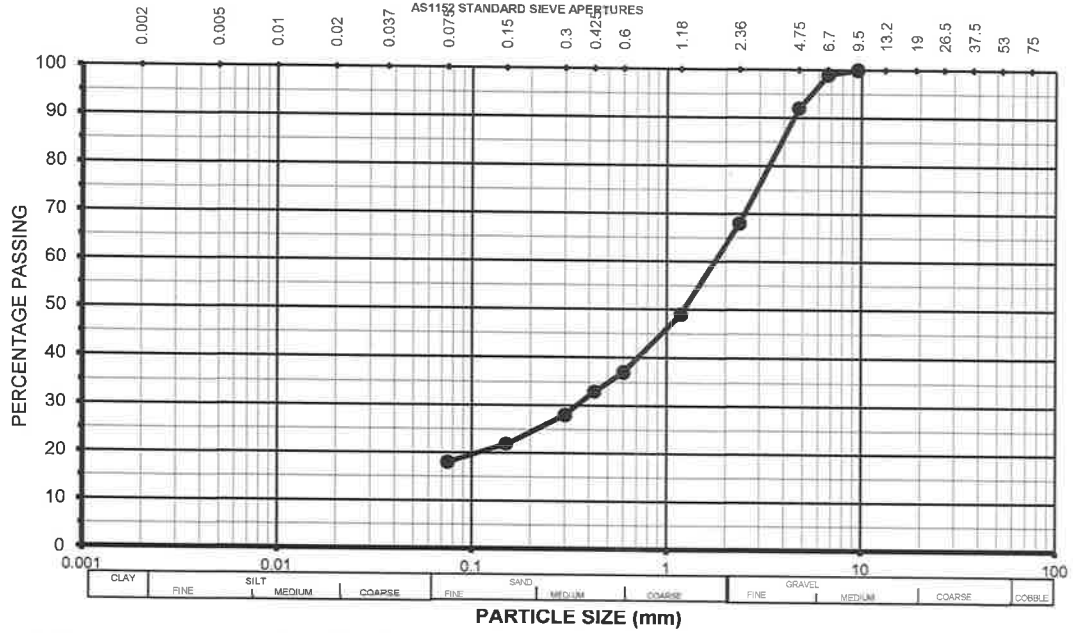
TABLE C
PARTICLE SIZE DISTRIBUTION TEST REPORT

Client: JK Geotechnics
Project: Proposed Eurobodalla Health Service
Location: Lot 6 DP1212271, Princes Highway, Moruya, NSW

Ref No: 33942LT
Report No: C
Report Date: 13/05/2021
Page 2 of 6

Borehole Number: 17
Depth (m): 0.50 - 0.95



SIEVE ANALYSIS RESULTS

SIEVE SIZE	% PASSING
9.50 mm	100
6.70 mm	99
4.75 mm	92
2.36 mm	68
1.18 mm	49
600 µm	37
425 µm	33
300 µm	28
150 µm	22
75 µm	18

Test Method: AS1289.3.6.1 & 3.6.3 Dry Sieve (washed)

- **Notes:** Sampled and supplied by client. Sample tested as received.
- Please refer to appropriate notes for soil descriptions
- Date of receipt of sample: 28/04/2021.

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SOIL TEST SERVICES
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TABLE C
PARTICLE SIZE DISTRIBUTION TEST REPORT

Client: JK Geotechnics
Project: Proposed Eurobodalla Health Service
Location: Lot 6 DP1212271, Princes Highway, Moruya, NSW

Ref No: 33942LT
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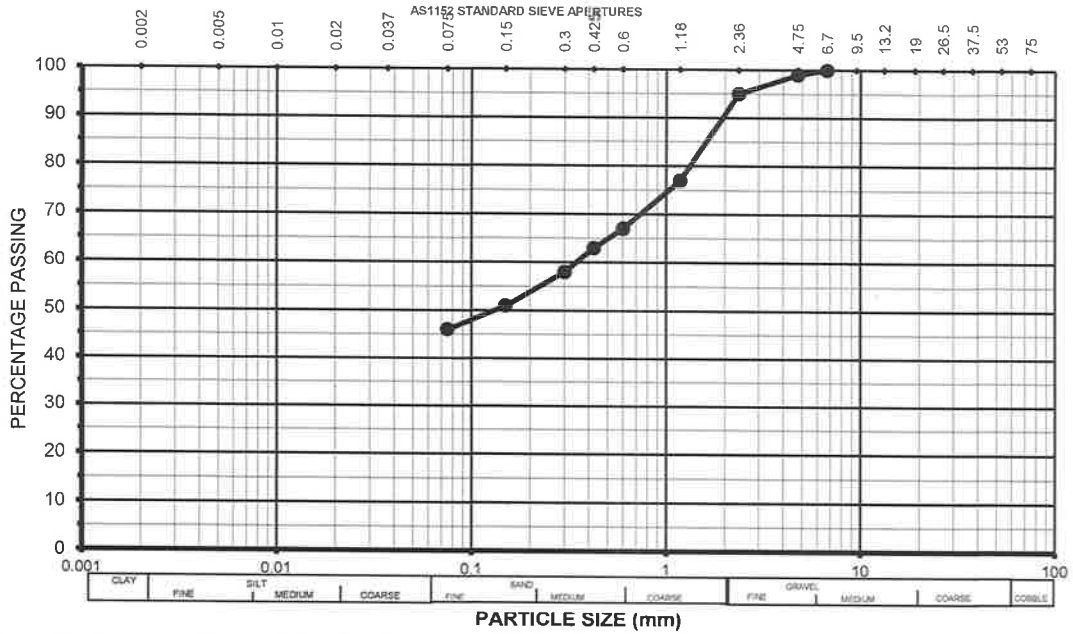
Borehole Number: 26
Depth (m): 0.20 - 1.20



SIEVE ANALYSIS RESULTS

SIEVE SIZE	% PASSING
6.70 mm	100
4.75 mm	99
2.36 mm	95
1.18 mm	77
600 µm	67
425 µm	63
300 µm	58
150 µm	51
75 µm	46

Test Method: AS1289.3.6.1 & 3.6.3 Dry Sieve (washed)

- **Notes:** Sampled and supplied by client. Sample tested as received.
- Please refer to appropriate notes for soil descriptions
- Date of receipt of sample: 28/04/2021.

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TABLE C
PARTICLE SIZE DISTRIBUTION TEST REPORT

Client: JK Geotechnics
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Location: Lot 6 DP1212271, Princes Highway, Moruya, NSW

Ref No: 33942LT
Report No: C
Report Date: 13/05/2021
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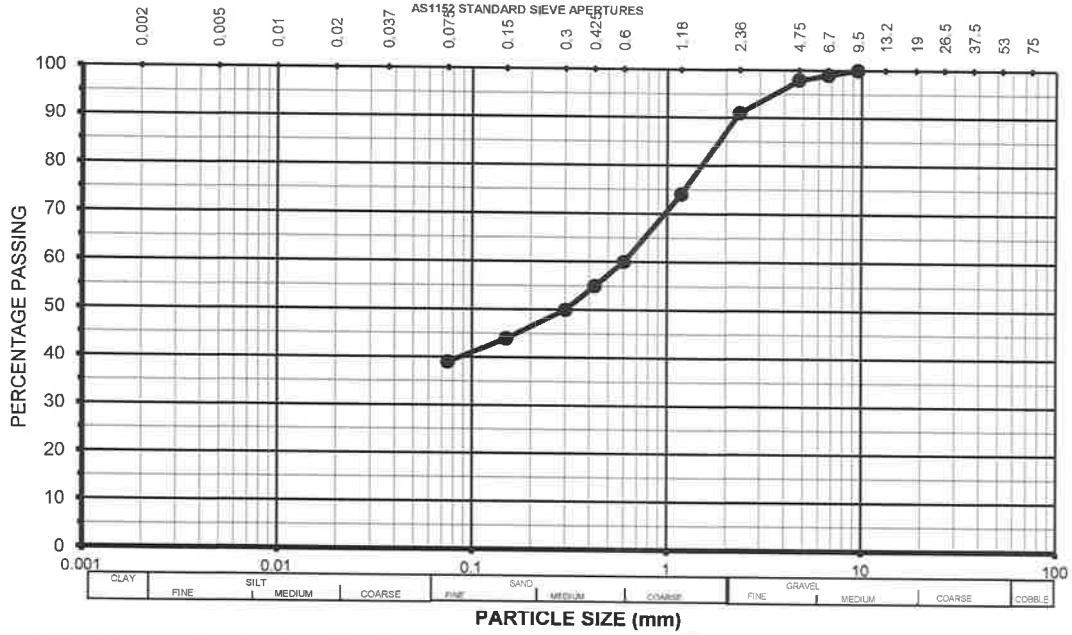

Borehole Number: 28
Depth (m): 0.50 - 0.95

SIEVE ANALYSIS RESULTS

SIEVE SIZE	% PASSING
9.50 mm	100
6.70 mm	99
4.75 mm	98
2.36 mm	91
1.18 mm	74
600 µm	60
425 µm	55
300 µm	50
150 µm	44
75 µm	39

Test Method: AS1289.3.6.1 & 3.6.3 Dry Sieve (washed)

- **Notes:** Sampled and supplied by client. Sample tested as received.
- Please refer to appropriate notes for soil descriptions
- Date of receipt of sample: 28/04/2021.

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TABLE C
PARTICLE SIZE DISTRIBUTION TEST REPORT

Client: JK Geotechnics
Project: Proposed Eurobodalla Health Service
Location: Lot 6 DP1212271, Princes Highway, Moruya, NSW

Ref No: 33942LT
Report No: C
Report Date: 13/05/2021
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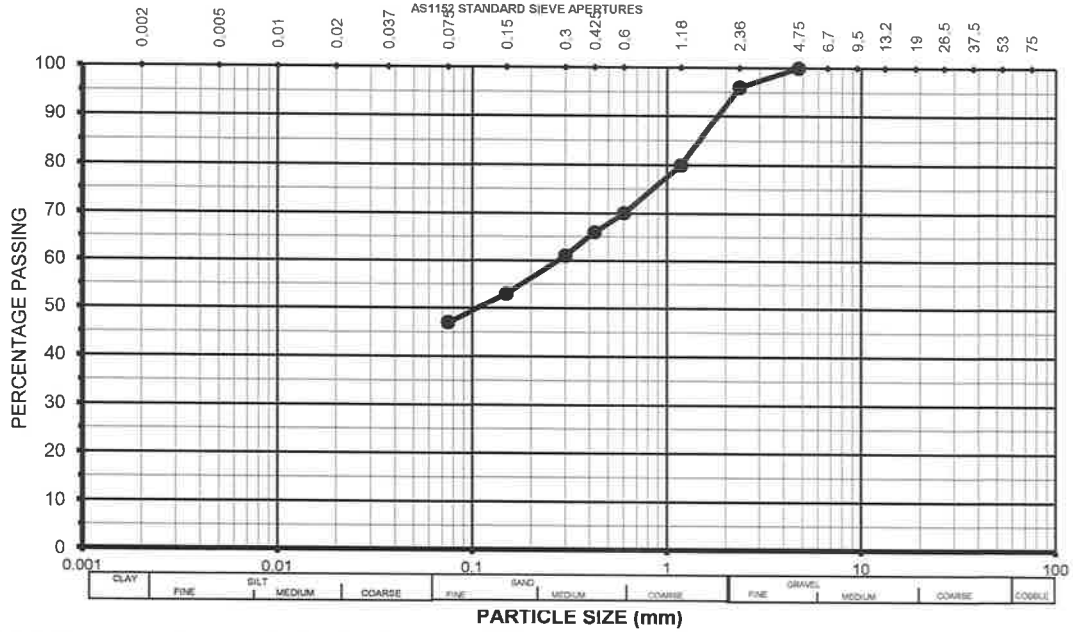
Borehole Number: 34
Depth (m): 0.20 - 1.00



SIEVE ANALYSIS RESULTS

SIEVE SIZE	% PASSING
4.75 mm	100
2.36 mm	96
1.18 mm	80
600 µm	70
425 µm	66
300 µm	61
150 µm	53
75 µm	47

Test Method: AS1289.3.6.1 & 3.6.3 Dry Sieve (washed)

- **Notes:** Sampled and supplied by client. Sample tested as received.
- Please refer to appropriate notes for soil descriptions
- Date of receipt of sample: 28/04/2021.

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TABLE C
PARTICLE SIZE DISTRIBUTION TEST REPORT

Client: JK Geotechnics
Project: Proposed Eurobodalla Health Service
Location: Lot 6 DP1212271, Princes Highway, Moruya, NSW

Ref No: 33942LT
Report No: C
Report Date: 13/05/2021
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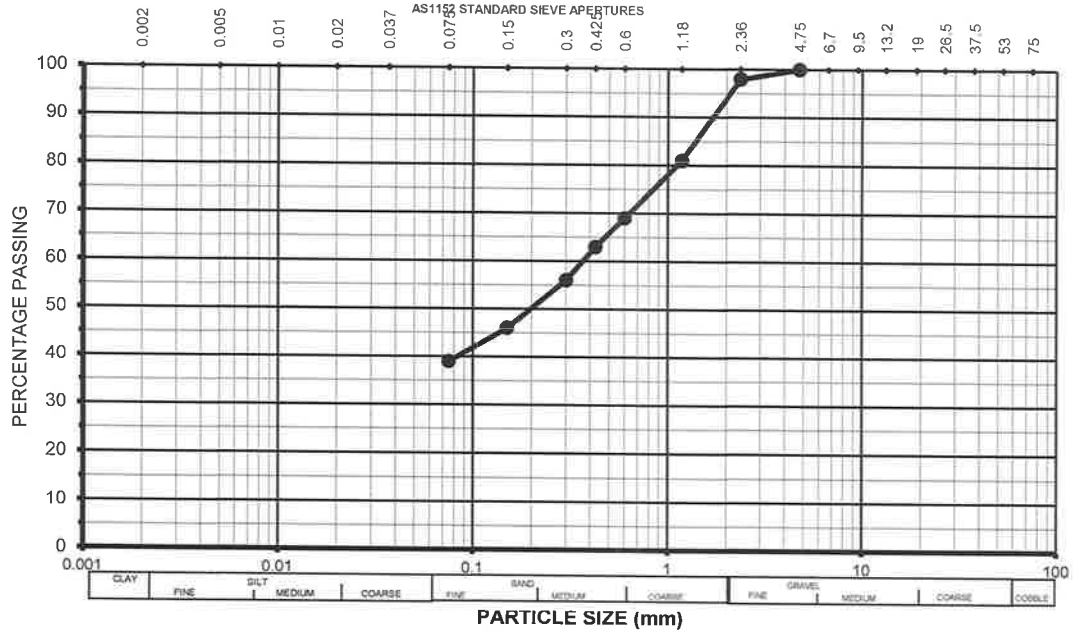
Borehole Number: 37
Depth (m): 0.20 - 1.00



SIEVE ANALYSIS RESULTS

SIEVE SIZE	% PASSING
4.75 mm	100
2.36 mm	98
1.18 mm	81
600 µm	69
425 µm	63
300 µm	56
150 µm	46
75 µm	39

Test Method: AS1289.3.6.1 & 3.6.3 Dry Sieve (washed)

- **Notes:** Sampled and supplied by client. Sample tested as received.
- Please refer to appropriate notes for soil descriptions
- Date of receipt of sample: 28/04/2021.

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SOIL TEST SERVICES
ABN 43 002 145 173

TABLE D
SHRINK - SWELL TEST REPORT
TEST METHOD: AS1289 7.1.1

Client: JK Geotechnics
Project: Proposed Eurobodalla Health Service
Location: Lot 6 DP1212271, Princes Highway, Moruya, NSW

STS Job No: 33942LT
Report: D
Report Date: 19/05/2021
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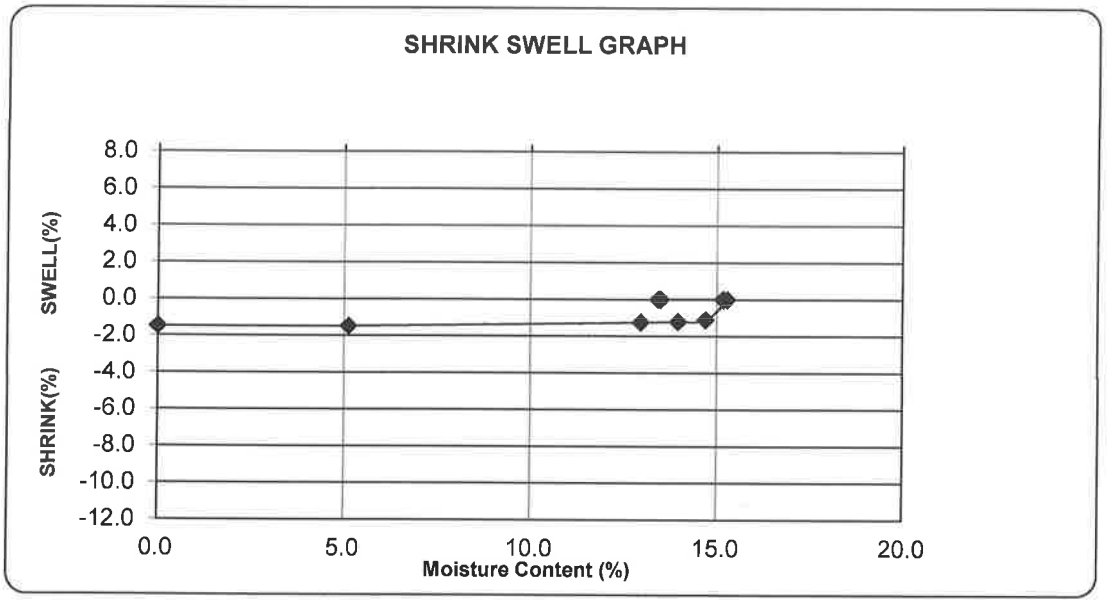
Borehole No.: 21		Depth: 0.20 - 0.50m			
MOISTURE CONTENT (SWELL)		ESTIMATED UNCONFINED COMPRESSIVE STRENGTH			
BEFORE TEST	AFTER TEST	BEFORE TEST		AFTER TEST	
13.5%	13.4%	200	kPa	100	kPa
LOAD	SETTLEMENT UNDER LOAD BEFORE SATURATION		SWELL ON SATURATION		SHRINKAGE
25	-0.6%		0.0%		1.4%



SHRINK SWELL INDEX
0.80 %/pF

Notes: Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 28/04/2021.

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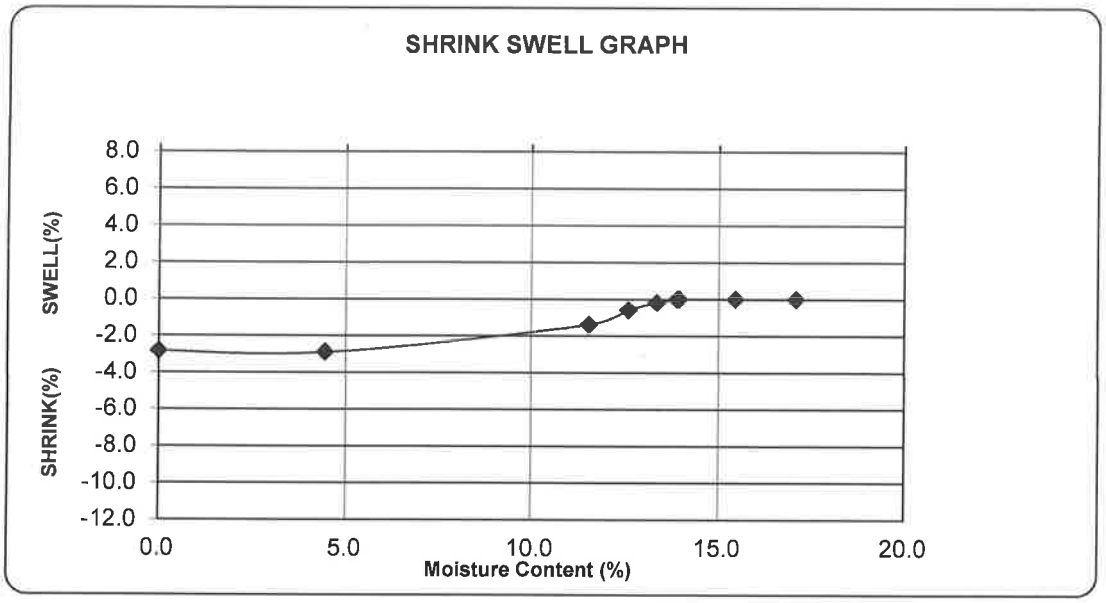
ABN 43 002 145 173

TABLE D
SHRINK - SWELL TEST REPORT
TEST METHOD: AS1289 7.1.1

Client: JK Geotechnics
Project: Proposed Eurobodalla Health Service
Location: Lot 6 DP1212271, Princes Highway, Moruya, NSW

STS Job No: 33942LT
Report: D
Report Date: 19/05/2021

Borehole No.: 3		Depth: 0.30 - 0.80m			
MOISTURE CONTENT (SWELL)		ESTIMATED UNCONFINED COMPRESSIVE STRENGTH			
BEFORE TEST	AFTER TEST	BEFORE TEST		AFTER TEST	
15.5%	17.1%	340	kPa	200	kPa
LOAD	SETTLEMENT UNDER LOAD BEFORE SATURATION		SWELL ON SATURATION	SHRINKAGE	
25	-0.7%		0.0%	2.8%	



SHRINK SWELL INDEX
1.57 %/pF

Notes: Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 28/04/2021.

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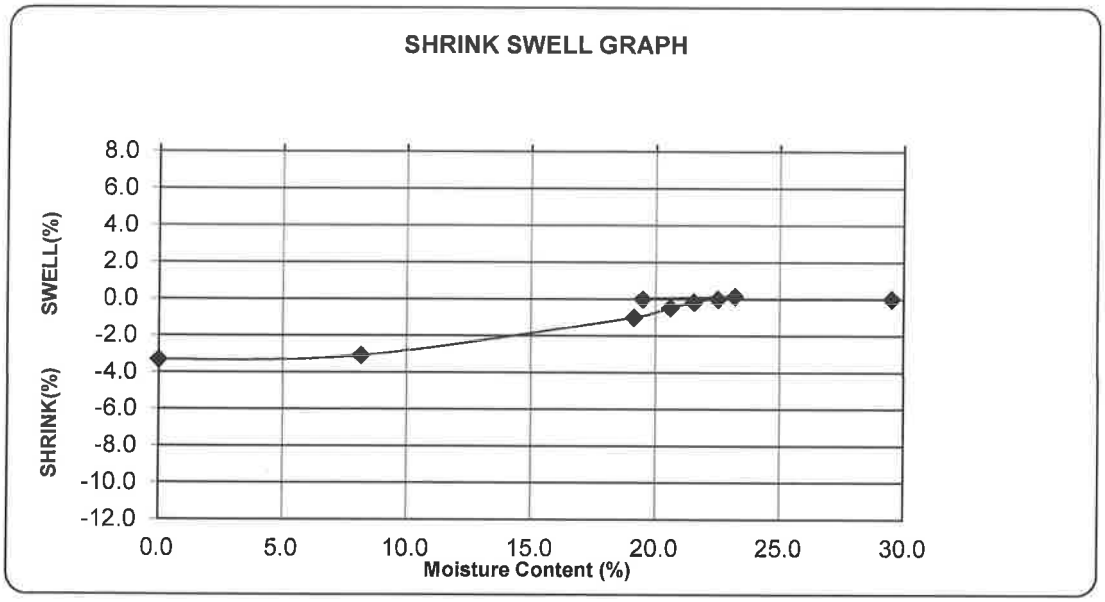
SOIL TEST SERVICES
ABN 43 002 145 173

TABLE D
SHRINK - SWELL TEST REPORT
TEST METHOD: AS1289 7.1.1

Client: JK Geotechnics
Project: Proposed Eurobodalla Health Service
Location: Lot 6 DP1212271, Princes Highway, Moruya, NSW

STS Job No: 33942LT
Report: D
Report Date: 19/05/2021
Page 2 of 6

Borehole No.: 10		Depth: 0.30 - 0.70m			
MOISTURE CONTENT (SWELL)		ESTIMATED UNCONFINED COMPRESSIVE STRENGTH			
BEFORE TEST	AFTER TEST	BEFORE TEST		AFTER TEST	
19.5%	23.2%	>300	kPa	150	kPa
LOAD	SETTLEMENT UNDER LOAD BEFORE SATURATION		SWELL ON SATURATION		SHRINKAGE
25	-0.7%		0.1%		3.3%



SHRINK SWELL INDEX
1.85 %/pF

Notes: Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 28/04/2021.

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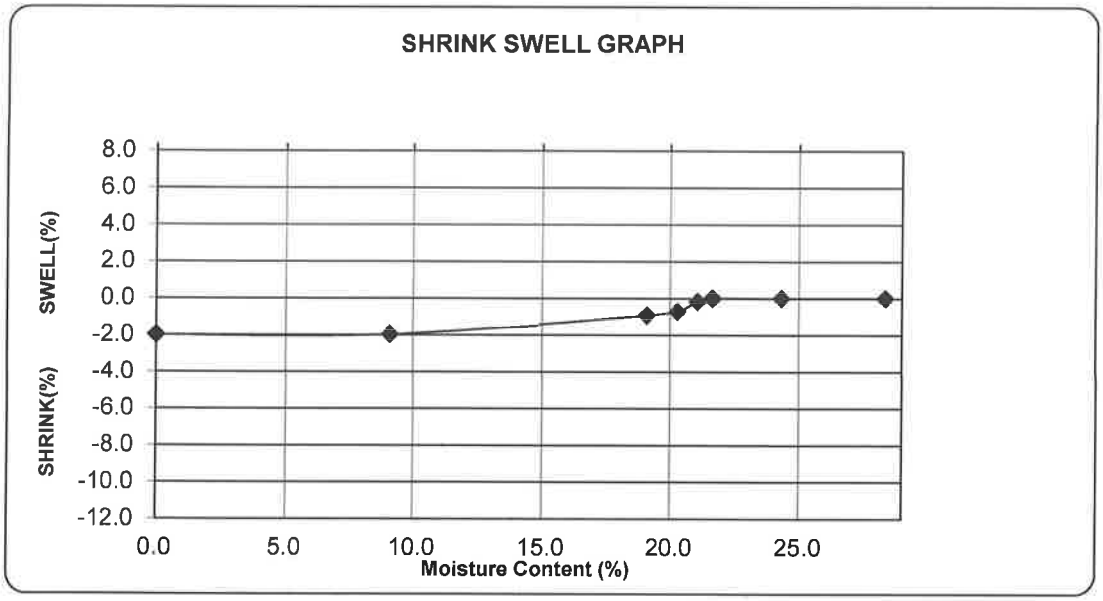
TABLE D
SHRINK - SWELL TEST REPORT
TEST METHOD: AS1289 7.1.1

Client: JK Geotechnics
Project: Proposed Eurobodalla Health Service
Location: Lot 6 DP1212271, Princes Highway, Moruya, NSW

STS Job No: 33942LT
Report: D
Report Date: 19/05/2021

Borehole No.: 26		Depth: 0.30 - 0.70m	
MOISTURE CONTENT (SWELL)		ESTIMATED UNCONFINED COMPRESSIVE STRENGTH	
BEFORE TEST	AFTER TEST	BEFORE TEST	AFTER TEST
24.3%	28.4%	150,480 kPa	230 kPa
LOAD	SETTLEMENT UNDER LOAD BEFORE SATURATION	SWELL ON SATURATION	SHRINKAGE
25	-0.7%	0.0%	2.0%



SHRINK SWELL INDEX
1.09 %/pF

Notes: Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 28/04/2021.

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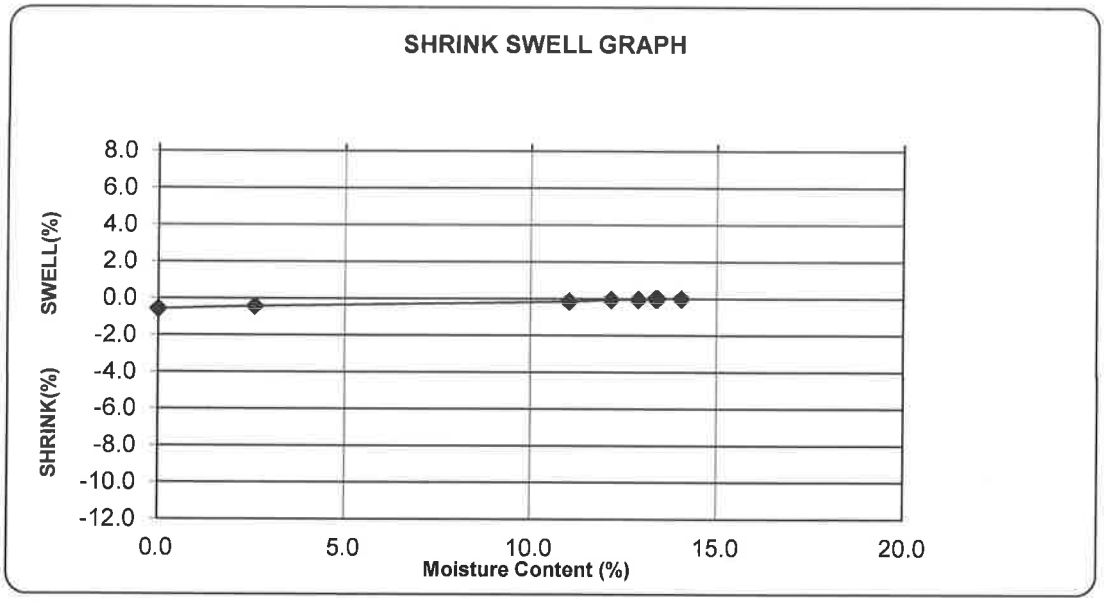
TABLE D
SHRINK - SWELL TEST REPORT
TEST METHOD: AS1289 7.1.1

Client: JK Geotechnics
Project: Proposed Eurobodalla Health Service
Location: Lot 6 DP1212271, Princes Highway, Moruya, NSW

STS Job No: 33942LT
Report: D
Report Date: 19/05/2021

Borehole No.: 31		Depth: 0.30 - 0.50m			
MOISTURE CONTENT (SWELL)		ESTIMATED UNCONFINED COMPRESSIVE STRENGTH			
BEFORE TEST	AFTER TEST	BEFORE TEST		AFTER TEST	
13.3%	14.0%	200	kPa	130	kPa
LOAD	SETTLEMENT UNDER LOAD BEFORE SATURATION		SWELL ON SATURATION	SHRINKAGE	
25	-0.5%		0.0%	0.6%	



SHRINK SWELL INDEX
0.32 %/pF

Notes: Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 28/04/2021.

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Authorised Signature / Date (D. Treweek) 19/5/21

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Macquarie Park, NSW 2113
PO Box 976
North Ryde, Bc 1670
Telephone: 02 9888 5000
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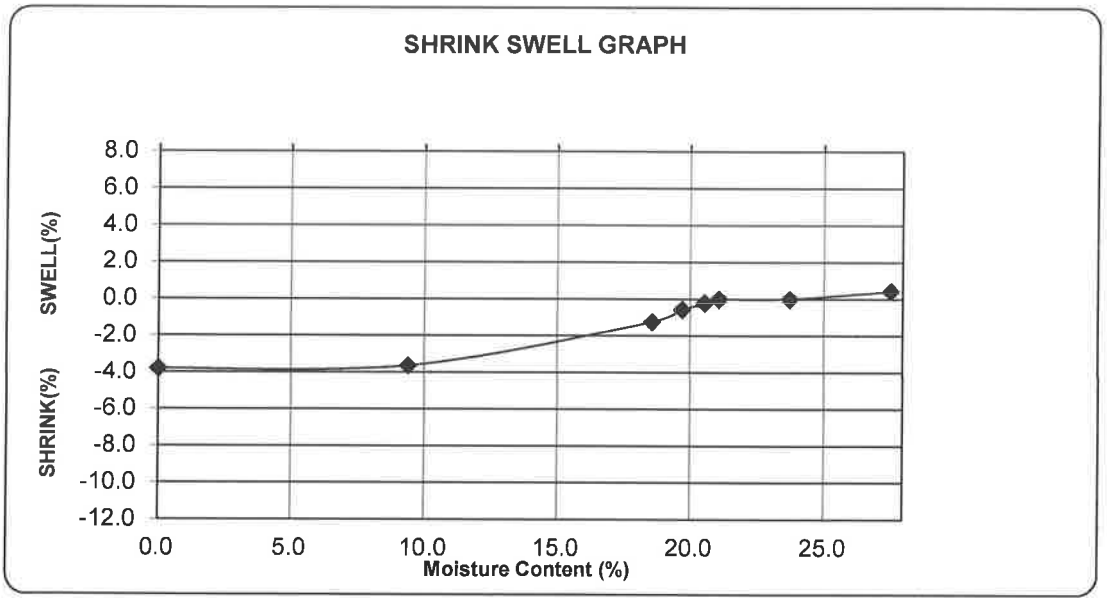
SOIL TEST SERVICES
ABN 43 002 145 173

TABLE D
SHRINK - SWELL TEST REPORT
TEST METHOD: AS1289 7.1.1

Client: JK Geotechnics
Project: Proposed Eurobodalla Health Service
Location: Lot 6 DP1212271, Princes Highway, Moruya, NSW

STS Job No: 33942LT
Report: D
Report Date: 19/05/2021

Borehole No.: 37		Depth: 0.30 - 0.55m			
MOISTURE CONTENT (SWELL)		ESTIMATED UNCONFINED COMPRESSIVE STRENGTH			
BEFORE TEST	AFTER TEST	BEFORE TEST		AFTER TEST	
23.7%	27.5%	300	kPa	240	kPa
LOAD	SETTLEMENT UNDER LOAD BEFORE SATURATION		SWELL ON SATURATION		SHRINKAGE
25	-0.6%		0.4%		3.8%



SHRINK SWELL INDEX
2.20 %/pF

Notes: Sampled and supplied by client. Sample tested as received.
- Suction Value used in calculation = 1.8pF
- Volume Change Coefficient (α) was assumed = 2
- Inert Inclusions by volume = 0-5%
- Shrinkage Cracking = Moderate
- Soil Crumbling = none
- Date of receipt of sample: 28/04/2021.

NATA
NATA Accredited Laboratory Number:1327

Authorised Signature / Date (D. Treweek) 19/5/21

TABLE E
POINT LOAD STRENGTH INDEX TEST REPORT

Client: Health Infrastructure **Ref No:** 33942LT

Project: Proposed Eurobodalla Health Service **Report:** E

Location: Lot 6 DP1212271, Princes Highway, MORUYA, NSW **Report Date:** 23/04/21

BOREHOLE NUMBER	DEPTH (m)	$I_{S(50)}$ (MPa)	ESTIMATED UNCONFINED COMPRESSIVE STRENGTH (MPa)	TEST DIRECTION
3	9.67 - 9.71	0.1	2	A
	10.19 - 10.24	6.2	124	A
	10.76 - 10.80	7.2	144	A
	11.25 - 11.29	5.4	108	A
4	20.20 - 20.24	2.4	48	A
	20.70 - 20.74	0.6	12	A
6	9.36 - 9.39	0.09	2	A
	9.85 - 9.89	0.1	2	A
	10.32 - 10.36	0.1	2	A
	11.32 - 11.36	5	100	A
7	6.60 - 6.64	0.6	12	A
	6.87 - 6.91	0.5	10	A
	7.29 - 7.34	0.5	10	A
	7.67 - 7.70	2.1	42	A
	8.32 - 8.36	5.5	110	A
	8.75 - 8.79	5.5	110	A
	9.02 - 9.05	6.4	128	A
16	8.12 - 8.16	0.07	1	A
	8.82 - 8.86	0.4	8	A
	9.26 - 9.30	0.3	6	A
	9.72 - 9.76	0.02	<1	A
	10.01 - 10.05	0.1	2	A
	10.46 - 10.50	0.2	4	A
20	7.25 - 7.29	0.06	1	A
	7.66 - 7.69	0.08	2	A

Note: See Page 2

TABLE E
POINT LOAD STRENGTH INDEX TEST REPORT

Client: Health Infrastructure **Ref No:** 33942LT

Project: Proposed Eurobodalla Health Service **Report:** E

Location: Lot 6 DP1212271, Princes Highway, MORUYA, NSW **Report Date:** 23/04/21

BOREHOLE NUMBER	DEPTH (m)	$I_{S(50)}$ (MPa)	ESTIMATED UNCONFINED COMPRESSIVE STRENGTH (MPa)	TEST DIRECTION
20	8.00 - 8.04	0.05	1	A
	8.80 - 8.83	0.07	1	A
	9.03 - 9.07	0.3	6	A
	9.56 - 9.60	0.2	4	A
24	7.33 - 7.37	0.4	8	A
	8.42 - 8.45	0.1	2	A
	8.80 - 8.84	0.2	4	A
	9.14 - 9.18	0.7	14	A
30	7.31 - 7.35	0.3	6	A
	8.62 - 8.66	0.1	2	A
	9.23 - 9.26	5.8	116	A
	9.69 - 9.73	5.3	106	A
	10.23 - 10.27	5.4	108	A
35	9.40 - 9.43	0.02	<1	A
	9.65 - 9.69	0.3	6	A
	10.20 - 10.24	0.5	10	A
	10.67 - 10.71	5.1	102	A
	11.31 - 11.35	5.1	102	A

NOTES

1. In the above table, testing was completed in test direction A for the axial direction, D for the diametral direction, B for the block test and L for the lump test.
2. The above strength tests were completed at the 'as received' moisture content.
3. Test Method: RMS T223.
4. For reporting purposes, the $I_{S(50)}$ has been rounded to the nearest 0.1MPa, or to one significant figure if less than 0.1MPa.
5. The estimated Unconfined Compressive Strength was calculated from the Point Load Strength Index based on the correlation provided in AS1726:2017 'Geotechnical Site Investigations' and rounded off to the nearest whole number: U.C.S. = 20 $I_{S(50)}$.

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CERTIFICATE OF ANALYSIS 268115

Client Details

Client	JK Geotechnics
Attention	Arthur Billingham
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**33942LT, Lot 6 DP1212271, Princes Highway, Moruya**
Number of Samples	12 Soil
Date samples received	03/05/2021
Date completed instructions received	03/05/2021

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	10/05/2021
Date of Issue	10/05/2021

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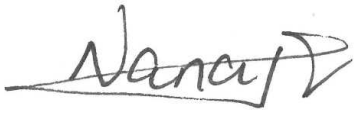
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Misc Inorg - Soil						
Our Reference		268115-1	268115-2	268115-3	268115-4	268115-5
Your Reference	UNITS	7	9	13	14	15
Depth		1.5-1.95	0.5-0.8	1.5-1.7	2.7-3.0	1.5-1.8
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	06/05/2021	06/05/2021	06/05/2021	06/05/2021	06/05/2021
Date analysed	-	06/05/2021	06/05/2021	06/05/2021	06/05/2021	06/05/2021
pH 1:5 soil:water	pH Units	5.8	6.1	5.8	6.1	5.7
Chloride, Cl 1:5 soil:water	mg/kg	53	22	94	46	180
Sulphate, SO4 1:5 soil:water	mg/kg	10	10	32	26	43
Resistivity in soil*	ohm m	130	340	96	140	52

Misc Inorg - Soil						
Our Reference		268115-6	268115-7	268115-8	268115-9	268115-10
Your Reference	UNITS	18	20	21	24	27
Depth		0.5-0.6	0.5-0.6	0.6-0.7	5.0-5.5	1.5-1.95
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	06/05/2021	06/05/2021	06/05/2021	06/05/2021	06/05/2021
Date analysed	-	06/05/2021	06/05/2021	06/05/2021	06/05/2021	06/05/2021
pH 1:5 soil:water	pH Units	5.8	5.9	5.2	7.3	6.0
Chloride, Cl 1:5 soil:water	mg/kg	40	10	20	56	35
Sulphate, SO4 1:5 soil:water	mg/kg	10	<10	110	<10	10
Resistivity in soil*	ohm m	180	320	120	160	190

Misc Inorg - Soil			
Our Reference		268115-11	268115-12
Your Reference	UNITS	35	36
Depth		0.5-0.95	0.5-0.95
Type of sample		Soil	Soil
Date prepared	-	06/05/2021	06/05/2021
Date analysed	-	06/05/2021	06/05/2021
pH 1:5 soil:water	pH Units	5.8	5.4
Chloride, Cl 1:5 soil:water	mg/kg	44	60
Sulphate, SO4 1:5 soil:water	mg/kg	<10	120
Resistivity in soil*	ohm m	170	74

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA 22nd ED 2510 and Rayment & Lyons. Resistivity is calculated from Conductivity (non NATA). Resistivity (calculated) may not correlate with results otherwise obtained using Resistivity-Current method, depending on the nature of the soil being analysed.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	268115-3
Date prepared	-			06/05/2021	1	06/05/2021	06/05/2021		06/05/2021	06/05/2021
Date analysed	-			06/05/2021	1	06/05/2021	06/05/2021		06/05/2021	06/05/2021
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	5.8	5.8	0	100	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	53	48	10	116	90
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	10	10	0	112	105
Resistivity in soil*	ohm m	1	Inorg-002	<1	1	130	140	7	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	11	06/05/2021	06/05/2021		[NT]	[NT]
Date analysed	-			[NT]	11	06/05/2021	06/05/2021		[NT]	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	11	5.8	5.7	2	[NT]	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	11	44	45	2	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	11	<10	<10	0	[NT]	[NT]
Resistivity in soil*	ohm m	1	Inorg-002	[NT]	11	170	170	0	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
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.
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.
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.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

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.

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 QA/QC tables for details; <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 (not SPOCAS); 60-140% for organics/SPOCAS (+/-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 insufficient in order to satisfy laboratory QA/QC protocols.

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.

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 and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

JKGeotechnics

BOREHOLE LOG

Borehole No.
BH1
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~7.7 m

Date: 13/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION									-	TOPSOIL: Silty sandy clay, low plasticity, brown, trace of root fibres.	w<PL			GRASS COVER
									CI	Silty sandy CLAY: medium plasticity, brown and orange brown, fine to medium grained sand, trace of fine grained quartz gravel and root fibres.	w~PL	St	120 110	RESIDUAL
					N = 43 9,20,23	7	1		-	Extremely Weathered granite: silty clayey SAND, fine to coarse grained, brown and light grey, trace of fine grained quartz gravel.	XW	D		HP ON DISTURBED WMP SAMPLE MORUYA TONALITE
					N=SPT 10/ 50mm REFUSAL	6	2							
						5	3							
					N=SPT 5/ 20mm REFUSAL	4	4							
						3	5							
						2	6			END OF BOREHOLE AT 6.00 m				GROUNDWATER MONITORING WELL INSTALLED TO 5.8m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 2.8m TO 5.8m. CASING 0.1m TO 2.8m. 2mm SAND BACKFILL 3m TO 5.8m. BENTONITE SEAL 2m TO 3m. BACKFILLED WITH CUTTINGS TO SURFACE COMPLETED WITH A CONCRETED GATIC COVER
						1								

JKGeotechnics

BOREHOLE LOG

Borehole No.
BH2
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~7.5 m

Date: 13/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■								-	TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w<PL			GRASS COVER
				■	N = 5 5,3,2	7	1		ML	Clayey sandy SILT low plasticity, brown and orange brown, fine to coarse grained sand, trace of fine grained quartz gravel and root fibres.	w<PL	VSt		RESIDUAL
▶				■	N=SPT 10/ 50mm REFUSAL	6	2		-	Extremely Weathered granite: silty clayey SAND, fine to coarse grained, brown and orange brown, trace of fine to coarse grained quartz gravel.	XW	D		MORUYA TONALITE
				■	N=SPT 15/ 100mm REFUSAL	5	3			as above, but light grey and brown.				
										GRANITE: medium to coarse grained, light grey and brown.	DW	VL - L		LOW 'TC' BIT RESISTANCE
				■	N > 7 15,7/ 50mm REFUSAL	4 3	4			GRANITE: medium to coarse grained, light grey and dark grey.		H - VH		VERY HIGH RESISTANCE
						2 1	5 6			END OF BOREHOLE AT 4.70 m				'TC' BIT REFUSAL

JKGeotechnics

BOREHOLE LOG

Borehole No.
BH3
1 / 3

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~10.8 m

Date: 21/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING									-	TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w>PL			GRASS COVER
									CI	Silty sandy CLAY: medium plasticity, brown and orange brown, fine to coarse grained sand, trace of fine grained quartz gravel and root fibres.	w<PL	VSt - Hd		RESIDUAL (0.75m) HP ON BASE OF U50 = 530kPa
					N > 27 2,7,20/ 50mm REFUSAL	10	1		-	Extremely Weathered granite: silty clayey SAND, fine to coarse grained, brown and orange brown, trace of fine grained quartz gravel.	XW	D	210 250	MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
					N = 32 12,14,18	9	2							
					N=SPT 12/ 100mm REFUSAL	8	3							
					N=SPT 6/ 50mm REFUSAL	7	4							
					N=SPT 7/ 50mm REFUSAL	6	5							
						5	6							
						4								

JKGeotechnics

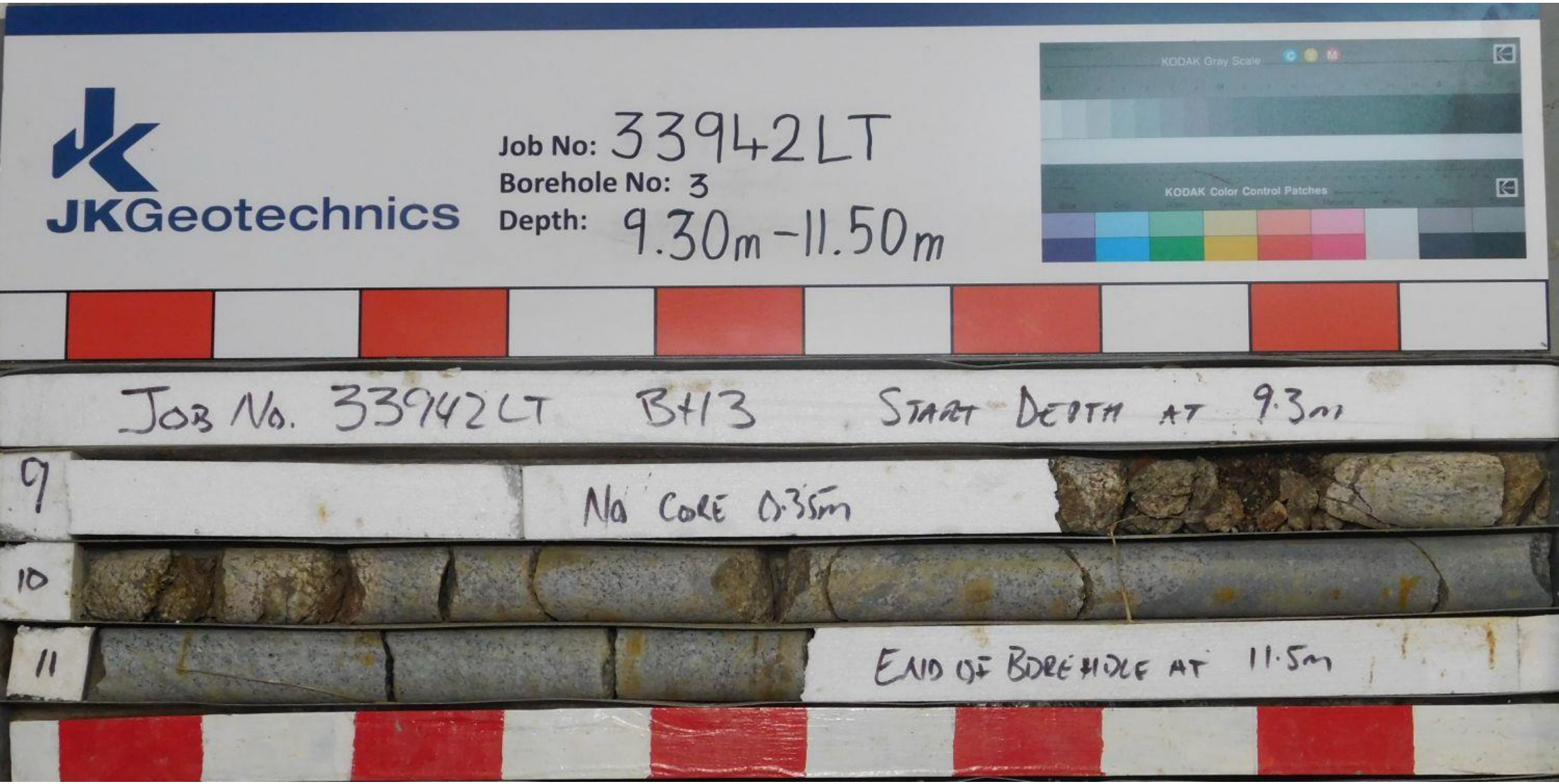
BOREHOLE LOG

Borehole No.
BH3
2 / 3

Client: HEALTH INFRASTRUCTURE
Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL
Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~10.8 m
Date: 21/4/21 **Datum:** AHD
Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
					N=SPT 5/ 0mm REFUSAL	3	8		-	Extremely Weathered granite: silty clayey SAND, fine to coarse grained, brown and orange brown, trace of fine grained quartz gravel. *(continued)*	XW	D		
						2	9			GRANITE: medium to coarse grained, light brown, light grey and dark grey.	DW	VL		LOW RESISTANCE
						1	10			REFER TO CORED BOREHOLE LOG				
						0	11							
						-1	12							
						-2	13							
						-3								


JKGeotechnics
Job No: 33942LT
Borehole No: 3
Depth: 9.30m-11.50m
KODAK Gray Scale
KODAK Color Control Patches
JOB No. 33942LT BH3 START DEPTH AT 9.3m
9
NO CORE 0.35m
10
11
END OF BOREHOLE AT 11.5m

JKGeotechnics

CORED BOREHOLE LOG

Borehole No. BH3 3 / 3

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Core Size:** NMLC **R.L. Surface:** ~10.8 m

Date: 21/4/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** W.S./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS SPACING (mm) DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
					START CORING AT 9.30m					
100% RETURN		1 0 -1 -2 -3 -4 -5	10 11 12 13 14 15		NO CORE 0.35m GRANITE: medium to coarse grained, light grey, dark grey and brown. as above, but light grey and dark grey. as above, but dark grey. GRANITE: medium to coarse grained, light grey diorite and dark grey. END OF BOREHOLE AT 11.50 m	HW FR	L - M VH	0.10 6.2 7.2 5.4	(9.70m) XWS, 0°, 150 mm.t (9.87m) J x 2, 70°, P, R, Cn (9.95m) J, 65°, P, R, Cn (10.07m) J, 10°, P, R, Cn (10.18m) J, 25°, P, R, Cn (10.47m) J, 20°, P, R, Cn (10.52m) J, 20°, P, R, Cn (10.65m) J, 30°, P, R, Cn	MORUYA TONALITE

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No.
BH4
1 / 5

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~17.2 m

Date: 20/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING						17			-	TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sands, trace of root fibres.	w<PL			GRASS COVER
									CI		w~PL			RESIDUAL
									-	Silty sandy CLAY: medium plasticity, brown and orange brown, fine to coarse grained sand, trace of fine grained quartz gravel and root fibres.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
					N=SPT 12/ 100mm REFUSAL					Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, brown and orange brown, fine grained quartz gravel.				
					N > 12 12,12/ 50mm REFUSAL	16	1							
					N=SPT 5/ 50mm REFUSAL	15	2							
					N=SPT 10/ 50mm REFUSAL	14	3							VERY LOW RESISTANCE WITH LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
					N=SPT 8/ 50mm REFUSAL	13	4							
						12	5							
						11	6							

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BOREHOLE LOG

Borehole No.
BH4
2 / 5

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~17.2 m

Date: 20/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
					N=SPT 10/ 50mm REFUSAL	10			-	Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, brown and orange brown, fine grained quartz gravel. *(continued)*	XW	D		
					N=SPT 5/ 0mm REFUSAL	9	8							
					N=SPT 5/ 0mm REFUSAL	8	9							
						7	10							
						6	11							
						5	12							
						4	13							

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BOREHOLE LOG

Borehole No.
BH4
3 / 5

Client: HEALTH INFRASTRUCTURE
Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL
Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~17.2 m
Date: 20/4/21 **Datum:** AHD
Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
						3			-	Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, brown and orange brown, fine grained quartz gravel. *(continued)*	XW	D		
						2	15			REFER TO CORED BOREHOLE LOG				
						1	16							
						0	17							
						-1	18							
						-2	19							
						-3	20							

JKGeotechnics

CORED BOREHOLE LOG

Borehole No.
BH4
4 / 5

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Core Size:** NMLC **R.L. Surface:** ~17.2 m

Date: 20/4/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** W.S./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DETAILS SPACING (mm) 600 200 60 20	DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		3			START CORING AT 14.90m						
100% RETURN		2	15		NO CORE 5.25m						
		1	16								
		0	17								
		-1	18								
		-2	19								
		-3	20		GRANITE: medium to coarse grained quartz, brown and dark grey.	SW	M - H	•2.4		(20.27m) J, 60°, P, R, Cn (20.40m) J, 75°, P, R, Cn	MORUYA TONALITE
					GRANITE: as below	FR		•0.60			

JK 9.02.4 LIB.GLB Log JK CORED BOREHOLE - MASTER 33942LT MORUYA.GPJ <<DrawingFile>> 28/07/2022 14:36 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

CORED BOREHOLE LOG

Borehole No.
BH4
5 / 5

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Core Size:** NMLC **R.L. Surface:** ~17.2 m

Date: 20/4/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** W.S./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DETAILS SPACING (mm) 600 200 60 20	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		-4			GRANITE: medium to coarse grained quartz, light grey and dark grey.	FR	M - H			(21.20m) J, 70 - 90°, P, R, Cn	
		-5	22		END OF BOREHOLE AT 21.50 m						
		-6	23								
		-7	24								
		-8	25								
		-9	26								
		-10	27								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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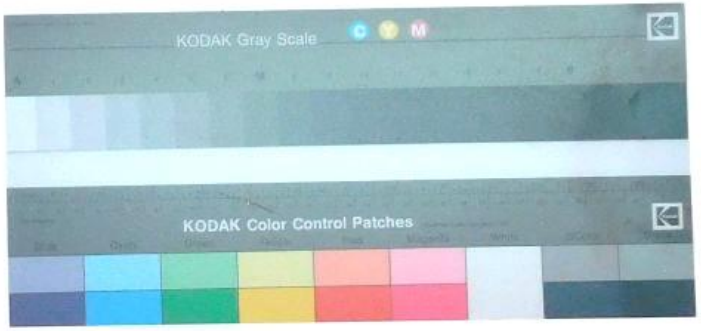
Job No: 33942LT
Borehole No: 4
Depth: 14.90m – 21.50m



JOB NO 33942LT BH 4 START DEPTH AT 14.9m

15

16 NO CORE 5.25m

17

18

19

20

21 END OF BOREHOLE AT 21.5m

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BOREHOLE LOG

Borehole No.
BH5
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~16.5 m

Date: 15/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION									-	TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CH	Silty sandy CLAY: high plasticity, brown and grey, fine to coarse grained sand, with fine grained quartz gravel and root fibres.	w<PL	VSt - Hd		RESIDUAL
				■	N > 10 3,10/ 100mm REFUSAL	16			-	Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown.	XW	D	340 300 460	MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
				■	N=SPT 13/ 100mm REFUSAL	15	1							
				■	N=SPT 11/ 100mm REFUSAL	14	2							
				■	N=SPT 6/ 50mm REFUSAL	13	3							
						12	4							
						11	5			GRANITE: medium to coarse grained, light grey, light brown and dark grey.	DW	VL		LOW RESISTANCE
						10	6			END OF BOREHOLE AT 6.00 m				

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BOREHOLE LOG

Borehole No.
BH6
1 / 2

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~14.3 m

Date: 20/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING									-	TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
						14			CH		w>PL	VSt - Hd		RESIDUAL
					N > 9 8,9/ 150mm REFUSAL					Silty sandy CLAY: high plasticity, brown and grey, fine to coarse grained sand, with fine to coarse grained quartz gravel and root fibres.			380 430	
							1		-	Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
					N=SPT 10/ 100mm REFUSAL	13								
							2							
						12								
					N=SPT 5/ 50mm REFUSAL		3							
						11								
							4			GRANITE: medium to coarse grained, light grey, light brown and dark grey.	DW	VL		LOW RESISTANCE
					N=SPT 7/ 50mm REFUSAL	10								
							5							
						9								
										REFER TO CORED BOREHOLE LOG				LOW RESISTANCE WITH MODERATE BANDS
							6							SAMPLE OF RETURN CUTTINGS COLLECTED. GRAVELLY SAND FINE TO MEDIUM GRAINED, QUARTZ GRAVEL.
						8								

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CORED BOREHOLE LOG

Borehole No.
BH6
2 / 2

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Core Size:** NMLC **R.L. Surface:** ~14.3 m

Date: 20/4/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** W.S./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DETAILS SPACING (mm) 600 200 60 20	DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		9			START CORING AT 5.60m						
100% RETURN		8	6		NO CORE 3.57m						
		7	7								
		6	8								
		5	9		GRANITE: medium to coarse grained, light grey, dark grey and light brown.	MW	L	0.090 0.10 0.10		(9.65m) J, 35°, P, R, Cn (9.72m) J, 35°, P, R, Cn (10.25m) J, 45°, P, R, Cn	MORUYA TONALITE
		4	10								
		3	11		as above, but light grey and dark grey.	FR	VH	5.0		(10.72m) XWS, 0°, 20 mm.t	
					END OF BOREHOLE AT 11.50 m						

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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Job No: 33942LT
Borehole No: 6
Depth: 5.60m – 11.50m

JOB NO 33942LT BH6 START DEPTH AT 5.6m

5 NQ CORE 3.57m

6

7

8

9

10

11 END OF BOREHOLE AT 11.50m

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BOREHOLE LOG

Borehole No.
BH7
1 / 2

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~9.1 m

Date: 21/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING						9			-	TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CH		w~PL	VSt		RESIDUAL
				■	N = 13 4,5,8					Silty sandy CLAY: high plasticity, brown and grey, fine to coarse grained sand, with fine grained quartz gravel and root fibres.			270 290	
						8	1							
									-	Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
				■	N = 31 12,14,17	7	2							
					N=SPT 8/ 50mm REFUSAL	6	3							
							4							VERY LOW RESISTANCE WITH LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
				■	N=SPT 6/ 50mm REFUSAL	5	5							
						4								
				■		3	6			GRANITE: medium to coarse grained sand and quartz gravel, light grey, dark grey and red brown.	DW	L - M		LOW RESISTANCE WITH MODERATE BANDS
										REFER TO CORED BOREHOLE LOG				

JKGeotechnics

CORED BOREHOLE LOG

Borehole No.
BH7
2 / 2

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

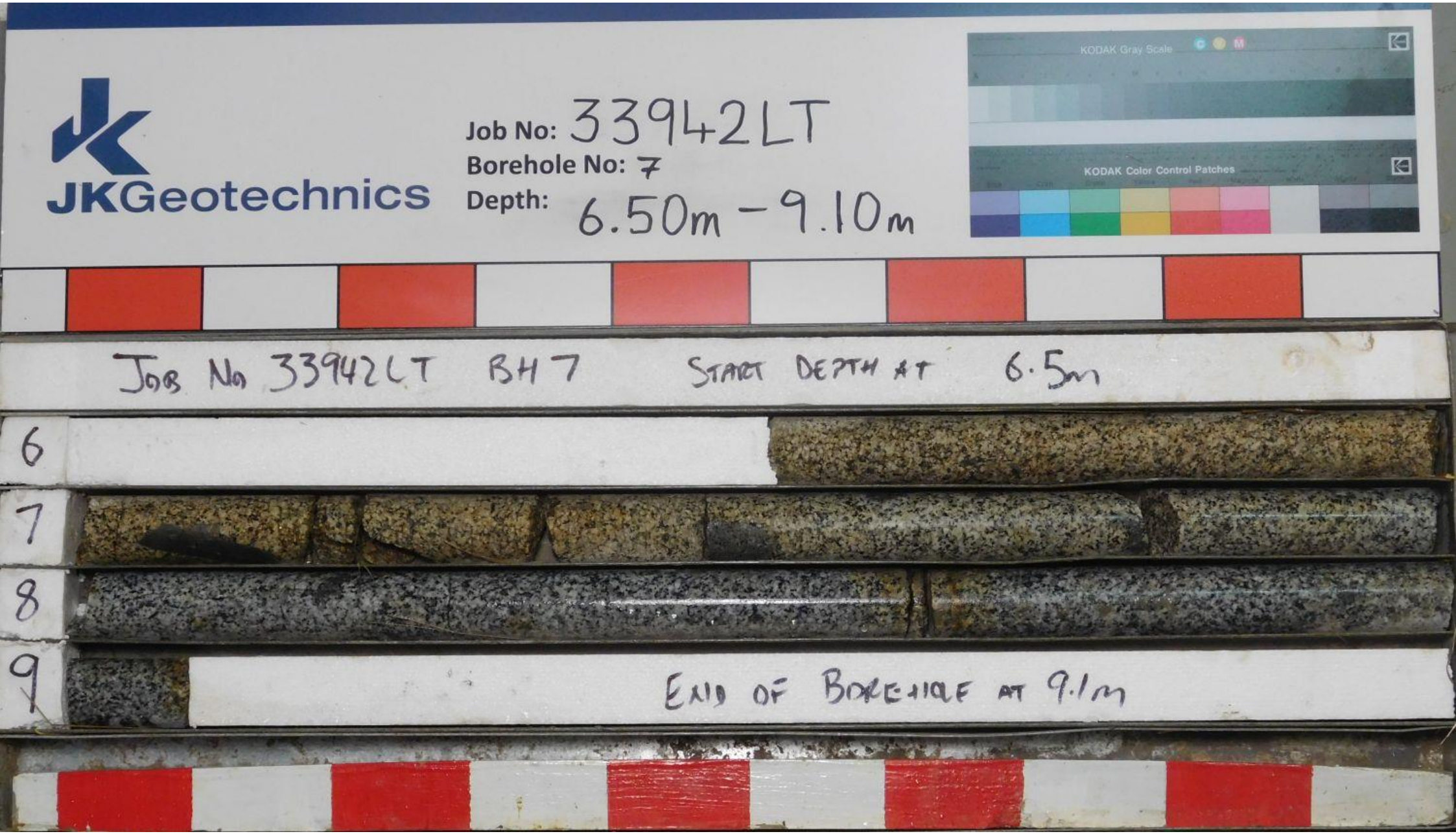
Job No.: 33942LT **Core Size:** NMLC **R.L. Surface:** ~9.1 m

Date: 21/4/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** W.S./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS SPACING (mm) DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		3			START CORING AT 6.50m					
100% RETURN		2	7		GRANITE: medium to coarse grained, light grey, dark grey and light brown.	MW	M	0.60, 0.50, 0.50, 2.1	(7.20m) J, 65°, P, R, Cn	MORUYA TONALITE
					as above, but light grey and dark grey.	SW				
		1	8			FR	VH	5.5, 5.5, 6.4	(8.10m) Ji, 50 - 90°, Un (8.60m) J, 0°, P, R, Fe Sn	
		0	9		END OF BOREHOLE AT 9.10 m					
		-1	10							
		-2	11							
		-3	12							

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS


JKGeotechnics
Job No: 33942LT
Borehole No: 7
Depth: 6.50m - 9.10m
KODAK Gray Scale
KODAK Color Control Patches
JOB No 33942LT BH 7 START DEPTH AT 6.5m
6
7
8
9
END OF BOREHOLE AT 9.1m

JKGeotechnics

BOREHOLE LOG

Borehole No.
BH8
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~12.7 m

Date: 14/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION										TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CH	Silty sandy CLAY: high plasticity, brown and orange brown, fine to coarse grained sand, trace of fine grained quartz gravel and root fibres.	w<PL	VSt - Hd	350 360 440	RESIDUAL
				■	N > 22 3,12,10/ 50mm REFUSAL	12								
							1		-	Extremely Weathered granite: silty clayey SAND, fine to coarse grained, light grey, brown and orange brown,with fine grained quartz gravel.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
				■	N > 34 15,22,12/ 50mm REFUSAL	11	2							
				■	N=SPT 15/ 100mm REFUSAL	10	3							
						9	4							
				■	N=SPT 22/ 150mm REFUSAL	8				GRANITE: medium to coarse grained, light grey, brown and dark grey.	DW	VL		LOW RESISTANCE
							5							
					N=SPT 5/ 0mm REFUSAL	7	6			END OF BOREHOLE AT 6.00 m				NO SPT SAMPLE RETURN
						6								

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BOREHOLE LOG

Borehole No.
BH9
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~13.4 m

Date: 14/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION										TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CI	Silty sandy CLAY: medium plasticity, brown and grey, fine to coarse grained sand, trace of fine grained quartz gravel and root fibres.	w~PL	VSt	250 260 270	RESIDUAL
					N = 10 2,3,7	13				Silty sandy CLAY: medium plasticity, light brown, fine to coarse grained sand, with fine to medium grained quartz gravel.	w<PL			
						12	1							
					N = 17 7,8,9								350 350 360	
						11	2		-	Extremely Weathered granite: silty clayey SAND, fine to coarse grained, light grey brown and light grey, with fine to coarse grained quartz gravel.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
					N = 29 10,14,15	10	3							
							4							BANDS OF LOW RESISTANCE (POSSIBLY LESS WEATHERED CORE STONES)
					N=SPT 10/ 50mm REFUSAL	9								
							5			GRANITE: Fine to medium grained quartz and sand, white, grey and red brown.	DW	L - M		LOW TO MODERATE RESISTANCE
						8								
							6			END OF BOREHOLE AT 6.00 m				
						7								

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BOREHOLE LOG

Borehole No.
BH10
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~17.1 m

Date: 14/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■					17				TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CI		w<PL	Hd		RESIDUAL
			■	■	N = 11 5,5,6					Silty sandy CLAY: medium plasticity, brown and grey, fine to coarse grained sand, trace of fine grained quartz gravel and root fibres.			>600 >600	
						16	1							
				■	N=SPT 13/ 100mm REFUSAL				-	Extremely Weathered granite: silty clayey SAND, fine to coarse grained, light grey, brown and orange brown, with fine grained quartz gravel.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
						15	2							
				■	N=SPT 6/ 50mm REFUSAL					GRANITE: medium to coarse grained, light grey brown and dark grey.	DW	VL		LOW RESISTANCE
						14	3							
							4							LOW RESISTANCE WITH MODERATE BANDS (POSSIBLY LESS WEATHERED CORE STONES)
					N=SPT 5/ 0mm REFUSAL	13								
							5							
				■		12								
							6			GRANITE: medium to coarse grained, light grey and dark grey.		M		MODERATE RESISTANCE
						11				END OF BOREHOLE AT 6.00 m				

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BOREHOLE LOG

Borehole No. BH11 1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~19.4 m

Date: 14/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION										TOPSOIL: silty sandy clay, low plasticity, brown, fine to coarse grained sands, trace of root fibres.	w~PL			GRASS COVER
						19			CH	Silty sandy CLAY: high plasticity, brown and grey, fine to coarse grained sand, trace of fine grained quartz gravel and root fibres.	w<PL	VSt		RESIDUAL
					N=SPT 22/ 150mm REFUSAL				-	Extremely Weathered granite: silty clayey SAND, fine to coarse grained, light grey, brown and orange brown, with fine grained quartz gravel.	XW	D	350	MORUYA TONALITE
					N=SPT 12/ 150mm REFUSAL	18	1							VERY LOW 'TC' BIT RESISTANCE
					N=SPT 7/ 50mm REFUSAL	17	2							VERY LOW RESISTANCE WITH LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
					N=SPT 5/ 0mm REFUSAL	16	3							
						15	4			GRANITE: medium to coarse grained, light grey, dark grey and brown.	DW	VL - L		LOW RESISTANCE WITH MODERATE BANDS
						14	5			GRANITE: medium to coarse grained, light grey and dark grey and brown.		L - M		MODERATE RESISTANCE
						13	6			END OF BOREHOLE AT 6.00 m				

JKGeotechnics

BOREHOLE LOG

Borehole No. BH12 1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~21.1 m

Date: 15/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■					21				TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CI		w>PL			RESIDUAL
				■	N = 37 13,23,14				-	Silty sandy CLAY: medium plasticity, brown and grey, fine to coarse grained sand, with fine grained quartz gravel and root fibres.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
						20	1			Extremely Weathered granite: clayey SAND, fine to coarse grained, light grey, brown and orange brown, with fine grained quartz gravel.				
				■	N=SPT 11/ 100mm REFUSAL	19	2							
				■	N=SPT 8/ 50mm REFUSAL	18	3			GRANITE: medium to coarse grained, light grey and dark grey.	DW	VH		VERY HIGH RESISTANCE
										END OF BOREHOLE AT 3.20 m				'TC' BIT REFUSAL
						17	4							
						16	5							
						15	6							

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BOREHOLE LOG

Borehole No.
BH13
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~16.7 m

Date: 15/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION										TOPSOIL: silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CH	Silty sandy CLAY: high plasticity, brown and grey, fine to coarse grained sand, with fine grained quartz gravel and root fibres.	w>PL	VSt		RESIDUAL
					N > 14 4,14/ 150mm REFUSAL	16					w~PL	Hd	290 600	MORUYA TONALITE
							1		-	Extremely Weathered granite: clayey gravelly SAND, fine grained, fine grained quartz gravel, light grey, brown and orange brown.	XW	D		VERY LOW 'TC' BIT RESISTANCE
					N > 10 10,10/ 50mm REFUSAL	15	2							
					N > 5 10,5/ 50mm REFUSAL	14								NO SPT SAMPLE RETURN
							3			END OF BOREHOLE AT 2.90 m				VERY HIGH RESISTANCE 'TC' BIT REFUSAL
						13	4							
						12	5							
						11	6							
						10								

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BOREHOLE LOG

Borehole No.
BH14
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~12.0 m

Date: 15/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■									TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CH		w>PL	VSt		RESIDUAL
				■	N=SPT 12/ 100mm REFUSAL					Sandy silty CLAY: high plasticity, brown and grey, fine to coarse grained sand, with fine grained quartz gravel and root fibres.			250 230 200	
						11	1		-	Extremely Weathered granite: clayey gravelly SAND, fine grained, fine to coarse grained quartz gravel, light grey, brown and orange brown.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
				■	N = 46 12,22,24	10	2							
				■	N > 36 13,16,20/ 50mm REFUSAL	9	3							
					N=SPT 5/ 0mm REFUSAL	8	4							
						7	5			GRANITE: medium to coarse grained, dark and light grey.	DW	L - M		LOW RESISTANCE WITH MODERATE BANDS
						6	6			END OF BOREHOLE AT 6.00 m				

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BOREHOLE LOG

Borehole No.
BH15
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~15.5 m

Date: 14/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION										TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									Cl	Silty sandy CLAY: medium plasticity, brown and grey, fine to coarse grained sand and quartz gravel, trace of fine grained quartz gravel and root fibres.	w>PL	Hd	400 550 >600	RESIDUAL
					N = 16 3,6,10	15	1							
					N > 29 8,18,11/ 50mm REFUSAL	14	2		-	Extremely Weathered granite: clayey sandy GRAVEL, fine to medium grained quartz, light grey, brown and orange brown, fine to coarse grained sand.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
					N=SPT 7/ 50mm REFUSAL	13	3							
						12	4							
					N=SPT 9/ 80mm REFUSAL	11	5							
						10	6			GRANITE: medium to coarse grained, light grey and dark grey.	DW	L - M		LOW TO MODERATE RESISTANCE
										END OF BOREHOLE AT 6.00 m				
						9								

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BOREHOLE LOG

Borehole No.
BH16
1 / 3

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~17.9 m

Date: 17/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING	■									TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CI		w>PL			RESIDUAL
				■	N=SPT 10/ 100mm REFUSAL				-	Silty sandy CLAY: medium plasticity, brown and grey, fine to coarse grained sand and quartz gravel, trace of fine grained quartz gravel and root fibres.	XW	D	>600	MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
						17	1			Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, light grey, brown and orange brown, fine grained quartz gravel.				
				■	N=SPT 20/ 150mm REFUSAL	16	2							
				■	N > 13 13,13/ 100mm REFUSAL	15	3							
				■	N=SPT 8/ 50mm REFUSAL	14	4							
						13	5			Extremely Weathered granite: gravelly SAND, fine to coarse grained, light grey, brown and orange brown, fine to coarse grained quartz gravel, trace of fines.				VERY LOW RESISTANCE WITH LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
					N=SPT 5/ 0mm REFUSAL	12	6							
						11								

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BOREHOLE LOG

Borehole No.
BH16
2 / 3

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~17.9 m

Date: 17/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
					N=SPT 10/ 50mm REFUSAL				-	Extremely Weathered granite: gravelly SAND, fine to coarse grained, light grey, brown and orange brown, fine to coarse grained quartz gravel, trace of fines.	XW	D		
										GRANITE: medium to coarse grained, dark grey and light grey.	DW	L - M		MODERATE RESISTANCE
						10	8			REFER TO CORED BOREHOLE LOG				
						9	9							
						8	10							
						7	11							
						6	12							
						5	13							
						4								

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CORED BOREHOLE LOG

Borehole No.
BH16
3 / 3

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

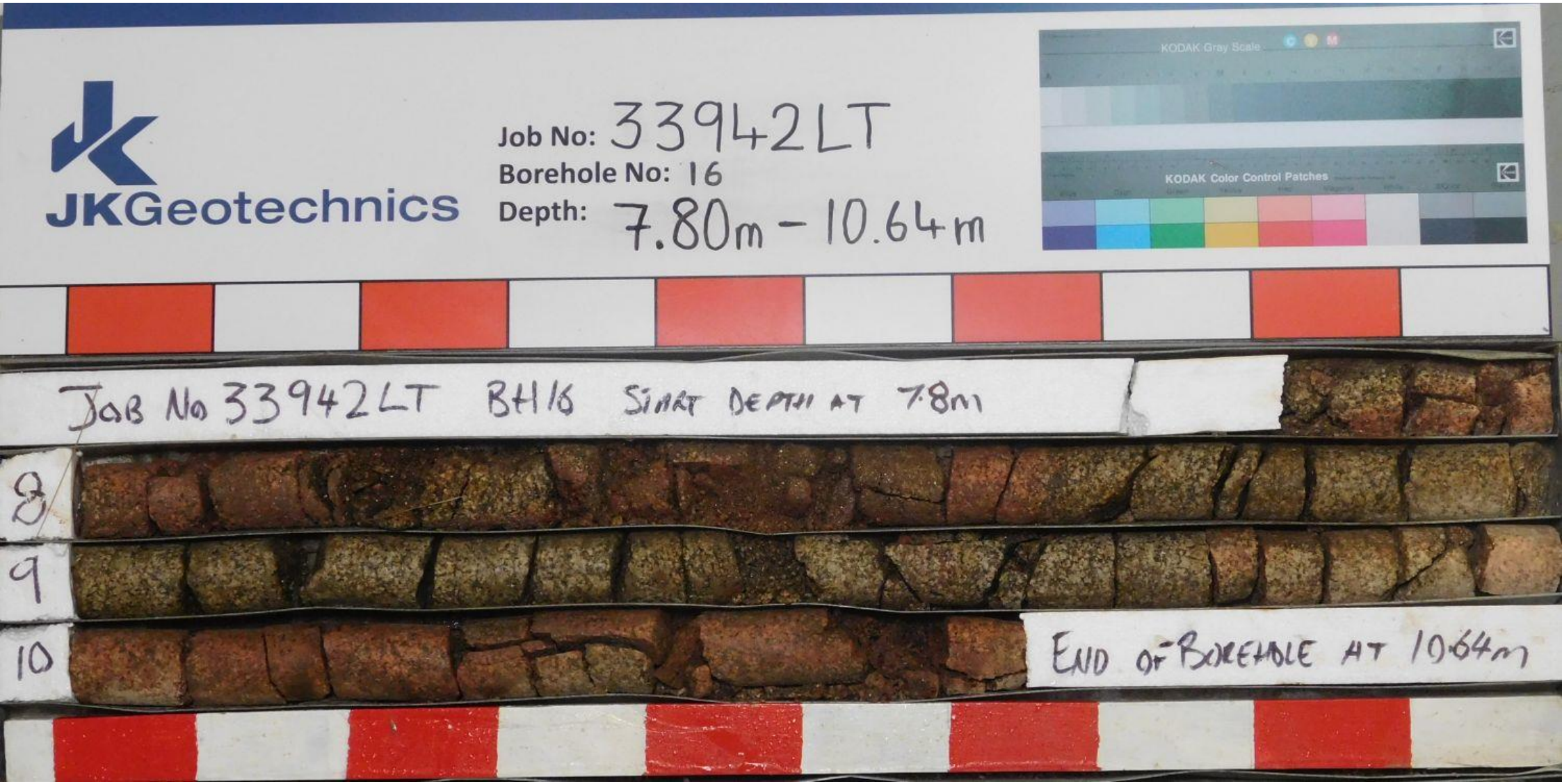
Job No.: 33942LT **Core Size:** NMLC **R.L. Surface:** ~17.9 m

Date: 17/4/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** W.S./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS SPACING (mm)	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
					START CORING AT 7.80m						
100% RETURN		10 9 8 7 6 5 4	8 9 10 11 12 13		GRANITE: medium to coarse grained, red brown, dark grey and light grey.	MW	L	0.070 0.40 0.30 0.020 0.10 0.20	600 200 60 20	(7.94m) J, 90°, P, S, Cn (8.21m) J, 15°, P, R, Cn (8.40m) J, 60 - 90°, Cu, R, Fe Sn, XW infill (8.74m) J, 45°, P, R, Cn (8.90m) J, 20°, P, R, Cn (9.13m) J, 0 - 20°, Cu, R, Cn (9.22m) J, 0 - 20°, Cu, R, Cn (9.50m) J, 40°, P, S, XW infill (9.55m) J, 40 - 90°, P, R, Cn (9.78m) J, 20°, P, R, Cn (9.90m) J, 70°, P, R, Fe Sn (10.30m) J, 75 - 90°, P, R, Fe Sn	MORUYA TONALITE
					END OF BOREHOLE AT 10.64 m						

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS


JKGeotechnics
Job No: 33942LT
Borehole No: 16
Depth: 7.80m - 10.64m
KODAK Gray Scale
KODAK Color Control Patches
JOB No 33942LT BH16 START DEPTH AT 7.8m
8
9
10
END OF BOREHOLE AT 10.64m

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BOREHOLE LOG

Borehole No. BH17 1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~17.4 m

Date: 14/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■					17	0		-	TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CL		w<PL			RESIDUAL
				■	N = 35 8,13,22				-	Silty sandy CLAY: low plasticity, brown and grey, fine to coarse grained sand and quartz gravel, trace of fine grained quartz gravel and root fibres.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
							1			Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, light grey, brown and orange brown, fine grained quartz gravel.				
				■	N=SPT 15/ 150mm REFUSAL	16								
							2							
						15								
				■	N=SPT 14/ 100mm REFUSAL		3							
						14								
							4							LOW RESISTANCE WITH VERY LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
				■	N=SPT 5/ 20mm REFUSAL	13								
							5							
						12								
							6			END OF BOREHOLE AT 6.00 m				
						11								

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BOREHOLE LOG

Borehole No.
BH18
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~19.3 m

Date: 14/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION									-	TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sands, trace of root fibres.	w~PL			GRASS COVER
						19			CL		w<PL			RESIDUAL
					N=SPT 20/ 100mm REFUSAL				-	Silty sandy CLAY: low plasticity, brown and grey, fine to coarse grained sand, trace of fine grained quartz gravel and root fibres.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
							1			Extremely Weathered GRANITE: Clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown.				
						18								
					N > 15 12,15/ 150mm REFUSAL		2							
						17								
					N=SPT 5/ 20mm REFUSAL		3							
						16								GROUNDWATER MONITORING WELL INSTALLED TO 5.8m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 2.8m TO 5.8m. CASING 0.1m TO 2.8m. 2mm SAND BACKFILL 3m TO 5.8m. BENTONITE SEAL 2m TO 3m. BACKFILLED WITH CUTTINGS TO SURFACE COMPLETED WITH A CONCRETED GATIC COVER
							4							
					N=SPT 6/ 20mm REFUSAL	15								
							5							VERY LOW RESISTANCE WITH LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
						14								
							6			GRANITE: medium to coarse grained quartz gravel and sand, orange brown, white grey and dark grey.	DW	M		MODERATE RESISTANCE
						13				END OF BOREHOLE AT 6.00 m				

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BOREHOLE LOG

Borehole No.
BH19
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~20.0 m

Date: 17/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■									TOPSOIL: Silty sandy clay, medium plasticity, brown grey, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CI	Silty sandy CLAY: medium plasticity, brown and grey, fine to coarse grained sand, trace of fine grained quartz gravel and root fibres.	w<PL	VSt - Hd		RESIDUAL
				■	N = 23 3,8,15				-	Extremely Weathered granite: Clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
						19	1							
				■	N=SPT 10/ 100mm REFUSAL					GRANITE: medium to coarse grained, orange brown, grey and dark grey.	DW			VERY LOW RESISTANCE WITH LOW BANDS
						18	2					M		MODERATE RESISTANCE
										END OF BOREHOLE AT 2.20 m				'TC' BIT REFUSAL
						17	3							
						16	4							
						15	5							
						14	6							

JK 9.02.4 LIB:GLB Log JK AUGERHOLE - MASTER 33942LT MORUYA.GPJ <<DrawingFile>> 28/07/2022 14:43 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

JKGeotechnics

BOREHOLE LOG

Borehole No.
BH20
1 / 2

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~20.6 m

Date: 17/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING	■									TOPSOIL: Silty sandy clay, medium plasticity, brown grey, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									Cl	Sandy silty CLAY: medium plasticity, brown and grey, fine to coarse grained sand, trace of fine grained quartz gravel and root fibres.	w~PL	St		RESIDUAL
				■	N = 21 3,7,14	20			-	Extremely Weathered granite: Clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown, trace of silt.	XW	D	170 / 200	MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
				■	N=SPT 12/ 100mm REFUSAL	19	1							
				■	N=SPT 8/ 50mm REFUSAL	18	2			Extremely Weathered granite: gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown.				
				■	N=SPT 5/ 20mm REFUSAL	17	3							
						16	4							VERY LOW RESISTANCE WITH LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
						15	5			GRANITE: medium to coarse grained, brown, light grey and dark grey.	DW	(L - M)		LOW RESISTANCE
										REFER TO CORED BOREHOLE LOG				
						14	6							

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CORED BOREHOLE LOG

Borehole No. BH20 2 / 2

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Core Size:** NMLC **R.L. Surface:** ~20.6 m

Date: 17/4/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** W.S./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
		15			START CORING AT 5.70m						
			6		NO CORE 1.20m						
		14									
80% RETURN			7		GRANITE: medium to coarse grained, light brown, light grey and dark grey.	HW	VL	0.060		(7.35m) J, 40°, P, R, Cn	MORUYA TONALITE
		13						0.080		(7.80m) J, 80 - 90°, C, R, Fe Sn	
			8					0.050		(8.05m) J, 70°, P, R, Cn	
										(8.30m) J, 20°, P, R, Fe Sn	
										(8.43m) J, 28°, P, R, Fe Sn	
		12								(8.65m) XWS, 0°, 50 mm.t	
								0.070		(8.88m) J, 20°, P, R, Fe Sn	
			9			MW	L	0.30		(9.17m) J, 45°, P, R, Cn	
										(9.32m) J, 55°, P, R, Cn	
		11						0.20		(9.55m) J, 60°, P, R, Cn	
										(9.73m) XWS, 0°, 100 mm.t	
			10		END OF BOREHOLE AT 9.80 m						
		10									
			11								
		9									

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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Job No: 33942LT
Borehole No: 20
Depth: 5.70m - 9.80m

Job No 33942LT BH20 START DEPTH AT 5.7m

5

6 No CORE 1.2m

7

8

9 EOBH @ 9.8m

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BOREHOLE LOG

Borehole No.
BH21
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~19.9 m

Date: 15/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION										TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CI	Silty sandy CLAY: medium plasticity, brown and grey, fine to coarse grained sand, with fine grained quartz gravel and root fibres.	w>PL	St - VSt		RESIDUAL HP ON BASE OF U50=200 kPa
					N > 14 12,14/ 100mm REFUSAL	19	1		-	Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
					N > 13 12,13/ 80mm REFUSAL	18	2							
					N=SPT 7/ 20mm REFUSAL	17	3							
					N=SPT 5/ 0mm REFUSAL	16	4							
						15	5			GRANITE: medium to coarse grained, light grey, brown and dark grey.	DW	VL		LOW RESISTANCE
						14	6			END OF BOREHOLE AT 6.00 m				
						13								

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BOREHOLE LOG

Borehole No.
BH22
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~12.6 m

Date: 15/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■									TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sands, trace of root fibres.	w~PL			GRASS COVER
									CI		w>PL	VSt	250	RESIDUAL
				■	N=SPT 22/ 100mm REFUSAL	12			-	Silty sandy CLAY: medium plasticity, brown and grey, fine to coarse grained sand, with fine grained quartz gravel and root fibres.	XW	D		HP DISTURBED AUGER SAMPLE
							1			Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown.				MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
				■	N > 18 16,18/ 100mm REFUSAL	11	2							
						10	3							
				■	N=SPT 18/ 150mm REFUSAL									
						9	4							VERY LOW RESISTANCE WITH LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
				■	N=SPT 14/ 100mm REFUSAL	8	5							
						7	6			END OF BOREHOLE AT 6.00 m				
						6								

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BOREHOLE LOG

Borehole No.
BH23
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~11.2 m

Date: 17/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION						11			CI	TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
											w>PL			RESIDUAL
									-	Sandy silty CLAY: medium plasticity, light brown and grey, fine to coarse grained sand, with fine grained quartz gravel and root fibres.	XW	D		MORUYA TONALITE
					N = 38 16,20,18		1			Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown.				VERY LOW 'TC' BIT RESISTANCE
						10								
					N=SPT 19/ 100mm REFUSAL		2							
						9								
					N=SPT 10/ 100mm REFUSAL		3							VERY LOW RESISTANCE WITH LOW BANDS
						8								(POSSIBLY LESS WEATHERED CORE STONES)
							4							
					N=SPT 7/ 50mm REFUSAL	7								
							5			GRANITE: medium to coarse grained quartz, light and dark grey.	DW	M		MODERATE RESISTANCE
						6								
							6			END OF BOREHOLE AT 6.00 m				
						5								

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BOREHOLE LOG

Borehole No.
BH24
1 / 3

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~13.7 m

Date: 16/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION										TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CI		w>PL	St	100	RESIDUAL
					N=SPT 21/ 150mm REFUSAL	13	1		-	Silty sandy CLAY: medium plasticity, orange brown, grey and brown, fine to coarse grained sand, with fine grained quartz gravel, trace of root fibres.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
					N=SPT 17/ 100mm REFUSAL	12	2			Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown.				
					N=SPT 12/ 150mm REFUSAL	11	3							
					N=SPT 6/ 20mm REFUSAL	10	4							
						9	5			GRANITE: medium to coarse grained, dark grey and red brown.	DW	L - M		LOW RESISTANCE WITH MODERATE BANDS
						8	6							
						7								

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BOREHOLE LOG

Borehole No.
BH24
2 / 3

Client: HEALTH INFRASTRUCTURE
Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL
Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~13.7 m
Date: 16/4/21 **Datum:** AHD
Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
										GRANITE: as above REFER TO CORED BOREHOLE LOG				

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CORED BOREHOLE LOG

Borehole No.
BH24
3 / 3

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

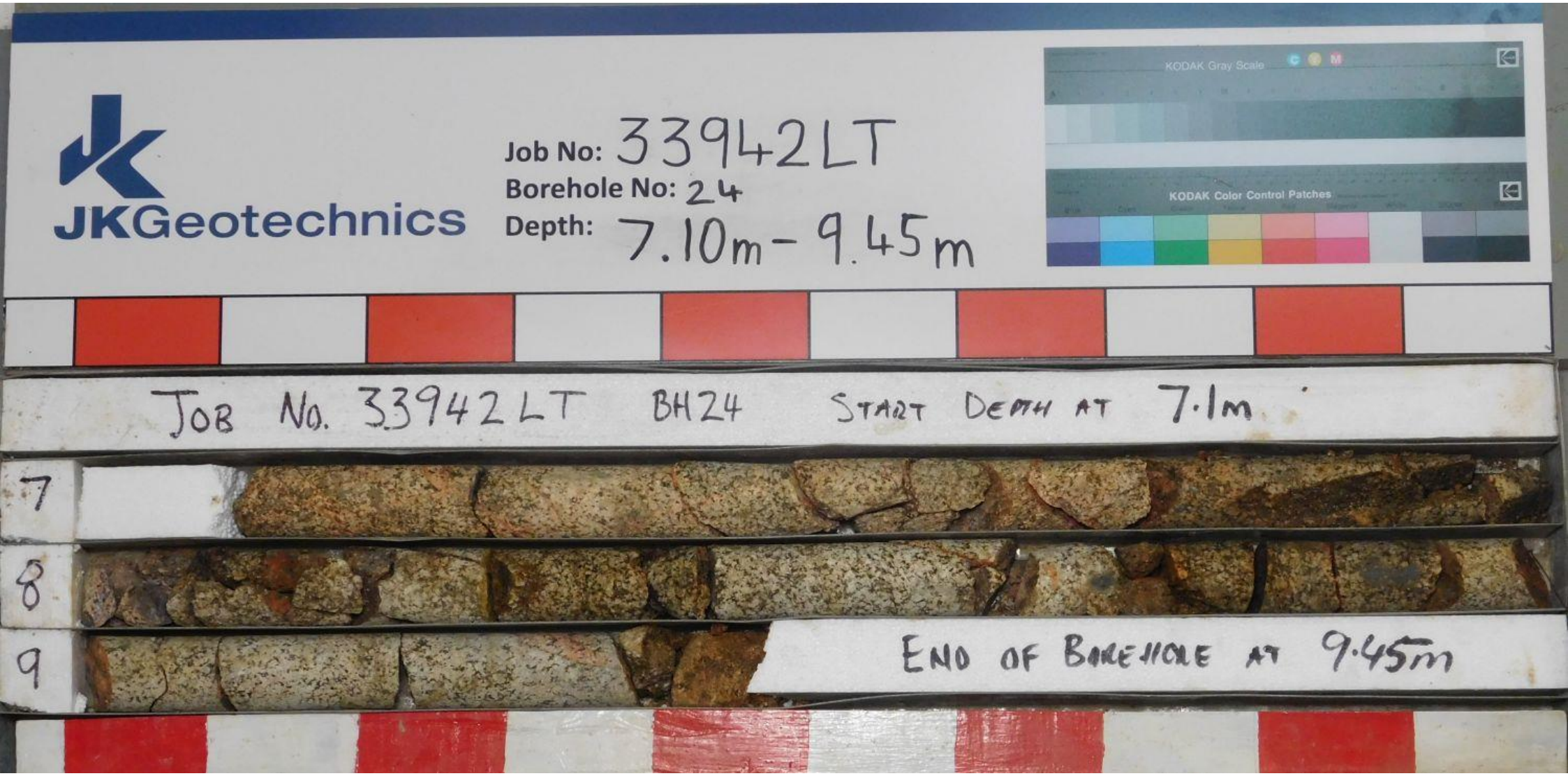
Job No.: 33942LT **Core Size:** NMLC **R.L. Surface:** ~13.7 m

Date: 16/4/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** W.S./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS SPACING (mm)	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
100% RETURN		6	8		START CORING AT 7.10m GRANITE: medium to coarse grained, dark grey and red brown.	SW	M	0.40		(7.26m) Jh, 30°, P (7.40m) J, 45°, P, R, Fe Sn (7.50m) J, 0°, P, R, Cn (7.55m) J, 90°, P, R, Fe Sn (7.60m) J, 20°, P, R, Fe Sn (7.67m) J, 40°, P, R, Fe Sn (7.75m) J, 65°, P, R, Fe Sn	MORUYA TONALITE
		5	9		as above. but light grey and dark grey.			0.10 0.20 0.70		(8.00m) J, 80 - 90°, P, R, Fe Sn (8.25m) J, 70 - 80°, P, R, Fe Sn (8.40m) J, 30°, P, R, Fe Sn (8.60m) J, 65°, P, R, Fe Sn (8.75m) J, 65°, P, R, Fe Sn (8.79m) J, 5°, P, R, Fe Sn (8.90m) J, 30°, P, S, Fe Sn (8.98m) J, 30°, P, S, Fe Sn (9.37m) J, 20°, P, R, Fe Sn (9.43m) J, 80 - 90°, P, R, Fe Sn	
		4	10		END OF BOREHOLE AT 9.45 m						
		3	11								
		2	12								
		1	13								
		0									

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS


JKGeotechnics
Job No: 33942LT
Borehole No: 24
Depth: 7.10m - 9.45m
KODAK Gray Scale
KODAK Color Control Patches
JOB No. 33942LT BH24 START DEPTH AT 7.1m
7
8
9
END OF BOREHOLE AT 9.45m

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BOREHOLE LOG

Borehole No.
BH25
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~15.2 m

Date: 16/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■			■		15				TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
	■								CI		w>PL			RESIDUAL
				■	N > 12 9,12/ 50mm REFUSAL				-	Silty sandy CLAY: medium plasticity, orange brown, grey and brown, fine to coarse grained sand, with fine to coarse grained quartz gravel, trace of root fibres.	XW	D		MORUYA TONALITE
						14	1			Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown.				VERY LOW 'TC' BIT RESISTANCE
				■	N=SPT 10/ 50mm REFUSAL	13	2							
					N=SPT 5/ 0mm REFUSAL	12	3							NO SPT SAMPLE RETURN
						11	4							
				■						GRANITE: medium to coarse grained, dark grey and light grey.	DW	H		HIGH RESISTANCE
										END OF BOREHOLE AT 4.50 m				'TC' BIT REFUSAL
						10	5							
						9	6							

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BOREHOLE LOG

Borehole No.
BH26
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~13.0 m

Date: 16/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION										TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CL	Silty sandy CLAY: low plasticity, orange brown, grey and brown, fine to coarse grained sand, trace of fine grained quartz gravel, and root fibres.	w<PL	St - VSt		RESIDUAL
					N = 6 2,3,3	12	1						250 150	
									-	Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
					N > 16 11,16/ 100mm REFUSAL					GRANITE: medium to coarse grained, dark grey and light grey.	DW	VH		VERY HIGH RESISTANCE
						11	2			END OF BOREHOLE AT 1.85 m				'TC' BIT REFUSAL
						10	3							
						9	4							
						8	5							
						7	6							

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BOREHOLE LOG

Borehole No.
BH27
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~17.3 m

Date: 15/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION										TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
						17			CI		w>PL			RESIDUAL
					N > 20 12,20/ 150mm REFUSAL				-	Silty sandy CLAY: medium plasticity, brown and grey, fine to coarse grained sand, with fine grained quartz gravel, trace of root fibres.	XW	D		MORUYA TONALITE
							1			Extremely Weathered granite: clayey SAND, fine to coarse grained, light grey, brown and orange brown, trace of fine grained quartz gravel.				VERY LOW 'TC' BIT RESISTANCE
					N = 44 13,21,23	16								
							2							
						15								
					N=SPT 11/ 100mm REFUSAL		3							
						14								
							4							
					N=SPT 5/ 50mm REFUSAL	13								
							5			GRANITE: medium to coarse grained, grey and red brown.	DW	L - M		LOW RESISTANCE WITH MODERATE BANDS
						12								GROUNDWATER MONITORING WELL INSTALLED TO 5.8m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 2.8m TO 5.8m. CASING 0.1m TO 2.8m. 2mm SAND BACKFILL 3m TO 5.8m. BENTONITE SEAL 2m TO 3m. BACKFILLED WITH CUTTINGS TO SURFACE COMPLETED WITH A CONCRETED GATIC COVER
							6			END OF BOREHOLE AT 6.00 m				
						11								

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BOREHOLE LOG

Borehole No.
BH28
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~9.8 m

Date: 19/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION										TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CI		w>PL			RESIDUAL
									-	Silty sandy CLAY: medium plasticity, brown and grey, fine to coarse grained sand, with fine grained quartz gravel and root fibres.	XW	Hd		MORUYA TONALITE
				■	N > 25 8,15,10/ 50mm REFUSAL	9	1						>600 >600	VERY LOW 'TC' BIT RESISTANCE
										Extremely Weathered granite: gravelly sandy CLAY, low plasticity, fine to coarse grained sand, light grey, brown and orange brown, trace of fine grained quartz gravel.				
				■	N > 35 13,18,17/ 50mm REFUSAL	8	2			Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained sand, fine grained quartz gravel, light grey and brown.		D		
				■	N > 22 7,12,10/ 10mm REFUSAL	7	3							
						6	4							
				■	N=SPT 6/ 50mm REFUSAL	5	5							VERY LOW RESISTANCE WITH LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
				■	N=SPT 6/ 50mm REFUSAL	4	6							
										END OF BOREHOLE AT 6.00 m				
						3								

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BOREHOLE LOG

Borehole No. BH29 1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~8.9 m

Date: 19/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■			■						TOPSOIL: Silty clay, medium plasticity, dark brown, trace of root fibres.	w>PL			GRASS COVER
				■	N = 5 2,2,3	8	1		CI	Silty CLAY: medium plasticity, brown and grey, trace of fine to medium grained sand and root fibres.	w>PL	St	150 150	RESIDUAL
				■	N=SPT 13/ 150mm REFUSAL	7	2		-	Extremely Weathered granite: silty CLAY, medium plasticity, with fine to medium grained sand, trace of fine grained quartz gravel, grey, brown and orange brown.	XW	Hd		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
				■	N > 21 11,12,9/ 50mm REFUSAL	6	3			Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained sand, fine grained quartz gravel, light grey and brown.		D		
				■	N = 19 9,9,10	5	4							
				■	N=SPT 5/ 50mm REFUSAL	4	5							VERY LOW RESISTANCE WITH LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
						3	6			END OF BOREHOLE AT 6.00 m				
						2								

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BOREHOLE LOG

Borehole No.
BH30
1 / 3

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~10.5 m

Date: 16/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING										TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CL		w>PL	VSt		RESIDUAL
					N = 11 3,3,8	10				Silty sandy CLAY: low plasticity, grey and brown, fine to coarse grained sand, with fine grained quartz gravel, trace of root fibres.			250 350	
							1		-	Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
					N=SPT 10/ 50mm REFUSAL	9	2							
						8	3							
					N=SPT 8/ 50mm REFUSAL									
						7	4			Extremely Weathered granite: gravelly clayey SAND, fine to coarse grained, fine grained quartz gravel, grey.				
					N=SPT 12/ 100mm REFUSAL	6	5							
						5	6			Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown.				
					N > 10 15,10/ 50mm REFUSAL	4								

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BOREHOLE LOG

Borehole No.
BH30
2 / 3

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~10.5 m

Date: 16/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
				■	N=SPT 10/ 100mm REFUSAL	3			-	Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, fine grained quartz gravel, light grey, brown and orange brown. *(continued)*	XW	D		LOW RESISTANCE WITH MODERATE BANDS (POSSIBLY LESS WEATHERED CORE STONES)
						2	8			REFER TO CORED BOREHOLE LOG				
						1	9							
						0	10							
						-1	11							
						-2	12							
						-3	13							

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CORED BOREHOLE LOG

Borehole No. BH30 3 / 3

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Core Size:** NMLC **R.L. Surface:** ~10.5 m

Date: 16/4/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** W.S./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS SPACING (mm) DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		3			START CORING AT 7.70m					
100% RETURN			8		NO CORE 0.30m					
		2			GRANITE: medium to coarse grained, light brown, dark grey and light grey .	MW	M	0.30 0.10	(8.20m) J, 45°, P, R, Cn (8.70m) J, 45°, P, S, Fe Sn (8.79m) J, 45°, P, S, Fe Sn (8.90m) J, 30°, P, R, Cn	MORUYA TONALITE
		1	9		GRANITE: medium to coarse grained, dark grey and light grey .	FR	VH	5.8 5.3 5.4	(9.43m) J, 15°, P, S, Fe Sn (9.52m) J, 10°, P, R, Fe Sn	
		0	10		END OF BOREHOLE AT 10.47 m					
		-1	11							
		-2	12							
		-3	13							

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS


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Job No: 33942LT
Borehole No: 30
Depth: 7.70m - 10.47m
KODAK Gray Scale
KODAK Color Control Patches
JOB No. 33942LT BH30 START DEPTH AT 7.7m
7
NO CORE 0.3m
8
9
10
END OF BOREHOLE AT 10.47m

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BOREHOLE LOG

Borehole No. BH31 1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~13.6 m

Date: 15/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION										TOPSOIL: Silty sandy clay, low plasticity, brown, fine to coarse grained sand, trace of root fibres.	w~PL			GRASS COVER
									CL-CI	Silty sandy CLAY: low to medium plasticity, orange brown and grey, fine to coarse grained sand, trace of fine grained quartz gravel, trace of root fibres.	w>PL	F - St		RESIDUAL
					N = 7 0,3,4	13	1					St - VSt	80 150 220	
					N > 18 10,18/ 100mm REFUSAL	12	2		-	Extremely Weathered granite: gravelly clayey SAND, fine to coarse grained, brown and orange brown.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
										Extremely Weathered granite: clayey gravelly SAND, fine to medium grained, light grey, brown and orange brown, fine grained quartz gravel.				
					N > 10 12,10/ 50mm REFUSAL	11	3							
						10	4							
					N=SPT 5/ 20mm REFUSAL	9	5			GRANITE: medium to coarse grained, light grey and dark grey.	DW	H		MODERATE TO HIGH RESISTANCE
						8	6			END OF BOREHOLE AT 5.30 m				'TC' BIT REFUSAL
						7								

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BOREHOLE LOG

Borehole No. BH32 1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~10.1 m

Date: 19/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION						10				TOPSOIL: Sandy silty clay, low plasticity, grey brown, trace of root fibres.	w>PL			GRASS COVER
									CL	Silty CLAY: low plasticity, orange brown and grey, trace of fine to medium grained sand and fine grained quartz gravel and root fibres.	w~PL	VSt	280 280	RESIDUAL
				■	N = 31 5,11,20				-	Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, brown and grey, fine grained quartz gravel.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
				■	N = 37 12,17,20	9	1							
				■	N=SPT 15/ 150mm REFUSAL	8	2							
						7	3							
				■	N=SPT 6/ 50mm REFUSAL	6	4							
				■		5	5			GRANITE: medium to coarse grained, dark grey and brown.	DW	L - M		LOW RESISTANCE WITH MODERATE BANDS
						4	6			END OF BOREHOLE AT 6.00 m				

JKGeotechnics

BOREHOLE LOG

Borehole No.
BH33
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~13.6 m

Date: 20/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■									TOPSOIL: Sandy silty clay, low plasticity, grey brown, trace of root fibres.	w~PL			GRASS COVER
									CL		w>PL	VSt - Hd		RESIDUAL
				■	N = 24 9,12,12	13	1			Silty CLAY: low plasticity, grey brown and grey, trace of fine to medium grained sand and fine grained quartz gravel and root fibres.			380 450	
				■	N > 12 12,12/ 100mm REFUSAL	12	2		-	Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, brown and grey, fine grained quartz gravel.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
				■	N=SPT 5/ 50mm REFUSAL	11	3							
				■	N=SPT 10/ 50mm REFUSAL	10	4							
						9	5							VERY LOW RESISTANCE WITH LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
				■	N=SPT 6/ 20mm REFUSAL	8	6							NO SPT SAMPLE RETURN
						7				END OF BOREHOLE AT 6.00 m				

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BOREHOLE LOG

Borehole No. BH34 1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~7.8 m

Date: 22/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION										TOPSOIL: Sandy silty clay, low plasticity, grey brown, trace of root fibres.	w>PL			GRASS COVER
									CL	Silty sandy CLAY: low plasticity, dark grey, fine to coarse grained sand, trace of fine grained quartz gravel and root fibres.	w<PL	VSt		RESIDUAL
					N = 14 5,6,8	7	1			as above, but dark grey and orange brown.			250 280	
					N=SPT 7/ 50mm REFUSAL	6	2		-	Extremely Weathered granite: gravelly sandy CLAY, low plasticity, fine to medium grained sand, brown and light grey, fine grained quartz gravel.	XW	Hd		MORUYA TONALITE
					N > 12 9,12/ 50mm REFUSAL	5	3						>600 >600	
ON COMPLETION OF AUGERING						4	4			Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, orange brown and light grey, fine grained quartz gravel.		D		
					N = 29 9,13,16	3	5							
					N=SPT 15/ 100mm REFUSAL	2	6			GRANITE: medium to coarse grained, orange brown.	DW	L		LOW 'TC' BIT RESISTANCE
						1				END OF BOREHOLE AT 6.00 m				

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BOREHOLE LOG

Borehole No.
BH35
1 / 3

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~10.5 m

Date: 19/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING	■									TOPSOIL: Sandy silty clay, low plasticity, grey brown, trace of root fibres.	w>PL			GRASS COVER
									CI		w>PL			RESIDUAL
				■	N = 40 9,16,24	10			-	Silty gravelly CLAY: medium plasticity, orange brown and grey, fine grained quartz gravel, trace of sand and root fibres.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
							1			Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, brown and light grey, fine to coarse grained quartz gravel.				
				■	N = 39 10,16,23	9	2							
				■	N=SPT 10/ 100mm REFUSAL	8	3							
				■	N=SPT 10/ 50mm REFUSAL	7	4							
				■	N=SPT 12/ 100mm REFUSAL	6	5							VERY LOW RESISTANCE WITH LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
						5								
						4	6							

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BOREHOLE LOG

Borehole No.
BH35
2 / 3

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~10.5 m

Date: 19/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
					N=SPT 6/ 50mm REFUSAL	3	8		-	Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, brown and light grey, fine to coarse grained quartz gravel. *(continued)*	XW	D		VERY LOW RESISTANCE WITH LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
						2								LOW RESISTANCE WITH MODERATE BANDS
							9			REFER TO CORED BOREHOLE LOG				
						1	10							
						0	11							
						-1	12							
						-2	13							
						-3								

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CORED BOREHOLE LOG

Borehole No. BH35 3 / 3

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Core Size:** NMLC **R.L. Surface:** ~10.5 m

Date: 19/4/21 **Inclination:** VERTICAL **Datum:** AHD

Plant Type: JK308 **Bearing:** N/A **Logged/Checked By:** W.S./A.B.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS SPACING (mm)	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		2			START CORING AT 8.70m						
			9		NO CORE 0.35m						
100% RETURN		1			GRANITE: medium to coarse grained, brown and dark grey.	HW	VL - L	0.020		(9.25m) J, 70°, P, R, Fe Sn (9.32m) J, 60°, P, R, Fe Sn (9.50m) J, 90°, P, R, Fe Sn, XW infill	MORUYA TONALITE
			10		as above, but light grey and dark grey.	SW	M	0.30 0.50		(9.76m) J, 30°, P, S, Cn (10.17m) J, 0 - 45°, Ir, R, Fe Sn (10.25m) J, 30°, P, R, Fe Sn (10.35m) J, 70°, P, R, Fe Sn	
		0				FR	VH	5.1		(10.58m) J, 35°, P, R, Fe Sn	
			11					5.1		(10.82m) J, 50°, P, R, Fe Sn (11.00m) J, 40°, P, S, Fe Sn, XW infill (11.22m) J, 55°, P, R, Fe Sn (11.48m) J, 25°, P, R, Fe Sn	
		-1			END OF BOREHOLE AT 11.60 m						
			12								
		-2									
			13								
		-3									
			14								
		-4									

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS


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Job No: 33942LT
Borehole No: 35
Depth: 8.70m - 11.60m
KODAK Gray Scale
KODAK Color Control Patches
Job No. 33942LT BH 35 START DEPTH AT 8.7m
8
NO CORE 0.35m
9
10
11
END OF BOREHOLE AT 11.6m

JKGeotechnics

BOREHOLE LOG

Borehole No.
BH36
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~12.0 m

Date: 22/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION										TOPSOIL: Sandy silty clay, low plasticity, grey brown, trace of root fibres.	w>PL			GRASS COVER
									CI		w~PL	Hd		RESIDUAL
					N = 21 8,8,13	11	1		CH	Silty gravelly CLAY: medium plasticity, orange brown and grey, fine grained quartz gravel, trace of sand and root fibres. Gravelly sandy CLAY: high plasticity, grey and brown, fine to coarse graned sand, fine grained quartz gravel.				
					N > 24 9,10,14/ 100mm REFUSAL								570 >600	
					N=SPT 7/ 50mm REFUSAL	10	2		-	Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, brown and light grey, fine grained quartz gravel.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
						9	3							
						8	4							
					N=SPT 6/ 50mm REFUSAL									VERY LOW RESISTANCE WITH LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
					N=SPT 5/ 0mm REFUSAL	7	5							
						6	6			END OF BOREHOLE AT 6.00 m				

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BOREHOLE LOG

Borehole No.
BH37
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~12.3 m

Date: 19/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION						12.3	0			TOPSOIL: Sandy silty clay, low plasticity, grey brown, trace of root fibres.	w>PL			GRASS COVER
						12			CI-CH	Silty sandy CLAY: medium to high plasticity, orange brown and grey, fine to coarse grained, trace of fine grained quartz gravel and root fibres.	w>PL	Hd		RESIDUAL
					N = 18 6,8,10		1						500 550	
						11			-	Extremely Weathered granite: clayey gravelly SAND, fine to coarse grained, brown and light grey, fine grained quartz gravel.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
					N = 23 10,11,12	10	2							
					N > 18 10,18/ 150mm REFUSAL		3							
						9								
					N=SPT 4/ 0mm REFUSAL	8	4							
						7	5							
					N=SPT 5/ 50mm REFUSAL		6							NO SPT SAMPLE RETURN
						6				END OF BOREHOLE AT 6.00 m				

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BOREHOLE LOG

Borehole No.
BH38
1 / 1

Client: HEALTH INFRASTRUCTURE

Project: PROPOSED EUROBODALLA REGIONAL HOSPITAL

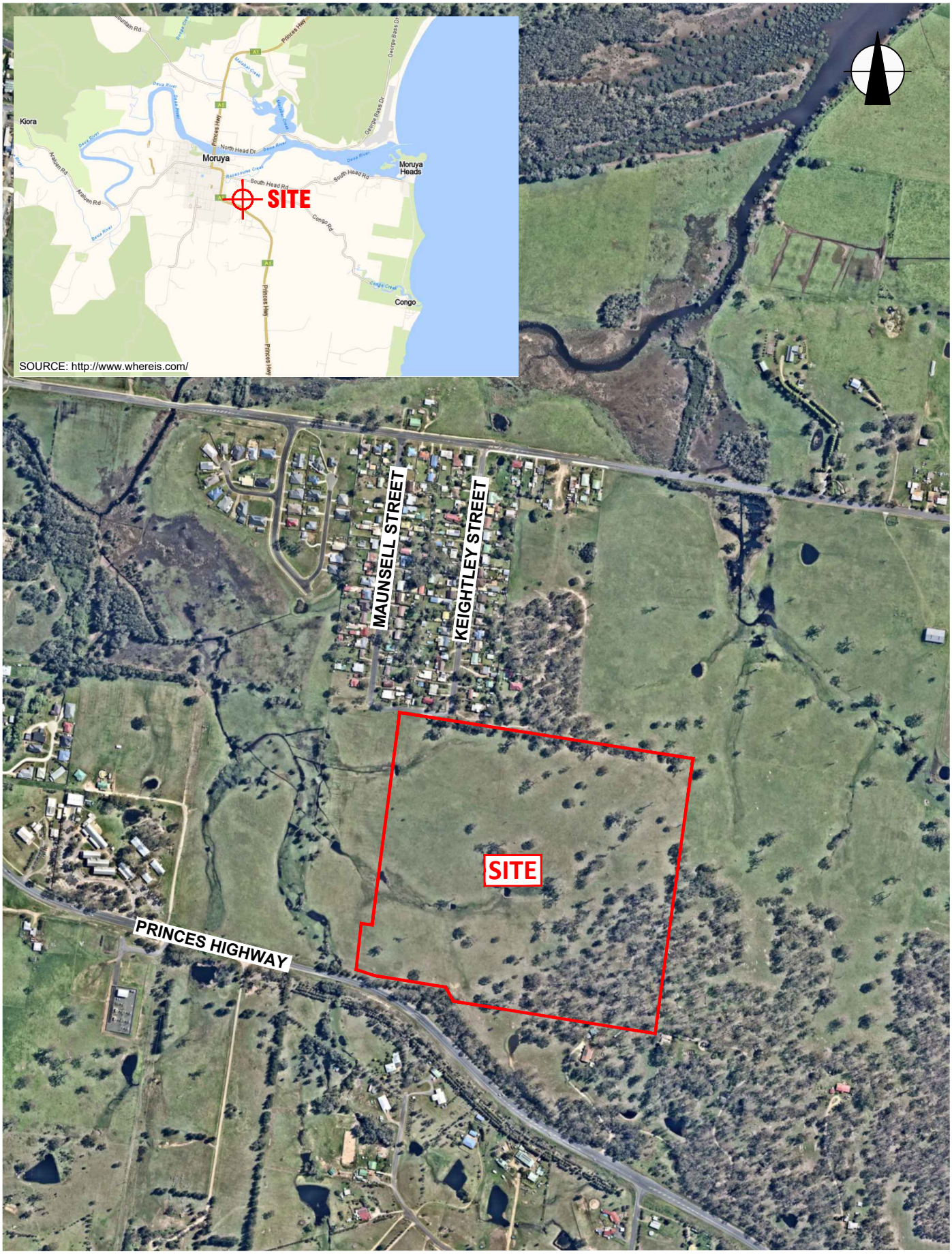
Location: LOT 2 DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Job No.: 33942LT **Method:** SPIRAL AUGER **R.L. Surface:** ~15.4 m

Date: 20/4/21 **Datum:** AHD

Plant Type: JK308 **Logged/Checked By:** W.S./A.B.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION									-	TOPSOIL: sandy silty clay, low plasticity, grey brown, trace of root fibres.	w~PL			GRASS COVER
									CI	Silty CLAY: medium plasticity, orange brown and grey, trace of fine to medium grained sand and fine grained quartz gravel and root fibres.	w<PL			RESIDUAL
					N > 27 10,17,10/ 50mm REFUSAL	15			-	Extremely Weathered GRANITE: clayey gravelly SAND, fine to coarse grained, brown and grey, fine to coarse grained quartz gravel.	XW	D		MORUYA TONALITE VERY LOW 'TC' BIT RESISTANCE
					N=SPT 10/ 50mm REFUSAL	14	1							
					N=SPT 5/ 20mm REFUSAL	13	2							
					N=SPT 5/ 50mm REFUSAL	12	3							
					N=SPT 5/ 0mm REFUSAL	11	4							VERY LOW RESISTANCE WITH LOW BANDS (POSSIBLY LESS WEATHERED CORE STONES)
						10	5							
						9	6			END OF BOREHOLE AT 6.00 m				



AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

This plan should be read in conjunction with the JK Geotechnics report.

Title: **SITE LOCATION PLAN**

Location: LOT 2 IN DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Report No: 33942LT3

Figure No: 1

JKGeotechnics

PLOT DATE: 9/12/2022 12:00:45 PM DWG FILE: S:\6 GEOTECHNICAL\6F GEOTECHNICAL JOBS\33000'S\33942LT MORUYA\CAD\33942LT3.DWG

LEGEND

- CORED BOREHOLE
- AUGERED BOREHOLE

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

0 25 50 75 100 125

SCALE 1:2500 @A3 METRES

This plan should be read in conjunction with the JK Geotechnics report.

Title: **BOREHOLE LOCATION PLAN**

Location: LOT 2 IN DP1281576, PRINCES HIGHWAY, MORUYA, NSW

Report No: 33942LT3

Figure No: 2

JKGeotechnics

PLOT DATE: 9/12/2022 12:01:59 PM DWG FILE: S:\6 GEOTECHNICAL\6F GEOTECHNICAL JOBS\33000'S\33942LT MORUYA\CAD\33942LT3.DWG

REPORT EXPLANATION NOTES

INTRODUCTION

These notes have been provided to amplify the geotechnical report in regard to classification methods, field procedures and certain matters relating to the Comments and Recommendations section. Not all notes are necessarily relevant to all reports.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Geotechnical engineering involves gathering and assimilating limited facts about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and time when the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726:2017 *'Geotechnical Site Investigations'*. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geotechnical practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached soil classification table qualified by the grading of other particles present (eg. sandy clay) as set out below:

Soil Classification	Particle Size
Clay	< 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2.36mm
Gravel	2.36 to 63mm
Cobbles	63 to 200mm
Boulders	> 200mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose (VL)	< 4
Loose (L)	4 to 10
Medium dense (MD)	10 to 30
Dense (D)	30 to 50
Very Dense (VD)	> 50

Cohesive soils are classified on the basis of strength (consistency) either by use of a hand penetrometer, vane shear, laboratory testing and/or tactile engineering examination. The strength terms are defined as follows.

Classification	Unconfined Compressive Strength (kPa)	Indicative Undrained Shear Strength (kPa)
Very Soft (VS)	≤ 25	≤ 12
Soft (S)	> 25 and ≤ 50	> 12 and ≤ 25
Firm (F)	> 50 and ≤ 100	> 25 and ≤ 50
Stiff (St)	> 100 and ≤ 200	> 50 and ≤ 100
Very Stiff (VSt)	> 200 and ≤ 400	> 100 and ≤ 200
Hard (Hd)	> 400	> 200
Friable (Fr)	Strength not attainable – soil crumbles	

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'shale' is used to describe fissile mudstone, with a weakness parallel to bedding. Rocks with alternating inter-laminations of different grain size (eg. siltstone/claystone and siltstone/fine grained sandstone) is referred to as 'laminite'.

SAMPLING

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

Disturbed samples taken during drilling provide information on plasticity, grain size, colour, moisture content, minor constituents and, depending upon the degree of disturbance, some information on strength and structure. Bulk samples are similar but of greater volume required for some test procedures.

Undisturbed samples are taken by pushing a thin-walled sample tube, usually 50mm diameter (known as a U50), into the soil and withdrawing it with a sample of the soil contained in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shrink-swell behaviour, strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling used are given on the attached logs.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application. All methods except test pits, hand auger drilling and portable Dynamic Cone Penetrometers require the use of a mechanical rig which is commonly mounted on a truck chassis or track base.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils and 'weaker' bedrock if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for a large excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Refusal of the hand auger can occur on a variety of materials such as obstructions within any fill, tree roots, hard clay, gravel or ironstone, cobbles and boulders, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of limited reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock cuttings. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be assessed from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term 'mud' encompasses a range of products ranging from bentonite to polymers. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (eg. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, NMLC or HQ triple tube core barrels, which give a core of about 50mm and 61mm diameter, respectively, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as NO CORE. The location of NO CORE recovery is determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the bottom of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils, as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289.6.3.1–2004 (R2016) *'Methods of Testing Soils for Engineering Purposes, Soil Strength and Consolidation Tests – Determination of the Penetration Resistance of a Soil – Standard Penetration Test (SPT)'*.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63.5kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm 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 150mm of, say, 4, 6 and 7 blows, as

  N = 13
  4, 6, 7

- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm, as

  N > 30
  15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

A modification to the SPT is where the same driving system is used with a solid 60° tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as 'N_c' on the borehole logs, together with the number of blows per 150mm penetration.

Cone Penetrometer Testing (CPT) and Interpretation: The cone penetrometer is sometimes referred to as a Dutch Cone. The test is described in Australian Standard 1289.6.5.1–1999 (R2013) *'Methods of Testing Soils for Engineering Purposes, Soil Strength and Consolidation Tests – Determination of the Static Cone Penetration Resistance of a Soil – Field Test using a Mechanical and Electrical Cone or Friction-Cone Penetrometer'*.

In the tests, a 35mm or 44mm diameter rod with a conical tip is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with a hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the frictional resistance on a separate 134mm or 165mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are electrically connected by wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck. The CPT does not provide soil sample recovery.

As penetration occurs (at a rate of approximately 20mm per second), the information is output as incremental digital records every 10mm. The results given in this report have been plotted from the digital data.

The information provided on the charts comprise:

- Cone resistance – the actual end bearing force divided by the cross sectional area of the cone – expressed in MPa. There are two scales presented for the cone resistance. The lower scale has a range of 0 to 5MPa and the main scale has a range of 0 to 50MPa. For cone resistance values less than 5MPa, the plot will appear on both scales.
- Sleeve friction – the frictional force on the sleeve divided by the surface area – expressed in kPa.
- Friction ratio – the ratio of sleeve friction to cone resistance, expressed as a percentage.

  The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1% to 2% are commonly encountered in sands and occasionally very soft clays, rising to 4% to 10% in stiff clays and peats. Soil descriptions based on cone resistance and friction ratios are only inferred and must not be considered as exact.

Correlations between CPT and SPT values can be developed for both sands and clays but may be site specific.

Interpretation of CPT values can be made to empirically derive modulus or compressibility values to allow calculation of foundation settlements.

Stratification can be inferred from the cone and friction traces and from experience and information from nearby boreholes etc. Where shown, this information is presented for general guidance, but must be regarded as interpretive. The test method provides a continuous profile of engineering properties but, where precise information on soil classification is required, direct drilling and sampling may be preferable.

There are limitations when using the CPT in that it may not penetrate obstructions within any fill, thick layers of hard clay and very dense sand, gravel and weathered bedrock. Normally a 'dummy' cone is pushed through fill to protect the equipment. No information is recorded by the 'dummy' probe.

Flat Dilatometer Test: The flat dilatometer (DMT), also known as the Marchetti Dilometer comprises a stainless steel blade having a flat, circular steel membrane mounted flush on one side.

The blade is connected to a control unit at ground surface by a pneumatic-electrical tube running through the insertion rods. A gas tank, connected to the control unit by a pneumatic cable, supplies the gas pressure required to expand the membrane. The control unit is equipped with a pressure regulator, pressure gauges, an audio-visual signal and vent valves.

The blade is advanced into the ground using our CPT rig or one of our drilling rigs, and can be driven into the ground using an SPT hammer. As soon as the blade is in place, the membrane is inflated, and the pressure required to lift the membrane (approximately 0.1mm) is recorded. The pressure then required to lift the centre of the membrane by an additional 1mm is recorded. The membrane is then deflated before pushing to the next depth increment, usually 200mm down. The pressure readings are corrected for membrane stiffness.

The DMT is used to measure material index (I_D), horizontal stress index (K_D), and dilatometer modulus (E_D). Using established correlations, the DMT results can also be used to assess the 'at rest' earth pressure coefficient (K_o), over-consolidation ratio (OCR), undrained shear strength (C_u), friction angle (ϕ), coefficient of consolidation (C_h), coefficient of permeability (K_h), unit weight (γ), and vertical drained constrained modulus (M).

The seismic dilatometer (SDMT) is the combination of the DMT with an add-on seismic module for the measurement of shear wave velocity (V_s). Using established correlations, the SDMT results can also be used to assess the small strain modulus (G_o).

Portable Dynamic Cone Penetrometers: Portable Dynamic Cone Penetrometer (DCP) tests are carried out by driving a 16mm diameter rod with a 20mm diameter cone end with a 9kg hammer dropping 510mm. The test is described in Australian Standard 1289.6.3.2–1997 (R2013) *'Methods of Testing Soils for Engineering Purposes, Soil Strength and Consolidation Tests – Determination of the Penetration Resistance of a Soil – 9kg Dynamic Cone Penetrometer Test'*.

The results are used to assess the relative compaction of fill, the relative density of granular soils, and the strength of cohesive soils. Using established correlations, the DCP test results can also be used to assess California Bearing Ratio (CBR).

Refusal of the DCP can occur on a variety of materials such as obstructions within any fill, tree roots, hard clay, gravel or ironstone, cobbles and boulders, and does not necessarily indicate rock level.

Vane Shear Test: The vane shear test is used to measure the undrained shear strength (C_u) of typically very soft to firm fine grained cohesive soils. The vane shear is normally performed in the bottom of a borehole, but can be completed from surface level, the bottom and sides of test pits, and on recovered undisturbed tube samples (when using a hand vane).

The vane comprises four rectangular blades arranged in the form of a cross on the end of a thin rod, which is coupled to the bottom of a drill rod string when used in a borehole. The size of the vane is dependent on the strength of the fine grained cohesive soils; that is, larger vanes are normally used for very low strength soils. For borehole testing, the size of the vane can be limited by the size of the casing that is used.

For testing inside a borehole, a device is used at the top of the casing, which suspends the vane and rods so that they do not sink under self-weight into the 'soft' soils beyond the depth at which the test is to be carried out. A calibrated torque head is used to rotate the rods and vane and to measure the resistance of the vane to rotation.

With the vane in position, torque is applied to cause rotation of the vane at a constant rate. A rate of 6° per minute is the common rotation rate. Rotation is continued until the soil is sheared and the maximum torque has been recorded. This value is then used to calculate the undrained shear strength. The vane is then rotated rapidly a number of times and the operation repeated until a constant torque reading is obtained. This torque value is used to calculate the remoulded shear strength. Where appropriate, friction on the vane rods is measured and taken into account in the shear strength calculation.

LOGS

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

The terms and symbols used in preparation of the logs are defined in the following pages.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than 'straight line' variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

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

- Although groundwater may be present, in low permeability soils it may enter the hole slowly or perhaps not at all during the time it 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 and may not be the same at the time of construction.
- 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 be washed out of the hole or 'reverted' chemically if reliable water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after the groundwater level has stabilised at intervals ranging from several days to 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 perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (eg. bricks, steel, etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably assess the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density, strength and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse engineering characteristics or behaviour. If the volume and quality of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing is normally carried out in accordance with Australian Standard 1289 *'Methods of Testing Soils for Engineering Purposes'* or appropriate NSW Government Roads & Maritime Services (RMS) test methods. Details of the test procedure used are given on the individual report forms.

ENGINEERING REPORTS

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building) the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

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

- Unexpected variations in ground conditions – the potential for this will be partially dependent on borehole spacing and sampling frequency as well as investigation technique.
- Changes in policy or interpretation of policy by statutory authorities.
- The actions of persons or contractors responding to commercial pressures.
- Details of the development that the Company could not reasonably be expected to anticipate.

If these occur, the Company will be pleased to assist with investigation or advice to resolve any problems occurring.

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, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

REPRODUCTION OF INFORMATION FOR CONTRACTUAL PURPOSES

Where information obtained from this investigation 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. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Copyright in all documents (such as drawings, borehole or test pit logs, reports and specifications) provided by the Company shall remain the property of Jeffery and Katauskas Pty Ltd. Subject to the payment of all fees due, the Client alone shall have a licence to use the documents provided for the sole purpose of completing the project to which they relate. Licence to use the documents may be revoked without notice if the Client is in breach of any obligation to make a payment to us.

REVIEW OF DESIGN

Where major civil or structural developments are proposed or where only a limited investigation has been completed or where the geotechnical conditions/constraints are quite complex, it is prudent to have a joint design review which involves an experienced geotechnical engineer/engineering geologist.

SITE INSPECTION

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related.

Requirements could range from:

i) a site visit to confirm that conditions exposed are no worse than those interpreted, to

ii) a visit to assist the contractor or other site personnel in identifying various soil/rock types and appropriate footing or pile founding depths, or

iii) full time engineering presence on site.

SYMBOL LEGENDS

SOIL


FILL


TOPSOIL


CLAY (CL, CI, CH)


SILT (ML, MH)


SAND (SP, SW)


GRAVEL (GP, GW)


SANDY CLAY (CL, CI, CH)


SILTY CLAY (CL, CI, CH)


CLAYEY SAND (SC)


SILTY SAND (SM)


GRAVELLY CLAY (CL, CI, CH)


CLAYEY GRAVEL (GC)


SANDY SILT (ML, MH)


PEAT AND HIGHLY ORGANIC SOILS (Pt)

ROCK


CONGLOMERATE


SANDSTONE


SHALE/MUDSTONE


SILTSTONE


CLAYSTONE


COAL


LAMINITE


LIMESTONE


PHYLLITE, SCHIST


TUFF


GRANITE, GABBRO


DOLERITE, DIORITE


BASALT, ANDESITE


QUARTZITE

OTHER MATERIALS


BRICKS OR PAVERS


CONCRETE


ASPHALTIC CONCRETE

CLASSIFICATION OF COARSE AND FINE GRAINED SOILS

Major Divisions		Group Symbol	Typical Names	Field Classification of Sand and Gravel	Laboratory Classification	
Coarse grained soil (more than 65% of soil excluding oversize fraction is greater than 0.075mm)	GRAVEL (more than half of coarse fraction is larger than 2.36mm	GW	Gravel and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 4$ $1 < C_c < 3$
		GP	Gravel and gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		GM	Gravel-silt mixtures and gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	Fines behave as silt
		GC	Gravel-clay mixtures and gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	Fines behave as clay
	SAND (more than half of coarse fraction is smaller than 2.36mm)	SW	Sand and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 6$ $1 < C_c < 3$
		SP	Sand and gravel-sand mixtures, little or no fines	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		SM	Sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	N/A
		SC	Sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	

Major Divisions		Group Symbol	Typical Names	Field Classification of Silt and Clay			Laboratory Classification
				Dry Strength	Dilatancy	Toughness	% < 0.075mm
Fine grained soils (more than 35% of soil excluding oversize fraction is less than 0.075mm)	SILT and CLAY (low to medium plasticity)	ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity	None to low	Slow to rapid	Low	Below A line
		CL, CI	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay	Medium to high	None to slow	Medium	Above A line
		OL	Organic silt	Low to medium	Slow	Low	Below A line
	SILT and CLAY (high plasticity)	MH	Inorganic silt	Low to medium	None to slow	Low to medium	Below A line
		CH	Inorganic clay of high plasticity	High to very high	None	High	Above A line
		OH	Organic clay of medium to high plasticity, organic silt	Medium to high	None to very slow	Low to medium	Below A line
	Highly organic soil	Pt	Peat, highly organic soil	–	–	–	–

Laboratory Classification Criteria

A well graded coarse grained soil is one for which the coefficient of uniformity $Cu > 4$ and the coefficient of curvature $1 < C_c < 3$. Otherwise, the soil is poorly graded. These coefficients are given by:

$$C_U = \frac{D_{60}}{D_{10}} \qquad and \qquad C_C = \frac{(D_{30})^2}{D_{10}\, D_{60}}$$

Where D_{10}, D_{30} and D_{60} are those grain sizes for which 10%, 30% and 60% of the soil grains, respectively, are smaller.

NOTES:

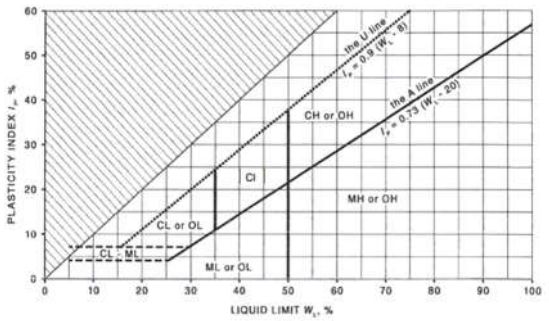
1 For a coarse grained soil with a fines content between 5% and 12%, the soil is given a dual classification comprising the two group symbols separated by a dash; for example, for a poorly graded gravel with between 5% and 12% silt fines, the classification is GP-GM.

2 Where the grading is determined from laboratory tests, it is defined by coefficients of curvature (C_c) and uniformity (C_u) derived from the particle size distribution curve.

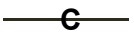
3 Clay soils with liquid limits > 35% and ≤ 50% may be classified as being of medium plasticity.

4 The U line on the Modified Casagrande Chart is an approximate upper bound for most natural soils.

Modified Casagrande Chart for Classifying Silts and Clays according to their Behaviour



LOG SYMBOLS

Log Column	Symbol	Definition
Groundwater Record		Standing water level. Time delay following completion of drilling/excavation may be shown.
		Extent of borehole/test pit collapse shortly after drilling/excavation.
		Groundwater seepage into borehole or test pit noted during drilling or excavation.
Samples	ES	Sample taken over depth indicated, for environmental analysis.
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.
	DB	Bulk disturbed sample taken over depth indicated.
	DS	Small disturbed bag sample taken over depth indicated.
	ASB	Soil sample taken over depth indicated, for asbestos analysis.
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.
	SAL	Soil sample taken over depth indicated, for salinity analysis.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration. 'Refusal' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	N_c = 5 7 3R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60° solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25	Vane shear reading in kPa of undrained shear strength.
	PID = 100	Photoionisation detector reading in ppm (soil sample headspace test).
Moisture Condition (Fine Grained Soils)	w > PL	Moisture content estimated to be greater than plastic limit.
	$w \approx$ PL	Moisture content estimated to be approximately equal to plastic limit.
	w < PL	Moisture content estimated to be less than plastic limit.
	$w \approx$ LL	Moisture content estimated to be near liquid limit.
	w > LL	Moisture content estimated to be wet of liquid limit.
(Coarse Grained Soils)	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.
Strength (Consistency) Cohesive Soils	VS	VERY SOFT – unconfined compressive strength ≤ 25kPa.
	S	SOFT – unconfined compressive strength > 25kPa and ≤ 50kPa.
	F	FIRM – unconfined compressive strength > 50kPa and ≤ 100kPa.
	St	STIFF – unconfined compressive strength > 100kPa and ≤ 200kPa.
	VSt	VERY STIFF – unconfined compressive strength > 200kPa and ≤ 400kPa.
	Hd	HARD – unconfined compressive strength > 400kPa.
	Fr	FRIABLE – strength not attainable, soil crumbles.
	( )	Bracketed symbol indicates estimated consistency based on tactile examination or other assessment.
Density Index/ Relative Density (Cohesionless Soils)		**Density Index (I_D) Range (%)** / **SPT 'N' Value Range (Blows/300mm)**
	VL	VERY LOOSE – ≤ 15 – 0 – 4
	L	LOOSE – > 15 and ≤ 35 – 4 – 10
	MD	MEDIUM DENSE – > 35 and ≤ 65 – 10 – 30
	D	DENSE – > 65 and ≤ 85 – 30 – 50
	VD	VERY DENSE – > 85 – > 50
	( )	Bracketed symbol indicates estimated density based on ease of drilling or other assessment.
Hand Penetrometer Readings	300 250	Measures reading in kPa of unconfined compressive strength. Numbers indicate individual test results on representative undisturbed material unless noted otherwise.

Log Column	Symbol	Definition
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Twin pronged tungsten carbide bit.
	T_{60}	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.
	Soil Origin	The geological origin of the soil can generally be described as: RESIDUAL – soil formed directly from insitu weathering of the underlying rock. No visible structure or fabric of the parent rock. EXTREMELY WEATHERED – soil formed directly from insitu weathering of the underlying rock. Material is of soil strength but retains the structure and/or fabric of the parent rock. ALLUVIAL – soil deposited by creeks and rivers. ESTUARINE – soil deposited in coastal estuaries, including sediments caused by inflowing creeks and rivers, and tidal currents. MARINE – soil deposited in a marine environment. AEOLIAN – soil carried and deposited by wind. COLLUVIAL – soil and rock debris transported downslope by gravity, with or without the assistance of flowing water. Colluvium is usually a thick deposit formed from a landslide. The description 'slopewash' is used for thinner surficial deposits. LITTORAL – beach deposited soil.

Classification of Material Weathering

Term		Abbreviation		Definition
Residual Soil		RS		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered		XW		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly Weathered	Distinctly Weathered (Note 1)	HW	DW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered		MW		The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered		SW		Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh		FR		Rock shows no sign of decomposition of individual minerals or colour changes.

NOTE 1: The term 'Distinctly Weathered' is used where it is not practicable to distinguish between 'Highly Weathered' and 'Moderately Weathered' rock. 'Distinctly Weathered' is defined as follows: *'Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores'*. There is some change in rock strength.

Rock Material Strength Classification

Term	Abbreviation	Uniaxial Compressive Strength (MPa)	Guide to Strength	
			Point Load Strength Index $Is_{(50)}$ (MPa)	Field Assessment
Very Low Strength	VL	0.6 to 2	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30mm thick can be broken by finger pressure.
Low Strength	L	2 to 6	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium Strength	M	6 to 20	0.3 to 1	Scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High Strength	H	20 to 60	1 to 3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High Strength	VH	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High Strength	EH	> 200	> 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Abbreviations Used in Defect Description

Cored Borehole Log Column		Symbol Abbreviation	Description
Point Load Strength Index		• 0.6	Axial point load strength index test result (MPa)
		x 0.6	Diametral point load strength index test result (MPa)
Defect Details	– Type	Be	Parting – bedding or cleavage
		CS	Clay seam
		Cr	Crushed/sheared seam or zone
		J	Joint
		Jh	Healed joint
		Ji	Incipient joint
		XWS	Extremely weathered seam
	– Orientation	Degrees	Defect orientation is measured relative to normal to the core axis (ie. relative to the horizontal for a vertical borehole)
	– Shape	P	Planar
		C	Curved
		Un	Undulating
		St	Stepped
		Ir	Irregular
	– Roughness	Vr	Very rough
		R	Rough
		S	Smooth
		Po	Polished
		Sl	Slickensided
	– Infill Material	Ca	Calcite
		Cb	Carbonaceous
		Clay	Clay
		Fe	Iron
		Qz	Quartz
		Py	Pyrite
	– Coatings	Cn	Clean
		Sn	Stained – no visible coating, surface is discoloured
		Vn	Veneer – visible, too thin to measure, may be patchy
		Ct	Coating ≤ 1mm thick
		Filled	Coating > 1mm thick
	– Thickness	mm.t	Defect thickness measured in millimetres