APPENDIX A QUARRY INVESTIGATIONS

Eurobodalla Southern Storage - Technical Note

Technical Note No.:	**ESS-TN-02**	**Date:**	**23 June 2017**
Title:	**Eurobodalla Quarry Geotechnical Investigations**		
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Originator:	**SMEC Design Team**	**Reviewer:**	**Dave Evans**
Discipline:	**Storage**		

1. Introduction

Geotechnical investigations were undertaken at Eurobodalla Quarry on 18 and 19 January 2017. The investigations were targeted at confirming the volume and suitability of available earthfill material for potential use in construction of the new earth and rockfill embankment, as part of the Eurobodalla Southern Storage project.

Eurobodalla Quarry is located off Nerrigundah Mountain Rd, as shown in Figure 1. It is estimated to be approximately 5 km north-west of the proposed water supply storage site.

This technical note documents the investigations and provides an estimate of the volume of available earthfill at the site.

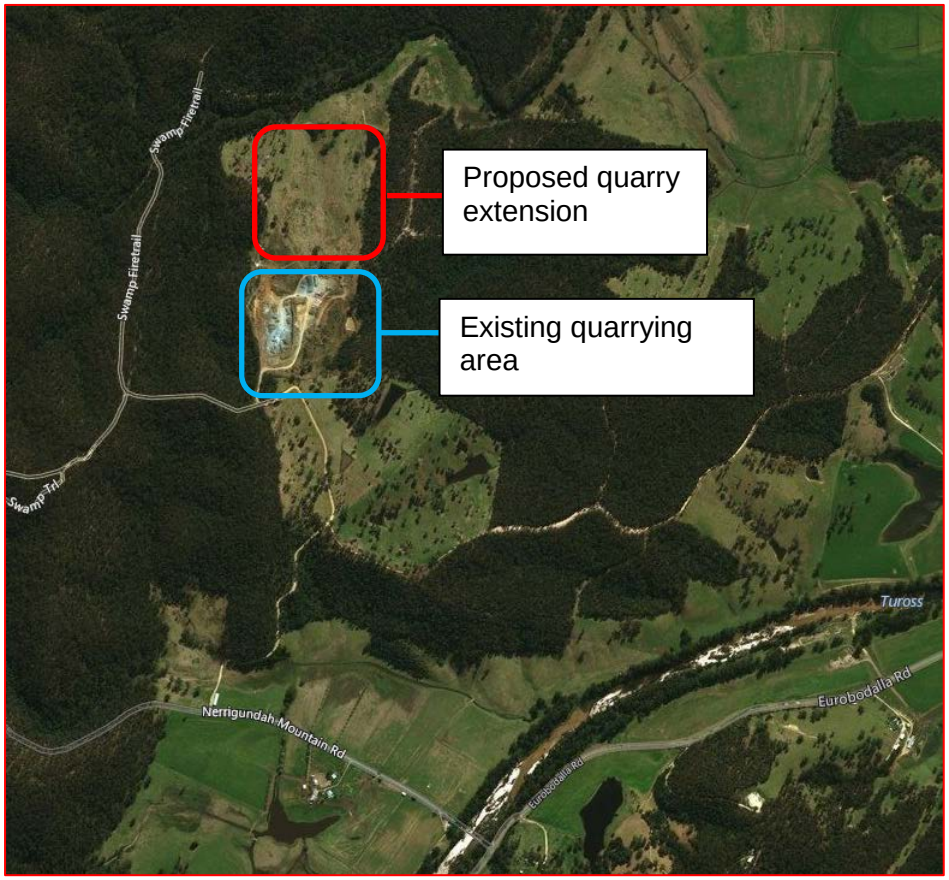


Figure 1: Eurobodalla Quarry Location (Bing Maps)

2. Geological Conditions

Eurobodalla Quarry is located within the Commerong Volcanics which include Rhyolite, Dolerite and interbedded meta-sediments (DoC, 2006). Quarrying predominantly Dolerite for production of crushed rock products, servicing the local concrete and pavement industry.

Overburden materials comprise residual soils and XW/HW Dolerite classifying as CH and CL Clay, Sandy/ Gravelly Clay, SC and GC. These materials have been classified as dispersive clays when tested in distilled water (ECN 1 and 2).

3. Previous Investigations

Feasibility Design Stage Geotechnical Investigations (DoC, 2005)

The investigations were targeted at developing an interpreted geological model of the storage site, assessing embankment and spillway foundation conditions and identifying potential borrow sources for embankment construction.

The investigations included:

- Excavation of 25 test pits (EQTP1 to EQTP25) at Eurobodalla Quarry;
- 35 test pits (SCTP1 to SCTP35) along the centreline of the proposed embankment, spillway channel and upstream and downstream of the proposed embankment;
- Shallow seismic refraction survey along the proposed alignment of the embankment and spillway channel.

Site investigations determined that there are no suitable low permeability clay soils on the storage site, with the limited quantity of alluvials and hillwash soils in the lower slopes and gullies determined to be dispersive and of low clay content.

Off-site earthfill sources were investigated by DoC (2005, 2006), and identified two feasible commercial sources:

- Eurobodalla Quarry, currently identified as the preferred source
- Spring Water Quarry, alternative source

Concept Design Stage Geotechnical Investigations (DoC, 2006a)

Investigations undertaken during the 2006 concept design stage were targeted at confirming the extent of the potential earthfill source at Eurobodalla Quarry; identifying alternative sources of earthfill in the region; assessment of sources of filter material; and assessing the erodibility and dispersity of material within the storage and the proposed spillway channel.

The scope of investigations included excavation of an additional 30 test pits at the Eurobodalla Quarry (EQTP26 to EQTP55), hand augering of materials on the dam site to test for dispersion, hand augering at other potential earthfill borrow locations, and sampling of quarry products from various commercial sites around the region.

A total reserve volume of 140,000 m^3 of earthfill suitable for use in the embankment core was estimated to be present at the Eurobodalla Quarry and the area immediately to the north of the existing quarry workings. This was based on the assumption that CH residual soils and the underlying extremely to highly weathered dolerite (typically classifying as SC) could be mixed to create a relatively homogeneous material. Potential issues with mixing these materials in the field was identified.

Memorandum: Stony Creek Dam Trial Embankment (DoC, 2006c)

A trial embankment was constructed using material sourced from the Eurobodalla Quarry overburden soils. The trial embankment was constructed from approximately equal proportions of residual soil (classifying as CH with a liquid limit of 81%) and extremely weathered to highly weathered Dolerite (classifying as GC with a liquid limit of 56%). The aim of the trial was to assess the suitability of the combined material for use in the core of the dam.

The earthfill was compacted in approximately 150 mm thick (compacted) lifts using a 3 tonne twin (smooth) drum roller. It is understood that minimal moisture conditioning of the material was undertaken, with only light spraying of the lift prior to placement of the subsequent lift. Despite the high plasticity of the individual materials, they were observed to be reasonably workable during placement.

Field density and permeability testing was undertaken on the completed embankment. Hilf density ratios of between 94.2% to 99.3% with a moisture range of 0.1% wet to 0.4% dry of optimum based on four test results, however the trial is understood to have followed a period of consistently wet weather. In-situ permeability testing undertaken on the compacted trial embankment resulted in a permeability range of between 1.0x10-9 m/s to 3.0x10-9 m/s.

Four bulk samples were taken of the material, one from each of the different sources (residual soil and weathered Dolerite) and two from the combined samples following compaction. The combined samples classified as CH sandy, gravelly clay with fines contents of 62% and 63% and both tested as ECN 1 in distilled water. The results of the testing are summarised in Table 1.

Table 1: Summary of Trial Embankment Test Results (DoC, 2006c)

	Residual Soil Stockpile (2721)	Weathered Rock Stockpile (2722)	Combined Sample (2723)	Combined Sample (2724)
Description	High plasticity clay	Clayey sandy gravel	High plasticity clay with sand and gravel	High plasticity clay with sand and gravel
Classification	CH	GC	CH	CH
Cobble size (%)	0	3	3	0
Gravel size (%)	8	33	25	14
Sand size (%)	11	30	19	22
Silt size (%)	25	14	29	21
Clay size (%)	56	20	33	43
Liquid Limit (%)	81	56	65	70
Plastic Limit (%)	28	27	27	27
Plasticity Index (%)	53	29	38	43
Emerson Class No.	2	2	1	1

4. Current Investigations

Objectives

The objectives of the geotechnical investigations undertaken on 18 and 19 January 2017 at Eurobodalla Quarry were to:

- Confirm findings from previous investigations. Conducting similar test pitting to confirm previous outcomes and suitability of observed materials.
- Confirm quantities: A decade has passed since initial investigations. The availability of materials will need to be re-investigated.
- Understand variability of material.

Methodology

The investigations involved test pitting within and to the north of the current quarrying area as shown in Figure 1, Figure 5 and Figure 6. A total of 18 test pits were excavated using a 16T excavator. Test pits were logged by a SMEC geotechnical engineer.

The location of the test pits were selected to be nearby the previously excavated test pits for comparison with previous logging, or at locations to give greater coverage for estimation of potential earthfill volume. The location of test pits was recorded with a hand-held GPS with an accuracy of approximately +/- 10m.

Test pits were typically excavated to an approximate dimension of 4 m x 3 m. Topsoil was initially stripped and stockpiled, with excavated materials stockpiled separately for logging and sampling.

Backfilling of the test pits was undertaken in approximately 0.5 m lifts and compacted by tamping with the excavator bucket. Once the excavation was completely backfilled, the topsoil was replaced and the test pit track-rolled with the excavator.

Ground Conditions

Topsoil depths were found to range between 0.15 m to 0.3 m and was encountered in all test pits except for TP-EQ04 which was excavated in an area of fill. Topsoil was commonly underlain to a depth of up to 0.5m by colluvial material (encountered in TP-EQ07, 08, 09, 10, 12, 13, 14, 16, 17) and typically described as angular cobbles within a sandy gravel matrix.

Residual soil and weathered Dolerite rock was typically encountered within the test pits. Test pits were generally terminated on or near refusal within highly to moderately weathered Dolerite assessed as being not suitable for use as earthfill in the core of the embankment. The only exceptions to this were TP-EQ08 which refused on suspected shale; TP-EQ13 which was terminated in suspected highly weathered Rhyolite; and TP-EQ15 which was terminated in extremely weathered Dolerite at the limit of reach of the excavator (5.4 m depth).

The depth of weathered zones varied significantly between test pits, however greater depths of weathering were typically observed within natural gullies. A summary of the classification of the major material zones encountered in the test pits is provided below. An example of this profile is shown in Figure 2. The test pit logs are provided in Appendix A to this technical note.

Residual Soil: typically classified as high plasticity Clay (CH), red-brown, commonly with trace sand and gravel, typically moist (MC<PL, at the time of the investigations), very stiff.

Extremely Weathered Dolerite: material classified as CH Clay/ Sandy Clay, CL Clay/ Sandy Clay and SC Clayey Sand, mottled brown, orange and grey, with minor constituents of less weathered Dolerite gravels and cobbles. Material was typically found to be moist at close to the plastic limit (at the time of the investigations) and of stiff to very stiff consistency.

Highly Weathered Dolerite: material was typically recovered as fractured rock consisting of gravels and cobbles within a clayey sand matrix. The strength of the intact rock was estimated to be typically high strength but ranged between medium to very high strength.

The boundary between residual soil and extremely weathered Dolerite was often gradational, while the boundary between extremely and highly weathered Dolerite was typically more distinct although occasional gravels and cobbles were encountered towards the base of the extremely weathered zone.

No groundwater was encountered during the investigations.

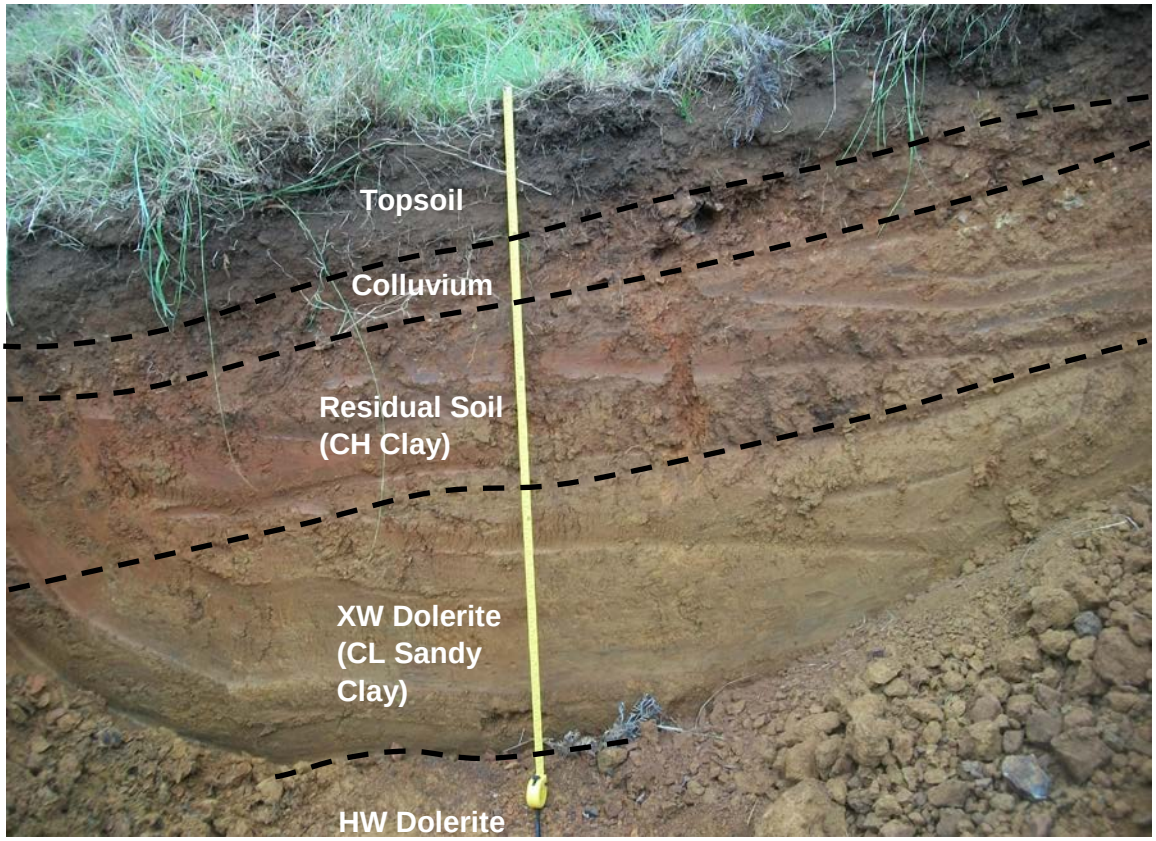


Figure 2: TP-EQ16 ground conditions

5. Laboratory Testing

General

Select samples were retrieved for laboratory testing from the test pitting at Eurobodalla Quarry as well material sampled from Springwater Quarry and Cadgee Quarry. Testing was undertaken at the NATA accredited geotechnical testing facility Civil Geotechnical Services in Melbourne.

Table 2 summarising the testing undertaken on the sampled materials with laboratory certificated provided in Appendix B.

Table 2: Laboratory testing

Laboratory Test	No. of Tests
Particle Size Distribution	▪ Three tests on sampled Residual Soil (RS) ▪ Nine tests on sampled Extremely Weathered (XW) material ▪ Four tests on combined RS and XW material ▪ One test on sample Highly Weathered Dolerite ▪ Two tests on sampled unprocessed material from Springwater Quarry (potentially for use as a fine filter) ▪ One test on sampled processed material from Cadgee Quarry (potentially for use as a fine filter)
Atterberg Limits and Emerson Class (inclusive of LL, PL, PI, LS, FMC and ECN)	▪ Three tests on sampled Residual Soil (RS) ▪ Nine tests on sampled Extremely Weathered (XW) material ▪ Four tests on combined RS and XW material ▪ One test on sample Highly Weathered Dolerite
Standard Compaction	▪ One test on sampled Extremely Weathered (XW) material ▪ Four tests on combined RS and XW material
Triaxial Tests (multi-stage Consolidated Undrained with pore pressure measurement)	▪ One test on sampled Extremely Weathered (XW) material ▪ Four tests on combined RS and XW material
Permeability Tests (Constant head)	▪ Two tests on combined RS and XW material

Classification Testing

Classification testing comprised:

- field moisture content;
- Atterberg Limits including Liquid Limit, Plastic Limit, Plasticity Index and Linear Shrinkage;
- particle size distribution; and
- Emerson Class Number.

The results of the classification testing undertaken are presented in Table 3, Figure 3 and Figure 4.

The test results indicate:

- Residual Soil classifies as SM Silty Sand and CH Clay/ Silty Clay with Liquid Limits ranging between 51% to 69% and fines content ranging between 47% to 84% based on three tests.
- Extremely weathered material classifies as CI Clay/ Silty Clay, GC Clayey Gravel, CH Clay/ Sandy Clay/ Silty Clay and MH Silt. Based on the results of nine tests the Liquid Limits ranging between 44% to 91% and the fines contents range between 22% to 91%.

- Samples combined from residual soil and extremely weathered material classified as CH Clay/ Silty Clay/ Gravelly Clay. Based on the results of four tests the Liquid Limits ranging between 61% to 82% and the fines contents range between 57% to 76%.
- Sampled materials are potentially dispersive, when tested in distilled water, with two of 17 results producing Emerson Class Numbers (ECN) of 2. Seven tests produced results of ECN3 indicating they are dispersive after remoulding and eight tests produced results of ECN5 (non-dispersive).

Table 3: Summary laboratory test results – Eurobodalla Quarry potential earthfill borrow source

Testpit	Depth	Material Classification	Field Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Passing 0.075mm sieve (%)	Emerson Class Number
TP-EQ01	0.3-1.2m	CH Gravelly CLAY (combined RS and XW material)	28	82	31	51	18	66	3
TP-EQ03	0.25-2.2m	CI CLAY (XW material)	24.3	47	21	26	12.5	78	3
TP-EQ03	2.6-3.1m	GC Clayey GRAVEL (HW rock)	19	46	22	24	12	23	2
TP-EQ04	1.6-2.0m	GC Clayey GRAVEL (XW material)	17.7	44	22	22	11	22	3
TP-EQ07	0.5-1.0m	SM Silty SAND (Residual Soil)	31.5	52	34	18	11.5	47	3
TP-EQ07	1.0 -2.5m	CH Silty CLAY (XW material)	31.8	74	32	42	18.5	71	5
TP-EQ07	0.5-2.5m	CH Clay (combined RS and XW material)	32.1	65	30	35	15.5	74	5
TP-EQ10	0.8-1.4m	GC Clayey GRAVEL (XW material)	20.1	52	28	24	11.5	37	3
TP-EQ10	0.3-1.4m	CH Clay (combined RS and XW material)	25.4	61	28	33	12.5	57	3
TP-EQ11	0.2-1.3m	CH CLAY (XW material)	35.9	91	35	56	22.5	91	5
TP-EQ12	0.5-1.5m	CH CLAY (Residual Soil)	18.6	51	21	30	13.5	72	2
TP-EQ15	0.75-5.4m	MH SILT (XW material)	44.4	66	35	31	16	88	5
TP-EQ16	0.4-0.8m	CH Silty CLAY (Residual Soil)	31.9	69	31	38	16.5	84	5
TP-EQ16	0.8-1.5m	CH Sandy CLAY (XW material)	32.9	53	29	24	13.5	59	3
TP-EQ16	0.4-1.5m	CH Clay (combined RS and XW material)	32.3	66	29	37	15	76	5

Testpit	Depth	Material Classification	Field Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Passing 0.075mm sieve (%)	Emerson Class Number
TP-EQ17	1.7-3.6m	CI Silty CLAY (XW material)	24.6	49	27	22	12	53	5
TP-EQ18	0.3-1.5m	CH CLAY (XW material)	19.5	55	24	31	14	78	5

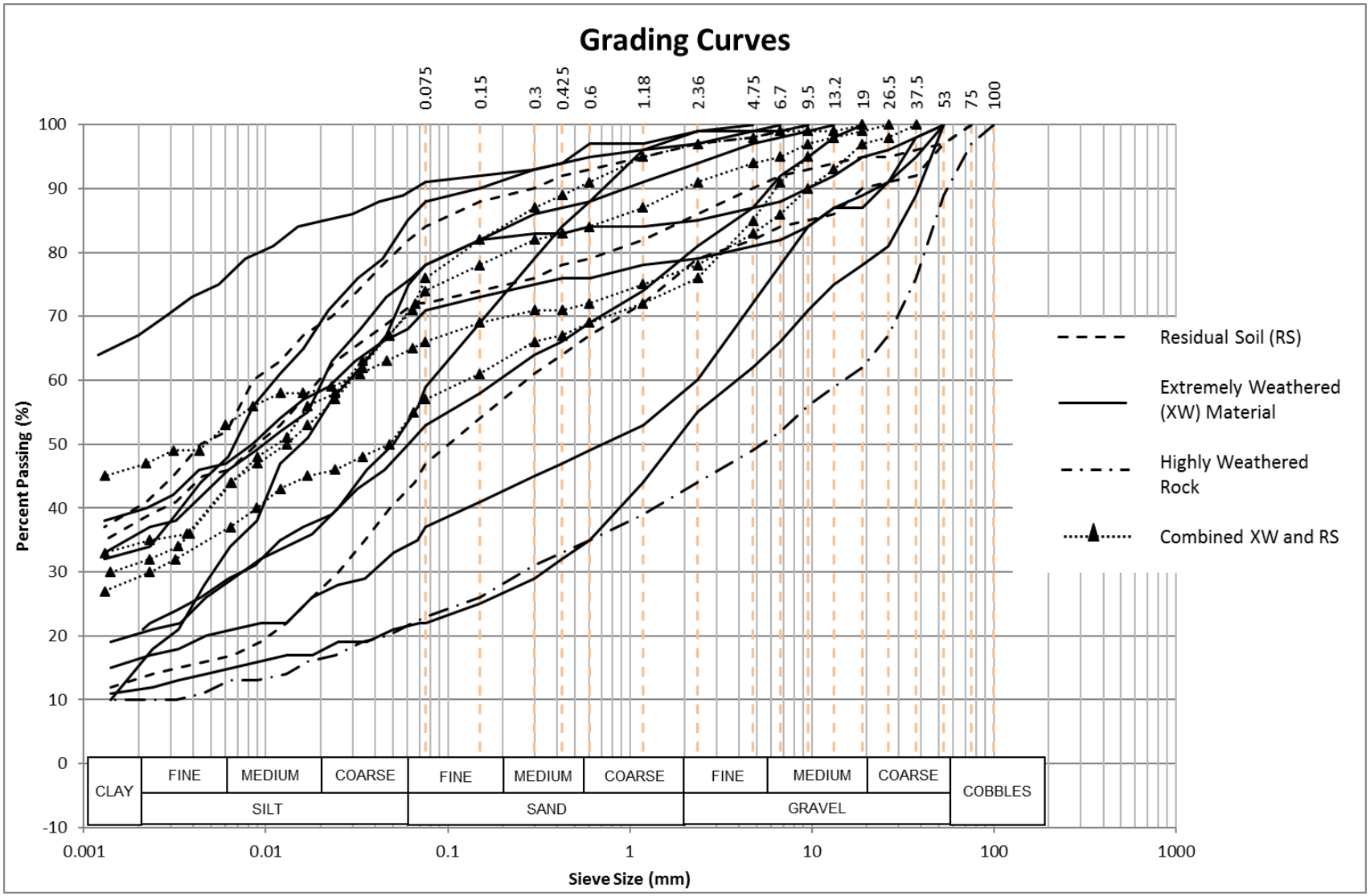


Figure 3: Particle Size Distribution - Eurobodalla Quarry potential earthfill borrow source

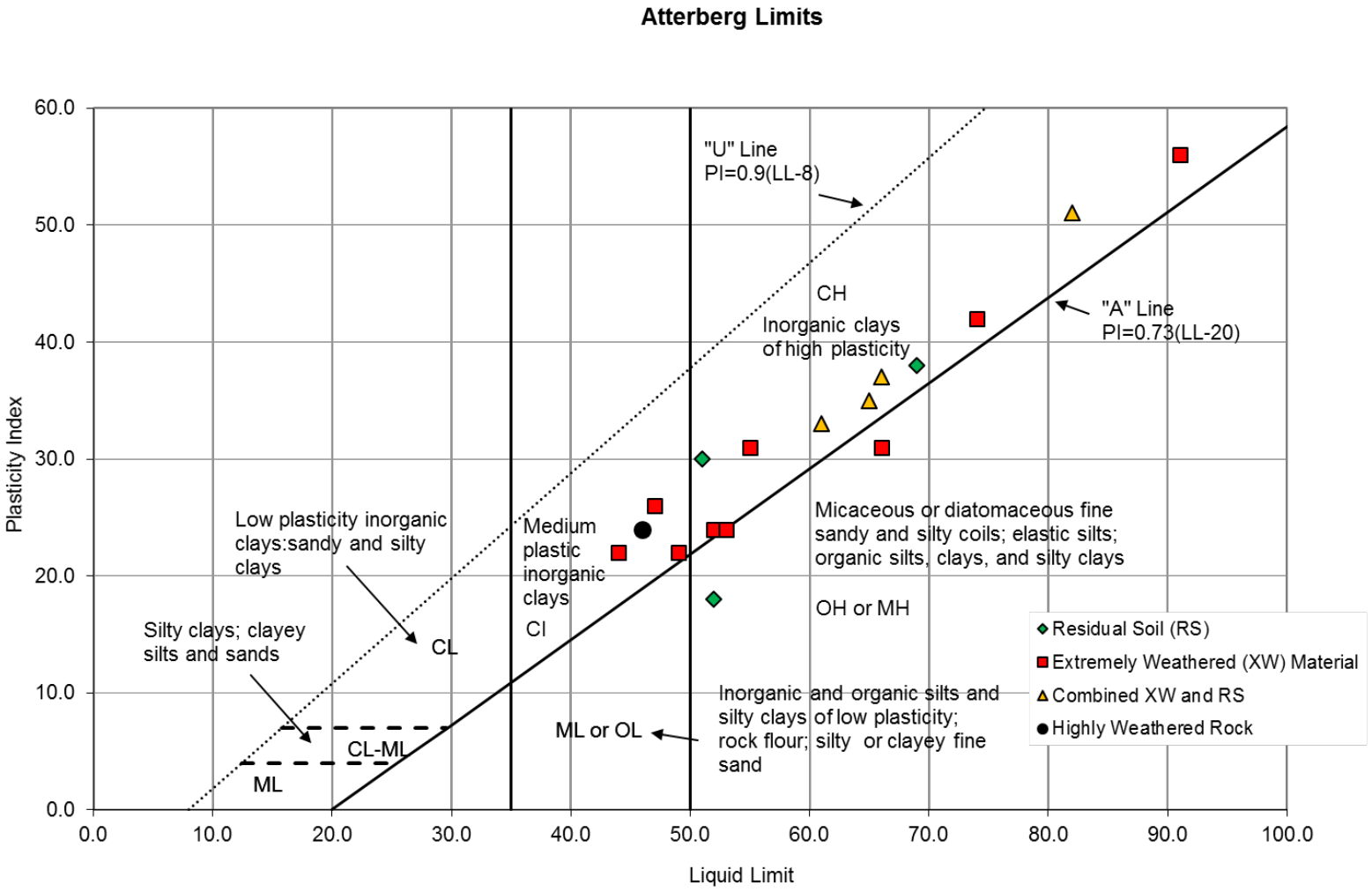


Figure 4: Atterberg Limits - Eurobodalla Quarry potential earthfill borrow source

Standard Compaction

Five standard compaction tests were undertaken to estimate the potential density of the earthfill and field moisture content relative to Optimum Moisture Content (OMC).

At the time of sampling the materials (between 18 and 19 of January 2017) and based on a limited number of four tests undertaken on combined residual soil and extremely weathered material, the field moisture content ranged between 2.5% dry to approximately OMC.

During construction of the trial embankment in 2006 (DoC), the material was also noted to be at or close to OMC.

The one standard compaction test undertaken on extremely weathered material sampled from TP- EQ15 excavated at up to 5.4m depth, indicated the material was approximately 7% wet of OMC.

It is noted that these results may differ during construction work depending on the depth of excavation, climatic conditions and groundwater levels at the time of the works.

Table 4: Standard compaction results - Eurobodalla Quarry potential earthfill borrow source

Testpit	Depth	Material Classification	Field Moisture Content (date of sample)	Standard Optimum Moisture Content	Standard Maximum Dry Density (T/m^3)
TP-EQ01	0.3-1.2m	CH Gravelly Clay (combined RS and XW Sample)	28.0% (19/1/17)	30.5%	1.41
TP-EQ07	0.5-2.5m	CH Clay (combined RS and XW Sample)	32.1% (18/1/17)	32.0%	1.39
TP-EQ10	0.3-1.4m	CH Clay (combined RS and XW Sample)	25.4% (18/1/17)	27.0%	1.48
TP-EQ15	0.75-5.4m	MH Silt (XW Dolerite)	44.4% (18/1/17)	37.5%	1.26
TP-EQ16	0.4-1.5m	CH Clay (combined RS and XW Sample)	32.3% (18/1/17)	32.5%	1.37

Permeability

Two constant head permeability tests were undertaken on combined samples of residual soil and extremely weathered material and are presented in Table 5. The two tests were undertaken on high plasticity clay and gravelly clay and indicated that the material is very low permeability with a coefficient of permeability estimated at $2x10^{-11}$ and $4x10^{-11}$ m/s.

Table 5: Constant head permeability test results - Eurobodalla Quarry potential earthfill borrow source

Testpit	Depth	Material Classification	Constant Head Permeability (m/s)
TP-EQ01	0.3-1.2m	CH Gravelly Clay (combined RS and XW Sample)	$4x10^{-11}$
TP-EQ07	0.5-2.5m	CH Clay (combined RS and XW Sample)	$2x10^{-11}$

6. Estimation of Available Earthfill

Licensing Considerations

Following conversations with Troy Hollis of Eurobodalla Quarry, it is understood that the quarry was applying for an extended licence (in January 2017) into the paddock to the north of the existing quarrying operation. It is understood that the license includes a request to extend the annual extraction rate from 100,000 tonnes to 170,000 tonnes. The licence would be required to maintain a 40 m clearance from Swampy Creek and is therefore proposed to not extend north of the existing farm dams located in the northern paddock.

It is also understood that the license has recently been extended to the East, however the details of this are not known.

Estimation of In-situ Material

The information collected from the current investigations was combined with the data from previous investigations (DoC 2005 and 2006a) to estimate the potential earthfill volume available at Eurobodalla Quarry. Volume estimates were based on material classified as either residual soil or extremely weathered Dolerite. Less weathered material (i.e. high weathered or 'better') has not been considered as part of this estimate as it was assessed as being unlikely to be suitable for use in the core of the embankment due to the high gravel and cobble content (and of relatively high strength).

Table 6 summarises the approximate depth of potential earthfill zones (residual soil and XW Dolerite).

Table 6: Summary of potential earthfill depths

Test pit	Hole Depth (m)	Residual Soil Thickness (m)	XW Rock Thickness (m)	Total Potential Earthfill Thickness (m)
TP-EQ01	2.4	0.5	0.4	0.9
TP-EQ02	1.3	0.2	0.4	0.6
TP-EQ03	3.3	2.0	0.4	2.4
TP-EQ04	2.3	0.5	0.4	0.9
TP-EQ05	1.6	0.6	0.3	0.9
TP-EQ06	1.2	0.0	0.0	0.0
TP-EQ07	3.2	1.0	1.7	2.7
TP-EQ08	1.6	0.0	0.7	0.7
TP-EQ09	3.4	2.1	0.5	2.6
TP-EQ10	1.6	0.5	0.6	1.1
TP-EQ11	1.5	0.0	1.1	1.1
TP-EQ12	1.7	1.0	0.0	1.0
TP-EQ13	1.2	0.0	0.0	0.0
TP-EQ14	1.2	0.0	0.0	0.0
TP-EQ15	5.4	0.5	4.6	5.1
TP-EQ16	1.8	0.4	0.7	1.1
TP-EQ17	4.0	0.7	2.5	3.2
TP-EQ18	1.6	0.0	1.2	1.2

Estimated thicknesses of the respective material zones were plotted against the previous investigations (DoC 2005 and 2006a) as shown in Figure 5 and Figure 6. The magenta coloured test pits indicate the current investigations with the green test pits representing the previous investigations. The Cyan boxes represent the areas considered for the volume estimates presented in Table 7.

Volume estimates have been undertaken by dividing the quarry into areas based on similar depths of potential earthfill. These areas were then multiplied by average thickness of combined residual soil and XW Dolerite (thickness adopted to be on the conservative side) to estimate the volume of potential earthfill. Where possible, the naming convention for areas used to estimate the material volume has been adopted to be consistent with that used in DoC 2006a to enable comparison.

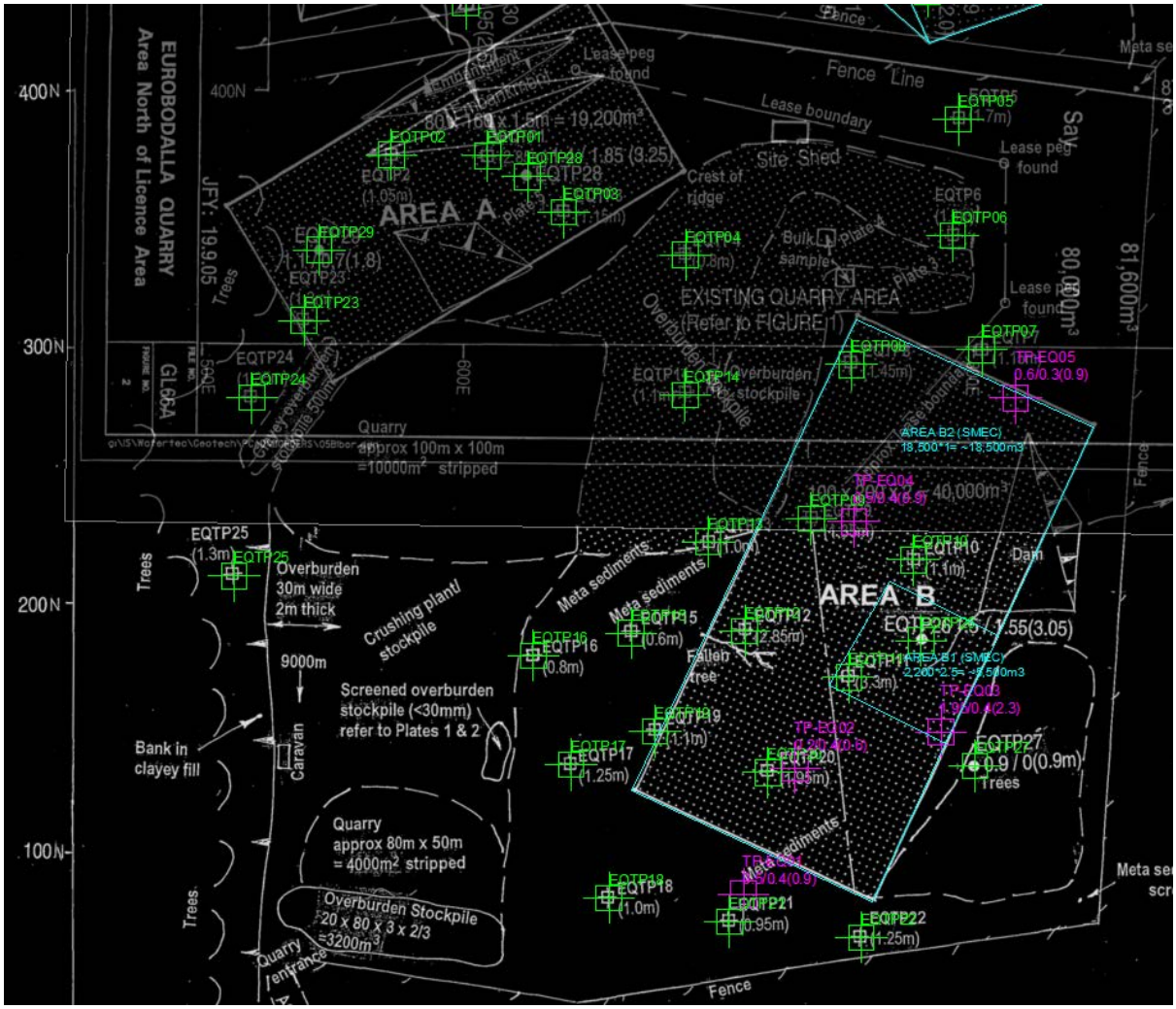


Figure 5: Southern paddock volume estimate – current estimates shown in cyan, current test pits shown in magenta (adapted from DoC 2006a)

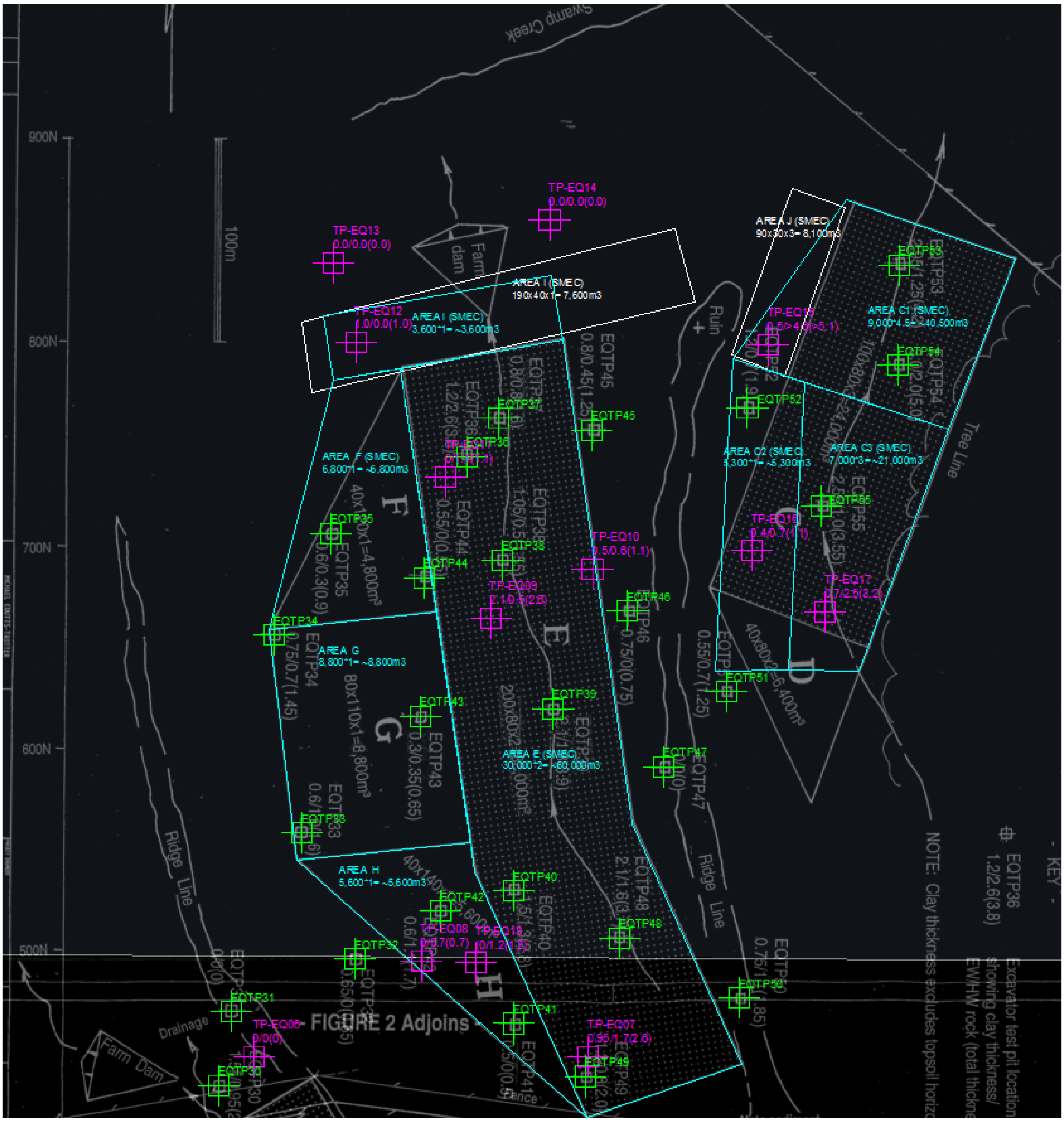


Figure 6: Northern paddock volume estimate – current estimates shown in cyan, current test pits shown in magenta (adapted from DoC 2006a)

Table 7: Potential earthfill volume estimates

Area ID	DoC Volume Estimate (m^3)	Current Estimate			Comment
		Area (m^2)	Approx Depth (m)	Volume Estimate (m^3)	
Area A	19,200			-	Area has now been partially quarried with haul routes now established in the area. Small volume expected to be available.
Area B1 (US of dam)	40,000	2,200	2.5	5,500	Separated into region within gully where greater depth expected (2.5m) with shallower depth adopted elsewhere (1.0m).
Area B2 (remainder)		18,500	1.0	18,500	
Area C1 (SMEC)	24,000	9,000	4.5	40,500	Separated into Northern region where deeper earthfill expected, with Southern region further separated into gully region (deeper weathering) and shallow material on slope.
Area C2 (SMEC)		5,300	1.0	5,300	
Area C3 (SMEC)		7,000	3.0	21,000	
Area D	6,400			-	Now accounted for within C2 and C3
Area E	32,000	30,000	2.0	60,000	Consistent with DoC assessment, however length previously underestimated
Area F	4,800	6,800	1.0	6,800	Updated from DoC
Area G	8,800	8,800	1.0	8,800	Consistent with DoC assessment
Area H	5,600	5,600	1.0	5,600	Consistent with DoC assessment
Area I (SMEC)	-	3,600	1.0	3,600	Additional area
Total	140,800			175,600	Excluding area B (outside of proposed) total estimated volume is approximately 150,000 m^3

Based on the revised quantity estimates, the total volume of potential earthfill available at Eurobodalla Quarry is estimated to be approximately 175,000 m^3. This includes Areas B1 and B2, which is understood to partially fall out of the current and proposed future lease boundary. Furthermore, B1 is a relatively large area to be working for an expected low yield of earthfill. Excluding these areas i.e. only allowing for material to be won from the paddock to the northern extent of the existing lease area reduces the estimate of the potential earthfill volume to 150,000 m^3. This compares to the currently estimated volume of approximately 110,000 m^3 of earthfill required for construction of the core of the embankment. Note this volume is an in-bank (compacted) volume and does not allow for any over-placement, losses during handling and deterioration of the earthfill due to contamination of moisture content.

Stockpiled Material

Some stockpiles understood to consist of overburden material are located around the existing quarry. These stockpiles were estimated to total less than 4,000 m^3 by DoC (2006a). Based on conversations with the quarry owner (Troy Hollis) the stockpiles have not been added to since these previous investigations.

These stockpiles have not been accounted for within the volume estimate provided in this document due to the relatively small estimated volumes and potentially variable nature of the stockpiles. No testpitting was undertaken within the existing stockpiled material, however it is understood, based on conversations with the quarry owner, that the overburden material was excavated and placed using scrapers. It is likely that this resulted in poor quality control of the material during excavation and hence the stockpiles are expected to consist of inconsistent materials.

7. Other Quarry Products

In addition to the investigations undertaken at Eurobodalla Quarry, other material suppliers were visited on 20 January 2017 to understand their available products for potential use in construction of the embankment. These included:

- Congo Sand Pit – Quarry was not visited; however available products were discussed with owner (Norm Shepherd as for Springwater Quarry)
- Bay Sand and Gravel
- Springwater Quarry – quarrying sand with some potential earthfill material available
- Cadgee Quarry Concrete

Eurobodalla Quarry

Based on discussion with the Quarry Owner (Troy Hollis) the other products produced from Dolerite rock at Eurobodalla Quarry are understood to include:

- 5 mm minus crusher dust
- 14/20 aggregate
- 7/10 aggregate
- 40 mm minus crushed rock
- 80 to 20 mm Gabion basket rockfill

Following a blast undertaken within the pit, the resulting rockfill was observed to be well-graded between approximately 20 mm to 400 mm. This material would likely be suitable for use as rockfill zones for embankment construction with minimal processing, subject to confirmation of suitability from laboratory testing.

Figure 7: Rockfill stockpile following blast at Eurobodalla Quarry 17/1/17

It is also understood that the quarry sells lesser quantities of 1-2 mm alluvial sand, rhyolite rock and has plans to expand into an area of Siltsone.

Springwater Quarry

Springwater Quarry is approximately 42 km north of the proposed storage site. The quarry operates within a sequence of tertiary sediments that include Sandstones, conglomerate and Claystone (DoC 2006a). The quarry produces a gravelly sand (based on visual classification) that prior to processing is understood to have a fines content ranging between 8 to 15% (based on conversations with quarry owner Norm Shepherd). Two samples of this product were collected for testing. The licence limit at the Springwater Quarry was reported to be 30,000 m^3/annum.

At the time of visiting, the quarry was not in operation and had not been in operation for several years. Plans were in place to upgrade the plant and this was projected to be completed by June 2017. The upgraded plant is planned to include a cyclone with the capacity to reduce the fines content of the processed sand to approximately 2 to 3%.

The quarry is also understood to have material potentially suitable for use as earthfill, however the quantity and variability of this material is not known. Based on previous testing undertaken at the site (DoC, 2006a) this material classified as SC (three tests), CH (one test) and MH (one test).

Congo Sand Pit

This quarry was not visited, however available products were discussed with the owner (Norm Shepherd for Springwater Quarry). It is understood that material available from Congo Sand Pit is a poorly graded single sized 0.3 mm sand. This would not be suitable for use as a fine filter to the core of the embankment.

Cadgee Quarry Concrete

A concrete plant in Dalmeny was visited with samples of 'Coarse River Sand' collected and tested. Based on discussions with operators at the plant, it is understood that the quarry is located on the Tuross River near Cadgee. Quarried material includes alluvial sand and cobbles. The river sand goes through very little processing and is sold as 'Coarse River Sand'. Based on visual classification the material grades as a medium to coarse sand, would likely be missing the coarse end of the grading to be suitable for use a fine filter.

In the process, the alluvial cobbles are crushed to produce a gravel product.

Bay Sand and Gravel

Basalt Quarry supplying aggregates and rockfill products. This material would likely be suitable for use as a coarse filter (Zone 2B) and rockfill zones, subject to confirmation of material properties from laboratory testing. At the time of visiting the plant was producing approximately 200 mm rockfill as shown in Figure 8.

Figure 8: Rockfill stockpile at Bay Sand and Gravel 20/1/17

8. Conclusions

- Based on visual classification and laboratory testing of the materials, the residual soil and XW Dolerite available at Eurobodalla Quarry would likely be suitable for use as the earthfill core during construction of the Eurobodalla Southern Storage. However, the materials are expected to be sensitive to moisture content due to the high plasticity and are potentially dispersive.

- Some materials display characteristics of Halloysite, a tubular clay structure that when remoulded can release interstitial water resulting in a large increase in the moisture content. X-ray diffraction of the material has not been completed to determine if Halloysite is present.

- There is likely to be adequate volume of earthfill available for construction of Stage 1 of the Eurobodalla Southern Storage, provided the overburden material is not quarried or stockpiled without appropriate quality control. This would require residual soil material and XW Dolerite to be mixed. The estimated volume of in-bank material required for construction of the Stage 1 embankment is currently estimated to be approximately 110,000 m^3. This compares to approximately 150,000 m^3 of material estimated to be available to the north of the existing quarry area within the proposed licence extension area.

- To meet demand for earthfill for construction of the core will require mixing of the residual soil and XW material. Generally the residual soil classifies as high plasticity clay/ cilt, with the extremely weathered material typically classifying as a medium to high plasticity clay/ silt and clay-gravel mixtures. Mixing of the residual soil and extremely weathered materials to create a homogeneous, low permeability fill, may be challenging given the high plasticity of the materials.

- Subject to confirmation from laboratory testing, it is expected that the coarse filter will be able to be sourced from Eurobodalla Quarry or Bay Sand and Gravel or alternative commercial quarries in the area.

- A potential source of fine filter has not yet been confirmed and is subject to the result of material testing from Springwater Quarry. Additional testing would be required to demonstrate that the Quarry could consistently meet the grading requirement for the fine filter.

REFERENCES

- NSW Department of Commerce. “Eurobodalla water supply augmentation. Stony Creek Dam Site 2. Feasibility Design Stage Geotechnical Investigation.” Report No. 04-GJ67A. May 2005.
- NSW Department of Commerce. “Eurobodalla water supply augmentation. Stony Creek Dam Site 2. Concept Design Stage Geotechnical Investigation.” Report No. 05-GL66A. January 2006.
- NSW Department of Commerce. “Stony Creek Storage. Concept Design Report.” Report No. DC05202. March 2006.
- NSW Department of Commerce. “Stony Creek Dam Trial Embankment.” Memorandum No. GM37A-S1. Sept 2006.

APPENDIX A. TESTPIT LOGS

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ01

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767708.000, N: 5998089.000 (55 MGA94)
SURFACE ELEVATION : 73.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 3.50 m LONG 2.50 m WIDE

DRILLING					MATERIAL					
PENETRATION (VE, E, F, H)	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER (kPa)	STRUCTURE & Other Observations
		GNE	0.30m B	73.0 / 0.0			TOPSOIL				TOPSOIL
				0.30m			CH CLAY, high plasticity, red-brown, trace gravel, moist MC<PL, very stiff.	M (<PL)	VSt		RESIDUAL SOIL
				0.5							
				0.80m			SC CLAYEY SAND, fine to coarse, angular, mottled yellow and orange, high plasticity fines, with gravel, moist, dense, XW DOLERITE.	M	D		EXTREMELY WEATHERED ROCK
			1.20m	72.0 / 1.0							
				1.20m			DOLERITE, brown and orange with black staining, intact rock typically high strength, highly weathered, fractured, rock cobbles recovered within a clayey sand matrix.				WEATHERED ROCK
				1.5							
				2.0							
				71.0							
				2.40m			EXCAVATION TP-EQ01 TERMINATED AT 2.40 m Target depth				
				2.5							
				3.0							
				70.0							
				3.5							
				4.0							
				69.0							
				4.5							
				5.0							
				68.0							
				5.5							
				6.0							
				67.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ02

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767728.000, N: 5998138.000 (55 MGA94)
SURFACE ELEVATION : 66.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 3.50 m LONG 2.50 m WIDE

DRILLING | MATERIAL

VE / E / F / H PENETRATION	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER kPa (100 / 200 / 300 / 400)	STRUCTURE & Other Observations
		GNE		66.0 / 0.0			TOPSOIL				TOPSOIL
				0.30m			CH CLAY, high plasticity, red-brown, moist MC<PL, very stiff.	M (<PL)	VSt		RESIDUAL SOIL
				0.5			CH SANDY CLAY, high plasticity, mottled yellow and orange, sand is fine to coarse, trace gravel, moist MC~PL, stiff to very stiff, XW DOLERITE.	M (c PL)	St to VSt		EXTREMELY WEATHERED ROCK
				0.90m			DOLERITE, brown and orange with black staining, intact rock typically high strength, highly weathered, fractured, rock cobbles recovered within a clayey sand matrix.				WEATHERED ROCK
				65.0 / 1.0 / 1.30m			EXCAVATION TP-EQ02 TERMINATED AT 1.30 m Target depth				
				64.0 / 2.0							
				63.0 / 3.0							
				62.0 / 4.0							
				61.0 / 5.0							
				60.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ03

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767785.000, N: 5998152.000 (55 MGA94)
SURFACE ELEVATION : 63.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 3.00 m LONG 2.00 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER kPa (100 200 300 400)	STRUCTURE & Other Observations
			0.25m	63.0 / 0.0			TOPSOIL 0.25m				TOPSOIL
		GNE	B	0.5			CH CLAY, high plasticity, mottled grey and orange, trace sand, moist MC>PL, stiff to very stiff, XW DOLERITE.	M (>PL)	St to VSt		EXTREMELY WEATHERED ROCK
				62.0 / 1.0							
				1.5							
			2.20m	61.0 / 2.0			2.20m				
			2.60m	2.5			SC CLAYEY SAND, fine to coarse, angular, mottled grey and orange, high plasticity fines, trace gravel, moist, dense, XW DOLERITE. 2.60m	M	D		
			B 3.10m	60.0 / 3.0			DOLERITE, brown and orange with black staining, intact rock typically medium strength, highly weathered, fractured, rock cobbles recovered within a clayey sand matrix. 3.30m				WEATHERED ROCK
				3.5			EXCAVATION TP-EQ03 TERMINATED AT 3.30 m Target depth				3.30: Near refusal on HW Rock
				59.0 / 4.0							
				4.5							
				58.0 / 5.0							
				5.5							
				57.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ04

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767751.000, N: 5998234.000 (55 MGA94)
SURFACE ELEVATION : 67.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 3.50 m LONG 2.50 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION (Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components)	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER kPa	STRUCTURE & Other Observations
		GNE		67.0 / 0.0		GC	CH GRAVELLY CLAY, high plasticity, mottled brown, red-brown and orange, gravel is fine to coarse, with sand, trace cobbles, moist MC<PL, stiff, FILL.	M (<PL)	St		FILL
				0.80m		OH	OH CLAY, high plasticity, black, with some gravel, moist MC<PL, very stiff, rootlets present.		VSt		
				66.0 / 1.10m		CH	CH CLAY, high plasticity, mottled grey and red, trace gravel (fine to medium grained), moist MC~PL, stiff, XW DOLERITE.	M (c PL)	St		EXTREMELY WEATHERED ROCK
			1.60m B 2.00m	1.60m		CH	CH SANDY CLAY, medium plasticity, mottled grey and orange, sand is fine to coarse, moist MC~PL, stiff, XW DOLERITE.				
				65.0 / 2.00m			DOLERITE, brown and orange with black staining, intact rock medium to high strength, highly weathered, fractured, rock cobbles recovered within a clayey sand matrix.				WEATHERED ROCK 2.00: Minor SHALE (grey with orange staining, medium to high strength, moderately weathered) observed.
				2.30m			EXCAVATION TP-EQ04 TERMINATED AT 2.30 m Target depth				2.30: Near refusal on HW Dolerite
				64.0 / 3.0							
				63.0 / 4.0							
				62.0 / 5.0							
				61.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ05

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767814.000, N: 5998282.000 (55 MGA94)
SURFACE ELEVATION : 51.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 3.50 m LONG 2.50 m WIDE

DRILLING | MATERIAL

VE / PENETRATION / E / F / H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER kPa (100 / 200 / 300 / 400)	STRUCTURE & Other Observations
		GNE		51.0 / 0.0			TOPSOIL 0.30m				TOPSOIL
				0.5			CH CLAY, high plasticity, mottled red-brown and orange, moist MC~PL, stiff to very stiff, XW DOLERITE 0.90m	M (c PL)	St to VSt		EXTREMELY WEATHERED ROCK
				50.0 / 1.0			SC CLAYEY SAND, fine to coarse, angular, mottled yellow and orange, high plasticity fines, with gravel, moist, dense, XW DOLERITE. 1.20m	M	D		
				1.5			DOLERITE, brown and orange with black staining, intact rock high to very high strength, highly weathered, fractured, rock cobbles recovered within a clayey sand matrix. 1.60m				WEATHERED ROCK
				49.0 / 2.0			EXCAVATION TP-EQ05 TERMINATED AT 1.60 m Target depth				1.60: Near refusal on HW Dolerite
				2.5							
				48.0 / 3.0							
				3.5							
				47.0 / 4.0							
				4.5							
				46.0 / 5.0							
				5.5							
				45.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE / E / F / H / VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ06

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767617.000, N: 5998450.000 (55 MGA94)
SURFACE ELEVATION : 65.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 3.50 m LONG 2.50 m WIDE

DRILLING | MATERIAL

VE / E / F / H PENETRATION	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER (kPa)	STRUCTURE & Other Observations
		GNE		65.0 / 0.0			TOPSOIL 0.20m				TOPSOIL
				0.5			DOLERITE, brown and orange with black staining, intact rock high to very high strength, highly weathered, fractured, rock cobbles recovered within a clayey sand matrix.				WEATHERED ROCK
				64.0 / 1.0			1.20m				
				1.5			EXCAVATION TP-EQ06 TERMINATED AT 1.20 m Target depth				1.20: Near refusal on HW Dolerite
				63.0 / 2.0							
				2.5							
				62.0 / 3.0							
				3.5							
				61.0 / 4.0							
				4.5							
				60.0 / 5.0							
				5.5							
				59.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ07

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767781.000, N: 5998450.000 (55 MGA94)
SURFACE ELEVATION : 47.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 4.00 m LONG 2.00 m WIDE

DRILLING | MATERIAL

VE / PENETRATION / E / F / H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER kPa	STRUCTURE & Other Observations
				47.0 / 0.0			TOPSOIL 0.25m				TOPSOIL
							CL GRAVELLY CLAY, medium plasticity, brown, gravel is fine to coarse, angular, with cobbles, moist MC<PL. 0.50m	M (<PL)			ALLUVIUM/COLLUVIUM
			0.50m B	0.5			CH CLAY, high plasticity, red-brown, trace gravel (fine to coarse), moist MC~PL, very stiff.	M (c PL)	VSt		RESIDUAL SOIL
			1.00m B	46.0 / 1.0			1.00m CH CLAY, high plasticity, mottled red-brown and orange, trace gravel (fine to coarse), moist MC~PL, stiff. 1.20m		St		EXTREMELY WEATHERED ROCK
		GNE		1.5			SC CLAYEY SAND, fine to coarse, angular, mottled yellow and orange, high plasticity fines, with gravel, trace cobbles, moist, dense, XW DOLERITE.		D		1.70: Increasing cobbles
			2.50m	45.0 / 2.0 / 2.5			2.90m				
				44.0 / 3.0			DOLERITE, brown and orange, intact rock high to very high strength, highly weathered, fractured, rock cobbles recovered within a clayey sand matrix. 3.20m				WEATHERED ROCK 3.00: Increased resistance
				3.5			EXCAVATION TP-EQ07 TERMINATED AT 3.20 m Target depth				3.20: Near refusal on HW Dolerite
				43.0 / 4.0							
				4.5							
				42.0 / 5.0							
				5.5							
				41.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ08

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767699.000, N: 5998497.000 (55 MGA94)
SURFACE ELEVATION : 48.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 3.60 m LONG 2.10 m WIDE

DRILLING						MATERIAL					
PENETRATION (VE, E, F, H)	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER (kPa)	STRUCTURE & Other Observations
				48.0 / 0.0			TOPSOIL 0.20m				TOPSOIL
			0.50m				COBBLES within sandy gravel matrix, grey-brown, dry. 0.50m	D			ALLUVIUM/COLLUVIUM
		GNE	B	0.5			CH CLAY, high plasticity, mottled brown, grey and orange, with some gravel (fine to coarse), trace cobbles, moist MC~PL, very stiff, XW DOLERITE	M (c PL)	VSt		EXTREMELY WEATHERED ROCK
			1.20m	47.0 / 1.0			1.20m				
				1.5			SHALE, grey with orange and red, intact rock high to very high strength, fractured. 1.60m				WEATHERED ROCK
							EXCAVATION TP-EQ08 TERMINATED AT 1.60 m Refusal				
				46.0 / 2.0							
				2.5							
				45.0 / 3.0							
				3.5							
				44.0 / 4.0							
				4.5							
				43.0 / 5.0							
				5.5							
				42.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE, E, F, H, VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ09

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767733.000, N: 5998665.000 (55 MGA94)
SURFACE ELEVATION : 34.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 3.00 m LONG 2.00 m WIDE

DRILLING | MATERIAL

VE / E / F / H PENETRATION	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER kPa (100 / 200 / 300 / 400)	STRUCTURE & Other Observations
		GNE		34.0 / 0.0			TOPSOIL				TOPSOIL
				0.20m			COBBLES within sandy gravel matrix, grey-brown, dry.	D			ALLUVIUM/COLLUVIUM
			0.40m B	0.40m			CH CLAY, high plasticity, mottled brown, orange and grey, trace gravel (fine to coarse), moist MC~PL, very stiff, XW DOLERITE.	M (c PL)	VSt		EXTREMELY WEATHERED ROCK
			2.50m	2.50m			CH SANDY CLAY, medium plasticity, mottled brown, orange and grey, sand is fine to coarse, moist MC~PL, XW DOLERITE.				
				3.00m			DOLERITE, grey and brown, intact rock high to very high strength, moderately weathered, fractured.				WEATHERED ROCK
				3.40m			EXCAVATION TP-EQ09 TERMINATED AT 3.40 m Target depth				

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ10

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767783.000, N: 5998689.000 (55 MGA94)
SURFACE ELEVATION : 33.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 3.00 m LONG 2.20 m WIDE

DRILLING | MATERIAL

VE / E PENETRATION F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETROMETER kPa	STRUCTURE & Other Observations
				33.0 / 0.0			TOPSOIL 0.15m				TOPSOIL
			0.30m				COBBLES within sandy gravel matrix, grey-brown, dry. 0.30m	D			ALLUVIUM/COLLUVIUM
		GNE	B	0.5			CH CLAY, high plasticity, red-brown, trace sand and gravel, moist MC<PL, very stiff.	M (<PL)	VSt		RESIDUAL SOIL
			0.80m B	32.0 / 1.0			0.80m CL SANDY CLAY, low plasticity, mottled brown, orange and grey, sand is fine to coarse, trace gravel, moist MC~PL, stiff to very stiff, XW DOLERITE.	M (c PL)	St to VSt		EXTREMELY WEATHERED ROCK
			1.40m	1.5			1.40m DOLERITE, brown and orange with black staining, intact rock typically high strength, highly weathered, fractured. 1.60m				WEATHERED ROCK
				31.0 / 2.0			EXCAVATION TP-EQ10 TERMINATED AT 1.60 m Target depth				
				2.5							
				30.0 / 3.0							
				3.5							
				29.0 / 4.0							
				4.5							
				28.0 / 5.0							
				5.5							
				27.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ11

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767711.000, N: 5998734.000 (55 MGA94)
SURFACE ELEVATION : 29.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 3.30 m LONG 2.50 m WIDE

DRILLING | MATERIAL

VE / E / PENETRATION / F / H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETROMETER kPa (100 / 200 / 300 / 400)	STRUCTURE & Other Observations
			0.20m	29.0 / 0.0			TOPSOIL 0.20m				TOPSOIL
		GNE	B	0.5			CH CLAY, high plasticity, mottled brown, orange and grey, trace sand and gravel, moist MC~PL, very stiff, XW DOLERITE.	M (c PL)	VSt		EXTREMELY WEATHERED ROCK
			1.30m	28.0 / 1.0			1.30m DOLERITE, brown and orange with black staining, intact rock typically high strength, highly weathered, fractured. 1.50m				WEATHERED ROCK
				1.5			EXCAVATION TP-EQ11 TERMINATED AT 1.50 m Target depth				
				27.0 / 2.0							
				2.5							
				26.0 / 3.0							
				3.5							
				25.0 / 4.0							
				4.5							
				24.0 / 5.0							
				5.5							
				23.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE / E / F / H / VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ12

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767667.000, N: 5998800.000 (55 MGA94)
SURFACE ELEVATION : 23.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 4.00 m LONG 2.40 m WIDE

DRILLING | MATERIAL

VE / E / F / H PENETRATION	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER (kPa)	STRUCTURE & Other Observations
				23.0 / 0.0			TOPSOIL				TOPSOIL
				0.20m			GRAVELS and COBBLES within sandy clay matrix, dry.	D			ALLUVIUM/COLLUVIUM
		GNE	0.50m B	0.5			CH CLAY, high plasticity, mottled brown, orange and grey, trace sand, moist MC~PL, very stiff.	M (c PL)	VSt		RESIDUAL SOIL
			1.50m	22.0 / 1.0 / 1.5							
				1.50m			DOLERITE, brown and orange with black staining, intact rock typically high strength, highly weathered, fractured.				WEATHERED ROCK
				1.70m			EXCAVATION TP-EQ12 TERMINATED AT 1.70 m Target depth				1.70: Near refusal on HW Dolerite
				21.0 / 2.0 / 2.5 / 20.0 / 3.0 / 3.5 / 19.0 / 4.0 / 4.5 / 18.0 / 5.0 / 5.5 / 17.0 / 6.0						100 / 200 / 300 / 400	

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ13

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767656.000, N: 5998839.000 (55 MGA94)
SURFACE ELEVATION : 17.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 3.00 m LONG 2.00 m WIDE

DRILLING | MATERIAL

PENETRATION (VE, E, F, H)	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION (Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components)	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER (kPa)	STRUCTURE & Other Observations
		GNE	0.50m B	17.0 / 0.0			TOPSOIL				TOPSOIL
				0.20m							
							COBBLES within sandy gravel matrix, grey-brown, dry.	D			ALLUVIUM/COLLUVIUM
				0.5							
				0.50m							
							RHYOLITE, mottled grey, white and orange, intact rock high to very high strength strength, highly weathered, fractured, recovered as gravel and cobbles within a sandy clay matrix.				WEATHERED ROCK
			1.20m	16.0 / 1.0							
				1.20m			EXCAVATION TP-EQ13 TERMINATED AT 1.20 m Target depth				1.20: Near refusal on HW Rhyolite
				1.5							
				15.0 / 2.0							
				2.5							
				14.0 / 3.0							
				3.5							
				13.0 / 4.0							
				4.5							
				12.0 / 5.0							
				5.5							
				11.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
N Natural Exposure
E Existing Excavation
BH Backhoe Bucket
B Bulldozer Blade
R Ripper

SUPPORT
T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
U50 - Undisturbed Sample 50 mm diameter
D - Disturbed Sample
B - Bulk Disturbed Sample
MC - Moisture Content
HP - Hand Penetrometer (UCS kPa)
VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
D - Dry
M - Moist
W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ14

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767762.000, N: 5998860.000 (55 MGA94)
SURFACE ELEVATION : 29.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 3.50 m LONG 2.00 m WIDE

DRILLING | MATERIAL

VE / E / F / H PENETRATION	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	HAND PENETROMETER kPa (100 / 200 / 300 / 400)	STRUCTURE & Other Observations
		GNE		29.0 / 0.0			TOPSOIL				TOPSOIL
				0.20m							
							COBBLES within sandy gravel matrix, grey-brown, dry.	D			ALLUVIUM/COLLUVIUM
				0.5							
							DOLERITE, brown and orange with black staining, intact rock typically medium to high strength, highly weathered, fractured, recovered as gravels and cobbles in a clayey sand matrix.				WEATHERED ROCK
				28.0 / 1.0							
				1.20m			EXCAVATION TP-EQ14 TERMINATED AT 1.20 m Target depth				1.20: Near refusal on HW Dolerite
				1.5							
				27.0 / 2.0							
				2.5							
				26.0 / 3.0							
				3.5							
				25.0 / 4.0							
				4.5							
				24.0 / 5.0							
				5.5							
				23.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ15

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767869.000, N: 5998799.000 (55 MGA94)
SURFACE ELEVATION : 29.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 3.50 m LONG 2.50 m WIDE

DRILLING | MATERIAL

VE / E / F / H PENETRATION	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION (Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components)	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER (kPa)	STRUCTURE & Other Observations
				29.0 / 0.0			TOPSOIL				TOPSOIL
				0.25m			CH CLAY, high plasticity, red-brown, trace fine to medium sand, moist MC<PL, very stiff.	M (<PL)			RESIDUAL SOIL
		GNE	0.75m B	0.5							
				0.75m			CL CLAY, medium plasticity, mottled red and orange, with some fine to medium grained sand, moist MC~PL, very stiff, XW DOLERITE.				EXTREMELY WEATHERED ROCK
				28.0 / 1.0							
				1.5							
				27.0 / 2.0							
				2.5							
				26.0 / 3.0				M (c PL)	VSt		
				3.5							
				25.0 / 4.0							
				4.5							
				24.0 / 5.0							
			5.40m				5.40m				
				5.5			EXCAVATION TP-EQ15 TERMINATED AT 5.40 m Machine Limit				
				23.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ16

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767861.000, N: 5998698.000 (55 MGA94)
SURFACE ELEVATION : 36.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 4.00 m LONG 2.80 m WIDE

DRILLING | MATERIAL

VE / PENETRATION E F H	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION (Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components)	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER (kPa)	STRUCTURE & Other Observations
				36.0 / 0.0			TOPSOIL				TOPSOIL
							0.20m				
							GRAVELS and COBBLES within sandy clay matrix, dry.	D			ALLUVIUM/COLLUVIUM
			0.40m				0.40m				
			B	0.5			CH CLAY, high plasticity, red-brown, trace fine to medium grained sand, moist MC~PL, very stiff.		VSt		RESIDUAL SOIL
		GNE	0.80m				0.80m				
			B	35.0 / 1.0			CL SANDY CLAY, medium plasticity, mottled brown, orange and grey, sand is fine to medium grained, trace fine to coarse gravel, moist M~PL, stiff, XW DOLERITE.	M (c PL)	St		EXTREMELY WEATHERED ROCK
			1.50m				1.50m				
				1.5			DOLERITE, brown and orange with black staining, intact rock typically high strength, highly weathered, fractured.				WEATHERED ROCK
							1.80m				
				34.0 / 2.0			EXCAVATION TP-EQ16 TERMINATED AT 1.80 m Target depth				1.80: Near refusal on HW Dolerite
				2.5							
				33.0 / 3.0							
				3.5							
				32.0 / 4.0							
				4.5							
				31.0 / 5.0							
				5.5							
				30.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ17

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767897.000, N: 5998668.000 (55 MGA94)
SURFACE ELEVATION : 32.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 4.00 m LONG 2.40 m WIDE

DRILLING | MATERIAL

VE / E / F / H PENETRATION	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER (kPa)	STRUCTURE & Other Observations
				32.0 / 0.0			TOPSOIL				TOPSOIL
				0.20m							
							GW SANDY GRAVEL, fine to coarse, brown, sand is fine to coarse grained, with some fines, dry, COLLUVIUM.	D			ALLUVIUM/COLLUVIUM
				0.40m							
				0.5			CH CLAY, high plasticity, mottled dark brown, red and orange, with fine to coarse grained sand, moist MC<PL, very stiff.				RESIDUAL SOIL
				31.0 / 1.0				M (<PL)	VSt		
				1.10m							
							CH CLAY, high plasticity, mottled brown, red and orange, with fine to coarse grained sand, moist MC<PL, very stiff, XW Dolerite.				EXTREMELY WEATHERED ROCK
				1.5							
			1.70m	1.70m							
			B				CL SANDY CLAY, medium plasticity, mottled brown, red and orange, sand is fine to coarse grained, moist M~PL, XW DOLERITE.				1.70: Increasing sand content with depth
				30.0 / 2.0							
				2.5				M (c PL)			
				29.0 / 3.0							
				3.5							
			3.60m	3.60m							
							DOLERITE, brown and orange with black staining, intact rock typically high strength, highly weathered, fractured.				WEATHERED ROCK
				4.00m							
				28.0 / 4.0			EXCAVATION TP-EQ17 TERMINATED AT 4.00 m Target depth				4.00: Near refusal on HW Dolerite
				4.5							
				27.0 / 5.0							
				5.5							
				26.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

EXCAVATION - GEOLOGICAL LOG

PIT NO : TP-EQ18

PROJECT : Eurobodalla Southern Storage
LOCATION : Eurobodalla Quarry
CLIENT : Eurobodalla Shire Council
FEATURE : Potential Earthfill Borrow
FILE / JOB NO : 30012127
SHEET : 1 OF 1

POSITION : E: 767726.000, N: 5998496.000 (55 MGA94)
SURFACE ELEVATION : 52.000 (AHD)

EQUIPMENT TYPE : 16t Excavator
METHOD : Test Pit

DATE EXCAVATED : 19/1/17
LOGGED BY : CP
CHECKED BY : RW

EXCAVATION DIMENSIONS : 3.80 m LONG 2.50 m WIDE

DRILLING | MATERIAL

VE / E / F / H PENETRATION	SUPPORT	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	ELEVATION (RL) / DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Plasticity or Particle Characteristic, Colour, Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	HAND PENETROMETER kPa (100 / 200 / 300 / 400)	STRUCTURE & Other Observations
				52.0 / 0.0			TOPSOIL				TOPSOIL
			0.30m				0.30m				
		GNE	B	51.0 / 1.0			CH CLAY, high plasticity, mottled brown, orange and grey, trace gravel (fine to coarse), moist MC~PL, very stiff, XW DOLERITE.	M (c PL)	VSt		EXTREMELY WEATHERED ROCK 1.10: Colour changes to mottled grey and orange 1.30: Some low to medium strength rock appearing
			1.50m	1.5			1.50m				
							1.60m DOLERITE, grey and brown, intact rock typically high strength, highly weathered, fractured.				WEATHERED ROCK
				50.0 / 2.0			EXCAVATION TP-EQ18 TERMINATED AT 1.60 m Refusal				
				49.0 / 3.0							
				48.0 / 4.0							
				47.0 / 5.0							
				46.0 / 6.0							

PHOTOGRAPHS NOTES ☒ YES ☐ NO

METHOD
- N Natural Exposure
- E Existing Excavation
- BH Backhoe Bucket
- B Bulldozer Blade
- R Ripper

SUPPORT
- T Timbering

PENETRATION
VE E F H VH — No Resistance

WATER
10 Oct., 73 Water Level on Date shown
water inflow
water outflow

SAMPLES & FIELD TESTS
- U50 - Undisturbed Sample 50 mm diameter
- D - Disturbed Sample
- B - Bulk Disturbed Sample
- MC - Moisture Content
- HP - Hand Penetrometer (UCS kPa)
- VS - Vane Shear; P-Peak, R-Remouded (uncorrected kPa)
- PBT - Plate Bearing Test

CLASSIFICATION SYMBOLS & SOIL DESCRIPTION
Based on Unified Classification System

MOISTURE
- D - Dry
- M - Moist
- W - Wet

CONSISTENCY/ RELATIVE DENSITY

VS	- Very Soft
S	- Soft
F	- Firm
St	- Stiff
VSt	- Very Stiff
H	- Hard
VL	- Very Loose
L	- Loose
MD	- Medium Dense
D	- Dense
VD	- Very Dense

See Explanatory Notes for details of abbreviations & basis of descriptions.

SMEC AUSTRALIA

APPENDIX B. LABORTORY TESTING

Appendix	Laboratory Test
B1	Particle Size Distribution
B2	Atterberg Limits and Emerson Class
B3	Standard Compaction
B4	Triaxial Tests
B5	Permeability Tests

B1 – Particle Size Distribution

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R001
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF

Sample Identification TP-EQ01 0.3 - 1.2m *Sample No* 17102001

Sample Description

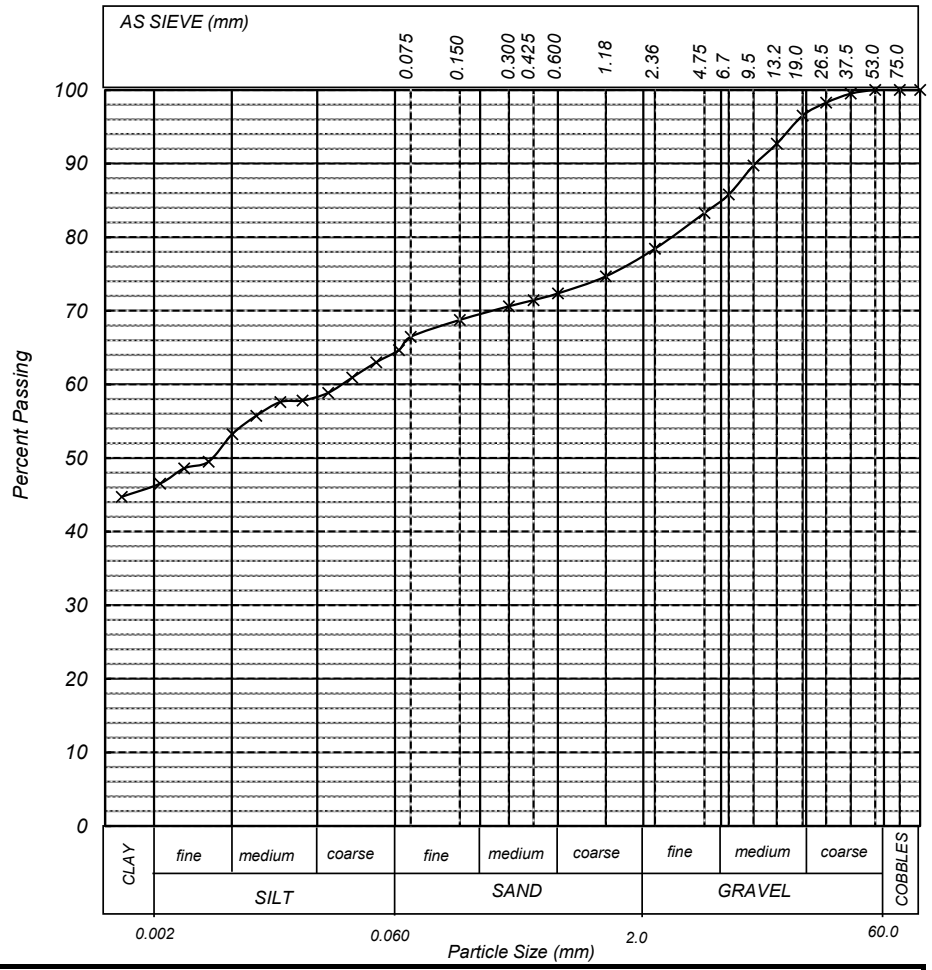
gravelly CLAY, high plasticity, brown, fine to coarse gravel, trace of fine to coarse sand

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	98
19.0	97
13.2	93
9.5	90
6.7	86
4.75	83
2.36	78
1.18	75
0.600	72
0.425	71
0.300	71
0.150	69
0.075	66
0.064	65
0.046	63
0.033	61
0.023	59
0.016	58
0.012	58
0.0085	56
0.0060	53
0.0043	49
0.0031	49
0.0022	47
0.0013	45



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	3.2%	*coarse*	5.2%	*coarse*	5.6%	*Gravel*	22.5%
medium	11.8%	*medium*	2.8%	*medium*	5.2%	*Sand*	13.5%
fine	7.5%	*fine*	5.5%	*fine*	7.0%	*Silt*	17.8%
Total	22.5%	*Total*	13.5%	*Total*	17.8%	*Clay*	46.2%
						Total	100.0%

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R002
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF

Sample Identification TP-EQ03 2.6 - 3.1m *Sample No* 17102002

Sample Description

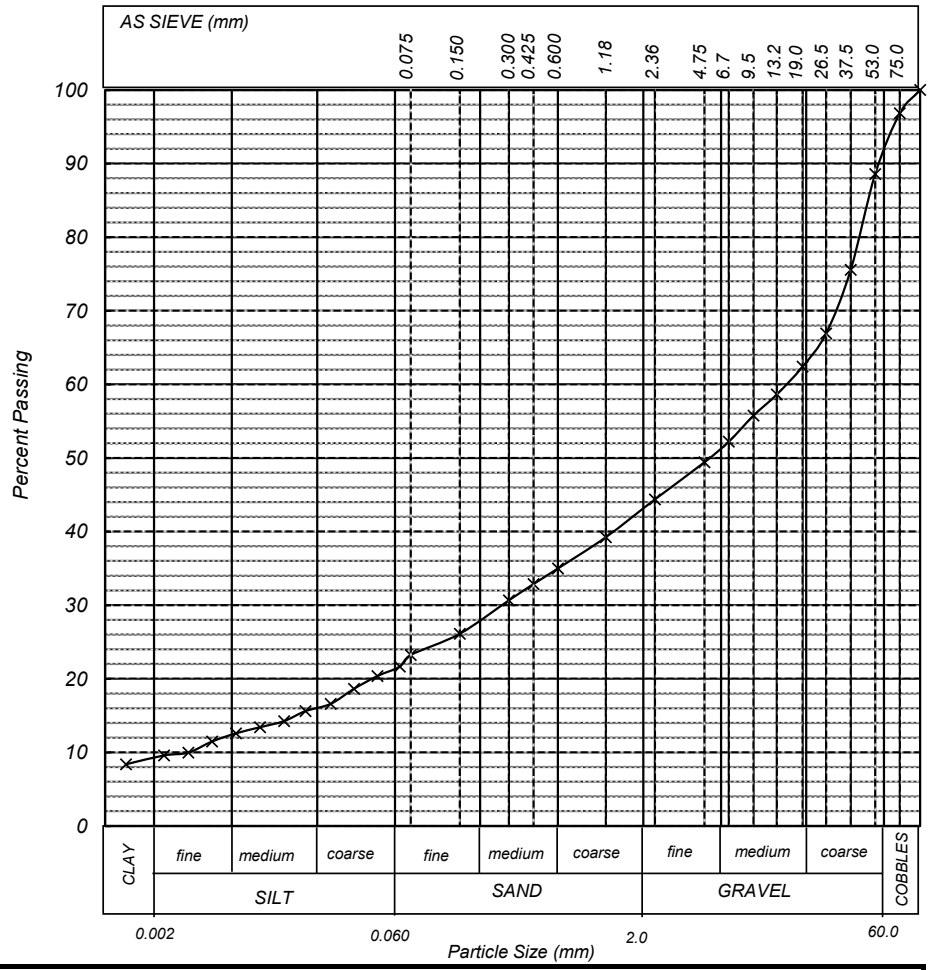
clayey GRAVEL, fine to coarse, brown, fines of medium plasticity, with fine to coarse sand

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	97
53.0	89
37.5	76
26.5	67
19.0	62
13.2	59
9.5	56
6.7	52
4.75	49
2.36	44
1.18	39
0.600	35
0.425	33
0.300	31
0.150	26
0.075	23
0.064	22
0.047	20
0.034	19
0.024	17
0.017	16
0.013	14
0.0089	13
0.0064	13
0.0045	11
0.0032	10
0.0023	10
0.0013	8



Gravel		*Sand*		*Silt*		*Cobbles*	6.1%
coarse	30.8%	*coarse*	8.2%	*coarse*	4.9%	*Gravel*	50.8%
medium	11.8%	*medium*	7.0%	*medium*	3.7%	*Sand*	22.2%
fine	8.2%	*fine*	7.0%	*fine*	3.0%	*Silt*	11.6%
Total	50.8%	*Total*	22.2%	*Total*	11.6%	*Clay*	9.3%
						Total	100.0%

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R003
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF

Sample Identification TP-EQ04 1.6 - 2.0m *Sample No* 17102003

Sample Description

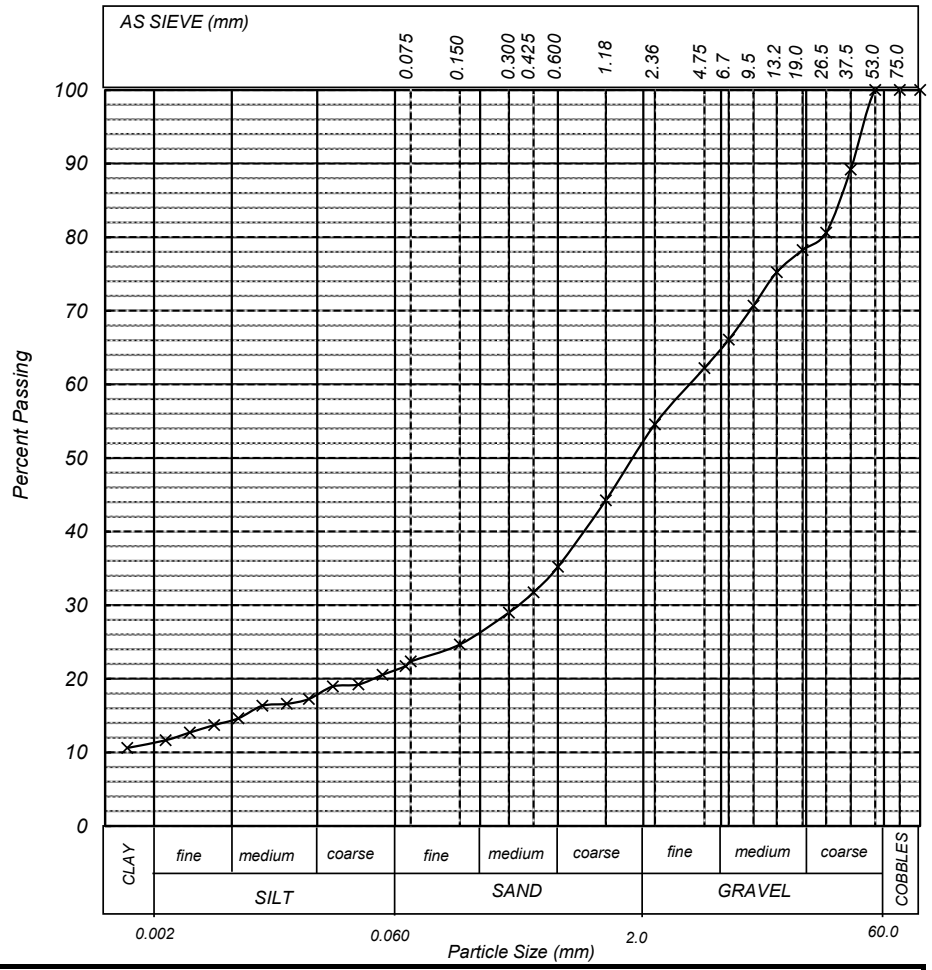
clayey GRAVEL, fine to coarse, brown, fines of medium plasticity, with fine to coarse sand

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	89
26.5	81
19.0	78
13.2	75
9.5	71
6.7	66
4.75	62
2.36	55
1.18	44
0.600	35
0.425	32
0.300	29
0.150	25
0.075	22
0.070	22
0.050	21
0.036	19
0.025	19
0.018	17
0.013	17
0.0092	16
0.0066	15
0.0047	14
0.0033	13
0.0024	12
0.0014	11



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	21.4%	*coarse*	16.9%	*coarse*	2.6%	*Gravel*	47.9%
medium	13.8%	*medium*	8.8%	*medium*	3.5%	*Sand*	31.8%
fine	12.7%	*fine*	6.1%	*fine*	2.9%	*Silt*	9.0%
Total	47.9%	*Total*	31.8%	*Total*	9.0%	*Clay*	11.3%
						Total	100.0%

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R004
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF

Sample Identification TP-EQ03 0.25 - 2.2m *Sample No* 17102004

Sample Description

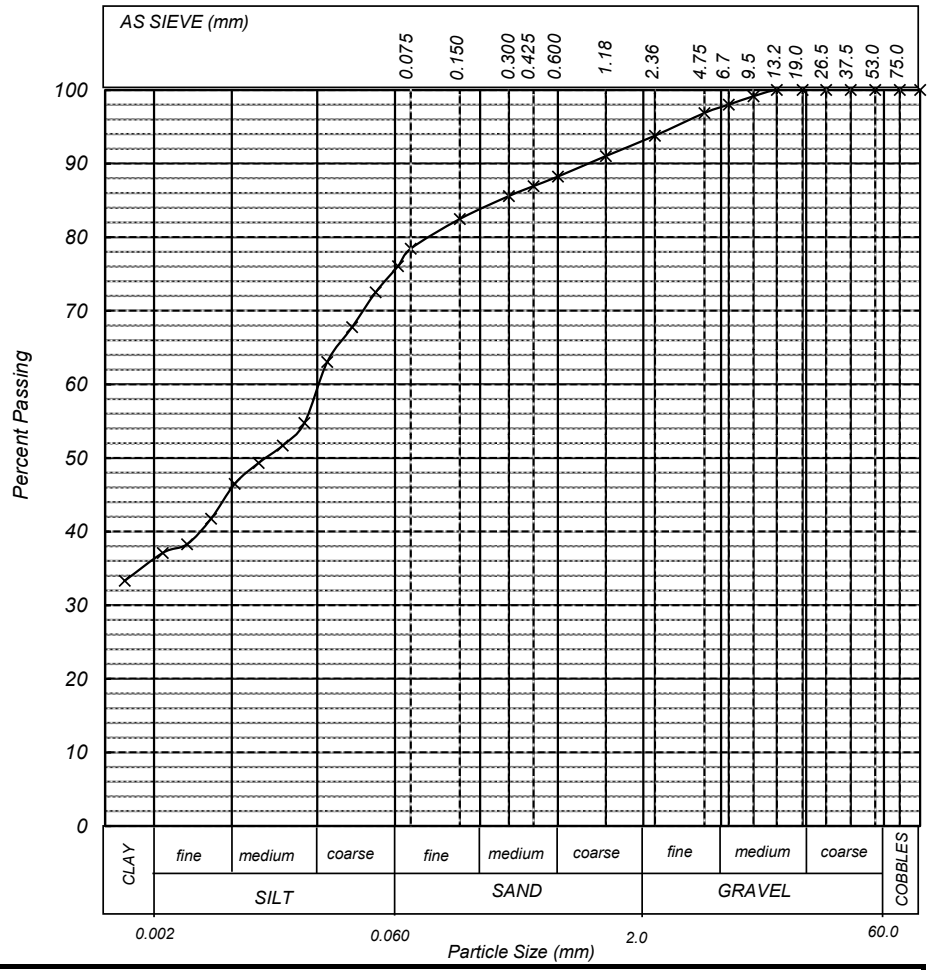
CLAY, medium plasticity, brown, with fine to coarse sand, trace of fine to medium gravel

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	100
9.5	99
6.7	98
4.75	97
2.36	94
1.18	91
0.600	88
0.425	87
0.300	86
0.150	82
0.075	78
0.063	76
0.046	73
0.033	68
0.023	63
0.017	55
0.012	52
0.0088	49
0.0062	46
0.0045	42
0.0032	38
0.0023	37
0.0013	33



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	0.0%	*coarse*	4.9%	*coarse*	16.1%	*Gravel*	6.9%
medium	2.4%	*medium*	4.5%	*medium*	13.5%	*Sand*	17.7%
fine	4.5%	*fine*	8.3%	*fine*	9.6%	*Silt*	39.2%
Total	6.9%	*Total*	17.7%	*Total*	39.2%	*Clay*	36.2%
						Total	100.0%

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R005
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF

Sample Identification TP-EQ07 0.5 - 1.0m *Sample No* 17102005

Sample Description

silty SAND, fine to coarse, brown, fines of high liquid limit, with fine to coarse gravel

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	97
37.5	92
26.5	91
19.0	90
13.2	86
9.5	85
6.7	84
4.75	82
2.36	79
1.18	72
0.600	67
0.425	64
0.300	61
0.150	54
0.075	47
0.066	44
0.048	40
0.035	35
0.025	30
0.018	26
0.013	22
0.0093	19
0.0066	17
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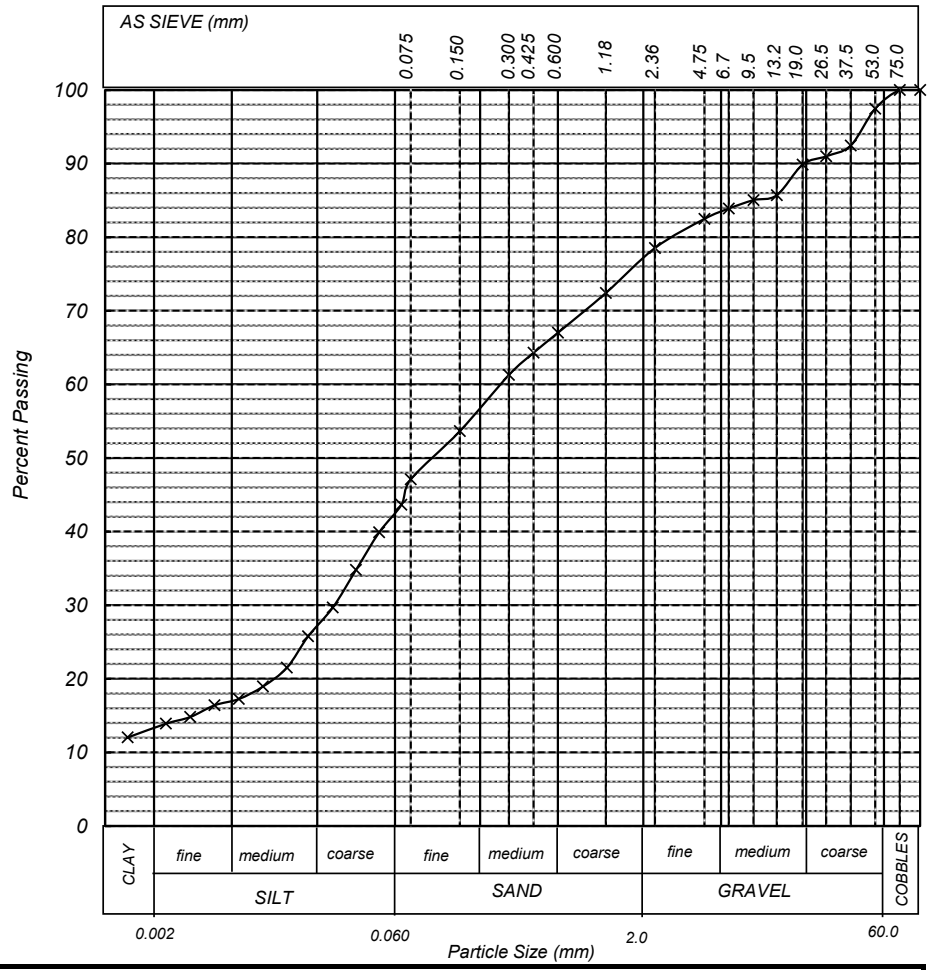
0.0024	14
0.0014	12



Gravel		*Sand*		*Silt*		*Cobbles*	0.9%
coarse	9.1%	*coarse*	10.0%	*coarse*	14.1%	*Gravel*	22.1%
medium	6.6%	*medium*	10.2%	*medium*	10.2%	*Sand*	35.7%
fine	6.4%	*fine*	15.5%	*fine*	3.7%	*Silt*	28.0%
Total	22.1%	*Total*	35.7%	*Total*	28.0%	*Clay*	13.3%
						Total	100.0%

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES
6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R006
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	Tested by	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	Date tested	02/03/17
Location	EUROBODALLA QUARRY	Checked by	PJF

Sample Identification TP-EQ12 0.5 - 1.5m — Sample No 17102006

Sample Description

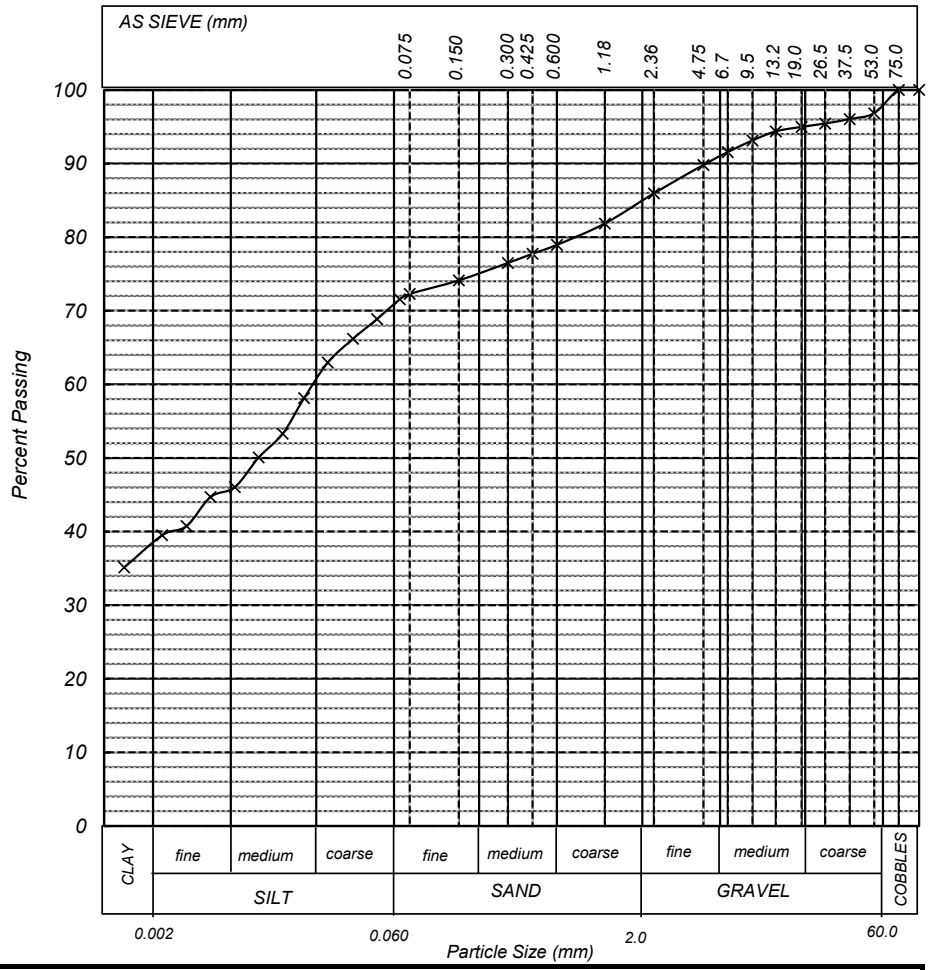
CLAY, high plasticity, brown, trace of fine to coarse sand and fine to coarse gravel

Assumed soil particle density 2.65 g/cm³

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	Loss in pretreatment	0%
Hydrometer type	g/l	Variation to method	-

Particle Size (mm)	Percent Passing
100.0	100
75.0	100
53.0	97
37.5	96
26.5	95
19.0	95
13.2	94
9.5	93
6.7	92
4.75	90
2.36	86
1.18	82
0.600	79
0.425	78
0.300	76
0.150	74
0.075	72
0.065	72
0.047	69
0.034	66
0.024	63
0.017	58
0.012	53
0.0089	50
0.0063	46
0.0045	45
0.0032	41
0.0023	39
0.0013	35



Gravel		Sand		Silt		Cobbles	1.1%
coarse	3.8%	coarse	6.0%	coarse	10.3%	Gravel	13.9%
medium	4.1%	medium	3.8%	medium	14.8%	Sand	14.0%
fine	6.0%	fine	4.2%	fine	7.4%	Silt	32.5%
Total	13.9%	Total	14.0%	Total	32.5%	Clay	38.5%
						Total	100.0%

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R007
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF

Sample Identification TP-EQ11 0.2 - 1.3m *Sample No* 17102007

Sample Description

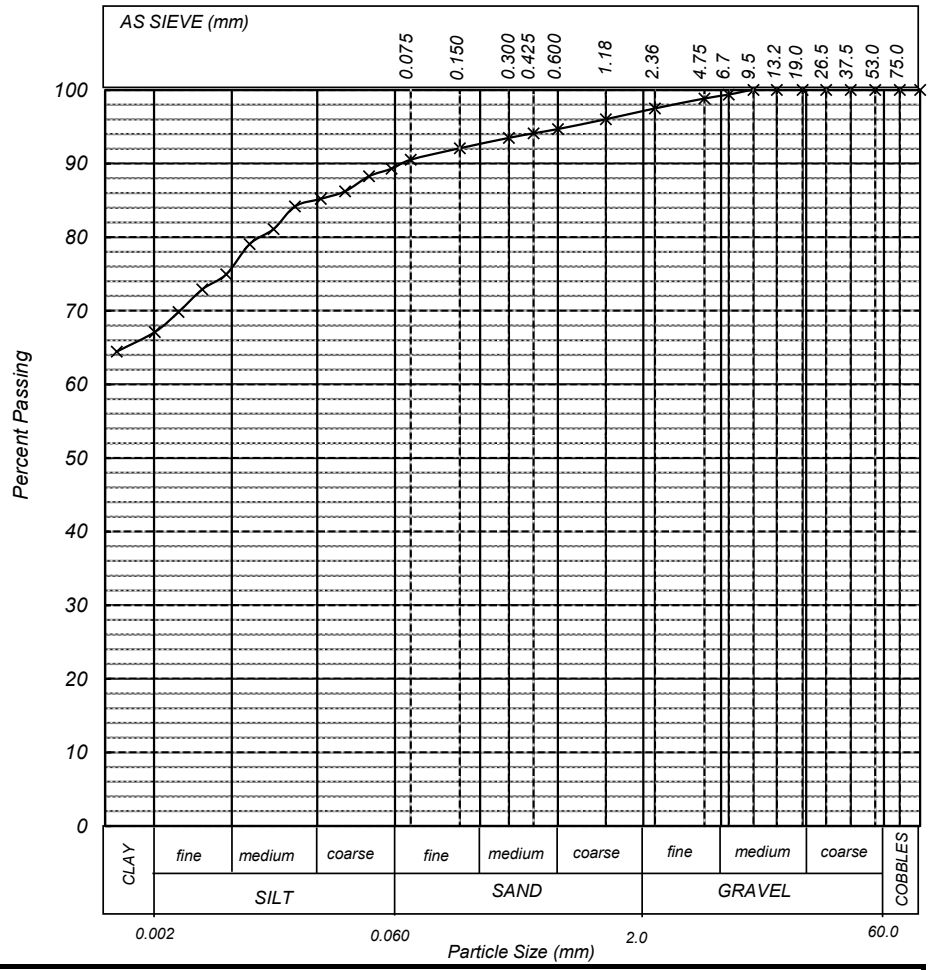
CLAY, high plasticity, brown, trace of fine to coarse sand

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	100
9.5	100
6.7	99
4.75	99
2.36	97
1.18	96
0.600	95
0.425	94
0.300	93
0.150	92
0.075	91
0.057	89
0.042	88
0.030	86
0.021	85
0.015	84
0.011	81
0.0077	79
0.0055	75
0.0039	73
0.0028	70
0.0020	67
0.0012	64



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	0.0%	*coarse*	2.5%	*coarse*	4.5%	*Gravel*	2.9%
medium	0.8%	*medium*	2.0%	*medium*	9.1%	*Sand*	7.6%
fine	2.1%	*fine*	3.1%	*fine*	8.8%	*Silt*	22.4%
Total	2.9%	*Total*	7.6%	*Total*	22.4%	*Clay*	67.1%
						Total	100.0%

Approved Signatory : Peter Fry

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R008
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF

Sample Identification TP-EQ18 0.3 - 1.5m *Sample No* 17102008

Sample Description

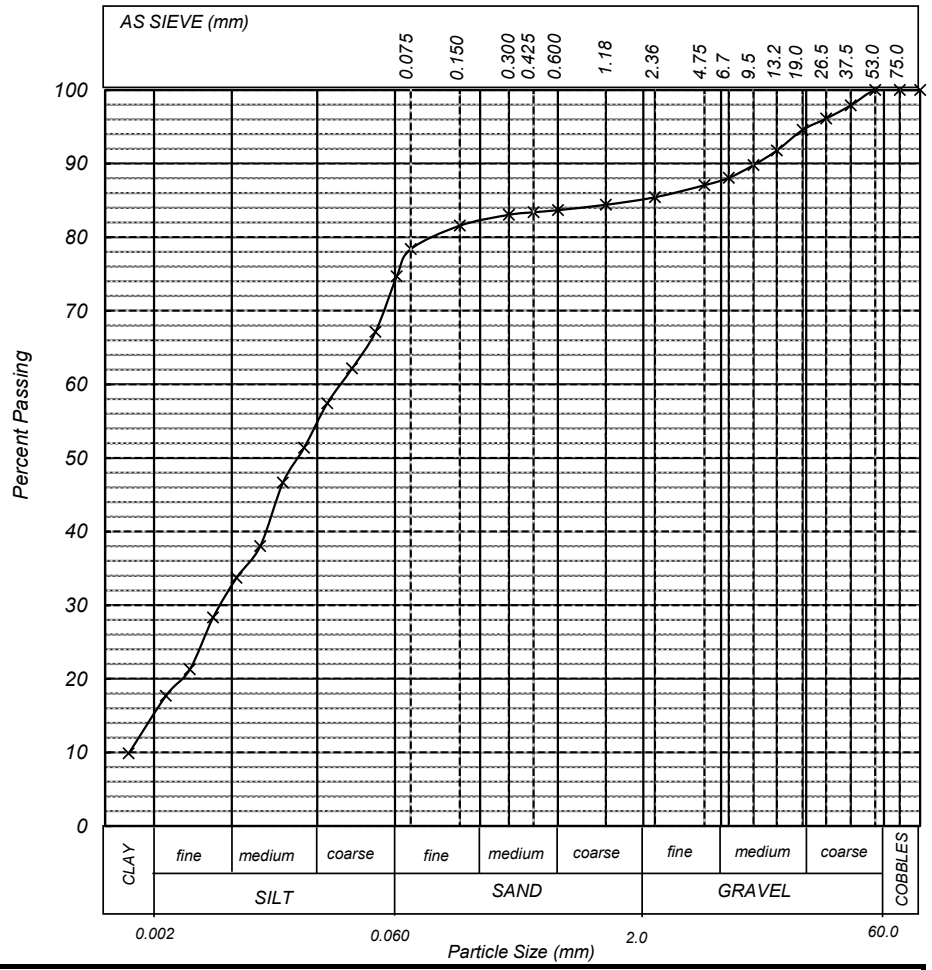
CLAY, high plasticity, brown, with fine to coarse gravel, trace of fine to coarse sand

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	98
26.5	96
19.0	95
13.2	92
9.5	90
6.7	88
4.75	87
2.36	85
1.18	84
0.600	84
0.425	83
0.300	83
0.150	82
0.075	78
0.061	75
0.046	67
0.033	62
0.023	57
0.017	51
0.012	47
0.0089	38
0.0064	34
0.0046	28
0.0033	21
0.0024	18
0.0014	10



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	5.2%	*coarse*	1.5%	*coarse*	19.3%	*Gravel*	14.9%
medium	7.1%	*medium*	1.5%	*medium*	22.1%	*Sand*	11.1%
fine	2.6%	*fine*	8.1%	*fine*	17.4%	*Silt*	58.8%
Total	14.9%	*Total*	11.1%	*Total*	58.8%	*Clay*	15.2%
						Total	100.0%

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R009
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF

Sample Identification TP-EQ07 1.0 - 2.5m *Sample No* 17102009

Sample Description

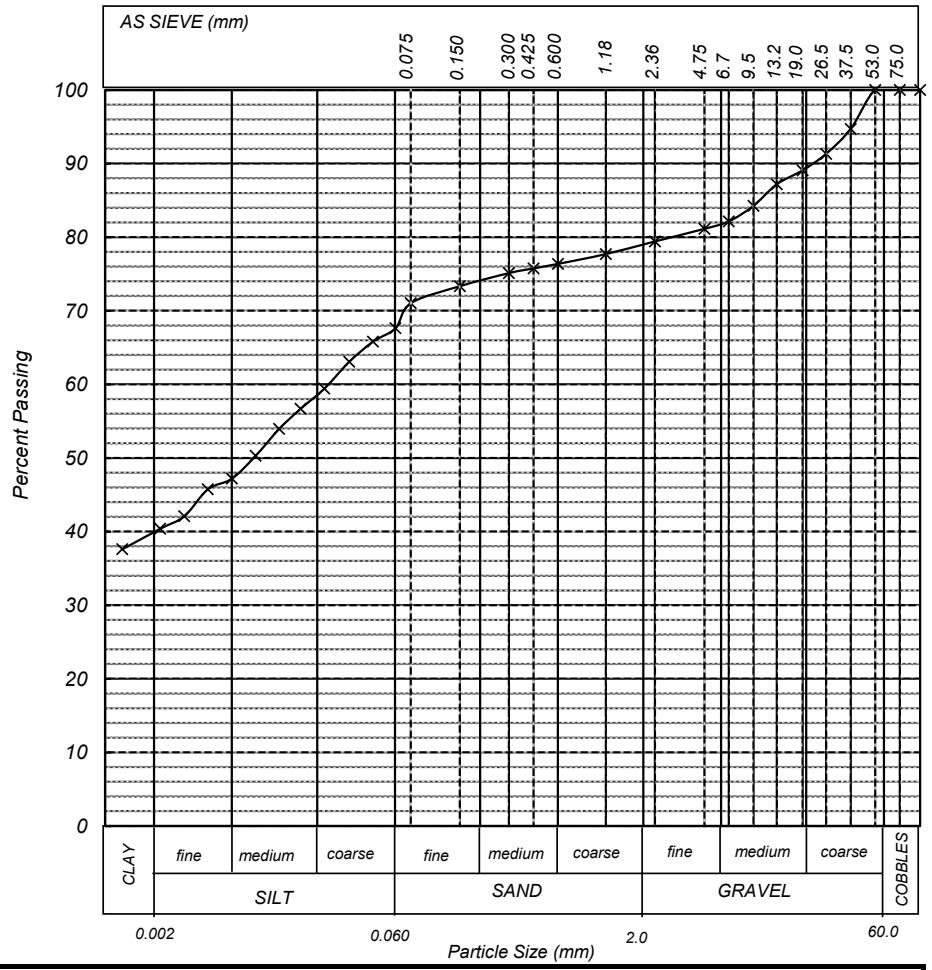
silty CLAY, high plasticity, brown, with fine to coarse gravel, trace of fine to coarse sand

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	95
26.5	91
19.0	89
13.2	87
9.5	84
6.7	82
4.75	81
2.36	79
1.18	78
0.600	76
0.425	76
0.300	75
0.150	73
0.075	71
0.060	68
0.044	66
0.031	63
0.022	59
0.016	57
0.012	54
0.0084	50
0.0060	47
0.0043	46
0.0031	42
0.0022	40
0.0013	38



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	10.6%	*coarse*	2.6%	*coarse*	8.9%	*Gravel*	21.0%
medium	7.6%	*medium*	2.3%	*medium*	11.4%	*Sand*	11.4%
fine	2.8%	*fine*	6.5%	*fine*	7.3%	*Silt*	27.6%
Total	21.0%	*Total*	11.4%	*Total*	27.6%	*Clay*	40.0%
						Total	100.0%

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R010
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF

Sample Identification TP-EQ10 0.8 - 1.4m *Sample No* 17102010

Sample Description

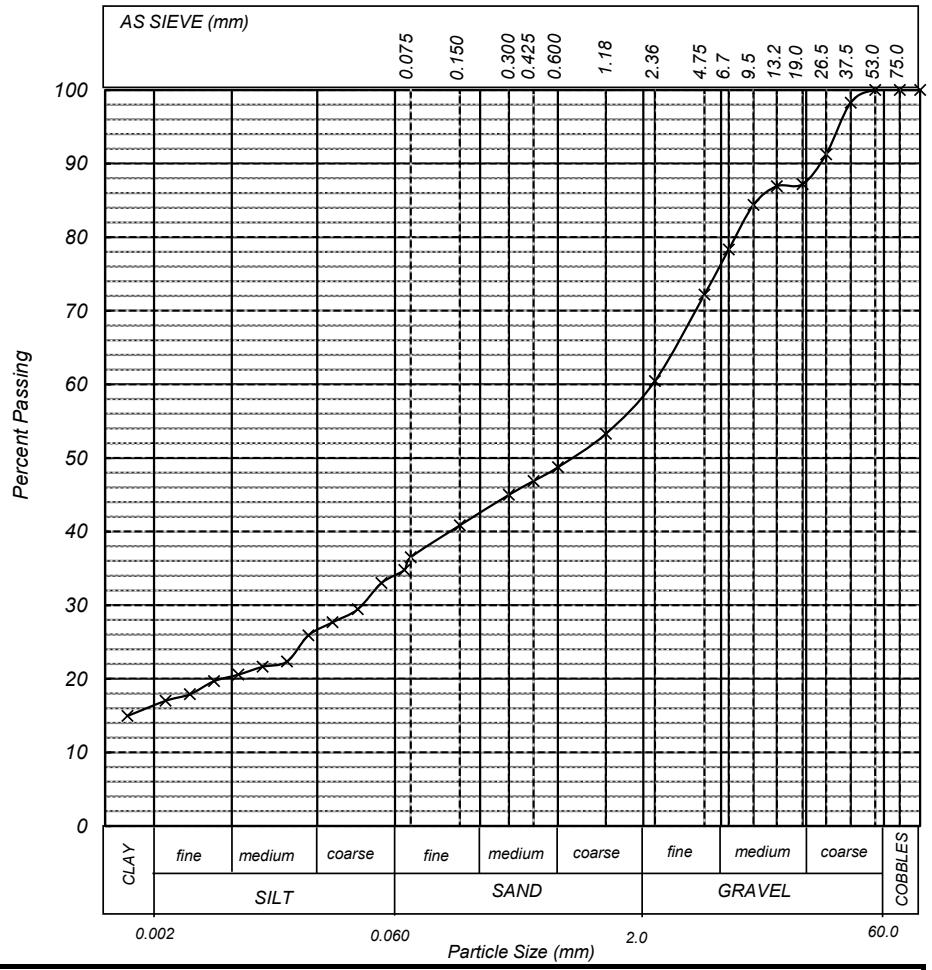
silty / clayey GRAVEL, fine to coarse, brown, fines of high plasticity, with fine to coarse sand

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	98
26.5	91
19.0	87
13.2	87
9.5	84
6.7	78
4.75	72
2.36	60
1.18	53
0.600	49
0.425	47
0.300	45
0.150	41
0.075	37
0.068	35
0.050	33
0.035	29
0.025	28
0.018	26
0.013	22
0.0093	22
0.0066	21
0.0047	20
0.0033	18
0.0023	17
0.0014	15



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	12.2%	*coarse*	10.0%	*coarse*	5.7%	*Gravel*	41.3%
medium	11.5%	*medium*	6.2%	*medium*	6.2%	*Sand*	26.5%
fine	17.6%	*fine*	10.3%	*fine*	3.9%	*Silt*	15.8%
Total	41.3%	*Total*	26.5%	*Total*	15.8%	*Clay*	16.4%
						Total	100.0%

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES
6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R011
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	Tested by	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	Date tested	02/03/17
Location	EUROBODALLA QUARRY	Checked by	PJF

Sample Identification TP-EQ16 0.4 - 0.8m — *Sample No* 17102011

Sample Description

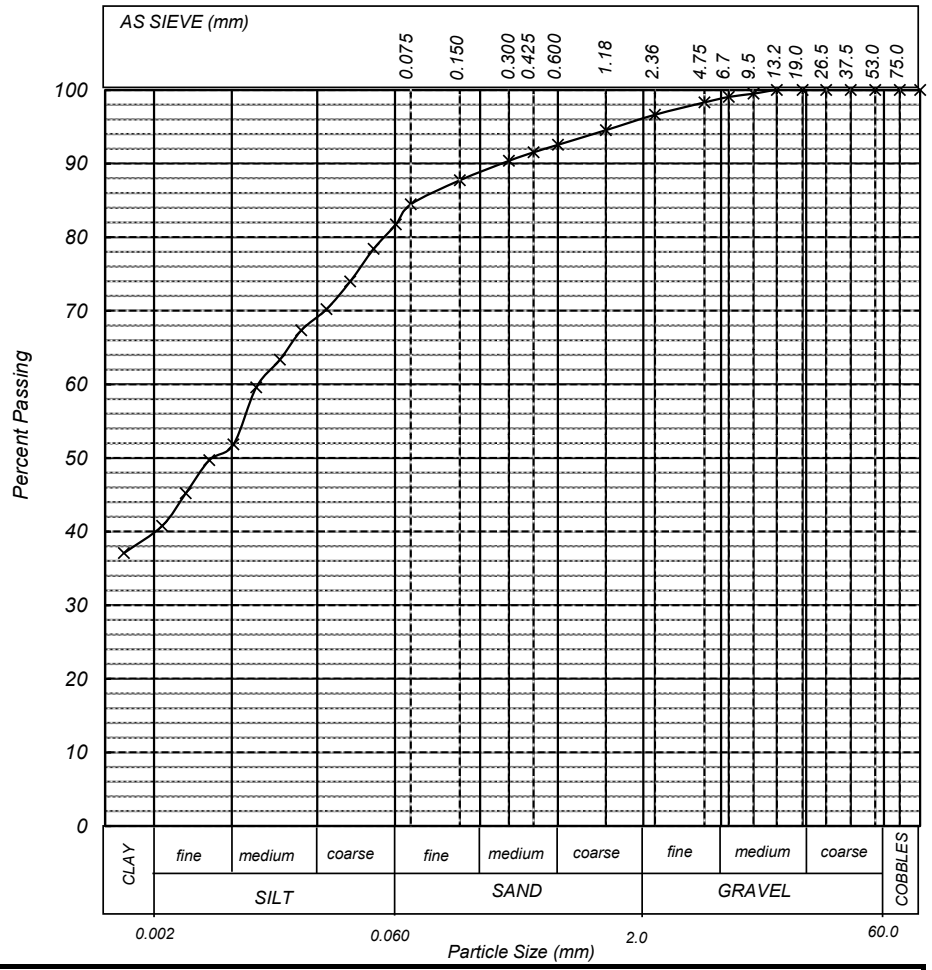
silty CLAY, high plasticity, brown, with fine to coarse sand

Assumed soil particle density 2.65 g/cm³

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	Percent Passing
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	100
9.5	100
6.7	99
4.75	98
2.36	97
1.18	95
0.600	93
0.425	92
0.300	90
0.150	88
0.075	84
0.061	82
0.044	78
0.032	74
0.023	70
0.016	67
0.012	63
0.0085	60
0.0061	52
0.0044	50
0.0031	45
0.0022	41
0.0013	37



Gravel		Sand		Silt		Cobbles	0.0%
coarse	0.0%	coarse	3.6%	coarse	12.4%	Gravel	3.9%
medium	1.2%	medium	3.7%	medium	17.4%	Sand	14.6%
fine	2.7%	fine	7.3%	fine	11.7%	Silt	41.5%
Total	3.9%	Total	14.6%	Total	41.5%	Clay	40.0%
						Total	100.0%

Approved Signatory : Peter Fry

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R012
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF

Sample Identification TP-EQ15 0.75 - 5.4m *Sample No* 17102012

Sample Description

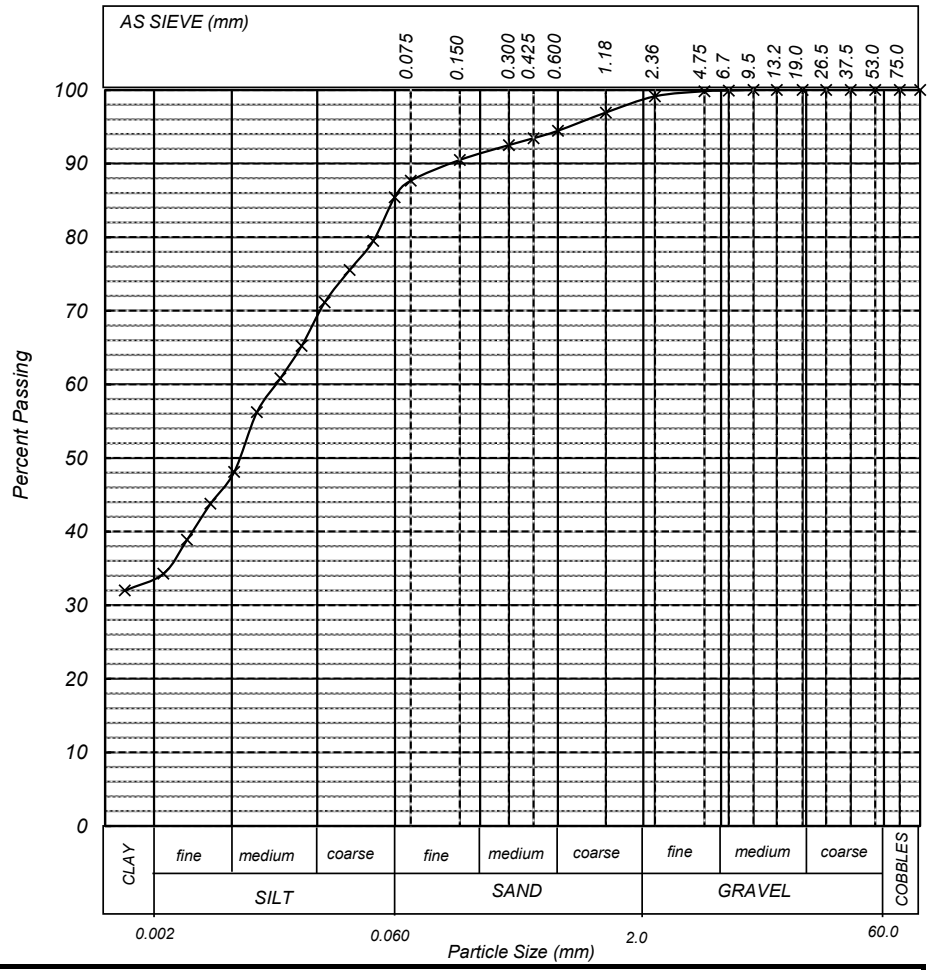
SILT, high liquid limit, brown, trace of fine to coarse sand

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	100
9.5	100
6.7	100
4.75	100
2.36	99
1.18	97
0.600	94
0.425	93
0.300	93
0.150	90
0.075	88
0.060	85
0.044	79
0.032	76
0.022	71
0.016	65
0.012	61
0.0085	56
0.0062	48
0.0044	44
0.0032	39
0.0023	34
0.0013	32



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	0.0%	*coarse*	4.2%	*coarse*	16.2%	*Gravel*	1.4%
medium	0.1%	*medium*	3.1%	*medium*	21.5%	*Sand*	13.2%
fine	1.3%	*fine*	5.9%	*fine*	14.0%	*Silt*	51.7%
Total	1.4%	*Total*	13.2%	*Total*	51.7%	*Clay*	33.7%
						Total	100.0%

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES
6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R013
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	Tested by	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	Date tested	02/03/17
Location	EUROBODALLA QUARRY	Checked by	PJF

Sample Identification TP-EQ16 0.8 - 1.5m — *Sample No* 17102013

Sample Description

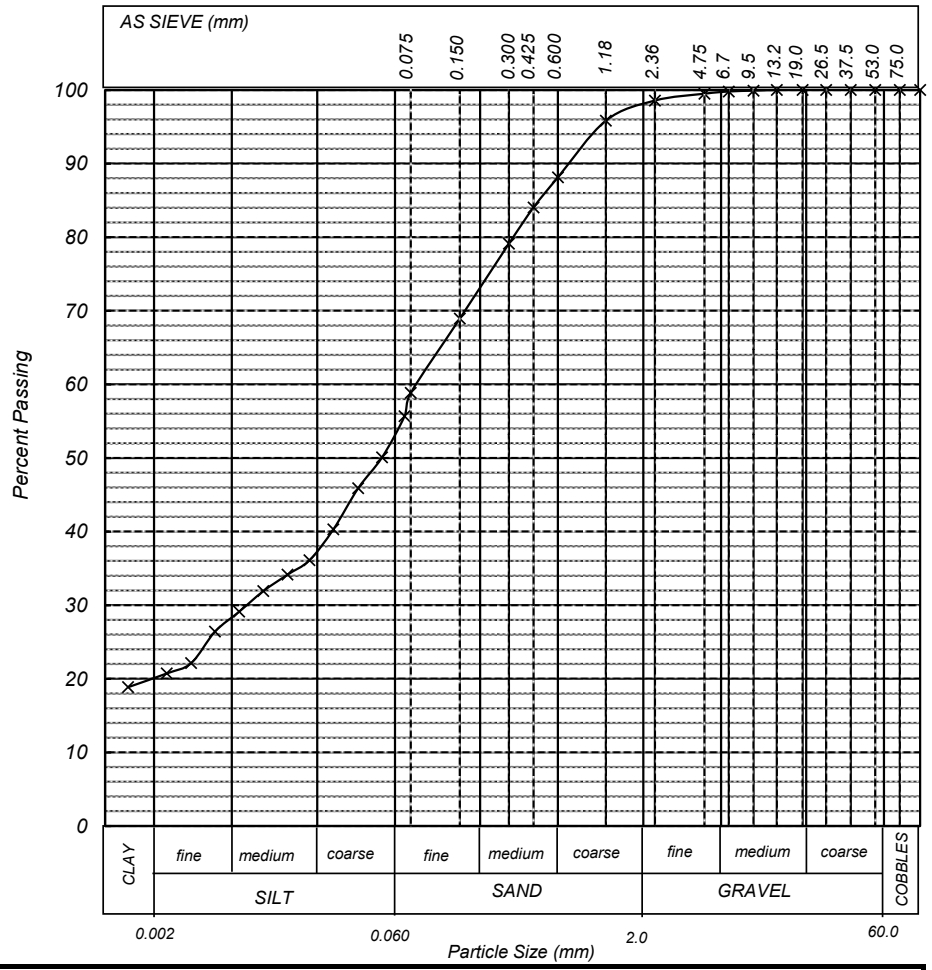
sandy CLAY / sandy SILT, high plasticity, brown, fine to coarse sand

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	Percent Passing
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	100
9.5	100
6.7	100
4.75	99
2.36	99
1.18	96
0.600	88
0.425	84
0.300	79
0.150	69
0.075	59
0.069	56
0.050	50
0.036	46
0.025	40
0.018	36
0.013	34
0.0093	32
0.0066	29
0.0047	26
0.0034	22
0.0024	21
0.0014	19



Gravel		Sand		Silt		Cobbles	0.0%
coarse	0.0%	coarse	9.8%	coarse	13.4%	Gravel	2.1%
medium	0.3%	medium	15.0%	medium	9.2%	Sand	47.1%
fine	1.8%	fine	22.3%	fine	8.1%	Silt	30.7%
Total	2.1%	Total	47.1%	Total	30.7%	Clay	20.1%
						Total	100.0%

Approved Signatory : Peter Fry

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R014
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF

Sample Identification TP-EQ17 1.7 - 3.6m *Sample No* 17102014

Sample Description

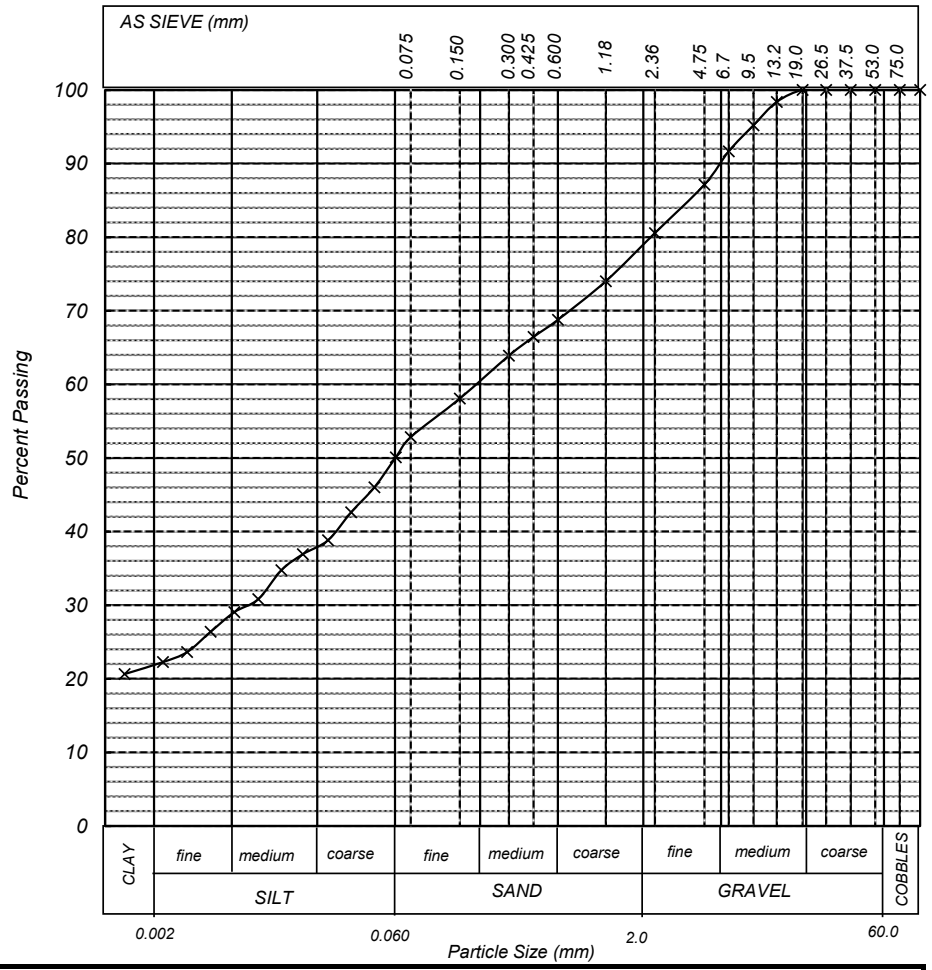
silty CLAY, medium plasticity, brown, with fine to coarse sand and fine to medium gravel

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	98
9.5	95
6.7	92
4.75	87
2.36	81
1.18	74
0.600	69
0.425	66
0.300	64
0.150	58
0.075	53
0.061	50
0.045	46
0.032	43
0.023	39
0.016	37
0.012	35
0.0087	31
0.0062	29
0.0044	26
0.0032	24
0.0023	22
0.0013	21



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	0.0%	*coarse*	10.2%	*coarse*	11.9%	*Gravel*	21.0%
medium	9.8%	*medium*	8.3%	*medium*	9.2%	*Sand*	29.1%
fine	11.2%	*fine*	10.6%	*fine*	6.9%	*Silt*	28.0%
Total	21.0%	*Total*	29.1%	*Total*	28.0%	*Clay*	21.9%
						Total	100.0%

PARTICLE SIZE DISTRIBUTION

AS 1289.3.6.1

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

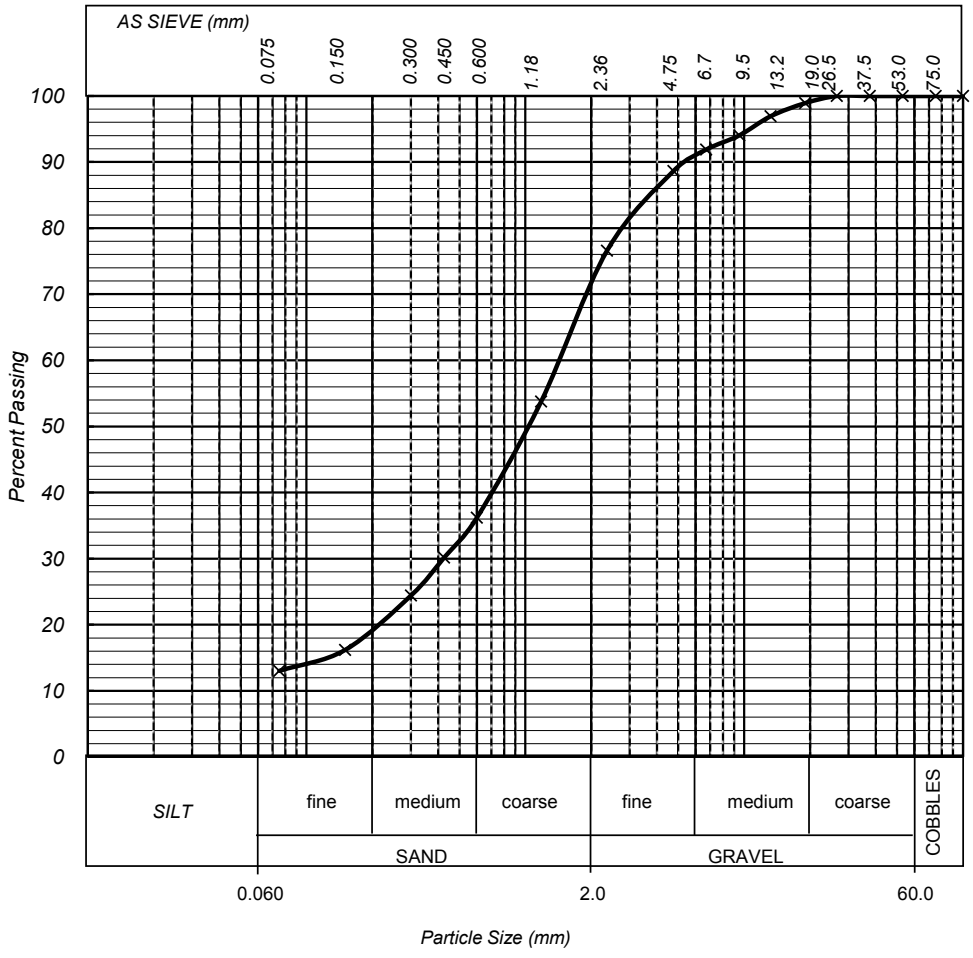
Job No	17102		
Report No	17102/R015		
Date of Issue	04/04/17		
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	CC
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF
Sample Identification	Springwater Quarry Sample 1	*Sample No*	17102015
Sampling method	By Client	*Sampled by*	Client
		Sampling date	2017

Sample Description

silty SAND, fine to coarse, brown, fines of low plasticity, with fine to coarse gravel

Particle Size Distribution

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	99
13.2	97
9.5	94
6.7	92
4.75	89
2.36	77
1.18	54
0.600	36
0.425	30
0.300	24
0.150	16
0.075	13



Gravel		*Sand*		*Cobbles*	0.0%
coarse	0.9%	*coarse*	34.9%	*Gravel*	28.8%
medium	8.2%	*medium*	16.6%	*Sand*	58.2%
fine	19.7%	*fine*	6.7%	*Fines*	13.0%
Total	28.8%	*Total*	58.2%	*Total*	100.0%

Approved Signatory : Peter Fry

PARTICLE SIZE DISTRIBUTION

AS 1289.3.6.1

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

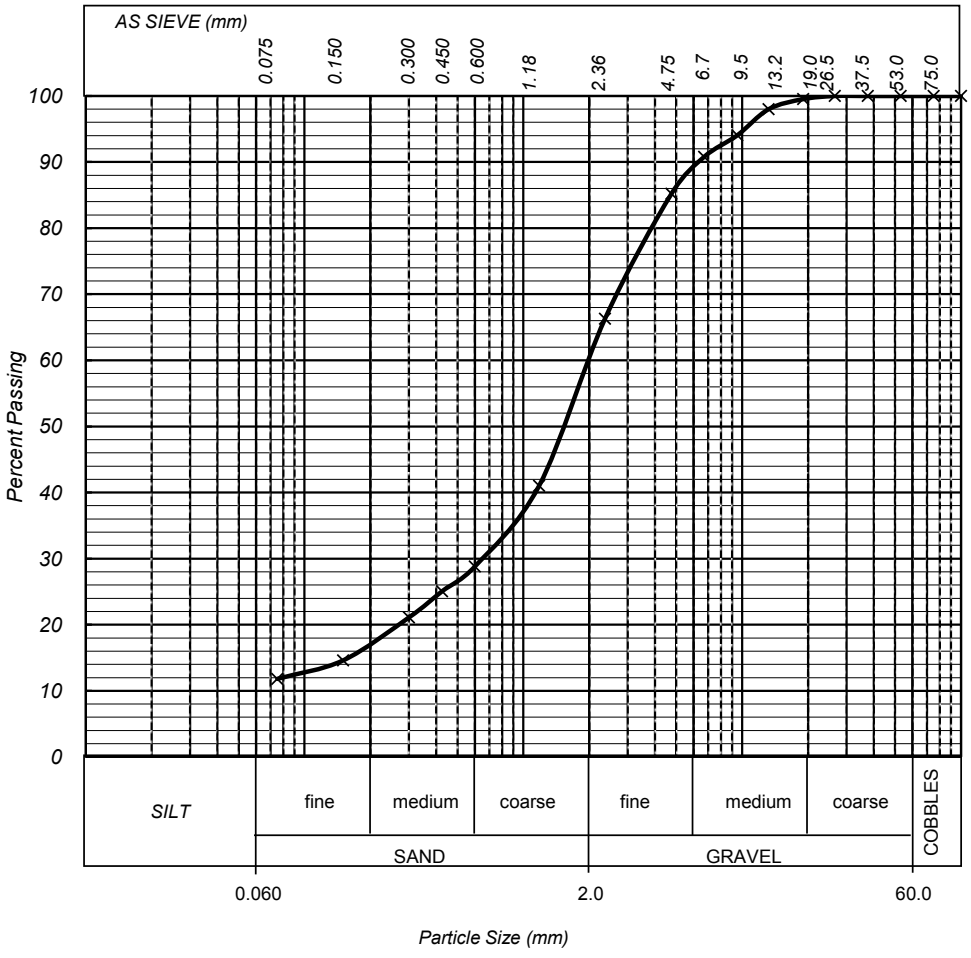
Job No	17102		
Report No	17102/R016		
Date of Issue	04/04/17		
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	CC
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF
Sample Identification	Springwater Quarry Sample 2	*Sample No*	17102016
Sampling method	By Client	*Sampled by*	Client
		Sampling date	2017

Sample Description

silty SAND, fine to coarse, brown, fines of low plasticity, with fine to coarse gravel

Particle Size Distribution

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	98
9.5	94
6.7	91
4.75	85
2.36	66
1.18	41
0.600	29
0.425	25
0.300	21
0.150	15
0.075	12



Gravel		*Sand*		*Cobbles*	0.0%
coarse	0.4%	*coarse*	31.4%	*Gravel*	39.7%
medium	10.6%	*medium*	11.5%	*Sand*	48.5%
fine	28.7%	*fine*	5.6%	*Fines*	11.8%
Total	39.7%	*Total*	48.5%	*Total*	100.0%

Approved Signatory : Peter Fry

PARTICLE SIZE DISTRIBUTION

AS 1289.3.6.1

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

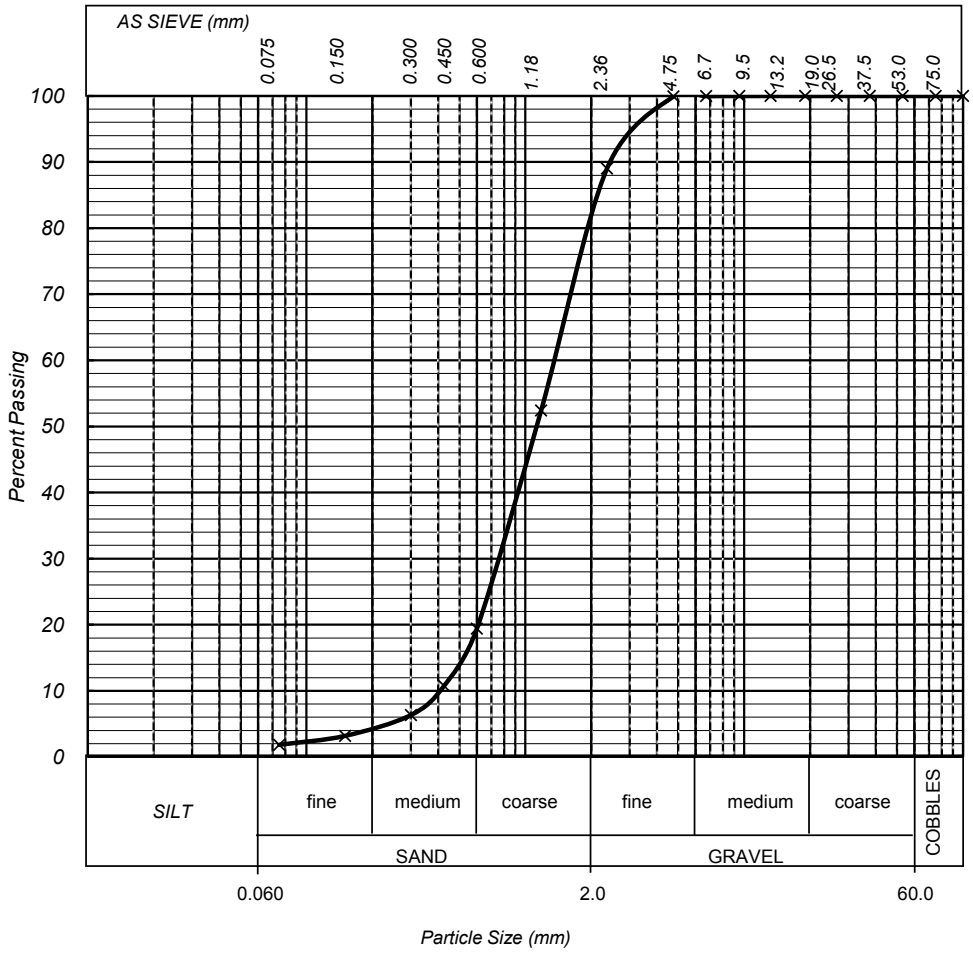
Job No	17102		
Report No	17102/R017		
Date of Issue	04/04/17		
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	CC
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF
Sample Identification	Cadgee Quarry	*Sample No*	17102017
Sampling method	By Client	*Sampled by*	Client
		Sampling date	2017

Sample Description

gravelly SAND, fine to coarse, brown, fine gravel

Particle Size Distribution

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	100
9.5	100
6.7	100
4.75	100
2.36	89
1.18	52
0.600	19
0.425	11
0.300	6
0.150	3
0.075	2



Gravel		*Sand*		*Cobbles*	0.0%
coarse	0.0%	*coarse*	60.9%	*Gravel*	19.7%
medium	0.0%	*medium*	14.9%	*Sand*	78.5%
fine	19.7%	*fine*	2.7%	*Fines*	1.8%
Total	19.7%	*Total*	78.5%	*Total*	100.0%

Approved Signatory : Peter Fry

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R025
		Date of Issue	28/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	25/05/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR

Sample Identification TP-EQ07 0.5 - 2.5m *Sample No* 17102018

Sample Description

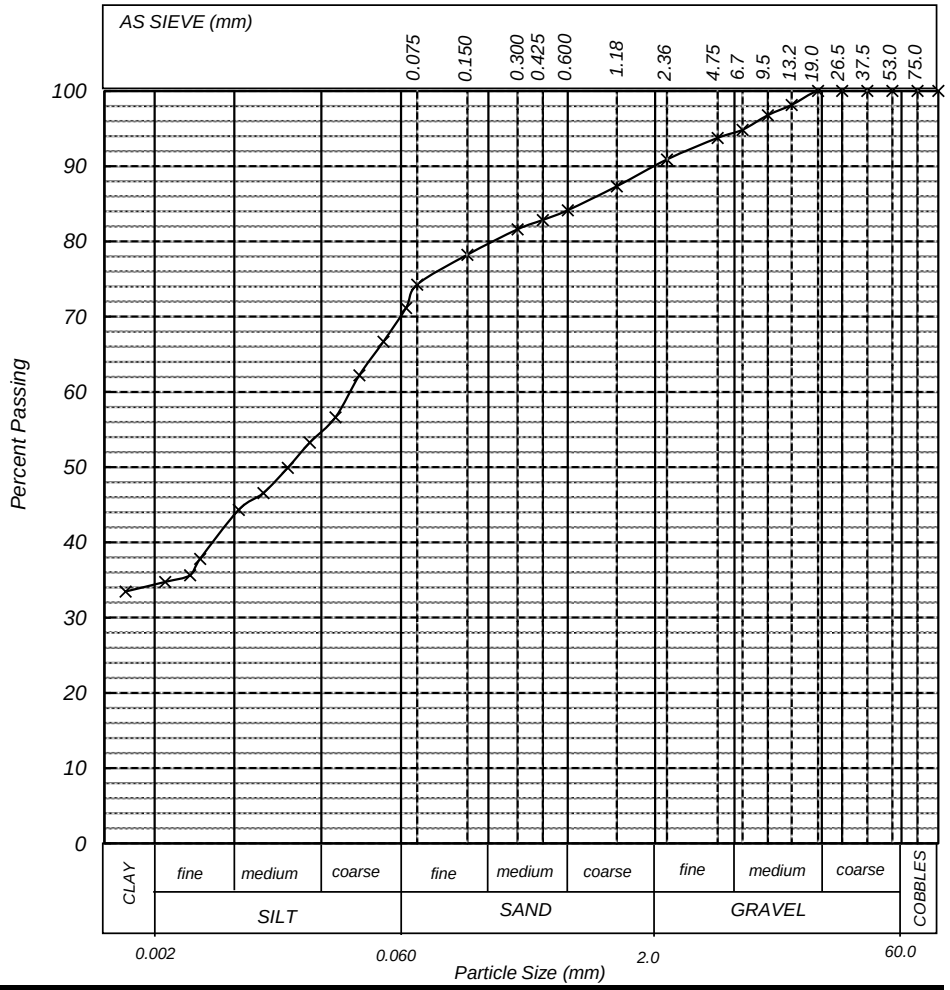
CLAY, high plasticity, brown, with fine to coarse sand, trace of fine to medium gravel.

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	98
9.5	97
6.7	95
4.75	94
2.36	91
1.18	87
0.600	84
0.425	83
0.300	82
0.150	78
0.075	74
0.064	71
0.047	67
0.034	62
0.024	57
0.017	53
0.013	50
0.0090	47
0.0064	44
0.0037	38
0.0033	36
0.0023	35
0.0013	33



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	0.0%	*coarse*	5.9%	*coarse*	15.0%	*Gravel*	10.0%
medium	5.5%	*medium*	4.5%	*medium*	11.2%	*Sand*	20.3%
fine	4.5%	*fine*	9.9%	*fine*	9.1%	*Silt*	35.3%
Total	10.0%	*Total*	20.3%	*Total*	35.3%	*Clay*	34.4%
						Total	100.0%

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES
6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R026
		Date of Issue	28/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	25/05/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR

Sample Identification TP-EQ10 0.3 - 1.4m *Sample No* 17102019

Sample Description

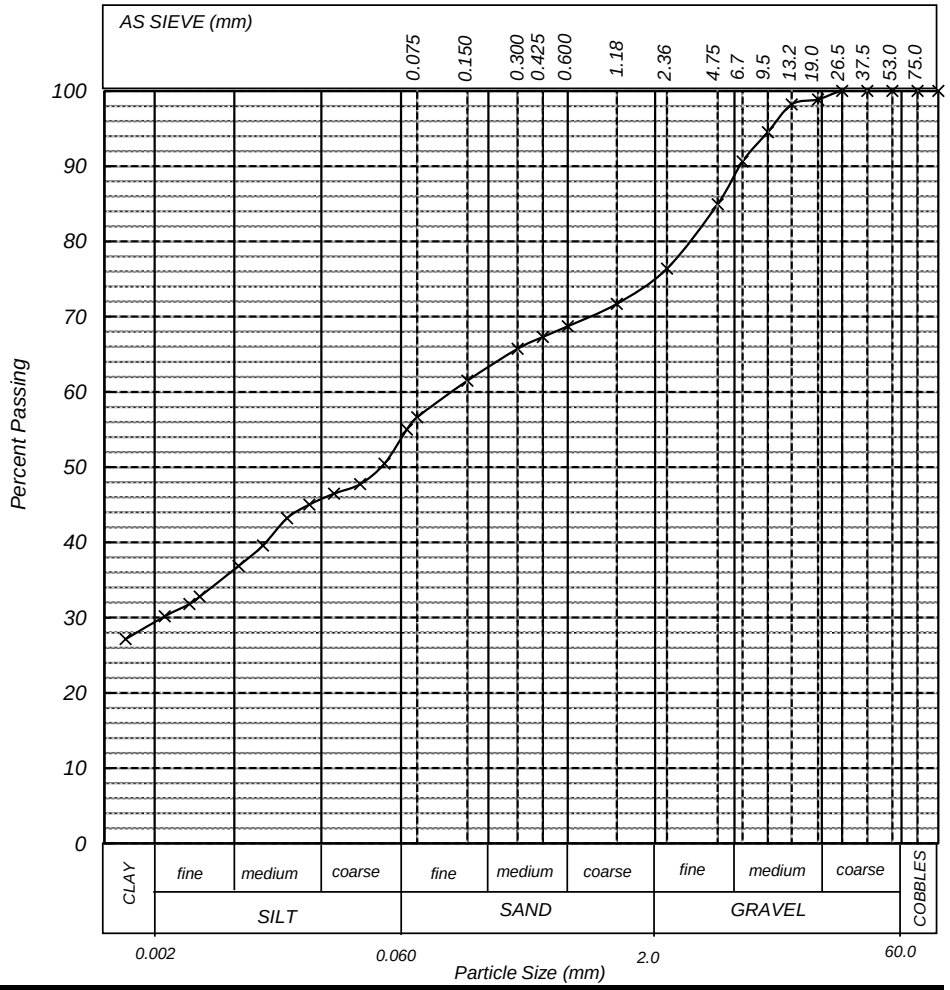
CLAY, high plasticity, brown, with fine to coarse gravel, with fine to coarse sand.

Assumed soil particle density 2.65 *g/cm³*

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	*Loss in pretreatment*	0%
Hydrometer type	g/l	*Variation to method*	-

Particle Size (mm)	*Percent Passing*
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	99
13.2	98
9.5	95
6.7	91
4.75	85
2.36	76
1.18	72
0.600	69
0.425	67
0.300	66
0.150	61
0.075	57
0.065	55
0.048	50
0.034	48
0.024	46
0.017	45
0.012	43
0.0089	40
0.0064	37
0.0037	33
0.0032	32
0.0023	30
0.0013	27



Gravel		*Sand*		*Silt*		*Cobbles*	0.0%
coarse	1.0%	*coarse*	6.5%	*coarse*	8.1%	*Gravel*	24.7%
medium	10.2%	*medium*	5.5%	*medium*	9.3%	*Sand*	21.4%
fine	13.5%	*fine*	9.4%	*fine*	7.1%	*Silt*	24.5%
Total	24.7%	*Total*	21.4%	*Total*	24.5%	*Clay*	29.4%
						Total	100.0%

PARTICLE SIZE DISTRIBUTION

CIVIL GEOTECHNICAL SERVICES
6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R027
		Date of Issue	28/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	Tested by	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	Date tested	25/05/17
Location	EUROBODALLA QUARRY	Checked by	ANR

Sample Identification TP-EQ16 0.4 - 1.5m — Sample No 17102020

Sample Description

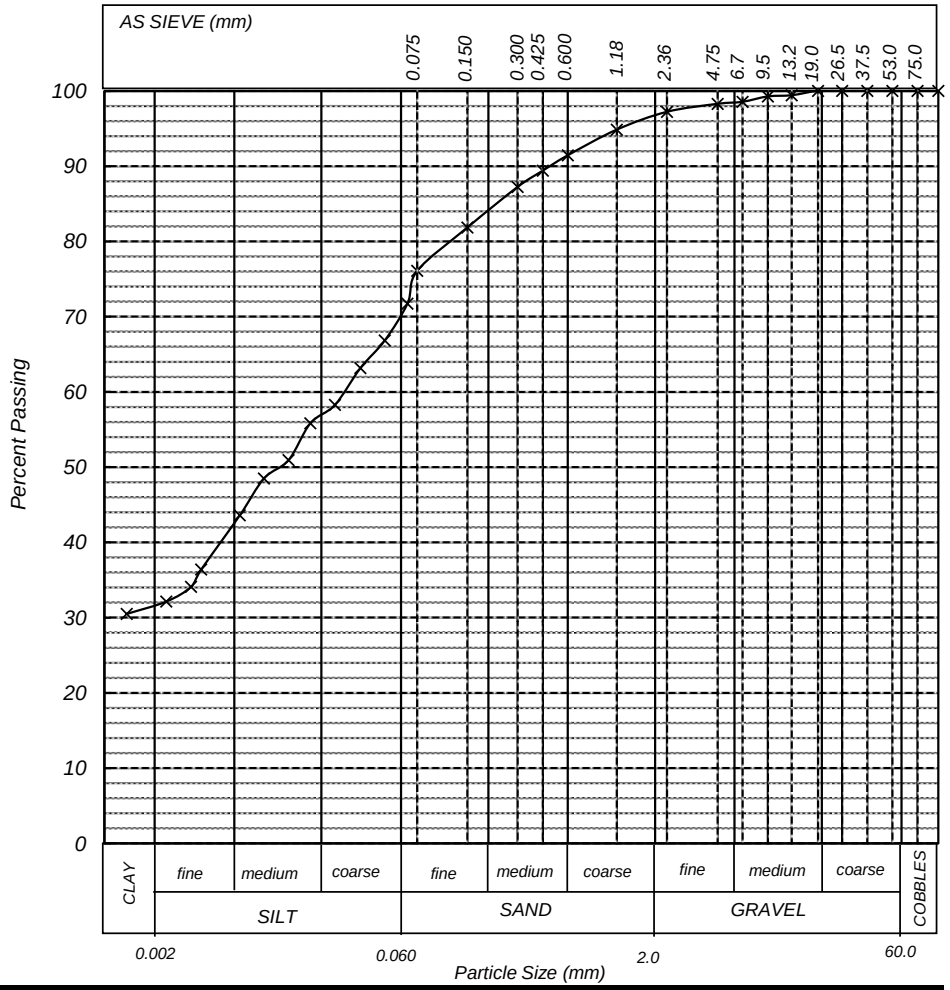
CLAY, high plasticity, brown, with fine to coarse sand, trace of fine to medium gravel.

Assumed soil particle density 2.65 g/cm³

AS 1289.3.6.1 and 3.6.3 - Particle Size Distribution - Sieve and Hydrometer

Method of dispersion	Mechanical	Loss in pretreatment	0%
Hydrometer type	g/l	Variation to method	-

Particle Size (mm)	Percent Passing
100.0	100
75.0	100
53.0	100
37.5	100
26.5	100
19.0	100
13.2	99
9.5	99
6.7	99
4.75	98
2.36	97
1.18	95
0.600	91
0.425	89
0.300	87
0.150	82
0.075	76
0.066	72
0.048	67
0.034	63
0.024	58
0.017	56
0.013	51
0.0090	48
0.0065	44
0.0038	36
0.0033	34
0.0023	32
0.0014	30



Gravel		Sand		Silt		Cobbles	0.0%
coarse	0.0%	coarse	5.2%	coarse	11.9%	Gravel	3.3%
medium	1.5%	medium	7.4%	medium	14.4%	Sand	27.8%
fine	1.8%	fine	15.2%	fine	10.9%	Silt	37.2%
Total	3.3%	Total	27.8%	Total	37.2%	Clay	31.7%
						Total	100.0%

Approved Signatory : Andrew Roberts

B2 – Atterberg Limits and Emerson Class

TEST RESULTS

AS 1289.2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.6.1 & 3.8.1

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R018
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	SK
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	06/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF

Sample Identification	*Soil Description*	*Field Moisture Content* %	*Liquid Limit* %	*Plastic Limit* %	*Plasticity Index* %	*Linear Shrinkage* %	*% Passing 75µm sieve*	*Emerson Class No**
17102001 TP-EQ01 0.3 - 1.2m	gravelly CLAY, high plasticity, brown, fine to coarse gravel, trace of fine to coarse sand	28.0	82	31	51	18.0	66	3
17102002 TP-EQ03 2.6 - 3.1m	clayey GRAVEL, fine to coarse, brown, fines of medium plasticity, with fine to coarse sand	19.0	46	22	24	12.0	23	2
17102003 TP-EQ04 1.6 - 2.0m	clayey GRAVEL, fine to coarse, brown, fines of medium plasticity, with fine to coarse sand	17.7	44	22	22	11.0	22	3
17102004 TP-EQ03 0.25 - 2.2m	CLAY, medium plasticity, brown, with fine to coarse sand, trace of fine to medium gravel	24.3	47	21	26	12.5	78	3
17102005 TP-EQ07 0.5 - 1.0m	silty SAND, fine to coarse, brown, fines of high liquid limit, with fine to coarse gravel	31.5	52	34	18	11.5	47	3
17102006 TP-EQ12 0.5 - 1.5m	CLAY, high plasticity, brown, trace of fine to coarse sand and fine to coarse gravel	18.6	51	21	30	13.5	72	2
17102007 TP-EQ11 0.2 - 1.3m	CLAY, high plasticity, brown, trace of fine to coarse sand	35.9	91	35	56	22.5	91	5
17102008 TP-EQ18 0.3 - 1.5m	CLAY, high plasticity, brown, with fine to coarse gravel, trace of fine to coarse sand	19.5	55	24	31	14.0	78	5
17102009 TP-EQ07 1.0 - 2.5m	silty CLAY, high plasticity, brown, with fine to coarse gravel, trace of fine to coarse sand	31.8	74	32	42	18.5	71	5

Notes

AS 1289.3.1.2,3.2.1,3.4.1	*Method of drying:*	Oven dried	*AS 1289.3.8.1**	*Water used:*	Distilled water
	Dry/Wet sieve:	Dry		*Temperature:*	20.5 - 20.8 °C
	Curing time:	>24hrs		*Date sampled:*	2017

Approved Signatory : Peter Fry

TEST RESULTS

AS 1289.2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.6.1 & 3.8.1

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R019
		Date of Issue	04/04/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	SK
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	06/03/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF

Sample Identification	*Soil Description*	*Field Moisture Content* %	*Liquid Limit* %	*Plastic Limit* %	*Plasticity Index* %	*Linear Shrinkage* %	*% Passing 75µm sieve*	*Emerson Class No**
17102010 TP-EQ10 0.8 - 1.4m	silty / clayey GRAVEL, fine to coarse, brown, fines of high plasticity, with fine to coarse sand	20.1	52	28	24	11.5	37	3
17102011 TP-EQ16 0.4 - 0.8m	silty CLAY, high plasticity, brown, with fine to coarse sand	31.9	69	31	38	16.5	84	5
17102012 TP-EQ15 0.75 - 5.4m	SILT, high liquid limit, brown, trace of fine to coarse sand	44.4	66	35	31	16.0	88	5
17102013 TP-EQ16 0.8 - 1.5m	sandy CLAY / sandy SILT, high plasticity, brown, fine to coarse sand	32.9	53	29	24	13.5	59	3
17102014 TP-EQ17 1.7 - 3.6m	silty CLAY, medium plasticity, brown, with fine to coarse sand and fine to medium gravel	24.6	49	27	22	12.0	53	5
17102015 Springwater Quarry Sample 1	silty SAND, fine to coarse, brown, fines of low plasticity, with fine to coarse gravel	5.5	-	-	-	-	13	-
17102016 Springwater Quarry Sample 2	silty SAND, fine to coarse, brown, fines of low plasticity, with fine to coarse gravel	6.4	-	-	-	-	12	-
17102017 Cadgee Quarry	gravelly SAND, fine to coarse, brown, fine gravel	2.8	-	-	-	-	2	-

Notes

AS 1289.3.1.2,3.2.1,3.4.1 *Method of drying:* Oven dried
Dry/Wet sieve: Dry
Curing time: >24hrs

*AS 1289.3.8.1** *Water used:* Distilled water
Temperature: 20.5 - 20.7 °C
Date sampled: 2017

Approved Signatory : Peter Fry

TEST RESULTS

AS 1289.2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.6.1 & 3.8.1

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

Job No	17102
Report No	17102/R035
Date of Issue	29/06/17

Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	SK
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	31/5-4/6/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR

Sample Identification	*Soil Description*	*Field Moisture Content* %	*Liquid Limit* %	*Plastic Limit* %	*Plasticity Index* %	*Linear Shrinkage* %	*% Passing 75µm sieve*	*Emerson Class No**
17102018 TP-EQ07 0.5 - 2.5m	CLAY, high plasticity, brown, with fine to coarse sand, trace of fine to medium gravel.	32.1	65	30	35	15.5	74	5
17102019 TP-EQ10 0.3 - 1.4m	CLAY, high plasticity, brown, with fine to coarse gravel, with fine to coarse sand.	25.4	61	28	33	12.5	57	3
17102020 TP-EQ16 0.4 - 1.5m	CLAY, high plasticity, brown, with fine to coarse sand, trace of fine to medium gravel.	32.3	66	29	37	15.0	76	5

Notes

AS 1289.3.1.2,3.2.1,3.4.1	*Method of drying:*	Oven dried	*AS 1289.3.8.1**	*Water used:*	Distilled water
	Dry/Wet sieve:	Dry		*Temperature:*	20.5 °C
	Curing time:	>24hrs		*Date sampled:*	2017

Approved Signatory : Andrew Roberts

B3 – Standard Compaction

STANDARD COMPACTION

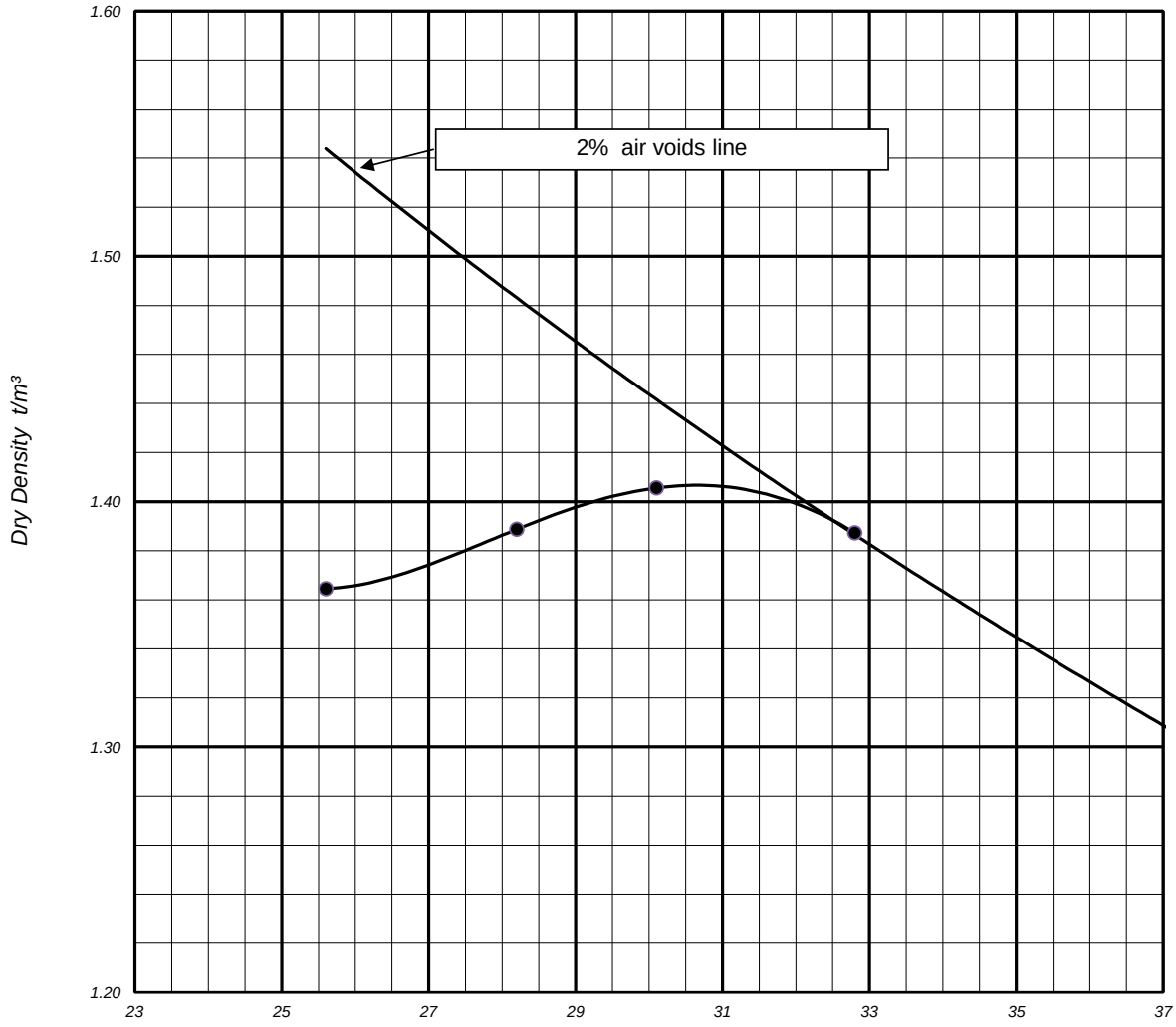
AS 1289.5.1.1

		Job No	17102
CIVIL GEOTECHNICAL SERVICES		*Report No*	17102/R020
6 - 8 Rose Avenue, Croydon, Vic 3136		*Date of Issue*	28/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	GW
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	25/05/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF
Sample Identification	TP-EQ01 0.3 - 1.2m	*Sample No*	17102001
Sample Description	gravelly CLAY, high plasticity, brown, fine to coarse gravel, trace of fine to coarse sand	*Sampled by*	Client
		Sampling date	2017

Oversize material retained on 19.0mm sieve = 2 %		*Mould Type*	A
Maximum Dry Density	1.41 *t/m³*	*Optimum Moisture Content*	30.5 *%*

DRY DENSITY - MOISTURE CONTENT PLOT

Calculated apparent particle density = 2.64 *t/m³*



AS512-R7-OCT 09

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Accreditation No 9909

Approved Signatory : Andrew Roberts

STANDARD COMPACTION

AS 1289.5.1.1

CIVIL GEOTECHNICAL SERVICES

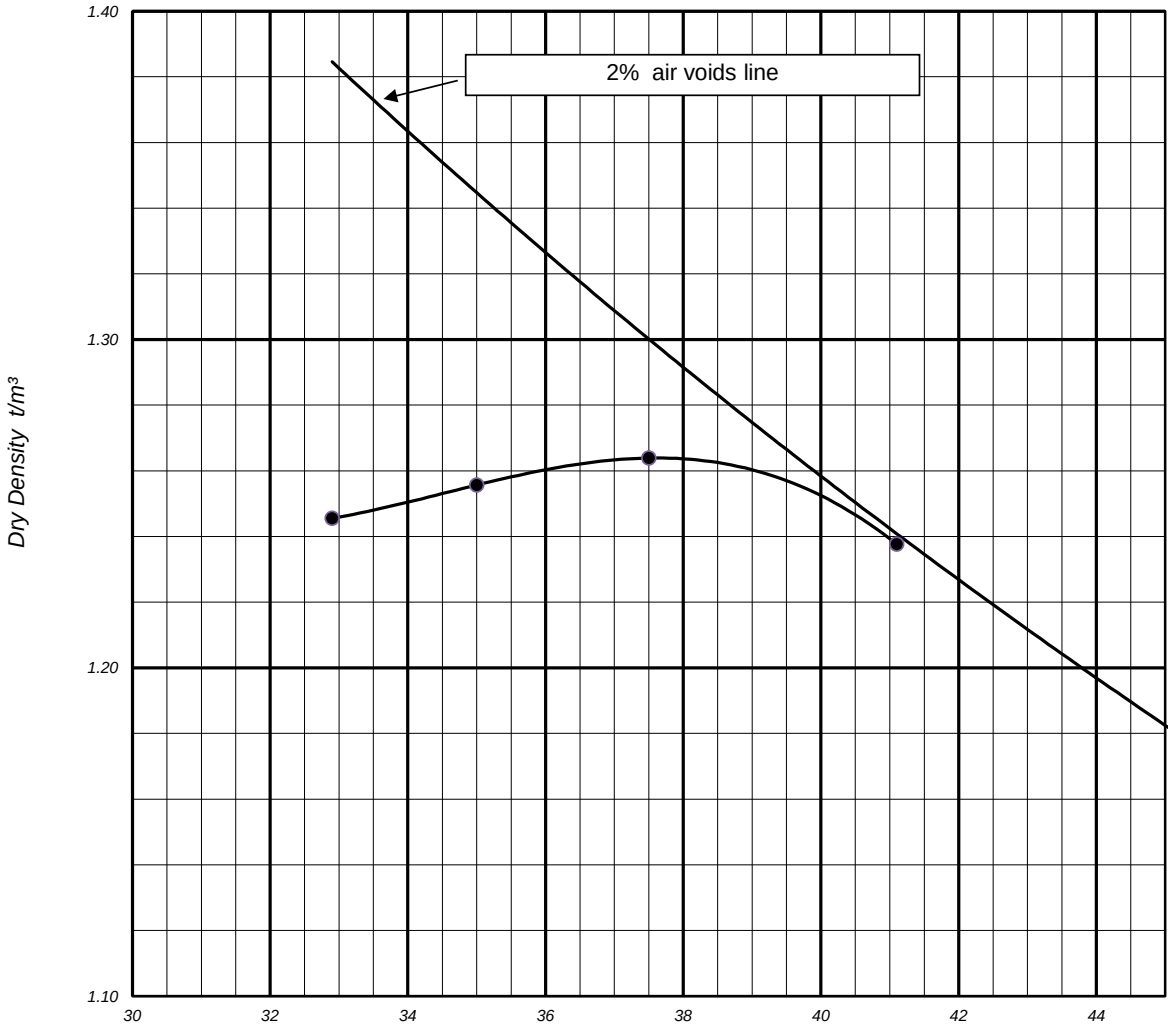
6 - 8 Rose Avenue, Croydon, Vic 3136

		Job No	17102
		Report No	17102/R023
		Date of Issue	28/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	GW
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	25/05/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF
Sample Identification	TP-EQ15 0.75 - 5.4m	*Sample No*	17102012
Sample Description		*Sampled by*	Client
SILT, high liquid limit, brown, trace of fine to coarse sand		*Sampling date*	2017

Oversize material retained on 19.0mm sieve = 0 %		*Mould Type*	A
Maximum Dry Density	1.26 *t/m³*	*Optimum Moisture Content*	37.5 *%*

DRY DENSITY - MOISTURE CONTENT PLOT

Calculated apparent particle density = 2.64 *t/m³*



AS512-R7-OCT 09

Approved Signatory : Andrew Roberts

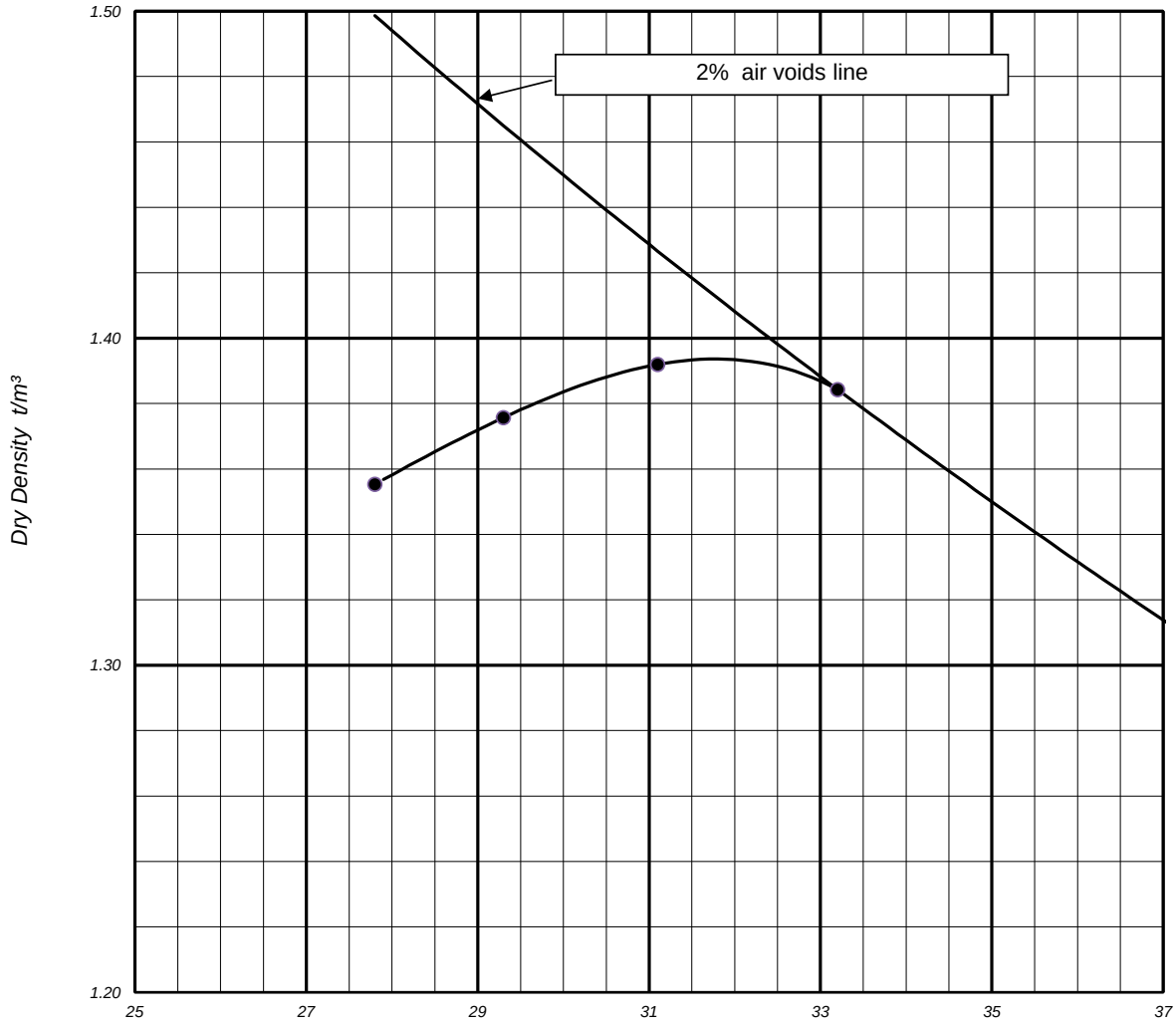
STANDARD COMPACTION

AS 1289.5.1.1

		Job No	17102
CIVIL GEOTECHNICAL SERVICES		*Report No*	17102/R028
6 - 8 Rose Avenue, Croydon, Vic 3136		*Date of Issue*	28/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	GW
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	25/05/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample Identification	TP-EQ07 0.5 - 2.5m	*Sample No*	17102018
Sample Description		*Sampled by*	Client
CLAY, high plasticity, brown, with fine to coarse sand, trace of fine to medium gravel.		*Sampling date*	2017
Oversize material retained on 19.0mm sieve = 0 %		*Mould Type*	A
Maximum Dry Density	1.39 *t/m³*	*Optimum Moisture Content*	32.0 %

DRY DENSITY - MOISTURE CONTENT PLOT

Calculated apparent particle density = 2.66 *t/m³*



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Accreditation No 9909

Approved Signatory : Andrew Roberts

STANDARD COMPACTION

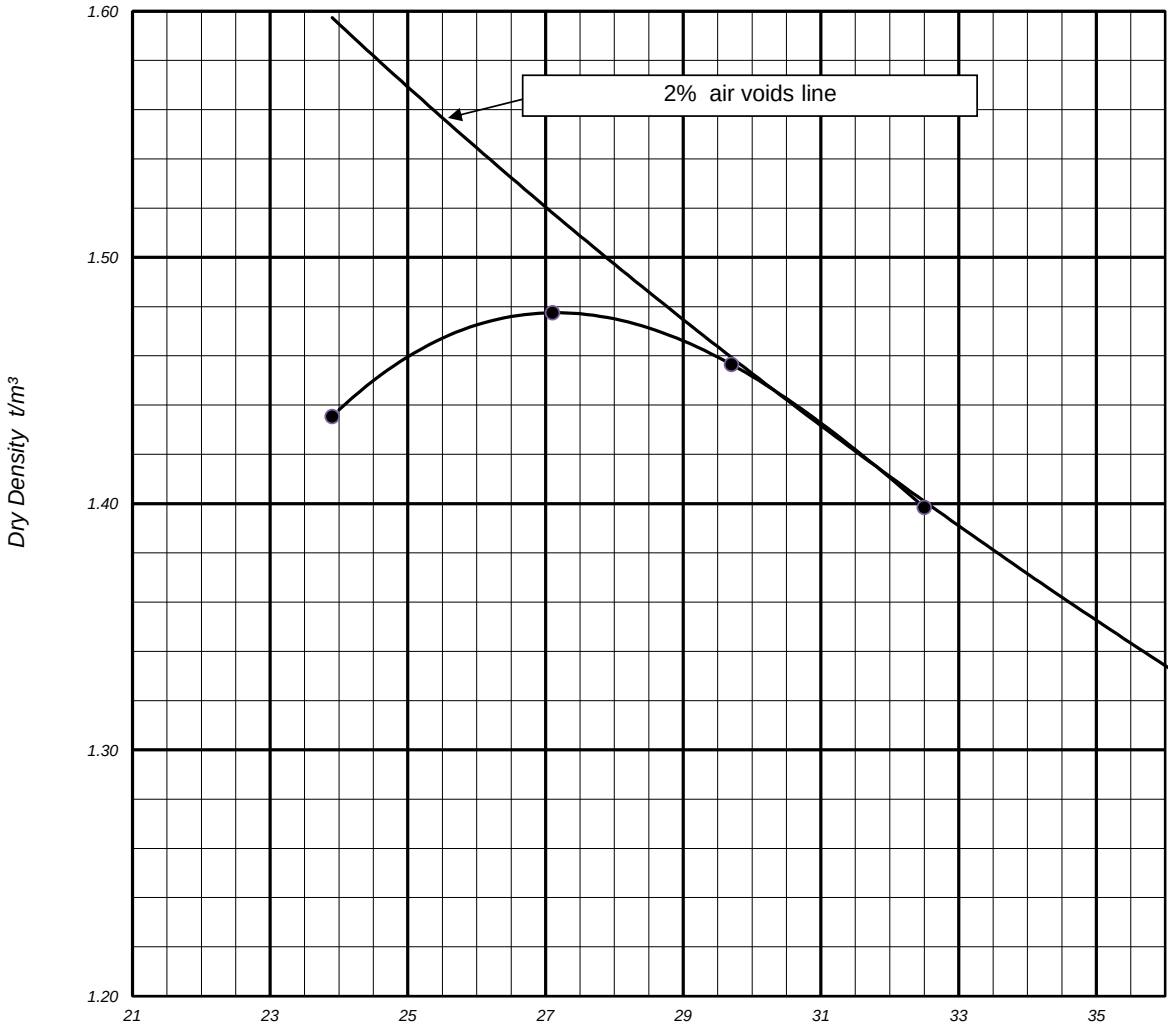
AS 1289.5.1.1

		Job No	17102
CIVIL GEOTECHNICAL SERVICES		*Report No*	17102/R029
6 - 8 Rose Avenue, Croydon, Vic 3136		*Date of Issue*	28/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	GW
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	25/05/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF
Sample Identification	TP-EQ10 0.3 - 1.4m	*Sample No*	17102019
Sample Description		*Sampled by*	Client
CLAY, high plasticity, brown, with fine to coarse gravel, with fine to coarse sand.		*Sampling date*	2017

Oversize material retained on 19.0mm sieve = 1 %		*Mould Type*	A
Maximum Dry Density	1.48 *t/m³*	*Optimum Moisture Content*	27.0 *%*

DRY DENSITY - MOISTURE CONTENT PLOT

Calculated apparent particle density = 2.67 *t/m³*



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Approved Signatory : Andrew Roberts

STANDARD COMPACTION

AS 1289.5.1.1

CIVIL GEOTECHNICAL SERVICES

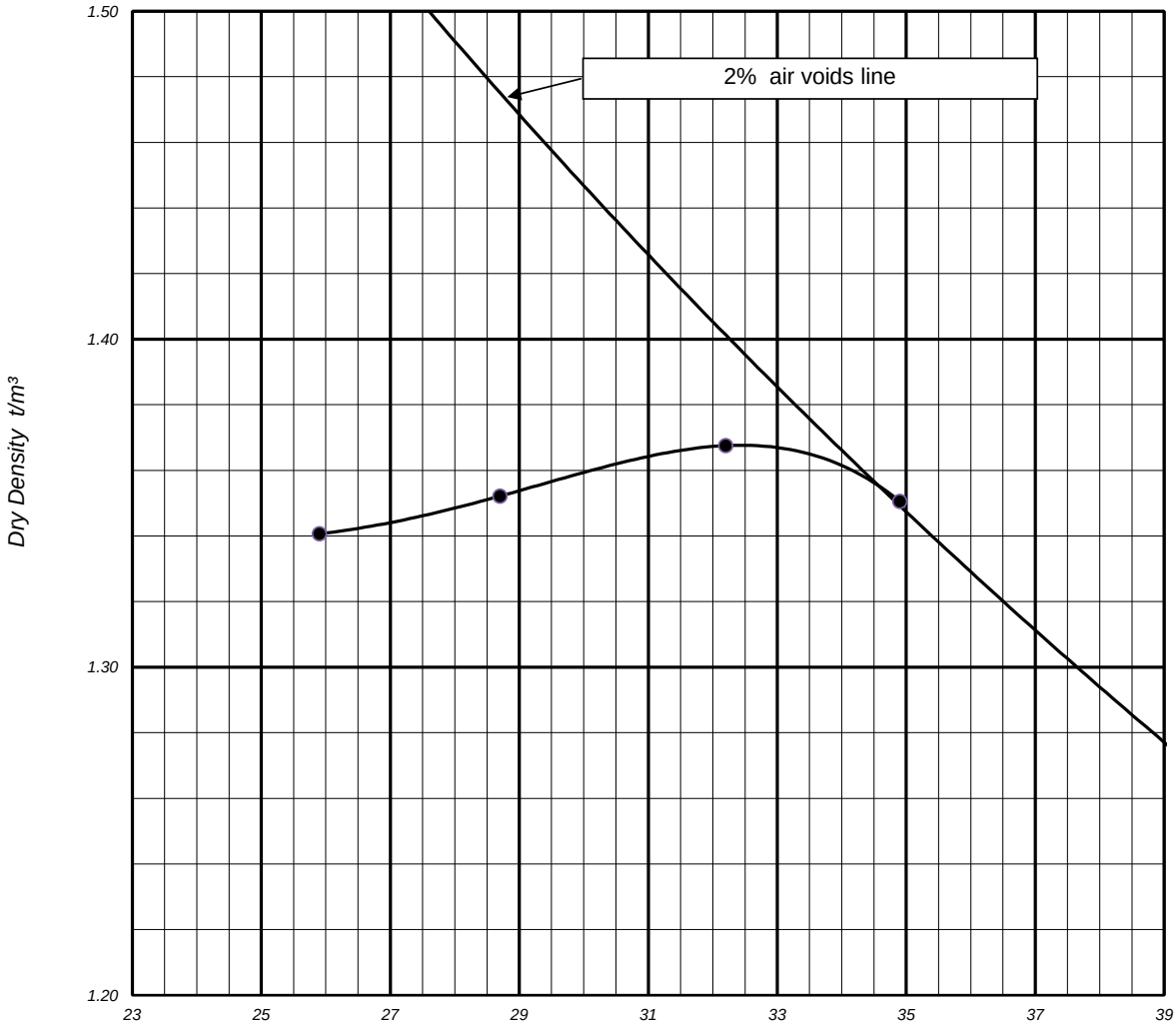
6 - 8 Rose Avenue, Croydon, Vic 3136

		Job No	17102
		Report No	17102/R030
		Date of Issue	28/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	GW
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	25/05/17
Location	EUROBODALLA QUARRY	*Checked by*	PJF
Sample Identification	TP-EQ16 0.4 - 1.5m	*Sample No*	17102020
Sample Description		*Sampled by*	Client
CLAY, high plasticity, brown, with fine to coarse sand, trace of fine to medium gravel.		*Sampling date*	2017

Oversize material retained on 19.0mm sieve = 0 %		*Mould Type*	A
Maximum Dry Density	1.37 *t/m³*	*Optimum Moisture Content*	32.5 *%*

DRY DENSITY - MOISTURE CONTENT PLOT

Calculated apparent particle density = 2.65 *t/m³*



B4 – Triaxial Tests

EFFECTIVE STRESS TRIAXIAL TEST

AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES
6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R021
		Issue date	29/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02-26/06/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR

Sample No	17102001	*Sampled by*	Client
Sample location	TP-EQ01 0.3 - 1.2m	*Sampling date*	2017

Type of sample R100

Type of test Compressive strength of a saturated specimen tested in undrained triaxial compression with measurement of pore water pressure (multi stage)

Drainage conditions Top, bottom and side

Failure criteria Principle Stress Ratio

Test Details

	Stage No	1	2	3
Initial cell pressure	*kPa*	700	900	900
Back pressure	*kPa*	500	500	100
Effective axial stress at failure	*kPa*	219	440	786
Effective lateral stress at failure	*kPa*	92	206	409
Effective pore pressure at failure	*kPa*	109	194	391
Deviator stress at failure	*kPa*	128	234	377
Strain at failure	*%*	2.92	6.27	10.09
Degree of saturation before test (B)			0.99	
Rate of strain	*mm/min*		0.013	

Sample Details

Initial sample length	*mm*	200.2
Initial sample diameter	*mm*	99.6
Initial dry density	*t/m³*	1.37
Initial moisture content	*%*	31.3

Moisture content after test

Moisture Content	*%*	32.0

Test Results

EFFECTIVE COHESION	*kPa*	**20**
EFFECTIVE ANGLE OF FRICTION	*o*	**17**

Sample Description gravelly CLAY, high plasticity, brown, fine to coarse gravel, trace of fine to coarse sand. Specimen remoulded to 97.1% Standard Compactive Effort at 0.7% wet of OMC

Mode of Failure Plastic barrelling

EFFECTIVE STRESS TRIAXIAL TEST

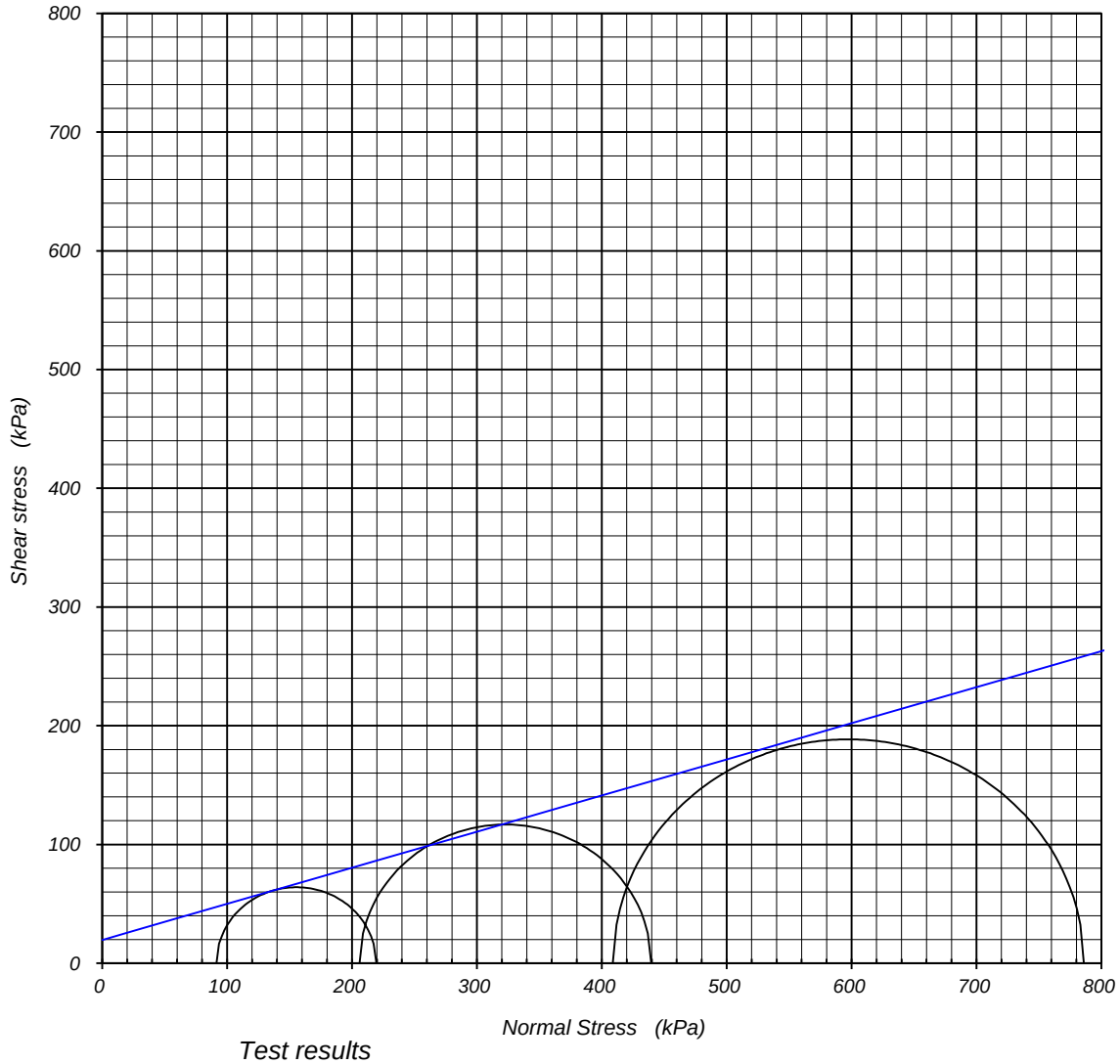
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R021
		Issue date	29/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02-26/06/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ01 0.3 - 1.2m	*Sample No*	17102001

SHEAR STRESS - NORMAL STRESS PLOT



Test results

EFFECTIVE COHESION	20	*kPa*
EFFECTIVE ANGLE OF FRICTION	17	*o*

EFFECTIVE STRESS TRIAXIAL TEST

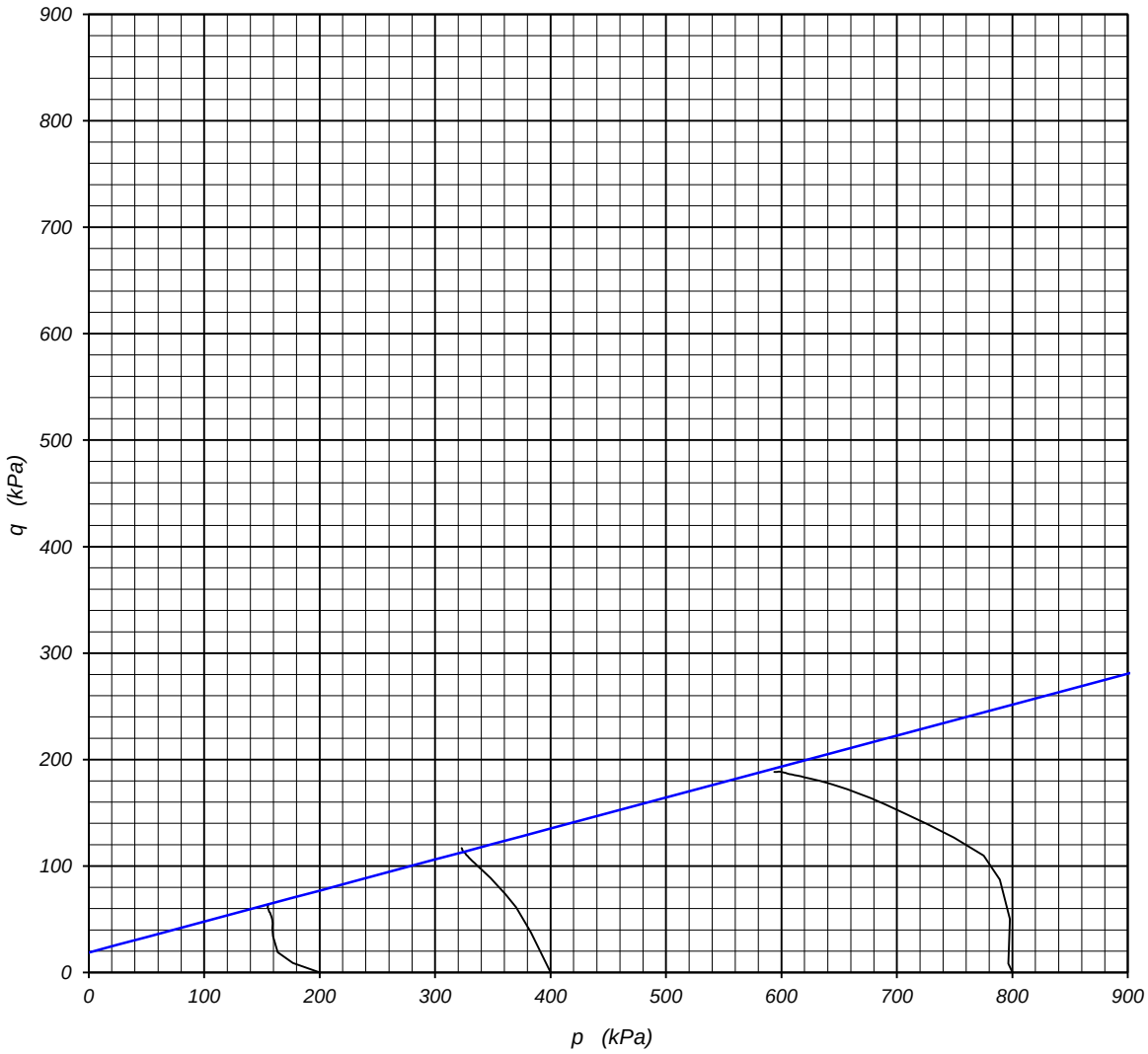
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R021
		Issue date	29/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02-26/06/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ01 0.3 - 1.2m	*Sample No*	17102001

p' - q' PLOT



EFFECTIVE STRESS TRIAXIAL TEST

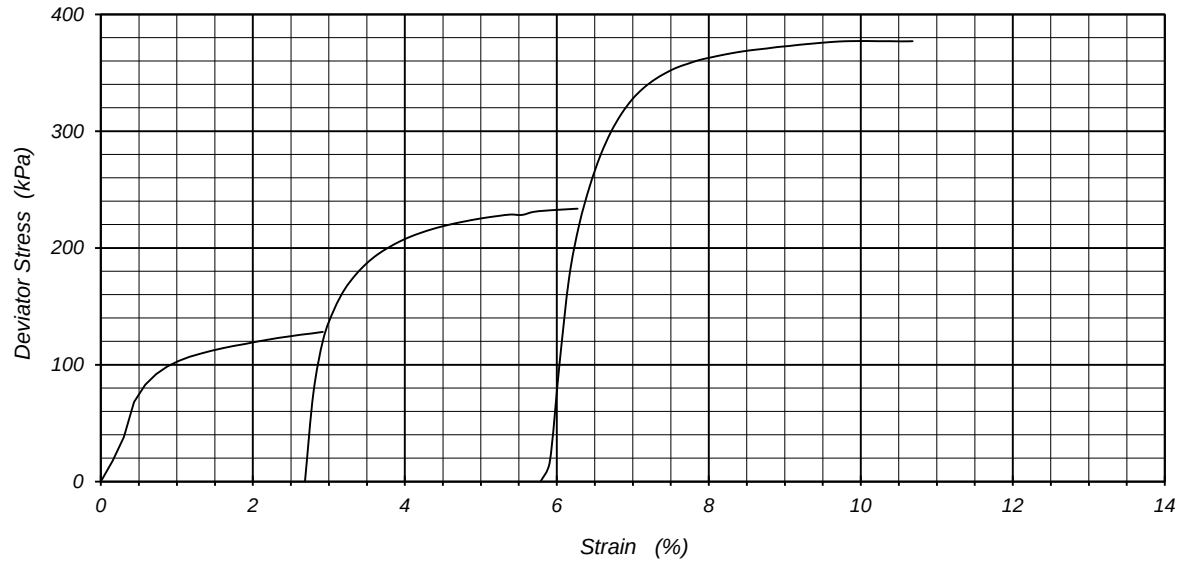
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

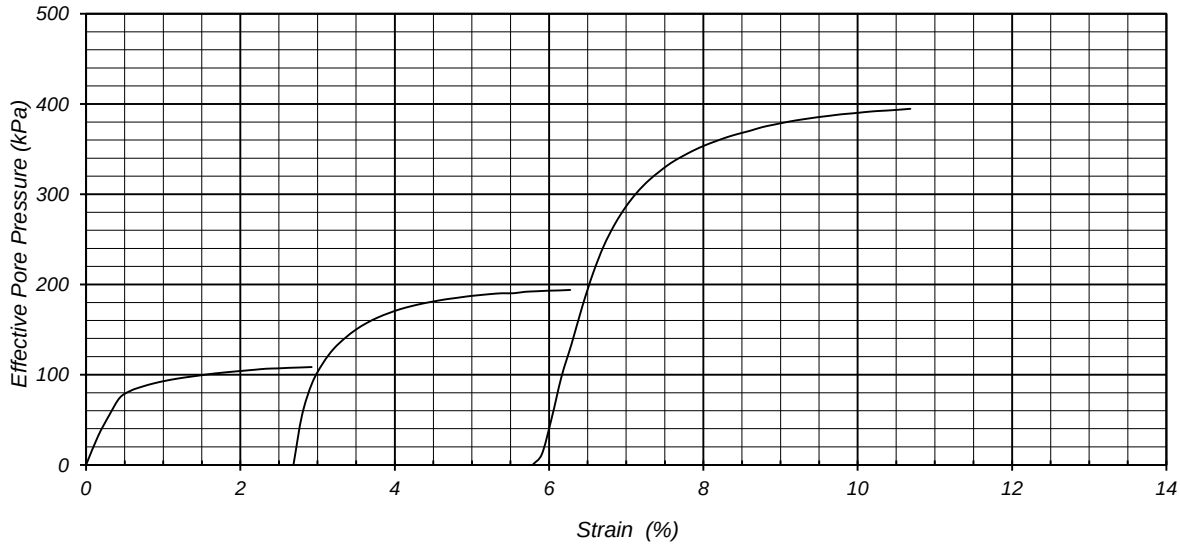
6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R021
		Issue date	29/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02-26/06/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ01 0.3 - 1.2m	*Sample No*	17102001

STRESS - STRAIN PLOT



EFFECTIVE PORE PRESSURE - STRAIN PLOT



EFFECTIVE STRESS TRIAXIAL TEST

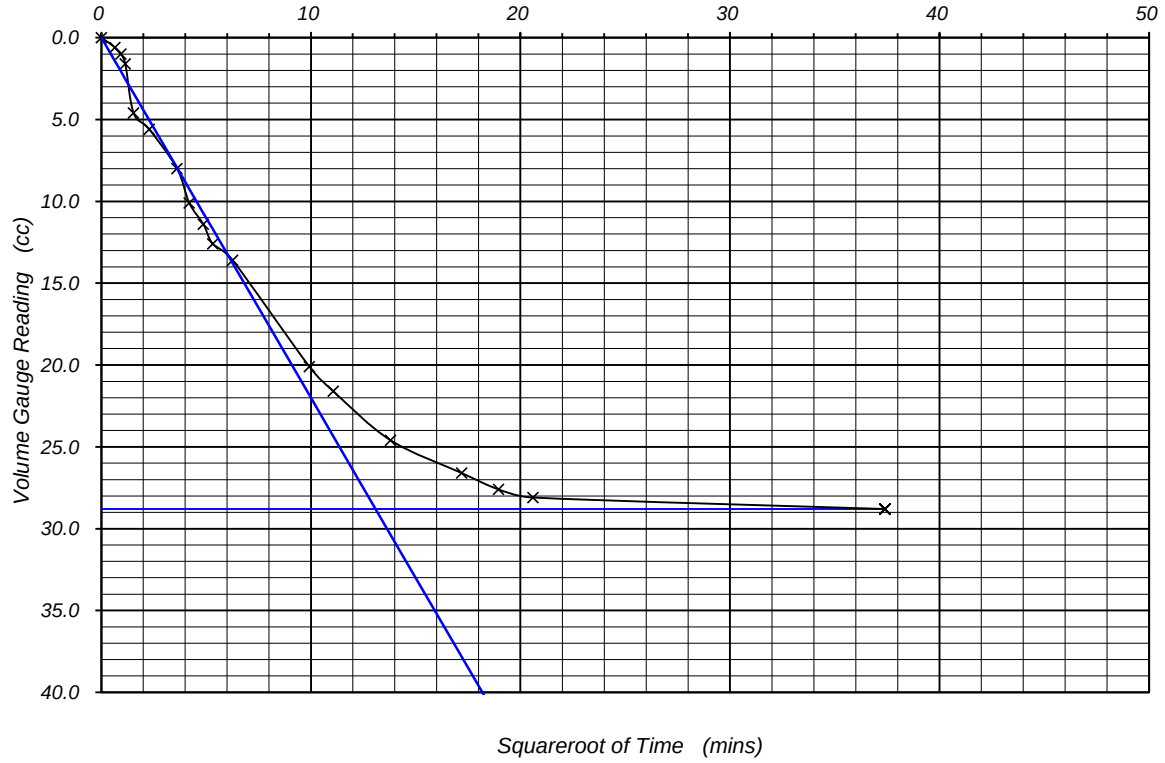
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R021
		Issue date	29/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	02-26/06/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ01 0.3 - 1.2m	*Sample No*	17102001

CONSOLIDATION TEST



Stage No	1	
Effective cell pressure	200	*kPa*
Consolidation 100% (t_{100})	171.4	*mins*
Coefficient of consolidation (c_v)	1.0	*M² / year*

EFFECTIVE STRESS TRIAXIAL TEST

AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R024
		Issue date	13/07/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	23/6-9/6/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR

Sample No	17102012	*Sampled by*	Client
Sample location	TP-EQ15 0.75 - 5.4m	*Sampling date*	2017

Type of sample R100

Type of test Compressive strength of a saturated specimen tested in undrained triaxial compression with measurement of pore water pressure (multi stage)

Drainage conditions Top, bottom and side

Failure criteria Principle Stress Ratio

Test Details

	Stage No	1	2	3
Initial cell pressure	*kPa*	700	900	900
Back pressure	*kPa*	500	500	100
Effective axial stress at failure	*kPa*	229	497	976
Effective lateral stress at failure	*kPa*	75	177	380
Effective pore pressure at failure	*kPa*	125	223	420
Deviator stress at failure	*kPa*	154	320	596
Strain at failure	*%*	6.28	10.16	14.15
Degree of saturation before test (B)			1.00	
Rate of strain	*mm/min*		0.040	

Sample Details

Initial sample length	*mm*	199.8
Initial sample diameter	*mm*	99.5
Initial dry density	*t/m³*	1.22
Initial moisture content	*%*	38.1

Moisture content after test

Moisture Content	*%*	37.6

Test Results

EFFECTIVE COHESION	*kPa*	**13**
EFFECTIVE ANGLE OF FRICTION	*o*	**25**

Sample Description SILT, high liquid limit, brown, trace of fine to coarse sand
Specimen remoulded to 96.4% Standard Compactive effort at 0.5% wet of OMC.
See test report no 17102/R023 for compaction test details.

Mode of Failure Plastic barrelling

EFFECTIVE STRESS TRIAXIAL TEST

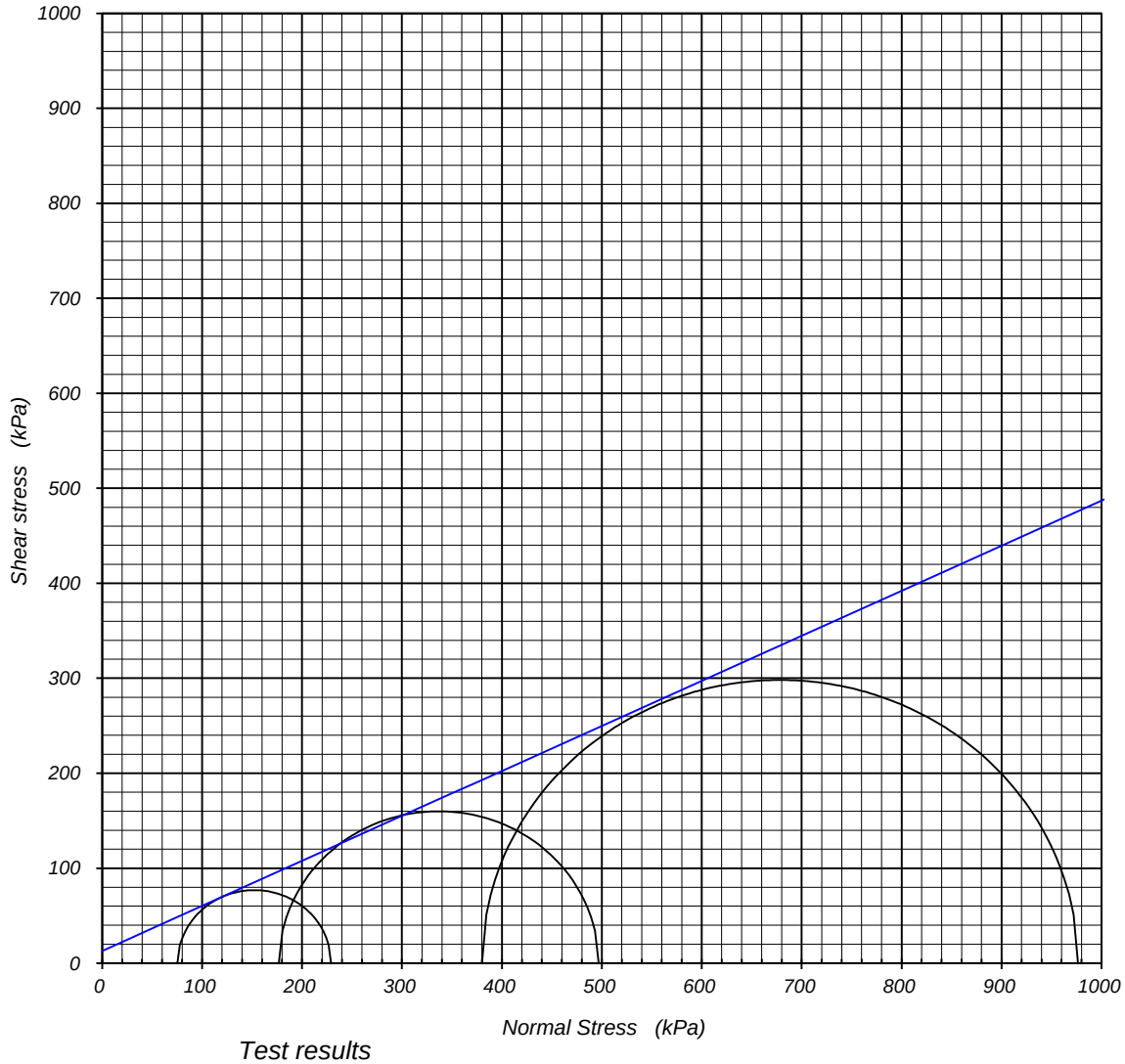
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R024
		Issue date	13/07/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	23/6-9/6/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ15 0.75 - 5.4m	*Sample No*	17102012

SHEAR STRESS - NORMAL STRESS PLOT



Test results

EFFECTIVE COHESION	13	*kPa*
EFFECTIVE ANGLE OF FRICTION	25	*o*

EFFECTIVE STRESS TRIAXIAL TEST

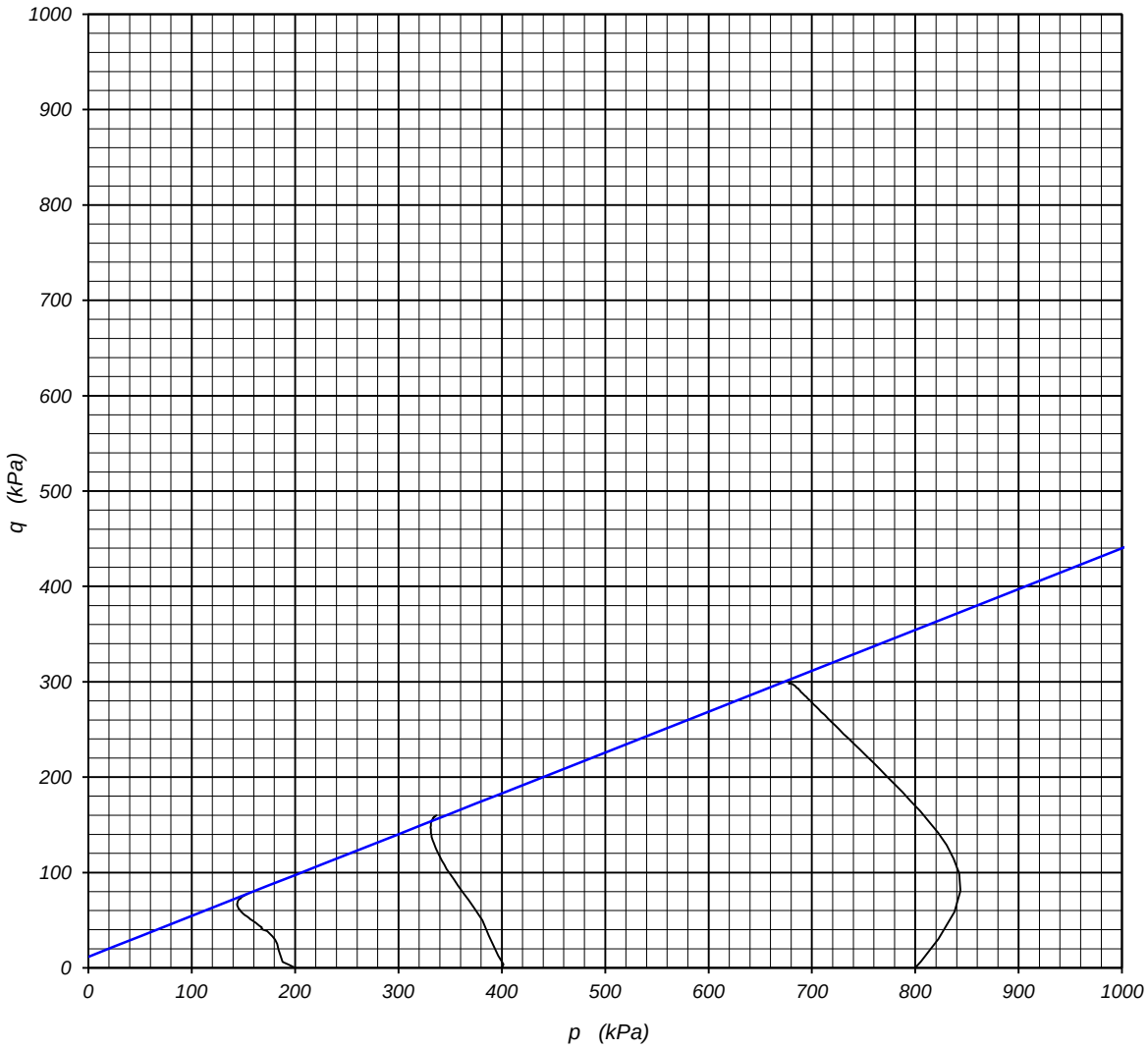
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R024
		Issue date	13/07/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	23/6-9/6/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ15 0.75 - 5.4m	*Sample No*	17102012

p' - q' PLOT



EFFECTIVE STRESS TRIAXIAL TEST

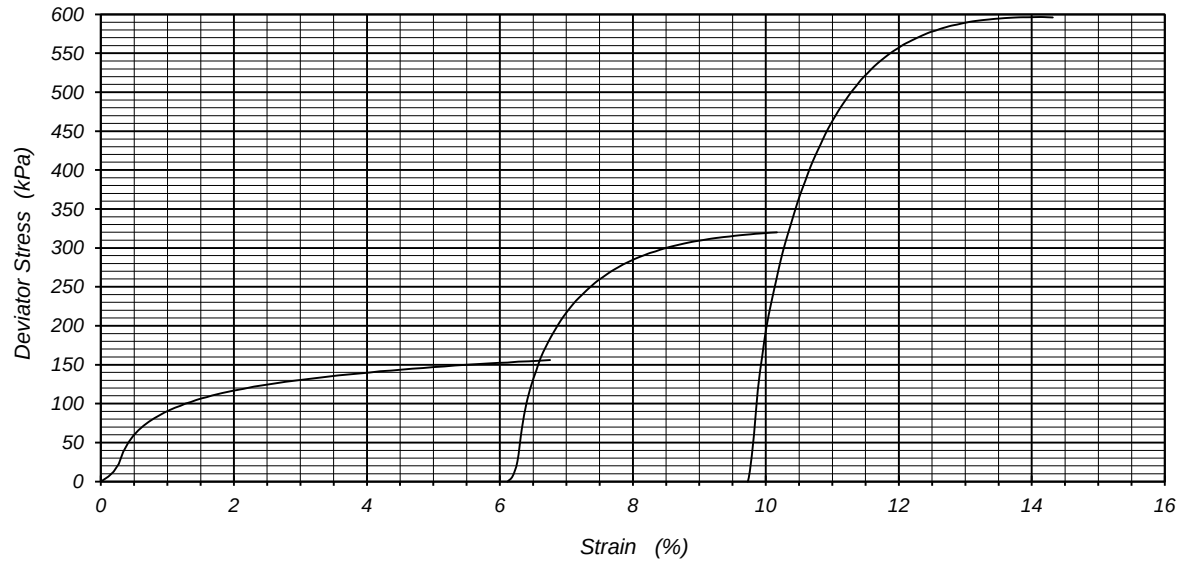
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

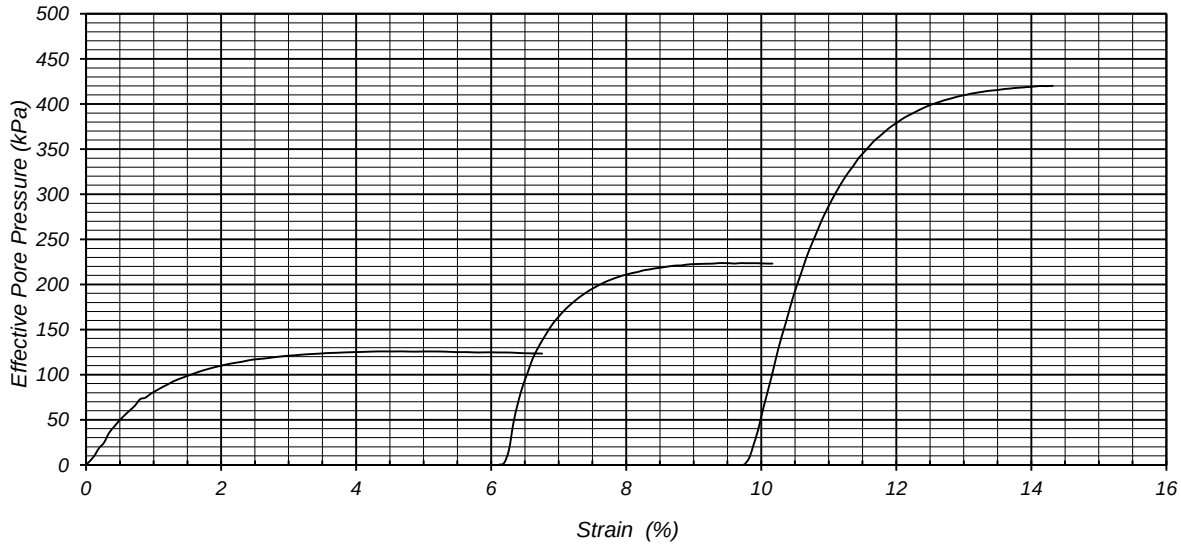
6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R024
		Issue date	13/07/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	23/6-9/6/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ15 0.75 - 5.4m	*Sample No*	17102012

STRESS - STRAIN PLOT



EFFECTIVE PORE PRESSURE - STRAIN PLOT



EFFECTIVE STRESS TRIAXIAL TEST

AS 1289.6.4.2

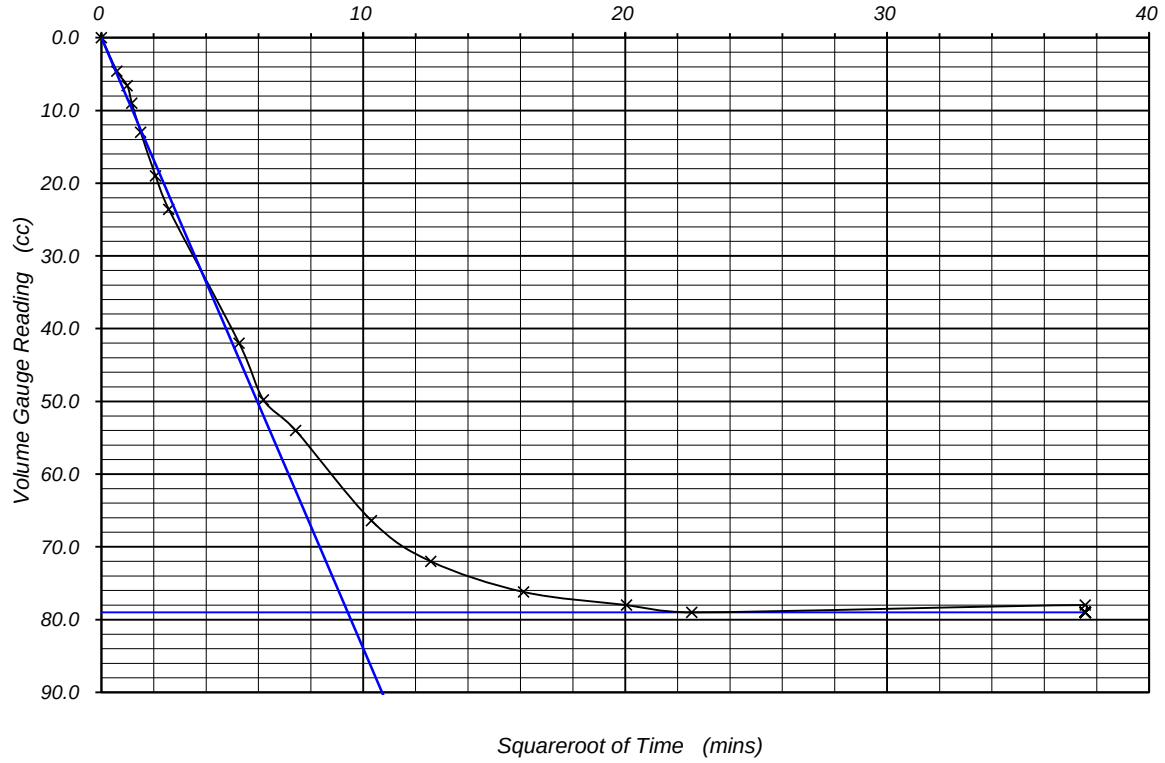
CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R024
		Issue date	13/07/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	23/6-9/6/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR

Sample location	TP-EQ15 0.75 - 5.4m	*Sample No*	17102012

CONSOLIDATION TEST



Stage No	1	
Effective cell pressure	200	*kPa*
Consolidation 100% (t_{100})	88.4	*mins*
Coefficient of consolidation (c_v)	1.9	*M² / year*

EFFECTIVE STRESS TRIAXIAL TEST

AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R031
		Issue date	29/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	14-26/06/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR

Sample No	17102018	*Sampled by*	Client
Sample location	TP-EQ07 0.5 - 2.5m	*Sampling date*	2017

Type of sample R100

Type of test Compressive strength of a saturated specimen tested in undrained triaxial compression with measurement of pore water pressure (multi stage)

Drainage conditions Top, bottom and side

Failure criteria Principle Stress Ratio

Test Details

	Stage No	1	2	3
Initial cell pressure	*kPa*	700	900	900
Back pressure	*kPa*	500	500	100
Effective axial stress at failure	*kPa*	221	466	969
Effective lateral stress at failure	*kPa*	76	166	382
Effective pore pressure at failure	*kPa*	124	234	419
Deviator stress at failure	*kPa*	146	300	587
Strain at failure	*%*	3.80	7.61	11.53
Degree of saturation before test (B)			0.97	
Rate of strain	*mm/min*		0.013	

Sample Details

Initial sample length	*mm*	200.0
Initial sample diameter	*mm*	99.6
Initial dry density	*t/m³*	1.35
Initial moisture content	*%*	33.0

Moisture content after test

Moisture Content	*%*	32.8

Test Results

EFFECTIVE COHESION	*kPa*	**10**
EFFECTIVE ANGLE OF FRICTION	*o*	**25**

Sample Description CLAY, high plasticity, brown, with fine to coarse sand, trace of fine to medium gravel. Specimen remoulded to 96.8% Standard Compactive Effort at 1.2% wet of OMC

Mode of Failure Plastic barrelling

EFFECTIVE STRESS TRIAXIAL TEST

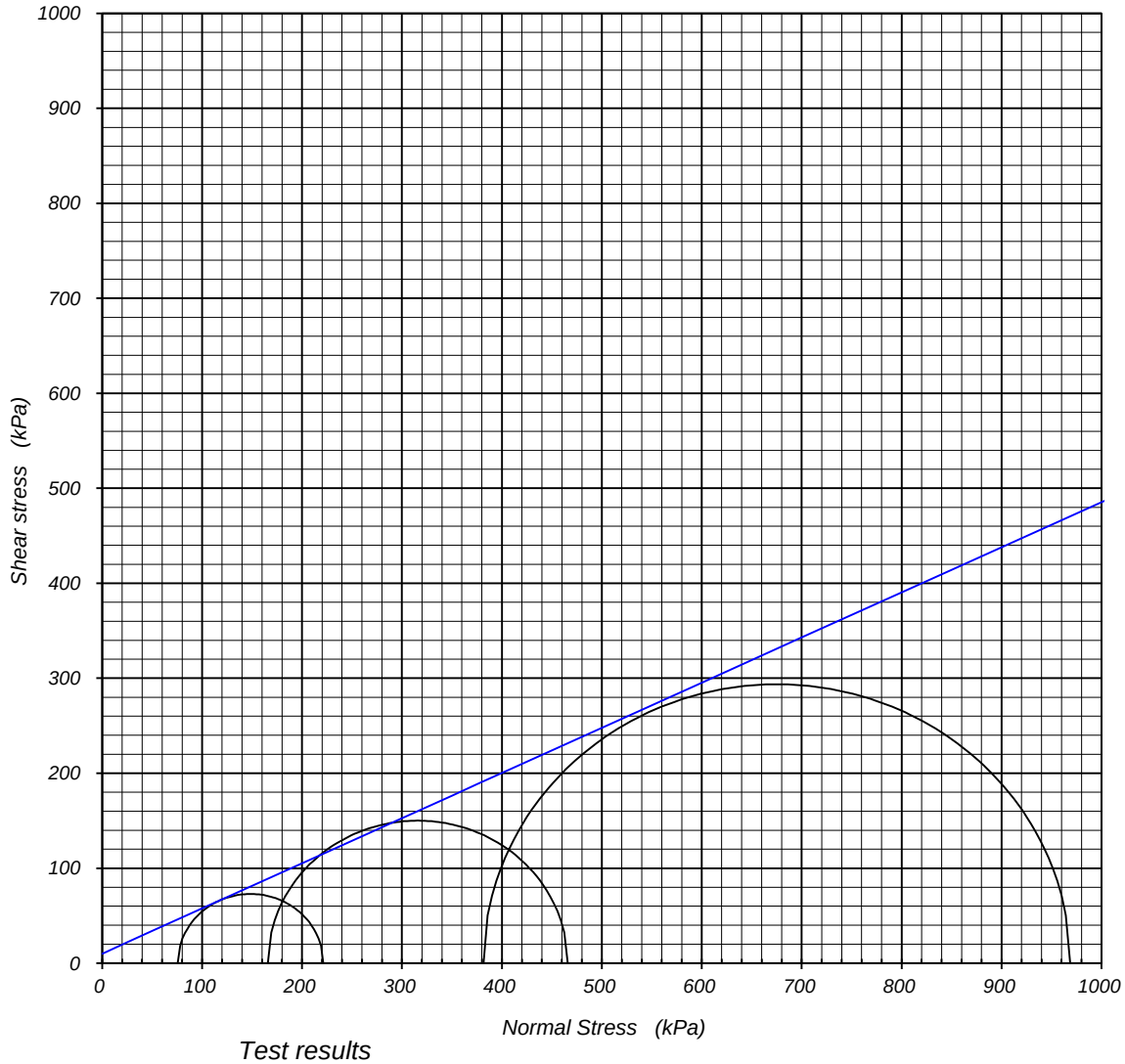
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R031
		Issue date	29/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	14-26/06/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ07 0.5 - 2.5m	*Sample No*	17102018

SHEAR STRESS - NORMAL STRESS PLOT



Test results

EFFECTIVE COHESION	10	*kPa*
EFFECTIVE ANGLE OF FRICTION	25	*o*

EFFECTIVE STRESS TRIAXIAL TEST

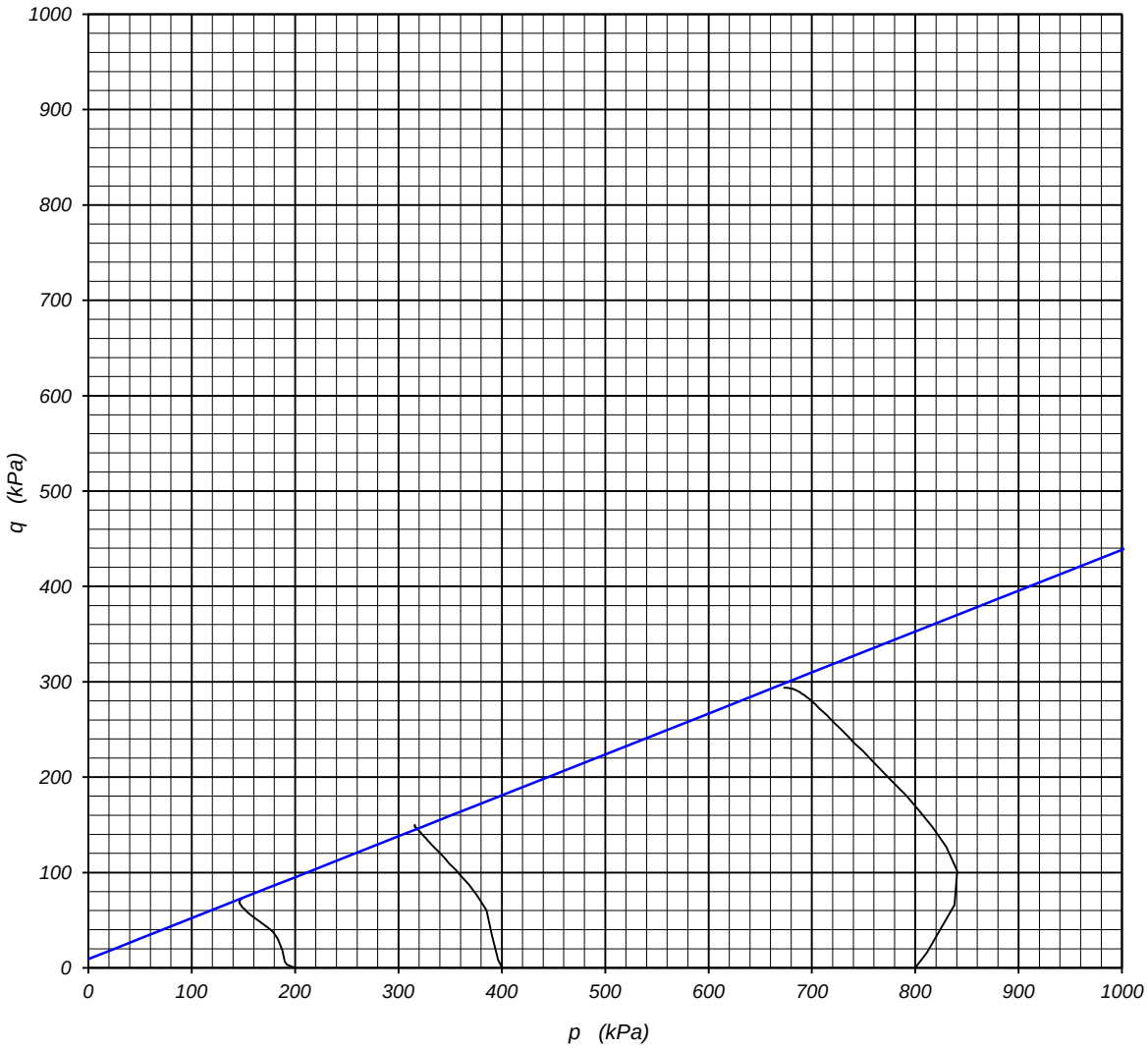
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R031
		Issue date	29/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	14-26/06/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ07 0.5 - 2.5m	*Sample No*	17102018

p' - q' PLOT

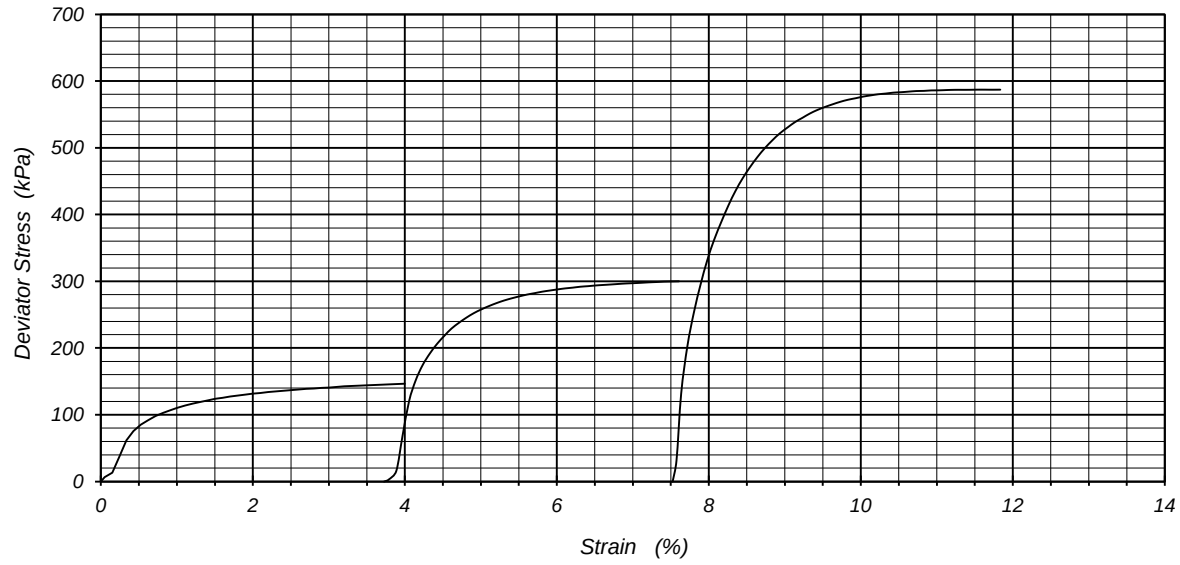


EFFECTIVE STRESS TRIAXIAL TEST

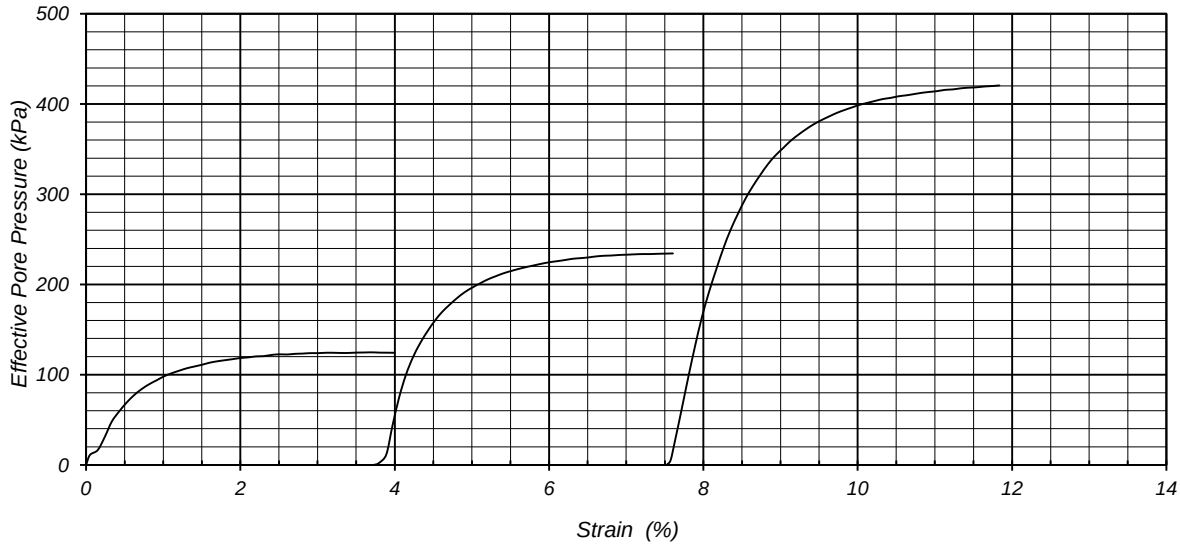
AS 1289.6.4.2

		Job No	17102
CIVIL GEOTECHNICAL SERVICES		*Report No*	17102/R031
6 - 8 Rose Avenue, Croydon 3136		*Issue date*	29/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	14-26/06/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ07 0.5 - 2.5m	*Sample No*	17102018

STRESS - STRAIN PLOT



EFFECTIVE PORE PRESSURE - STRAIN PLOT



EFFECTIVE STRESS TRIAXIAL TEST

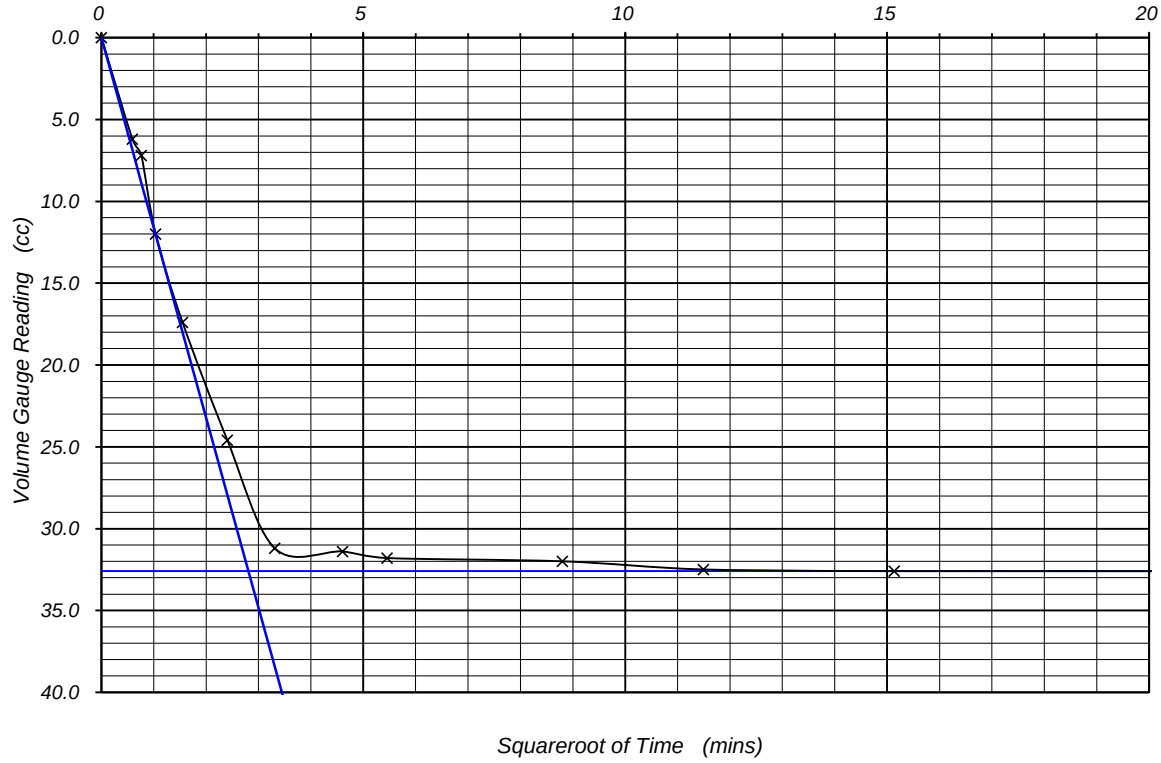
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R031
		Issue date	29/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	14-26/06/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ07 0.5 - 2.5m	*Sample No*	17102018

CONSOLIDATION TEST



Stage No	1	
Effective cell pressure	200	*kPa*
Consolidation 100% (t_{100})	7.9	*mins*
Coefficient of consolidation (c_v)	20.9	*M² / year*

EFFECTIVE STRESS TRIAXIAL TEST

AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R032
		Issue date	07/11/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	23/06-7/07/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR

Sample No	17102019	*Sampled by*	Client
Sample location	TP-EQ10 0.3 - 1.4m	*Sampling date*	2017

Type of sample R100

Type of test Compressive strength of a saturated specimen tested in undrained triaxial compression with measurement of pore water pressure (multi stage)

Drainage conditions Top, bottom and side

Failure criteria Principle Stress Ratio

Test Details

	Stage No	1	2	3
Initial cell pressure	*kPa*	700	900	900
Back pressure	*kPa*	500	500	100
Effective axial stress at failure	*kPa*	217	481	1081
Effective lateral stress at failure	*kPa*	76	184	463
Effective pore pressure at failure	*kPa*	124	216	338
Deviator stress at failure	*kPa*	141	297	619
Strain at failure	*%*	2.87	6.73	10.78
Degree of saturation before test (B)			0.97	
Rate of strain	*mm/min*		0.040	

Sample Details

Initial sample length	*mm*	200.0
Initial sample diameter	*mm*	99.6
Initial dry density	*t/m³*	1.43
Initial moisture content	*%*	28.8

Moisture content after test

Moisture Content	*%*	29.4

Test Results

EFFECTIVE COHESION	*kPa*	**14**
EFFECTIVE ANGLE OF FRICTION	*o*	**23**

Sample Description CLAY, high plasticity, brown, with fine to coarse gravel, with fine to coarse sand. Specimen remoulded to 96.7% Standard Compactive Effort at 1.6% wet of OMC See Report no 17102/R029 for Compaction details

Mode of Failure Plastic barrelling

EFFECTIVE STRESS TRIAXIAL TEST

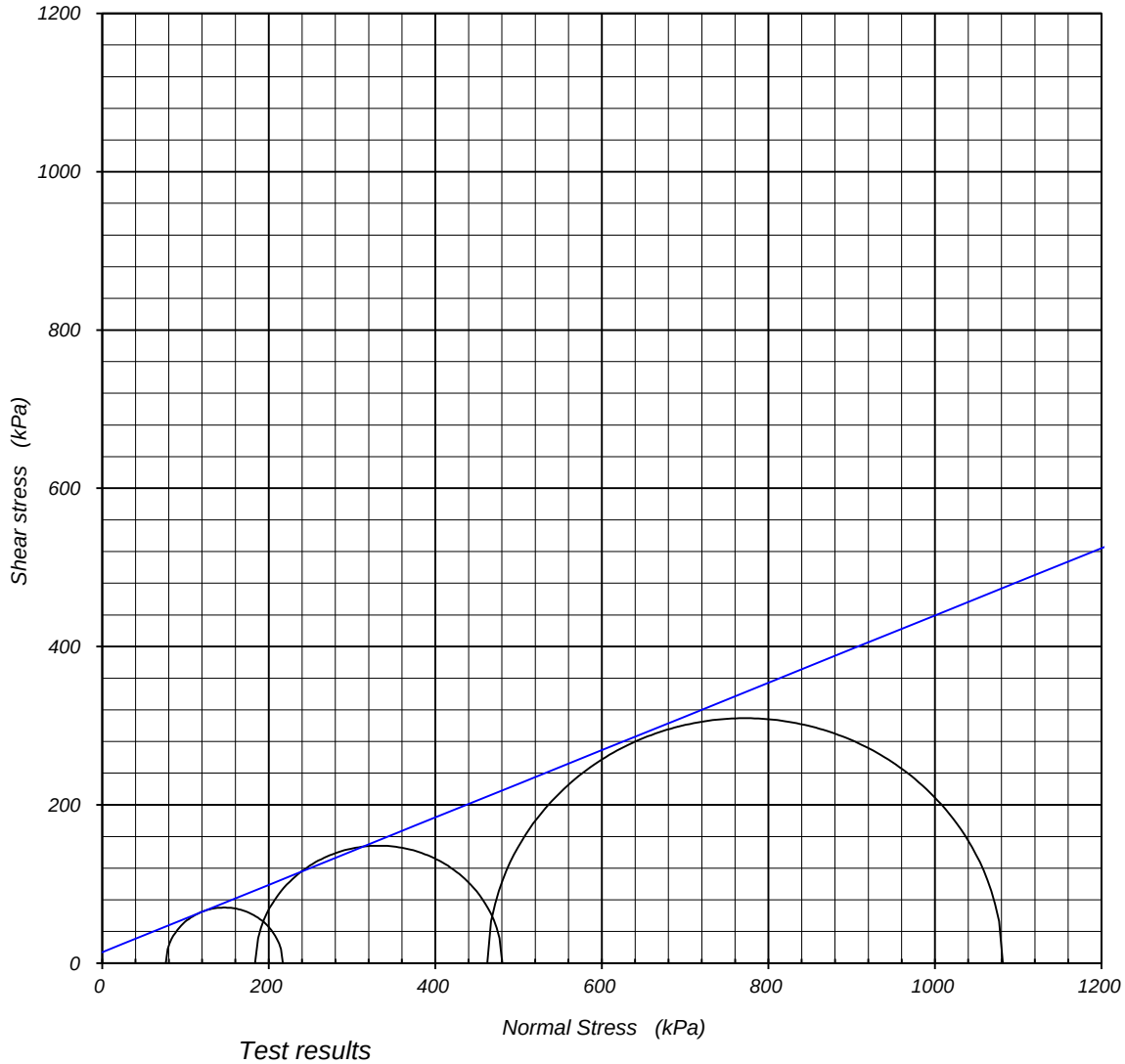
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R032
		Issue date	07/11/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	23/06-7/07/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ10 0.3 - 1.4m	*Sample No*	17102019

SHEAR STRESS - NORMAL STRESS PLOT



Test results

EFFECTIVE COHESION	14	*kPa*
EFFECTIVE ANGLE OF FRICTION	23	*o*

EFFECTIVE STRESS TRIAXIAL TEST

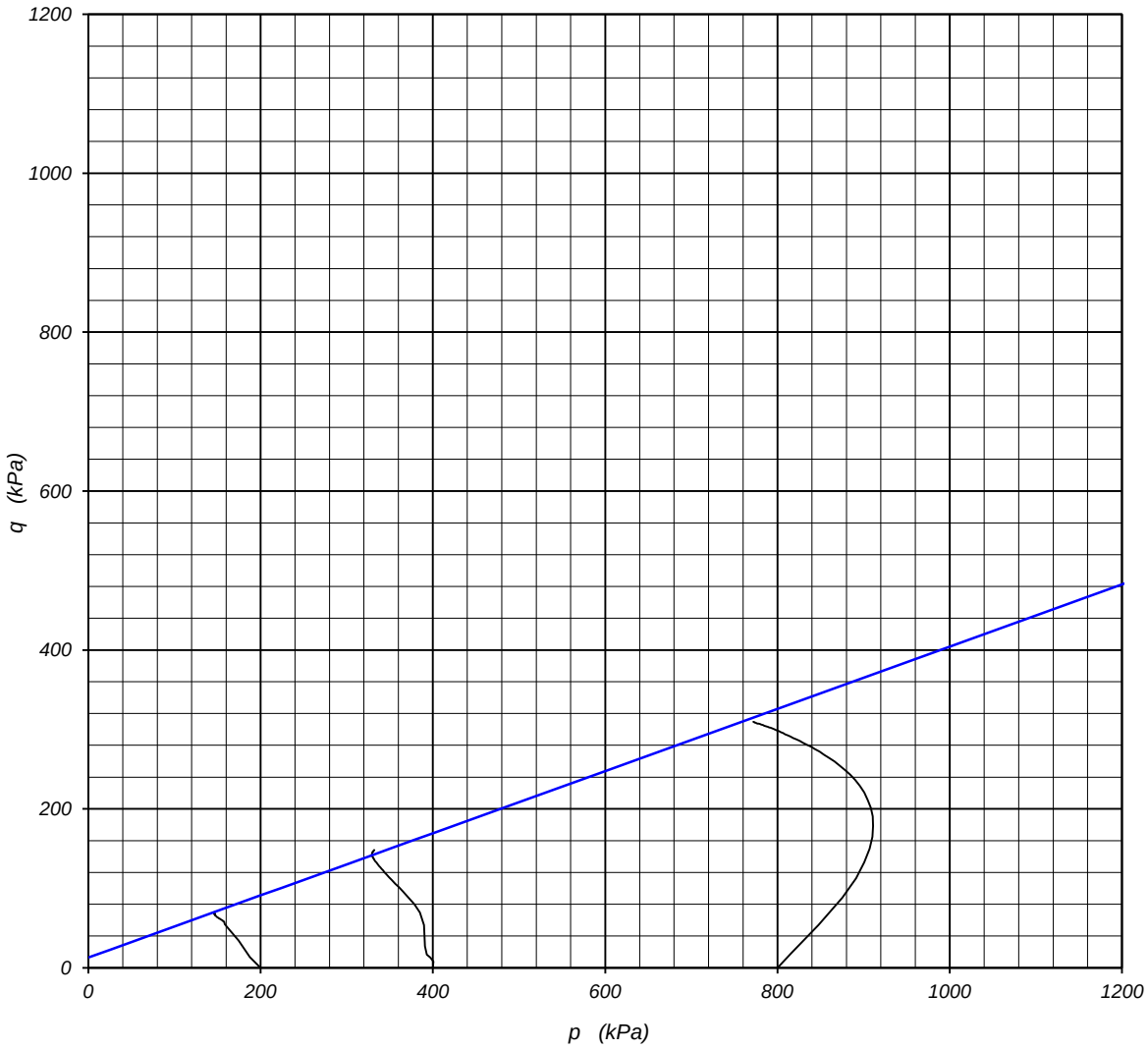
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R032
		Issue date	07/11/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	23/06-7/07/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ10 0.3 - 1.4m	*Sample No*	17102019

p' - q' PLOT



EFFECTIVE STRESS TRIAXIAL TEST

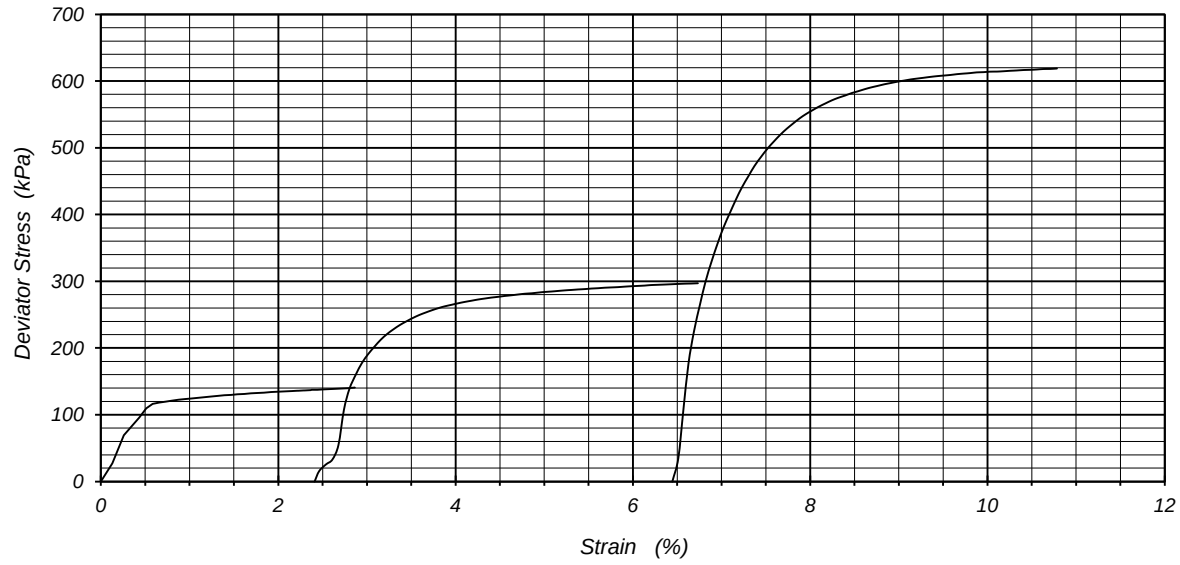
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

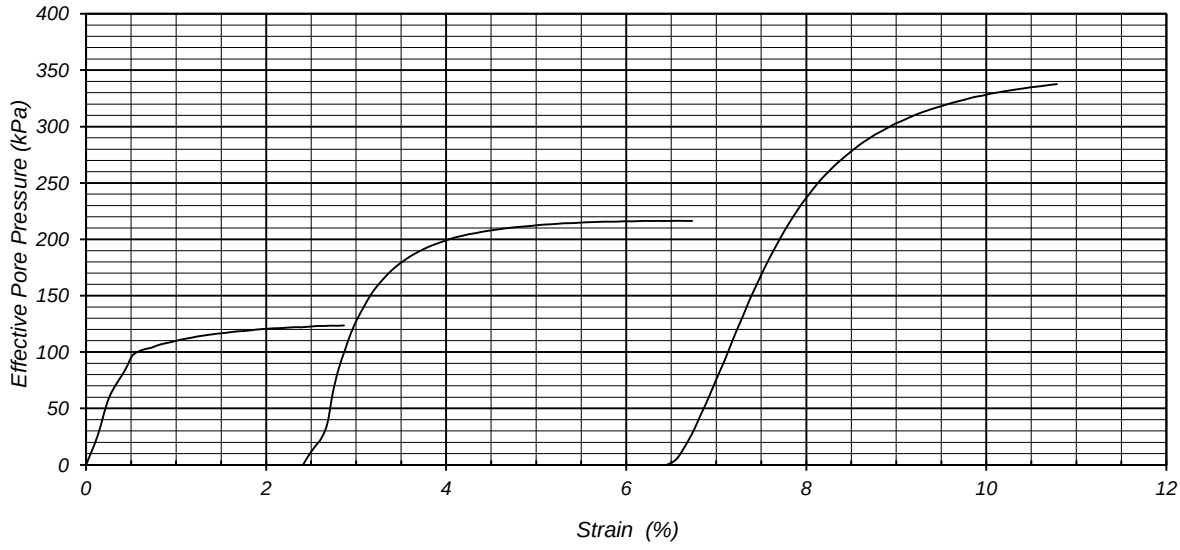
6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R032
		Issue date	07/11/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	23/06-7/07/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ10 0.3 - 1.4m	*Sample No*	17102019

STRESS - STRAIN PLOT



EFFECTIVE PORE PRESSURE - STRAIN PLOT



EFFECTIVE STRESS TRIAXIAL TEST

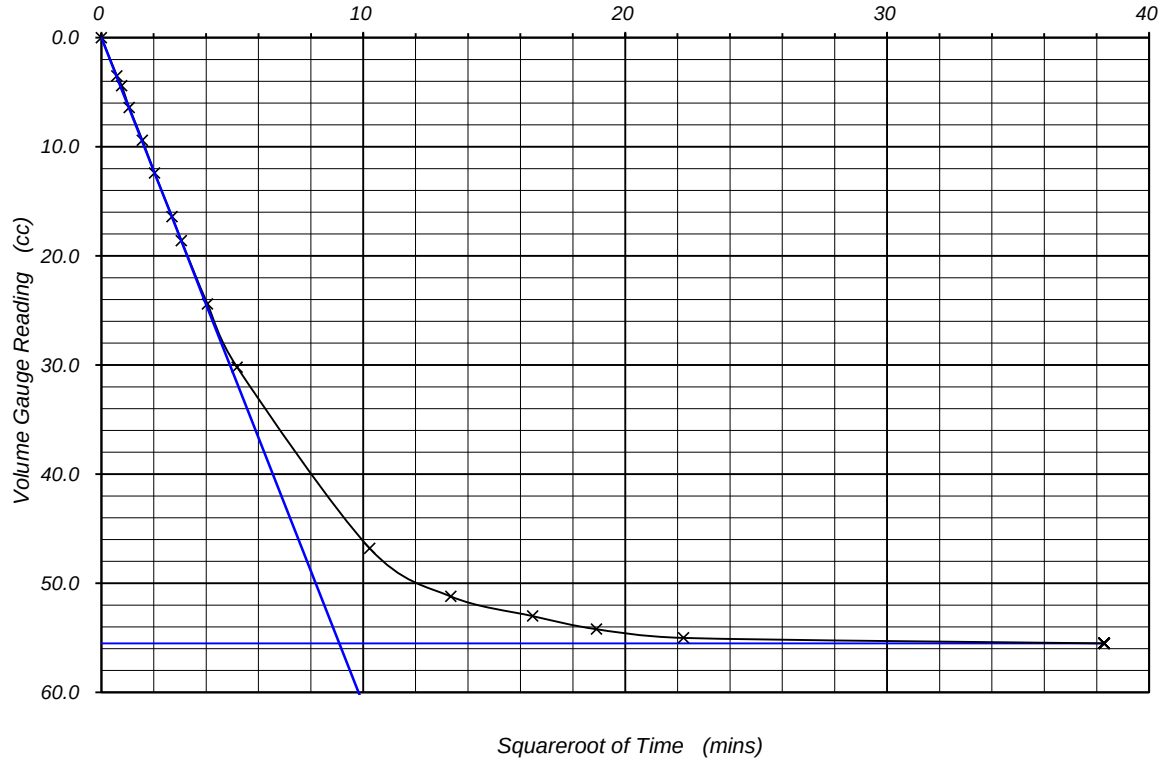
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R032
		Issue date	07/11/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	23/06-7/07/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ10 0.3 - 1.4m	*Sample No*	17102019

CONSOLIDATION TEST



Stage No	1	
Effective cell pressure	200	*kPa*
Consolidation 100% (t_{100})	82.5	*mins*
Coefficient of consolidation (c_v)	2.0	*M² / year*

EFFECTIVE STRESS TRIAXIAL TEST

AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES
6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R033
		Issue date	11/07/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	28/06-10/07/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR

Sample No	17102020	*Sampled by*	Client
Sample location	TP-EQ16 0.4 - 1.5m	*Sampling date*	2017

Type of sample R63
Type of test Compressive strength of a saturated specimen tested in undrained triaxial compression with measurement of pore water pressure (multi stage)
Drainage conditions Top, bottom and side
Failure criteria Principle Stress Ratio

Test Details

	Stage No	1	2	3
Initial cell pressure	*kPa*	700	900	900
Back pressure	*kPa*	500	500	100
Effective axial stress at failure	*kPa*	239	538	1236
Effective lateral stress at failure	*kPa*	86	219	520
Effective pore pressure at failure	*kPa*	114	181	280
Deviator stress at failure	*kPa*	153	319	716
Strain at failure	*%*	4.07	7.83	13.18
Degree of saturation before test (B)			0.97	
Rate of strain	*mm/min*		0.025	

Sample Details

Initial sample length	*mm*	126.8
Initial sample diameter	*mm*	63.2
Initial dry density	*t/m³*	1.33
Initial moisture content	*%*	32.7

Moisture content after test

Moisture Content	*%*	31.2

Test Results

EFFECTIVE COHESION	*kPa*	**14**
EFFECTIVE ANGLE OF FRICTION	*o*	**23**

Sample Description CLAY, high plasticity, brown, with fine to coarse sand, trace of fine to medium gravel.
Specimen remoulded to 97.3% Standard Compactive Effort at 0.3% wet of OMC
See Report no 17102/R030 for Compaction details

Mode of Failure Plastic barrelling

Approved Signatory : Andrew Roberts

EFFECTIVE STRESS TRIAXIAL TEST

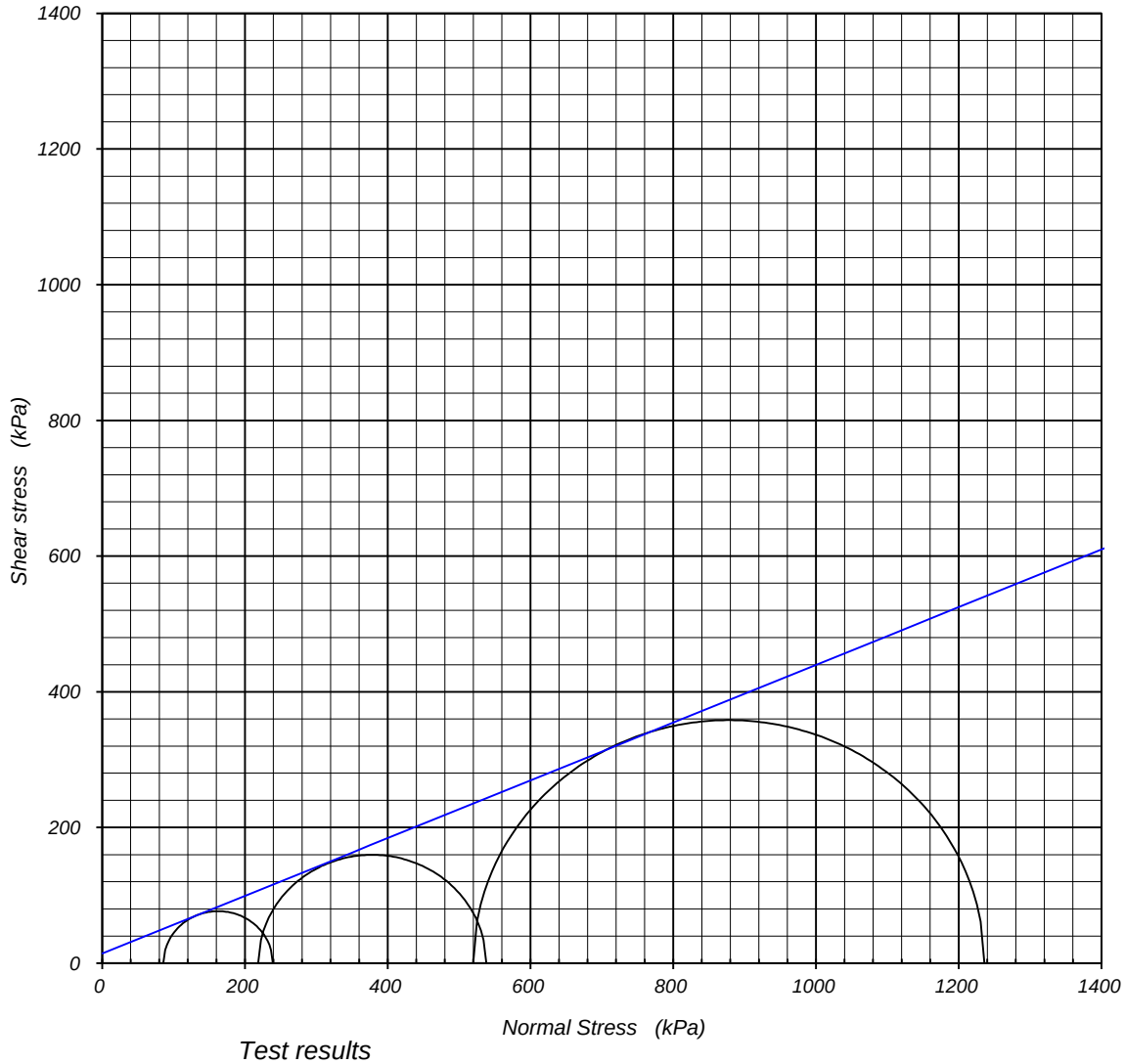
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R033
		Issue date	11/07/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	28/06-10/07/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ16 0.4 - 1.5m	*Sample No*	17102020

SHEAR STRESS - NORMAL STRESS PLOT



Test results

EFFECTIVE COHESION	14	*kPa*
EFFECTIVE ANGLE OF FRICTION	23	*o*

EFFECTIVE STRESS TRIAXIAL TEST

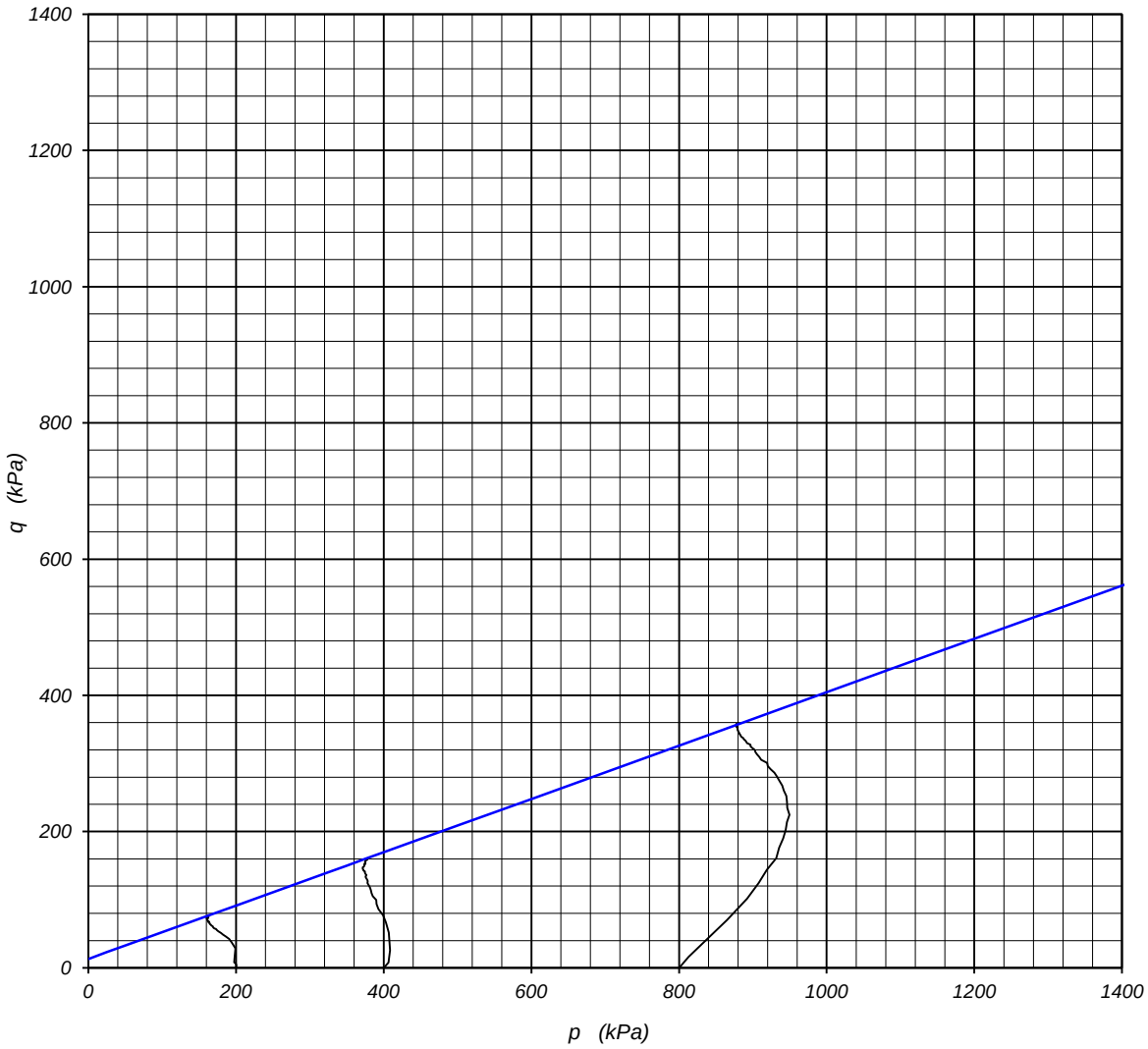
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R033
		Issue date	11/07/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	28/06-10/07/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ16 0.4 - 1.5m	*Sample No*	17102020

p' - q' PLOT



EFFECTIVE STRESS TRIAXIAL TEST

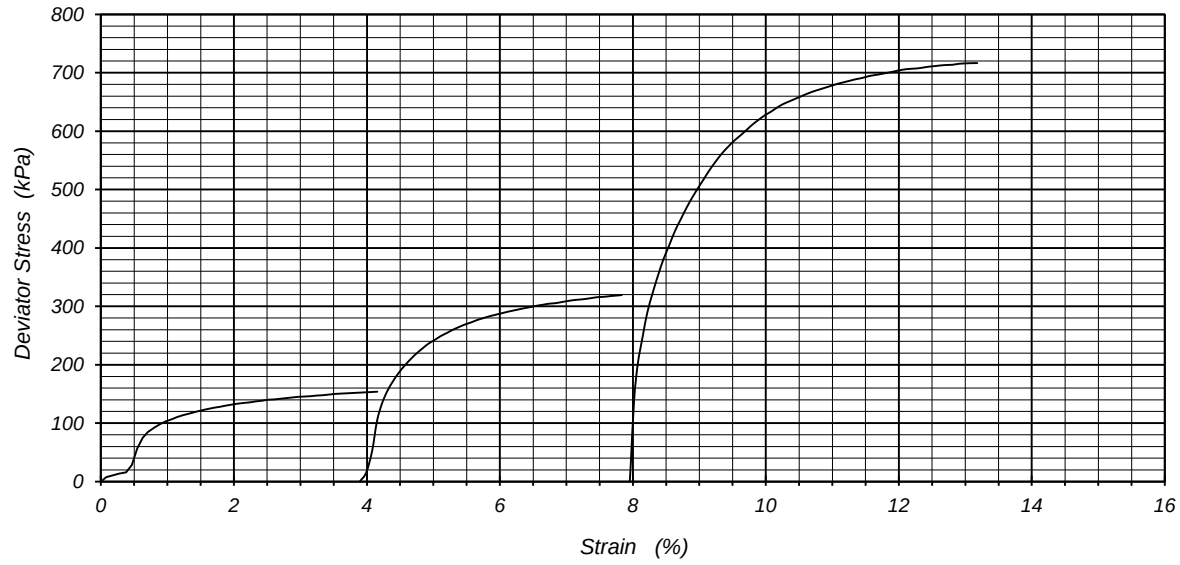
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

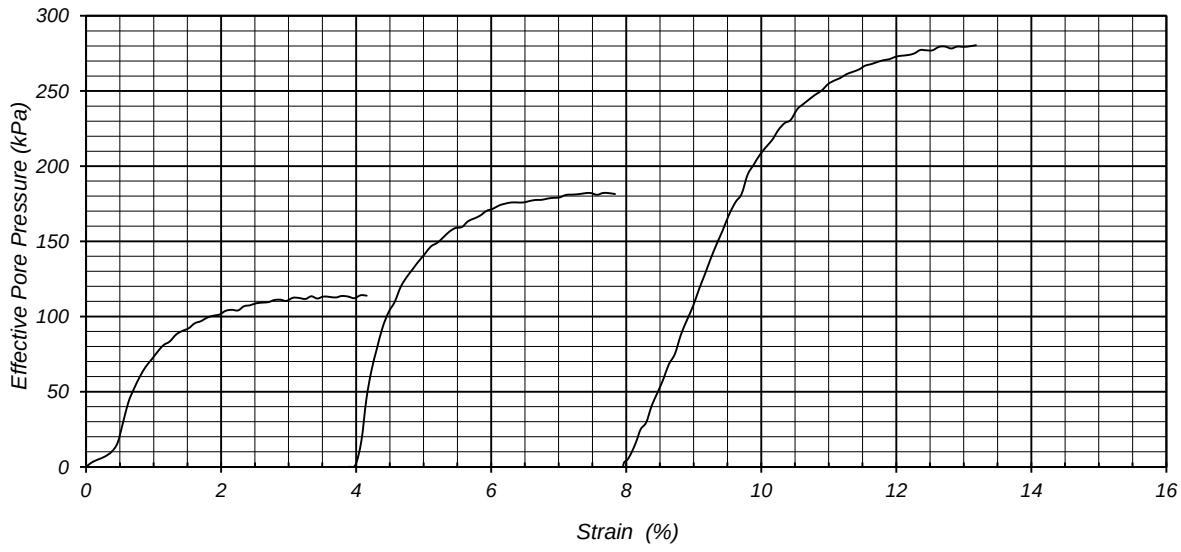
6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R033
		Issue date	11/07/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	28/06-10/07/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ16 0.4 - 1.5m	*Sample No*	17102020

STRESS - STRAIN PLOT



EFFECTIVE PORE PRESSURE - STRAIN PLOT



EFFECTIVE STRESS TRIAXIAL TEST

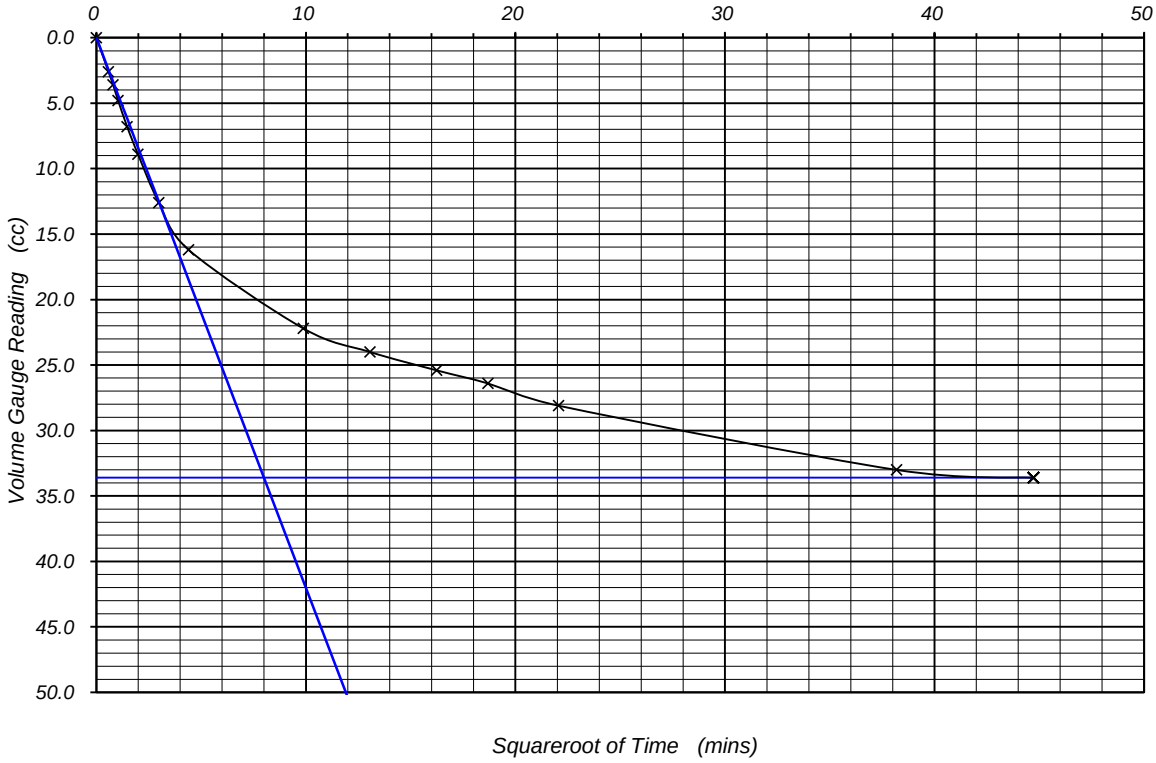
AS 1289.6.4.2

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R033
		Issue date	11/07/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	28/06-10/07/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR
Sample location	TP-EQ16 0.4 - 1.5m	*Sample No*	17102020

CONSOLIDATION TEST



Stage No	1	
Effective cell pressure	200	*kPa*
Consolidation 100% (t_{100})	64.0	*mins*
Coefficient of consolidation (c_v)	1.0	*M² / year*

B5 – Permeability Tests

CONSTANT HEAD PERMEABILITY TEST

AS 1289.6.7.3

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R022
		Date of Issue	29/06/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	16-23/06/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR

Sample No		17102001
Sample identification		TP-EQ01 0.3 - 1.2m
Date sampled		2017
Sampled by		Client
Sampling method		By Client
Sample type		Bulk Disturbed
Sample Preparation		
Oversize material retained on 19mm sieve	%	2
Percent of material discarded		2
Compaction details 1		
AS1289 5.1.1 Standard Compaction see Report No		17102/R020
Maximum Dry Density	t/m³	1.41
Optimum Moisture Content	%	30.5
Oversize material retained on 19.0mm sieve	%	2
Compaction details 2		
Target laboratory density ratio	%	97
Method of compaction		Compaction by tamping in equal layers
No of layers		3
Length of specimen	mm	100.0
Diameter of specimen	mm	99.6
Length to diameter ratio		1: 1.0
Specimen details before test		
Dry density	t/m³	1.37
Moisture content	%	31.8
Laboratory moisture ratio	%	104
Laboratory density ratio	%	97
Specimen details after test		
Moisture content	%	34.6
Mean effective stress	kPa	100
Permeant used		Distilled water
PERMEABILITY (k)	m/sec	4 x 10 $^{-11}$
Sample description		gravelly CLAY, high plasticity, brown, fine to coarse gravel, trace of fine to coarse sand

CONSTANT HEAD PERMEABILITY TEST

AS 1289.6.7.3

CIVIL GEOTECHNICAL SERVICES

6 - 8 Rose Avenue, Croydon 3136

		Job No	17102
		Report No	17102/R034
		Date of Issue	11/07/17
Client	SMEC AUSTRALIA LIMITED (MELBOURNE)	*Tested by*	ANR
Project	30012127 EUROBODALLA SOUTHERN STORAGE	*Date tested*	23-30/06/17
Location	EUROBODALLA QUARRY	*Checked by*	ANR

Sample No		17102018
Sample identification		TP-EQ07 0.5 - 2.5m
Date sampled		2017
Sampled by		Client
Sampling method		By Client
Sample type		Bulk Disturbed
Sample Preparation		
Oversize material retained on 10mm sieve	%	0
Percent of material discarded		0
Compaction details 1		
AS1289 5.1.1 Standard Compaction see Report No		17102/R028
Maximum Dry Density	t/m³	1.39
Optimum Moisture Content	%	32.0
Oversize material retained on 19.0mm sieve	%	0
Compaction details 2		
Target laboratory density ratio	%	97
Method of compaction		Compaction by tamping in equal layers
No of layers		3
Length of specimen	mm	99.9
Diameter of specimen	mm	99.6
Length to diameter ratio		1: 1.0
Specimen details before test		
Dry density	t/m³	1.34
Moisture content	%	32.7
Laboratory moisture ratio	%	103
Laboratory density ratio	%	97
Specimen details after test		
Moisture content	%	40.1
Mean effective stress	kPa	100
Permeant used		Distilled water
PERMEABILITY (k)	m/sec	2×10^{-11}
Sample description		CLAY, high plasticity, brown, with fine to coarse sand, trace of fine to medium gravel.