

St Vincent's Foundation

Geotechnical Site Classification

Proposed Residential Subdivision

Stage 3, Precinct B, Rainbow Beach, Ocean Drive, Lake Cathie

Report No. RGS20337.1-CW

28 June 2023



RGS20337.1-CW

28 June 2023

St Vincent's Foundation
c/ King & Campbell Pty Ltd
PO Box 243
PORT MACQUARIE NSW 2444

Attention: Julian Jones

Dear Julian,

RE: Proposed Residential Subdivision – Stage 3, Precinct B, Rainbow Beach, Ocean Drive, Lake Cathie
Geotechnical Site Classification

As requested, Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken a geotechnical a site classification in accordance with AS2870-2011 *Residential Slabs and Footings* for Stage 3, Precinct B of the Rainbow Beach residential development, Ocean Drive, Lake Cathie.. Stage 3 comprises Lot No's 400 to 413 as shown on the supplied plan titled "Plan of Subdivision of Lot 702 DP1279092".

Based on the existing profiles encountered at the time of the field investigations and on the basis that all fill present in the fill platform was placed under Level One Inspection and Testing as defined in AS3798-2007, the building areas within the lots present would be classified as in accordance with AS2870-2011 as detailed in the attached report.

If you have any questions regarding this project, please contact the undersigned.

For and on behalf of **Regional Geotechnical Solutions Pty Ltd**

Prepared by



Tim Morris

Principal Engineering Geologist

Reviewed by



Adam Holzhauser

Principal Geotechnical Engineer



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1 INTRODUCTION

Regional Geotechnical Solutions Pty Ltd has undertaken a geotechnical site classification in accordance with AS2870-2011 *Residential Slabs and Footings* for Stage 3, Precinct B of the Rainbow Beach residential development, Ocean Drive, Lake Cathie. Stage 3 comprises Lot No's 400 to 413 as shown on the supplied plan titled "Plan of Subdivision of Lot 702 DP1279092".

The residential lots have been modified by site regrading works comprising up to approximately 3m cut. Where weathered rock was exposed at the base of the cut, the exposed profile was excavated an additional 0.6m to 1.0m and replaced with site won crushed rock fill.

Filling works was undertaken by Kazac Civil Pty Ltd, with Level One Inspection and Testing of the works undertaken by AC Testing Services Pty Ltd on behalf of RGS. The Level 1 Report was prepared by RGS (Report Ref: RGS20337.1-BW, dated 19 October 2021).

The work was commissioned by Julian Jones on behalf of St Vincent's Foundation Pty Ltd and was undertaken in accordance with proposal RGS20337.1-BR dated 31 August 2020.

2 METHODOLOGY

Field work for the assessment was undertaken on 19 May 2023 and was based on the supplied drawing titled "Plan of Subdivision of Lot 702 DP1279092". Fieldwork was undertaken by an Engineering Geologist from RGS and included:

- Observation of site features and surrounding features relevant to the geotechnical conditions of the site;
- Eight boreholes undertaken by a 4WD mounted drilling rig to depths up to 1m logged and sampled by an Engineering Geologist; and
- Bulk samples collected from representative soil profiles.

Engineering logs of the bore holes are presented in Appendix A. Investigation locations are shown on Figure 1 and were obtained by measurements to prominent site features. Coordinates of investigation locations were recorded using a handheld GPS and the coordinates are shown on the engineering logs.

3 LABORATORY TESTING

Samples considered representative of foundation soils were submitted to a NATA accredited laboratory for the particle size distribution and Atterberg's Limits testing. Results are presented in Appendix B and summarised in Table 1.

Table 1: Laboratory Testing Summary

Location	Depth (m)	Lot	Material	Passing 2.36mm (%)	Passing 75µm (%)	Plasticity Index (%)
BH4	0.3 – 0.4	407/408	Gravelly Clayey SAND	63	18	10

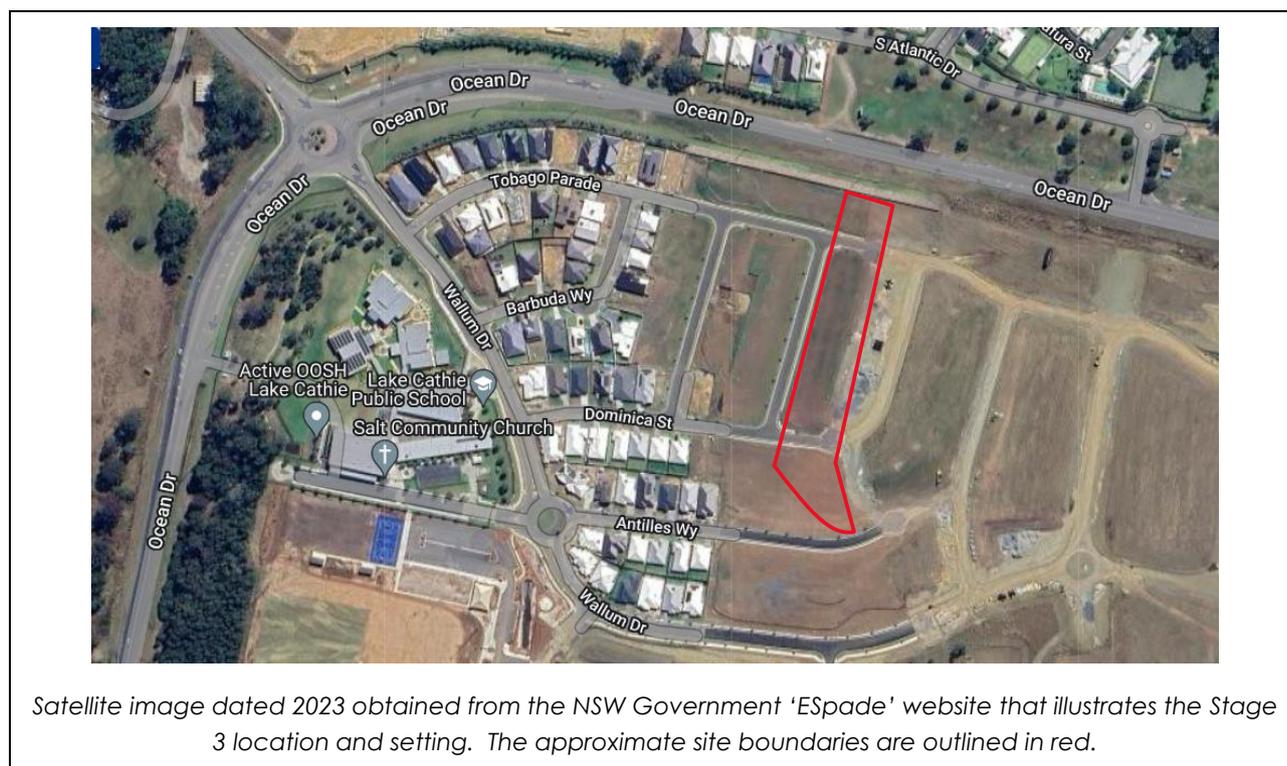


4 SITE CONDITIONS

4.1 Surface Conditions

Stage 3 of Precinct B is located in the Rainbow Beach residential subdivision and is situated in an area of moderately undulating terrain on the south-west facing middle to upper slopes of a broad rounded southeast plunging ridgeline. Surface elevations range from 23m AHD at the upper slopes of the ridge in north to approximately 13m AHD in the south. Surface slopes following site regrading range from 2 – 5° across the site to the south-west.

An image of the site taken from the NSW Department of Property Information website that shows the location of the site and the site setting is reproduced below.



Lots 401 to 413 had been modified by earthworks comprising placement of between 0.3m and 0.7m of site won Sandy Clayey GRAVEL to Gravelly Clayey SAND that was placed under Level One inspection and monitoring as defined in AS3798-2007 *Guidelines on Earthworks for Commercial and Residential Developments* by AC Testing Services Pty Ltd. The Level 1 Report was prepared by RGS (Report Ref: RGS20337.1-BW, dated 19 October 2021). The approximate extent of earthworks is shown on Figure 2, based on the supplied drawing titled "Total Cut Fill BC".

There was sparse grass growth within the subject lots at the time of the investigation. Street trees had been recently planted more than 10m from the propose dwelling footprints. Within the adjacent Lot 208, excavations for a building pad on the Lot 400 boundary had exposed 0.6m of gravel fill overlying weathered dolerite.

Drainage of the site would be via a combination of overland flow and surface infiltration.

Surrounding developments include dwellings under construction to the west and undeveloped lots to the east.

Typical site photographs are presented below.



Looking north over Lot no's 405 to 408. Topsoil recently placed over fill profile. Small street trees planted at front of lots within road reserve.



Looking east at excavated profile on boundary of Lot 208 and 400 exposing topsoil overlaying site won gravel fill to 0.7m.

4.2 Subsurface Conditions

The site is situated in an area underlain by undifferentiated rocks of the Watonga Formation which can include slate, siltstone, chert, mudstone, and by the intrusive Karikeree Meta-dolerite.

The materials encountered during the investigation are summarised in Table 2 and 3. Further details are presented on the engineering logs in Appendix B.

Table 2: Summary of Geotechnical Units

Unit	Material	Material Description
UNIT 1	TOPSOIL/ FILL	Sandy CLAY: Low plasticity, dark brown, traces of gravel, fine to coarse
UNIT 2	FILL (CONTROLLED)	Sandy Clayey GRAVEL: Fine to coarse, sub angular, angular dolerite low to high strength, grey/brown, some plastic fines. Coarse gravel resulted in auger refusal.



Table 3: Summary of Subsurface Profiles - Depth to Base of Material Layer (m)

BH	Lot	Unit 1 Topsoil	Unit 2 Fill- Gravel
BH 1	411/412	0.3	≥ 1.0*
BH 2	413	0.25	≥ 0.3*
BH 3	409/410	0.35	≥ 0.6*
BH 4	407/408	0.20	≥ 0.35*
BH 5	405/406	0.25	≥ 0.6*
BH 6	403/404	0.2	≥ 0.5*
BH 7	400/401	0.25	≥ 0.4*
BH 8	401/402	0.25	≥ 0.45*

Note: ≥ Indicates that base of material layer was not encountered
* Indicates that the test was terminated due to practical auger refusal on rock fill or weathered rock

Groundwater was not encountered within the boreholes. It should be noted that fluctuations in groundwater levels can occur because of seasonal variations, temperature, rainfall and other similar factors, the influence of which may not have been apparent at the time of the assessment.

5 SITE CLASSIFICATION

For structures or components that are similar in construction, performance expectation, and loading to a typical domestic structure, the guidance provided in AS2870-2011 "Residential Slabs and Footings" would be appropriate.

In assessing the estimated characteristic surface movement (y_s) values the following has been adopted:

- All crushed rock fill of > 0.4m thickness was placed under Level 1 Inspection and Testing as defined in AS3798-2007, and can therefore be considered as Controlled Fill;
- Suction change at ground surface of pf 1.2;
- Depth of suction change of 1.5m;
- Characteristic I_{ss} for the gravel/sand fill of 0.5%;
- Weathered rock inferred to be present 0.6m to 1m below surface.

The proposed building area for Lots 401- 413 as shown on Figure 1 have been modified by filling works of >0.4m thickness. These lots are classified as **Class P** in accordance with AS2870-2011, Clause 2.5.3 Section (a) due to the presence of fill >0.4 m, requiring footings to be designed in accordance with engineering principles.

The building area for these lots modified by filling works undertaken under Level 1 supervision have been reclassified as summarised in Table 4 in accordance with Clause 2.5.3 Section C of AS2870-2011, based on the existing profile at the time of field investigation, the properties of the Controlled Fill that was placed under Level 1 supervision as defined by AS3798-2007, the properties of the underlying natural profile and the estimated surface movement (y_s).



Table 4: Site Re-Classification Summary

Lots	Site Classification	Expected Surface Movement (mm)
400 to 413	S	0 – 20 mm

6 CONSTRUCTION AND SITE MAINTENANCE CONSIDERATIONS

All structural footings should be founded as follows:

- All footings should be founded in Controlled Fill below all topsoil and uncontrolled fill materials;
- Footings can be designed on the basis of a maximum allowable base bearing pressure of **100kPa** for footings founded within the Controlled Fill;
- All footings, edge beams and internal beams should be entirely founded on similar material and outside or below the zones of influence resulting from existing or future service trenches and other subsurface structures;
- The soils in the Port Macquarie area are prone to fretting and softening on exposure to air and water. It is therefore recommended that concrete be poured as soon as possible after footing excavation. In the event that wet weather occurs prior to pouring of concrete, the base of footing excavations should be checked for the presence of loose or softened material, which should be removed prior to pouring concrete; and
- Prior to the placement of concrete we recommend that footings be observed and assessed by a suitably experienced geotechnical engineer to assess that the correct founding material has been achieved.

Where lot filling works are proposed, all fill for the support of structures should be placed and compacted in accordance with the recommendations outlined in AS3798-2007 *Guidelines on Earthworks for Residential and Commercial Developments*, under Level 1 supervision, for it to be considered Controlled Fill as defined in AS2870-2011. The founding of structures on fill that is not placed in accordance with Level 1 requirements is not recommended.

Site maintenance must comply with the recommendations and advice provided in CSIRO Sheet BTF18 "*Foundation Maintenance and Footing Performance: A Homeowners Guide*" a copy of which is available from the CSIRO website <http://www.publish.csiro.au/pid/7076.htm>

Shrink-swell related movements can be affected by alterations to the soil profile by cutting and filling, and by the suction related effects of trees close to the building area. The effects of any such cutting, filling, tree planting should be taken into account when selecting design values for differential movement across the building.

If further site regarding works are undertaken at the site, reclassification may be required once final cut and fill depths and fill material types are known.



7 LIMITATIONS

This report comprises the results of an investigation carried out for a specific purpose and client as defined in the document. The report should not be used by other parties or for purposes or projects other than those assumed and stated within the report, as it may not contain adequate or appropriate information for applications other than those assumed or advised at the time of its preparation. The contents of the report are for the sole use of the client and no responsibility or liability will be accepted to any third party. The report should not be reproduced either in part or in full, without the express permission of Regional Geotechnical Solutions Pty Ltd.

Geotechnical site investigation is based on data collection, judgment, experience, and opinion. By its nature, it is less exact than other engineering disciplines. The findings presented in this report and used as the basis for the recommendations presented herein were obtained using normal, industry accepted geotechnical design practises and standards. To our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points.

The recommended depth and properties of any soil, rock, groundwater, or other material referred to in this report is an engineering estimate based on the information available at the time of its writing. The estimate is influenced and limited by the fieldwork method and testing carried out in the site investigation, and other relevant information as has been made available. In cases where information has been provided to Regional Geotechnical Solutions for the purposes of preparing this report it has been assumed that the information is accurate and appropriate for such use. No responsibility is accepted by Regional Geotechnical Solutions for inaccuracies within any data supplied by others.

If site conditions encountered during construction vary significantly from those discussed in this report, Regional Geotechnical Solutions Pty Ltd should be contacted for further advice.

This report alone should not be used by contractors as the basis for preparation of tender documents or project estimates. Contractors using this report as a basis for preparation of tender documents should avail themselves of all relevant background information regarding the site before deciding on selection of construction materials and equipment.

If you have any questions regarding this project, or require any additional consultations, please contact the undersigned.

For and on behalf of **Regional Geotechnical Solutions Pty Ltd**

Prepared by

Tim Morris

Principle Engineering Geologist

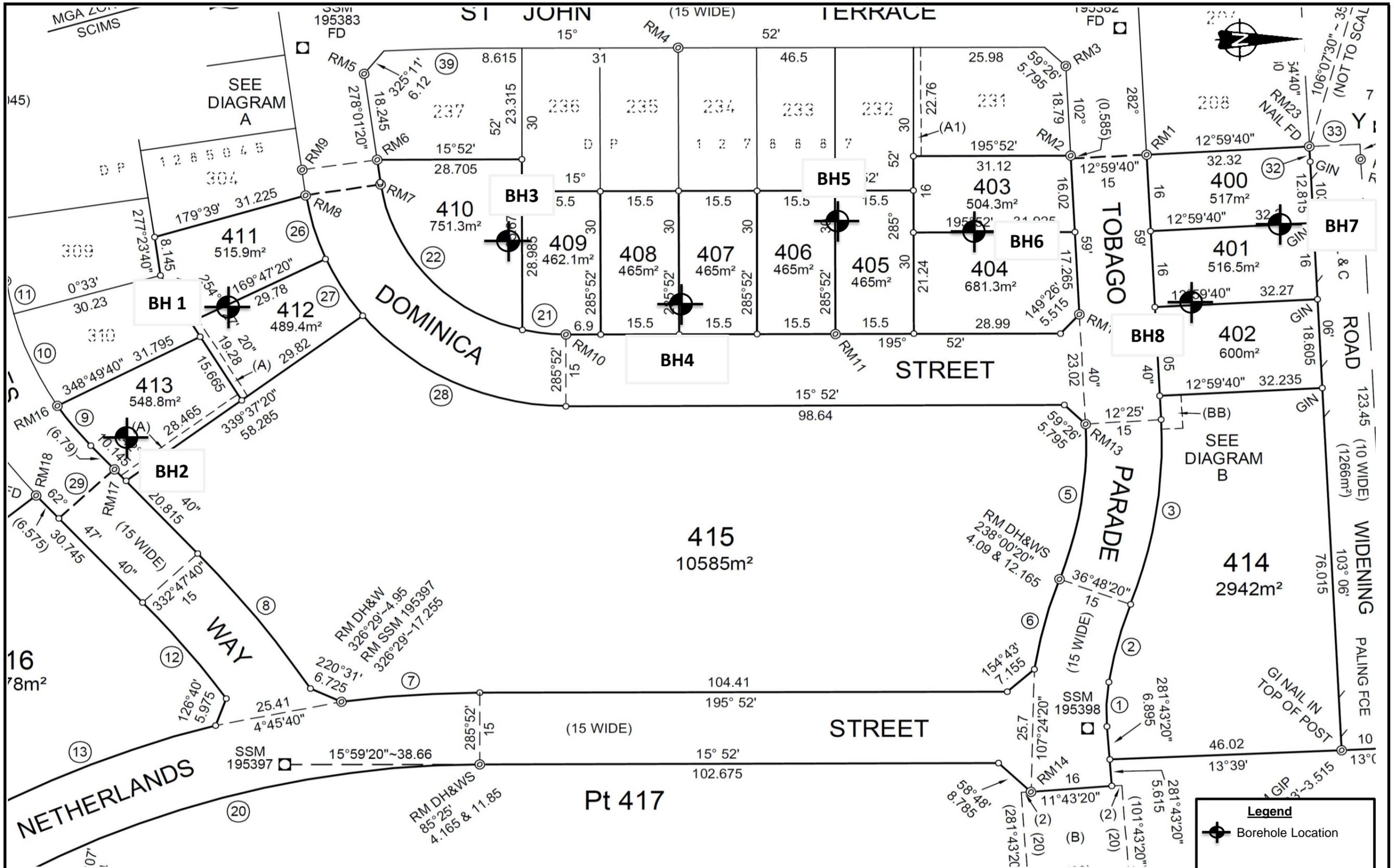
Reviewed by

Adam Holzhauser

Principal Geotechnical Engineer

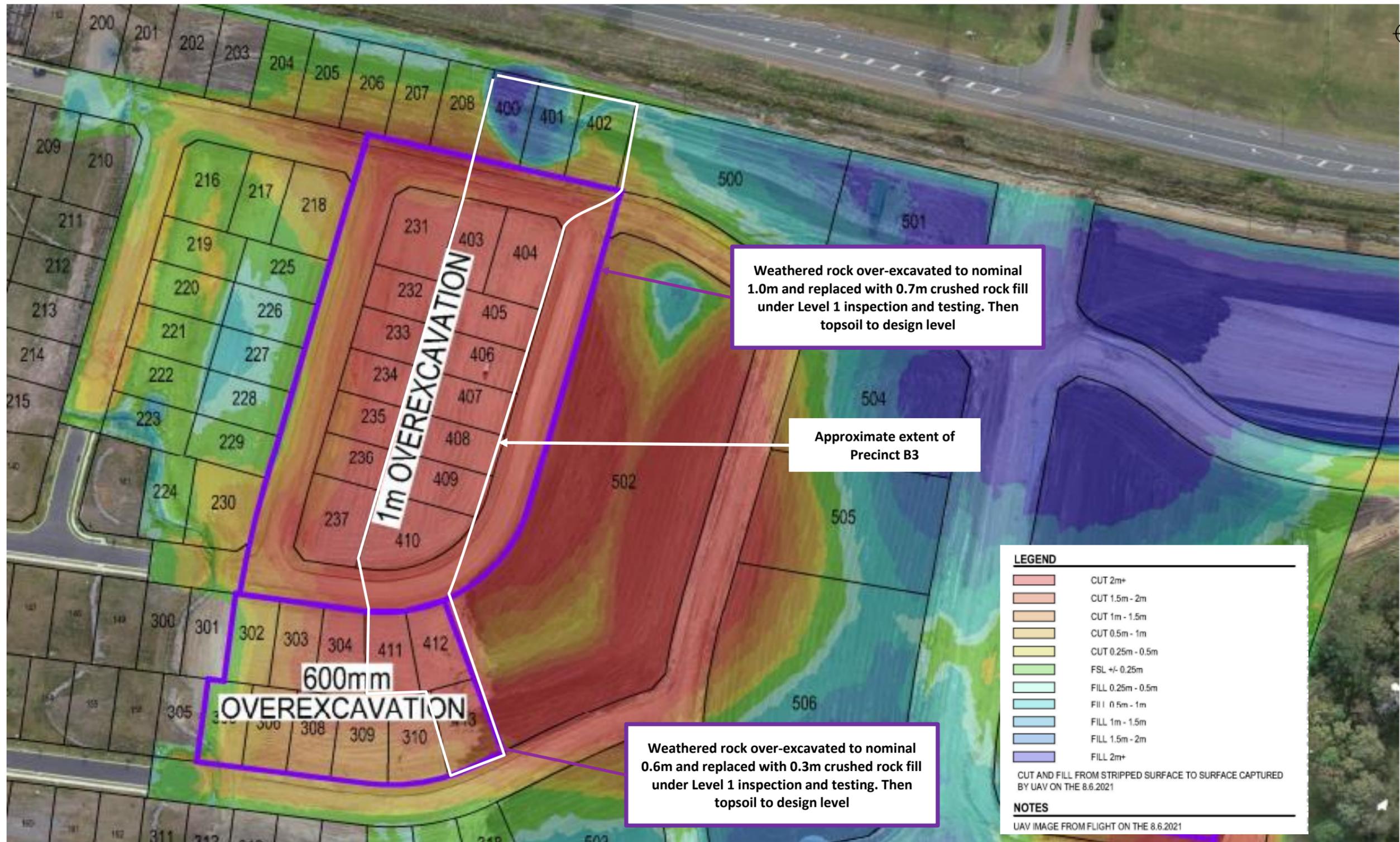


Figures



Based on supplied drawing titled " PLAN OF SUBDIVISION OF LOT 702 DP 1279092 "

	Client:	KING & CAMPBELL	Job No.	RGS20337.1_CW
	Project:	PROPOSED RESIDENTIAL SUBDIVISION	Drawn By:	MJ
		LAKE CATHIE	Scale:	NTS
	Title:	PLAN OF SUBDIVISION OF LOT 702 DP 1279092	Date:	26-Jun-23
			Figure No.	1



Based on supplied drawing titled " TOTAL CUT FILL BC "

	Client:	ST VINCENT'S FOUNDATION PTY LTD	Job No.	RGS20337.1
	Project:	PROPOSED RESIDENTIAL SUBDIVISION	Drawn By:	TM
		STAGE 3, PRECINCT B, RAINBOW BEACH	Scale:	NTS
	Title:	LEVEL 1 FILLING PLAN	Date:	27-Jun-23
			Figure No.	2



Appendix A

Results of Field Investigations



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH3-01**

CLIENT: King and Campbell
 PROJECT NAME: Precinct 3 Rainbow Beach
 SITE LOCATION: Ocean Drive, Lake Cathie
 TEST LOCATION: Lot 411/412

PAGE: 1 of 1
 JOB NO: RGS20337.1
 LOGGED BY: MJ
 DATE: 19/5/23

DRILL TYPE: RGS Ute Mounted Drill Rig EASTING: 484023 m SURFACE RL: 16.0 m
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6507312 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
AD/T	Not Encountered		15.8	0.2		CL	FILL: Sandy CLAY, low plasticity, dark brown, with gravel	M				TOPSOIL/FILL	
			15.6	0.4		0.30m	GW	FILL: Sandy GRAVEL, fine to medium grained, subangular/angular, grey/brown, trace plastic fines	D				FILL
			15.4	0.6									
			15.2	0.8									
			15.0	1.0		1.00m	Hole Terminated at 1.00 m Refusal due to Rock						
			14.8	1.2									
			14.6	1.4									
			14.4	1.6									
			14.2	1.8									

RG 2.00.3.LIB.GLB.Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS20337.1_BH3-01 TO B3307 LOGS MAY 2023.GPJ <DrawingFile> 28/6/2023 09:49 10.03.00.09 Daiged Lab and In Situ Test - DGD Lib RG 2.00.3 2023-03-03 Proj RG 2.00.0 2021-06-30

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH3-02**

CLIENT: King and Campbell
 PROJECT NAME: Precinct 3 Rainbow Beach
 SITE LOCATION: Ocean Drive, Lake Cathie
 TEST LOCATION: Lot 413

PAGE: 1 of 1
 JOB NO: RGS20337.1
 LOGGED BY: MJ
 DATE: 19/5/23

DRILL TYPE: RGS Ute Mounted Drill Rig EASTING: 484041 m SURFACE RL: 14.5 m
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6507281 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
AD/T	Not Encountered		14.4	0.2		CL	FILL: Silty CLAY, dark brown	M				TOPSOIL/FILL
			14.2	0.25m		GW	FILL: Sandy GRAVEL, fine to medium grained, subangular/angular, grey/brown, trace plastic fines	D				FILL
				0.4			Hole Terminated at 0.30 m Refusal due to Rock or Cobble					
				14.0								
				0.6								
				13.8								
				0.8								
				13.6								
				1.0								
				13.4								
				1.2								
				13.2								
				1.4								
				13.0								
				1.6								
				12.8								
				1.8								
				12.6								

RG 2.00.31.LIB.GLB.Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS20337.1_BH3-01 TO B3-07 LOGS MAY 2023.GPJ <DrawingFile> 28/6/2023 09:49 10.03.009 Daiged Lab and In Situ Test - DGD Lib - RG 2.00.3 2023-03-03 Proj_RG 2.00.0 2021-06-30

LEGEND:	Notes, Samples and Tests	Consistency	UCS (kPa)	Moisture Condition
Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Field Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH3-03**

CLIENT: King and Campbell
 PROJECT NAME: Precinct 3 Rainbow Beach
 SITE LOCATION: Ocean Drive, Lake Cathie
 TEST LOCATION: Lot 409/410

PAGE: 1 of 1
 JOB NO: RGS20337.1
 LOGGED BY: MJ
 DATE: 19/5/23

DRILL TYPE: RGS Ute Mounted Drill Rig EASTING: 484022 m SURFACE RL: 17.0 m
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6507363 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
AD/T	Not Encountered		16.8	0.2		CL	FILL: Silty Sandy CLAY, low plasticity, dark brown	M				TOPSOIL/FILL
			16.6	0.4		GW	FILL: Sandy GRAVEL, fine to medium grained, subangular/angular, grey/brown, trace plastic fines	D				FILL
			16.4	0.6			Hole Terminated at 0.60 m Refusal due to Rock or Cobble					
			16.2	0.8								
			16.0	1.0								
			15.8	1.2								
			15.6	1.4								
			15.4	1.6								
			15.2	1.8								

RG 2.00.3.LIB.GLB.Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS20337.1_BH3-01 TO B3-07 LOGS MAY 2023.GPJ <DrawingFile> 28/6/2023 09:50 10.03.009 Daiged Lab and In Situ Test - DGD Lib RG 2.00.3 2023-03-03 Proj RG 2.00.0 2021-06-30

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH3-04**

CLIENT: King and Campbell
 PROJECT NAME: Precinct 3 Rainbow Beach
 SITE LOCATION: Ocean Drive, Lake Cathie
 TEST LOCATION: Lot 407/408

PAGE: 1 of 1
 JOB NO: RGS20337.1
 LOGGED BY: MJ
 DATE: 19/5/23

DRILL TYPE: RGS Ute Mounted Drill Rig EASTING: 484044 m SURFACE RL: 18.5 m
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6507388 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
AD/T	Not Encountered	0.25m	18.4	0.2	[Cross-hatched pattern]	CL	FILL: Sandy CLAY, low plasticity, dark brown	M				TOPSOIL/FILL
		B 0.35m	18.2	0.25m		GW	FILL: Sandy GRAVEL, fine to medium grained, subangular/angular, grey/brown, trace plastic fines	D				FILL
			18.0	0.4			Hole Terminated at 0.35 m Refusal due to Rock					
			17.8	0.6								
			17.6	0.8								
			17.4	1.0								
			17.2	1.2								
			17.0	1.4								
			16.8	1.6								
			16.6	1.8								

RG 2.00.3.LIB.GLB.Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS20337.1_BH3-01 TO B3-07 LOGS MAY 2023.GPJ <DrawingFile> 28/6/2023 09:50 10.03.009 D:\rgl Lab and In Situ Test - DGD Lib - RG 2.00.3 2023-03-03 Proj_RG 2.00.0 2021-06-30

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH3-05**

CLIENT: King and Campbell
 PROJECT NAME: Precinct 3 Rainbow Beach
 SITE LOCATION: Ocean Drive, Lake Cathie
 TEST LOCATION: Lot 405/406

PAGE: 1 of 1
 JOB NO: RGS20337.1
 LOGGED BY: MJ
 DATE: 19/5/23

DRILL TYPE: RGS Ute Mounted Drill Rig EASTING: 484858 m SURFACE RL: 19.0 m
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6507373 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
AD/T	Not Encountered		18.8	0.2		CL	FILL: Sandy CLAY, low plasticity, dark brown	M				TOPSOIL/FILL
			18.6	0.4		GW	FILL: Sandy GRAVEL, fine to medium grained, subangular/angular, grey/brown, trace plastic fines	D				FILL
			18.4	0.6								
			18.2	0.8			Hole Terminated at 0.60 m Refusal due to Rock or Cobble					
			18.0	1.0								
			17.8	1.2								
			17.6	1.4								
			17.4	1.6								
			17.2	1.8								

RGS 2.00.3.LIB.GLB.Log_RG.NON-CORED.BOREHOLE-TEST.PLT_RGS20337.1.BH3-01 TO B3-07 LOGS.MAY.2023.GPJ <DrawingFile> 28/6/2023 09:50 10.03.009 Daiged Lab and In Situ Test - DGD Lib. RG 2.00.3 2023-03-03 Pjt. RG 2.00.0 2021-06-30

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH3-06**

CLIENT: King and Campbell
 PROJECT NAME: Precinct 3 Rainbow Beach
 SITE LOCATION: Ocean Drive, Lake Cathie
 TEST LOCATION: Lot 403/404

PAGE: 1 of 1
 JOB NO: RGS20337.1
 LOGGED BY: MJ
 DATE: 19/5/23

DRILL TYPE: RGS Ute Mounted Drill Rig EASTING: 484047 m SURFACE RL: 20.0 m
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6507456 m DATUM: AHD

Drilling and Sampling				Material description and profile information						Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T	Not Encountered		19.8	0.2		CL	FILL: Sandy CLAY, low plasticity, dark brown	M				TOPSOIL/FILL
			19.6	0.4		GW	FILL: Sandy GRAVEL, fine to medium grained, subangular/angular, grey/brown, trace plastic fines	D				FILL
			19.4	0.6			Hole Terminated at 0.50 m Refusal due to Rock or Cobble					
			19.2	0.8								
			19.0	1.0								
			18.8	1.2								
			18.6	1.4								
			18.4	1.6								
			18.2	1.8								

RG 2.00.3.LIB.GLB.Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS20337.1_BH3-01 TO B3-07 LOGS MAY 2023.GPJ <DrawingFile> > 28/6/2023 09:50 10.03.009 Dajjal Lab and In Situ Test - DGD Lib - RG 2.00.3 2023-03-03 Proj_RG 2.00.0 2021-06-30

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH3-07**

CLIENT: King and Campbell
 PROJECT NAME: Precinct 3 Rainbow Beach
 SITE LOCATION: Ocean Drive, Lake Cathie
 TEST LOCATION: Lot 400/401

PAGE: 1 of 1
 JOB NO: RGS20337.1
 LOGGED BY: MJ
 DATE: 19/5/23

DRILL TYPE: RGS Ute Mounted Drill Rig EASTING: 484062 m SURFACE RL: 22.5 m
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6507501 m DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
AD/T	Not Encountered		22.4	0.2	[Cross-hatched pattern]	CL	FILL: Sandy CLAY, low plasticity, dark brown	M				TOPSOIL/FILL
			22.2	0.25m		GW	FILL: Sandy GRAVEL, fine to medium grained, subangular/angular, grey/brown, trace plastic fines	D				FILL
			22.0	0.4	0.40m		Hole Terminated at 0.40 m Refusal due to Rock					
			21.8	0.6								
			21.6	0.8								
			21.4	1.0								
			21.2	1.2								
			21.0	1.4								
			20.8	1.6								
			20.6	1.8								

RG 2.00.31.LIB.GLB.Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS20337.1_BH3-01 TO B3-07 LOGS MAY 2023.GPJ <DrawingFile> 28/6/2023 09:50 10.03.009 D:\rgf Lab and In Situ Test - DGD Lib - RG 2.00.3 2023-03-03 Proj_RG 2.00.0 2021-06-30

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH3-08**

CLIENT: King and Campbell
 PROJECT NAME: Precinct 3 Rainbow Beach
 SITE LOCATION: Ocean Drive, Lake Cathie
 TEST LOCATION: Lot 401/402

PAGE: 1 of 1
 JOB NO: RGS20337.1
 LOGGED BY: MJ
 DATE: 19/5/23

DRILL TYPE: RGS Ute Mounted Drill Rig EASTING: 484073 m SURFACE RL: 20.5 m
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: 6507481 m DATUM: AHD

Drilling and Sampling				Material description and profile information						Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T	Not Encountered		20.4	0.2		CL	FILL: Sandy CLAY, low plasticity, dark brown	M				TOPSOIL/FILL
			20.2	0.4		GW	FILL: Sandy GRAVEL, fine to medium grained, subangular/angular, grey/brown, trace plastic fines	D				FILL
			20.0	0.6			Hole Terminated at 0.45 m Refusal due to Rock					
			19.8	0.8								
			19.6	1.0								
			19.4	1.2								
			19.2	1.4								
			19.0	1.6								
			18.8	1.8								
			18.6									

RG_2.00.31.LIB.GLB_Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS20337.1_BH3-01 TO B3-07 LOGS MAY 2023.GPJ <DrawingFile> 28/6/2023 09:50 10.03.009 Dajdel Lab and In Situ Test - DGD Lib - RG_2.00.3 2023-03-03 Pit_RG_2.00.0 2021-06-30

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



Appendix B

Laboratory Test Result Sheets

Report No: MAT:NEW23W-2401-S01

Issue No: 1

Material Test Report

Client: Regional Geotechnical Solutions Pty Ltd
 44 Bent Street
 Wingham NSW 2429

Project No.: MNC16P-0001
Project Name: Various Testing
Project Location: Ocean Drive, Lake Cathie, NSW



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

B. Cullen
 Approved Signatory: Brent Cullen
 (Engineering Geologist)
 NATA Accredited Laboratory Number: 18686
 Date of Issue: 13/06/2023

Sample ID: NEW23W-2401-S01
Date Sampled: 22/05/2023
Date Received: 24/05/2023
Source: On-Site Insitu
Material: Clay
Specification: No Specification
 The results outlined below apply to the sample as received

TRN: RGS20337.1
Sample Location: BH4 - (0.3 - 0.4m)

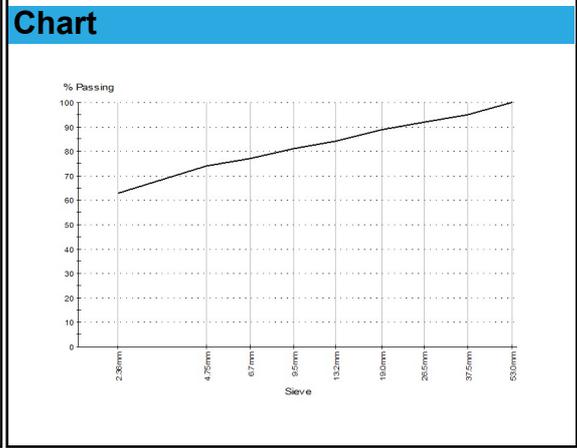
Particle Size Distribution

Method: RMS T106
Drying by: Oven
Date Tested: 7/06/2023

Sieve Size	% Passing	Limits
53.0mm	100	
37.5mm	95	
26.5mm	92	
19.0mm	89	
13.2mm	84	
9.5mm	81	
6.7mm	77	
4.75mm	74	
2.36mm	63	

Other Test Results

Description	Method	Result	Limits
Ratio A	RMS T107	49	
Ratio B		56	
Ratio C		62	
Observations		MF	
Passing 2.36mm sieve (%)	RMS T106, RMS T107	63	
Passing 425µm sieve (%)		31	
Passing 75µm sieve (%)		18	
Passing 13.5µm sieve (%)		11	
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Liquid Limit (%)	RMS T108	23	
Method		Four Point	
Plastic Limit (%)	RMS T109	13	
Plasticity Index (%)	RMS T109	10	
Date Tested		9/06/2023	



Comments
 N/A