Report

Colac Northern Development Area Quarry Project - Open Mine Pit Wall Rehabilitation - Geotechnical Assessment

Prepared for Holcim Australia Pty Ltd

3 November 2023

Calibre Professional Services One Pty Ltd
55 150 624 356

QUALITY ASSURANCE STATEMENT

TASK	NAME	SIGNATURE
Project Manager	[redacted]	
Prepared by		
Reviewed by		
Approved for Issue by		

DOCUMENT CONTROL

ISSUE	DATE	ISSUE DETAILS	AUTHOR	CHECKED	APPROVED
Rev 0	16/3/2023	Issued for Use	[redacted]		
Rev 1	05/5/2023	Issued for Use			
Rev 2	09/06/2023	Issued for Use			
Rev 3	25/08/2023	Issued for Use			
Rev 4	07/09/2023	Issued for Use			
Rev 5	20/09/2023	Issued for Use			
Rev 6	03/11/2023	Issued for Use			

COPP22265.001.REP.6.Docx

Contents

Tables

Figures

Appendices

1. Introduction

It is understood Holcim Australia Pty Ltd (Holcim) is proposing to expand its existing Colac construction rock aggregate quarrying operations, referred to as Work Authority 158 (WA158), onto land bound by 170 Ondit-Warrion Road (parcel 6LP8005), Ondit, Victoria, referred to as the Northern Development Area (NDA).

Holcim has engaged Calibre Professional Services One Pty. Ltd. (referred to herein as Calibre) to provide a geotechnical assessment for the proposed NDA. The focus of this assessment is the development of a quarry rehabilitation plan for the NDA at end of the life of mine (LoM).

This report presents the geotechnical assessment and proposed design requirements for the quarry rehabilitation works.

2. Background

Holcim has provided Calibre Resource and Mining (Calibre Professional Services One Pty. Ltd.; referred to herein as Calibre) with the following information:

- a site layout drawing showing the NDA location and design quarry footprint;
- cross-section drawings detailing the proposed NDA design quarry pit shell geometry; and
- an Excel spreadsheet detailing the mining volume estimates.

A copy of the above information is included in Appendix A of this report.

Based on the provided information, including discussions with Holcim, the following pertinent geotechnical details to the proposed NDA quarrying operation are understood:

1. Surficial soil overburden (referred to as overburden) within the NDA quarry footprint will be stripped to expose the fresh rock formation. A total of 0.42 MT of overburden material is expected to be stripped. Laboratory testing has been completed detailing the particle size distribution (PSD) grading curves, compaction testing, and dispersivity (Emerson class) testing for in-situ overburden samples derived from test-pitting work within NDA, including stockpiled overburden material derived from WA158 operations. The corresponding test certificates are included in Appendix B of this report.
2. Fresh rock quarrying will be carried out to a maximum depth of 17.4 m below the existing ground surface, with proposed quarry basin floor of approximately RL 110 m AHD. The formed quarry will have near-vertical (~80° from the horizontal plane) slopes cut in the fresh rock material and flatter battered slopes through the relatively thin overburden horizon.
3. At end of the LoM, rehabilitation of the pit walls will be undertaken as part of quarry closure, involving placement of previously excavated overburden to reshape the quarry wall profile to a flatter gradient. Dewatering for the NDA quarry will be terminated, and groundwater recharge of the quarry will occur. The NDA quarry wall rehabilitation is envisaged to be carried out in a similar manner to that previously undertaken for an exhausted quarry pit located in the northern pit lake area of WA158. Holcim has provided Calibre with an as-built survey contour layout drawing of the rehabilitated WA158 pit lake area and photographs taken of the rehabilitated pit slopes. This drawing and photographs are also included Appendix A of this report.
4. For management of surface erosion, the pit wall rehabilitation is proposed to incorporate a vegetated soil cover for portions of the placed overburden above the pond surface, whereas a graded coarse-grained soil filter cover will be placed over surfaces located underwater. By-product materials derived from rock crushing processes, comprising ‘crusher-dust’ and gravel aggregate, are proposed to be used to form the filter cover. Holcim has provided Calibre with laboratory test certificates detailing the PSD curves for the aforementioned material. These are included in Appendix C of this report.

Holcim submitted the Xstract documents to the Victoria Department of Jobs, Precinct and Regions (Vic DJPR) for review as part of the Work Plan Variation application to commence quarrying within the NDA, and subsequently received geotechnical review comments from Vic DJPR as summarised in a technical services memorandum dated 2nd August 2022 (Vic DJPR memorandum subject: WA007635 (PLN-001672) – Geotechnical Report Review, see Appendix D of this report). This Vic DJPR memorandum listed several outstanding geotechnical engineering concerns that Holcim must address for the design of quarry pit wall rehabilitation, subsequent to which two geotechnical engagement teleconference sessions were held between Holcim and Vic DJPR personnel to discuss a resolution pathway (meeting minutes also provided in Appendix D of this report); the outstanding concerns and agreed resolution approach is detailed as follows:

1. Long-term hydrogeological conditions and its impact on the geotechnical stability of the rehabilitated slope must be considered. Agreed approach: Review of long-term groundwater monitoring data will be undertaken and "worst-case" groundwater condition to be adopted for geotechnical stability assessment of proposed rehabilitated slope design geometry.
2. Rehabilitated slope surface must be shaped to form a beaching slope for public safety aspect, with geotechnical design assessment for the rehabilitated slope to reference the Victoria Earth Resources Regulation (Vic ERR) guideline *Geotechnical Guideline for Terminal and Rehabilitated Slopes – Extractive Industry Projects* (September 2020). Agreed approach: Rehabilitated slopes for the southern and western pit wall will be graded to be no steeper than 1V:3H, rehabilitated slopes for the eastern and northern pit wall will be graded to be no steeper than 1V:2H and shall possess sufficient geotechnical stability as represented by a minimum deterministic geotechnical slope stability Factor of Safety (FoS_{slope}) ≥ 1.6.
3. Geotechnical stability assessment for the proposed rehabilitated slope must consider Lower Bound geotechnical shear strength parameters of the overburden fill material to be utilised for slope rehabilitation.
4. Erosion management controls must be put in place for proposed rehabilitated slope, including (i) grading of fill material used to form the rehabilitated slope to mitigate the potentially dispersive behaviour of natural overburden present within NDA to be utilised as fill, and (ii) provide drainage to divert runoff from dispersive fill.

This report details the findings of geotechnical engineering assessments undertaken to address the above Vic DJPR concerns for the design of the proposed pit wall rehabilitation.

3. Previous Studies

For the proposed NDA development, Holcim has engaged the following engineering consultants to facilitate different aspects of the expansion approvals process:

1. Xstract Mining Consultants Pty Ltd (Xstract; now known as Calibre) has undertaken quarry open pit wall stability assessment including consideration for pit wall rehabilitation after quarry closure, including provision of a ground control management plan (GCMP), with findings detailed in an Xstract memorandum and report dated 15th October 2021 titled "Slope Stability Assessment – Colac Quarry NDA";
2. An updated ground control management plan (GCMP) has been completed, titled "Colac Quarry – Northern Development Area (WA7635) Ground Control Management Plan (Red Rock Geotechnical, 2023)", and a slope stability assessment of operating faces titled "Updated Slope Stability Assessment of Operating Faces – Colac Quarry NDA (WA7635) (Red Rock Geotechnical, 2023)". These have been undertaken by Red Rock Geotechnical;
3. Aurecon Group has undertaken a site-specific hydrology and hydrogeological study, titled "Colac Northern Development Area: Surface Water and Groundwater Impact Assessment and Water Management Plan (Aurecon, 2023)";
4. Colac Quarry (WA158) Ground Control Management Plan (Xstract Group, 2020); and
5. Slope Stability Assessment - Colac Quarry Stage 5 and Stage 6 (Xstract Group, 2020).

4. Geotechnical Scope of Work

The geotechnical Scope of Work (SoW) covered by this report is as follows:

- Review of provided geotechnical information.
- Derivation of geotechnical engineering parameters for the available overburden soils, crusher by-product dust, and gravel aggregate material to be used for pit wall rehabilitation.
- Geotechnical slope stability assessment to provide recommendation for the design rehabilitated slope batter that satisfies relevant regulatory requirements.
- Provide erosion management control recommendations to be incorporated into the rehabilitated slope design.

4.1 Referenced Geotechnical Information

Relevant geotechnical site investigation data that have been made available to Calibre for reference comprise the following:

- Certificates for laboratory tests on overburden samples collected from both WA158 and NDA as per above discussion (see Appendix B of this report). Undertaken tests comprise PSD grading, Atterberg Limits, standard Proctor compaction test, direct shear box tests, and Emerson class (dispersivity) test;
- Certificates for laboratory tests carried out on crusher dust and gravel material derived from rock crushing activities carried out as part of Colac construction rock aggregate quarrying operations (see Appendix C of this report). Undertaken tests comprise PSD grading; and
- Data from hand-held Dynamic Cone Penetrometer (DCP) undertaken by Calibre personnel within NDA as part of the Xstract quarry open pit wall stability assessment, with DCP test certificate presented in the Xstract report dated 15th October 2021. DCP testing was carried out to 1.2 m depth, with blow count readings averaging 5 ± 1 blows per 100 mm penetration. Additionally, Holcim also commissioned further DCP testing via Construction Science, with blow count readings also averaging 5 blows per 100 mm penetration or higher; DCP test certificates are provided in Appendix B.
- Finding of the slope stability assessment undertaken for the Colac Quarry Stage 5 and Stage 6, (Xstract Group, 2020)

A summary of the laboratory test data is presented in Table 1.

Table 1: Geotechnical laboratory soil test result summary

Geological unit	Test certificate number	Physical properties									Compaction properties		Emerson Class	Shear strength properties (direct shear test)				
		% soil content smaller than following particle size (mm):						Liquid Limit (%)	Plasticity Index, I_p (%)	Linear Shrinkage (%)	Optimum moisture content, OMC (%)	Maximum Standard Dry Density (t/m^3)		Normal stress (kPa)	Failure peak shear stress (kPa)	Failure residual shear stress (kPa)	Mohr-Coulomb parameters (φ and c')	
		63	19	6.7	2.36	0.425	0.075										Peak	Residual
Overburden (NDA)	13739-R-17179 13739-R-17227 13739-R-17228 (See Appendix B)	100	100	97	83	77	69	35	16	6.5	22.5	1.59	-	50 100 200	32.5 58.7 133.7	32.3 58.5 133.6	φ = 34.4° and c' = 0 kPa	φ = 34.4° and c' = 0 kPa
		100	100	98	91	86	79	52	30	15	29	1.45	-	-	-	-	-	-
		100	100	94	76	70	64	25	4	2.5	17	1.72	-	50 100 200	44.2 83.9 162.9	41.1 83.9 162.9	φ = 38.2° and c' = 5 kPa	φ = 38.8° and c' = 2 kPa
		100	100	97	78	70	64	24	4	2	16	1.75	-	-	-	-	-	-
Overburden (WA158)		93	90	85	79	69	57	59	32	15	1.38	29.5	-	50 100 200	41.8 74.2 121.4	34.9 71.8 117	φ = 27.6° and c' = 18.3 kPa	φ = 28.1° and c' = 12.4 kPa
		100	93	88	82	70	58	56	32	15	1.41	30.5	-	-	-	-	-	-
	13739-R-14135 13739-R-14136 03145-R-6841 13739-R-13547 13739-R-13548 (See Appendix B)	100	97	88	81	73	64	56	27	13.5	-	-	-	-	-	-	-	-
		100	99	93	87	81	71	66	37	17.5	-	-	-	-	-	-	-	-
		100	99	89	84	79	71	62	32	16	-	-	-	-	-	-	-	-
		100	100	88	78	69	61	55	27	13	-	-	-	-	-	-	-	-
		100	97	88	81	75	65	63	35	16.5	-	-	-	-	-	-	-	-
		100	100	89	79	69	60	60	33	16	-	-	-	-	-	-	-	-
		100	98	90	82	72	63	66	35	16.5	-	-	-	-	-	-	-	-
		100	99	90	81	71	63	62	32	15.5	-	-	-	-	-	-	-	-
		100	96	85	76	67	59	66	36	17	-	-	-	-	-	-	-	-
		100	97	86	78	71	60	68	38	17	-	-	-	-	-	-	-	-
		100	100	99	94	77	50	48	25	14	-	-	3	-	-	-	-	-
Crusher dust	03145-R-9690 03145-R-9720 (See Appendix C)	100	100	99	60	26	16	-	-	-	-	-	-	-	-	-	-	-
20 mm aggregate		100	94	3	1	1	1	-	-	-	-	-	-	-	-	-	-	-

5. Geotechnical Site Condition

5.1 Site Topography

The NDA ground surface can generally be characterised as a flat undulating grass plain, with surface elevation varying between RL 125 m AHD and RL 127 m AHD across most of the site, and sloping down to around RL 121 m AHD towards the eastern / south-eastern site boundary.

5.2 Subsurface Conditions

5.2.1 Site Geology

Rock aggregates produced from the Colac quarrying operations are basalts typical of Newer Volcanics basalt flow layer spread across the Victorian Western Plains, overlying paleosols derived from the weathering of earlier lava flows.

The Newer Volcanics basalt flow layer is predominantly 15 m to 16.5 m thick across the NDA footprint, reducing to approximately 9 m towards the eastern boundary. The base of this geological unit varies between RL 110 m AHD and RL 112 m AHD.

The Newer Volcanics basalt is overlain by a variably thick layer of residual soils (i.e. overburden) derived from weathering of its underlying parent rock, with thickness ranging between 0 m and 3 m along the proposed NDA quarry pit wall perimeter.

5.2.2 Geotechnical Characterisation

5.2.2.1 Overburden (in-situ state)

Soil composition of the overburden material within WA158 and NDA can be summarised as follows:

- Gravel content averaging 19% ± 4%.
- Sand content averaging 17% ± 3%.
- Fines content (< 0.075 mm) averaging 64% ± 6%.
- Liquid limit averaging 55% ± 14%.
- Plasticity index averaging 28% ± 10%.

PSD grading curves for all tested overburden samples, including plotting of Atterberg Limits test data onto a Casagrande chart, is presented in Figure 1 and Figure 2 respectively.

From the laboratory test result findings, the in-situ overburden can be classified to be composed of gravelly sandy CLAY of high plasticity in general accordance with Australian Standard AS1726:2017 Geotechnical Site Investigations. DCP testing also indicate the in-situ overburden to be of stiff consistency.

Due to its high plasticity and stiff consistency, the in-situ overburden is anticipated to geotechnically shear in a dilative manner under all soil stress conditions (static and transient), as such its geotechnical shear strength can be conservatively prescribed under the Mohr-Coulomb failure criterion and is represented by the effective drained friction angle ϕ' and apparent cohesion c' parameters.

Based on past project experience with residual soils derived from weathering of igneous rock, including reference to published laboratory test data specific to the Newer Volcanics basaltic clays in Victoria by Shannon and Kodikara (2017), ϕ' is anticipated to range between 25° and 30° with c' ranging between 10 kPa and 20 kPa.

5.2.2.2 Overburden (excavated stockpile)

Laboratory standard Proctor compaction tests indicate an optimum moisture content (OMC) of 24% ± 6% is required to achieve the standard maximum dry density (SMDD), with OMC approximately 60% of the liquid limit range described above. The compaction test finding is indicative of compaction difficulty in reconstituting the excavated overburden spoils into its original in-situ stiff consistency.

It is anticipated that compacted overburden spoils are still likely to geotechnically shear in a contractive manner, with its geotechnical shear strength mobilising in a drained manner under static soil stress conditions, however, will mobilise in an undrained manner under transient (i.e., seismic, high rainfall intensity) soil stress conditions.

Its drained geotechnical shear strength can be defined using the Mohr-Coulomb failure criterion, with the governing parameter for this criterion being the effective friction angle ϕ' and apparent cohesion c'. ϕ' and c' has been interpreted by back-analysing the as-built rehabilitated slope of the exhausted and flooded quarry pit located at the north-west portion of WA158. The back-analysis has been undertaken based on the following consideration / assumption:

- Slope profile based on as-built survey contour layout as per Appendix A.
- As-built slope extends from a crest of RL 126 m AHD to a toe of RL 110 m AHD.
- Pond water level at RL 116 m AHD.
- Slope batter is 1V:1.5H.
- A 2 m thick overburden cover overlies the Newer Volcanics basalt layer.
- The as-built slope batter is geotechnically stable, as evidenced by the provided photographs, and its present-day stability can be represented by a FoS_{slope} of at least 1.1 based on past project experience including guidance from U.S. WSDoT *Geotechnical Design Manual M46-03*.
- Limit equilibrium slope stability analyses have been undertaken using the commercial slope stability analysis software Geostudio SLOPE/W 2012, based on the above as-built rehabilitated slope batter geometry, to calibrate ϕ' and c' corresponding to FoS_{slope} = 1.1.

SLOPE/W output illustrating the back-analysed as-built WA158 rehabilitated slope is presented in Figure 3. From this back-analysis, it can be inferred that the placed overburden material to rehabilitate the WA158 quarry pit walls possess ϕ' and c' of at least 25° and 10 kPa respectively. These back-analysed Mohr-Coulomb parameter values are anticipated to be applicable for the proposed NDA quarry pit wall rehabilitation exercise, subject to placement of the overburden material in a similar / identical manner to that previously adopted for WA158.

Laboratory direct shear box testing, on overburden samples reconstituted to 92% of SMDD to simulate traffic-induced compaction by dozers and haul trucks, indicate ϕ' ranging between 27.6° and 38.2° with c' ranging between 0 kPa and 18.3 kPa. On the basis of the above laboratory test results, the back-analysed Mohr-Coulomb parameters detailed above is deemed to be a conservative representation of the overburden material upon placement to form the slope rehabilitation, and have been adopted for geotechnical slope stability assessments undertaken as part of this report preparation.

Its undrained shear strength can be defined using the Tresca failure criterion, and the governing parameter for this criterion is the undrained shear strength S_u.

S_u has been interpreted using the MIT SHANSEP model as defined by the equation below:

$$\frac{S_u}{\sigma_v'} = \frac{1}{2} sin\varphi' . OCR^m$$

Where:

σ_v' = effective vertical soil overburden pressure (kPa) = 19.z, where z is the depth below formation surface (m)

ϕ' = effective friction angle (°)

OCR = Over-consolidation ratio = 1.0

M = stress exponent (default value = 0.8)

Based on the back-analysed ϕ' = 25°, S_u is estimated to be 4.z (kPa), with a minimum S_u of 20 kPa deemed conservatively appropriate to represent strength-gain in placed overburden spoils that have been trafficked over by earthwork machinery and include allowance for softening due to soil reactivity to seasonal moisture changes.

5.2.2.3 Newer Volcanics

Geotechnical characterisation of the Newer Volcanics basalt formation has previously been undertaken with findings detailed in the 15 October 2021 Xstract report. Pertinent findings from the Xstract study (2021) are presented below, however these should be read in conjunction with the aforementioned Xstract report.

The Geological Survey of Victoria *1:50,000 Geological Map Series for Colac* identifies the entire quarry site as within the "Stony Rise" basalt, comprising quaternary aged, young phase newer volcanic olivine basalt (commonly vesicular). "Stony Rise" basalt sequence comprised of a number of basalt flows, of which the Newer Volcanics basalt formation are locally the upper most flow. In subsequent parts of this report, the term "Stony Rise" and "Newer Volcanics" have been used interchangeably but are essentially the same geological formation taken into consideration for the geotechnical assessments covered by this report.

The main basalt flow trends across the northern end of the site, and as such similar conditions may be expected in the NDA as seen in the exposed northern end of the existing WA158 quarry pit. These conditions suggest comparatively regular, consistent, massive, and potentially continuous strata of the Stoney Rise basalt in the WA158.

The Stony Rise basalt rock mass exposed in the quarry is typically of high strength (50 to 100 MPa estimate) for the fresh rock materials. The rock mass within the Stony Rise basalt is fractured and, in some areas, columnar jointing is well developed. Jointing is generally tight. Rock block sizes are variable and up to 2.5 m diameter.

The geotechnical strength of this basalt formation has been interpreted based on visually estimated Geological Strength Index (GSI) and the estimated unconfined compressive strength (UCS) of the intact rock ranging between 50 MPa and 100 MPa. The Generalised Hoek-Brown ("GHB") model has been used to develop shear strength parameters based on the GSI and UCS. A blast disturbance factor (D) of 1.0 has been assumed.

The Barton-Bandis model has been used to estimate the shear strength of joint structures within the basalt rock mass, and involve modelling the well-developed sub-vertical columnar jointing within the basalt as a subvertical plane of anisotropy with shear strength controlled by the undulating, smooth and slightly weathered joint surfaces.

Geotechnical shear strength estimates for the rock mass and jointing, represented by equivalent Mohr-Coulomb failure criterion parameters ϕ_{eq}' and c_{eq}', are presented in Table 2.

Table 2: Geotechnical shear strength of Newer Volcanics basalt formation

Shear strength component	Shear strength model	Equivalent Mohr-Coulomb Shear Strength Parameters	
		ϕ_{eq}' (°)	c_{eq}' (kPa)
Rock mass	Generalised Hoek-Brown GSI = 60, UCS = 75 MPa mi = 25, D = 1.0	59	361
Jointing	Barton-Bandis JRC_n = 6.3, JCS_n = 37.6MPa Residual Friction = 35°	45	23

5.2.2.4 Paleosol

From a site visit undertaken by Xstract personnel as part of the 15th October 2021 Xstract report preparation, paleosols below the Newer Volcanics basalt formation has been identified to be composed of a mix of CLAY, SILT, and SAND material.

Just like how the in-situ surficial overburden layer is formed from weathering of the underlying Newer Volcanics basalt formation, the paleosol is similarly derived from the weathering of earlier lava flows preceding the Newer Volcanics basalt formation. On this basis, the paleosol is anticipated to possess similar or stronger (due to over-consolidation from overlying basalt overburden) geotechnical strength properties compared to the in-situ overburden formation.

5.2.3 Geotechnical Design Parameters

Based on the above interpretive findings, a conservative set of geotechnical shear strength parameters to represent each geological unit has been adopted for assessments covered by this report and is summarised in Table 3.

Table 3: Design soil / rock geotechnical shear strength parameters under static conditions

Geological Unit	Bulk unit weight, γ_b (kN/m^3)	Characteristic static geotechnical shear strength parameters		
		Effective stress state (drained)		Total stress state (undrained)
		ϕ' (°)	C' (kPa)	Undrained shear strength, S_u (kPa)
Overburden (stockpiled)	19	25	10	$S_u/\sigma_v' = 4.z$ where z is depth below formation surface (m)
Overburden (in-situ)	19	27	20	N/A
Newer Volcanics Basalt	19	45	23	N/A
Paleosol	19	27	20	N/A

Figure 1: Particle size distribution (PSD) grading curves for tested overburden samples

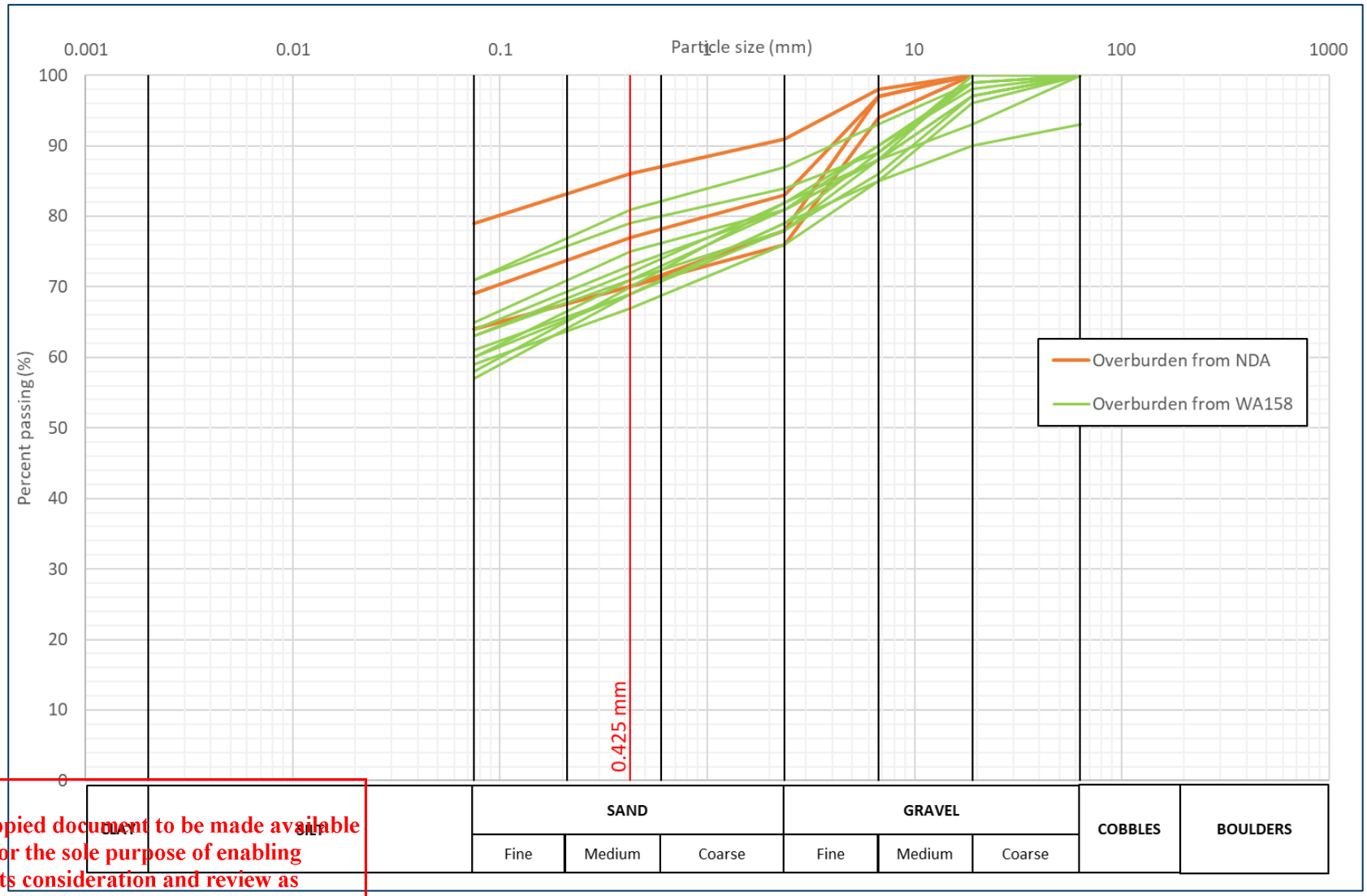


Figure 2: Atterberg Limits test result for tested overburden samples

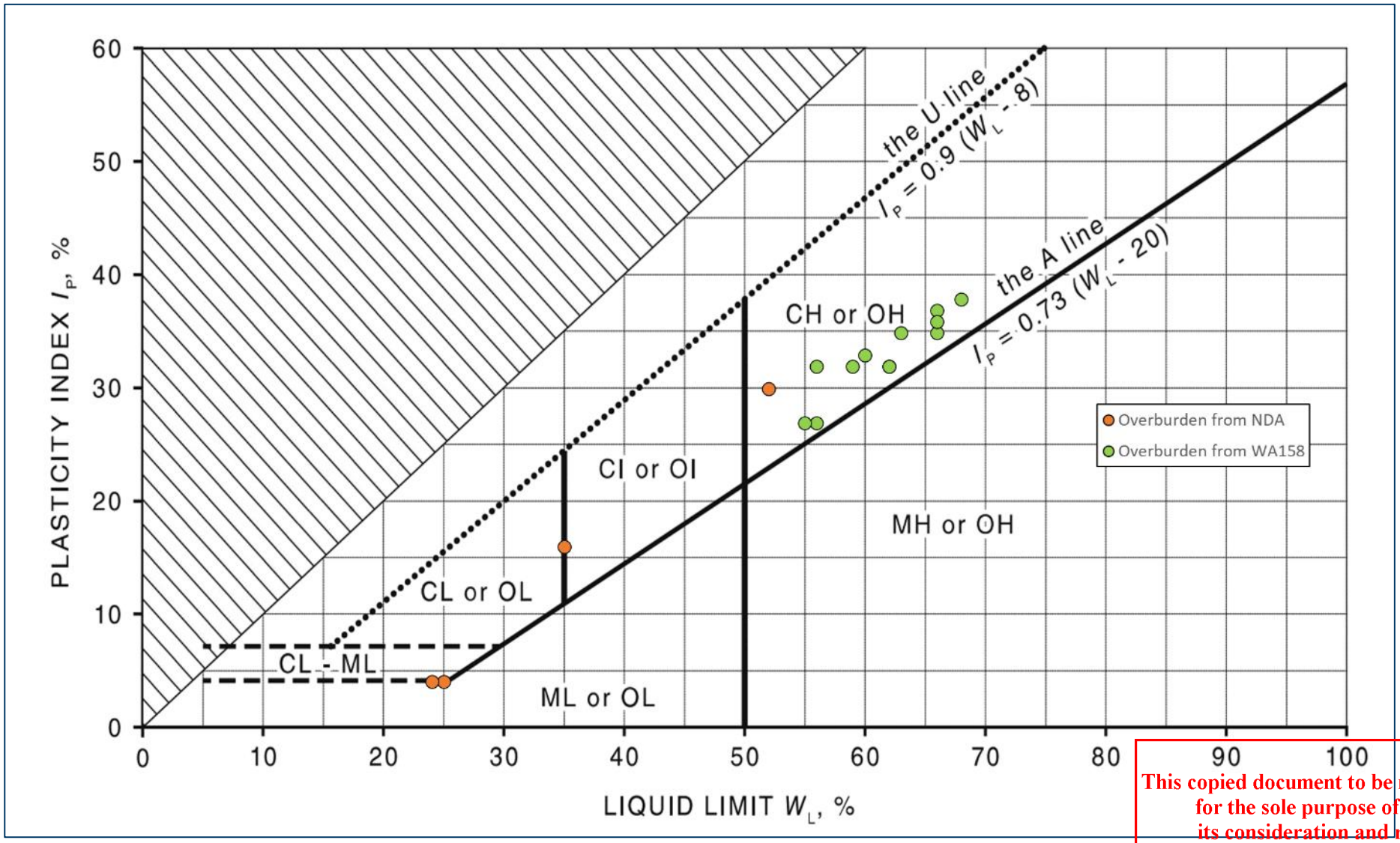
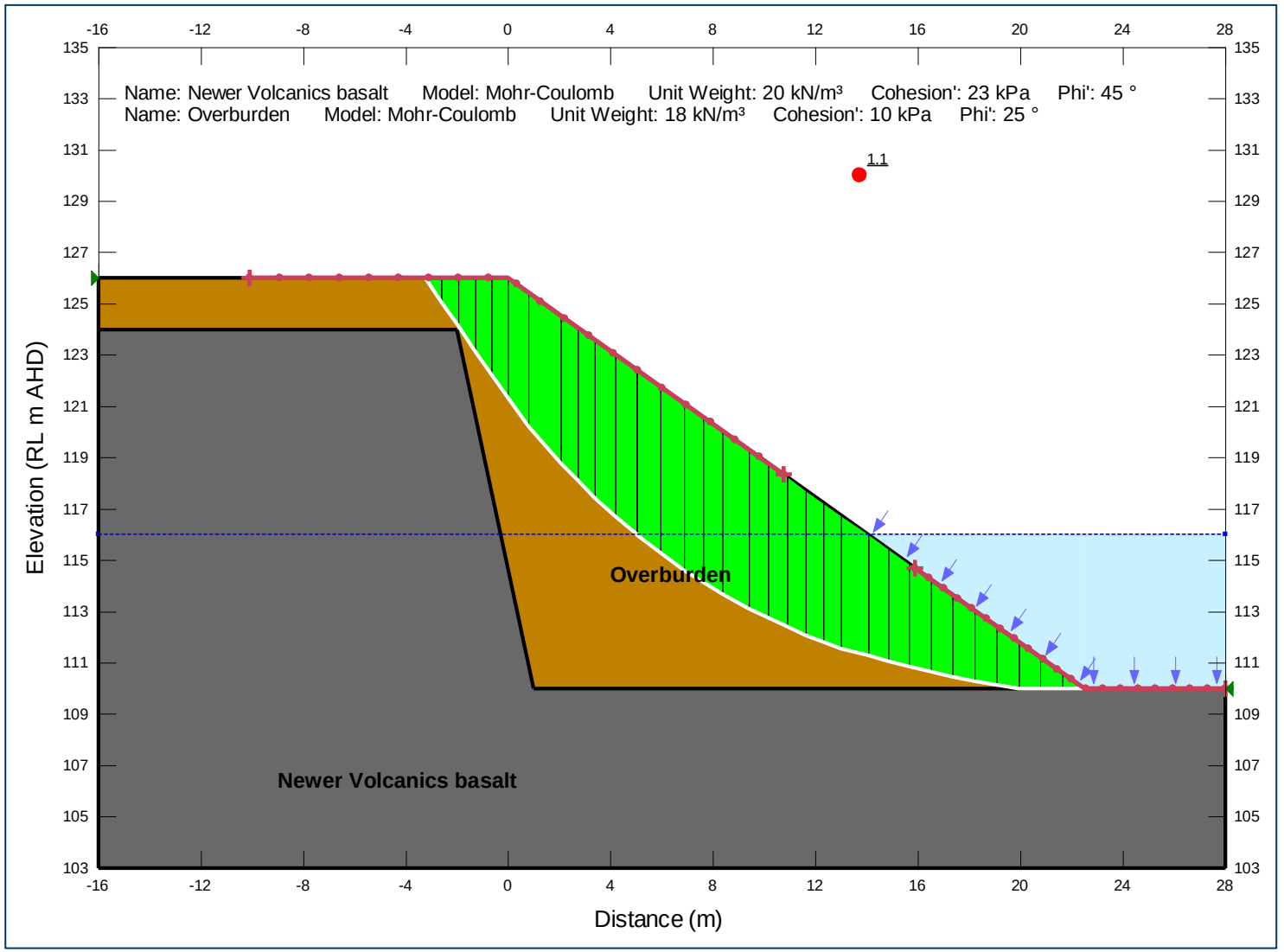


Figure 3: SLOPE/W output – Back-analysis of as-built WA158 rehabilitated pit wall slope



5.3 Groundwater Condition

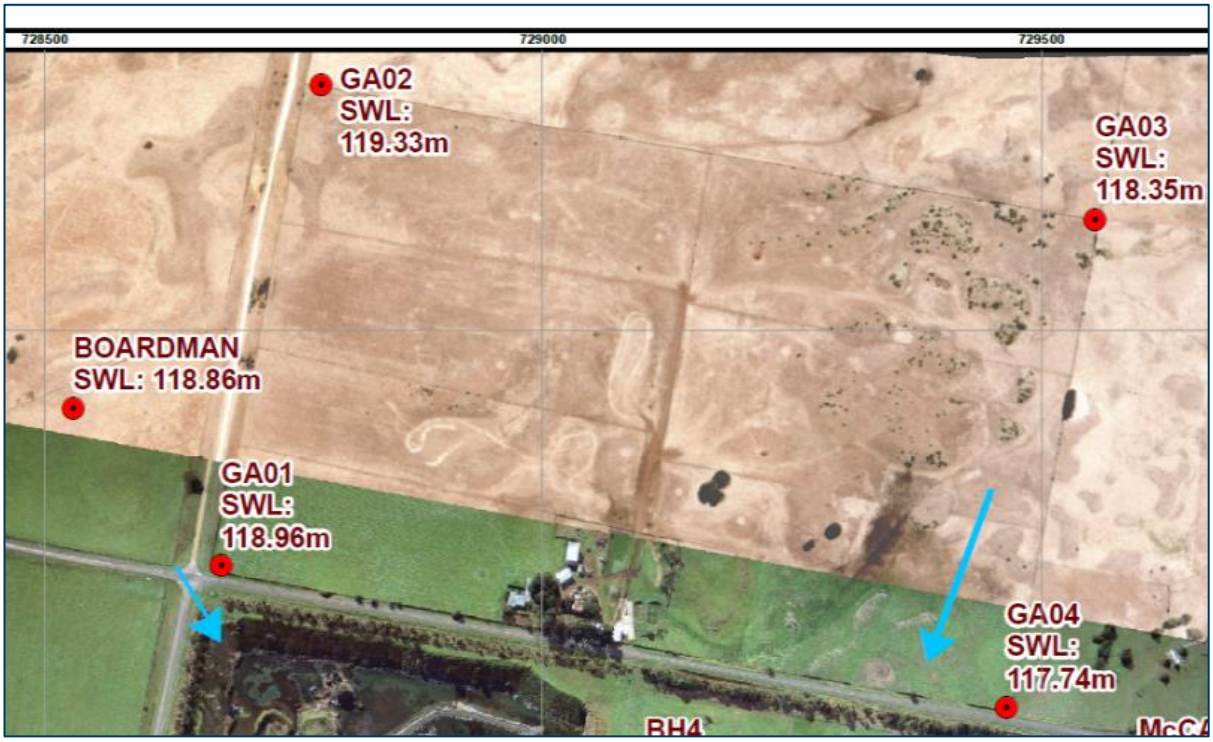
There are four (4) groundwater monitoring wells located at each corner of the NDA site boundary (GA01 to GA04). A site layout plan with indicative location of each well is presented in Figure 4. Groundwater level records have been made available for the four monitoring wells, taken from the following Aurecon report: Colac Northern Development Area: Surface Water and Groundwater Impact Assessment and Water Management Plan (Aurecon, 2023) Monitoring commenced in December 2004 through to March 2022.

The groundwater record statistics are summarised in Table 4 below.

Table 4: NDA Groundwater Monitoring Well Data

Statistical bound	Recorded groundwater surface (RL m AHD) at following well location			
	GA01	GA02	GA03	GA04
Minimum	116.11	115.96	116.51	116.50
Maximum	121.79	121.35	119.09	121.88
Average	118.59	118.39	118.09	119.01

Figure 4: Groundwater monitoring wells in NDA



5.4 Seismic Condition

5.4.1 Seismic Parameters

Seismic parameters relevant for engineering assessments are generally the bedrock peak ground acceleration (PGA) and moment wave magnitude (M_w). The design PGA and M_w value depends on the design Annual Exceedance Probability (AEP), which has been conservatively estimated to not exceed 500-year AEP in accordance with Australian Standard AS1170.0:2022 *Structural design actions, Part 0: General principles*.

The design PGA = 0.035 g and M_w = 6.2 has been interpreted based on the Geoscience Australia *2018 National Seismic Hazard Assessment (NSHA) for Australia* document including complementary record catalogue.

It is however to be noted that as seismic shaking waves are propagated from the quarry basin and vertically into the overlying overburden fill used to rehabilitate the pit wall, the waves may amplify/attenuate as it passes through the overburden fill body; this phenomenon is generally referred to as 'seismic site effects'. Furthermore, the reflection and diffraction of seismic waves as they reach the rehabilitated slope surface can also cause further amplification of ground motions within soils close to the slope surface and is referred to as topographical amplification. Discussion on site effects and topographical amplification are provided below.

5.4.2 Site Effects

An approximate estimation of the ground surface motion considering soil amplification/attenuation effects has been undertaken by referencing the characteristic natural period of the soil cover overlying bedrock against a design, uniform hazard spectra, and the corresponding spectral acceleration is taken to represent the ground surface PGA accounting for such effects. Based on the uniform hazard spectra provided in the Geoscience Australia 2018 NSHA document, a PGA amplification factor of 2.0 is deemed conservatively appropriate (PGA acting on rehabilitated slope considering site effects = 2.0 x bedrock PGA = 0.07 g).

5.4.3 Topographical Amplification

Besides seismic soil effects on the bedrock ground motion, the reflection and diffraction of seismic waves as they reach the rehabilitated surface can also cause further amplification of ground motions within soils close to the slope surface and is referred to as topographical amplification.

Eurocode 8 *Designs of structures for earthquake resistance Part 5: Foundations, retaining structures and geotechnical aspects* and the New Zealand Transport Agency report NZ TA 613 *Seismic design and performance of high cut slopes* provides recommendations for topographical amplification factors to be applied to the bedrock PGA on top of soil effects. Accordingly, a topographical amplification factor of 1.2 is deemed appropriate for design (PGA acting on the rehabilitated slope profile considering site effects and topographical amplification = 2.0 x 1.2 x bedrock PGA = 0.084 g).

6. Geotechnical Assessment

6.1 Geotechnical Slope Stability

6.1.1 General

Geotechnical slope stability assessment has been undertaken to recommend the maximum design batter gradient of the proposed rehabilitated quarry pit wall slope to be built using available overburden stockpile materials as fill.

6.1.2 Methodology

The geotechnical slope stability assessment has been undertaken based on a deterministic Factor of Safety (FoS_{slope}) approach, and the FoS_{slope} is estimated based on the Limit Equilibrium Morgernstern-Price method of slices. To this end, the commercial analysis software GeoStudio SLOPE/W 2012 has been utilised. The evaluated soil stress conditions are summarised as follows:

- Long-term static operating condition, where the geotechnical shear strength of all soils is governed by the effective stress state (drained);
- Transient storm condition, adopting the same geotechnical soil shear strength as for long-term static operating condition except for the overburden fill, which is to be modelled based on undrained conditions. A phreatic drawdown profile is also modelled to simulate the potential for perched groundwater conditions to persist within the overburden fill body, long after the storm event has passed, and the quarry pond has drained to reach equilibrium with the natural groundwater table; and

Seismic condition as defined by a 500-year AEP earthquake event. A pseudo-static slope stability analysis has been undertaken by applying a horizontal pseudo-static seismic acceleration coefficient k_h (taken as 0.5 x design PGA) to represent the 500-year AEP earthquake event. The same geotechnical soil strength properties as that for the transient storm scenario is adopted for this seismic scenario.

6.1.3 Design criteria

The design slope rehabilitation batter shall be specified such that it possesses sufficient geotechnical stability in terms of deterministic Factors of Safety (FoS_{slope}) as per following requirements set out primarily in Vic ERR (2020) *Geotechnical guideline for terminal and rehabilitated slopes*; referenced FoS_{slope} requirement table is illustrated below and $FoS_{slope} \geq 1.6$ has been adopted to comply with Vic ERR stipulation.

Table 5: Geotechnical slope stability FoS_{slope} criteria – Long-term static operating condition

Consequence of failure impacting on public safety, infrastructure, environment, land or property	Acceptable (Mean) FOS	Acceptable Minimum PoF
Not serious	1.3	10%
Moderately serious	1.6	1%
Very serious	2.0	0.5%

6.1.4 Assumptions

6.1.4.1 Quarry Pit Dimensions

The quarry pit wall extends from a crest elevation of RL 127 m AHD to a toe elevation of ~RL 110 m AHD, with a single pit wall batter of ~80°.

6.1.4.2 Sub-Soil Stratigraphy

The modelled sub-soil stratigraphy is as follows:

- 2 m thick in-situ overburden (RL 127 m AHD to RL 125 m AHD); overlying
- ~15 m thick Newer Volcanics basalt (RL125 m AHD to RL 110 m AHD); overlying
- Paleosols.

6.1.4.3 Slope Rehabilitation Extent

Quarry pit wall rehabilitation, involving placement of stockpiled overburden fill material to form a flatter slope batter, is proposed to encompass the entire pit wall from crest (RL 127 m AHD) to toe (~RL 110 m AHD).

6.1.4.4 Modelled Phreatic Surface

For long-term static operating and seismic conditions, a phreatic surface of RL 118.4 m AHD is adopted sunny-day conditions.

For transient storm condition, the phreatic surface within the overburden fill body is taken as RL 123.5 m AHD, whilst pond surface outside of the rehabilitated slope is at RL 118 m AHD. This is to conservatively simulate the “worst-case” drawdown effect based on the available groundwater monitoring well records as summarised in Section 5.3.

6.1.4.5 Seismic Condition

The 500-year AEP earthquake event is simulated with a k_h coefficient of 0.042 g (0.5 x PGA x factors accounting for site effect and topographical amplification).

6.1.5 Assessment Results and Recommendations

SLOPE/W output illustrating the critical slope failure mechanism (minimum FoS surface) based on the above batter requirement is presented in Figure 5 to Figure 7.

The SLOPE/W output indicates the stockpiled overburden fill, proposed to be used for shaping the quarry pit remedial slopes during closure, must be graded at a batter of no steeper than 1V:2.5H (21.8°) to comply with Vic ERR FoS_{slope} requirements as per Section 6.1.3).

It shall be noted that this batter gradient requirement is a lower angle than that specified within Xstract’s memo report dated 15th October 2021 titled “Slope Stability Assessment – Colac Quarry NDA” (1V:2H).

Figure 5: SLOPE/W output – Long-term static operating condition

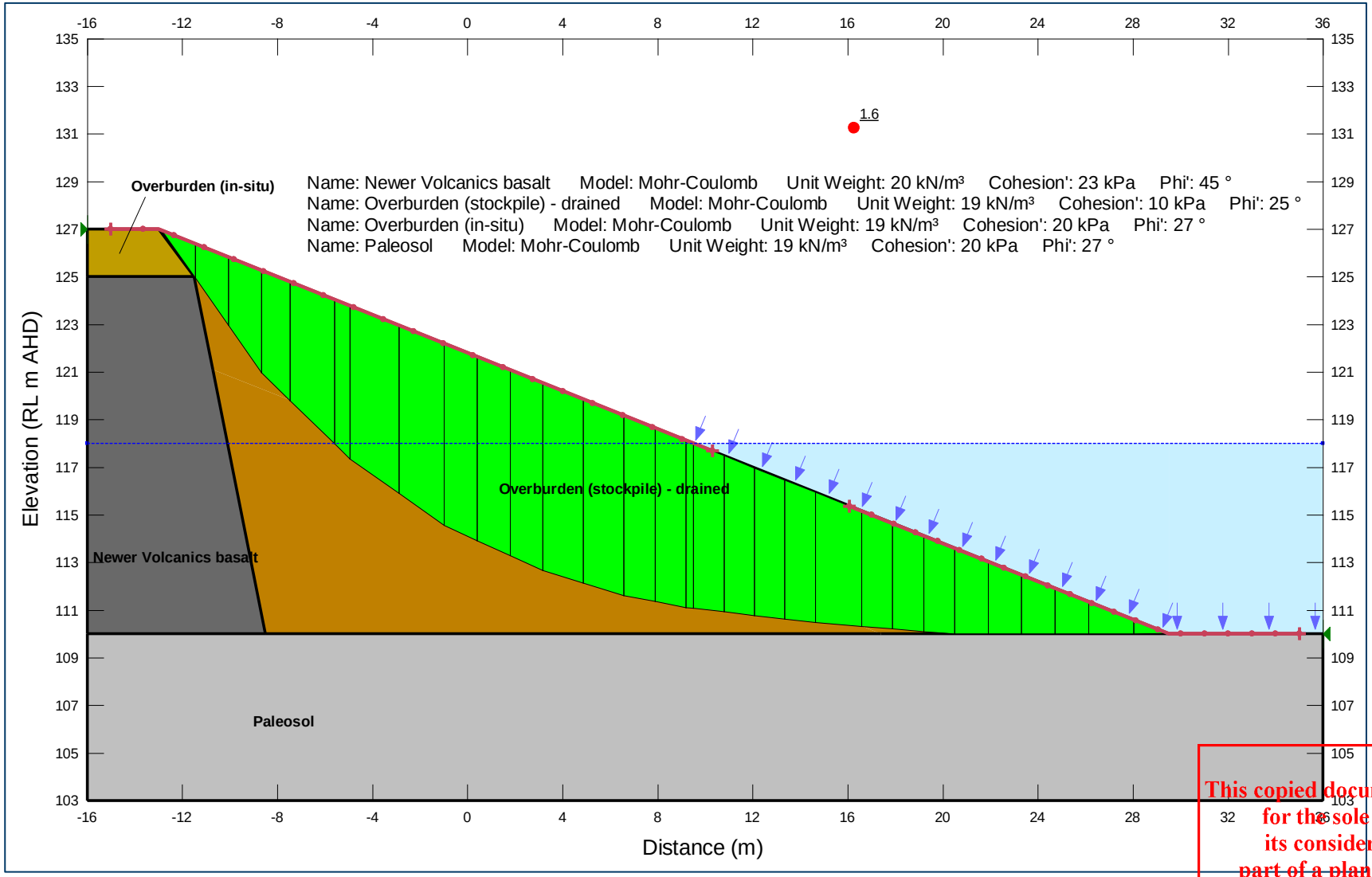


Figure 6: SLOPE/W output – Transient storm condition

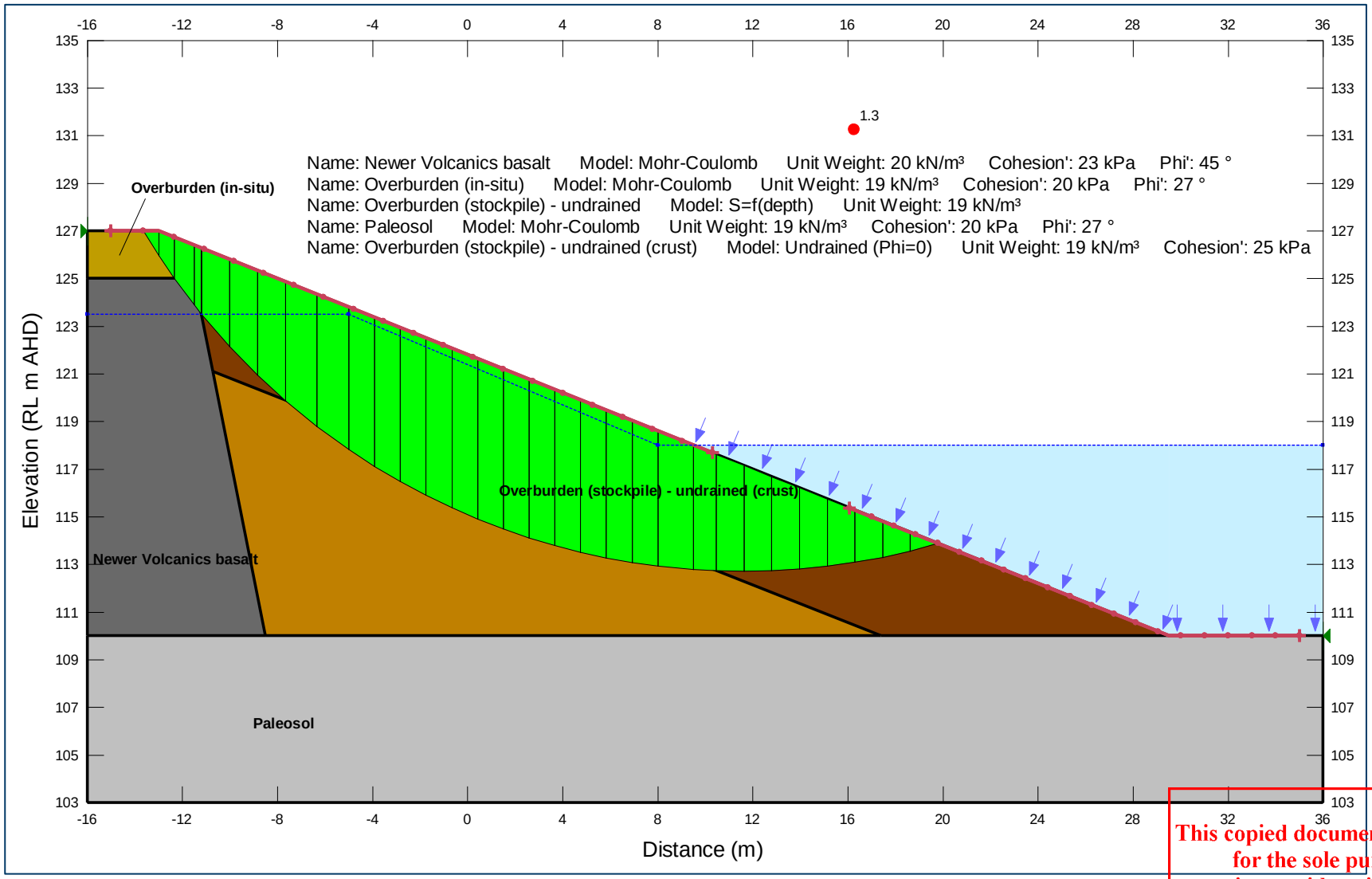
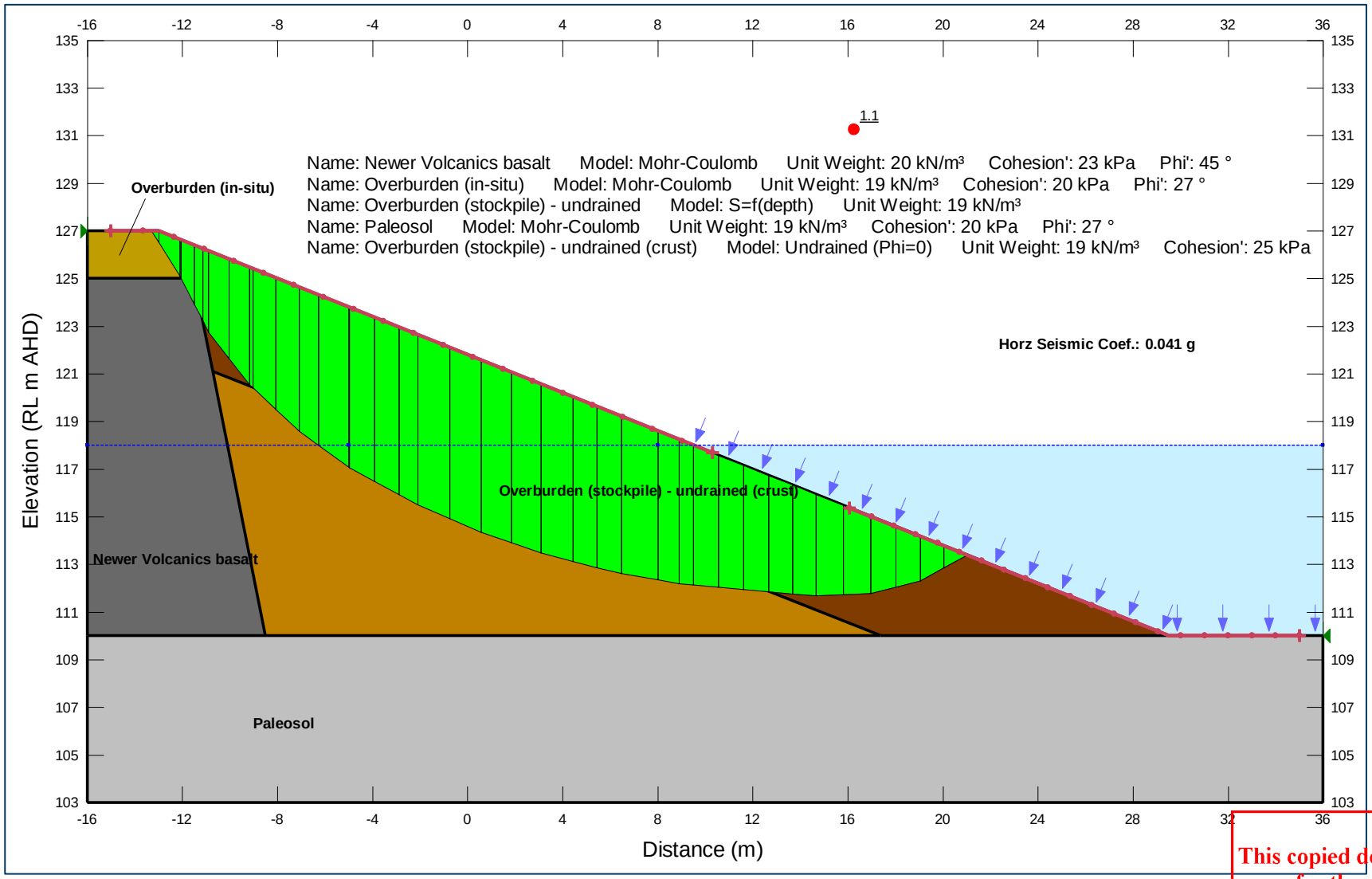


Figure 7: SLOPE/W output – Seismic condition



7. Erosion Management Control

7.1 General

As the stockpiled overburden fill, proposed for flattening the quarry pit walls as part of closure rehabilitation, has been identified to be difficult to compact, will be partly submerged when the quarry is allowed to pond, along with the dispersive nature of the overburden material, the following credible internal erosion modes have been identified in the event of runoff / groundwater flow from the quarry walls into the quarry basin:

- Surface erosion as rain runoff causes the fine-grained component of the overburden soil to disperse and wash-off into the pond, subsequently resulting in dislodgement of coarser-grained components that also gets washed off.
- Internal erosion within the poorly-compacted overburden fill body: Migration of the dispersive fine-grained soil component through voids within the sand / gravel matrix.
- Interface instability between the placed overburden and overlying crusher dust / gravel filter cover: Dispersive overburden soil particle are conveyed through voids of the crusher dust / gravel material.

Assessment of the above internal erosion risks have been undertaken with the following publicly available guidelines:

- US Bureau of Reclamation (July 2019) *Best Practice Training Manual*; and
- CIRIA C683 The Rock Manual: The use of rock in hydraulic engineering 2nd Edition.

7.2 Surface Erosion Risk

Based on review of photographs taken of the as-built rehabilitated quarry pit wall slopes within WA158, the slope is observed to be densely vegetated with grass with negligible to no signs of surface erosion (refer photographs in Appendix A of this report). The slopes within WA158 were constructed using the stockpiled overburden material, as is proposed for NDA quarry pit wall rehabilitation, which has similar material characteristics.

On the above basis, the overburden stripping process during NDA quarry development must stockpile the top 200 mm of stripped overburden spoils (including vegetation) separately from overburden excavated at greater depth. This stockpiled surficial overburden material is then utilised to form a minimum 0.2 m thick growth cover layer, and as a surface erosion mitigation cover, onto portions of the rehabilitated pit wall slope located above RL 119 m AHD (expected maximum future pond level based on groundwater monitoring records).

7.3 Internal Erosion Risk

The migration potential of the overburden soil component through the voids of the gravel matrix is a function of the soil particle size, soil submerged specific gravity, and seepage flow velocity through the overburden fill body. The migration potential of the fill soil particle has been evaluated utilising the Hjulström diagram (see Figure 8). This diagram defines the minimum velocity (erosion velocity curve) required to initiate soil particle erosion and movement, and the minimum velocity (settling velocity curve) required to maintain soil particle suspension in the liquid flow after erosion initiation, falling below which the soil particle will settle and no longer migrate.

Numerical two-dimensional Finite Element (2D FE) seepage analysis have been undertaken, utilising the commercial 2D FE seepage analysis software SEEP/W 2012, to estimate the velocity of seepage flow through the overburden fill materials used to construct the rehabilitated quarry slope. The following assumptions have been made for the analysis:

- Transient storm condition to model “worst-case” drawdown effect as detailed in Section 6.1.4.4.
- Hydraulic conductivity of placed overburden fill ranging between 1 x 10^{-6} m/s (Upper Bound) and 1 x 10^{-10} m/s (Lower Bound).

SEEP/W output is presented in Figure 9 and Figure 10.

The seepage analysis indicates a maximum seepage flow velocity of less than 1 x 10^{-6} m/s through the proposed overburden fill material forming the rehabilitated quarry slope.

In comparing the above parameters to the Hjulström diagram, the seepage flow is deemed to be sufficiently slow that erosion of the overburden fill soil particles cannot be initiated, and as such the risk of internal erosion within the overburden fill material is deemed to be negligible.

7.4 Interface Instability Risk

For overburden fill material placed above water, the risk of interface instability can be deemed to be negligible provided a minimum 0.2 m thick vegetation growth cover layer is placed onto the overburden fill batter (refer to Section 7.2).

For submerged overburden fill material, the risk of interface instability is deemed to be negligible subject to satisfying the following criterion:

$$d_{15o} / d_{85u} < 5$$

Where:

d_{15o} = particle size at which 15% of all filter soil content (placed over overburden fill surface) passes through.

d_{85u} = particle size at which 85% of all overburden soil content passes through.

A comparison of the crusher dust and 20 mm aggregate PSD curve against that of the stockpiled overburden material is presented as a graph in Figure 11.

It is anticipated that the layering of crusher dust over the proposed rehabilitated slope built from stockpiled overburden material, followed by a final 20 mm aggregate capping layer on top of the crusher dust layer, will satisfy the above criterion and mitigate the risk of submerged overburden soil particle dispersion / migration through the crusher dust and gravel layer.

7.5 Recommendations

Based on the above assessment findings, the following erosion management controls must be put in place to enable utilisation of the stockpiled overburden fill for closure rehabilitation:

1. The exhausted mine pit shall remain dry throughout the placement of the stockpiled overburden fill material;
2. Placement of stockpiled overburden fill material must be undertaken in a controlled manner with (a) loose lift thickness not exceeding 300 mm, compaction by loader / truck trafficking to achieve a minimum Dynamic Cone Penetrometer (DCP) blow-count of 4 blows / 100 mm penetration;
3. DCP testing shall be undertaken every 10 lifts at 10 m spacing along the lift to ensure the above DCP blow-count requirement is achieved;
4. The compacted overburden fill batter surface above RL 119 m AHD must be covered in a minimum 200 mm thick vegetation growth cover layer (topsoil), whereas batter surface below RL 119 m AHD must be covered by a crusher dust layer followed by a 20 mm aggregate capping layer; and
5. Perimeter drainage must be formed along the crest edge of the terminal batter to minimise / prevent run off water flowing onto the rehabilitated slope batter surface.

It shall be noted that the above erosion management control requirements agree with those specified in the following Xstract memorandum and reports:

- Slope Stability Assessment – Colac Quarry NDA (15 October 2021)
- Slope Stability Assessment - Colac Quarry Stage 5 and Stage 6 (2020)

It is noted that ERR approved the Stage 5 and 6 extension based on the erosion management control requirements outlined within the above slope stability assessment. This adopted shallow rehabilitation batter angles with overburden materials that exhibit similar material properties as the NDA.

This is likely to be conservative in view of negligible to no signs of erosion of as-built rehabilitated quarry pit wall slopes within WA158 and can potentially be waived subject to confirmation of the stability of the submerged WA158 rehabilitated slopes via side scan sonar survey and / or inspection by divers.

Figure 8: Hjulström diagram

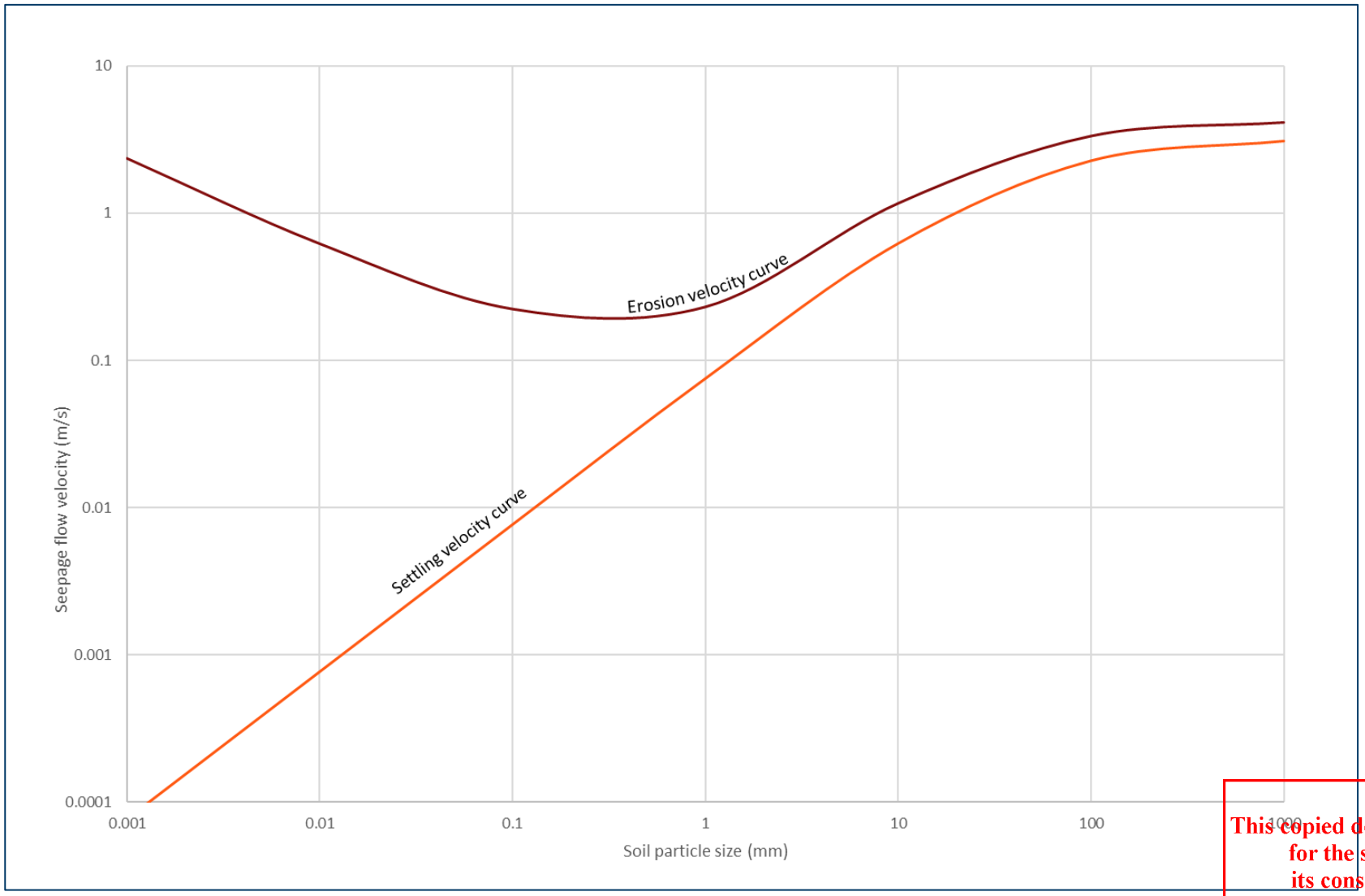


Figure 9: SEEP/W output – Upper Bound overburden fill hydraulic conductivity coefficient, k = 1 x 10^{-6} m/s

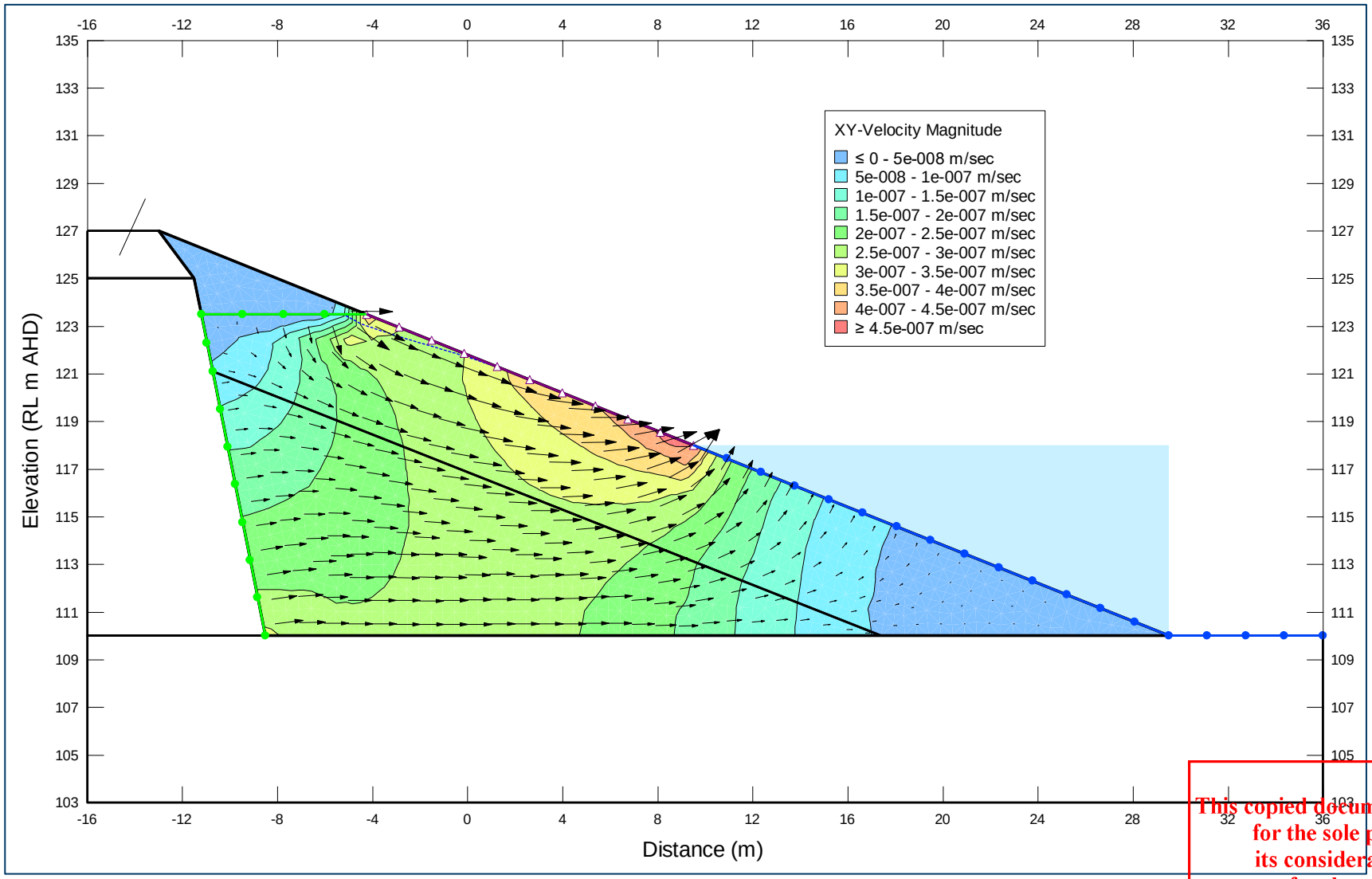


Figure 10: SEEP/W output – Lower Bound overburden fill hydraulic conductivity coefficient, k = 1 x 10^{-10} m/s

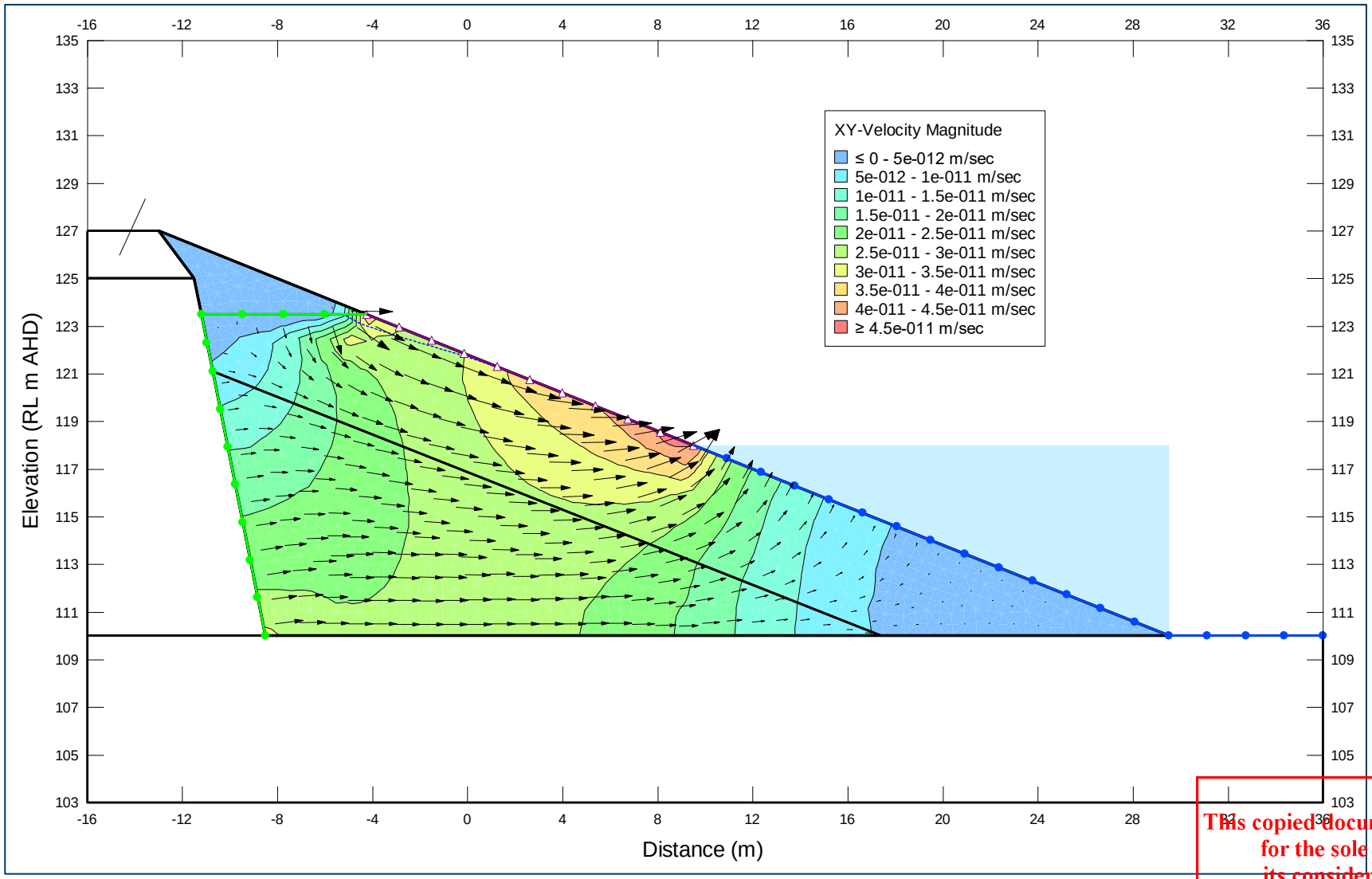
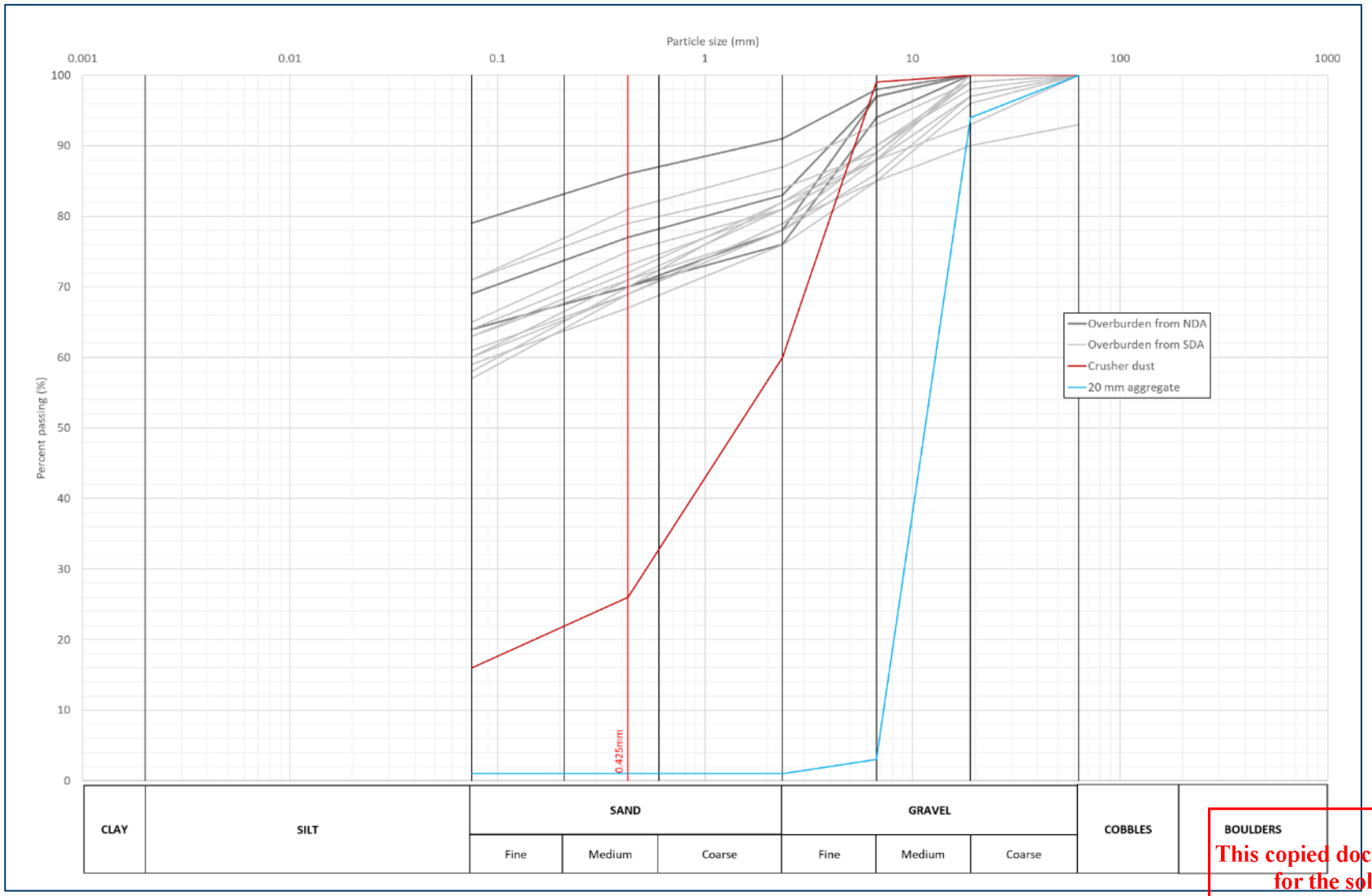


Figure 11: Comparison of particle size distribution (PSD) grading curves for tested overburden, crusher dust, and 20 mm rock aggregate samples

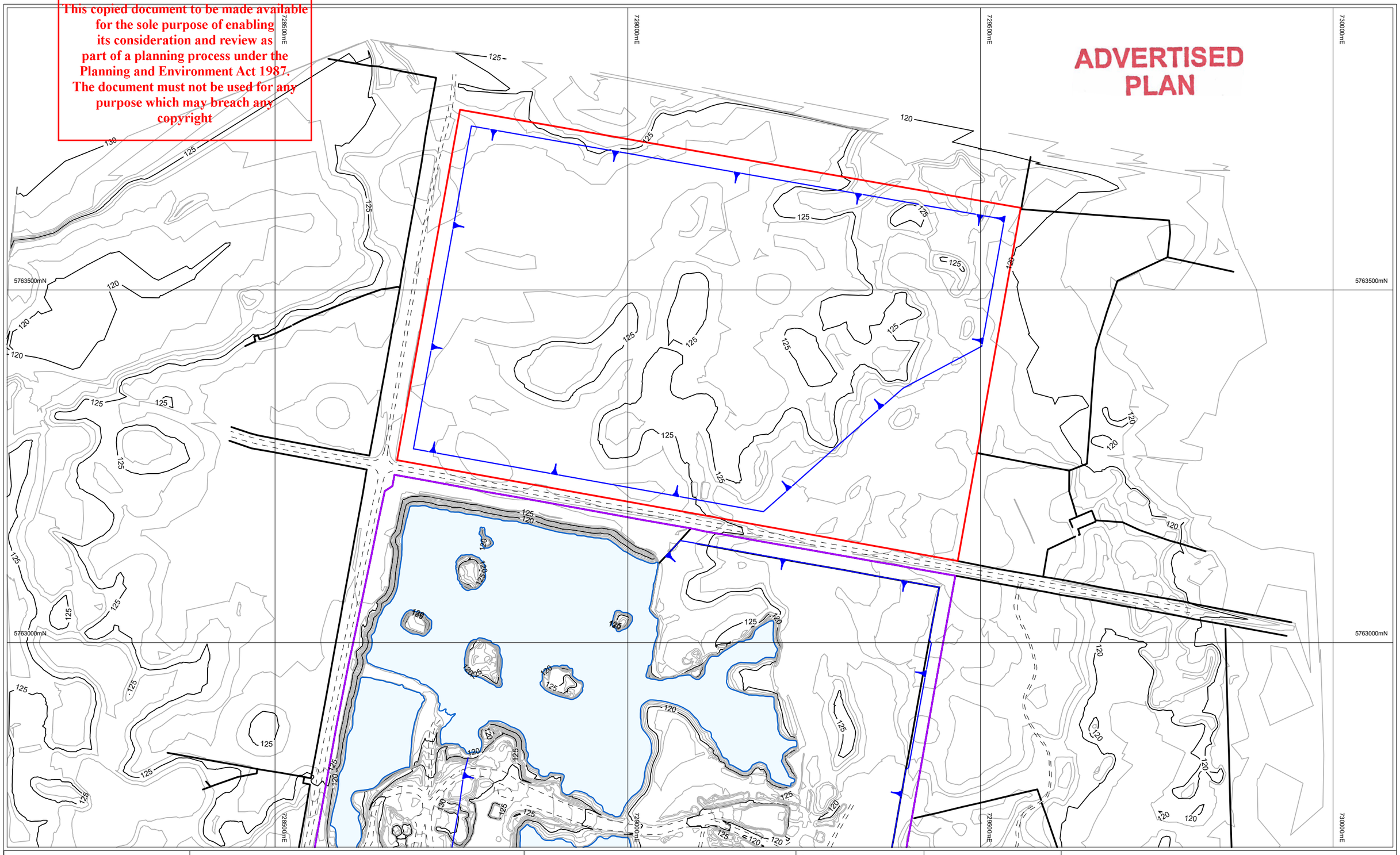


8. Conclusion

The placement of available stockpiled overburden material to rehabilitate the NDA quarry pit wall, by forming a flatter slope, must comply with the following requirements to satisfy Vic ERR concerns:

1. Placed overburden batter must not be steeper than 1V:2.5H;
2. For an overburden batter surface located above RL 119 m AHD, a minimum 200 mm thick vegetation growth media shall be placed and is to be sourced from the stripping of the top 200 mm in-situ overburden within the NDA footprint including vegetation; and,
3. For overburden batter surface located below RL 119 m AHD, a minimum 50 mm thick bedding layer composed of crusher dust must be placed over the overburden surface, overlain subsequently by a final 200 mm thick gravel capping layer composed of 20 mm aggregates. It shall be noted that this erosion management control requirement is likely to be conservative, in view of negligible to no signs of erosion of as-built rehabilitated quarry pit wall slopes within the WA158 and can potentially be waived subject to confirmation of the stability of the underwater WA158 rehabilitated slopes via side scan sonar survey and / or inspection by divers.

Appendix A NDA site layout and design quarry cross-section drawings



Australian Mine Design & Development Pty Ltd
Brisbane Office
4/46 Edward St, Brisbane
Tel. +61 7 3012 9256
www.amdad.com.au
Sydney
P.O.Box 381, Rozelle
NSW 2039
Tel. 0419 299 323

Australian Mine Design and Development Pty Ltd (AMDAD) uses its best endeavours to provide advice and designs which are practical, safe and environmentally sensitive, based on guidelines provided by experts in these areas. However, AMDAD are not experts in the areas of geotechnical engineering, safety and the environment. Prior to implementation of any of our advice or designs, we advise you to ensure that expert advice has been sought in these areas of geotechnical engineering, safety and the environment and that appropriate revisions to designs have been made to ensure the final designs as implemented do not pose a risk to the health and safety of any personnel, nor of impact on the environment.

This drawing, presenting a quarry plan based on design guidelines provided by Holcim or its third party specialist consultants, is approved for issue by AMDAD:-

Chris Desoe RPEQ No. 05769

Legend

- Roads or Tracks
- Northern Development Area Property Boundary (WA007635)
- Work Authority 158
- Limit of Extraction

Scale 1 @A3 : 5000

0 50 100 150 200 250

Coordinate System:
Horizontal: MGA Zone 54
Vertical Datum: AHD

N

Holcim

Colac Quarry

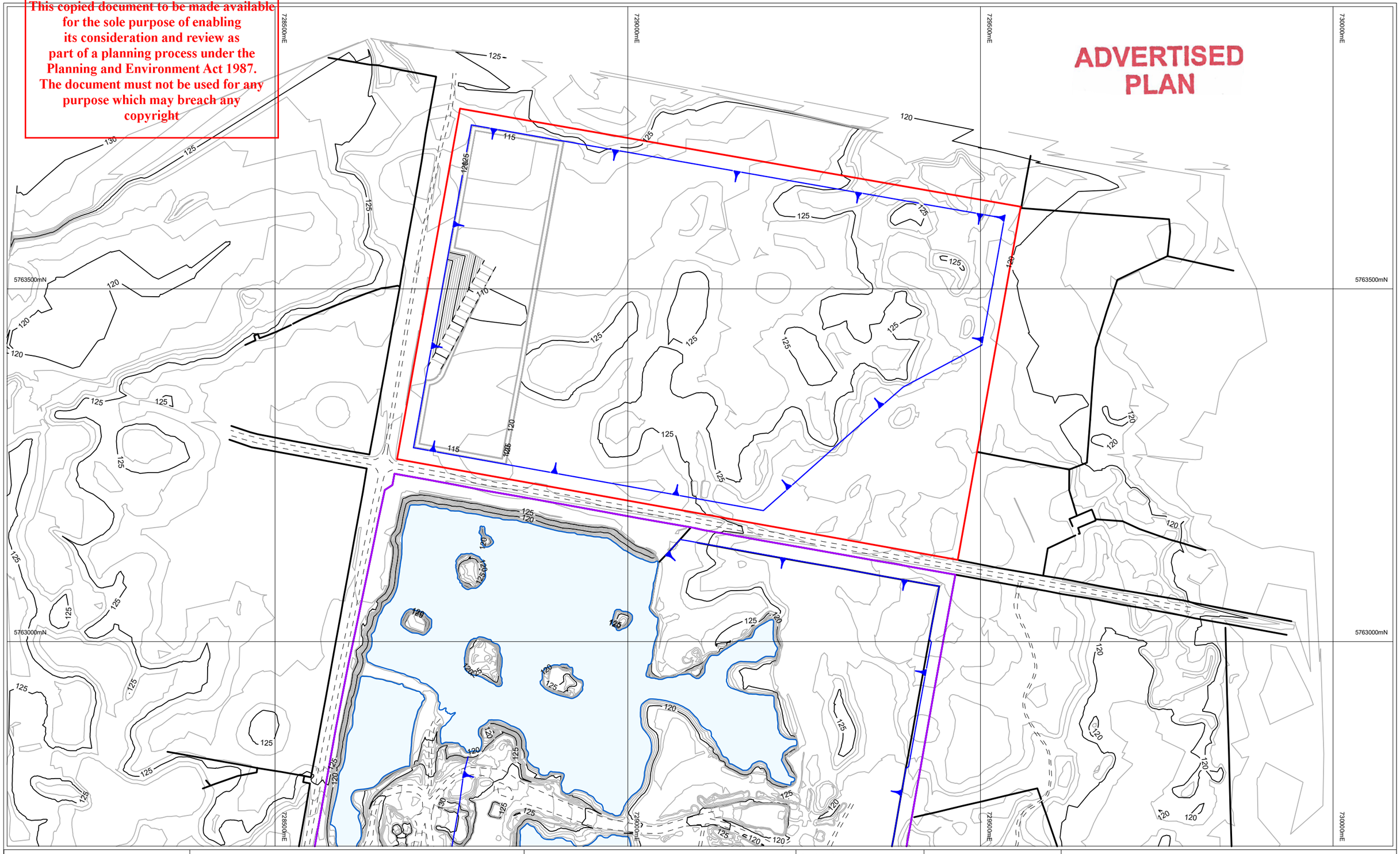
Northern Development Area
Current Topography
October 2018

Date: 20-Apr-23

Plan No. Rev05

1298

SURPAC - GEOVIA



Australian Mine Design & Development Pty Ltd
Brisbane Office
4/46 Edward St, Brisbane
Tel. +61 7 3012 9256
www.amdad.com.au
Sydney
P.O.Box 381, Rozelle
NSW 2039
Tel. 0419 299 323

Australian Mine Design and Development Pty Ltd (AMDAD) uses its best endeavours to provide advice and designs which are practical, safe and environmentally sensitive, based on guidelines provided by experts in these areas. However, AMDAD are not experts in the areas of geotechnical engineering, safety and the environment. Prior to implementation of any of our advice or designs, we advise you to ensure that expert advice has been sought in these areas of geotechnical engineering, safety and the environment and that appropriate revisions to designs have been made to ensure the final designs as implemented do not pose a risk to the health and safety of any personnel, nor of impact on the environment.

This drawing, presenting a quarry plan based on design guidelines provided by Holcim or its third party specialist consultants, is approved for issue by AMDAD:-

Chris Desoe RPEQ No. 05769

Legend

- Roads or Tracks
- Northern Development Area Property Boundary (WA007635)
- Work Authority 158
- Limit of Extraction

Scale 1 @A3 : 5000

0 50 100 150 200 250

Coordinate System:
Horizontal: MGA Zone 54
Vertical Datum: AHD

N

Holcim

Colac Quarry

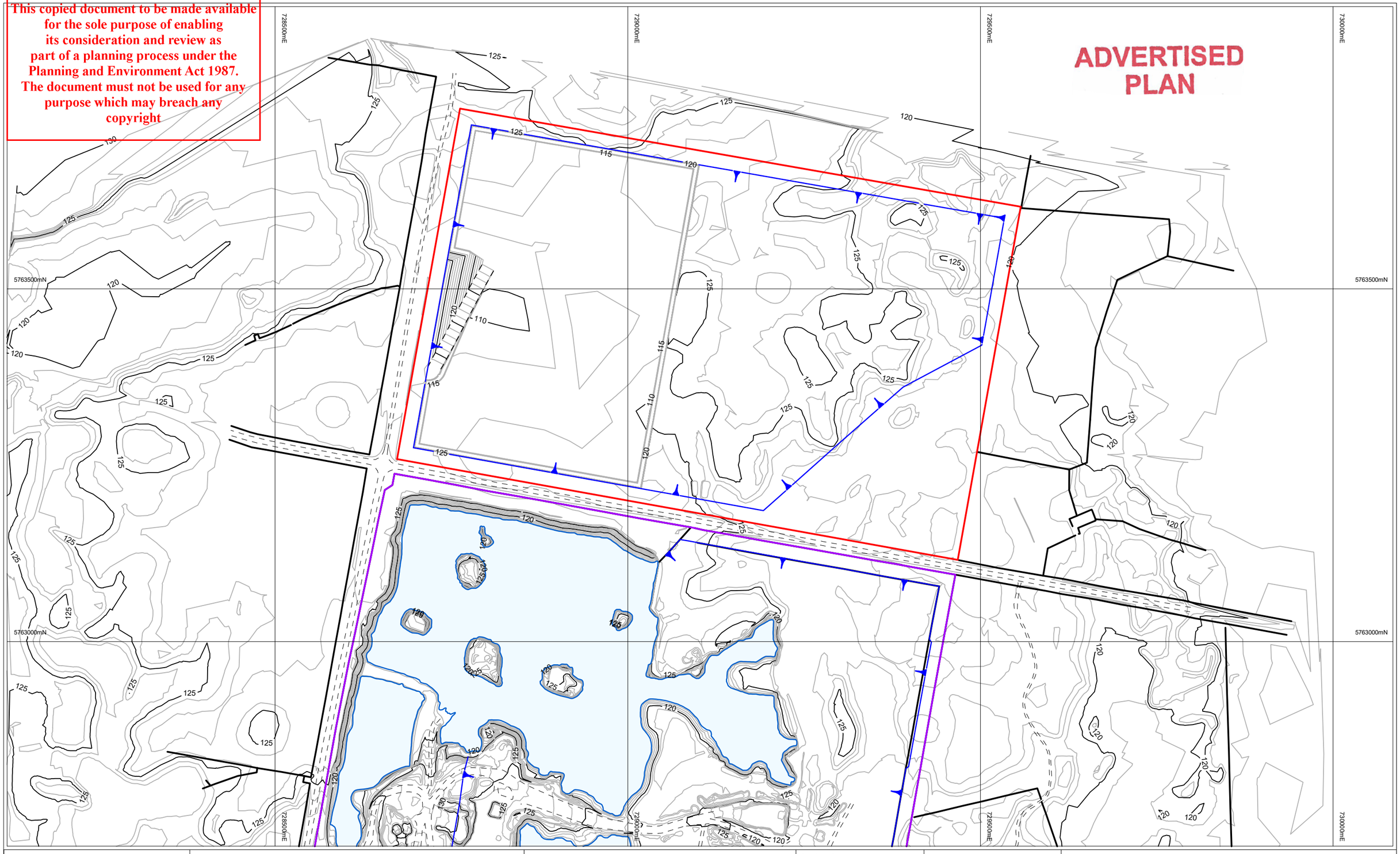
Northern Development Area
Stage 1 Development

Date: 20-Apr-23

Plan No. Rev05

1298

SURPAC - GEOVIA



Australian Mine Design & Development Pty Ltd
Brisbane Office
4/46 Edward St, Brisbane
Tel. +61 7 3012 9256
www.amdad.com.au
Sydney
P.O.Box 381, Rozelle
NSW 2039
Tel. 0419 299 323

Australian Mine Design and Development Pty Ltd (AMDAD) uses its best endeavours to provide advice and designs which are practical, safe and environmentally sensitive, based on guidelines provided by experts in these areas. However, AMDAD are not experts in the areas of geotechnical engineering, safety and the environment. Prior to implementation of any of our advice or designs, we advise you to ensure that expert advice has been sought in these areas of geotechnical engineering, safety and the environment and that appropriate revisions to designs have been made to ensure the final designs as implemented do not pose a risk to the health and safety of any personnel, nor of impact on the environment.

This drawing, presenting a quarry plan based on design guidelines provided by Holcim or its third party specialist consultants, is approved for issue by AMDAD:-

Chris Desoe RPEQ No. 05769

Legend

- Roads or Tracks
- Northern Development Area Property Boundary (WA007635)
- Work Authority 158
- Limit of Extraction

Scale 1 @A3 : 5000

0 50 100 150 200 250

Coordinate System:
Horizontal: MGA Zone 54
Vertical Datum: AHD

N

Holcim

Colac Quarry

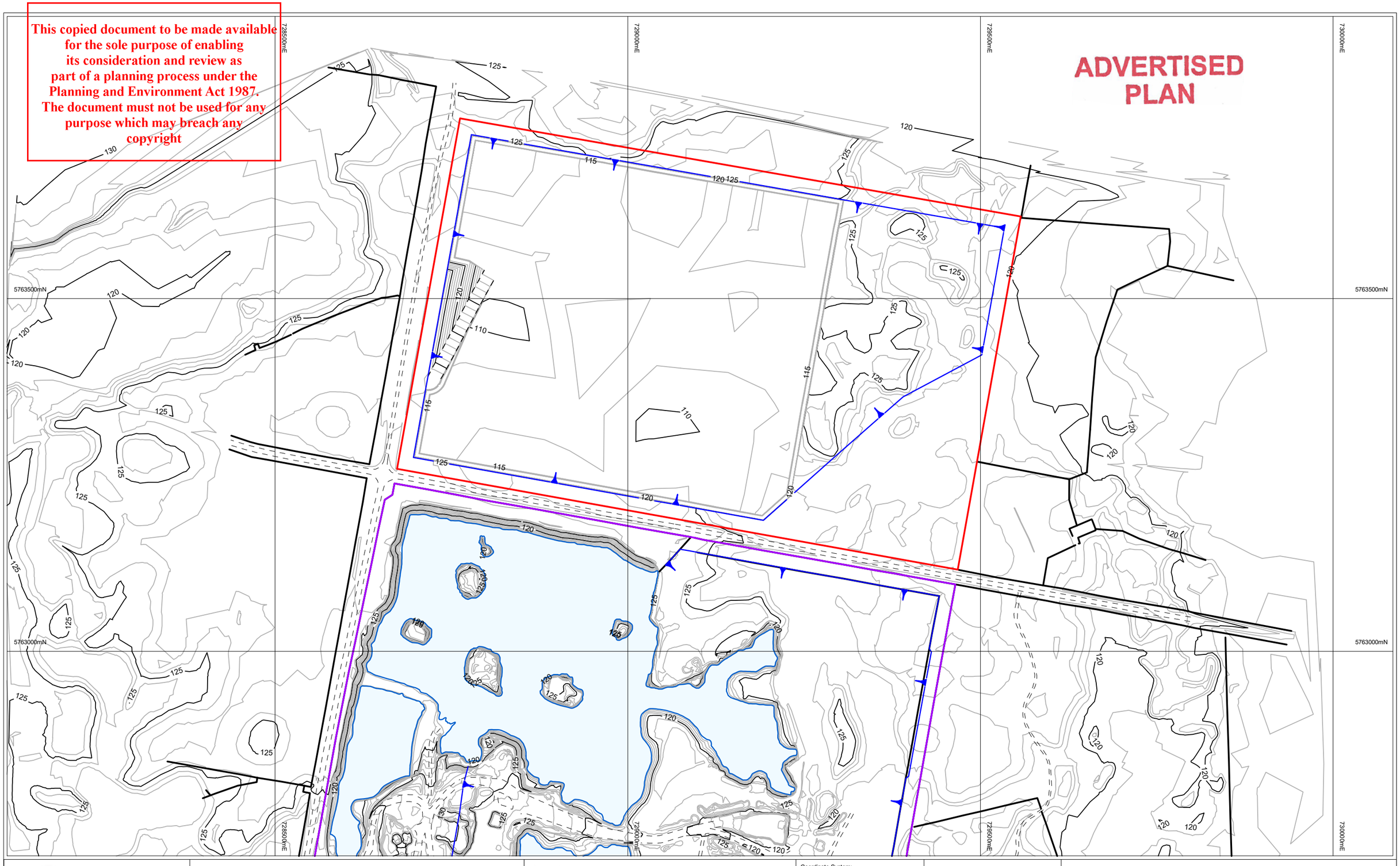
Northern Development Area
Stage 2 Development

Date: 20-Apr-23

Plan No. Rev05

1298

SURPAC - GEOVIA



Australian Mine Design & Development Pty Ltd
Brisbane Office
4/46 Edward St, Brisbane
Tel. +61 7 3012 9256
www.amdad.com.au
Sydney
P.O.Box 381, Rozelle
NSW 2039
Tel. 0419 299 323

Australian Mine Design and Development Pty Ltd (AMDAD) uses its best endeavours to provide advice and designs which are practical, safe and environmentally sensitive, based on guidelines provided by experts in these areas. However, AMDAD are not experts in the areas of geotechnical engineering, safety and the environment. Prior to implementation of any of our advice or designs, we advise you to ensure that expert advice has been sought in these areas of geotechnical engineering, safety and the environment and that appropriate revisions to designs have been made to ensure the final designs as implemented do not pose a risk to the health and safety of any personnel, nor of impact on the environment.

This drawing, presenting a quarry plan based on design guidelines provided by Holcim or its third party specialist consultants, is approved for issue by AMDAD:-

Chris Desoe RPEQ No. 05769

Legend

- Roads or Tracks
- Northern Development Area Property Boundary (WA007635)
- Work Authority 158
- Limit of Extraction

Scale 1 @A3 : 5000

0 50 100 150 200 250

Coordinate System:
Horizontal: MGA Zone 54
Vertical Datum: AHD

N

Holcim

Colac Quarry

Northern Development Area
Stage 3 Development

Date: 20-Apr-23

Plan No. Rev05

1298

SURPAC - GEOVIA

728500mE
729000mE
729500mE
730000mE
5763500mN
5763000mN

Australian Mine Design & Development Pty Ltd
Brisbane Office
4/46 Edward St, Brisbane
Tel. +61 7 3012 9256
www.amdad.com.au
Sydney
P.O.Box 381, Rozelle
NSW 2039
Tel. 0419 299 323

Australian Mine Design and Development Pty Ltd (AMDAD) uses its best endeavours to provide advice and designs which are practical, safe and environmentally sensitive, based on guidelines provided by experts in these areas. However, AMDAD are not experts in the areas of geotechnical engineering, safety and the environment. Prior to implementation of any of our advice or designs, we advise you to ensure that expert advice has been sought in these areas of geotechnical engineering, safety and the environment and that appropriate revisions to designs have been made to ensure the final designs as implemented do not pose a risk to the health and safety of any personnel, nor of impact on the environment.

This drawing, presenting a quarry plan based on design guidelines provided by Holcim or its third party specialist consultants, is approved for issue by AMDAD:-

Chris Desoe RPEQ No. 05769

Legend

- Roads or Tracks
- Northern Development Area Property Boundary (WA007635)
- Work Authority 158
- Limit of Extraction

Scale 1 @A3 : 5000

0 50 100 150 200 250

Coordinate System:
Horizontal: MGA Zone 54
Vertical Datum: AHD

N

Holcim

Colac Quarry

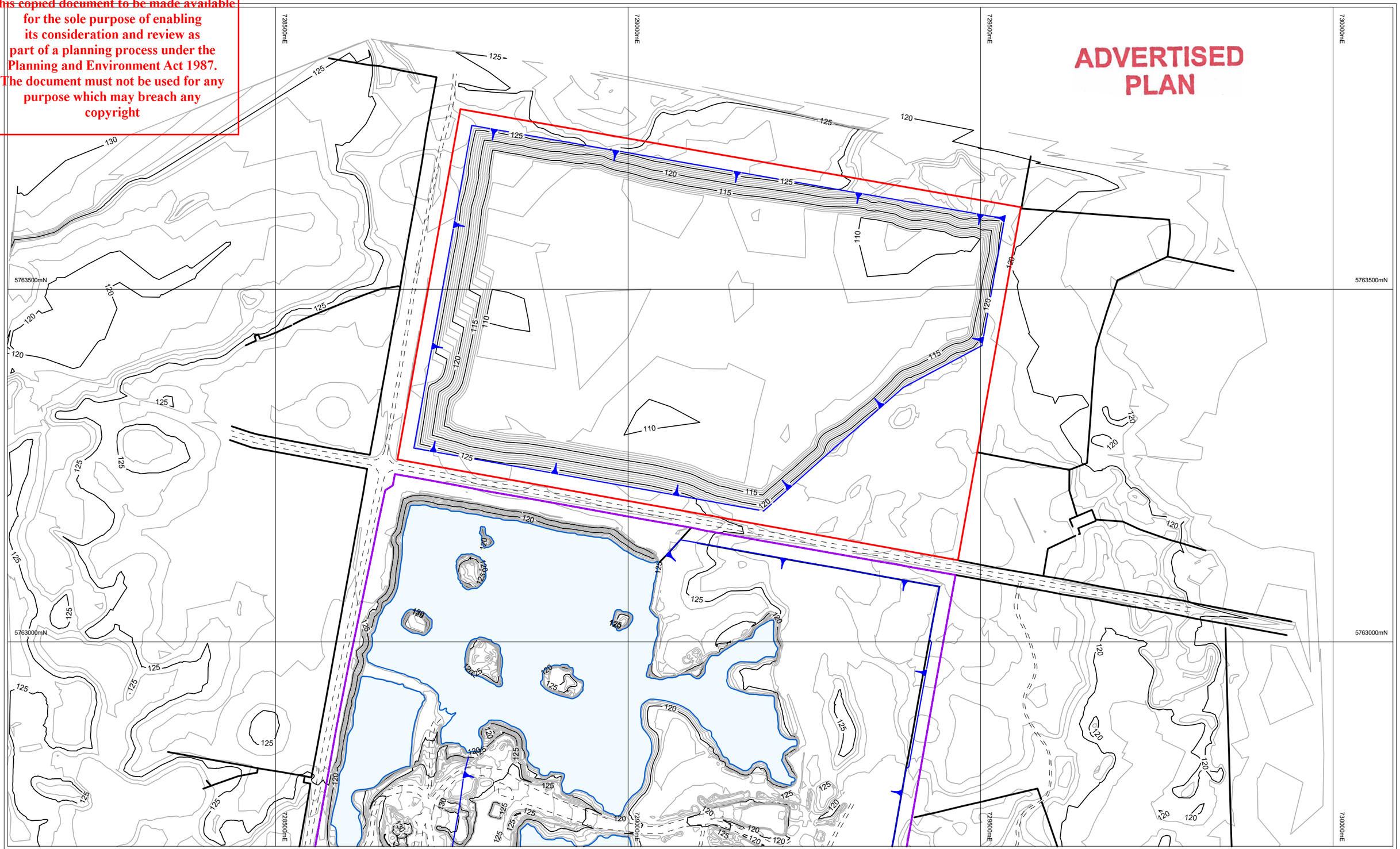
Northern Development Area
Final Pit Extraction

Date: 20-Apr-23

Plan No. Rev05

1298

SURPAC - GEOVIA



Australian Mine Design & Development Pty Ltd
Brisbane Office
4/46 Edward St, Brisbane
Tel. +61 7 3012 9256
www.amdad.com.au
Sydney
P.O.Box 381, Rozelle
NSW 2039
Tel. 0419 299 323

This drawing, presenting a quarry plan based on design guidelines provided by Holcim or its third party specialist consultants, is approved for issue by AMDAD:-

Chris Desoe RPEQ No. 05769

Legend

- Roads or Tracks
- Northern Development Area Property Boundary (WA007635)
- Work Authority 158
- Limit of Extraction

Scale 1 @A3 : 5000

0 50 100 150 200 250

Coordinate System:
Horizontal: MGA Zone 54
Vertical Datum: AHD

N

Colac Quarry

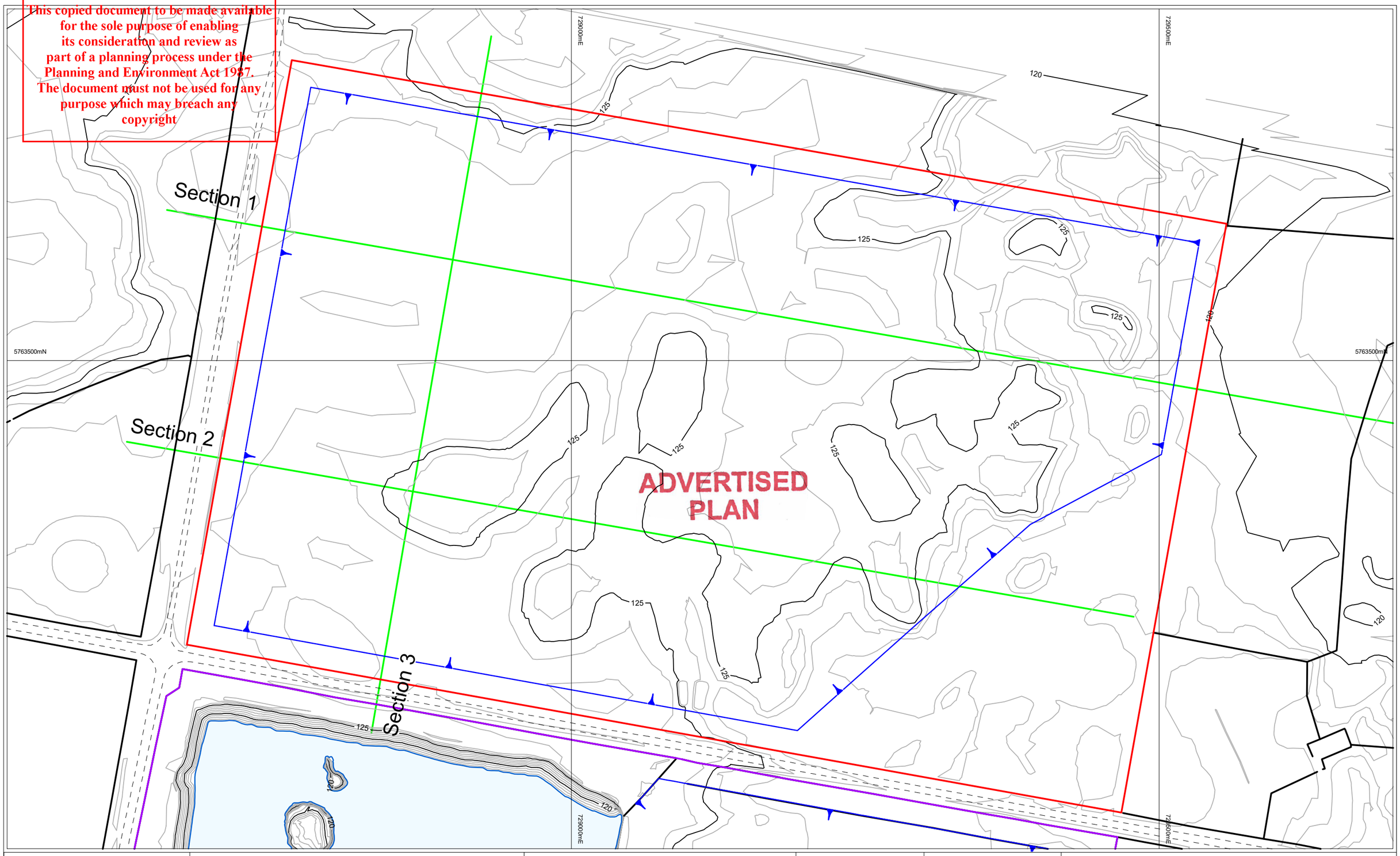
Northern Development Area
Final Pit Rehabilitation

Date: 20-Apr-23

Plan No. Rev05

1298

SURPAC - GEOVIA



Australian Mine Design & Development Pty Ltd
Brisbane Office
4/46 Edward St, Brisbane
Tel. +61 7 3012 9256
www.amdad.com.au
Sydney
P.O.Box 381, Rozelle
NSW 2039
Tel. 0419 299 323

Australian Mine Design and Development Pty Ltd (AMDAD) uses its best endeavours to provide advice and designs which are practical, safe and environmentally sensitive, based on guidelines provided by experts in these areas. However, AMDAD are not experts in the areas of geotechnical engineering, safety and the environment. Prior to implementation of any of our advice or designs, we advise you to ensure that expert advice has been sought in these areas of geotechnical engineering, safety and the environment and that appropriate revisions to designs have been made to ensure the final designs as implemented do not pose a risk to the health and safety of any personnel, nor of impact on the environment.

This drawing, presenting a quarry plan based on design guidelines provided by Holcim or its third party specialist consultants, is approved for issue by AMDAD:-

Chris Desoe RPEQ No. 05769

Legend

- Roads or Tracks
- Northern Development Area Property Boundary (WA007635)
- Work Authority 158
- Limit of Extraction
- Section Line

Scale 1 @A3 : 3000

0 30 60 90 120 150

Coordinate System:
Horizontal: MGA
Vertical Datum: AHD

N

Colac Quarry

Northern Development Area
Current Topography
Showing Section Lines

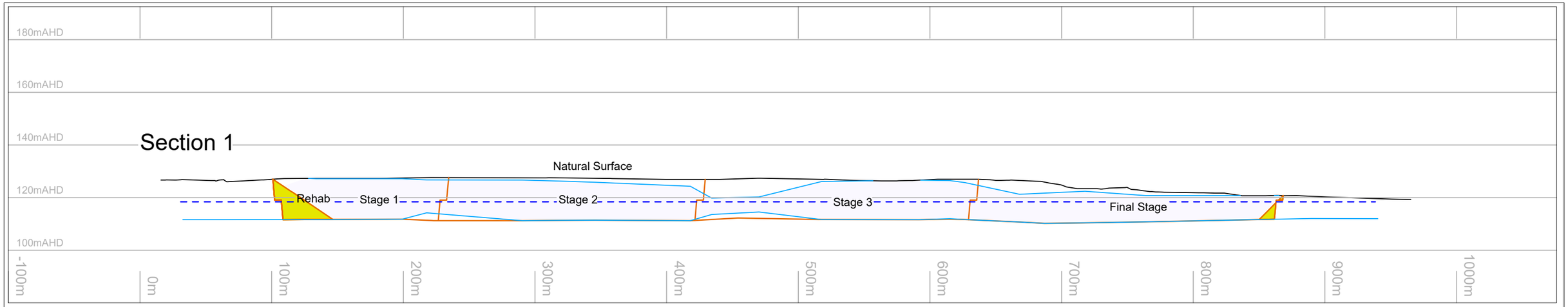
Date: 20-Apr-23

Plan No. Rev06

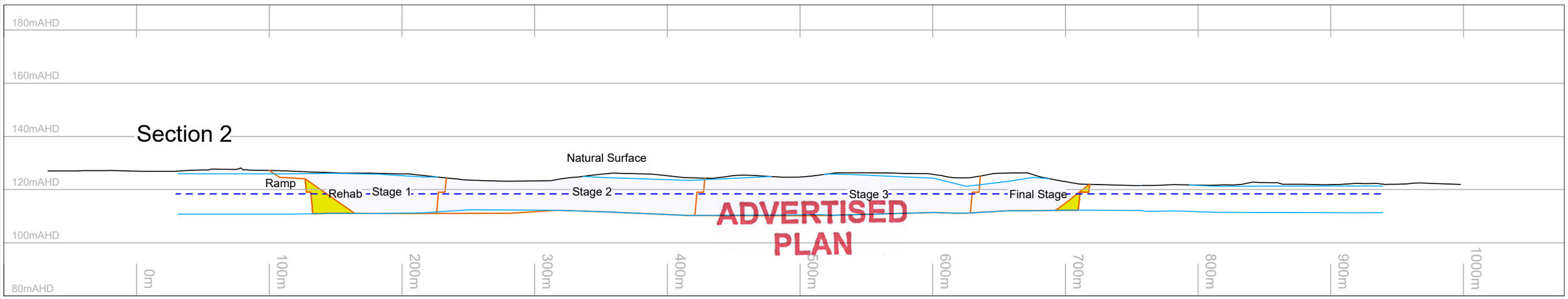
1298

SURPAC - GEOVIA

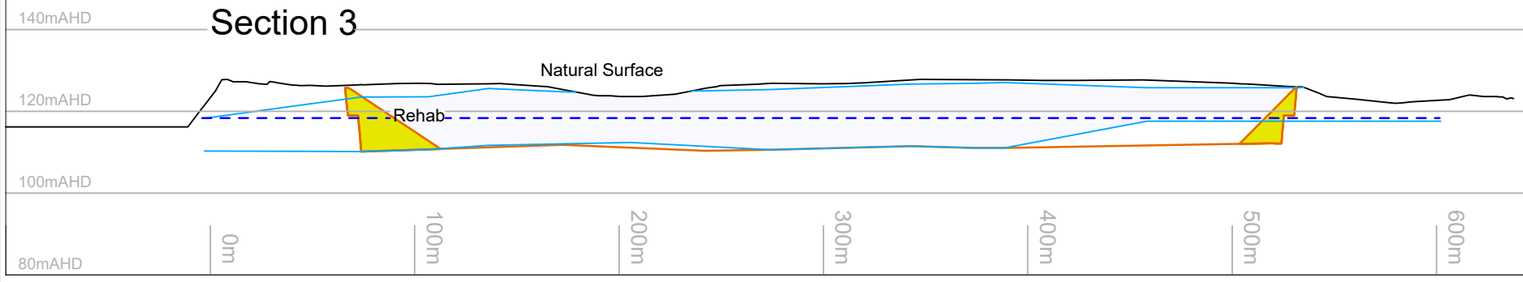
Section 1



Section 2



Section 3



Australian Mine Design & Development Pty Ltd
Brisbane Office
4/46 Edward St, Brisbane
Tel. +61 7 3012 9256
www.amdad.com.au
Sydney
P.O.Box 381, Rozelle
NSW 2039
Tel. 0419 299 323

This drawing, presenting a quarry plan based on design guidelines provided by Holcim or its third party specialist consultants, is approved for issue by AMDAD:-

Chris Desoe RPEQ No. 05769

Legend

- Inferred steady state water level post rehabilitation
- Fresh Basalt

V.E. = 2:1
H Scale (A3) 1 : 3000

0 30 60 90 120 150

Coordinate System:
Horizontal: MGA Zone 54
Vertical Datum: AHD

Colac Quarry

Northern Development Area
Sections

Date: 02-Jun-23

Plan No. Rev06

zzzz

SURPAC - GEOVIA

5 763 500 N
5 763 250 N
5 763 000 N
5 762 750 N
5 762 500 N
5 762 250 N
5 762 000 N
5 761 750 N
5 761 500 N
5 761 250 N
728 250 E
728 500 E
728 750 E
729 000 E
729 250 E
729 500 E
729 750 E

LEGEND

- APPROVED WA 158 BOUNDARY
- APPROVED MAX DISTURBANCE AREA
- NO GO ZONE
- CADASTRAL BOUNDARY (2010)
- APPROVED LIMIT OF EXTRACTION

NOTE:
LEVELS ARE TO AHD (AUSTRALIAN HEIGHT DATUM)
CO-ORDINATES ARE TO MGA (MAP GRID OF AUSTRALIA)

PLAN

COLAC
APRIL 2021

50 0 50 100
LENGTHS ARE IN METRES

SCALE 1:2500

JOB NUMBER:	2230409		
METHOD OF SURVEY:	PHOTOGRAMMETRIC 3D MAPPING		
DATE OF IMAGERY:	29/04/2021		
ACCURACY:	+/- 0.2m		
PLAN DATE:	18/04/2023	REVISION:	A
SHEET:	SHEET 1 OF 1	SIZE:	A0

MGA 94
ZONE 54

Landair surveys
1/87-91 Heatherdale Rd
Ringwood 3134
info@landair.com.au
www.landair.com.au
1300 130 158
(03) 9872 5092

REF: M:\DGN\HOLCIM\COLAC\2230409\Drawing\2230409-PLAN-Colac (290421)-A.dwg

Appendix B Laboratory test data for stockpiled overburden material and Insitu DCP Results

Construction Sciences

Construction Sciences Pty Ltd
ABN: 72 128 806 735

Address:
75 Potters Road,
Ondit VIC 3249

Laboratory: Colac Laboratory

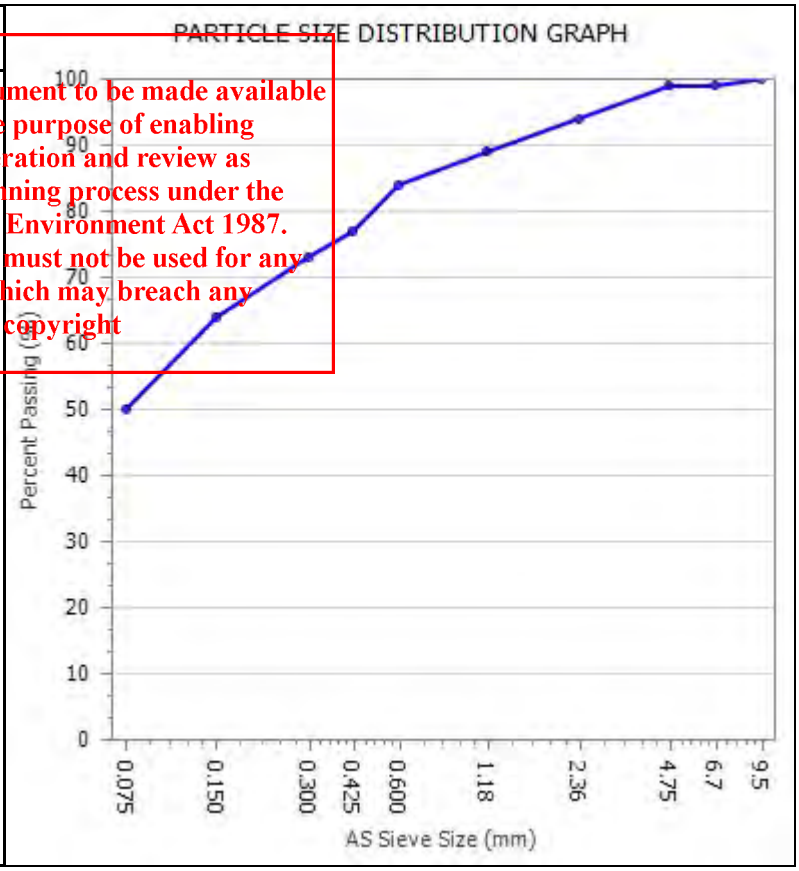
Holcim
Subcontracting Cardno testing services.
Concrete enquiries phone 131 188
Aggregate enquiries phone 1300 555 277

PARTICLE SIZE DISTRIBUTION REPORT

Client:	Holcim Australia Pty Ltd	Report Number:	03145/R/6841-1
Client Address:	PO Box 1513, Milton	Project Number:	03145/P/1
Project:	Quality Control Testing - Colac	Lot Number:	
Location:	Holcim Colac Quarry (5370)	Internal Test Request:	03145/T/2719
Supplied To:	Holcim Colac Quarry	Client Reference/s:	FL6.1.019.V
Area Description:		Report Date / Page:	29/06/2020 Page 1 of 1

Test Procedures:	AS1141.11.1		
Sample Number	03145/S/5934	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Colac Sample No	S/5934
Date Sampled	17/06/2020 15:00	Location	Stockpile
Sampled By	Joseph Hards	Sampled From	Production
Date Tested	24/06/2020	Material Code	VCOLOB
Laboratory Prepared	Washed		
Material Source	Holcim Colac Quarry	Material Type	Colac Overburden (VCOLOB)

AS Sieve (mm)	Specification Minimum (%)	Percent Passing (%)	Specification Maximum (%)
9.5		100	
6.7		99	
4.75		99	
2.36		94	
1.18		89	
0.600		84	
0.425		77	
0.300		73	
0.150		64	
0.075		50	



Remarks	Supplement to Simplified Report Number 200629JH1249

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation Number: 1986
Corporate Site Number: 03145

Approved Signatory: Joseph Hards
Form ID: W9Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

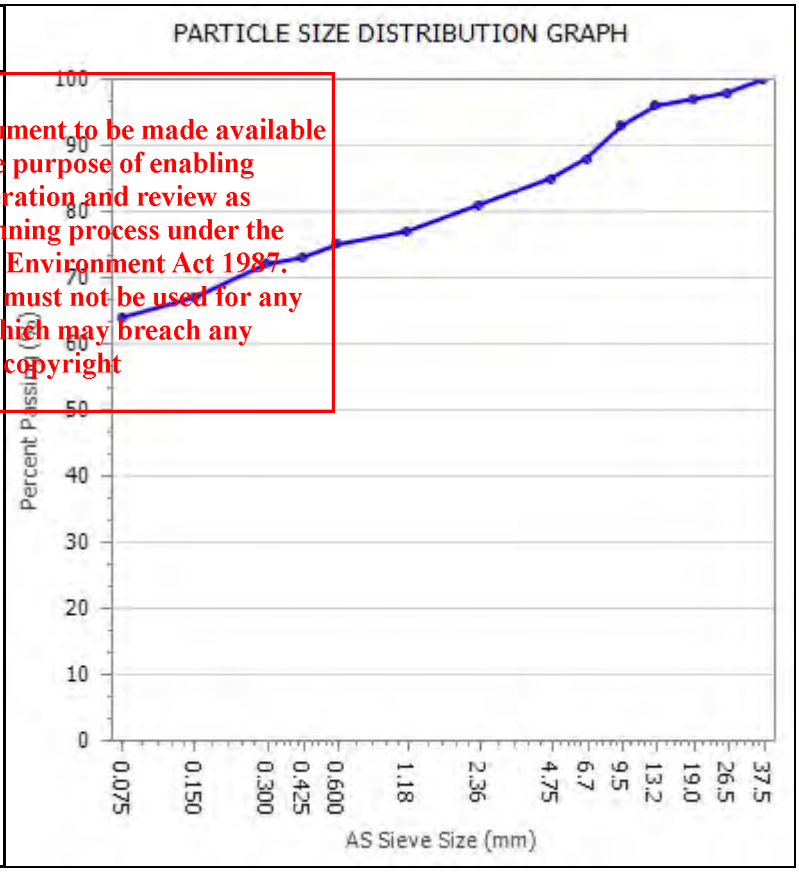
Laboratory: Ararat Laboratory

PARTICLE SIZE DISTRIBUTION REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14136-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 1 of 10

Test Procedures:	AS1289.3.6.1		
Sample Number	13739/S/32608	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7293
Date Sampled	29/10/2020 14:00	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	11/11/2020	Client ID	VCOLOB
Material Source	Holcim Colac Quarry	Material Type	Colac Overburden (VCOLOB)

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
37.5		**100**	
26.5		**98**	
19.0		**97**	
13.2		**96**	
9.5		**93**	
6.7		**88**	
4.75		**85**	
2.36		**81**	
1.18		**77**	
0.600		**75**	
0.425		**73**	
0.300		**72**	
0.150		**67**	
0.075		**64**	



Remarks	Supplement to Simplified Report Number 201112AS1110

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W9Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

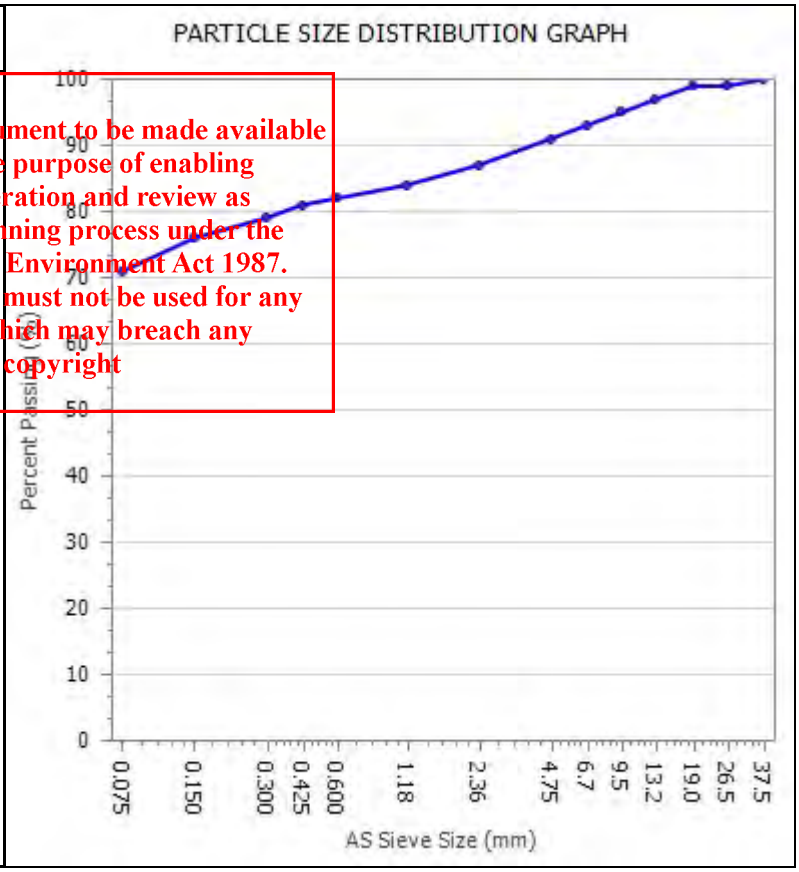
Laboratory: Ararat Laboratory

PARTICLE SIZE DISTRIBUTION REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14136-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 2 of 10

Test Procedures:	AS1289.3.6.1		
Sample Number	13739/S/32609	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7294
Date Sampled	29/10/2020 14:00	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	11/11/2020	Client ID	VCOLOB
Material Source	Holcim Colac Quarry	Material Type	Colac Overburden (VCOLOB)

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
37.5		**100**	
26.5		**99**	
19.0		**99**	
13.2		**97**	
9.5		**95**	
6.7		**93**	
4.75		**91**	
2.36		**87**	
1.18		**84**	
0.600		**82**	
0.425		**81**	
0.300		**79**	
0.150		**76**	
0.075		**71**	



Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W9Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

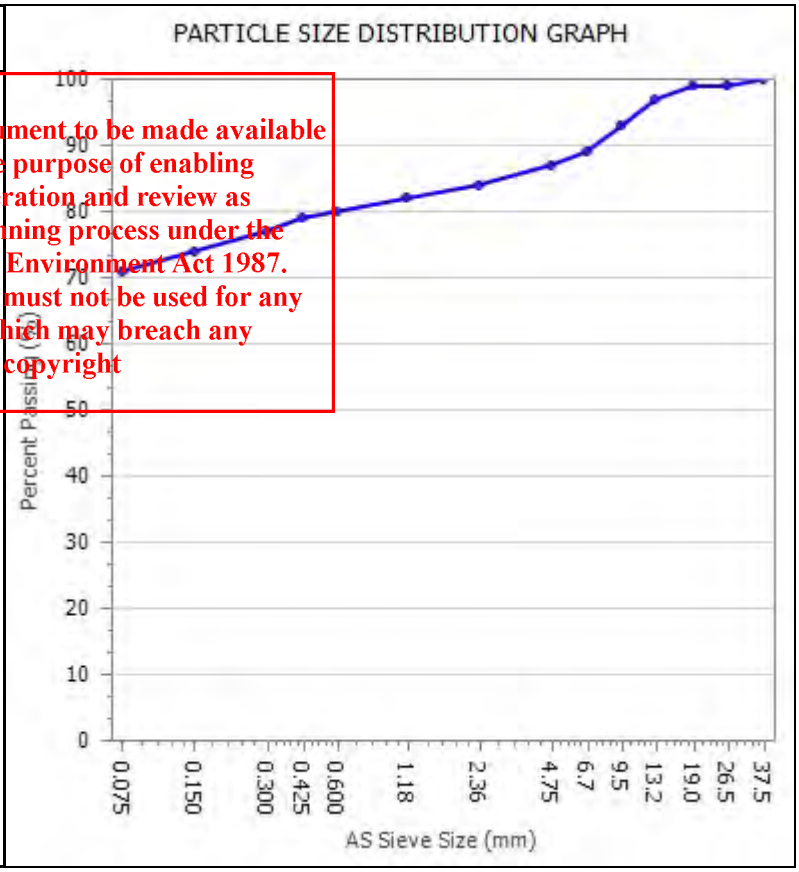
PARTICLE SIZE DISTRIBUTION REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14136-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 3 of 10

Test Procedures:	AS1289.3.6.1

Sample Number	13739/S/32610	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7295
Date Sampled	29/10/2020 14:00	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	11/11/2020	Client ID	VCOLOB
Material Source	Holcim Colac Quarry	Material Type	Colac Overburden (VCOLOB)

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
37.5		**100**	
26.5		**99**	
19.0		**99**	
13.2		**97**	
9.5		**93**	
6.7		**89**	
4.75		**87**	
2.36		**84**	
1.18		**82**	
0.600		**80**	
0.425		**79**	
0.300		**77**	
0.150		**74**	
0.075		**71**	



Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W9Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

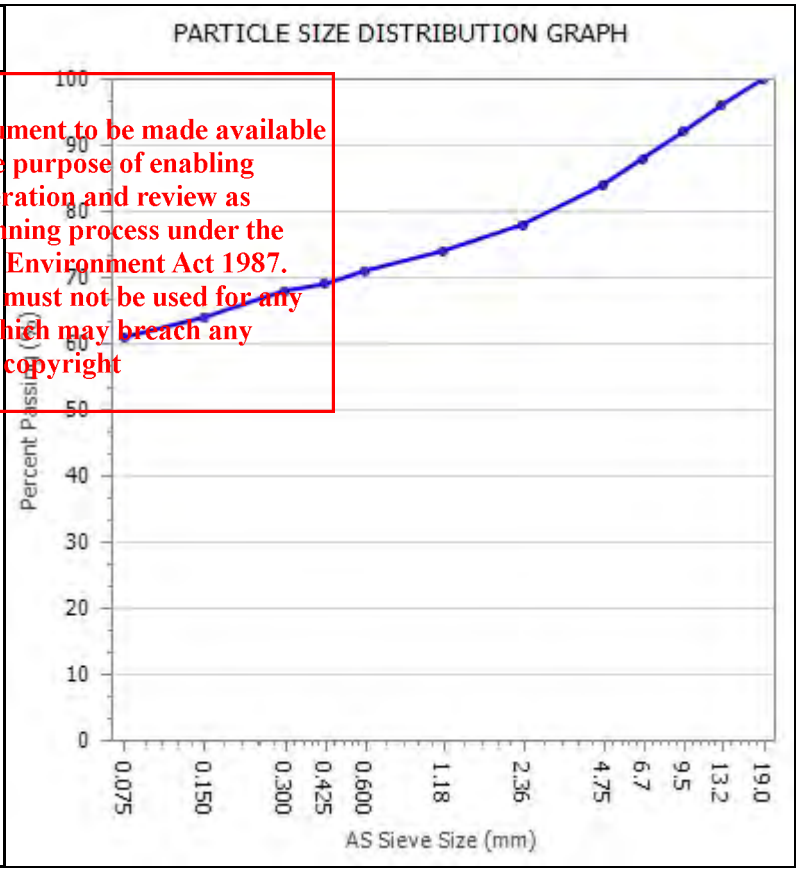
PARTICLE SIZE DISTRIBUTION REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14136-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 4 of 10

Test Procedures:	AS1289.3.6.1

Sample Number	13739/S/32611	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7296
Date Sampled	29/10/2020 14:00	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	11/11/2020	Client ID	VCOLOB
Material Source	Holcim Colac Quarry	Material Type	Colac Overburden (VCOLOB)

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
19.0		**100**	
13.2		**96**	
9.5		**92**	
6.7		**88**	
4.75		**84**	
2.36		**78**	
1.18		**74**	
0.600		**71**	
0.425		**69**	
0.300		**68**	
0.150		**64**	
0.075		**61**	



Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W9Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

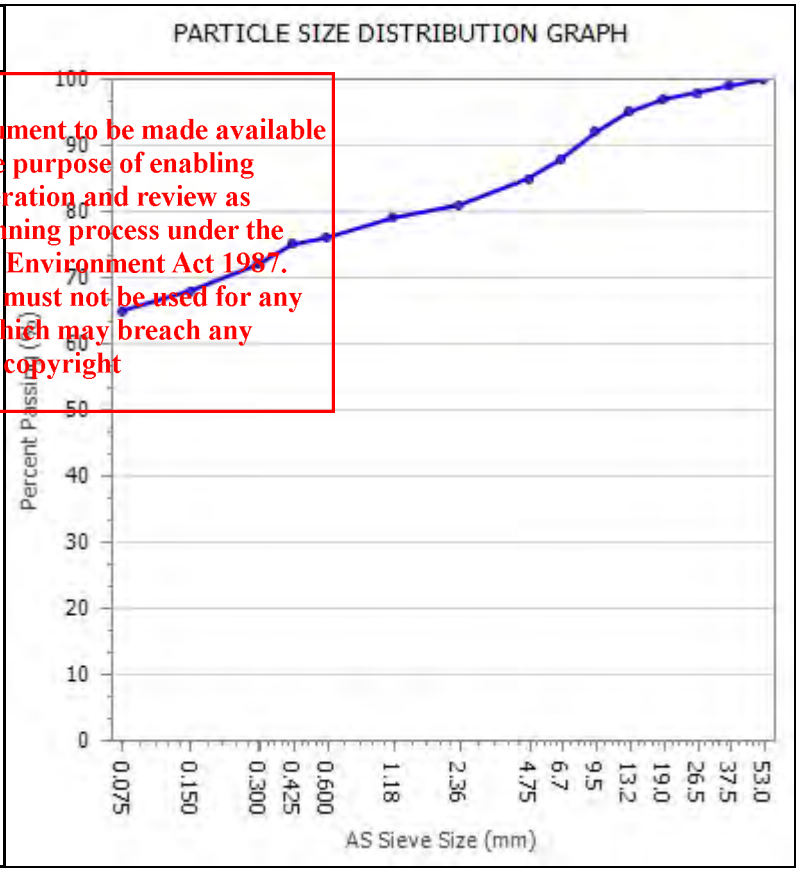
Laboratory: Ararat Laboratory

PARTICLE SIZE DISTRIBUTION REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14136-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 5 of 10

Test Procedures:	AS1289.3.6.1		
Sample Number	13739/S/32612	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7297
Date Sampled	29/10/2020 14:00	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	11/11/2020	Client ID	VCOLOB
Material Source	Holcim Colac Quarry	Material Type	Colac Overburden (VCOLOB)

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
53.0		**100**	
37.5		**99**	
26.5		**98**	
19.0		**97**	
13.2		**95**	
9.5		**92**	
6.7		**88**	
4.75		**85**	
2.36		**81**	
1.18		**79**	
0.600		**76**	
0.425		**75**	
0.300		**72**	
0.150		**68**	
0.075		**65**	



Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W9Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

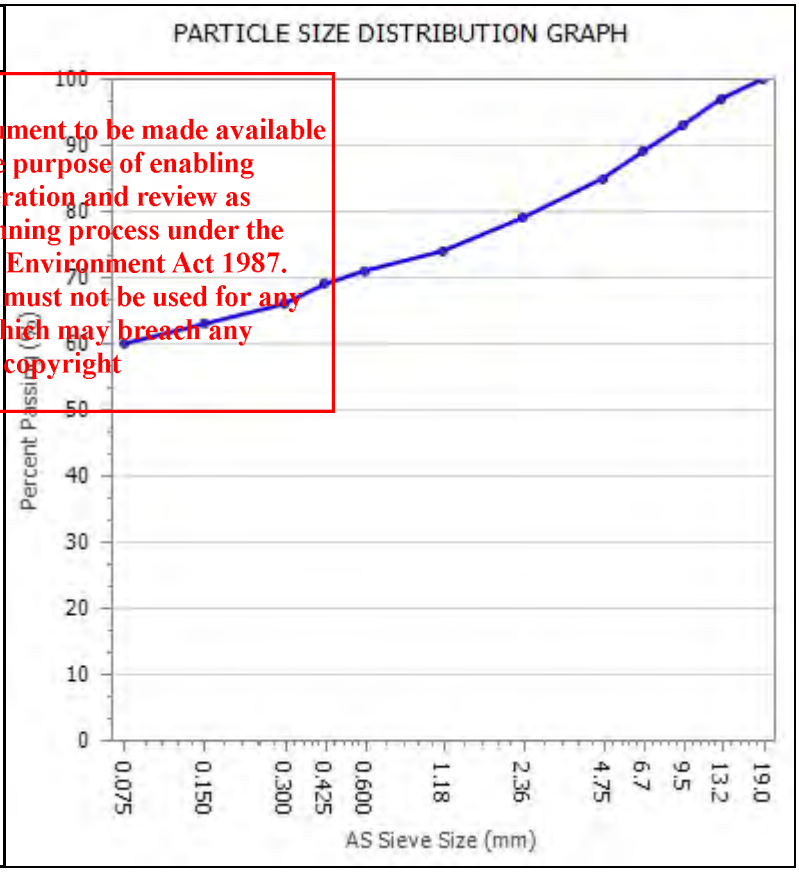
Laboratory: Ararat Laboratory

PARTICLE SIZE DISTRIBUTION REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14136-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 6 of 10

Test Procedures:	AS1289.3.6.1		
Sample Number	13739/S/32613	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7298
Date Sampled	29/10/2020 14:00	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	11/11/2020	Client ID	VCOLOB
Material Source	Holcim Colac Quarry	Material Type	Colac Overburden (VCOLOB)

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
19.0		**100**	
13.2		**97**	
9.5		**93**	
6.7		**89**	
4.75		**85**	
2.36		**79**	
1.18		**74**	
0.600		**71**	
0.425		**69**	
0.300		**66**	
0.150		**63**	
0.075		**60**	



Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W9Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

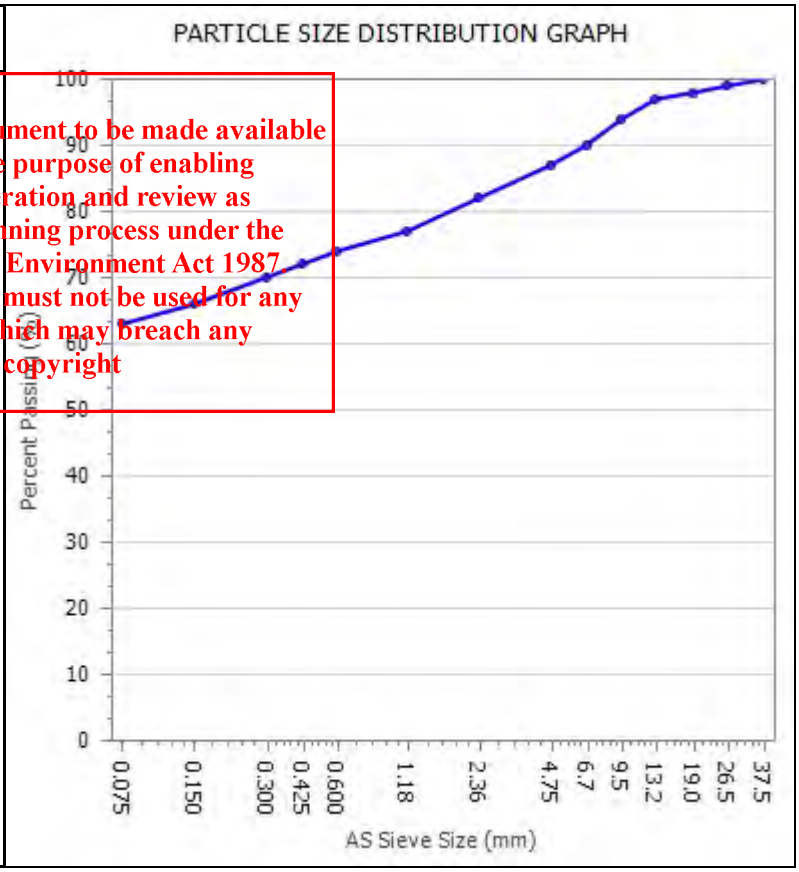
PARTICLE SIZE DISTRIBUTION REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14136-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 7 of 10

Test Procedures:	AS1289.3.6.1

Sample Number	13739/S/32614	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7299
Date Sampled	29/10/2020 14:00	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	11/11/2020	Client ID	VCOLOB
Material Source	Holcim Colac Quarry	Material Type	Colac Overburden (VCOLOB)

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
37.5		**100**	
26.5		**99**	
19.0		**98**	
13.2		**97**	
9.5		**94**	
6.7		**90**	
4.75		**87**	
2.36		**82**	
1.18		**77**	
0.600		**74**	
0.425		**72**	
0.300		**70**	
0.150		**66**	
0.075		**63**	



Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W9Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

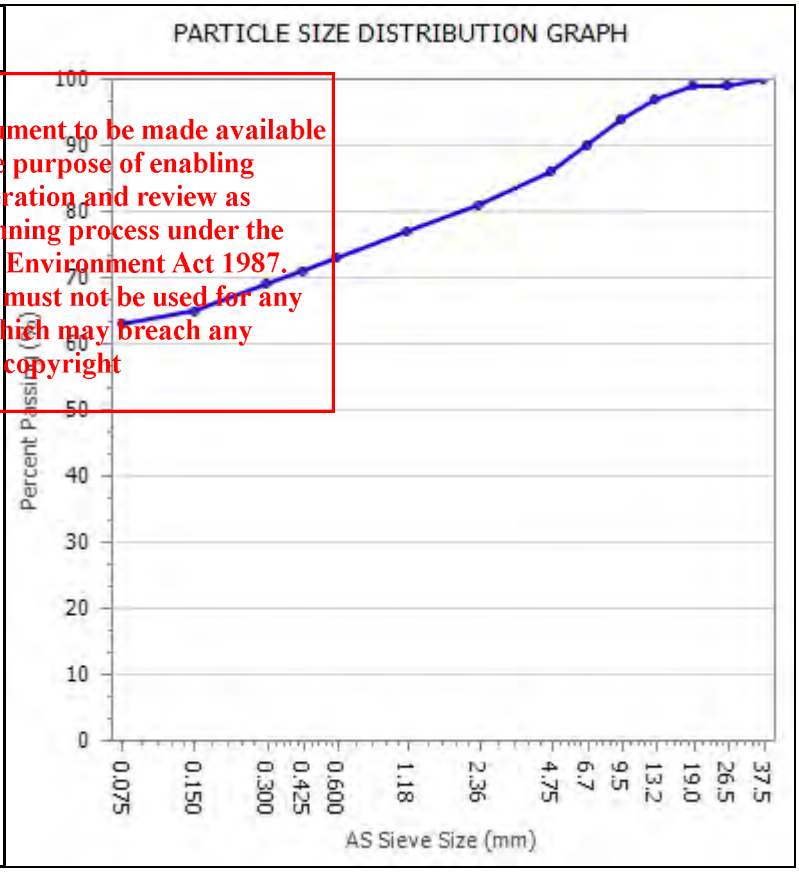
PARTICLE SIZE DISTRIBUTION REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14136-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 8 of 10

Test Procedures:	AS1289.3.6.1

Sample Number	13739/S/32615	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7300
Date Sampled	29/10/2020 14:00	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	11/11/2020	Client ID	VCOLOB
Material Source	Holcim Colac Quarry	Material Type	Colac Overburden (VCOLOB)

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
37.5		**100**	
26.5		**99**	
19.0		**99**	
13.2		**97**	
9.5		**94**	
6.7		**90**	
4.75		**86**	
2.36		**81**	
1.18		**77**	
0.600		**73**	
0.425		**71**	
0.300		**69**	
0.150		**65**	
0.075		**63**	



Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W9Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

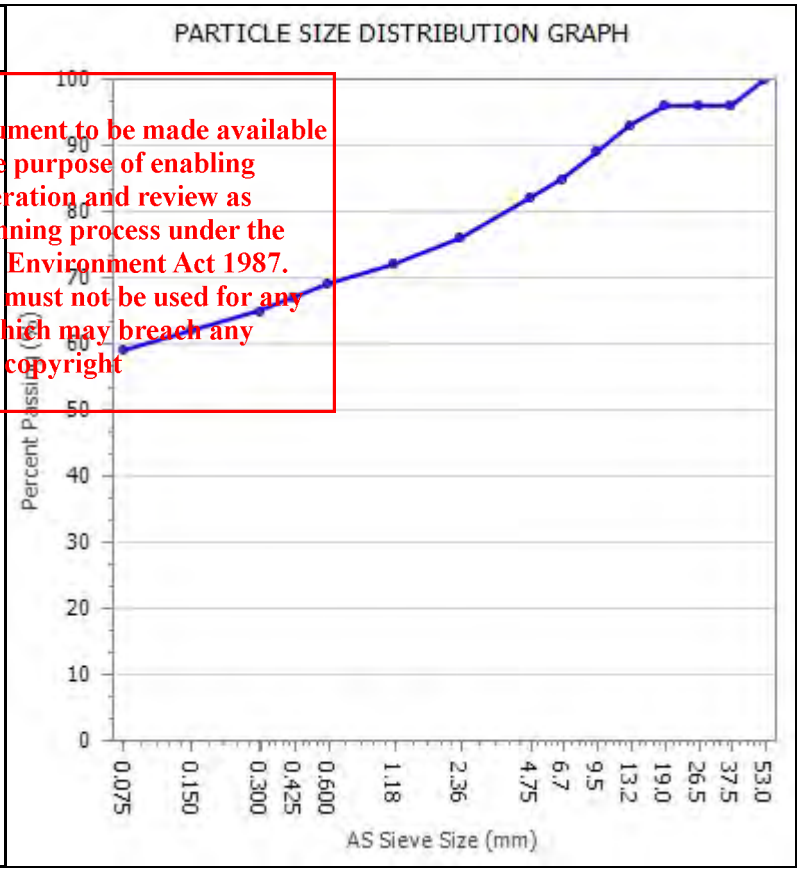
Laboratory: Ararat Laboratory

PARTICLE SIZE DISTRIBUTION REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14136-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 9 of 10

Test Procedures:	AS1289.3.6.1		
Sample Number	13739/S/32616	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7301
Date Sampled	29/10/2020 14:00	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	11/11/2020	Client ID	VCOLOB
Material Source	Holcim Colac Quarry	Material Type	Colac Overburden (VCOLOB)

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
53.0		**100**	
37.5		**96**	
26.5		**96**	
19.0		**96**	
13.2		**93**	
9.5		**89**	
6.7		**85**	
4.75		**82**	
2.36		**76**	
1.18		**72**	
0.600		**69**	
0.425		**67**	
0.300		**65**	
0.150		**62**	
0.075		**59**	



Remarks	Supplement to Simplified Report Number 201112AS1110

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W9Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

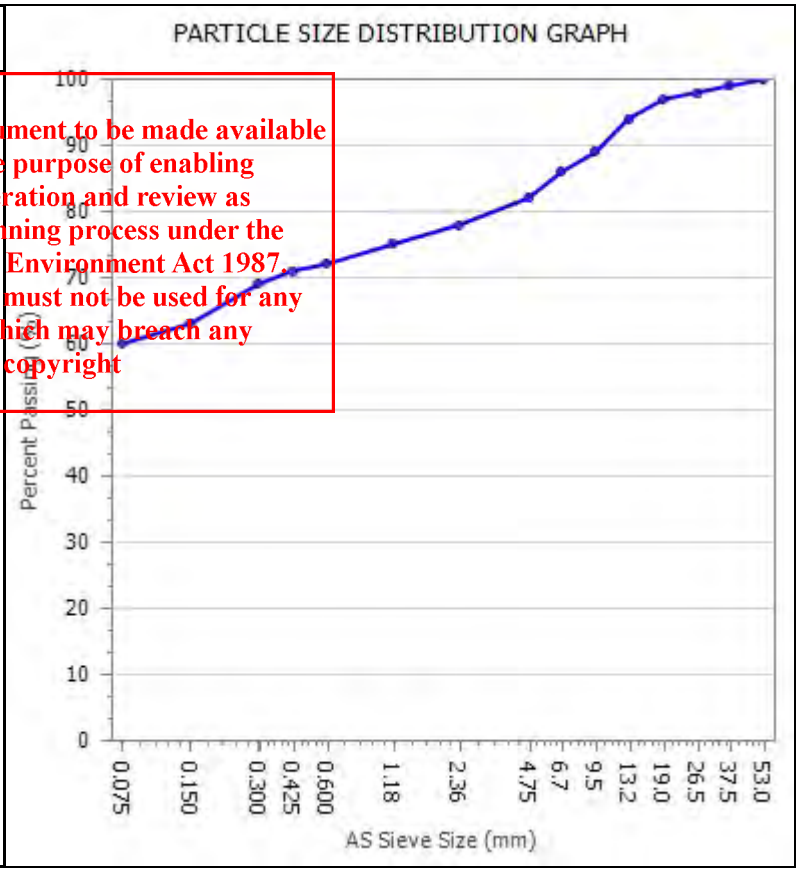
PARTICLE SIZE DISTRIBUTION REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14136-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 10 of 10

Test Procedures:	AS1289.3.6.1

Sample Number	13739/S/32617	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7302
Date Sampled	29/10/2020 14:00	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	11/11/2020	Client ID	VCOLOB
Material Source	Holcim Colac Quarry	Material Type	Colac Overburden (VCOLOB)

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
53.0		**100**	
37.5		**99**	
26.5		**98**	
19.0		**97**	
13.2		**94**	
9.5		**89**	
6.7		**86**	
4.75		**82**	
2.36		**78**	
1.18		**75**	
0.600		**72**	
0.425		**71**	
0.300		**69**	
0.150		**63**	
0.075		**60**	



Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W9Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

Laboratory: Ararat Laboratory

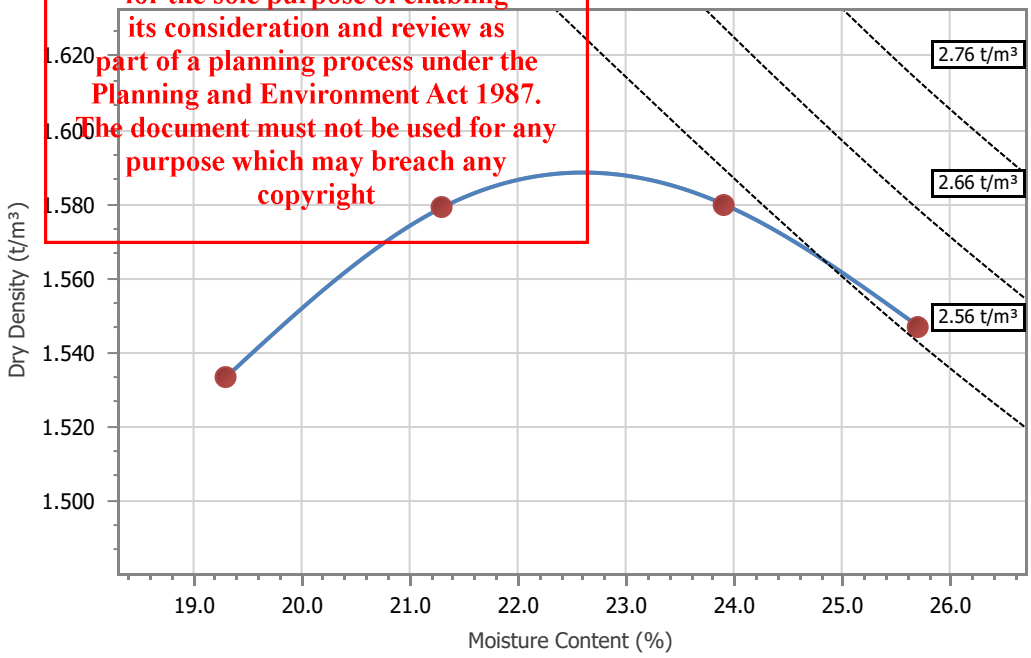
MOISTURE DENSITY RELATIONSHIP REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17179-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	22/11/2022 Page 1 of 6

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Test Pit No:	Pit 1
Sample Number	13739/S/42177	Depth: (m)	0.5
Sampling Method	AS1141.3.1 Cl 9.3		Sample 1
Date Sampled	7/11/2022		NDA
Sampled By	Joseph Hards	Prep Material > 53mm (%)	-
Date Tested	20/11/2022	Compactive Effort	Standard
Material Source	Holcim Colac Quarry	Fraction Tested (mm)	< 19.0mm
Material Type	Colac Overburden (VCOLOB)	Percent Oversize (%)	0
Liquid Limit Method	Estimation	Total Curing Time (hrs)	146.5
Material Description	Insitu		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
19.3	1.533
21.3	1.579
23.9	1.580
25.7	1.547



Maximum Dry Density (t/m³):	1.59	Optimum Moisture Content (%):	22.5

Remarks: Supplement to Simplified Report Number 221122AS1355,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W4Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

Laboratory: Ararat Laboratory

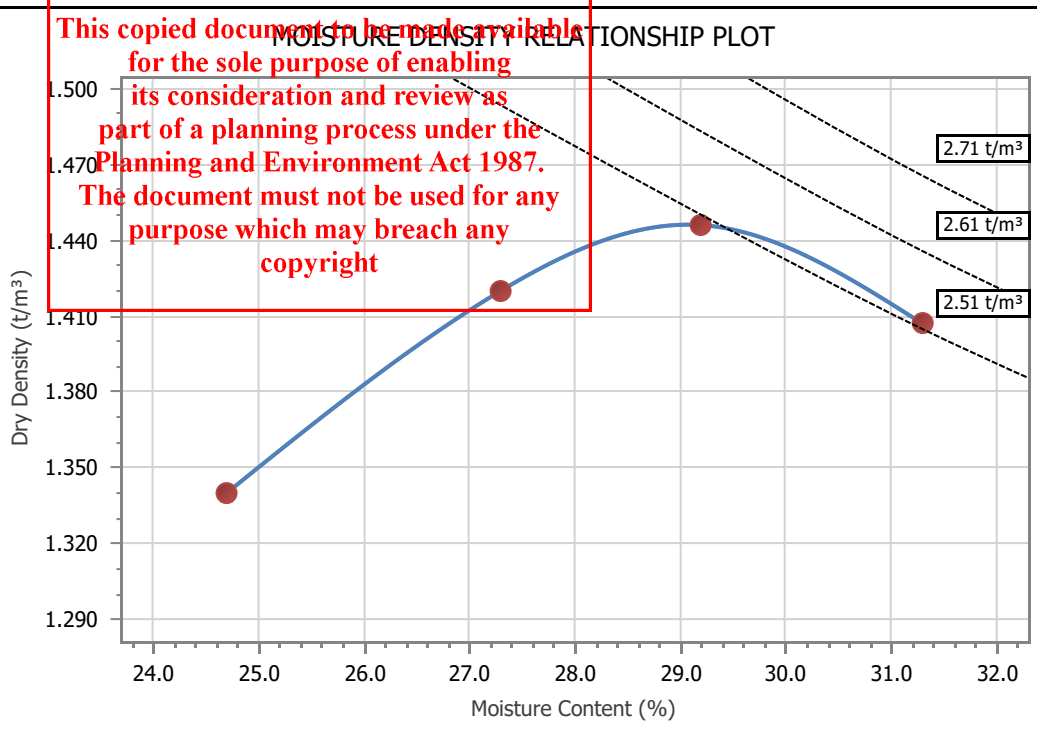
MOISTURE DENSITY RELATIONSHIP REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17179-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	22/11/2022 Page 2 of 6

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Test Pit No:	Pit 1
Sample Number	13739/S/42178	Depth: (m)	0.5
Sampling Method	AS1141.3.1 Cl 9.3		Sample 2
Date Sampled	7/11/2022		NDA
Sampled By	Joseph Hards	Prep Material > 53mm (%)	-
Date Tested	20/11/2022	Compactive Effort	Standard
Material Source	Holcim Colac Quarry	Fraction Tested (mm)	< 19.0mm
Material Type	Colac Overburden (VCOLOB)	Percent Oversize (%)	0
Liquid Limit Method	Estimation	Total Curing Time (hrs)	148.2
Material Description	Insitu		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
24.7	1.340
27.3	1.420
29.2	1.446
31.3	1.407



Maximum Dry Density (t/m³):	1.45	Optimum Moisture Content (%):	29.0

Remarks: Supplement to Simplified Report Number 221122AS1355,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W4Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

Laboratory: Ararat Laboratory

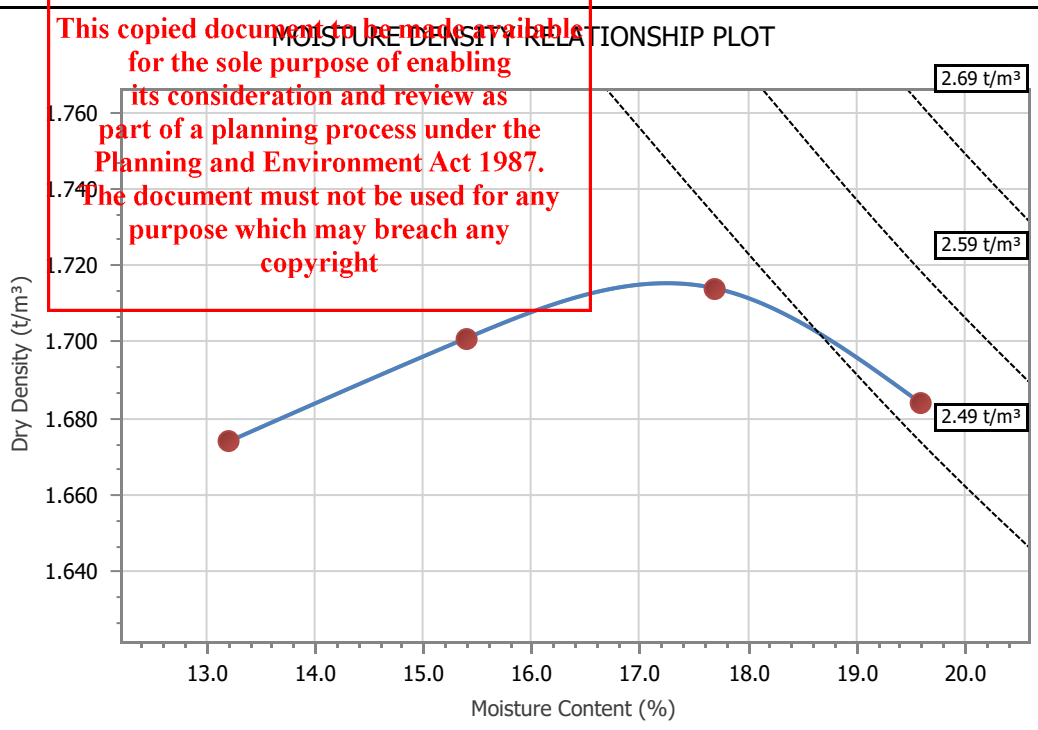
MOISTURE DENSITY RELATIONSHIP REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17179-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	22/11/2022 Page 3 of 6

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Test Pit No:	Pit 2
Sample Number	13739/S/42179	Depth: (m)	0.5
Sampling Method	AS1141.3.1 Cl 9.3		Sample 1
Date Sampled	7/11/2022		NDA
Sampled By	Joseph Hards	Prep Material > 53mm (%)	-
Date Tested	21/11/2022	Compactive Effort	Standard
Material Source	Holcim Colac Quarry	Fraction Tested (mm)	< 19.0mm
Material Type	Colac Overburden (VCOLOB)	Percent Oversize (%)	0
Liquid Limit Method	Estimation	Total Curing Time (hrs)	171.0
Material Description	Insitu		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
13.2	1.674
15.4	1.701
17.7	1.714
19.6	1.684



Maximum Dry Density (t/m³):	1.72	Optimum Moisture Content (%):	17.0

Remarks	Supplement to Simplified Report Number 221122AS1355,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W4Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

Laboratory: Ararat Laboratory

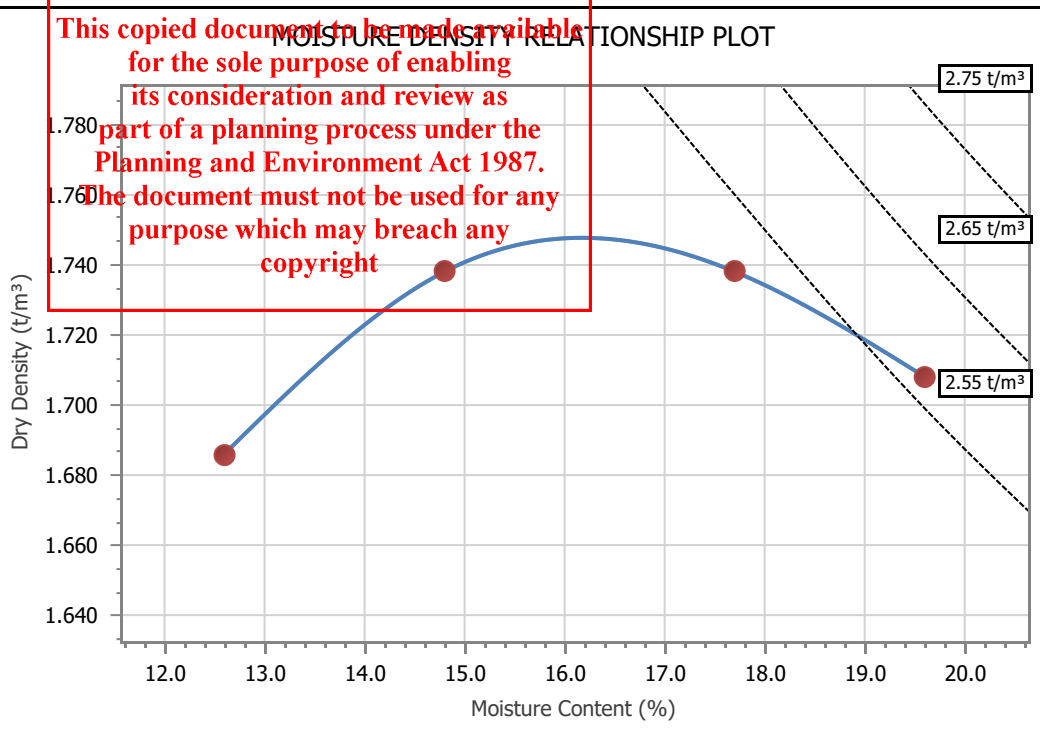
MOISTURE DENSITY RELATIONSHIP REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17179-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	22/11/2022 Page 4 of 6

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Test Pit No:	Pit 2
Sample Number	13739/S/42180	Depth: (m)	0.5
Sampling Method	AS1141.3.1 Cl 9.3		Sample 2
Date Sampled	7/11/2022		NDA
Sampled By	Joseph Hards	Prep Material > 53mm (%)	-
Date Tested	20/11/2022	Compactive Effort	Standard
Material Source	Holcim Colac Quarry	Fraction Tested (mm)	< 19.0mm
Material Type	Colac Overburden (VCOLOB)	Percent Oversize (%)	0
Liquid Limit Method	Estimation	Total Curing Time (hrs)	148.8
Material Description	Insitu		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
12.6	1.686
14.8	1.738
17.7	1.738
19.6	1.708



Maximum Dry Density (t/m³):	1.75	Optimum Moisture Content (%):	16.0

Remarks	Supplement to Simplified Report Number 221122AS1355,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W4Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

Laboratory: Ararat Laboratory

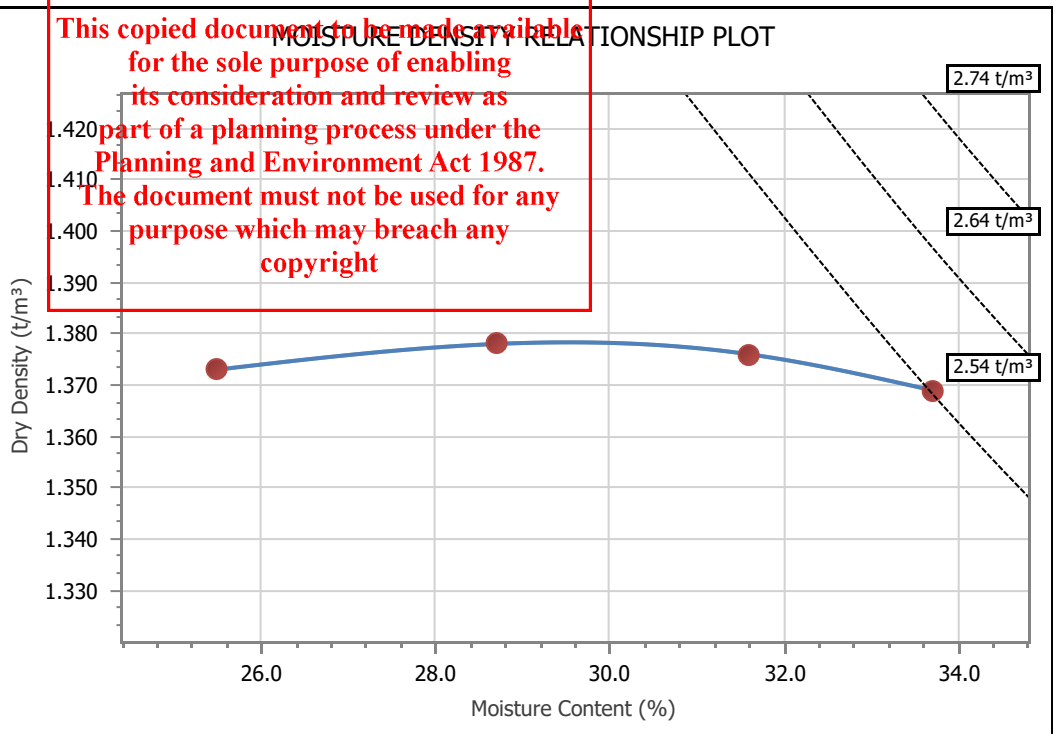
MOISTURE DENSITY RELATIONSHIP REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17179-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	22/11/2022 Page 5 of 6

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Test Pit No:	Overburden
Sample Number	13739/S/42181	Depth: (m)	N/A
Sampling Method	AS1141.3.1 Cl 9.3		Sample 1
Date Sampled	7/11/2022		SDA
Sampled By	Joseph Hards	Prep Material > 53mm (%)	-
Date Tested	21/11/2022	Compactive Effort	Standard
Material Source	Holcim Colac Quarry	Fraction Tested (mm)	< 19.0mm
Material Type	Colac Overburden (VCOLOB)	Percent Oversize (%)	0
Liquid Limit Method	Estimation	Total Curing Time (hrs)	170.2
Material Description	Insitu		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
25.5	1.373
28.7	1.378
31.6	1.376
33.7	1.369



Maximum Dry Density (t/m³):	1.38	Optimum Moisture Content (%):	29.5

Remarks	Supplement to Simplified Report Number 221122AS1355,

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W4Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

Laboratory: Ararat Laboratory

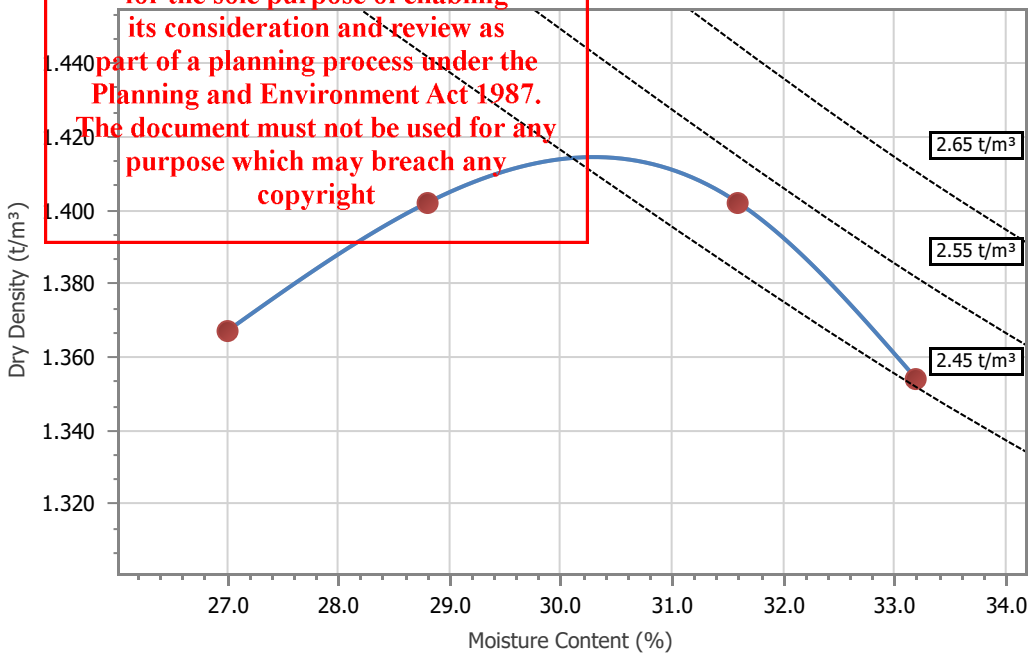
MOISTURE DENSITY RELATIONSHIP REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17179-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	22/11/2022 Page 6 of 6

Test Procedures	AS1289.5.1.1, AS1289.2.1.1, AS1289.1.1	Test Pit No:	Overburden
Sample Number	13739/S/42182	Depth: (m)	N/A
Sampling Method	AS1141.3.1 Cl 9.3		Sample 2
Date Sampled	7/11/2022		SDA
Sampled By	Joseph Hards	Prep Material > 53mm (%)	-
Date Tested	21/11/2022	Compactive Effort	Standard
Material Source	Holcim Colac Quarry	Fraction Tested (mm)	< 19.0mm
Material Type	Colac Overburden (VCOLOB)	Percent Oversize (%)	0
Liquid Limit Method	Estimation	Total Curing Time (hrs)	172.0
Material Description	Insitu		

Moisture / Density Relationship Data

Moisture Content (%)	Dry Density (t/m³)
27.0	1.367
28.8	1.402
31.6	1.402
33.2	1.354



Maximum Dry Density (t/m³):	1.41	Optimum Moisture Content (%):	30.5

Remarks	Supplement to Simplified Report Number 221122AS1355,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W4Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

Laboratory: Ararat Laboratory

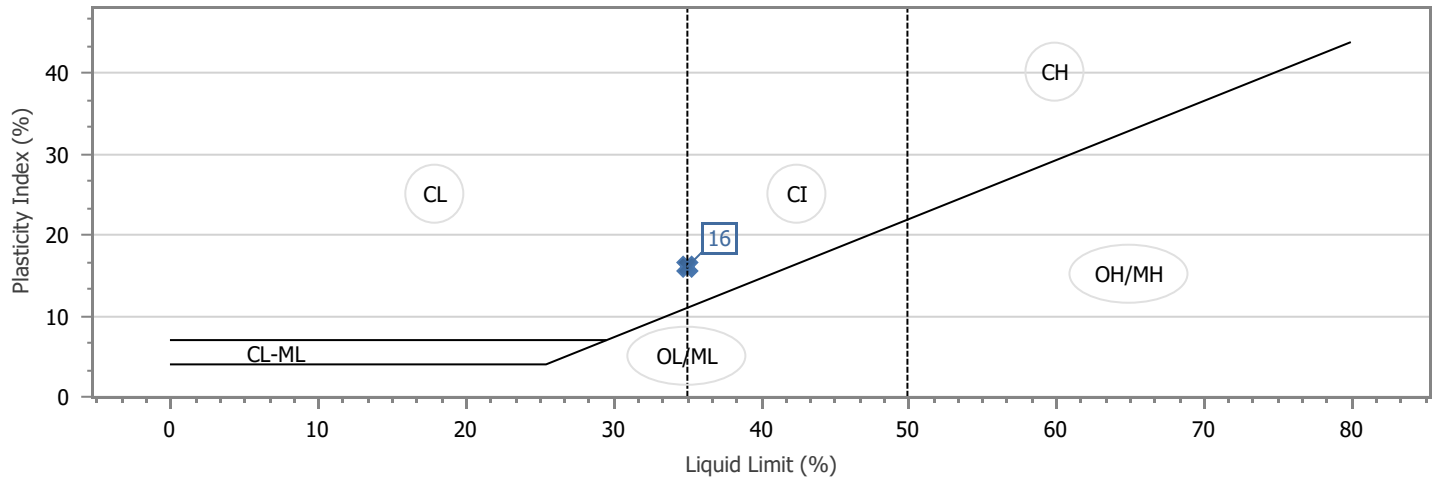
ATTERBERG LIMITS REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17227-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	29/11/2022 Page 1 of 6

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS1726 (Tables 9/10)		
Sample Number	13739/S/42177	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Test Pit No:	Pit 1
Date Sampled	7/11/2022	Depth: (m)	0.5
Sampled By	Joseph Hards		Sample 1
Date Tested	25/11/2022		NDA
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	Holcim Colac Quarry
LL Water Type	Potable	Material Type	Colac Overburden (VCOLOB)
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	CL, GRAVELY CLAY		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		35	
Plastic Limit (%)		19	
Plasticity Index (%)		16	
Linear Shrinkage (%)		6.5	
Linear Shrinkage Defects:	Cracking		

Atterberg Limits 'A-Line' Graph



Remarks	Supplement to Simplified Report Number 221129AS0931,

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

Laboratory: Ararat Laboratory

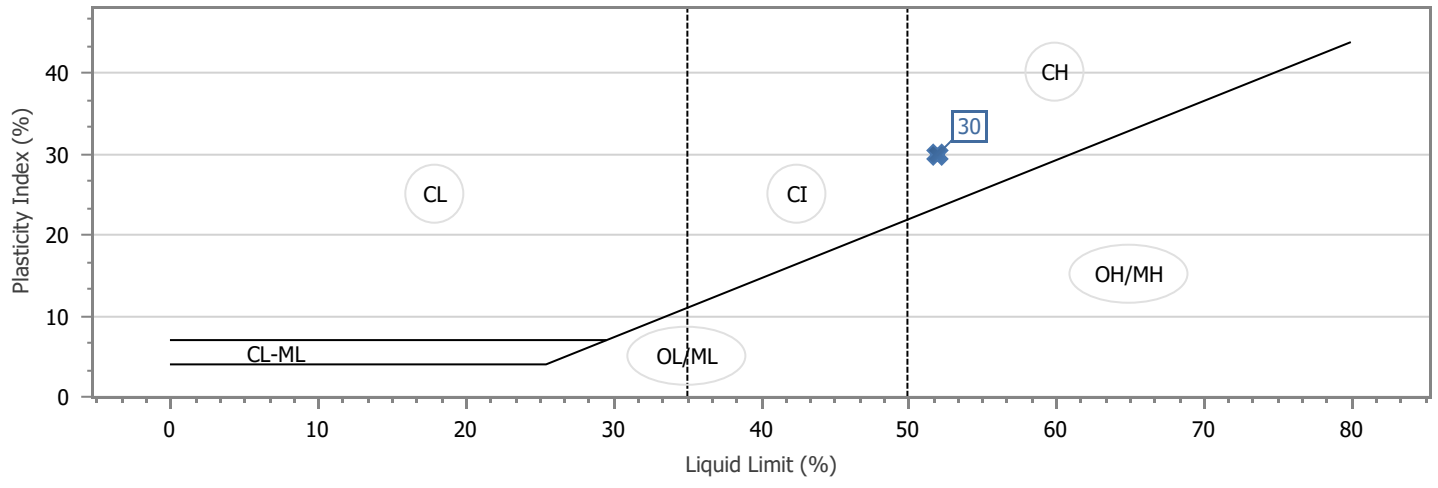
ATTERBERG LIMITS REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17227-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	29/11/2022 Page 2 of 6

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS1726 (Tables 9/10)		
Sample Number	13739/S/42178	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Test Pit No:	Pit 1
Date Sampled	7/11/2022	Depth: (m)	0.5
Sampled By	Joseph Hards		Sample 2
Date Tested	25/11/2022		NDA
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	Holcim Colac Quarry
LL Water Type	Potable	Material Type	Colac Overburden (VCOLOB)
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	CH, CLAY with sand		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		52	
Plastic Limit (%)		22	
Plasticity Index (%)		30	
Linear Shrinkage (%)		15.0	
Linear Shrinkage Defects:	Cracking		

Atterberg Limits 'A-Line' Graph



Remarks	Supplement to Simplified Report Number 221129AS0931,

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

Laboratory: Ararat Laboratory

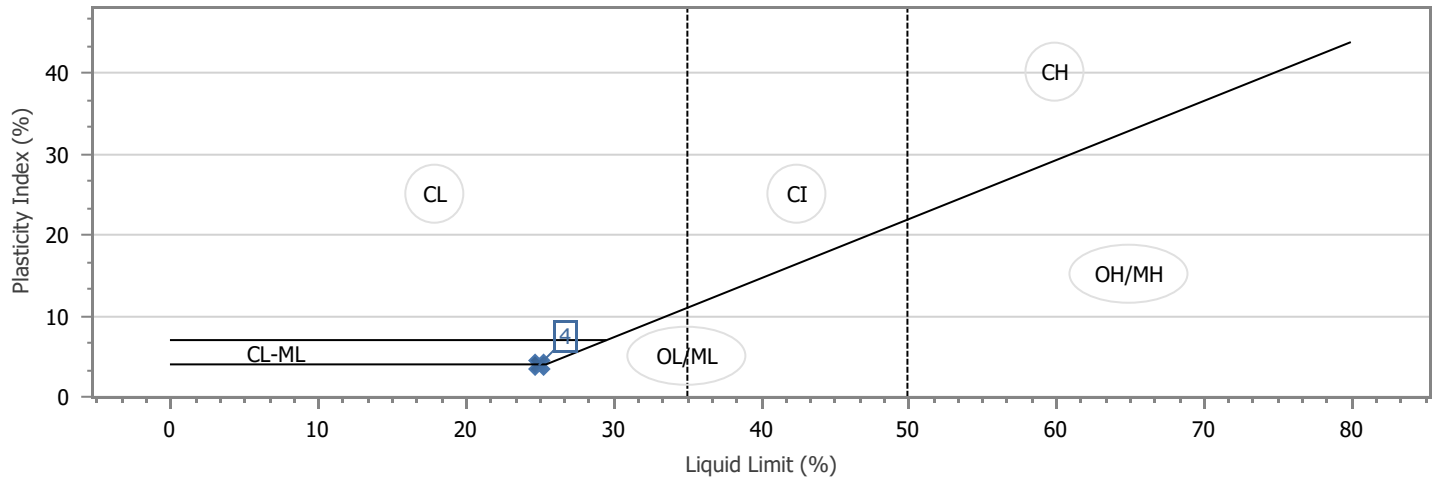
ATTERBERG LIMITS REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17227-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	29/11/2022 Page 3 of 6

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS1726 (Tables 9/10)		
Sample Number	13739/S/42179	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Test Pit No:	Pit 2
Date Sampled	7/11/2022	Depth: (m)	0.5
Sampled By	Joseph Hards		Sample 1
Date Tested	25/11/2022		NDA
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	Holcim Colac Quarry
LL Water Type	Potable	Material Type	Colac Overburden (VCOLOB)
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	ML, GRAVELY SILT		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		25	
Plastic Limit (%)		21	
Plasticity Index (%)		4	
Linear Shrinkage (%)		2.5	
Linear Shrinkage Defects:	Cracking		

Atterberg Limits 'A-Line' Graph



Remarks	Supplement to Simplified Report Number 221129AS0931,

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

Laboratory: Ararat Laboratory

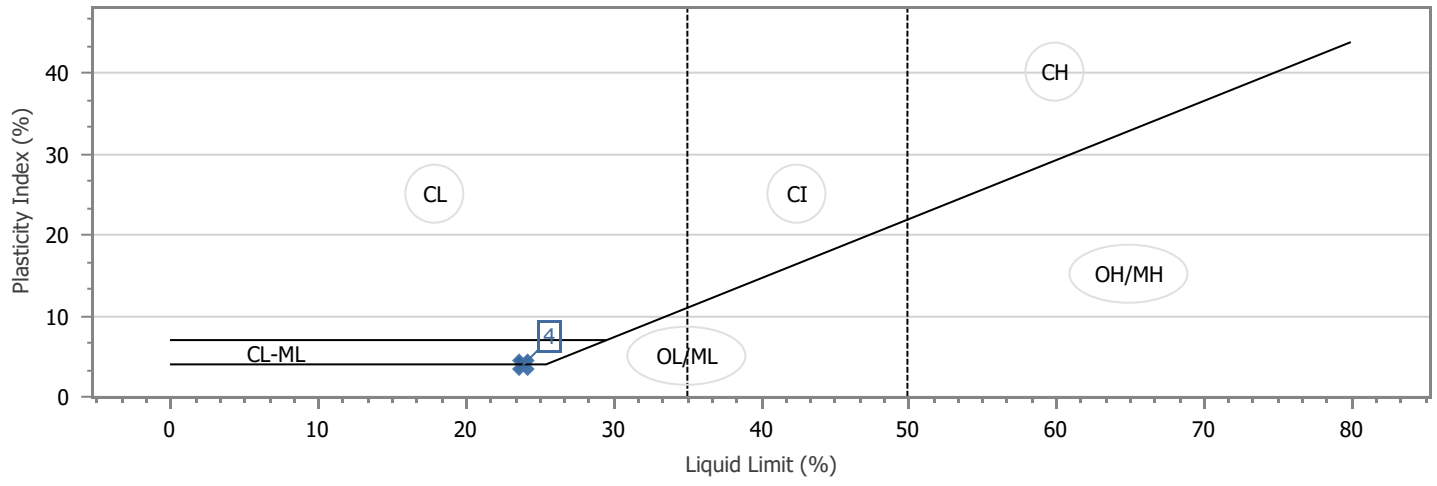
ATTERBERG LIMITS REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17227-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	29/11/2022 Page 4 of 6

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS1726 (Tables 9/10)		
Sample Number	13739/S/42180	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Test Pit No:	Pit 2
Date Sampled	7/11/2022	Depth: (m)	0.5
Sampled By	Joseph Hards		Sample 2
Date Tested	25/11/2022		NDA
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	Holcim Colac Quarry
LL Water Type	Potable	Material Type	Colac Overburden (VCOLOB)
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	ML, GRAVELY SILT		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		24	
Plastic Limit (%)		20	
Plasticity Index (%)		4	
Linear Shrinkage (%)		2.0	
Linear Shrinkage Mould Length / Defects:	Mould Length: 250.5mm / None		

Atterberg Limits 'A-Line' Graph



Remarks	Supplement to Simplified Report Number 221129AS0931,

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

Laboratory: Ararat Laboratory

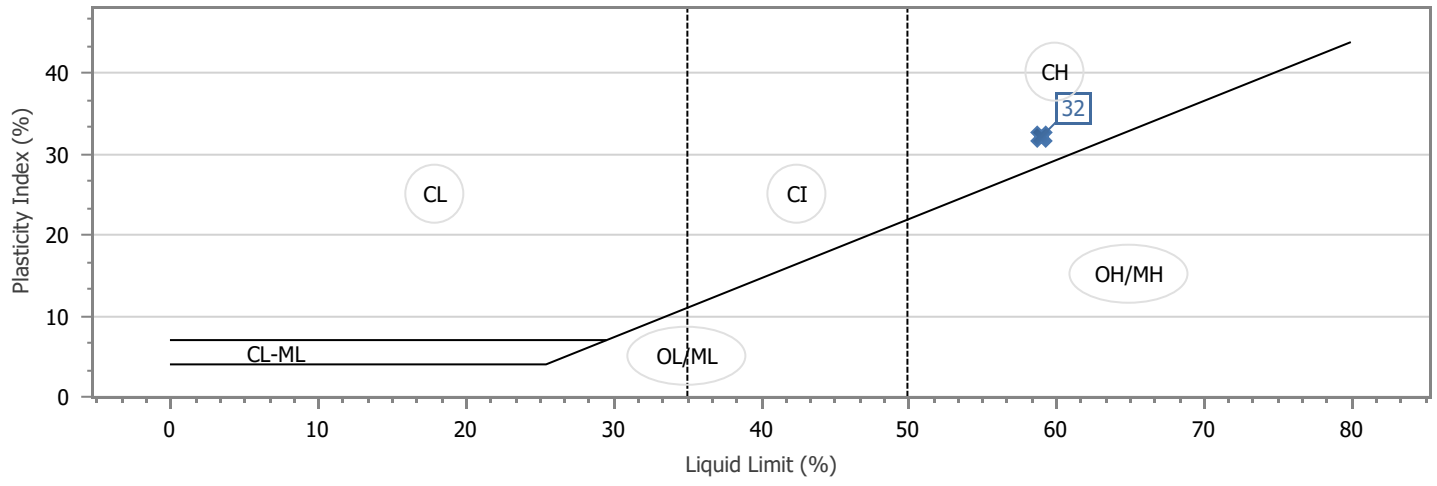
ATTERBERG LIMITS REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17227-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	29/11/2022 Page 5 of 6

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS1726 (Tables 9/10)		
Sample Number	13739/S/42181	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Test Pit No:	Overburden
Date Sampled	7/11/2022	Depth: (m)	N/A
Sampled By	Joseph Hards		Sample 1
Date Tested	25/11/2022		SDA
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	Holcim Colac Quarry
LL Water Type	Potable	Material Type	Colac Overburden (VCOLOB)
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	CH, SANDY CLAY		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		59	
Plastic Limit (%)		27	
Plasticity Index (%)		32	
Linear Shrinkage (%)		15.0	
Linear Shrinkage Mould Length / Defects:	Mould Length: 250.5mm / Cracking		

Atterberg Limits 'A-Line' Graph



Remarks	Supplement to Simplified Report Number 221129AS0931,

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

Laboratory: Ararat Laboratory

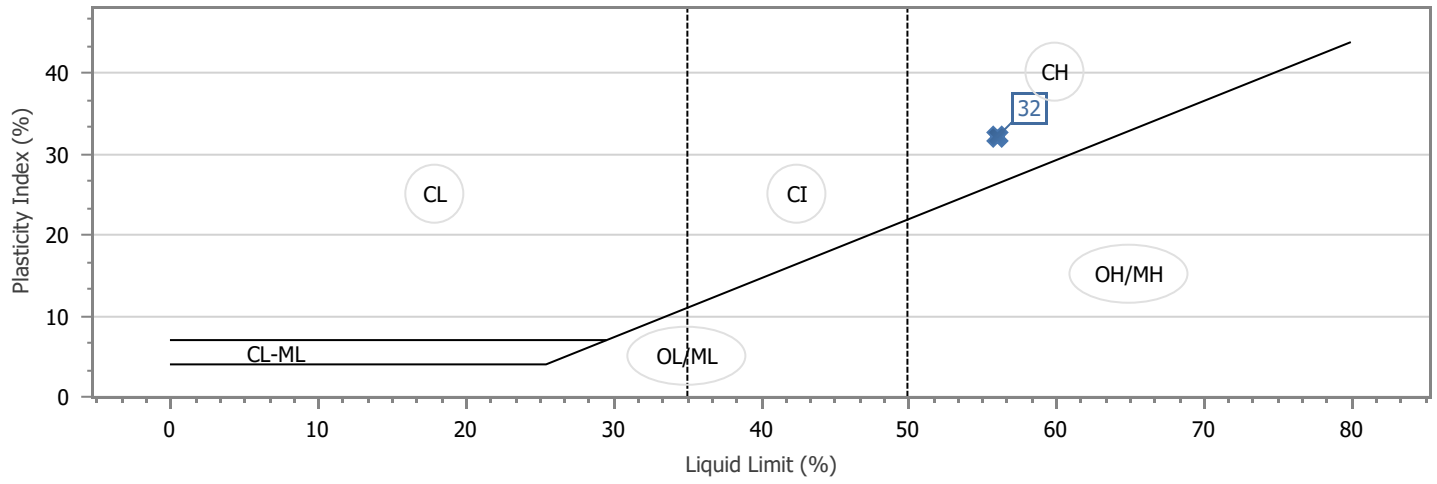
ATTERBERG LIMITS REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17227-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	29/11/2022 Page 6 of 6

Test Procedures:	AS1289.3.1.2, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS1726 (Tables 9/10)		
Sample Number	13739/S/42182	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Test Pit No:	Overburden
Date Sampled	7/11/2022	Depth: (m)	N/A
Sampled By	Joseph Hards		Sample 2
Date Tested	25/11/2022		SDA
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	Holcim Colac Quarry
LL Water Type	Potable	Material Type	Colac Overburden (VCOLOB)
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	CH, SANDY CLAY		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		56	
Plastic Limit (%)		24	
Plasticity Index (%)		32	
Linear Shrinkage (%)		15.0	
Linear Shrinkage Mould Length / Defects:	Mould Length: 250.5mm / Cracking		

Atterberg Limits 'A-Line' Graph



Remarks	Supplement to Simplified Report Number 221129AS0931,

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

Laboratory: Ararat Laboratory

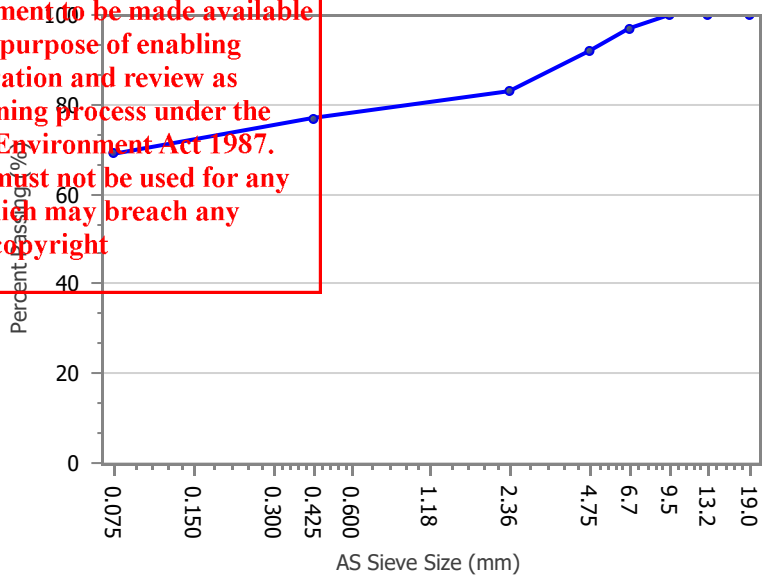
QUALITY OF MATERIALS REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17228-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	29/11/2022 Page 1 of 6

Test Procedures	AS1289.3.6.1, AS1289.3.1.2, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	13739/S/42177	Test Pit No:	Pit 1
Sampling Method	AS1141.3.1 Cl 9.3	Depth: (m)	0.5
Date Sampled	7/11/2022		Sample 1
Sampled By	Joseph Hards		NDA
Date Tested	28/11/2022	Material Source	Holcim Colac Quarry
PSD Preparation		Material Type	Colac Overburden (VCOLOB)
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	CL, GRAVELY CLAY		

AS Sieve (mm)	Specification Minimum (%)	Percent Passing (%)	Specification Maximum (%)
19.0		100	
13.2		100	
9.5		100	
6.7		97	
4.75		92	
2.36		83	
0.425		77	
0.075		69	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	Result	Specification Maximum (%)	Test Result	Specification Minimum (%)	Result	Specification Maximum (%)
Liquid Limit (%)		35		0.075/0.425 Fines Ratio		0.89	
Plastic Limit (%)		19		PI x 0.425 Ratio (%)		1236.8	
Plastic Index (%)		16		LS x 0.425 Ratio (%)		502.4	
Linear Shrinkage (%)		6.5		Linear Shrinkage Defects	Cracking		

Remarks	Supplement to Simplified Report Number 221129AS0931,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W85Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

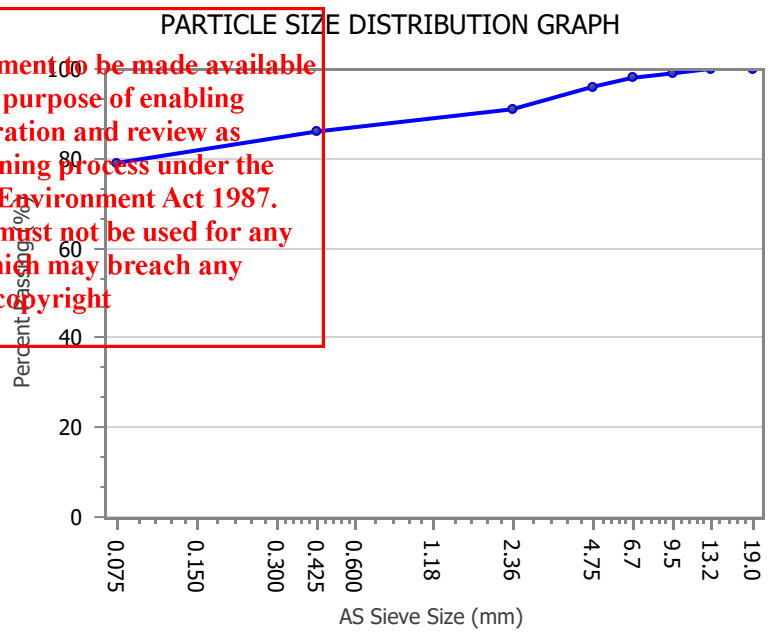
Laboratory: Ararat Laboratory

QUALITY OF MATERIALS REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17228-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	29/11/2022 Page 2 of 6

Test Procedures	AS1289.3.6.1, AS1289.3.1.2, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	13739/S/42178	Test Pit No:	Pit 1
Sampling Method	AS1141.3.1 Cl 9.3	Depth: (m)	0.5
Date Sampled	7/11/2022		Sample 2
Sampled By	Joseph Hards		NDA
Date Tested	23/11/2022	Material Source	Holcim Colac Quarry
PSD Preparation		Material Type	Colac Overburden (VCOLOB)
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	CH, CLAY with sand		

AS Sieve (mm)	Specification Minimum (%)	Percent Passing (%)	Specification Maximum (%)
19.0		100	
13.2		100	
9.5		99	
6.7		98	
4.75		96	
2.36		91	
0.425		86	
0.075		79	



Test Result	Specification Minimum (%)	Result	Specification Maximum (%)	Test Result	Specification Minimum (%)	Result	Specification Maximum (%)
Liquid Limit (%)		52		0.075/0.425 Fines Ratio		0.91	
Plastic Limit (%)		22		PI x 0.425 Ratio (%)		2592.0	
Plastic Index (%)		30		LS x 0.425 Ratio (%)		1296.0	
Linear Shrinkage (%)		15.0		Linear Shrinkage Defects	Cracking		

Remarks	Supplement to Simplified Report Number 221129AS0931,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W85Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

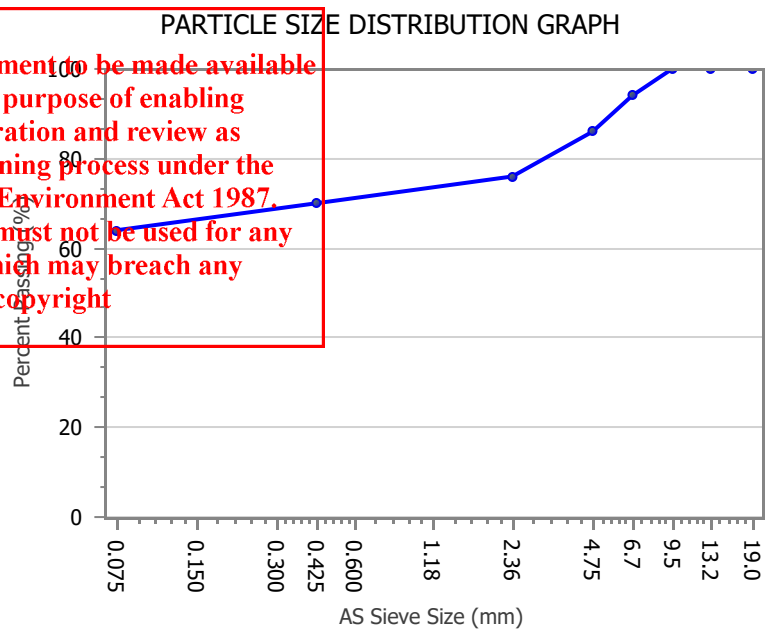
Laboratory: Ararat Laboratory

QUALITY OF MATERIALS REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17228-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	29/11/2022 Page 3 of 6

Test Procedures	AS1289.3.6.1, AS1289.3.1.2, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	13739/S/42179	Test Pit No:	Pit 2
Sampling Method	AS1141.3.1 Cl 9.3	Depth: (m)	0.5
Date Sampled	7/11/2022		Sample 1
Sampled By	Joseph Hards		NDA
Date Tested	21/11/2022	Material Source	Holcim Colac Quarry
PSD Preparation		Material Type	Colac Overburden (VCOLOB)
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	ML, GRAVELY SILT		

AS Sieve (mm)	Specification Minimum (%)	Percent Passing (%)	Specification Maximum (%)
19.0		100	
13.2		100	
9.5		100	
6.7		94	
4.75		86	
2.36		76	
0.425		70	
0.075		64	



Test Result	Specification Minimum (%)	Result	Specification Maximum (%)	Test Result	Specification Minimum (%)	Result	Specification Maximum (%)
Liquid Limit (%)		25		0.075/0.425 Fines Ratio		0.91	
Plastic Limit (%)		21		PI x 0.425 Ratio (%)		281.6	
Plastic Index (%)		4		LS x 0.425 Ratio (%)		176.0	
Linear Shrinkage (%)		2.5		Linear Shrinkage Defects	Cracking		

Remarks	Supplement to Simplified Report Number 221129AS0931,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W85Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

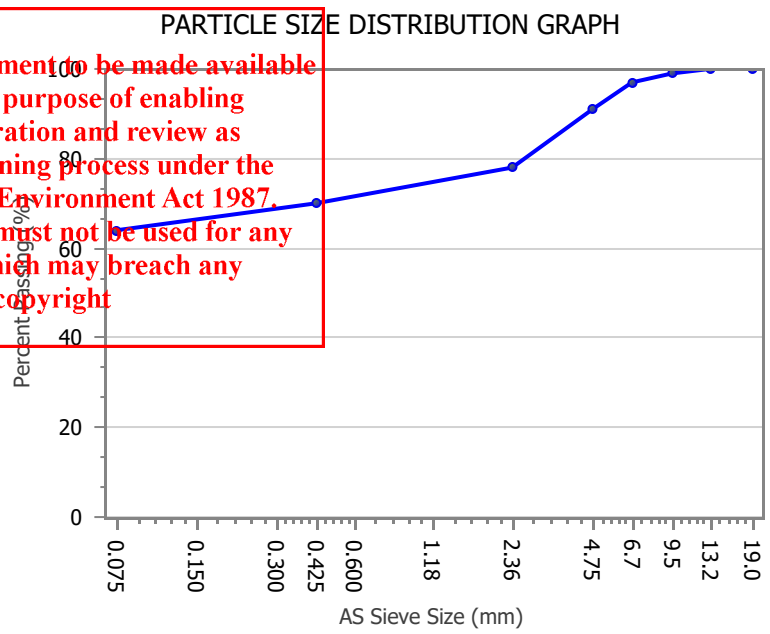
Laboratory: Ararat Laboratory

QUALITY OF MATERIALS REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17228-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	29/11/2022 Page 4 of 6

Test Procedures	AS1289.3.6.1, AS1289.3.1.2, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	13739/S/42180	Test Pit No:	Pit 2
Sampling Method	AS1141.3.1 Cl 9.3	Depth: (m)	0.5
Date Sampled	7/11/2022		Sample 2
Sampled By	Joseph Hards		NDA
Date Tested	23/11/2022	Material Source	Holcim Colac Quarry
PSD Preparation		Material Type	Colac Overburden (VCOLOB)
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	ML, GRAVELY SILT		

AS Sieve (mm)	Specification Minimum (%)	Percent Passing (%)	Specification Maximum (%)
19.0		100	
13.2		100	
9.5		99	
6.7		97	
4.75		91	
2.36		78	
0.425		70	
0.075		64	



Test Result	Specification Minimum (%)	Result	Specification Maximum (%)	Test Result	Specification Minimum (%)	Result	Specification Maximum (%)
Liquid Limit (%)		24		0.075/0.425 Fines Ratio		0.92	
Plastic Limit (%)		20		PI x 0.425 Ratio (%)		279.6	
Plastic Index (%)		4		LS x 0.425 Ratio (%)		139.8	
Linear Shrinkage (%)		2.0		Linear Shrinkage Defects	None		

Remarks	Supplement to Simplified Report Number 221129AS0931,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W85Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

Laboratory: Ararat Laboratory

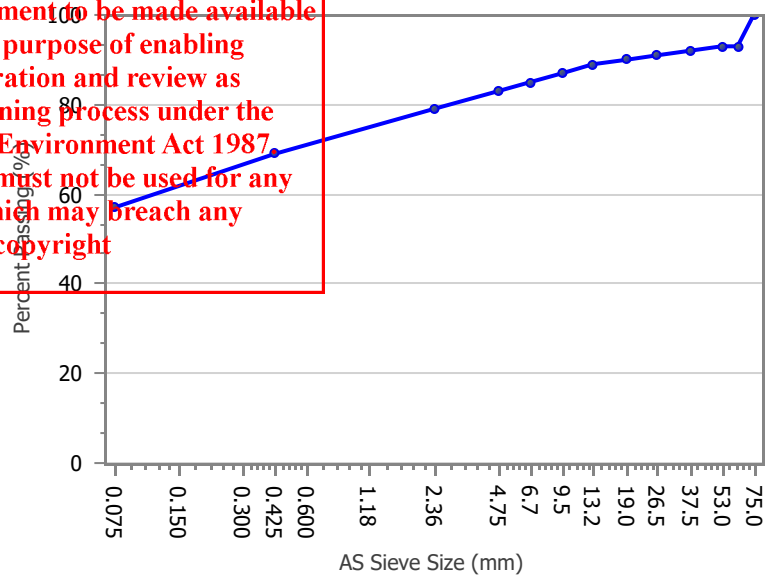
QUALITY OF MATERIALS REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17228-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	29/11/2022 Page 5 of 6

Test Procedures	AS1289.3.6.1, AS1289.3.1.2, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	13739/S/42181	Test Pit No:	Overburden
Sampling Method	AS1141.3.1 Cl 9.3	Depth: (m)	N/A
Date Sampled	7/11/2022		Sample 1
Sampled By	Joseph Hards		SDA
Date Tested	21/11/2022	Material Source	Holcim Colac Quarry
PSD Preparation		Material Type	Colac Overburden (VCOLOB)
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	CH, SANDY CLAY		

AS Sieve (mm)	Specification Minimum (%)	Percent Passing (%)	Specification Maximum (%)
75.0		100	
63.0		93	
53.0		93	
37.5		92	
26.5		91	
19.0		90	
13.2		89	
9.5		87	
6.7		85	
4.75		83	
2.36		79	
0.425		69	
0.075		57	

PARTICLE SIZE DISTRIBUTION GRAPH



Test Result	Specification Minimum (%)	Result	Specification Maximum (%)	Test Result	Specification Minimum (%)	Result	Specification Maximum (%)
Liquid Limit (%)		59		0.075/0.425 Fines Ratio		0.82	
Plastic Limit (%)		27		PI x 0.425 Ratio (%)		2195.8	
Plastic Index (%)		32		LS x 0.425 Ratio (%)		1029.3	
Linear Shrinkage (%)		15.0		Linear Shrinkage Defects	Cracking		

Remarks	Supplement to Simplified Report Number 221129AS0931,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W85Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat VIC 3377

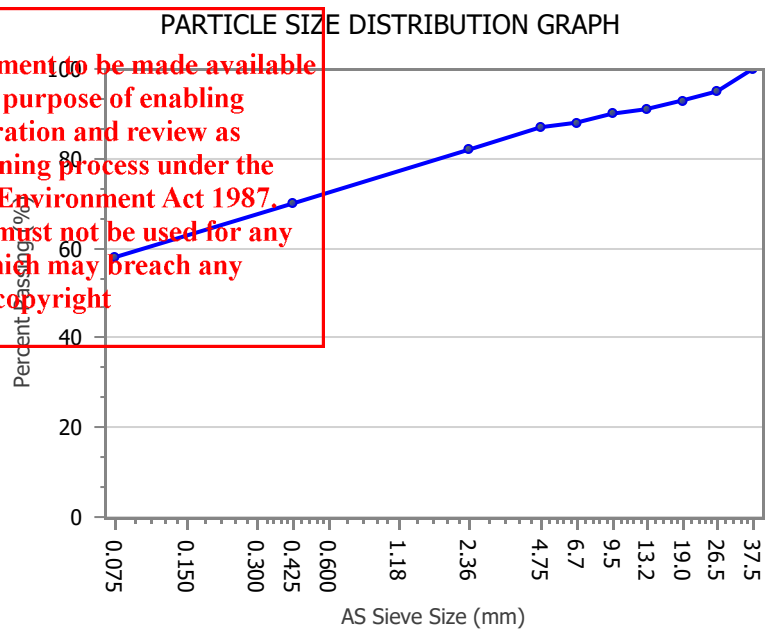
Laboratory: Ararat Laboratory

QUALITY OF MATERIALS REPORT

Client:	Holcim (Australia) Pty Ltd	Report Number:	13739/R/17228-1
Client Address:	PO Box 1513, Milton	Project Number:	13739/P/858
Project:	Quality Control Testing	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/9231
Component:	NDA and SDA	Client Reference/s:	PO: 4520806886
Area Description:	Colac Quarry	Report Date / Page:	29/11/2022 Page 6 of 6

Test Procedures	AS1289.3.6.1, AS1289.3.1.2, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1, AS 1289.3.3.1		
Sample Number	13739/S/42182	Test Pit No:	Overburden
Sampling Method	AS1141.3.1 Cl 9.3	Depth: (m)	N/A
Date Sampled	7/11/2022		Sample 2
Sampled By	Joseph Hards		SDA
Date Tested	21/11/2022	Material Source	Holcim Colac Quarry
PSD Preparation		Material Type	Colac Overburden (VCOLOB)
Atterberg Preparation	Dry Sieved / Oven Dried	Prep Material > 53.0mm (%)	
Material Description	CH, SANDY CLAY		

AS Sieve (mm)	Specification Minimum (%)	Percent Passing (%)	Specification Maximum (%)
37.5		100	
26.5		95	
19.0		93	
13.2		91	
9.5		90	
6.7		88	
4.75		87	
2.36		82	
0.425		70	
0.075		58	



Test Result	Specification Minimum (%)	Result	Specification Maximum (%)	Test Result	Specification Minimum (%)	Result	Specification Maximum (%)
Liquid Limit (%)		56		0.075/0.425 Fines Ratio		0.83	
Plastic Limit (%)		24		PI x 0.425 Ratio (%)		2237.7	
Plastic Index (%)		32		LS x 0.425 Ratio (%)		1048.9	
Linear Shrinkage (%)		15.0		Linear Shrinkage Defects	Cracking		

Remarks	Supplement to Simplified Report Number 221129AS0931,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W85Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

Holcim
Subcontracting Cardno testing services.
Concrete enquiries phone 131 188
Aggregate enquiries phone 1300 555 277

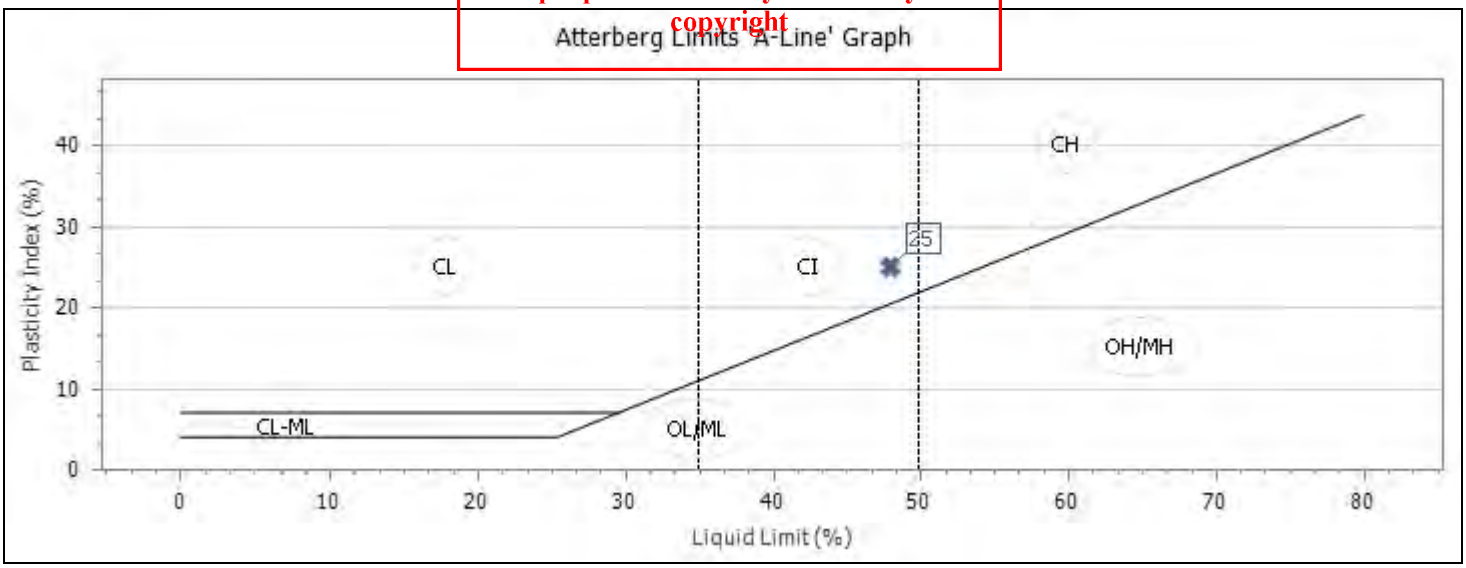
ATTERBERG LIMITS REPORT

Client:	Holcim Victoria	Report Number:	13739/R/13547-1
Client Address:	,	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7454
Supplied To:	n/a	Client Reference/s:	Quality Control Testing - Colac
Area Description:		Report Date / Page:	29/06/2020 Page 1 of 1

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	13739/S/31621	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/5934
Date Sampled	17/06/2020	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Production
Date Tested	24/06/2020	Client ID	VCOLOB
Att. Drying Method	Oven Dried	Material Source	Holcim Colac Quarry
Atterberg Preparation	Dry Sieved	Material Type	Colac Overburden (VCOLOB)
Material Description	-		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		48	
Plastic Limit (%)		23	
Plasticity Index (%)		25	
Linear Shrinkage (%)		14.0	
Linear Shrinkage Defects:	Curling		



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks	Supplement to Simplified Report Number 200629AS1047

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

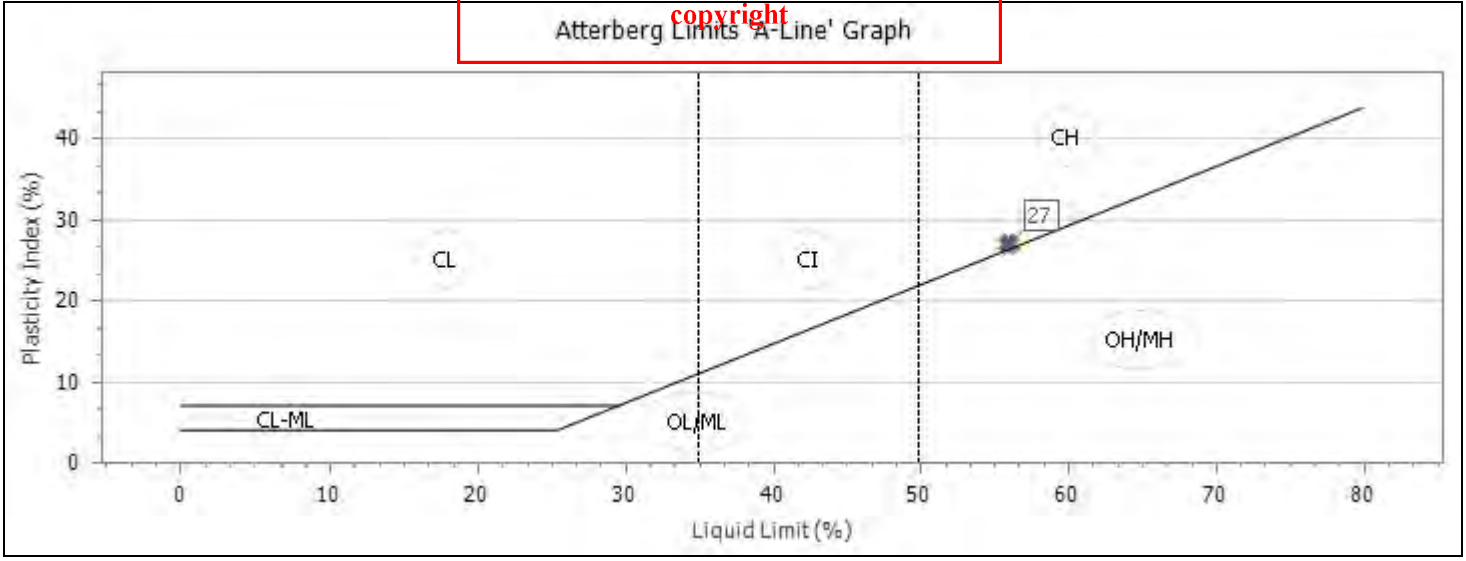
ATTERBERG LIMITS REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14135-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 1 of 10

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	13739/S/32608	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7293
Date Sampled	29/10/2020	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	10/11/2020	Client ID	VCOLOB
Att. Drying Method	Oven Dried	Material Source	Holcim Colac Quarry
Atterberg Preparation	Dry Sieved	Material Type	Colac Overburden (VCOLOB)
Material Description	CH, SANDY CLAY		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		56	
Plastic Limit (%)		29	
Plasticity Index (%)		27	
Linear Shrinkage (%)		13.5	
Linear Shrinkage Mould Length / Defects:	Mould Length: 250.7mm / Curling		



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks	Supplement to Simplified Report Number 201112AS1110

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

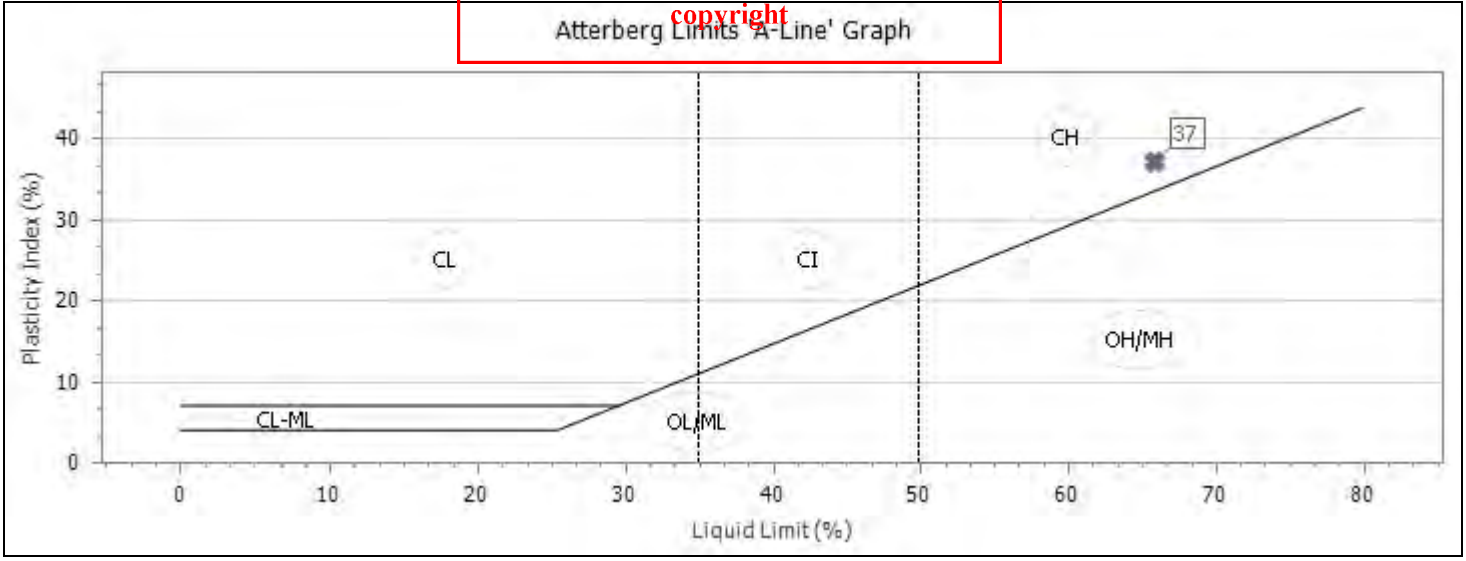
ATTERBERG LIMITS REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14135-1	
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768	
Project:	Colac Laboratory	Lot Number:		
Location:	Victoria	Internal Test Request:	13739/T/7666	
Supplied To:	n/a	Client Reference/s:	03145/CC/530	
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020	Page 2 of 10

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	13739/S/32609	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7294
Date Sampled	29/10/2020	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	10/11/2020	Client ID	VCOLOB
Att. Drying Method	Oven Dried	Material Source	Holcim Colac Quarry
Atterberg Preparation	Dry Sieved	Material Type	Colac Overburden (VCOLOB)
Material Description	CH, CLAY with sand		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		66	
Plastic Limit (%)		29	
Plasticity Index (%)		37	
Linear Shrinkage (%)		17.5	
Linear Shrinkage Mould Length / Defects:	Mould Length: 250.6mm / Curling		



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

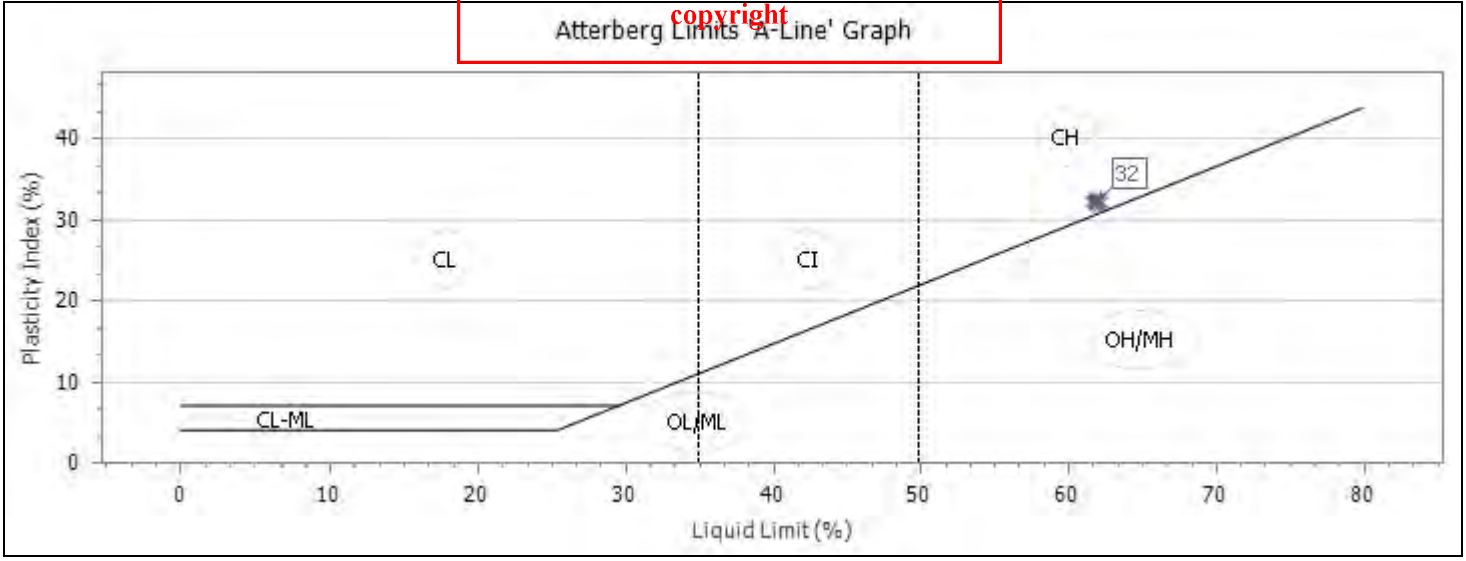
ATTERBERG LIMITS REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14135-1	
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768	
Project:	Colac Laboratory	Lot Number:		
Location:	Victoria	Internal Test Request:	13739/T/7666	
Supplied To:	n/a	Client Reference/s:	03145/CC/530	
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020	Page 3 of 10

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	13739/S/32610	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7295
Date Sampled	29/10/2020	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	10/11/2020	Client ID	VCOLOB
Att. Drying Method	Oven Dried	Material Source	Holcim Colac Quarry
Atterberg Preparation	Dry Sieved	Material Type	Colac Overburden (VCOLOB)
Material Description	CH, CLAY with sand		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		62	
Plastic Limit (%)		30	
Plasticity Index (%)		32	
Linear Shrinkage (%)		16.0	
Linear Shrinkage Mould Length / Defects:	Mould Length: 250.4mm / Curling		



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

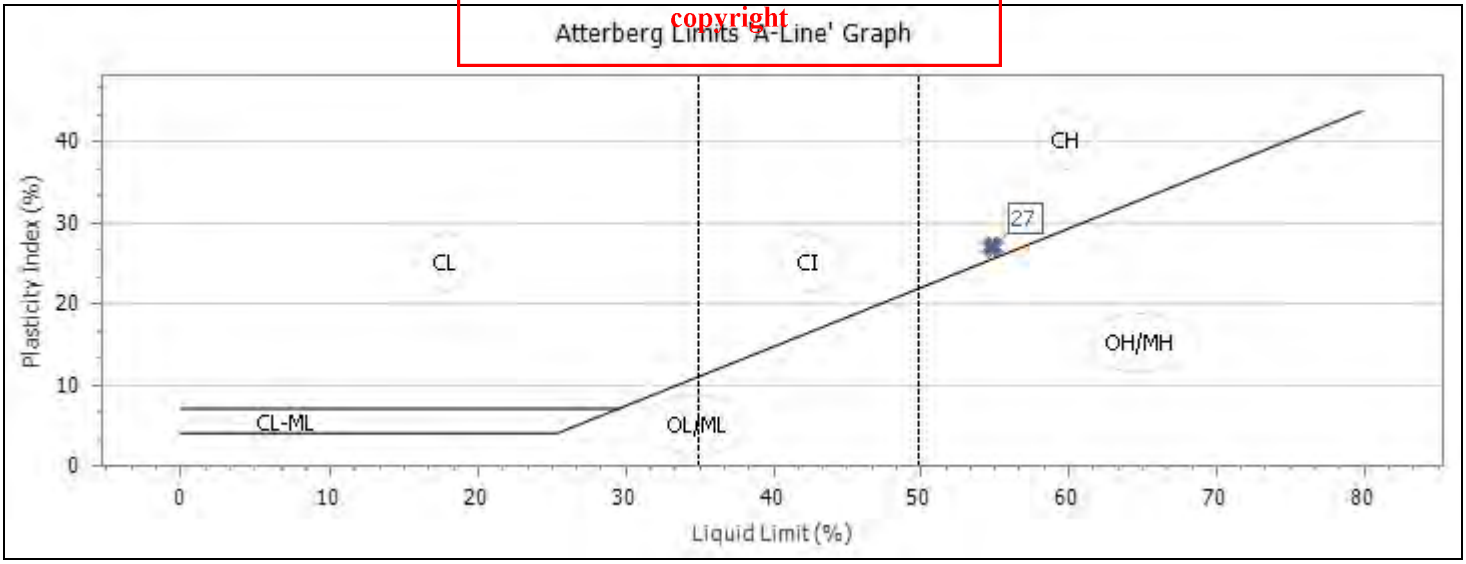
ATTERBERG LIMITS REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14135-1	
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768	
Project:	Colac Laboratory	Lot Number:		
Location:	Victoria	Internal Test Request:	13739/T/7666	
Supplied To:	n/a	Client Reference/s:	03145/CC/530	
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020	Page 4 of 10

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	13739/S/32611	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7296
Date Sampled	29/10/2020	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	10/11/2020	Client ID	VCOLOB
Att. Drying Method	Oven Dried	Material Source	Holcim Colac Quarry
Atterberg Preparation	Dry Sieved	Material Type	Colac Overburden (VCOLOB)
Material Description	CH, SANDY CLAY		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		55	
Plastic Limit (%)		28	
Plasticity Index (%)		27	
Linear Shrinkage (%)		13.0	
Linear Shrinkage Mould Length / Defects:	Mould Length: 249.8mm / Cracking		



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

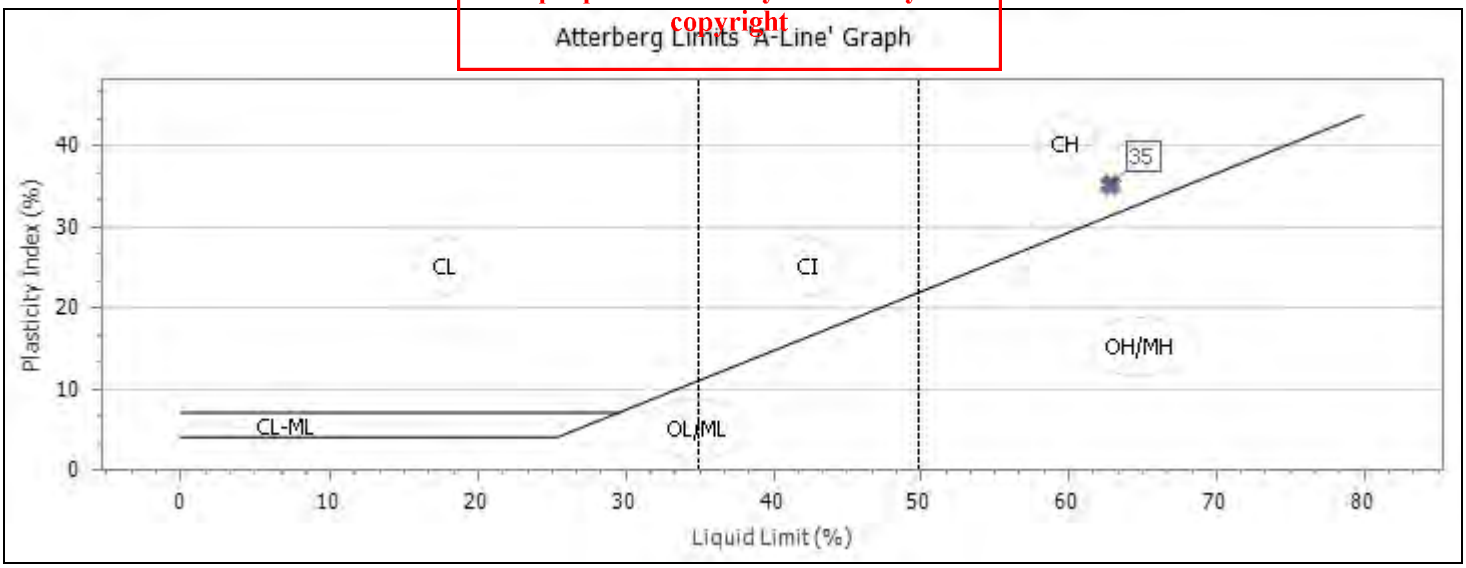
ATTERBERG LIMITS REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14135-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 5 of 10

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	13739/S/32612	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7297
Date Sampled	29/10/2020	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	10/11/2020	Client ID	VCOLOB
Att. Drying Method	Oven Dried	Material Source	Holcim Colac Quarry
Atterberg Preparation	Dry Sieved	Material Type	Colac Overburden (VCOLOB)
Material Description	CH, SANDY CLAY		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		63	
Plastic Limit (%)		28	
Plasticity Index (%)		35	
Linear Shrinkage (%)		16.5	
Linear Shrinkage Defects:	Curling		



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

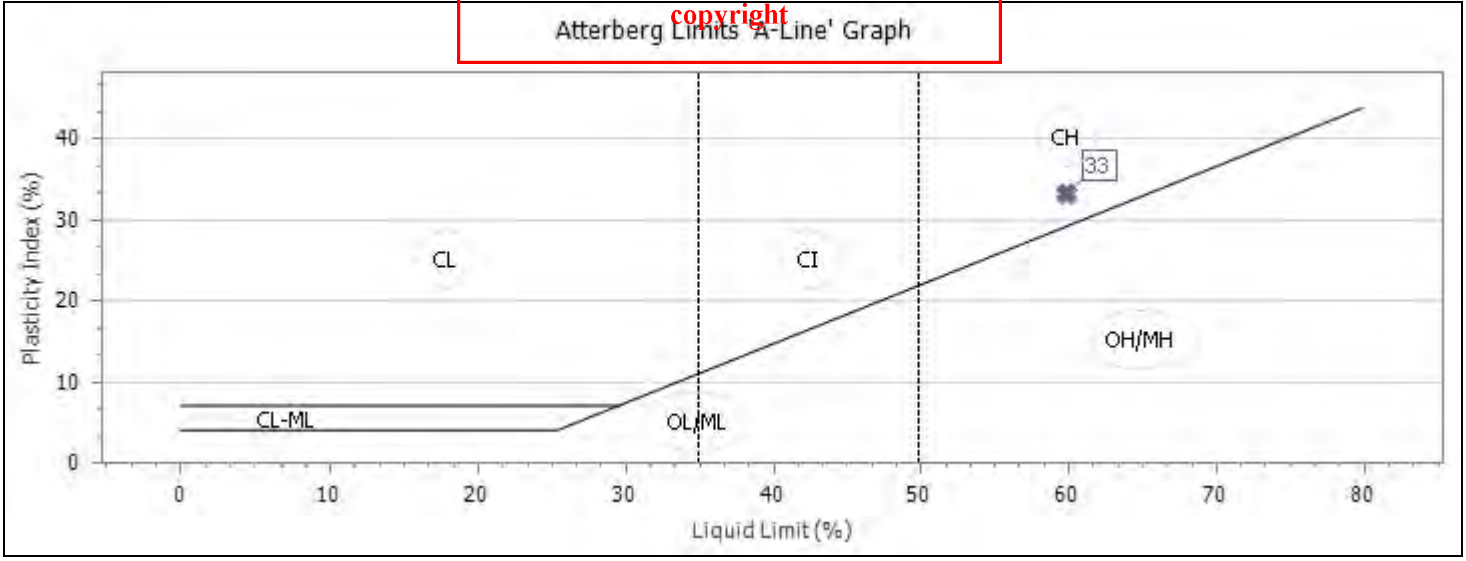
ATTERBERG LIMITS REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14135-1	
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768	
Project:	Colac Laboratory	Lot Number:		
Location:	Victoria	Internal Test Request:	13739/T/7666	
Supplied To:	n/a	Client Reference/s:	03145/CC/530	
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020	Page 6 of 10

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	13739/S/32613	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7298
Date Sampled	29/10/2020	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	10/11/2020	Client ID	VCOLOB
Att. Drying Method	Oven Dried	Material Source	Holcim Colac Quarry
Atterberg Preparation	Dry Sieved	Material Type	Colac Overburden (VCOLOB)
Material Description	CH, SANDY CLAY		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		60	
Plastic Limit (%)		27	
Plasticity Index (%)		33	
Linear Shrinkage (%)		16.0	
Linear Shrinkage Mould Length / Defects:	Mould Length: 249.6mm / Curling		



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks	Supplement to Simplified Report Number 201112AS1110

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

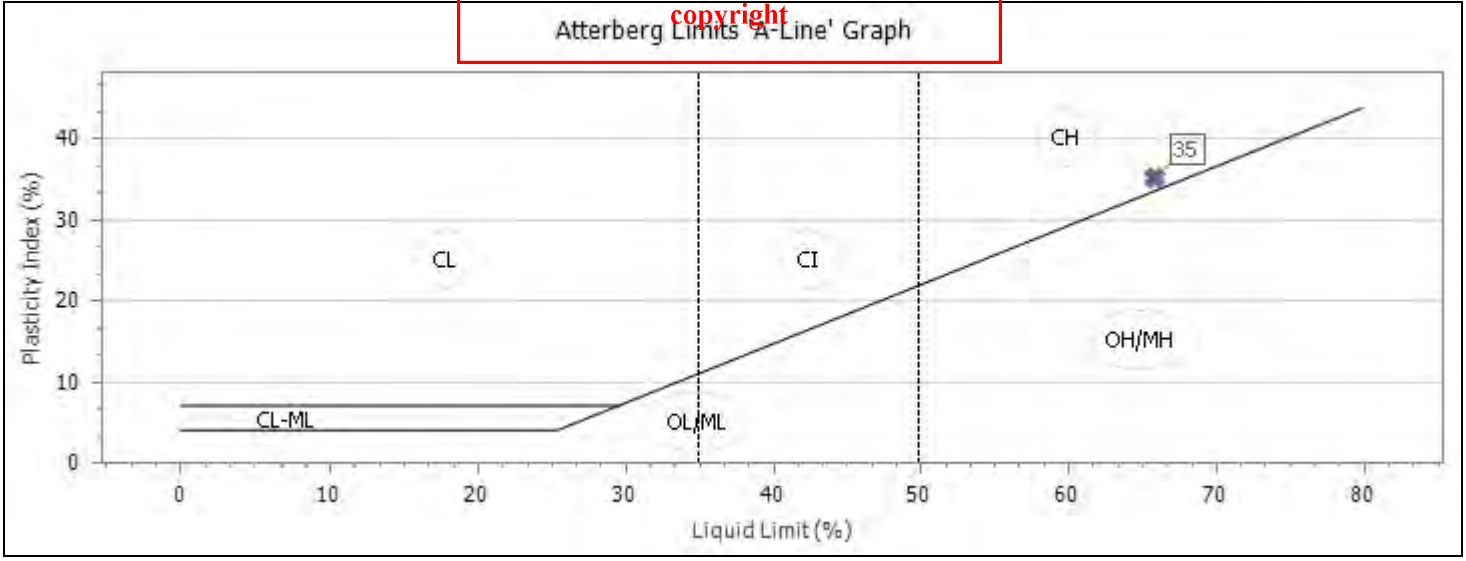
ATTERBERG LIMITS REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14135-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 7 of 10

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	13739/S/32614	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7299
Date Sampled	29/10/2020	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	11/11/2020	Client ID	VCOLOB
Att. Drying Method	Oven Dried	Material Source	Holcim Colac Quarry
Atterberg Preparation	Dry Sieved	Material Type	Colac Overburden (VCOLOB)
Material Description	CH, SANDY CLAY		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		66	
Plastic Limit (%)		31	
Plasticity Index (%)		35	
Linear Shrinkage (%)		16.5	
Linear Shrinkage Mould Length / Defects:	Mould Length: 249.6mm / Curling		



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

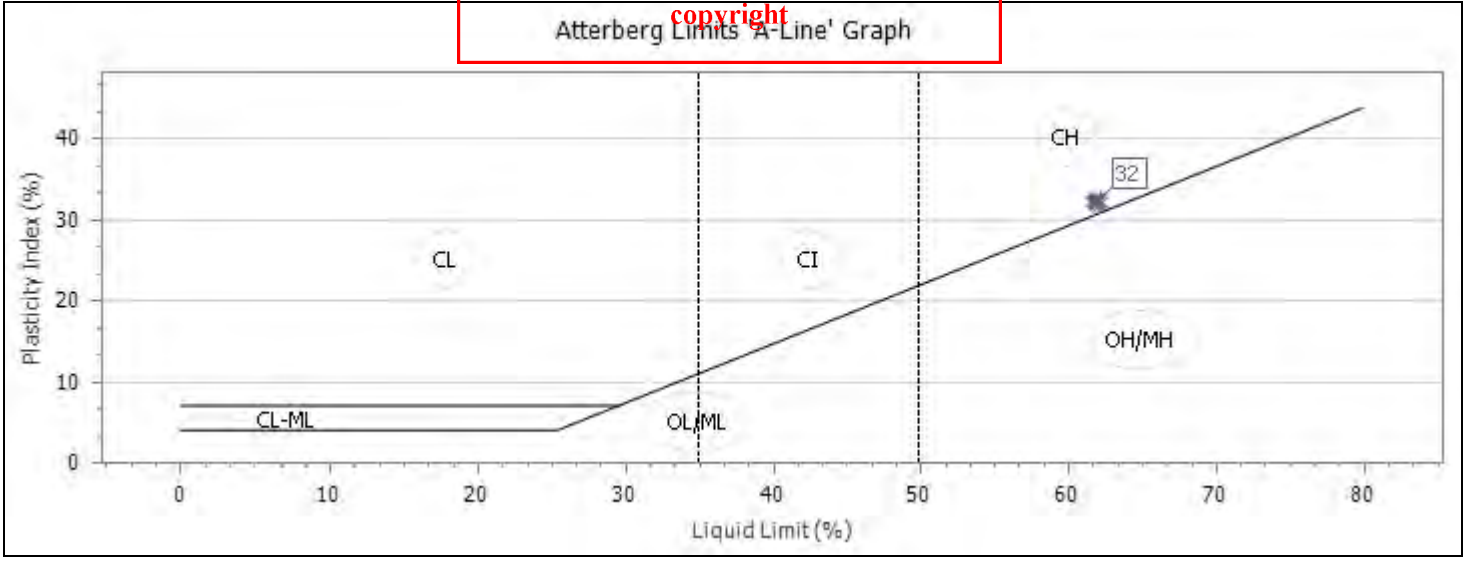
ATTERBERG LIMITS REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14135-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 8 of 10

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	13739/S/32615	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7300
Date Sampled	29/10/2020	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	11/11/2020	Client ID	VCOLOB
Att. Drying Method	Oven Dried	Material Source	Holcim Colac Quarry
Atterberg Preparation	Dry Sieved	Material Type	Colac Overburden (VCOLOB)
Material Description	CH, SANDY CLAY		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		62	
Plastic Limit (%)		30	
Plasticity Index (%)		32	
Linear Shrinkage (%)		15.5	
Linear Shrinkage Mould Length / Defects:	Mould Length: 250.7mm / Curling		



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

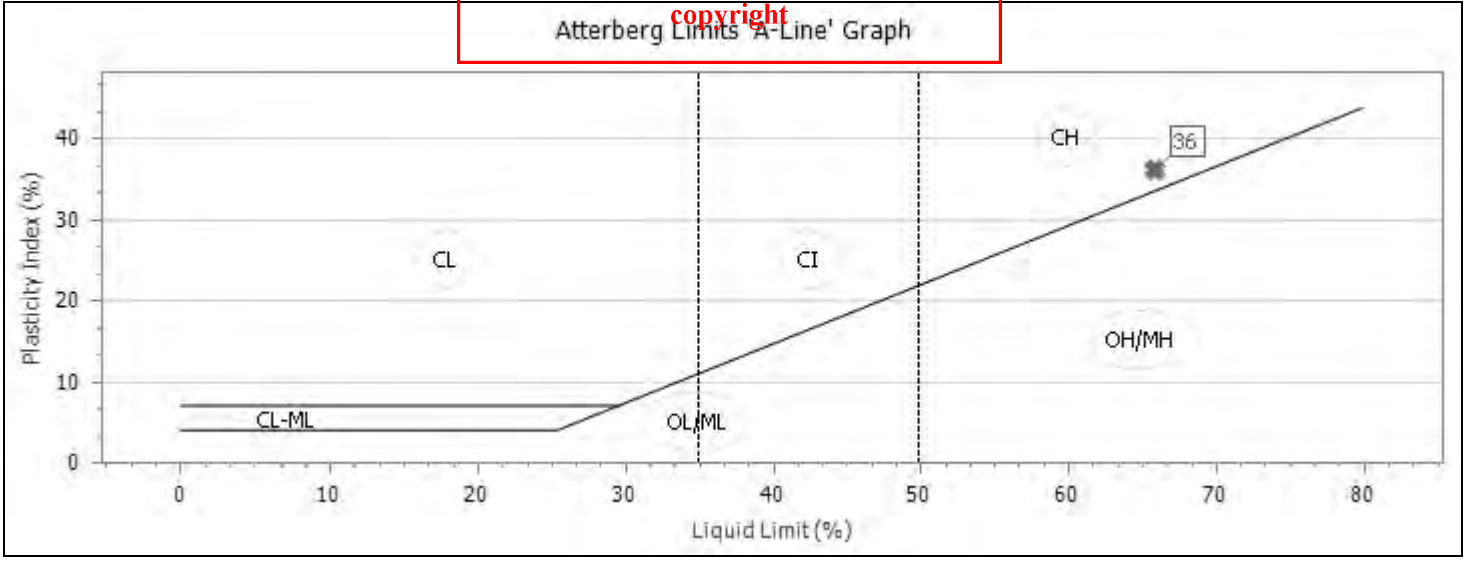
ATTERBERG LIMITS REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14135-1
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7666
Supplied To:	n/a	Client Reference/s:	03145/CC/530
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020 Page 9 of 10

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	13739/S/32616	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7301
Date Sampled	29/10/2020	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	11/11/2020	Client ID	VCOLOB
Att. Drying Method	Oven Dried	Material Source	Holcim Colac Quarry
Atterberg Preparation	Dry Sieved	Material Type	Colac Overburden (VCOLOB)
Material Description	CH, SANDY CLAY		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		66	
Plastic Limit (%)		30	
Plasticity Index (%)		36	
Linear Shrinkage (%)		17.0	
Linear Shrinkage Mould Length / Defects:	Mould Length: 250.6mm / Curling		



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

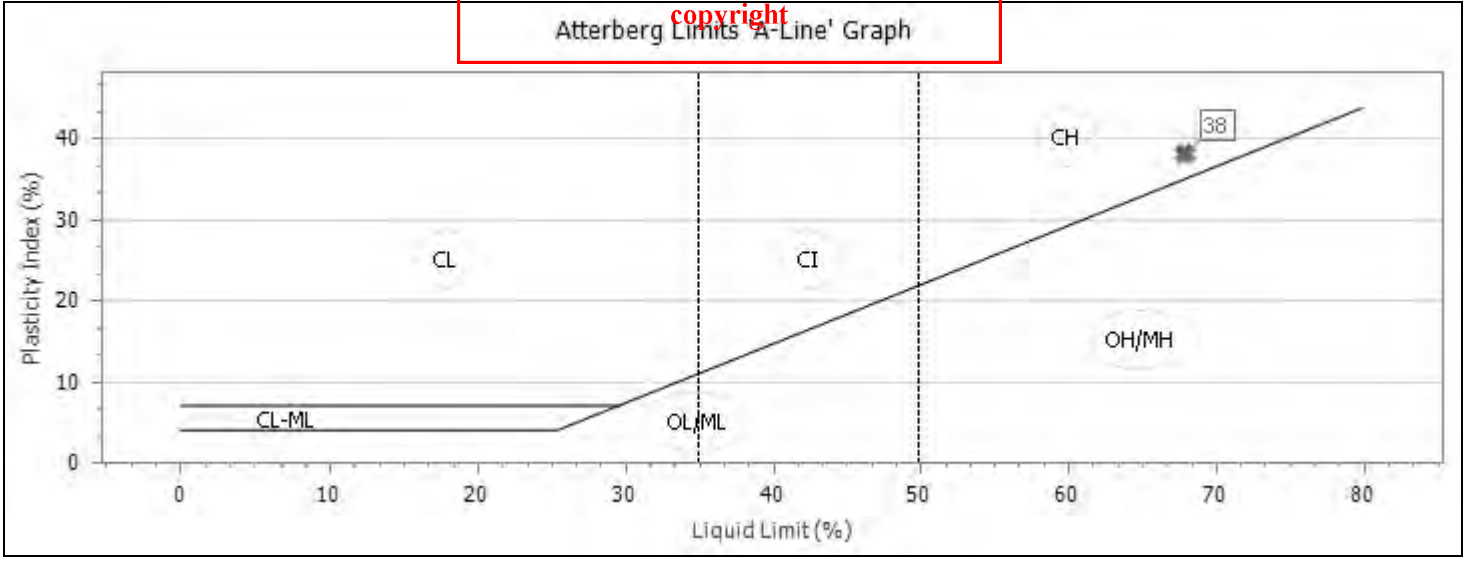
ATTERBERG LIMITS REPORT

Client:	Holcim Victoria	Report Number:	13739/R/14135-1	
Client Address:	P.O. Box 1513, Milton	Project Number:	13739/P/768	
Project:	Colac Laboratory	Lot Number:		
Location:	Victoria	Internal Test Request:	13739/T/7666	
Supplied To:	n/a	Client Reference/s:	03145/CC/530	
Area Description:	Quality Control Testing - Colac	Report Date / Page:	12/11/2020	Page 10 of 10

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	13739/S/32617	Sample Location	
Sampling Method	AS1141.3.1 Cl 9.3	Tested as Received	S/7302
Date Sampled	29/10/2020	Suppliers Name	Stockpile
Sampled By	Joseph Hards	Accreditation No.	Stockpile
Date Tested	11/11/2020	Client ID	VCOLOB
Att. Drying Method	Oven Dried	Material Source	Holcim Colac Quarry
Atterberg Preparation	Dry Sieved	Material Type	Colac Overburden (VCOLOB)
Material Description	CH, SANDY CLAY		

Atterberg Limits Results

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		68	
Plastic Limit (%)		30	
Plasticity Index (%)		38	
Linear Shrinkage (%)		17.0	
Linear Shrinkage Mould Length / Defects:	Mould Length: 249.8mm / Curling		



(AS1726 'A-Line' Graph Not Covered By NATA Endorsement)

Remarks	Supplement to Simplified Report Number 201112AS1110

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W11Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
326-328 Barkley Street,
Ararat Vic 3377

Laboratory: Ararat Laboratory

EMERSON CLASS NUMBER REPORT

Client:	Holcim Victoria	Report Number:	13739/R/13548-1
Client Address:	,	Project Number:	13739/P/768
Project:	Colac Laboratory	Lot Number:	
Location:	Victoria	Internal Test Request:	13739/T/7454
Supplied To:	n/a	Client Reference/s:	Quality Control Testing - Colac
Area Description:		Report Date / Page:	29/06/2020 Page 1 of 1

Test Procedures:	AS1289.3.8.1

Sample Number	13739/S/31621			
ID / Client ID	03145/S/5934			
Lot Number	-			
Date / Time Sampled	17/06/2020 15:00			
Date Tested	24/06/2020			
Material Source	Holcim Colac Quarry			
Material Type	Colac Overburden (VCOLOB)			
Sampling Method	AS1141.3.1 Cl 9.3			
Water Type	Distilled			
Water Temperature (C°)	16			
Tested as Received	S/5934			
Suppliers Name	Stockpile			
Accreditation No.	Production			
Client ID	VCOLOB			
Soil Description	-			
Emerson Class Number	**3**			

Remarks	Supplement to Simplified Report Number 200629AS1047

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025 - Testing

Accreditation Number: 1986
Corporate Site Number: 13739

Approved Signatory: Ashwin Singh
Form ID: W34Rep Rev 2

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

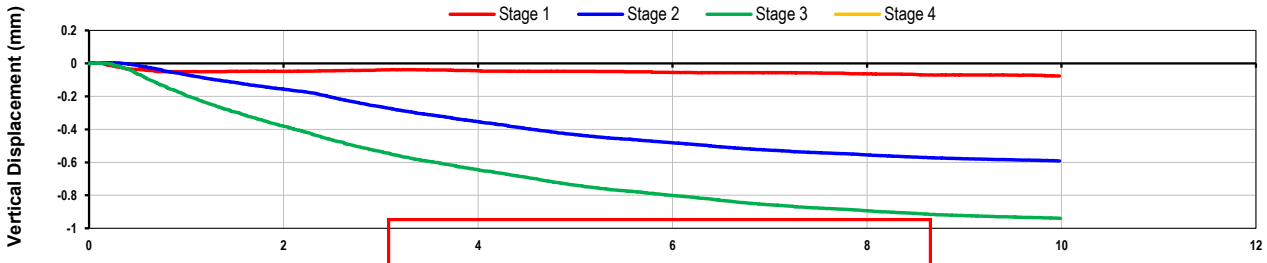
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

DIRECT SHEAR TEST REPORT

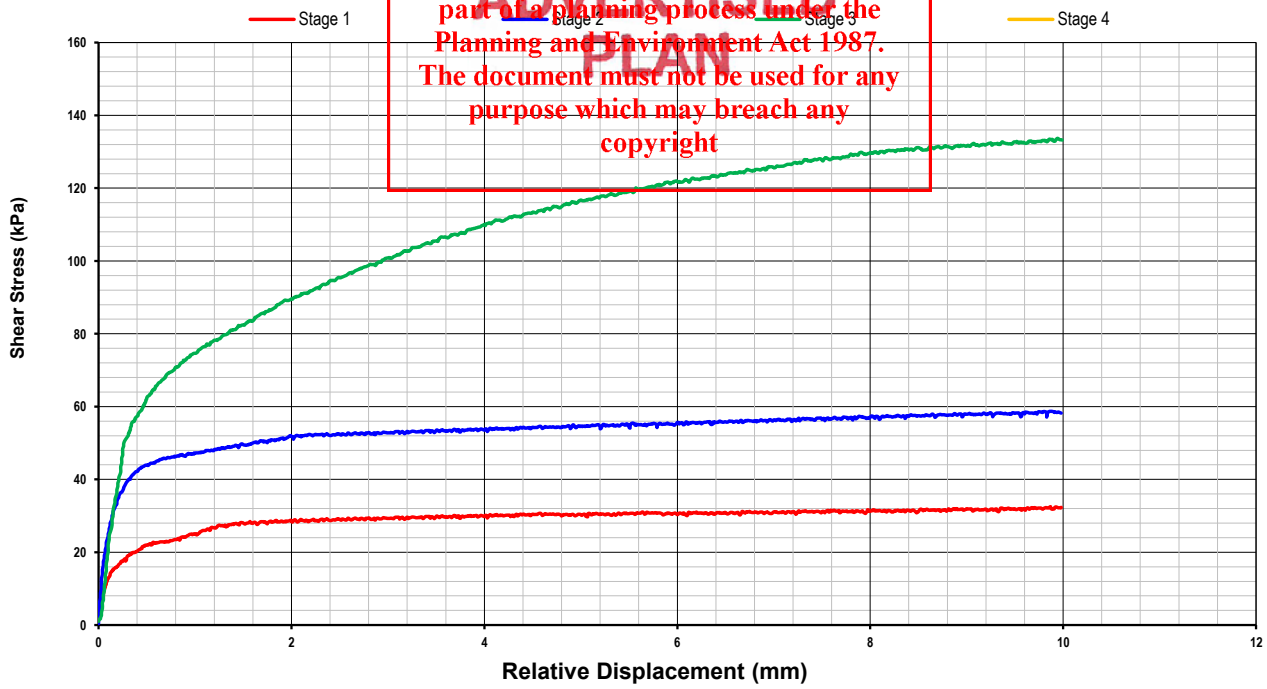
Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120123- DS
		Workorder No	0010514
Address	229 Woodward Road GOLDEN SQUARE VIC 3555	**Test Date**	26/01/2023
		Report Date	22/02/2023
Project	13739/P/858 - Quality Control Testing		
Client ID	Pit 1/ 0.5 / Sample 1 / NDA - 13739/S/42177	**Depth (m)**	Not Supplied
Description	-		
Sample Type	Three individual soil specimens - Remoulded to 92% of MDD @ 100% of OMC as requested by client.		

Vertical Displacement/Relative Displacement Plot



Shear Stress/Displacement Plot



Notes/Remarks: Tested As Requested

Note: Area correction based on square sample equation.

Graph not to scale — Sample/s supplied by the client

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Tested at Trilab Brisbane Laboratory

Authorised Signatory

J. Rasmussen

NATA WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

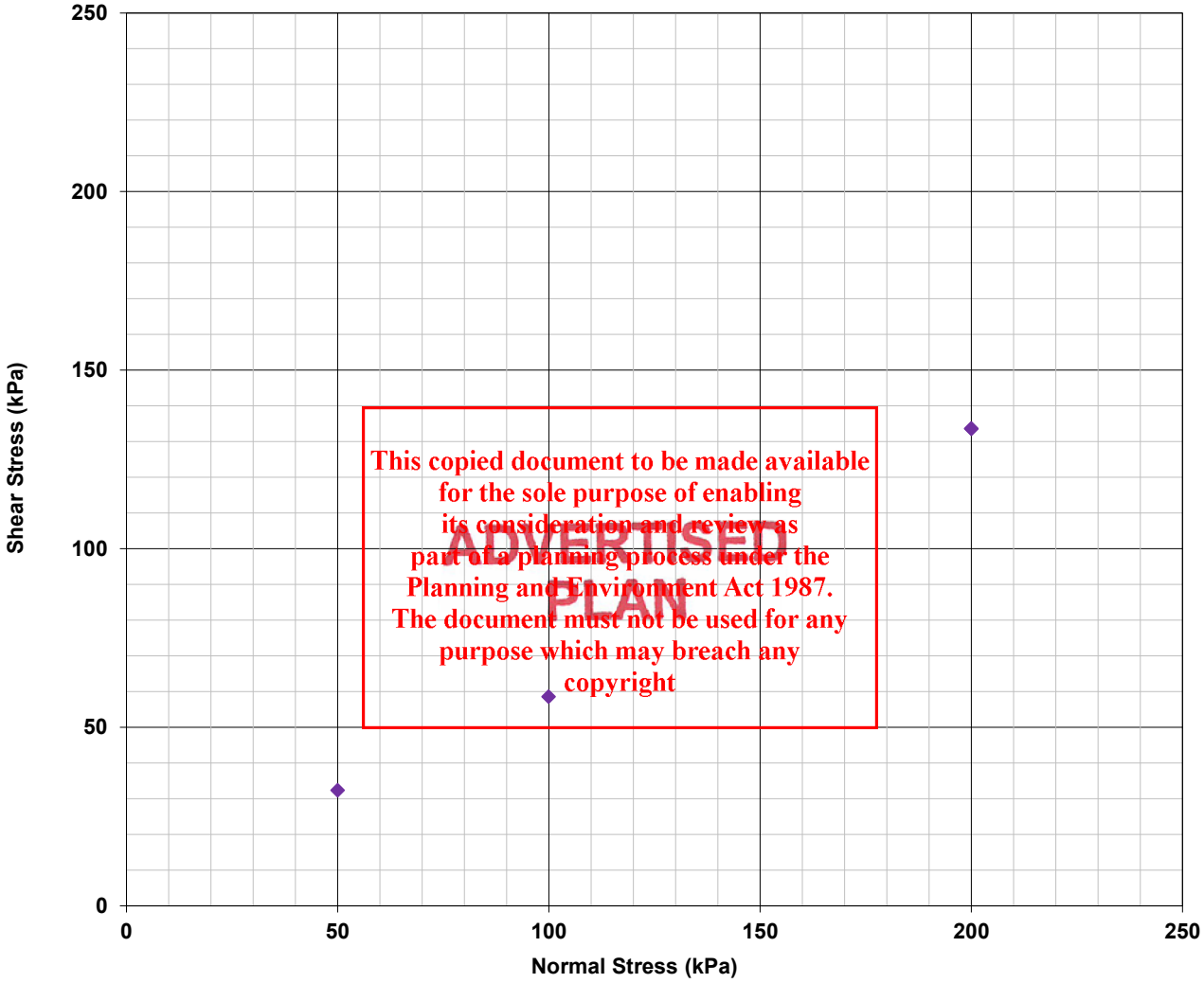
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120123- DS
Failure Criteria	**Residual @ 10 , 10 , 10 , mm Displacement**		

Residual - Normal Stress vs Shear Stress



Shear Angle (°)	**34.4**	**Cohesion (kPa)**	**-5.2**	**R^2**	**0.997**
Specimen Condition	Inundated	Normal Stress (kPa)		Corrected Shear Stress (kPa)	
Specimen Dimensions (mm)	100 * 100	Stage 1	50.0		32.3
Initial Height (mm)	42.0	Stage 2	99.9		58.5
Rate of Strain (mm/min)	0.008	Stage 3	200.0		133.6
Initial Moisture Content (%)	22.3				
Initial Wet Density(t/m^3)	1.79				
Initial Dry Density(t/m^3)	1.46				

Graph not to scale

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Authorised Signatory
J. Rasmussen

NATA
WORLD RECOGNISED ACCREDITATION

Tested at Trilab Brisbane Laboratory

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

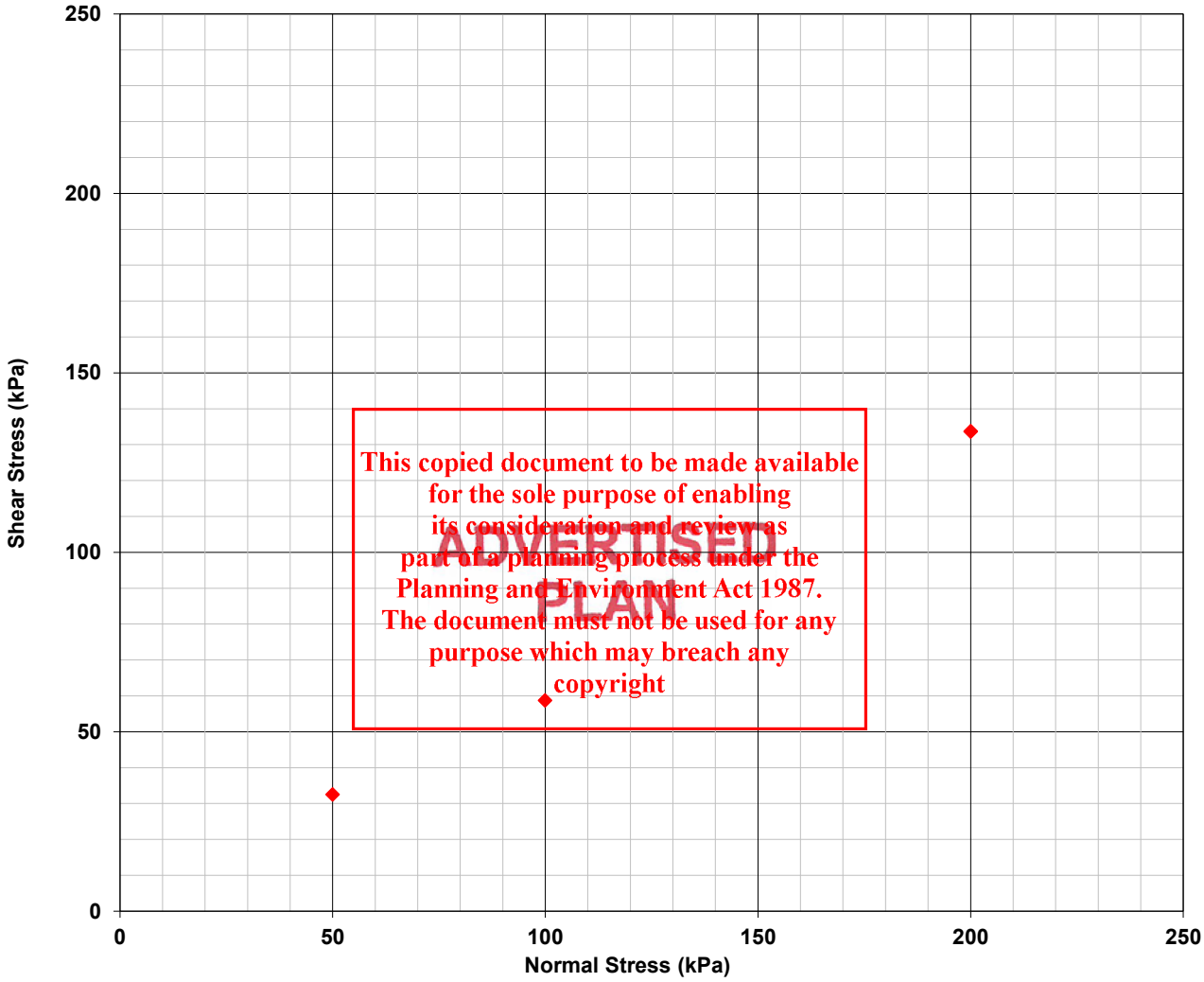
DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120123- DS

Failure Criteria **Peak**

Peak - Normal Stress vs Shear Stress



Shear Angle (°) 34.4	Cohesion (kPa) -4.9	R^2 0.997

		Normal Stress (kPa)	Corrected Shear Stress (kPa)
Specimen Condition	Inundated		
Specimen Dimensions (mm)	100 * 100	Stage 1	50.0	32.5
Initial Height (mm)	42.0	Stage 2	99.9	58.7
Rate of Strain (mm/min)	0.008	Stage 3	200.0	133.7
Initial Moisture Content (%)	22.3			
Initial Wet Density(t/m^3)	1.79			
Initial Dry Density(t/m3)	1.46			

Graph not to scale

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Tested at Trilab Brisbane Laboratory

Authorised Signatory
J. Rasmussen

NATA
WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

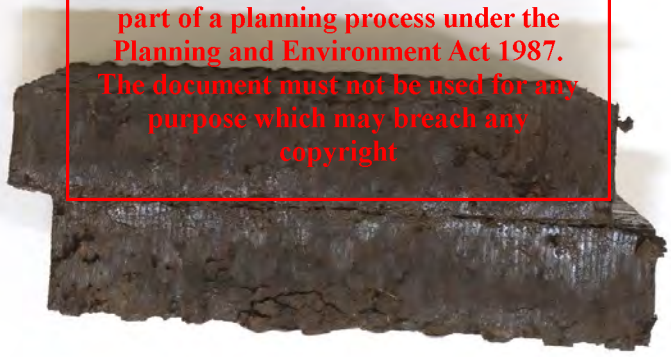
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120123- DS

CLIENT:	Construction Sciences Pty Ltd	
PROJECT:	13739/P/858 - Quality Control Testing	AFTER TEST
LAB SAMPLE No.	22120123	DATE: 31/01/2023
BOREHOLE:	Pit 1/ 0.5 / Sample 1 / NDA - 13739/S/42177	DEPTH: Not Supplied



Notes/Remarks:

Photo not to scale

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Tested at Trilab Brisbane Laboratory

Authorised Signatory

J. Rasmussen

NATA WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

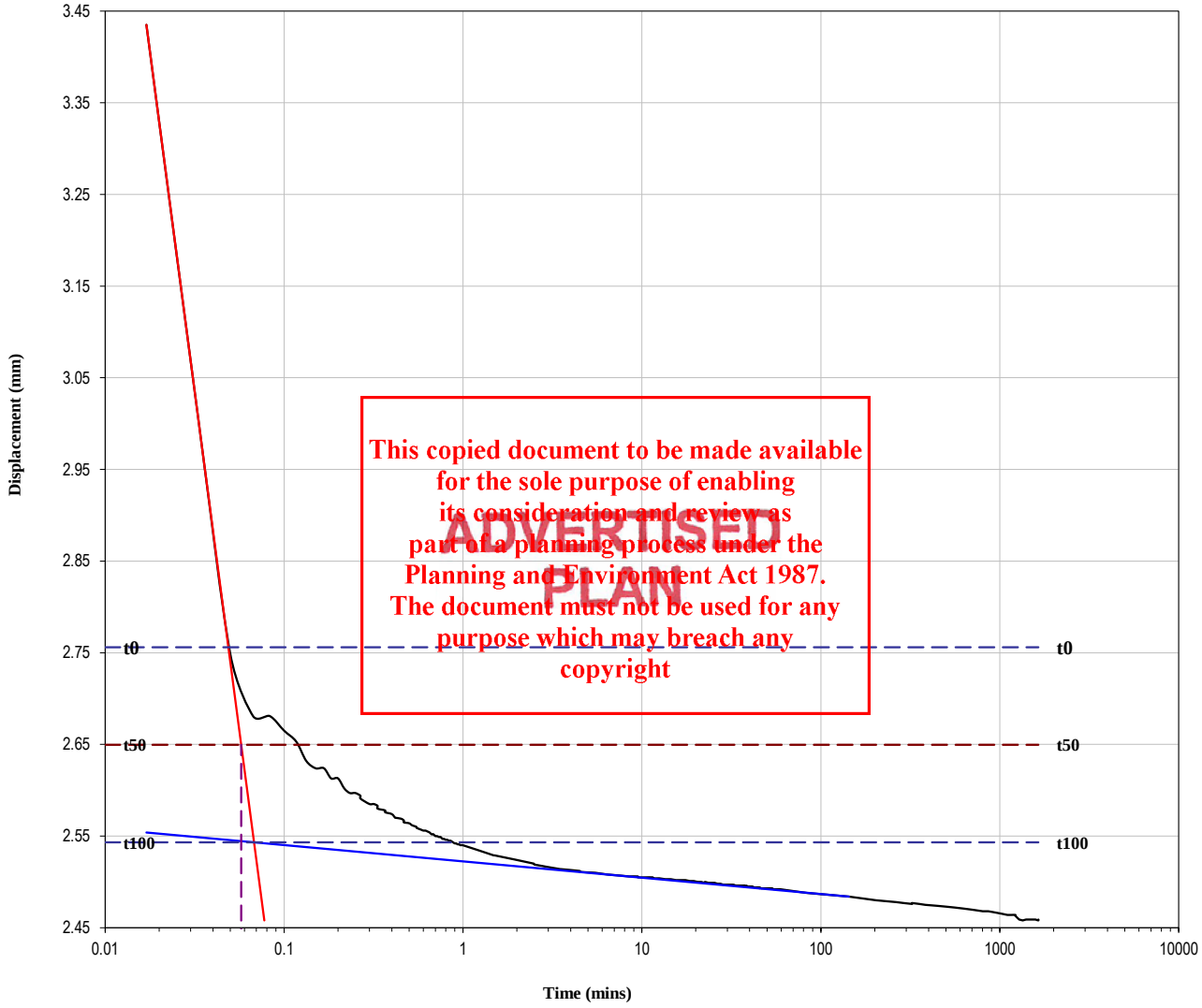
DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120123- DS

Stage 1 Consolidation

Displacement v's Time (Log Scale)



t_{50}	0.06	mins
t_{100}	0.07	mins
Time to Failure =	132.48	mins
Estimated Displacement to Failure =	10	mm
Displacement Rate =	0.0754829	mm/min

Notes/Remarks:

Graph not to scale

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Tested at Trilab Brisbane Laboratory

Authorised Signatory

J. Rasmussen

NATA WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

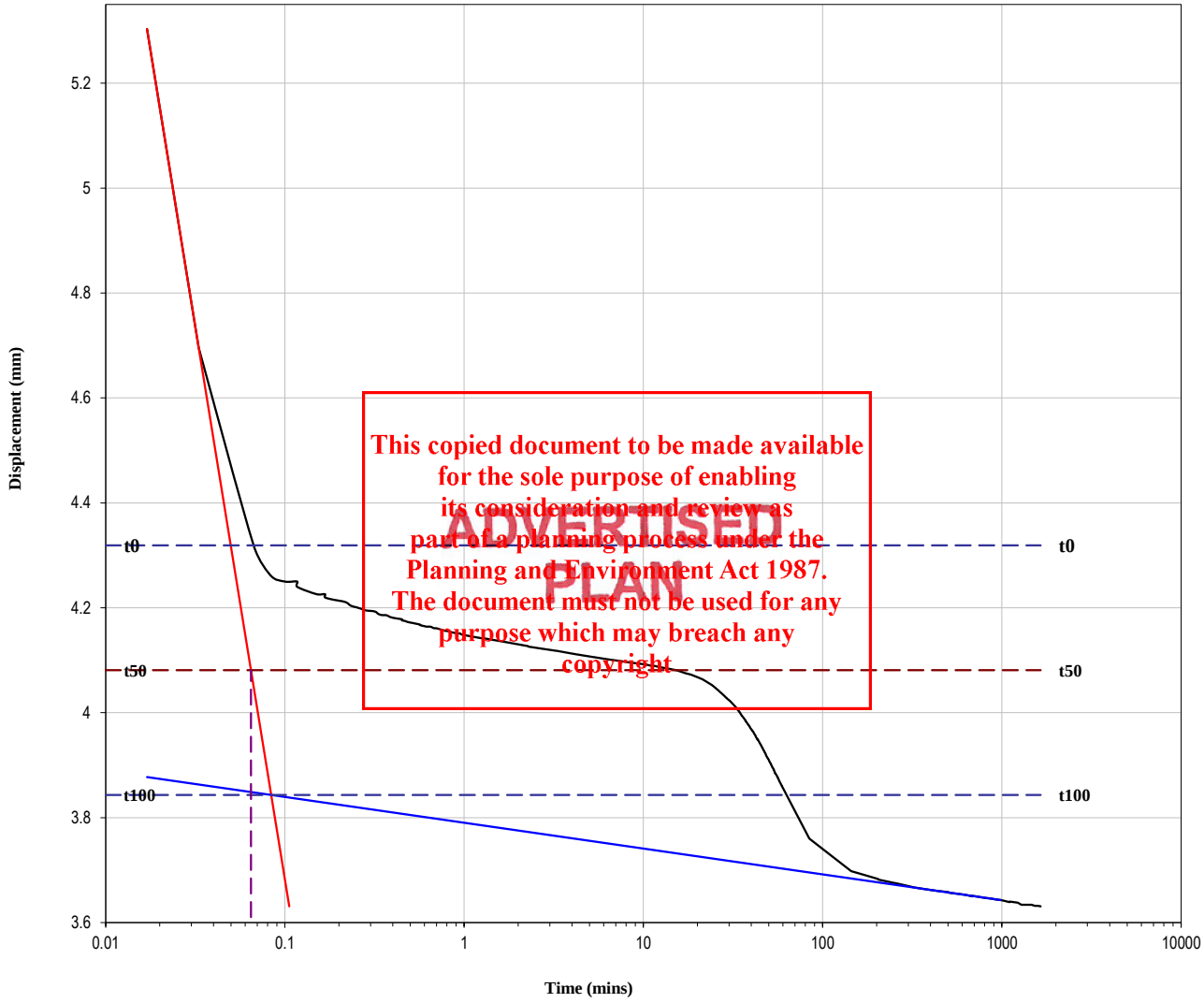
DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120123- DS

Stage 2 Consolidation

Displacement v's Time (Log Scale)



t_{50}	0.06	mins
t_{100}	0.08	mins
Time to Failure =	204.06	mins
Estimated Displacement to Failure =	10	mm
Displacement Rate =	0.0490059	mm/min

Notes/Remarks:

Graph not to scale

Tested at Trilab Brisbane Laboratory

Authorised Signatory
J. Rasmussen

NATA
WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

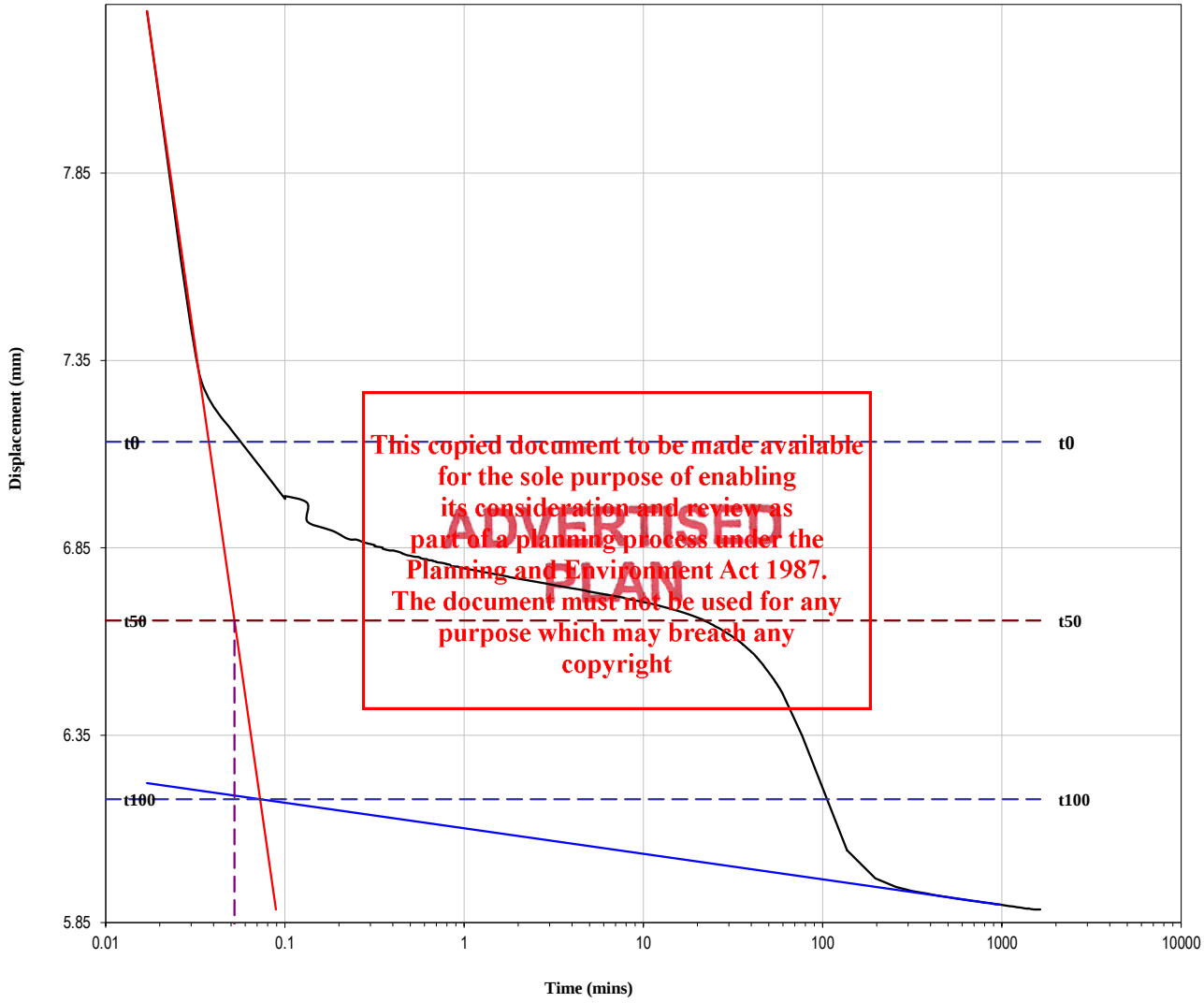
DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120123- DS

Stage 3 Consolidation

Displacement v's Time (Log Scale)



t_{50}	0.05	mins
t_{100}	0.07	mins
Time to Failure =	332.80	mins
Estimated Displacement to Failure =	10	mm
Displacement Rate =	0.0300476	mm/min

Notes/Remarks:

Graph not to scale

Tested at Trilab Brisbane Laboratory

Authorised Signatory
J. Rasmussen

NATA
WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

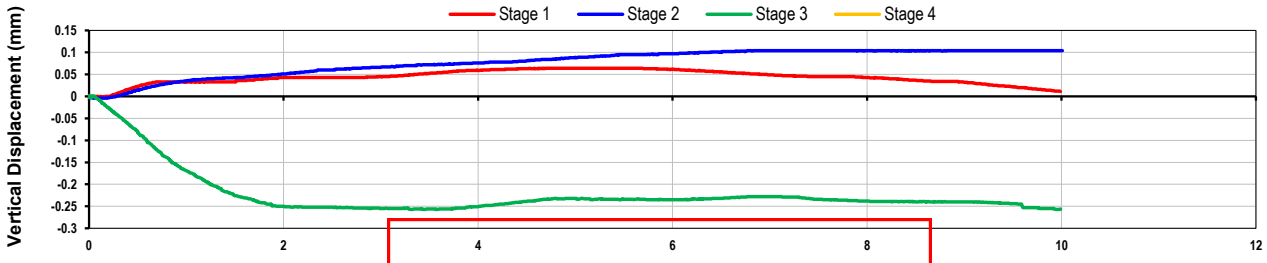
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

DIRECT SHEAR TEST REPORT

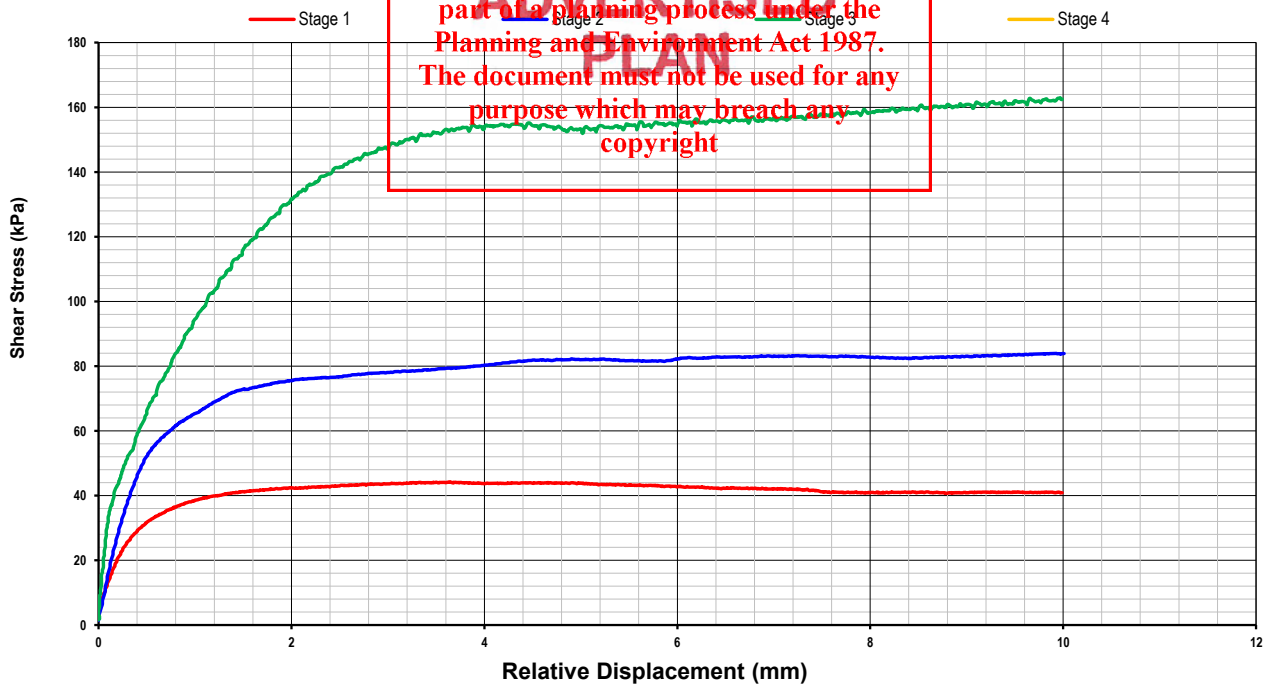
Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120124- DS
		Workorder No	0010514
Address	229 Woodward Road GOLDEN SQUARE VIC 3555	**Test Date**	31/01/2023
		Report Date	22/02/2023
Project	13739/P/858 - Quality Control Testing		
Client ID	Pit 2/ 0.5 / Sample 1 / NDA - 13739/S/42179	**Depth (m)**	Not Supplied
Description	-		
Sample Type	Three individual soil specimens - Remoulded to 95% of MDD @ 100% of OMC as requested by client.		

Vertical Displacement/Relative Displacement Plot



Shear Stress/Displacement Plot



Notes/Remarks: Tested As Requested

Note: Area correction based on square sample equation.

Graph not to scale

Sample/s supplied by the client

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Tested at Trilab Brisbane Laboratory

Authorised Signatory

J. Rasmussen

NATA
WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

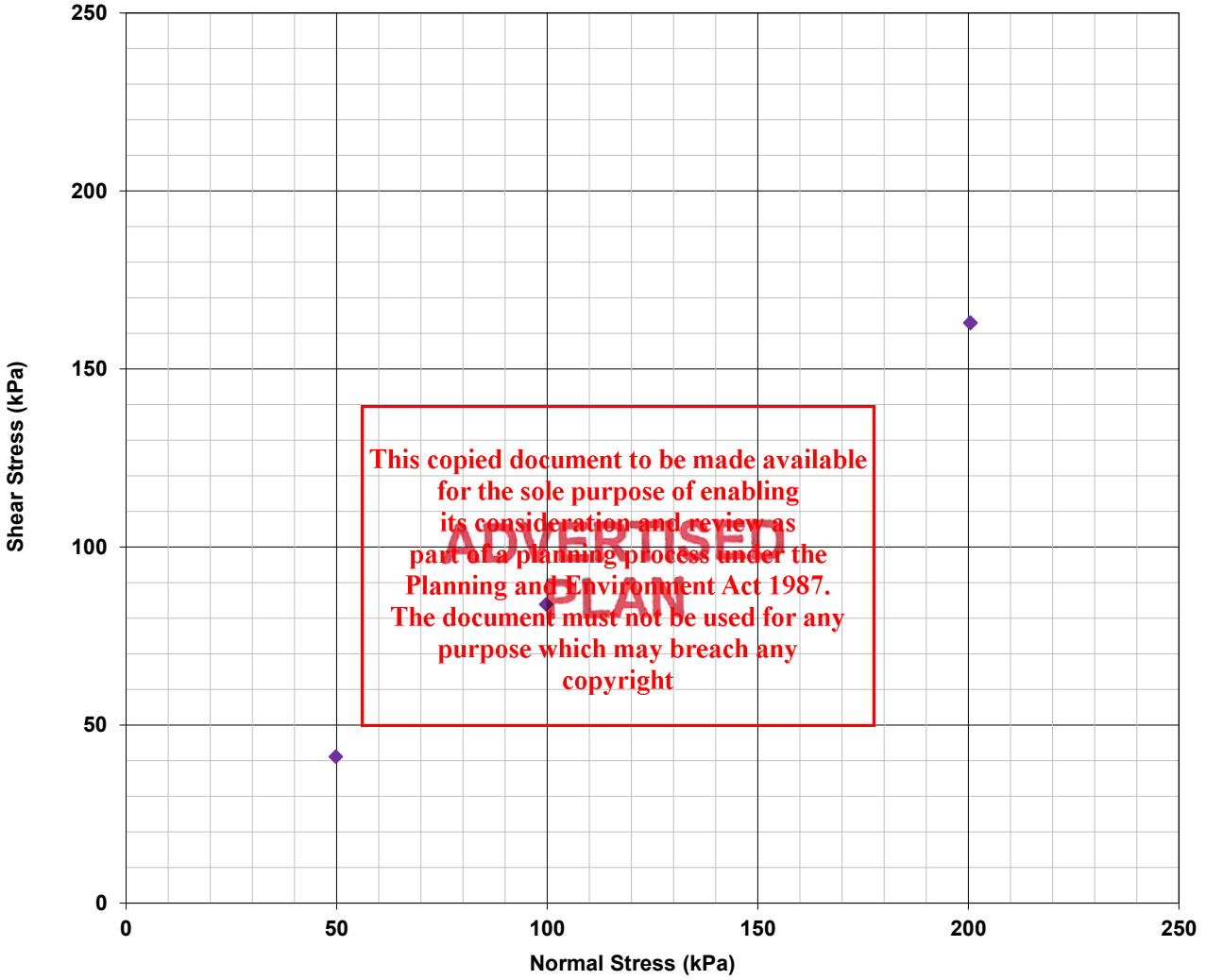
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120124- DS
Failure Criteria	**Residual @ 10 , 10 , 10 , mm Displacement**		

Residual - Normal Stress vs Shear Stress



Shear Angle (°)	38.8	Cohesion (kPa)	2.0	R^2	1.000
Specimen Condition	Inundated	Normal Stress (kPa)		Corrected Shear Stress (kPa)	
Specimen Dimensions (mm)	100 * 100	Stage 1	49.8		41.1
Initial Height (mm)	36.0	Stage 2	99.8		83.9
Rate of Strain (mm/min)	0.008	Stage 3	200.5		162.9
Initial Moisture Content (%)	17.0				
Initial Wet Density(t/m^3)	1.91				
Initial Dry Density(t/m^3)	1.63				

Graph not to scale

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Authorised Signatory
J. Rasmussen

NATA
WORLD RECOGNISED ACCREDITATION

Tested at Trilab Brisbane Laboratory

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

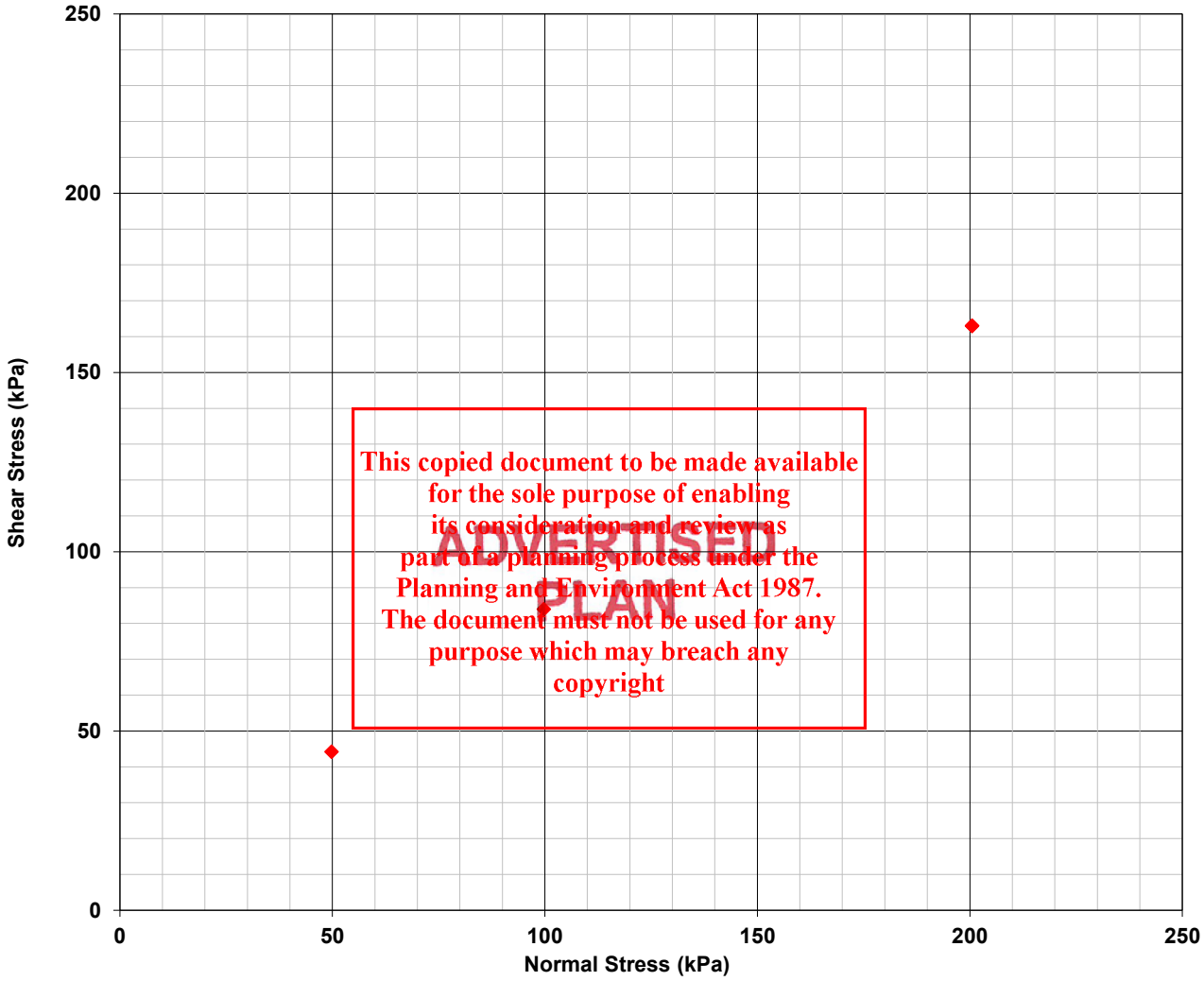
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120124- DS
Failure Criteria		**Peak**	

Peak - Normal Stress vs Shear Stress



Shear Angle (°) 38.2		**Cohesion (kPa)** 5.1		**R^2** 1.000
Specimen Condition	Inundated	Normal Stress (kPa)		Corrected Shear Stress (kPa)
Specimen Dimensions (mm)	100 * 100	Stage 1	49.8	44.2
Initial Height (mm)	36.0	Stage 2	99.8	83.9
Rate of Strain (mm/min)	0.008	Stage 3	200.5	162.9
Initial Moisture Content (%)	17.0			
Initial Wet Density(t/m^3)	1.91			
Initial Dry Density(t/m3)	1.63			

Graph not to scale

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Tested at Trilab Brisbane Laboratory

Authorised Signatory
J. Rasmussen

NATA
WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

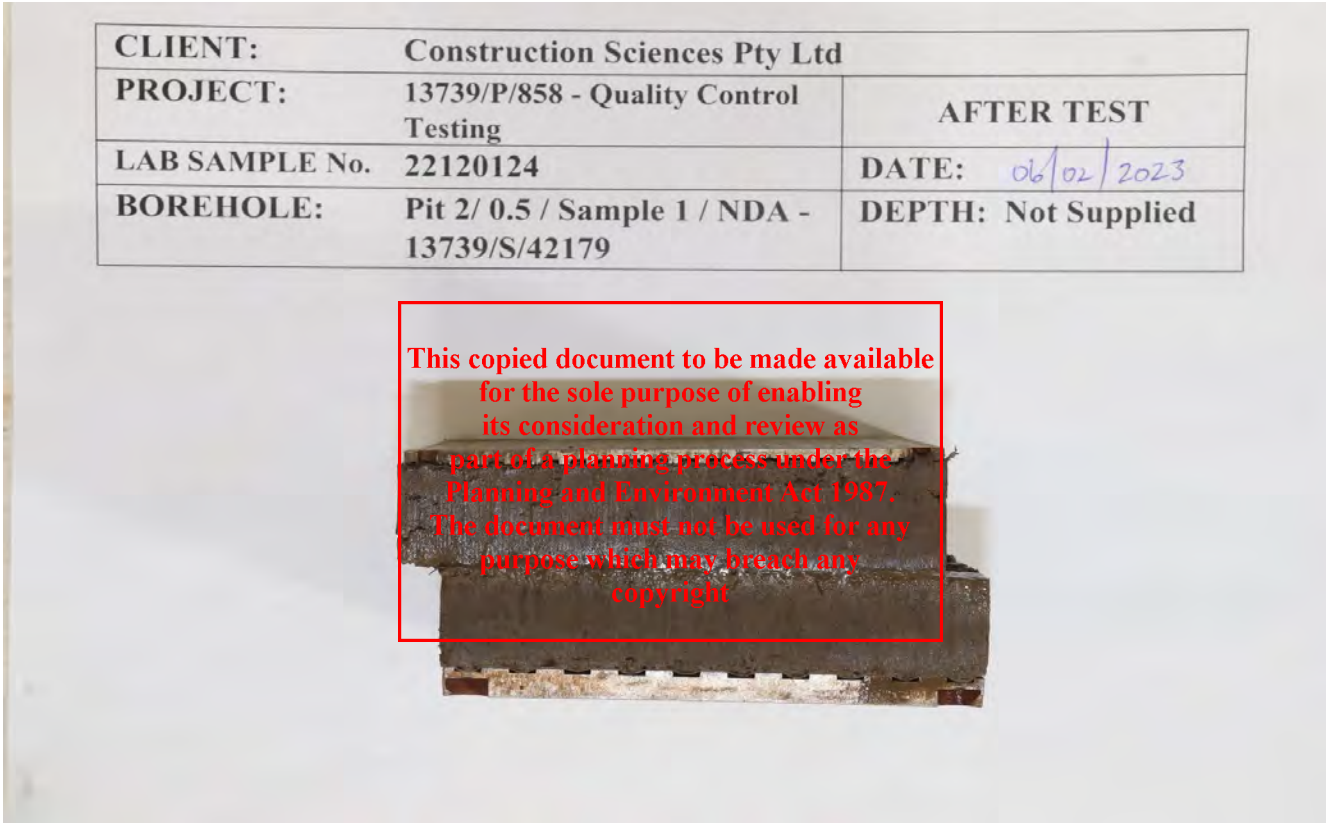
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120124- DS

CLIENT:	Construction Sciences Pty Ltd	
PROJECT:	13739/P/858 - Quality Control Testing	AFTER TEST
LAB SAMPLE No.	22120124	DATE: 06/02/2023
BOREHOLE:	Pit 2/ 0.5 / Sample 1 / NDA - 13739/S/42179	DEPTH: Not Supplied



Notes/Remarks:

Photo not to scale

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Tested at Trilab Brisbane Laboratory

Authorised Signatory

J. Rasmussen

NATA WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

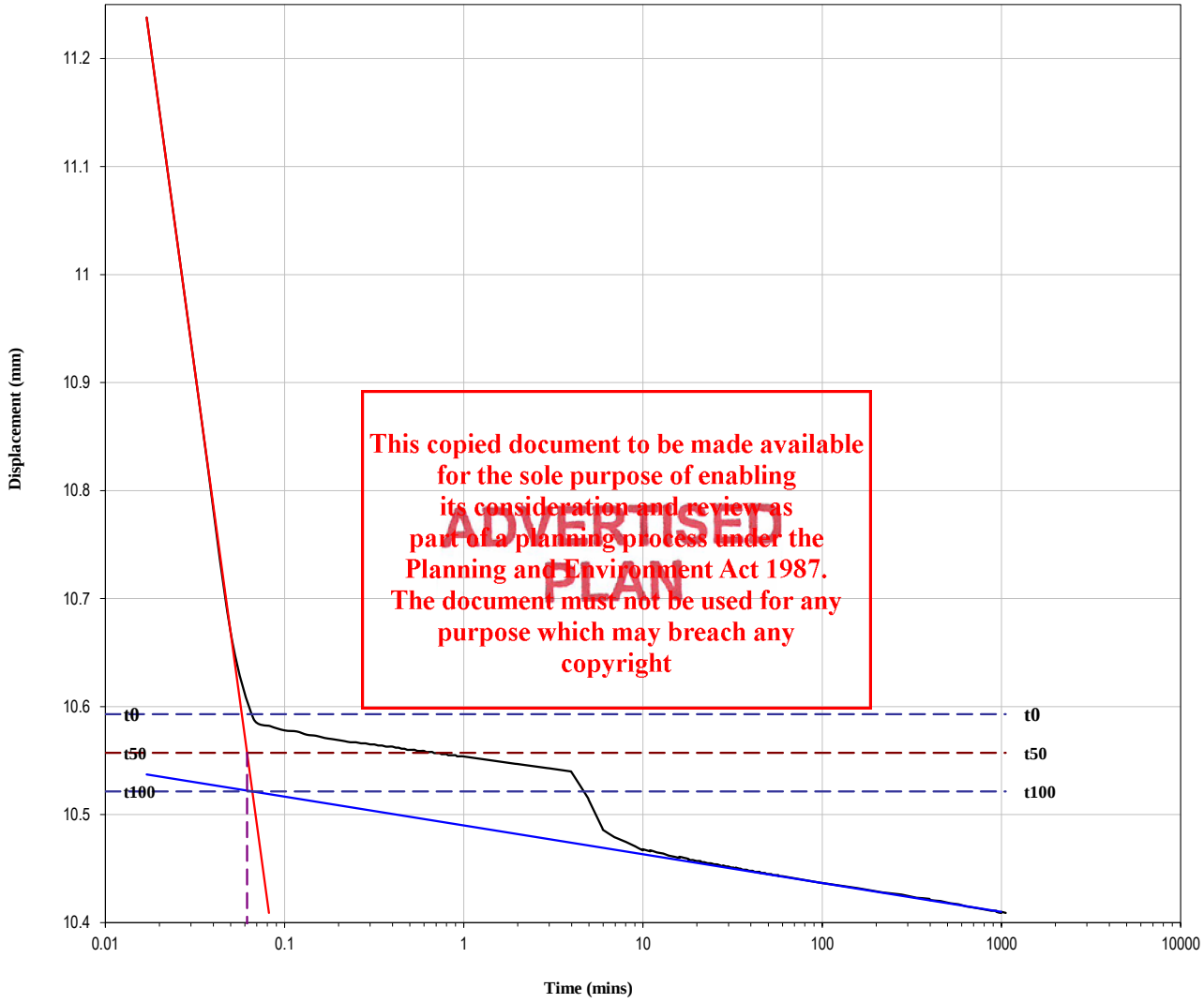
DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120124- DS

Stage 1 Consolidation

Displacement v's Time (Log Scale)



t_{50}	0.06	mins
t_{100}	0.07	mins
Time to Failure =	527.86	mins
Estimated Displacement to Failure =	10	mm
Displacement Rate =	0.0189443	mm/min

Notes/Remarks:

Graph not to scale

Tested at Trilab Brisbane Laboratory

Authorised Signatory

J. Rasmussen

NATA
WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

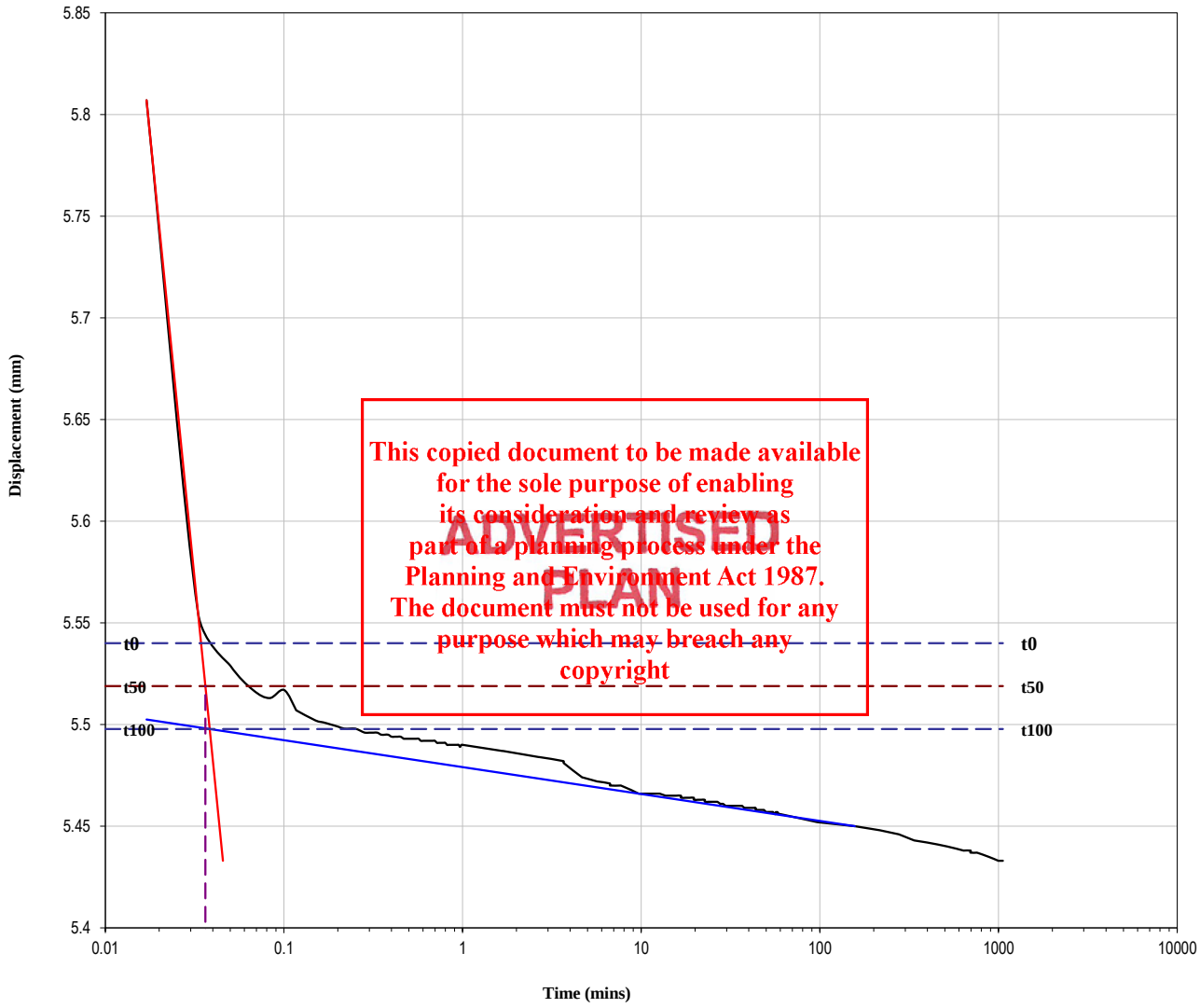
DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120124- DS

Stage 2 Consolidation

Displacement v's Time (Log Scale)



t_{50}	0.04	mins
t_{100}	0.04	mins
Time to Failure =	275.94	mins
Estimated Displacement to Failure =	10	mm
Displacement Rate =	0.0362391	mm/min

Notes/Remarks:

Graph not to scale

Tested at Trilab Brisbane Laboratory

Authorised Signatory

J. Rasmussen

NATA
WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

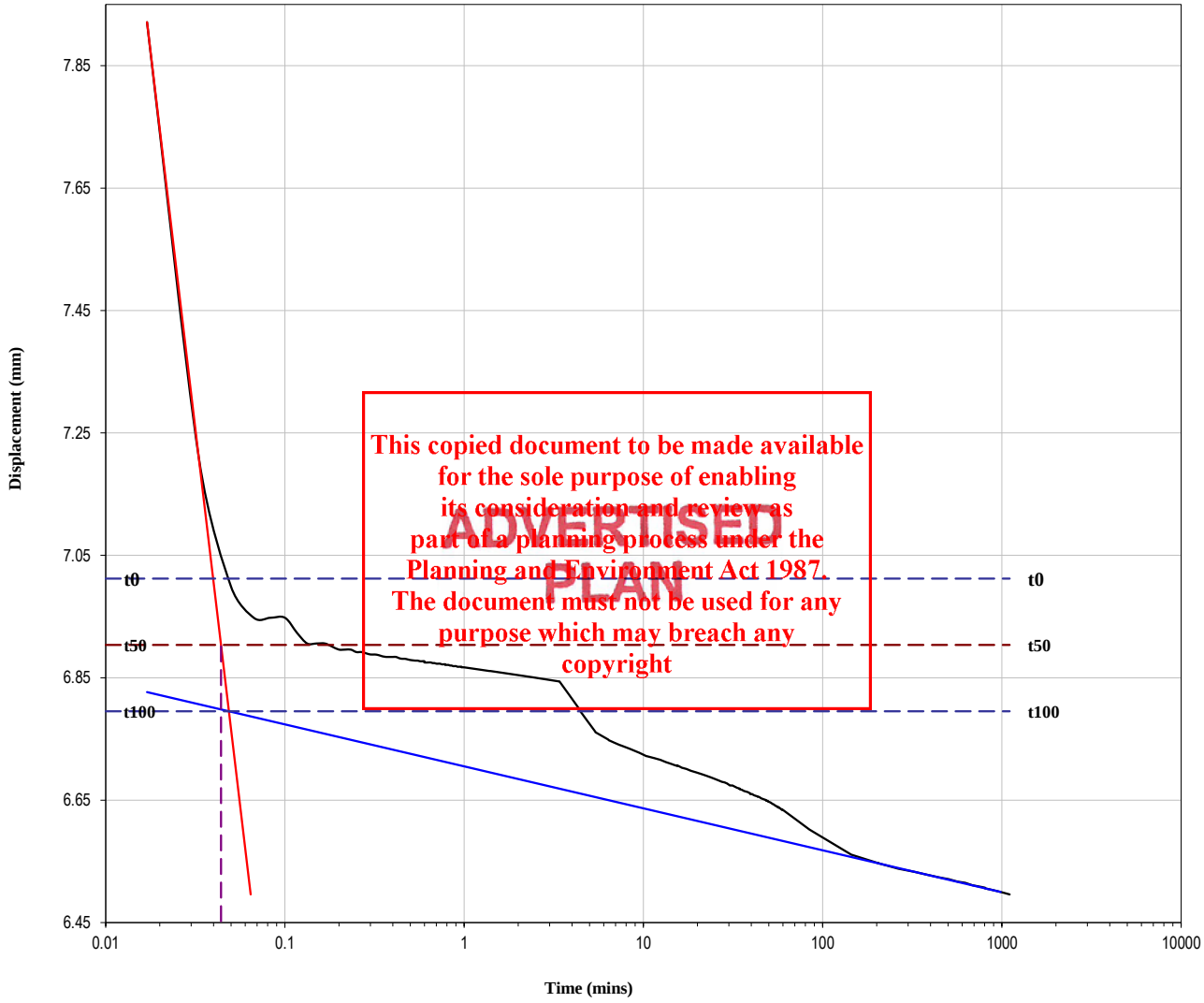
DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120124- DS

Stage 3 Consolidation

Displacement v's Time (Log Scale)



t_{50}	0.04	mins
t_{100}	0.05	mins
Time to Failure =	345.18	mins
Estimated Displacement to Failure =	5	mm
Displacement Rate =	0.0144852	mm/min

Notes/Remarks:

Graph not to scale

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Tested at Trilab Brisbane Laboratory

Authorised Signatory
J. Rasmussen

NATA
WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

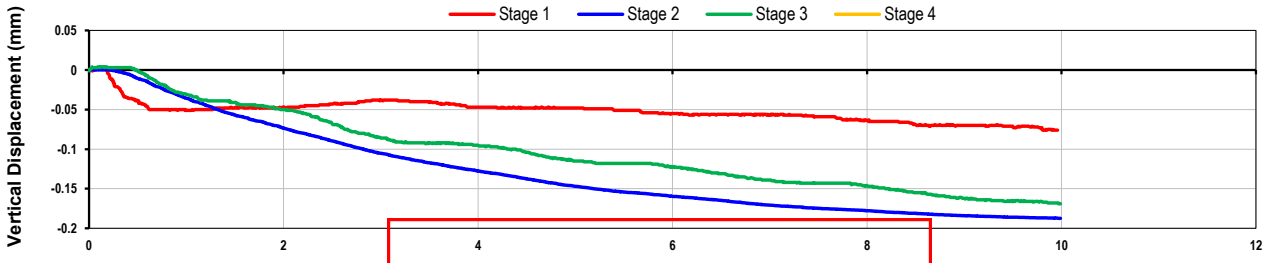
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

DIRECT SHEAR TEST REPORT

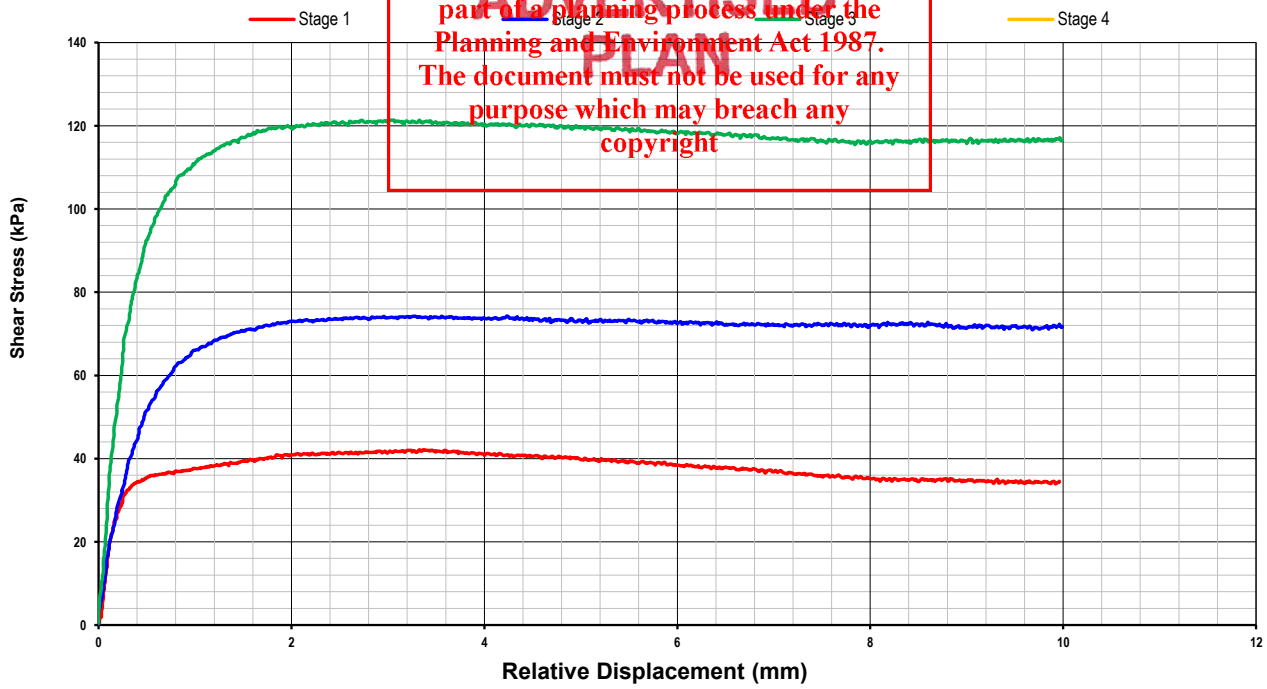
Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120125- DS
		Workorder No	0010514
Address	229 Woodward Road GOLDEN SQUARE VIC 3555	**Test Date**	31/01/2023
		Report Date	22/02/2023
Project	13739/P/858 - Quality Control Testing		
Client ID	Overburden / N/A / Sample 1 / SDA - 13739/S/42181	**Depth (m)**	Not Supplied
Description	-		
Sample Type	Three individual soil specimens - Remoulded to 98% of MDD @ 100% of OMC as requested by client.		

Vertical Displacement/Relative Displacement Plot



Shear Stress/Displacement Plot



Notes/Remarks: Tested As Requested

Note: Area correction based on square sample equation.

Graph not to scale

Sample/s supplied by the client

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Tested at Trilab Brisbane Laboratory

Authorised Signatory

J. Rasmussen

NATA WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

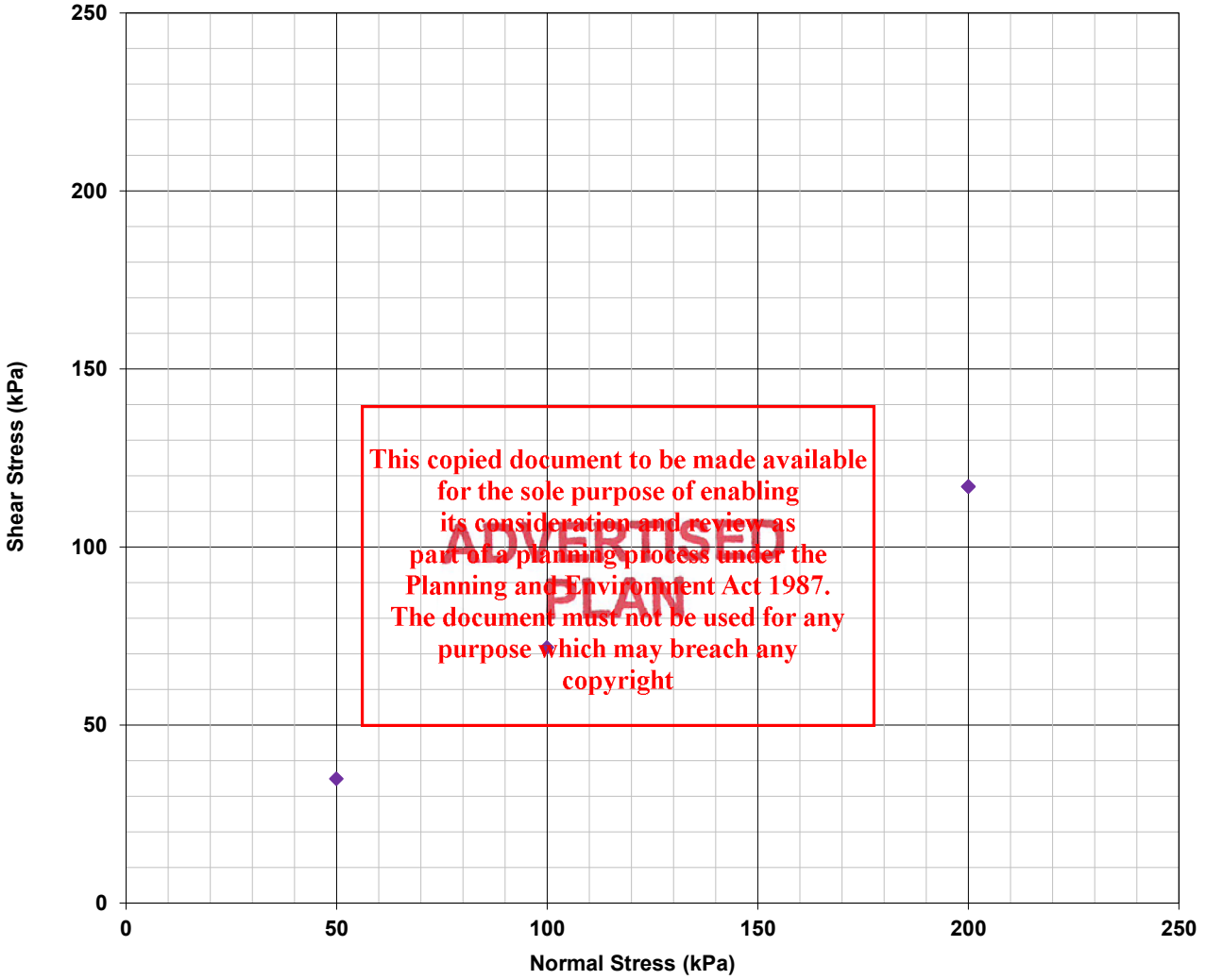
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120125- DS
Failure Criteria	**Residual @ 9 , 9 , 9 , mm Displacement**		

Residual - Normal Stress vs Shear Stress



Shear Angle (°)	**28.1**	**Cohesion (kPa)**	**12.4**	**R^2**	**0.991**
Specimen Condition	Inundated	Normal Stress (kPa)		Corrected Shear Stress (kPa)	
Specimen Dimensions (mm)	100 * 100	Stage 1	49.9		34.9
Initial Height (mm)	42.0	Stage 2	99.9		71.8
Rate of Strain (mm/min)	0.008	Stage 3	200.0		117.0
Initial Moisture Content (%)	22.4				
Initial Wet Density(t/m^3)	1.91				
Initial Dry Density(t/m^3)	1.56				

Graph not to scale

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Authorised Signatory
J. Rasmussen

NATA
WORLD RECOGNISED ACCREDITATION

Tested at Trilab Brisbane Laboratory

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

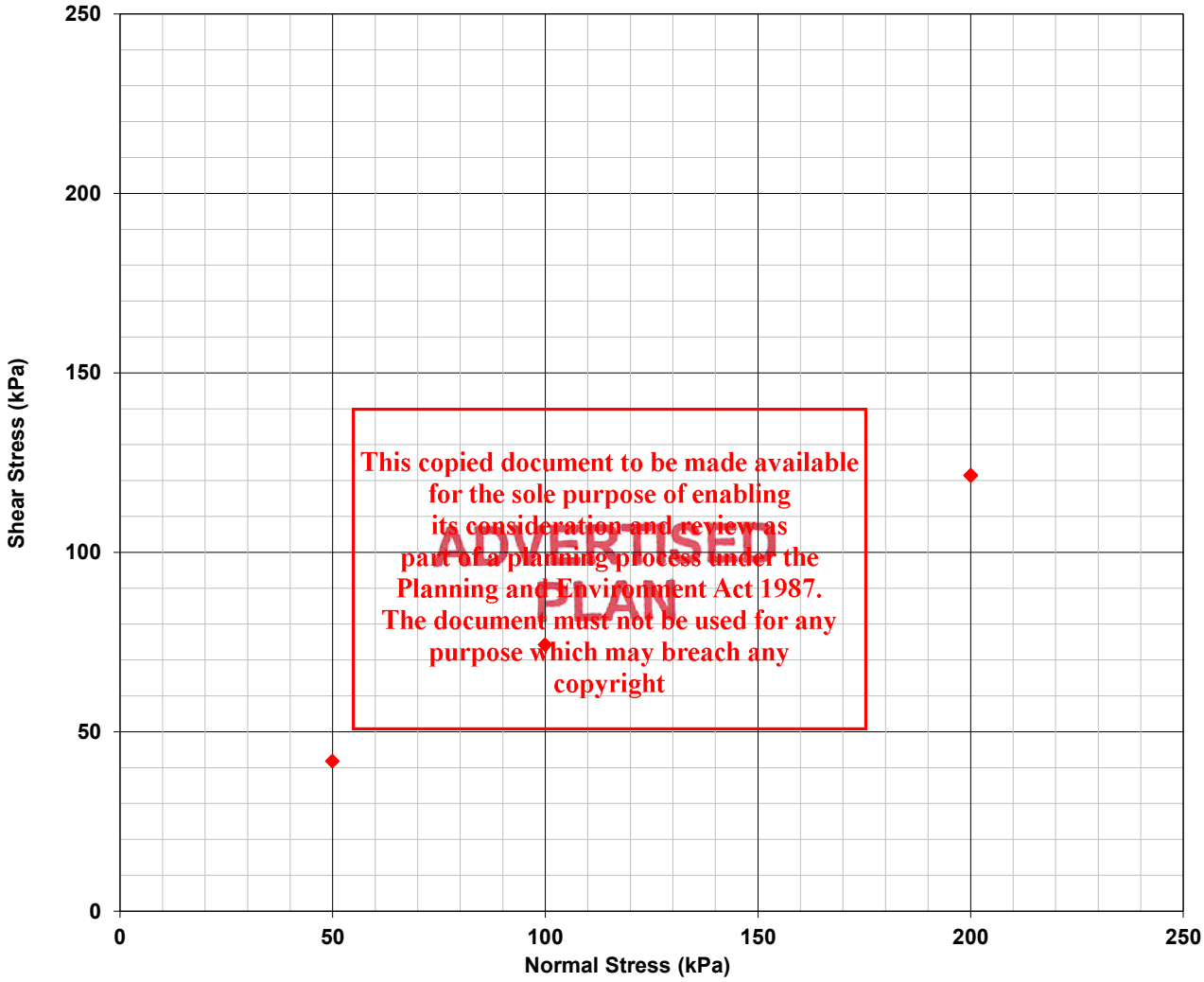
DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120125- DS

Failure Criteria **Peak**

Peak - Normal Stress vs Shear Stress



Shear Angle (°) 27.6		Cohesion (kPa) 18.3		R^2 0.996
Specimen Condition	Inundated	Normal Stress (kPa)		Corrected Shear Stress (kPa)
Specimen Dimensions (mm)	100 * 100	Stage 1	49.9	41.8
Initial Height (mm)	42.0	Stage 2	99.9	74.2
Rate of Strain (mm/min)	0.008	Stage 3	200.0	121.4
Initial Moisture Content (%)	22.4			
Initial Wet Density(t/m^3)	1.91			
Initial Dry Density(t/m3)	1.56			

Graph not to scale

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Authorised Signatory
J. Rasmussen

NATA
WORLD RECOGNISED ACCREDITATION

Tested at Trilab Brisbane Laboratory

Laboratory No. 9926

ACCURATE QUALITY RESULTS FOR TOMORROW'S ENGINEERING

Trilab
Soil Rock Calibration

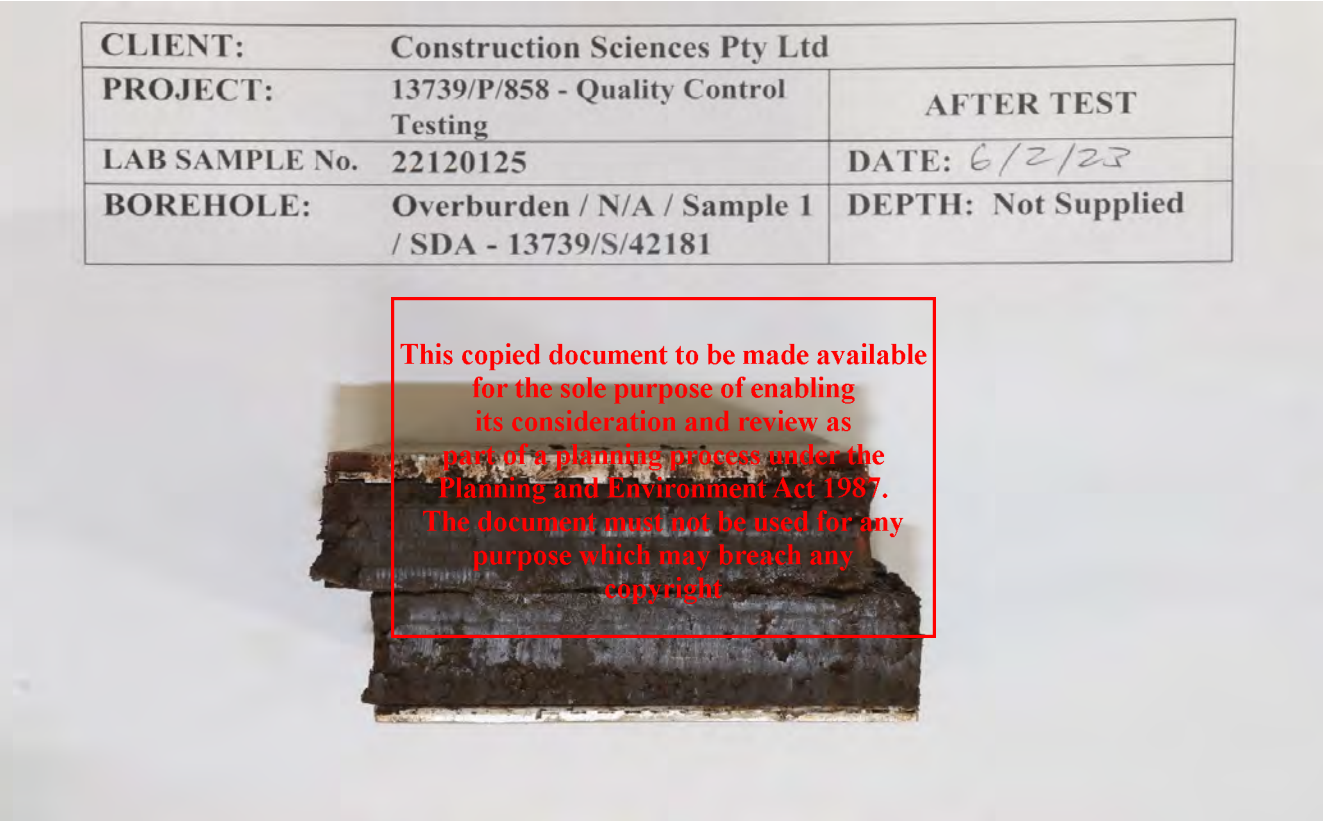
Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120125- DS



CLIENT:	Construction Sciences Pty Ltd	
PROJECT:	13739/P/858 - Quality Control Testing	AFTER TEST
LAB SAMPLE No.	22120125	DATE: 6/2/23
BOREHOLE:	Overburden / N/A / Sample 1 / SDA - 13739/S/42181	DEPTH: Not Supplied

Notes/Remarks:

Photo not to scale

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Tested at Trilab Brisbane Laboratory

Authorised Signatory

J. Rasmussen

NATA WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

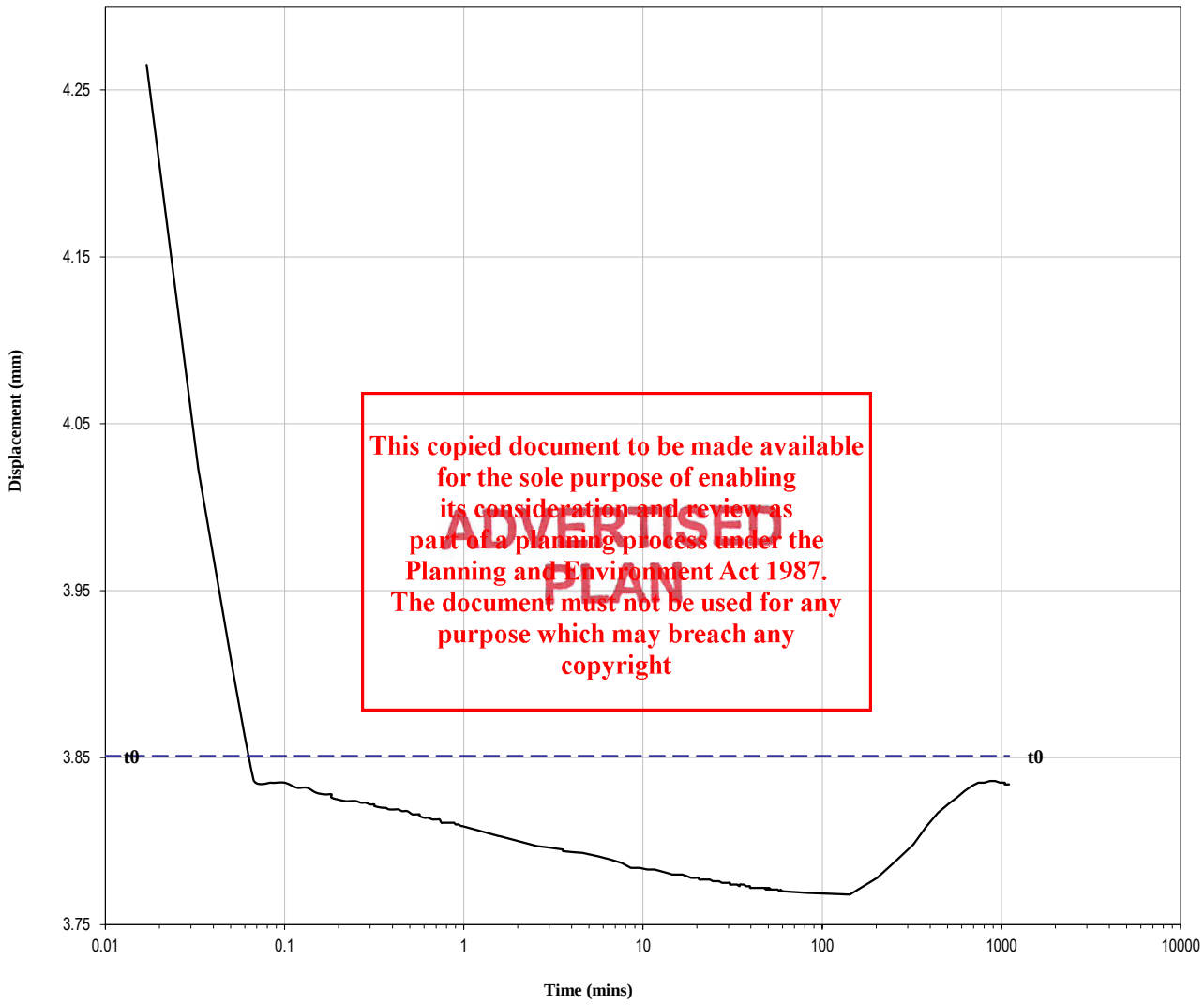
DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120125- DS

Stage 1 Consolidation

Displacement v's Time (Log Scale)



t_{50}	#N/A	mins
t_{100}	#N/A	mins
Time to Failure =	#N/A	mins
Estimated Displacement to Failure =	10	mm
Displacement Rate =	#N/A	mm/min

Notes/Remarks:

Graph not to scale

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Tested at Trilab Brisbane Laboratory

Authorised Signatory
J. Rasmussen

NATA
WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

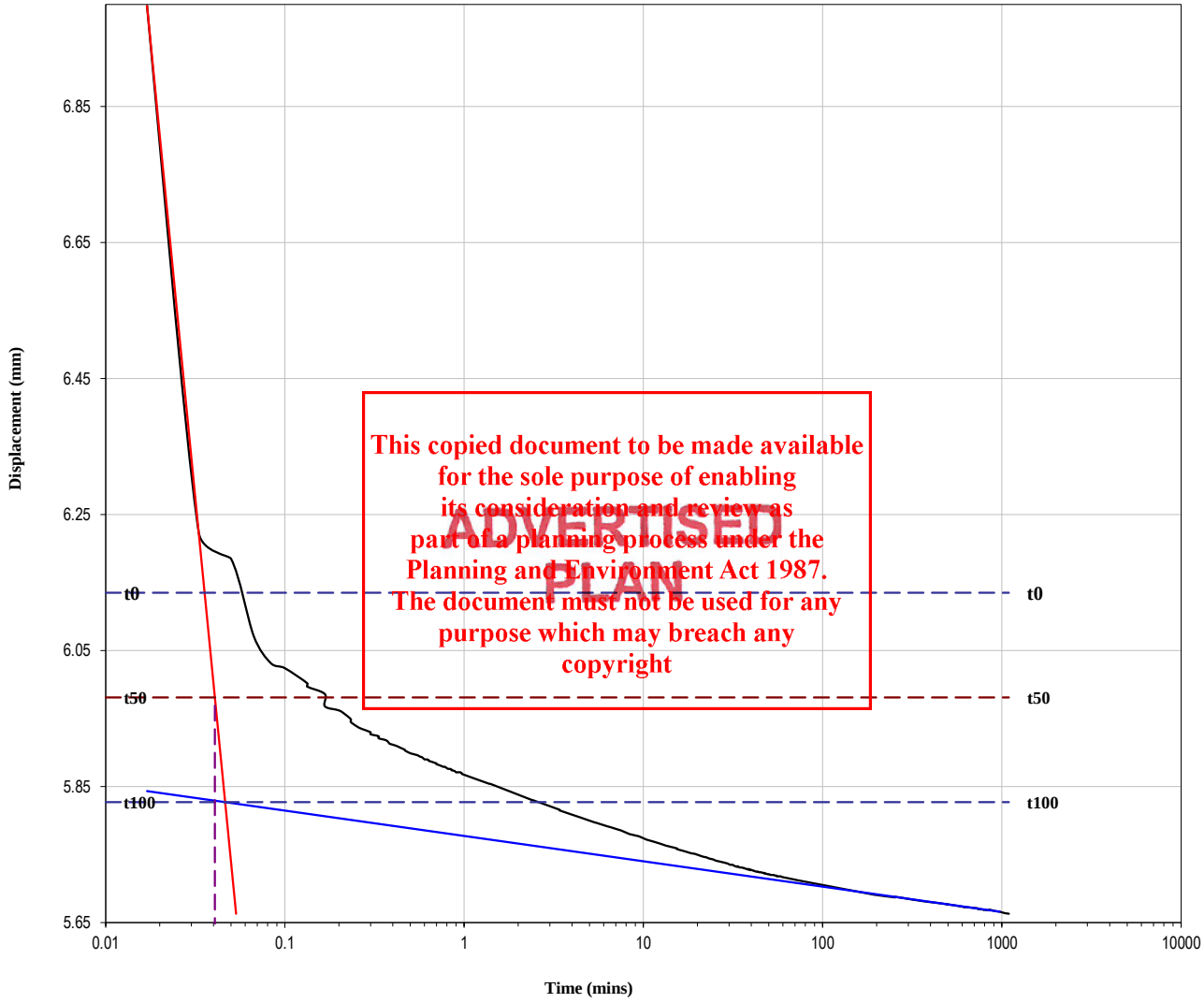
DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120125- DS

Stage 2 Consolidation

Displacement v's Time (Log Scale)



t_{50}	0.04	mins
t_{100}	0.05	mins
Time to Failure =	299.05	mins
Estimated Displacement to Failure =	10	mm
Displacement Rate =	0.0334389	mm/min

Notes/Remarks:

Graph not to scale

Authorised Signatory
J. Rasmussen

Tested at Trilab Brisbane Laboratory

Laboratory No. 9926

Trilab
Soil Rock Calibration

Brisbane
346A Bilsen Road,
Geebung
QLD 4034
Ph: +61 7 3265 5656

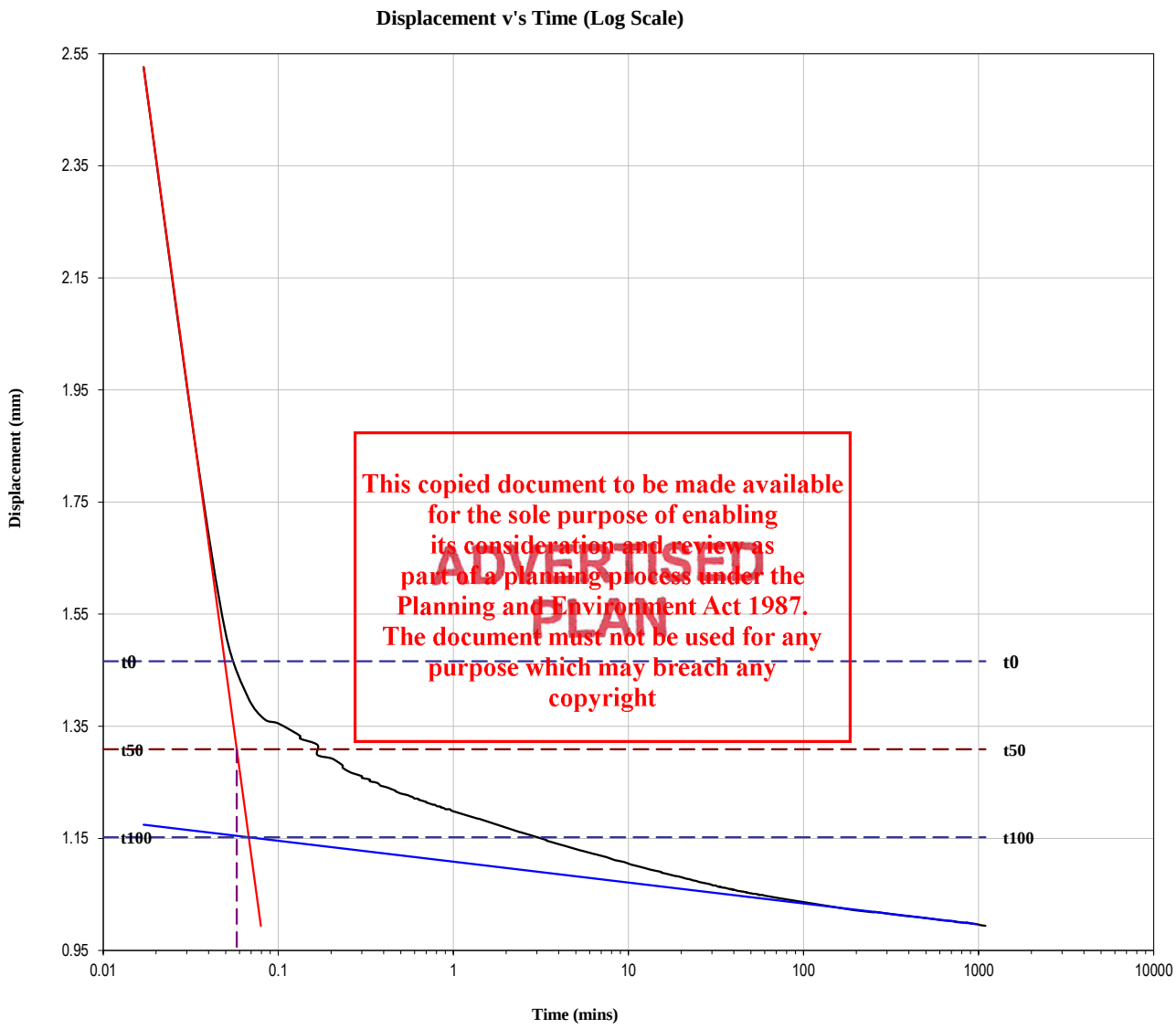
Perth
2 Kimmer Place,
Queens Park
WA 6107
Ph: +61 8 9258 8323

DIRECT SHEAR TEST REPORT

Test Method: AS 1289.6.2.2

Client	Construction Sciences Pty Ltd	**Report No.**	22120125- DS

Stage 3 Consolidation



t_{50}	0.06	mins
t_{100}	0.07	mins
Time to Failure =	65.45	mins
Estimated Displacement to Failure =	10	mm
Displacement Rate =	0.1527901	mm/min

Notes/Remarks:

Graph not to scale

Accredited for compliance with ISO/IEC 17025 - Testing.
The results of the tests, calibrations, and/or measurements included in this document are traceable to the International System of Units (SI). References are traceable to National Measurement Institutes or laboratories accredited to ISO/IEC 17025 by a signatory to the ILAC MRA.

Tested at Trilab Brisbane Laboratory

Authorised Signatory
J. Rasmussen

NATA
WORLD RECOGNISED ACCREDITATION

Laboratory No. 9926

Construction Sciences

DYNAMIC CONE PENETROMETER WORKSHEET

(blows per measurement)

Client:	Holcim			Project Number:	
Project:	Golac Quarry NDA South			Test Request Number:	
Prepared By:	C. Alexander	Date Prepared:	17/5/21	Lot Number:	
Tested By:	Joe Hards	Date Tested:	17/5/21	Material Source:	O'BURDEN
Checked By:		Date Checked:		Material Type:	BLACK SOIL

Procedures:	AS1289.6.3.2		Hammer: DCP01
Drop Height Checked [✓ (tick)		DCP Cone Tip Checked [✓ (tick)	DCP Cone Template: DCPTP-04.

Sample Number	1	2	3	4	5	6
Moisture Condition	DAMP	DAMP	DAMP	DAMP	DAMP	DAMP
Ground Water Level (m)						
Location	143°36·58.237 -38°14'59.367	143°3657.452 -38°14'59.286	143°3656.918 38°14'59.146	143°3656.485 38°14'59.095	143°3655.732 -38°14'58.664	143·3654.869 38°14'58.862
Depth	Blows	Blows	Blows	Blows	Blows	Blows
0-100	3	3	3	5	3	3
200	3	4	5	5	4	6
300	5	4	7	8	4	7
400	10	6	8	8	10	Refusal
500	Refusal	10	9	8	12	
600		7	7	10	12	
700		Refusal	10	10	Refusal	
800			8	12		
900			Refusal	Refusal		

Remarks	PAGE 1 of 2	
		W16WS - Ver 4

Construction Sciences

DYNAMIC CONE PENETROMETER WORKSHEET

(blows per measurement)

Client:	Holcim			Project Number:	
Project:	Colac Quarry NDA South.			Test Request Number:	
Prepared By:	C. ALEXANDER	Date Prepared:	17/5/21	Lot Number:	
Tested By:	Joe Hinds	Date Tested:	17/5/21	Material Source:	O'BURDEN
Checked By:		Date Checked:		Material Type:	BLACK SOIL

Procedures:	AS1289.6.3.2	Hammer:	DCP #1
Drop Height Checked [ ] (tick)	DCP Cone Tip Checked [ ] (tick)	DCP Cone Template:	DCPT #4.

Sample Number	7	8	9	10	11	12
Moisture Condition	DAMP	DAMP	DAMP	DAMP	DAMP	DAMP.
Ground Water Level (m)						
Location	143°36'54.726	143°36'53.734	143°36'53.167	143°36'52.693	143°36'52.286	143°36'51.59
	38°14'58.691	-38°14'58.833	38°14'58.865	38°14'58.597	-38°14'58.646	-38°14'58.392

Depth	Blows	Blows	Blows	Blows	Blows	Blows
0-100	8	4	5	4	5	3
200	8	6	7	5	7	4
300	6	Refusal	Refusal	6	5	5
400	6			14	7	6
500	9			5	8	7
600	Refusal			5	7	11
700				5	8	11
800				7	9	Refusal.
900				5	11	
1000				5	Refusal	
1100				56 (C.A.)		
1200				17		
1300				Refusal.		

Remarks	PAGE 2 of 2	
		W16WS - Ver 4

Appendix C Laboratory test data for crusher dust and gravel aggregate material

Construction Sciences

Construction Sciences Pty Ltd
ABN: 72 128 806 735

Address:
75 Potters Road,
Ondit VIC 3249

Laboratory: Colac Laboratory

AGGREGATE REPORT

Client:	Holcim Australia Pty Ltd	Report Number:	03145/R/9720-1
Client Address:	PO Box 1513, Milton	Project Number:	03145/P/1
Project:	Quality Control Testing - Colac	Lot Number:	
Location:	Holcim Colac Quarry (5370)	Internal Test Request:	03145/T/3968
Supplied To:	Test Portal	Client Reference/s:	FL6.1.019.V
Area Description:		Report Date / Page:	12/12/2022 Page 1 of 2

Sample Number	03145/S/9964	Colac Sample No	S/9964
Sampling Method	AS1141.3.1 Cl 9.3	Location	Stockpile
Date Sampled	7/12/2022	Sampled From	Sales
Specification Number	VCOL20	Material Code	VCOL20
Material Source	Holcim Colac Quarry	Material Type	20mm Aggregate (VCOL20)

Test Method	Sieve Size / Test Result	Test Date	Specification Minimum	Result	Specification Maximum	Specification Target [Diff]
AS1141.11.1	Particle Size Distribution (% passing)	12/12/2022				
	26.5mm		100	**100**	100	
	19.0mm		85	**94**	100	
	13.2mm			**39**		
	9.5mm		0	**7**	20	
	6.7mm			**3**		
	4.75mm		0	**2**	5	
	2.36mm			**1**		
	0.425mm			**1**		
	0.075mm		0	**1**	2	
AS1141.15	Flakiness Index (%)	12/12/2022	0	**24**	35	
AS1289.2.1.6	Moisture Content (%)	12/12/2022		**2.4**		
RC372.01	Sound Particles (%)	12/12/2022		**100**		
	Unsound Particles (%)			**0**		
	Unsound Plus Marginal Particles (%)			**0**		
AS1141.6.1	Apparent Particle Density (t/m³)	12/12/2022		**2.83**		
	Particle Density (Dry) (t/m³)			**2.66**		
	Particle Density (SSD) (t/m³)			**2.72**		
	Water Absorption (%)			**2.2**		

Remarks	Supplement to Simplified Report Number 221212JH1140,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 03145

Approved Signatory: Joseph Hards
Form ID: I04Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 72 128 806 735

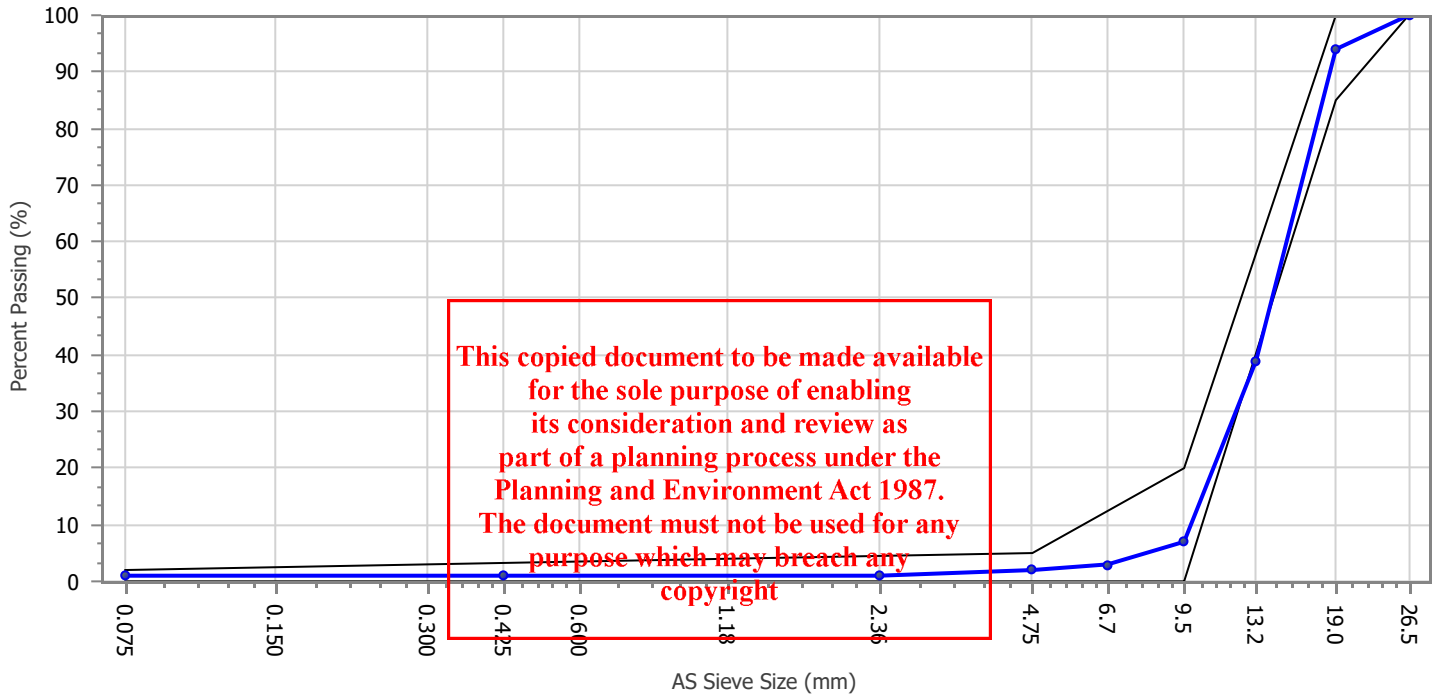
Address:
75 Potters Road,
Ondit VIC 3249

Laboratory: Colac Laboratory

AGGREGATE REPORT

Client:	Holcim Australia Pty Ltd	Report Number:	03145/R/9720-1
Client Address:	PO Box 1513, Milton	Project Number:	03145/P/1
Project:	Quality Control Testing - Colac	Lot Number:	
Location:	Holcim Colac Quarry (5370)	Internal Test Request:	03145/T/3968
Supplied To:	Test Portal	Client Reference/s:	FL6.1.019.V
Area Description:		Report Date / Page:	12/12/2022 Page 2 of 2

PARTICLE SIZE DISTRIBUTION GRAPH - 03145/S/9964



Method / Test	Test Details
AS1141.11.1 / Washed State:	Washed
AS1141.15 / Drying Method:	Hotplate
RC372.01 / Drying Method:	Hotplate
RC372.01 / Rock Type:	Newer Basalt
RC372.01 / Nominal Size (mm):	20.0
RC372.01 / Ref Prepared By:	Vic Roads
RC372.01 / Ref Date Prepared:	21/10/2019
RC372.01 / Ref Number:	GR0000531

Remarks: Supplement to Simplified Report Number 221212JH1140,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 03145

Approved Signatory: Joseph Hards
Form ID: I04Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 72 128 806 735

Address:
75 Potters Road,
Ondit VIC 3249

Laboratory: Colac Laboratory

AGGREGATE REPORT

Client:	Holcim Australia Pty Ltd	Report Number:	03145/R/9690-1
Client Address:	PO Box 1513, Milton	Project Number:	03145/P/1
Project:	Quality Control Testing - Colac	Lot Number:	
Location:	Holcim Colac Quarry (5370)	Internal Test Request:	03145/T/3956
Supplied To:	Test Portal	Client Reference/s:	FL6.1.019.V
Area Description:		Report Date / Page:	5/12/2022 Page 1 of 2

Sample Number	03145/S/9926	Colac Sample No	S/9926
Sampling Method	AS1141.3.1 Cl 9.3	Location	Stockpile
Date Sampled	29/11/2022	Sampled From	Sales
Specification Number	VIC - 200mm Diameter Sieve Grading	Material Code	VCOL7D
Material Source	Holcim Colac Quarry	Material Type	7 mm Dust (VCOL7D)

Test Method	Sieve Size / Test Result	Test Date	Specification Minimum	Result	Specification Maximum	Specification Target [Diff]
AS1141.11.1	Particle Size Distribution (% passing)	05/12/2022				
	9.5mm			100		
	6.7mm			99		
	4.75mm			92		
	2.36mm			60		
	1.18mm			42		
	0.600mm			32		
	0.425mm			26		
	0.300mm			23		
	0.150mm			19		
	0.075mm			16		
AS1289.2.1.6	Moisture Content (%)	05/12/2022		5.5		

Remarks	Supplement to Simplified Report Number 221205JH1007,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 03145

Approved Signatory: Joseph Hards
Form ID: I04Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 72 128 806 735

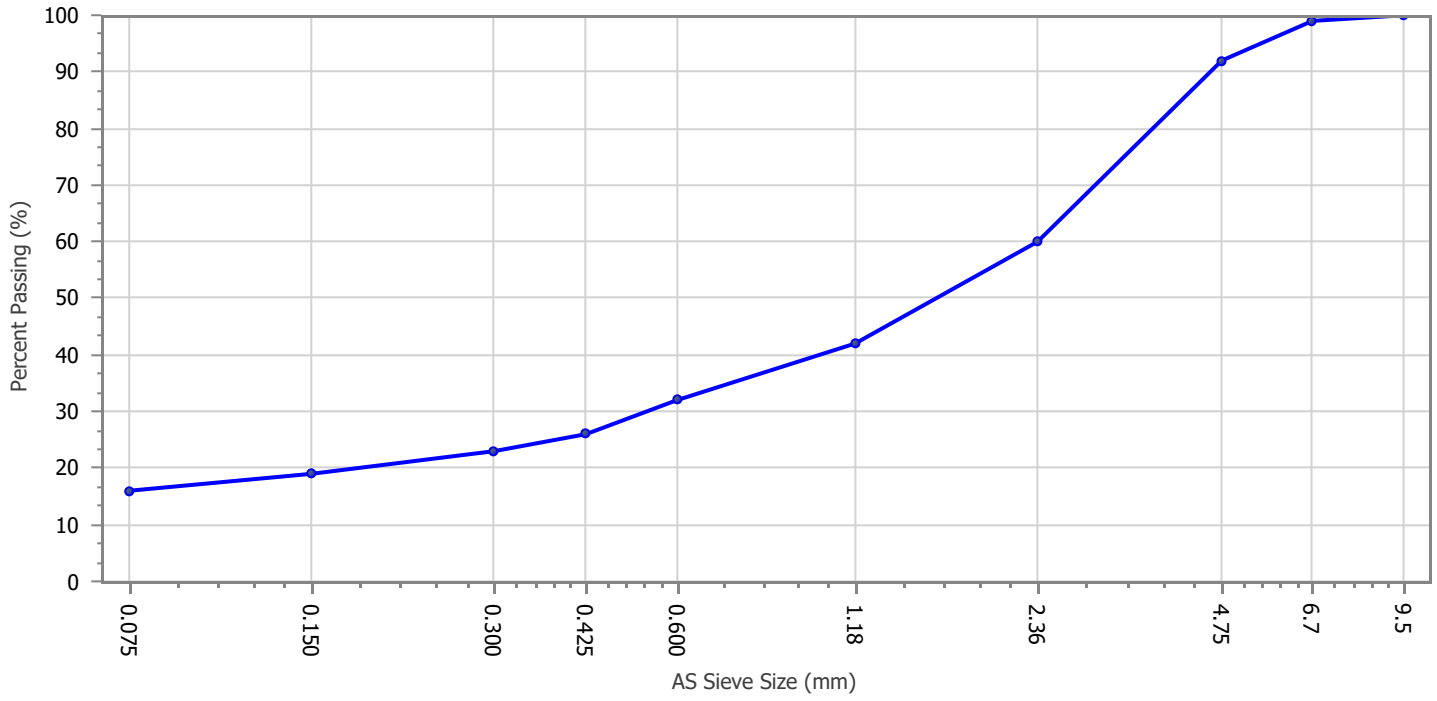
Address:
75 Potters Road,
Ondit VIC 3249

Laboratory: Colac Laboratory

AGGREGATE REPORT

Client:	Holcim Australia Pty Ltd	Report Number:	03145/R/9690-1
Client Address:	PO Box 1513, Milton	Project Number:	03145/P/1
Project:	Quality Control Testing - Colac	Lot Number:	
Location:	Holcim Colac Quarry (5370)	Internal Test Request:	03145/T/3956
Supplied To:	Test Portal	Client Reference/s:	FL6.1.019.V
Area Description:		Report Date / Page:	5/12/2022 Page 2 of 2

PARTICLE SIZE DISTRIBUTION GRAPH - 03145/S/9926



Method / Test	Test Details
AS1141.11.1 / Washed State:	Washed

Remarks	Supplement to Simplified Report Number 221205JH1007,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 03145

Approved Signatory: Joseph Hards
Form ID: I04Rep Rev 1

Appendix D Vic DJPR geotechnical review memorandum

Technical Services Memorandum

TO:	Julia Noorda Senior Assessment Officer	CC: Cecil Corloncito Senior Environmental Assessment Officer Muthu Muthukaruppan A/Assistant Director Technical Services
FROM:	KAREN SONNEKUS	
SUBJECT:	WA007635 (PLN-001672) – Geotechnical Report Review	
DATE:	2 August 2022	

PURPOSE

This purpose of this memo is to provide geotechnical review comments on the Geotechnical Report titled Slope Stability Assessment – Colac Quarry NDA (XSTRACT, 15 October 2021). The primary intent of this memo is to provide advice on the additional information required to clarify geotechnical issues which need to be addressed in the geotechnical report and which may also need to be addressed in the proposed work plan and rehabilitation plan.

GEOTECHNICAL REPORT

Introduction

Available Data

- The available data does not include any local hydrogeological modelling data to inform the long term lake rebound and fluctuations. **Required:** Long term hydrogeological modelling data/outcomes are required to inform the geotechnical stability assessments, considering the long term landform will be a lake.

- Mapping data will be required as the quarry faces are exposed: (1) Slope stability management will need to be documented in a site-specific GCMP. It will also be beneficial to confirm the stability of the slopes as the extraction progresses. (2) At the initial geotechnical engagement session on 22 July 2022, it was agreed that a conservative slope design be implemented which can be confirmed every 5 years through a stability assessment of the slopes to confirm conformance with the design. **Required:** (1) Ensure the site specific GCMP includes progressive mapping and assessment of geological structures as these are being exposed. (2) The workplan needs to commit to a 5 yearly stability assessment report completed by a suitably qualified and experienced geotechnical engineer

which confirm the ongoing pit slope stability as per the approved design and design acceptance criteria.

Site Layout

- Statements regarding maximum terminal batter heights need to be non-ambiguous. **Required:** State what the maximum terminal height is which will be adhered to as part of the slope design, regardless of depth to basalt foundation.

Batter and slope geometries

- The long term groundwater level has been based on the current groundwater level at WA158 (Holcim's Southern Development Area – SDA). However, there is a discrepancy in the groundwater level adopted in the XSTRACT Report (114.8mRL) versus the Aurecon Rehabilitation Plan for the NDA which states that groundwater would be expected to recover to a level of approximately 116mAHD to a maximum of 118.5mAHD.The groundwater profiles adopted in Figures 4 and 5 needs to be verified from long term hydraulic modelling to confirm the gradient, rebound and fluctuations associated with the long term groundwater levels in both the rock mass and the lake level. **Required:** Long term hydrogeological modelling data/outcomes are required to inform the geotechnical stability assessments considering the long term landform will be a lake.
- It should be made clear that Figure 3 are photographs taken from WA158 and not from the proposed NDA. Jointing and structural failure mechanisms may be different from that observed at WA158. **Required:** Clarify that Figure 3 are from the SDA to the south of the NDA and does not necessarily reflect the rock mass conditions at the NDA.
- The rehabilitated terminal batter will include overburden backfilled against the terminal slope to a final slope configuration of 1V:2H (refer to Figure 4). Figure 4 does not make reference to a beaching slope (for wave erosion and public safety considerations) or to upper slope treatments for public safety aspects. **Required:** Amend the slope design to include a beaching slope for public safety aspects as well as upper slope treatment considerations, Refer to ERR Guideline titled *Geotechnical Guideline for Terminal and Rehabilitated Slopes – Extractive Industry Projects* (September 2020).

Infrastructure

- The SDA (WA158) to the south of the proposed NDA must also be considered as a sensitive receptor. Impacts from quarrying in the NDA on the stability of the e.g. northern batters of the SDA must be included in the

risk assessment (e.g impact from blasting). **Required:** Include WA158 as a sensitive receptor in terms of potential impact from e.g. blasting in the southern area of the NDA on the stability of the SDA Northern Batters.

Engineering Geology

- It is understood that some mapping data exists from a drone flyover of the existing (WA158) quarry's eastern batter. While the data suggested that the potential for wedge and planar structurally controlled failure mechanisms is limited, *it should be noted that the collection of structural data from only west facing batter faces is likely to have generated some bias in the resulting data set against east dipping structures*. Without having done kinematic modelling (i.e. testing the size and scale of potential failure mechanisms such as wedge, slide, toppling, etc) using industry acceptable software such as the Rocscience suite of kinematic software (SLIDE, SWedge, etc), statements such as *The likelihood of batter scale instability developing is low and therefore the likelihood of long term impacts on public safety, infrastructure, the environment, land and property is low* should be taken with caution. **Required:** In addition to the stereonet assessment, complete kinematic (modelling) assessments for each batter to determine batter scale FoS and more importantly, the scale of potential backbreak from potential kinematic failures.
- The overburden is moderately dispersive and robust surface water management controls will need to be established in and around the final landform. **Required:** Provide robust surface drainage considering the erosion/dispersion impact on the overburden material. These surface water management controls are required for both the buffer areas as well as the placed backfilled material (which is assumed to be sourced from material on-site).

Geotechnical Model

- The shear strength values obtained from the DCP testing have not been correlated with laboratory shear strength testing and can not be seen as reliable. Table 3 notes that Mean values for the undrained shear strength values have been used and not e.g. lower bound values (as should be the norm, especially when data reliability is in question). **Required:** In the absence of reliable shear strength data, apply lower bound values for all material values.

Stability Assessments

- Table 5 summarises the Design Acceptance Criteria adopted for the slopes in the NDA. Reference is made to Read and Stacey. However, in this case, reference should have been made to the ERR Guideline titled *Geotechnical Guideline for Terminal and Rehabilitated Slopes – Extractive Industry Projects* (September 2020) and specifically Table 3. The batters against sensitive receptors (western and southern batters) must have a long term FoS of at least 2.0. This higher FoS will also consider the lack of data reliability. **Required:** Apply a FoS of at least 2 to those terminal and rehabilitated batters adjacent to sensitive receptors. Other batters will need to have a FoS that is commensurate to the data reliability and the risk profile.

- It is stated under the heading 'Terminal Batters' that limit equilibrium and kinematic approaches have been completed for wedge failures, however, only the stereonet analyses with PoF are shown. It is also noted that a PoF of 30% have been assumed to be appropriate. This is unacceptable and should PoF values be applied, then a PoF of <0.5% is required. **Required:** Provide the limit equilibrium modelling completed (in e,g SWedge) for the different kinematic failure mechanisms, showing FoS values and the maximum back break.

- Figure 11 depicts a stability section assessed for a case with No Rehabilitation (i.e. the terminal batter case) while another stability section was assessed with the terminal batter rehabilitated (backfill added at toe of batter, long term conditions). (1) It is assumed that the section is a generic stability section as different batters will have different structures exposed and that the columnar jointing represented in the basalt may not be the worst case/representative of the rest of the batters. It should also be considered that in both scenarios, failure through fresh rock (such as the basalt) is unlikely (unless it is failing along structural planes, in which case those scenarios need to be assessed). (2) The groundwater gradient interpretation for the No Rehabilitation case will also need to be reviewed and amended as per previous comments in this memo. **Required:** (1) Provide and assess representative stability sections for each of the pit slope domains (e.g. west wall, south wall, etc), considering that each slope domain may have different structures exposed and weathering profiles. Consideration of a beaching slope and upper slope treatment controls will need to be included in the updated stability sections (2) Long term hydrogeological modelling data/outcomes are required to inform the geotechnical stability assessments, considering the long term landform will be a lake.

Conclusions and recommendations

- The conclusions and recommendations listed in this section will need to be revised considering the new requirements as detailed in the previous comments.

- The recommendations regarding the development of the rehabilitation batters require further clarification. Reference to working within the framework of an acceptable industry standard such as AS3798 -2007 (Guidelines on earthworks for commercial and residential developments) needs to be provided. Clear technical specifications regarding quality control of the backfill sourcing, selection and placement needs to be documented. **Required**: Refer to suitable industry standards for backfilling practices such as AS3798 – 2007. Provide earthworks technical specification for the rehabilitation methodology which covers the requirements for forming and grading of earthworks including selection, placement and compaction of fill, trimming of batters, keying in of material, surface drains and the preparation of the final earthworks surfaces for all the slopes.

End of comments

Vic/SA Aggregates

Holcim (Australia) Pty Ltd
Tower B, Level 8
799 Pacific Hwy
Chatswood 2067
Australia

ABN 87 099 732 297
Phone +61 2 9412 6600
Fax +61 2 9412 6601
www.holcim.com.au

Meeting Minutes

Event:	WA7635: Work Plan 001672 (Colac NDA) - Geotechnical Engagement Session 2: Following additional requested changes received from ERR (in the memo from Technical Services dated 2/08/2022)
Date:	August 17, 2022
Place:	*Microsoft Teams*
Participants:	Karen Sonnekus (KS), Cecil O Corloncito (CC), Julia Noora (JN), Pat Walker (PW), Stewart Burton (SB)
Minutes:	Stewart Burton
Excused:	N/A
cct:	N/A

Item No. (this meeting)	Topic Discussed/ Action	Initials (for action)	Date Due
1.	**Available Data: Long term NDA pit lake level** KS indicated long term hydrogeological modeling is required to confirm long term fluctuations in the void, what the groundwater pressures are and gradients in the batters should be confirmed. PW responded that this can be addressed by taking the worst case (dry pit) scenario and modeling it but KS raised concern about GW fluctuation to cover off on 'beaching zones' (for wave erosion and public safety) to ensure these are not above or below the long term GW level. Agreed approach: Review of long term GW data to be undertaken and take the worst case fluctuations from this sensitivity analysis for the pit water level to allow the likely impact on slope stability to be assessed. ERR doesn't require a hydrogeological model with this approach. JN raised evapotranspiration rate vs. GW flow rate - would long term GW level in the NDA be maintained given		

Holcim (Australia) Pty Ltd
Tower B, Level 8
799 Pacific Hwy
Chatswood 2067
Australia

ABN 87 099 732 297
Phone +61 2 9412 6600
Fax +61 2 9412 6601
www.holcim.com.au

	evapotranspiration rate? **Actions:** 1) Evapotranspiration to be considered as part of the GW/Surface Water Management Plan. 2) Review of long term GW data to be undertaken and 'worst case' GW level to be modeled as part of updated geotechnical slope stability assessment	**SB** **SB/PW**	
2	**Terminal and Rehabilitated batters:** If ERR do not consider FoS for terminal batters to be appropriate, KS and NR confirmed conditional approval can be provided for a greater buffer distance than the standard 20m to allow additional geotechnical mapping and review as quarry faces are exposed to demonstrate batters will be safe, stable, sustainable in the long term. SB suggested a similar methodology as outlined in the table within ERR's geotechnical guideline be used as a conditional buffer until long term slope stability can be demonstrated to ERR (i.e condition fulfilled). ERR confirmed if/when condition is met, the buffer would be able to be reduced to 20m without the need for a future Work Plan Variation. SB proposed updated rehabilitation profile considering ERR's desire for less steep slopes: • 1V:3H batter on Southern and Western batters considering the public infrastructure on these sides (roads and utilities) • 1V:3H in OB/weathered material and 1V:2H in fresh on Eastern and Northern batters these abut private land holdings and the consequence of failure is lower. KS confirmed Eastern and Northern batters can have a lower FoS than the Western and Southern batters but unless the data is high in confidence level, minimum FoS should be 1.6. Risk based design acceptance criteria (i.e. Target FoS) is acceptable e.g. 1.6 or even 1.3 for north and east final batter slopes acceptable based on risk and quality of data. ERR supported the proposed amended rehabilitation design given it is proportional with the risk and there is insufficient material on site to construct 1V:3H batters around the whole site. **Actions:** 3) Holcim to propose wording and buffer distance (following updated geotechnical assessment) to ERR	**SB/PW**	

Holcim (Australia) Pty Ltd
Tower B, Level 8
799 Pacific Hwy
Chatswood 2067
Australia

ABN 87 099 732 297
Phone +61 2 9412 6600
Fax +61 2 9412 6601
www.holcim.com.au

	should the FoS not be viewed as adequate 4) Holcim will initiate for the rehabilitation batters in the pit to be redesigned to the profiles discussed above.	**SB**	
3	**Five yearly yearly geotechnical assessment:** KS advised this is to assess the performance of backfill and terminal batters as per the geotechnical stability model that has been completed prior to approval and the inspection should include face mapping of structures as the batters are exposed. SB indicated that there should be an endpoint at which the 5 yearly geotechnical assessments are no longer required - not just when terminal batters and depth are reached. JN indicated a 5 yearly review could be changed by Administrative Change following approval of the work plan if long term safe, stable, sustainable slope stability can be demonstrated. PW indicated initially 5 yearly geotechnical reviews make sense until such time that we're confident nothing is changing or the model is not correct (via ongoing inspections and data collection). JN suggested Holcim propose wording to ERR for 'end point' to 5 yearly geotechnical reviews. JN provided confirmation that GCMP is not an approved document as part of the Work Plan submission but the controls outlined within the GCMP should be pulled into the RMP as controls. It is not a requirement to provide the GCMP to support lodgement of the Work Plan if controls are pulled through into the RMP and there is a commitment to develop the GCMP outlined in the work plan. **Action:** 5) Holcim propose wording to ERR for 'end point' to 5 yearly geotechnical reviews	**SB/PW**	
4	**Surface Water Management Controls around final landform:** ERR confirmed their expectations - a runoff model is not required but Holcim needs to cater for drainage to deal with intense rainfall events - see points below: • Does drainage cater for 1:20 year rainfall event (or other reasonable large rainfall event) • Procedures as to how erosion of rehab batters will be manage • Grading of material so that it drains away from the	**SB**	

Holcim (Australia) Pty Ltd
Tower B, Level 8
799 Pacific Hwy
Chatswood 2067
Australia

ABN 87 099 732 297
Phone +61 2 9412 6600
Fax +61 2 9412 6601
www.holcim.com.au

	rehabilitated slope and how to keep water away from dispersive soils as much as possible • Make sure drains are in place for the long term that can direct water away from dispersive material • Identify drainage on a plan		

Next meeting scheduled for: TBC

Vic/SA Aggregates

Holcim (Australia) Pty Ltd
Tower B, Level 8
799 Pacific Hwy
Chatswood 2067
Australia

ABN 87 099 732 297
Phone +61 2 9412 6600
Fax +61 2 9412 6601
www.holcim.com.au

Meeting Minutes

Event:	WA7635: Work Plan 001672 (Colac NDA) - Geotechnical Engagement Session
Date:	July 22, 2022
Place:	*Microsoft Teams*
Participants:	Karen Sonnekus (KS), Cecil O Corloncito (CC), Julia Noora (JN), Muthu Mathukaruppan (MM), Pat Walker (PW), Stewart Burton (SB)
Minutes:	Stewart Burton and Pat Walker
Excused:	N/A
cct:	N/A

Item No. (this meeting)	Topic Discussed/ Action	Initials (for action)	Date Due
1.	KS confirmed that ERR's assessment of the Work Plan and the request for changes provided to Holcim on 28/06/2022 was incomplete and additional geotechnical concerns have been identified following the Notice of Changes Required being issued (due to ERR staff turnover). KS had only undertaken a preliminary review and raised the following matters which will be sent through as an additional request for changes by Friday 5th of August 2022: ● Indicated that minimum FoS of 2.0 should be required for terminal batters along Ondit-Warrion Road and Rattrays Road but if 'reliable data' is available, FoS of 1.6 will be suitable ● ERR prefer to see FoS for hard rock kinematics ● Kinematic analyses should acknowledge the size of instability under consideration ● Overburden slumping potential in the long term - it is not known how kinematic and rock fall potential has been assessed and overall failure ● Greater detail on rockfall mitigation requested ● Basalt batters should not be treated as "solid" rock for		

Holcim (Australia) Pty Ltd
Tower B, Level 8
799 Pacific Hwy
Chatswood 2067
Australia

ABN 87 099 732 297
Phone +61 2 9412 6600
Fax +61 2 9412 6601
www.holcim.com.au

	purposes of stability analysis - need to assess kinematic failure for wedge, slide etc analysis • Moderately dispersive materials at the site (i.e. overburden) needs greater attention and more information on how backfilling is going to be undertaken and maintained for erosion • Erosion needs assessment including drainage design and water control measures PW described the analysis that has been undertaken to address smaller scale failure mechanisms: • Kinematics have been considered through the stereonet analysis that has been undertaken • Existing quarry data across the road (which is the same deposit) has been used to support the analysis and potential for small scale failure is addressed through the operational controls outlined within the GCMP • Analysis focuses on batter scale and small scale toppling and rock fall etc is controlled through risk mitigation measures • Shear strengths used for the basalt are based on GS for the fractured rock mass and vertical anisotropy to account for the columnar nature of basalt to allow the effect of pervasive fractures on the overall rock mass strength to be assessed. Actions: KS to send through additional request for changes by Friday 5th of August. Following receipt of additional request for changes from ERR, RRG to update the geotechnical slope stability assessment and GCMP	 **KS** **PW**	 **05/08/22** **TBC**
2	Geotechnical slope stability - safe, stable and sustainable landform In regard to the long term stability of terminal and rehabilitated batters, ERR suggested (JN and KS): • Conservative design be put forward initially in regard to rehabilitation batter profile and that an administrative change could be pursued later to change to a steeper profile • PoF of 30% for terminal batters is very high for overall failure (PW indicated that the estimated PoF does not account for defect persistence or size of failure) • As quarrying progresses (towards the terminal batters) additional data to be gathered to allow high confidence design of the final terminal batters to		

Holcim (Australia) Pty Ltd
Tower B, Level 8
799 Pacific Hwy
Chatswood 2067
Australia

ABN 87 099 732 297
Phone +61 2 9412 6600
Fax +61 2 9412 6601
www.holcim.com.au

	progress steeper terminal and rehabilitation profile via administrative change • This requires quarrying to commence in the NDA away from the road corridor south of the NDA • A 5 yearly geotechnical assessment including design assumption reconciliation could be used to help achieve this • End use concerns re. unauthorized public access - ERR believes that 1V:2H batters at the water level are insufficient and suggested 1V:3H is more appropriate and will require further justification on why this slope is proposed from a public safety point of view. • ERR confirmed that 1V:5H batters/beaching zone is not required despite this being in the request for changes received on 28/06/22. • Conditional approval of the currently proposed rehab profile (1V:2H for fresh and 1V:3H for weathered basalt/OB) may be able to be pursued with condition specifying additional buffer from WA boundary whilst geotechnical matters are worked through with ERR. Actions: 1) Holcim to submit in writing the background re the conditional approval that was proposed for WA158 at Colac and make a request for this to occur in writing for the NDA if geotechnical matters cannot be resolved prior to Endorsement of the Work Plan.	**SB**	**19/08/22**
3	Additional stability analysis requested by ERR • Stability using “drained” backfill strengths • However, KS confirmed that ERR are not normally concerned with the submerged portion of batters in regard to scour • Drained strengths can be “book values” but need to be demonstrated that these are conservative but further assessment will need to be detailed within the GCMP for when sufficient pit development has occurred (e.g. every five years, a stability assessment should be committed within the GCMP/Work Plan) . Action: KS to confirm what scour means in the Request for Changes that has been received and whether this is only in relation to backfilled batters	**KS**	**5/08/22**
4	Erosion/Surface water diversion • KS confirmed no erosion assessment is required (in relation to the overburden). • Development of a drainage plan/ surface water control should use a 1:20 or 1:50 year rainfall event		

Holcim (Australia) Pty Ltd
Tower B, Level 8
799 Pacific Hwy
Chatswood 2067
Australia

ABN 87 099 732 297
Phone +61 2 9412 6600
Fax +61 2 9412 6601
www.holcim.com.au

	and provided context within the Work Plan to demonstrate how surface water will be managed in the long term		
5	• CC suggested that a whole of site water balance is required. • SB outlined that there is no data to support a water balance and that is why the triggers were outlined within the WMP - further context and justification will be provided in revised Work Plan submission		

Next meeting scheduled for: TBC

Contact Us

Calibre Professional Services One Pty Ltd
55 150 624 356

Level 2, 50 St Georges Terrace, Perth, WA 6000

PO Box Z5426, St Georges Terrace, Perth, WA 6831

+61 8 9265 3000

calibregroup.com