HDB Town Planning and Design

Proposed Rezoning

Weemala Development Stage E2

Geotechnical Assessment

Report No. RGS50006.1 - AC 5 May 2022

REGIONAL GEOTECHNICAL SOLUTIONS



RG\$50006.1 - AC

5 May 2022

HDB Town Planning and Design PO Box 40 MAITLAND NSW 2320

Attention: Rod Fletcher

Dear Rod,

RE: Proposed Rezoning – Weemala Development Stage E2 Geotechnical Assessment

As requested, Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken a geotechnical assessment for the Proposed Rezoning of Weemala Development Stage E2 located to the east of Main Road Boolaroo.

The results of assessment are presented in this report, together with comments and recommendations regarding the proposed rezoning, slope stability, and proposed deep cuts.

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

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1 INTRODUCTION

Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken a geotechnical assessment for the proposed rezoning of a parcel of land located off Main Road, Boolaroo. The rezoning is for Stage E2 of the Weemala Development as illustrated on Diagram 1 below.



Stage E2 is a parcel of land within Lot 1006 DP 1270101, that is subject to a large-scale subdivision with Phase 1 currently under construction and future stages currently in the planning phase. E2 occupies an area of approximately 2ha and is located near the centre of the lot on the eastern boundary as illustrated above. The site is proposed to be rezoned from C2 Environmental Conservation Zone to R2 Residential Zone.

As part of the rezoning application(s), geotechnical assessment is required. The purpose of the work presented herein is to satisfy the geotechnical requirement to support the re-zoning.



Based on the above, in order to support a rezoning application, the geotechnical assessment herein provides comments and recommendations on the following:

- Review of previous investigations undertaken by RGS for previous stages of the development;
- Assessment of soil properties and reactivity;
- Subsurface profile including the presence and extent of fill (if any) and the presence of groundwater (if encountered within the depths of the investigation);
- Preliminary indication of earthworks requirements;
- Preliminary indication of foundation conditions and road pavement subgrade conditions; and
- Additionally, the investigation has assessed the following:
 - Feasibility and retention of the proposed 8m to 10m cuts in the area;
 - Slope stability within previously identified instability risk area.

2 METHODOLOGY

Field work for the assessment was undertaken by a Senior Geotechnical Engineer from RGS and included:

- A walkover assessment to map the geotechnical conditions including identifying geotechnical hazards, geotechnical terrains, and identification of geotechnical materials;
- The excavation of twelve test (12) pits within the rezoning area and slope instability area;
- The drilling of three (3) boreholes along the crest of the proposed 8m to 10m cut to depths of up to 12.1m with a track mounted rig;
- Collection of samples for subsequent laboratory testing.

Engineering logs of the borehole are presented in Appendix A. The test locations are shown on Figure 1.

3 SITE CONDITIONS

3.1 Surface Conditions

Topographically, the wider site is dominated by two broad, northwesterly plunging ridge spurs that run off the main Munibung Hill ridgeline to the southeast of the site.

The location of E2 was not marked out at the time of the investigation, however, based on a Google Earth overlay, the area was assessed the encompass a west-northwest tending spur located on the western face of the main plunging ridgeline running along the eastern boundary of the site. The location is illustrated below in the satellite image below reproduced from Google Earth with three times elevation exaggeration to illustrate the geomorphology.



Diagram 2: Google Earth image that illustrates geomorphology of the site. The map has been oriented in a west-northwest direction.

The spur generally falls to the west-northwest at grades of up to 15°. It is bound by gullies on either side of the spur that are also running down the western face of the main ridge in a west northwest direction. The sides of the spur fall towards the gullies at grades of about 25°, with some localised steeper slopes falling at grades of up to 40° that were in areas generally approaching the centre of the gullies.

Vegetation over the upper portion of the slope comprises thick grass cover with sparse tree regrowth.

The lower portion of E2 is transected by an access track. Weathered sandstone and claystone outcrops are exposed in the toe of the slope above the track. The exposed rock is highly fractured and estimated to be low to medium strength. Weathered rock is also on the surface below the batter of the track and extends over the surface of the entire lower section of E2.

The track is 8.5m wide and the batter has been constructed at about 1.5:1 (about 35°). The track is constructed over the gully that runs along the southwest boundary of the section. Surface water flows from the gully are diverted along the track and directed into the next gully to the north. Some ponding was observed along the track.

Site photographs are presented below.



3.2 Subsurface Conditions

The site is situated within an area underlain by the Boolaroo Sub-Group of the Newcastle Coal Measures. The elevated ridges and steep slopes of Munibung Hill to south and east of the site are formed by the rocks of the Moon Island Beach Sub-Group, which encroaches onto the elevated southern end of the site.

The materials encountered during the investigation are summarised in Table 1 and Table 2. Further details are presented on the attached engineering logs.

Unit	Material	Material Description
Unit 1	Colluvial Soil	Silty CLAY, medium to high plasticity, with some fine to coarse grained angular gravel, firm to stiff
Unit 2	Residual Soil	Sandy CLAY and Silty CLAY, medium to high plasticity, fine to medium grained sand, firm to very stiff.
UNIT 3	Extremely Weathered Sandstone/Siltstone	Sandy CLAY, medium to plasticity, fine to medium grained sand, hard/friable.
UNIT 4	Moderately Weathered Sandstone/Siltstone	SANDSTONE/SILTSTONE, fine to medium grained, laminated to thinly bedded fractures generally spaced at 50mm to 400mm, generally low to medium strength, with medium to high strength bands of slightly weathered material. Generally interbedded with very low strength tuffaceous sandstone and coal layers.
UNIT 5	Tuffaceous Sandstone	TUFFACEOUS SANDSTONE, fine grained, laminated, very low to medium strength
UNIT 6	Coal	Weathered Coal, generally fragmented to highly fractured, very low to low strength
UNIT 7	Moderately to Fresh Weathered Sandstone/ Siltstone	SANDSTONE/SILTSTONE, fine to medium grained, laminated to thinly bedded fractures generally spaced at 50mm to 400mm, medium to high strength

Table 1: Summary of Geotechnical Units

Table 2: Summary of Subsurface Profile

		Depth of Material Layer (m)													
Borehole	UNIT 1 Colluvial Soil	UNIT 2 Residual Soil	UNIT 3 EW Sandstone/ Siltstone	UNIT 4 HW - MW Sandstone/ Siltstone	UNIT5 Tuffaceous Sandstone	UNIT 6 Coal	UNIT 7 MW - FR Sandstone/ Siltstone								
BH1		0-1.1		1.1 – 3.95	3.95 - 8.4		8.4 - ≥9.3								
BH2				0 - 6.8	0 - 6.8		6.8 – ≥10								
BH3			2^ - 8		9.1 – 11.5	3.4 – 8 (interbedded with unit 3) 9 – 9.1	11.5–≥12.1								
TP1		0 – 0.5		0.5 - 2			2 – ≥2.3*								
TP2		0-0.8	0.8 – 1.3	1.3 – 1.8			1.8 – ≥2.3*								
TP3	0 - 1	1.2 - 1.6			2.1 – 2.9 3.2 – ≥3.5	1 – 1.2 1.6 – 2.1 2.9 – 3.2									
TP4		0 - 0.8	-	0.8 - 1.4			1.4 – ≥1.9*								
TP5	0-0.8			0.8 – 1.1	1.1 – 1.3	1.3 - ≥1.4*									
TP6	0-0.6		0.6 -1.1	1.1 – 1.4		1.4 - ≥1.6*									
TP7	0-0.4			0.4 - 1.0		1 – 1.1	1.1 – ≥1.2*								
TP8	0-0.8				1.0 - ≥3.0										

		Depth of Material Layer (m)													
Borehole	UNIT 1 Colluvial Soil	UNIT 2 Residual Soil	UNIT 3 EW Sandstone/ Siltstone	UNIT 4 HW - MW Sandstone/ Siltstone	UNIT5 Tuffaceous Sandstone	UNIT 6 Coal	UNIT 7 MW - FR Sandstone/ Siltstone								
TP9					0-0.9		0.9 -≥1.2*								
TP10					0 – 0.7 0.9 – 1.5 2.0 – ≥3.5	0.7 – 0.9 1.5 – 2.0									
TP11	0 - 0.7				0.7 – 1.4		1.4 - ≥2.0								
TP12	0-0.6				0.6 – 1.1	1.1 – ≥1.3*									

Note: ≥ Indicates that base of material layer was not encountered

* Indicates that the borehole was terminated due to practical refusal on rock

Indicates that the material was not encountered at the test location

Indicates material inferred based on core loss
 Indicates material above comprised conglom

Indicates material above comprised conglomerate, borehole was drilled at approx. 2m above top of proposed cut

Up to 0.2m of topsoil was encountered in some of the borehole/test pit locations

A general representation of the profile encountered is illustrated below.



TP3 was excavated in the upper slope of the spur and encountered colluvial/residual soil overlying tuffaceous sandstone with interbedded coal layers.

TP 4 was excavated about 20m downslope of TP3 and did not encounter coal seams. The test pit encountered practical refusal at 1.9m



TP11 was excavated on the upper slope of the northern face of the spur and encountered colluvial soil overlying very low strength tuffaceous material overlying medium strength sandstone.

TP12 was excavated about 20m downslope of TP11 and encountered colluvial soil overlying tuffaceous material overlying interbedded claystone/coal followed by practical refusal at 1.3m.

Groundwater was encountered within TP1, TP2, and TP10, at depths ranging from 03m to 1.8m, and in some test pits at multiple depths, groundwater was not encountered within the other test pits. Due to the use of drilling water groundwater levels could not be accurately read within the boreholes. No long-term monitoring was undertaken.

It should be noted that fluctuations in groundwater levels can occur as a result of seasonal variations, temperature, rainfall, and other similar factors, the influence of which may not have been apparent at the time of the assessment.

A summary of the laboratory Atterberg limits test and point load test results are presented in Table 3 and Table 4. Laboratory test result sheets are presented in Appendix B.

Test Location	Depth	Material	Liquid Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	Inferred Shrink – Swell Index (%)
TP3	1.4 – 1.5	Residual CLAY	62	38	13	2.6
TP4	0.4 – 0.5	Residual CLAY	73	48	18	3.6
TP5	0.4 - 0.5	Colluvial CLAY	73	44	14	2.8
TP6	0.4 - 0.4	Colluvial CLAY	82	58	21	4.2
TP11	0.55 – 0.75	Colluvial CLAY	65	38	15	3.0

Table 4: Laboratory Test Results Summary – Atterberg Limits

 Table 5: Laboratory Test Results Summary – Point Load Index

Test Location	Depth	Rock Type	Diametral I _{s(50)} (MPa)	Strength Classification	Axial I _{s(50)} (MPa)	Strength Classification	Inferred UCS (MPa)
BH1	2.81-2.94	MW Sandstone	0.08	VL	0.12	L	2.36
BH1	3.43-3.55	MW Sandstone	0.63	м	0.66	м	13.22
BH1	5.0-5.07	MW Tuffaceous Sandstone	0.62	М	0.25	L	4.92
BH1	7.66-7.75	MW Tuffaceous Sandstone	0.07	VL	0.10	L	2.08
BH1	8.73-8.81	SW Siltstone	2.26	H 2.56		н	51.11
BH1	8.92-9.0	SW Sandstone	2.28	н			
BH2	5.25-5.35	MW Sandstone	0.18	L	0.28	L	5.66
BH2	7.05-7.2	SW Siltstone	1.98	н	3.08	νн	61.66
BH2	7.64-7.7	SW Sandstone	0.56	м	2.61	н	52.22
BH2	9.8-9.88	MW Siltstone	0.05	VL	0.15	L	2.95
BH3	8.46-8.58	EW Tuffaceous Sandstone	0.11	L	0.06	VL	1.22
BH3	10.86-10.95	EW Tuffaceous Sandstone	0.05	VL	0.18	L	3.64
BH3	12.0-12.1	MW Sandstone	0.11	L	0.06	VL	1.22

4 PROPOSED DEVELOPMENT



Cuts of up to 10m are proposed within the E2 section as illustrated below.

Based on the contour map it is understood that the base of the cut will be at approximately the level of the exposed weathered rock located on the downslope side of the access track that bisects the site. Based on the boreholes undertaken this material is expected to extend through the base of the entire cut.



Weathered rock outcrops exposed below the access track



5 SOIL CAPABILITY

5.1 Nature of Site Soils & Suitability for Reuse as Engineered Fill

The site generally had a subsurface profile comprising:

- Topsoil; overlying
- Colluvial soils comprising medium to high plasticity firm to stiff Silty CLAY; or
- Residual Soil comprising Silty CLAY and Sandy CLAY medium to high plasticity, firm to very stiff; overlying
- Weathered Rock comprising interbedded extremely weathered to slightly weathered sandstone, siltstone, tuffaceous sandstone, and coal.

A summary of the suitability of the site materials for reuse as controlled fill is presented below:

- Topsoil will not be suitable for reuse as controlled fill, however, the material may be reused for landscaping purposes;
- The colluvial and residual soils will be suitable for reuse as controlled fill, however, the material is highly reactive and consideration is required for future foundation designs as discussed in Section 4.3. The firm material encountered in TP6 and TP7 will require some moisture conditioning;
- The weathered rock profile will be suitable for reuse as controlled fill, however, the following should be considered:
 - Moisture control will be required for the tuffaceous sandstone layers due to the high silt content, it would be recommended to be placed and compacted slightly dry of optimum moisture content;
 - The slightly weathered siltstone and sandstone layers are expected to be excavated in large blocks up to 1m diameter and may require rock hammers or large compactors to breakdown.

5.2 Excavatability

The proposed deep cuts will predominantly encounter colluvial and residual soils overlying low to medium strength fractured sandstone and siltstone, tuffaceous sandstone, and coal that will generally excavate with the use of a medium to large excavator. As a guide the investigation was undertaken with a 23.5 tonne excavator, that achieved excavation within the low strength material, however, practical refusal was encountered within the high strength sandstone and coal layers. Generally, the edges of the spur and the lower portion of the slope encountered practical refusal at depths ranging from 1.2m to 1.9m. In the central and upper portions of the slope test pits were extended to up to 3.5m without refusal.

In a large bulk excavation these materials are likely to be excavatable by ripping with a large dozer, equipped with ripping tynes. Some harder rock that might require harder ripping or the use of rock hammers will likely be encountered. Of note is the siltstone encountered in BH1 from 8.4m and the sandstone encountered in BH2 from 7.2m.

Due to the nature of the weathering process of the tuffaceous materials some areas will encounter higher strength weathered sandstone/siltstone underlain by very low strength extremely weathered tuffaceous sandstone.

The use of rock hammers may be required in detailed excavations such as service trenches, or to avoid overbreak in detailed excavations. Where permanent cut batters will remain in the proposed deep cuts on the site boundaries, the use of pre-drilling, header wheels, or rock breakers to avoid overbreak will result in a cleaner and less fractured final batter than that produced by ripping alone, which would be advantageous for aesthetic appearance and future maintenance within a residential development area in the long term.

5.3 Preliminary Earthworks Requirements

Site preparation prior to the proposed site regrade will involve selective stripping and stockpiling of vegetation, localised areas of topsoil, and any organic, deleterious or otherwise unsuitable materials. These should be removed to spoil or stockpiled for re-use as landscaping materials within the proposed subdivision.

Residual and colluvial soils, and weathered rock excavated for proposed cuts can be stockpiled for later use. Some material may need to be moisture conditioned. Stripped surfaces should be proof rolled to identify any soft, excessively wet or heaving areas that should be removed and replaced with approved engineering fill prior to placement of further fill above.

The groundwater table is not expected to be encountered within the proposed excavations. However, water flows through joints and other defects within the weathered rock profiles may be encountered. The water tends to flow laterally through these layers and daylights as seepage on the slopes below wherever the coal or lower sandstone beds intersect the slope.

As discussed above, the access track constructed through the site has filled over the gully that runs along the southeast boundary of E2 impeding the natural flow path of surface waters. It is recommended that this is cleared or where filling of these gullies is required a drainage blanket must be incorporated. The blanket should comprise a geofabric wrapped drainage blanket of durable hard crushed rock placed in the base of the gully.

Some scouring of the surface was observed generally within the exposed weathered rock in the lower portion of the section. Scour and erosion are expected to be managed by controlling



stormwater runoff to divert away from the site into the stormwater system and re-establishing vegetation. Erosion protection such as geosynthetic meshes, geo-cells, etc will be required on cut/fill batter faces.

5.4 Preliminary Foundation Conditions

Based on the proposed cut depths the subgrade level is expected to be within a low to medium strength weathered sandstone profile. Based on this shallow footing systems are likely to be suitable for the support of structures at the site.

For conceptual purposes, for structures that meet the performance requirements detailed within AS2870-2011 '*Residential slabs and footings*' founded within weathered sandstone to be classified in accordance with AS2870-2011 as Class A.

If filling is undertaken in areas of proposed areas of structures, it is recommended to utilise the ripped weathered rock as engineered fill. The use of residual and colluvial clay in the upper 1.5m profile will result in significant shrink swell movement. The Atterberg limits testing indicates the residual and colluvial clay could have a shrink swell index of up to 4.2%. The use of this material in the upper 1.5m would be expected to produce a site classification of Class H2 or even high if trees are planted within the zone of influence of proposed structures.

Further assessment must be undertaken during the design stage of the development.

5.5 Preliminary Pavement Subgrade Conditions

Subgrades beneath proposed pavements are likely to comprise weathered siltstone or sandstone. These materials are likely to produce subgrades with four day soaked CBR values of about 8 to 10%. CBR values of 3 to 5% are likely if clay fill is proposed below pavements.

Investigations will need to be undertaken at completion of the bulk earthworks to confirm subgrade conditions and resultant pavement thickness designs.

6 SITE SUITABILITY

Based on the results of the assessment as outlined herein the site is considered suitable for the proposed residential development from a geotechnical perspective.

Further geotechnical assessment will be required for the purpose of specific earthworks, road pavement, and foundation design.

7 SLOPE STABILITY

7.1 Risk Assessment

The risk of slope instability has been assessed using the principles and procedures of the Australian Geomechanics Society publication *Practice Note Guidelines for Landslide Risk Management, 2007*. This methodology represents the currently accepted state of practice for landslide risk assessment in Australia.



The slope risk assessment process involves identification of a potential slope failure event, or hazard, followed by an estimation of the likelihood of the event occurring, and the potential consequences should the event occur. The onus is on the property owner, potential owner, or other interested party to decide whether the assessed level of risk is acceptable taking into account likely economic consequences of the risk and the recommended geotechnical constraints.

The terms used in the risk assessment process are defined below:

- Hazard: A condition with the potential for causing an undesirable consequence.
- Likelihood: The estimated probability that the hazardous event will occur.

Consequence: Loss or damage resulting from a hazard event.

Risk: A term combining the likelihood and consequence of an event in terms of adverse effects to property or the environment.

7.2 Hazard Identification

Based on the site walk over the following areas of concern were identified:

- Steep gully walls in particular within the northern face of the spur to the south of E2; and
- Over steep batter of track constructed through the site.

These areas are illustrated in the satellite image and photographs below.



Diagram 4: Identified slope risk areas outlined red.



The following potential slope stability hazards were assessed in relation to the site and the consequences to surrounding properties:

- Hazard 1: Translational slide of soil and weathered rock profile within steep gully wall resulting from ongoing stress relief due to erosion and valley formation processes that would cause debris flows. Debris flows could impact on structures or property located below the zone of instability. Debris flows of the magnitude that would typically cause moderate to major damage to structures or property in their path.
- Hazard 2: Translational or rotational sliding due to failure of unsupported cuts and fills or poorly designed, constructed, or otherwise inadequate retaining walls. Such a failure could cause localised damage requiring moderate repairs to part of an individual structure or property.
- Hazard 3:Translational or rotational slide of profile along weak tuffaceous or coal layers.Should such a failure occur it could potentially cause extensive structural damage



and require large scale, costly repairs, and possibly temporary evacuation of the building until repairs are complete.

7.3 Risk Evaluation for Existing Site Conditions

Table 2 summarises the factors affecting slope stability in relation to each of the hazards identified and assesses the risk of slope instability for each using the risk assessment matrix provided in Appendix C of the Australian Geomechanics Society (AGS) publication *Practice Note Guidelines for Landslide Risk Management, 2007*.

A copy of the risk matrix from the AGS document is presented in Appendix C.

Hazard	H1 – Large scale landslide and debris flow	H2 – Localised failure of poorly retained cuts/fill batters	H3 – Translational or rotational slide of profile along weak tuffaceous or coal layers		
Slope height	10m	Up to 3m	10 - 20m		
Cause or trigger	Slope deterioration followed by extreme prolonged weather	Cut steeper than angle of repose, unsupported,1 in 10yr rain event	Slope deterioration followed by extreme weather		
Proportion of slope	0.5	0.1	0.5		
Estimated probability	10 ⁻⁵ yr	10 ⁻³ yr	10 ⁻⁵ yr		
	Assessed Ris	k Without Mitigation			
Likelihood	Rare	Possible	Unlikely		
Consequence	Major	Minor	Major		
Risk	Low	Moderate	Moderate		
Proposed Mitigation	Install upslope drainage to divert water flows away from the face, install erosion protection.	Avoid or retain cuts >1m. Deep cuts constructed in accordance with Section 8 of this report. Remove or reconstruct access track with batt of up to 3:1	Potential failure plane expected to be removed within proposed cut depth, if not further assessment required. All structures should be founded within weathered rock.		
Assessed Risk with A	Aitigation	-			
Likelihood	Rare	Rare	Rare		
Consequence	Major	Minor	Major		
Risk	Low	Very Low	Low		

7.4 Evaluation of Risk Level

The assessment indicates a **Low to Moderate** risk of slope instability affecting the site. As shown in Table 6, by adopting the recommendations of this report, the risks can be reduced to **Low**.

This risk rating would normally be considered acceptable in Australia for hillside residential construction.

8 PROPOSED DEEP CUTS

8.1 Cut batters up to 1V:2H in soil or 1V:1H in rock

The permanent cut batters in the excavations at the site boundary will expose shallow soil profiles overlying weathered rock, predominantly comprising thinly bedded and fractured moderately to highly weathered sandstone and siltstone interbedded with coal and tuffaceous sandstone. Where space permits, these permanent cut slopes can be battered at 2H:1V for the shallow soil profile, and 1H:1V in rock. For cuts deeper that 4m a 1m wide horizontal bench would be recommended at the mid-point of the cut.

The boreholes revealed a profile of shallow soils underlain by weathered sandstone and siltstone, underlain by weathered tuffaceous sandstone, underlain by weathered sandstone/siltstone. Due to the weathering process of the tuffaceous material, it will generally behave like the residual clay profile.

The face is likely to fret and erode with time and therefore some erosion protection should be applied to the face to prevent accumulation of fines at the base of the cuttings which is likely to clog drainage and be aesthetically unacceptable in a residential development in the long term. Options include geosynthetic meshes, geo-cells and the like, used to support landscaping soil and vegetation, or shotcreting of the face.

If shotcrete is used for long term support, it must be doweled into the slope and provided with drainage measures such as strip drain pinned to the rock face and connected to weep holes at regular spacings through the shotcrete to prevent accumulation of water between the rock surface and the shotcrete facing. Fibrecrete sprayed directly onto the face with no dowelling, as is often used for temporary protection of rock faces in construction excavations, would not be suitable for the long-term protection of the face.

8.2 Support of cut Batters Steeper than 1H:1V

It is anticipated that the deep cut along the eastern boundary may be required to be steeper than 1H:1V due to space constraints.

The majority of the cuttings will expose weathered, highly fractured, and low strength rock with isolated seepage along defects for the full depth of the cut. Materials typically exposed below the upper soil profile would be similar to those encountered by the coring in borehole BH2, as illustrated in the photograph below.



Cuts exceeding 1.5m depth and battered at 1H:1V batter angle of steeper in materials of this nature will require support by a pattern of rock bolting and shotcrete facing. Bolts would be grouted in to Bolt and shotcrete requirements to support cuts. Detailed design of rock bolts and shotcreteing can be undertaken when further details of the proposed cuts are known.

Based on the boreholes the spur to the north will encounter better quality, slightly to moderately weathered sandstone/siltstone, with typical fracture spacings varying from fractured zones at 20mm spacing to 400mm spacings from about 7m to 8.5m. It is expected that the profile will be similar to that encountered by borehole BH1, as illustrated in the core photograph below.



Medium to high strength material encountered in BH1 from 8.4m



For this lower part of the cutting, at the batter angles of 0.75H:1V the profile would be expected to be generally "self-supporting" over a large proportion of the cut, and retention measures such as rock bolts are only expected to be required in isolated locations where fracturing and other adverse features are exposed. Bolt and shotcrete requirements for the lower half of this cutting would need to be assessed progressively as excavation proceeds on site, to allow for spot rock bolting of potentially unstable blocks and wedges in the face, together with localised shotcreting.

9 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

Reviewed by

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Figures

Regional Geotechnical Solutions RGS50006.1 - AC 5 May 2022





	Title:	Test Plan Satellite Image	Drawing No.	Figure 2
SOLUTIONS		Weemala Development Stage E2 Boolaroo	Date:	6-May-22
	Project:	Proposed Rezoning	Drawn By:	LD
	Client:	HDB Town Planning and Design	Job No.	RG\$50006.1



Appendix A

Results of Field Investigations

Regional Geotechnical Solutions RGS50006.1 - AC 5 May 2022

Γ		ENGINEERING LOG - TEST PIT												TEST PIT NO: TP1				
	4	REGION	AL HNIC/	u c		:		HDB To	wn Planni	ing and D	Design			Р	AGE		1	of 1
		SOLUTIO)NS	P	ROJEC	CT NA	ME:	Propose	ed Rezonii	ng				J	овι	NO:	R	GS50006.1
				S	ITE LO	CATI	ON:	Weema	la Develoj	pment St	age E2			L	.OGC	SED B	Y: LI)
				т	EST LO	CAT	'ION:	Refer to	Refer to Figure 1					D	DATE	:	5/	4/22
E	EQUIPMENT TYPE: 15T Excavator									EAS	STING:	37232	6 m 🖇	SURF	ACE	RL:		
Т	TEST PIT LENGTH: 4.0 m WIDTH: 1							.5 m		NO	rthing:	635368	4m I	DATU	M:		AHD	
	Exca	ation and S	Samplin	3			N	Material des	scription and	d profile inf	ormation		_		Fiel	d Test		
METHOD	WATER	SAMPLES	RL (Not measure	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	МА	ATERIAL D charad	ESCRIPTIC	DN: Soil ty lour,minor	oe, plasticit component	y/particle s	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure	e and additional ervations
Prt Ro 2.00.0 2221-06-30 E	•					CL	<u>0.</u> 50m	SANDSTC SANDSTC brown, gre 10-200mn	AY: Mediur g	n plasticity grained sar	, pale grey, d	dark e — — — t grey	M < Wp	St- VSt	_		MODERAT WEATHER SANDSTOI VERY LOW STRENGTH Minor greyw 0.8m	ELY — — — — — ED NE TO LOW H ater inflow at
· DGD Lib: RG 2.00.3 2022-03-03				2.0			2.00m 2.30m	SANDSTO	DNE: Fine to	o medium g	rained, pal	 e grey	-				SLIGHTLY TO FRESH MEDIUM S	WEATHERED SANDSTONE TRENGTH
TEST PTT RGS60006 1 TP LOGS GPJ < <dawingfile>> 114/2022 16:09 10:00:00:09 Daigei Lab and In Stu Tool</dawingfile>	GEND:			2.5 2.5 - - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - -	nd Test		Hole Term Practical F	Inated at 2.	30 m		Consist	ency			CS (kPa) <u>Moisture</u>	Condition
	Water Water Level (Date and time shown) → Water Inflow Water Outflow Strata Changes			U₅₀ CBR E ASS B <u>Field Test</u>	50mm Bulk s Enviro Acid S Bulk S	Diame ample f nmenta sulfate S ample	eter tube for CBR al sampl Soil Sarr	e sample t testing le nple				VS S F St VSt H Fb	Very Soft Soft Firm Stiff Very Stiff Hard Friable V	V	25 50 10 20 20 20 20	25 5 - 50 0 - 100 00 - 200 00 - 400 400	D D M M W V W _P P W _L L Density In	ry loist /et lastic Limit iquid Limit dex <15%
KG 2.00.3 LIB.GL	tra D st	ansitional stra efinitive or dis rata change	ata stict	PID DCP(x-y) HP	its Photoionisation detector reading (ppm) Dynamic penetrometer test (test depth interval shown) Hand Penetrometer test (UCS kPa)						L Loose Density Index <15% L Loose Density Index <15% MD Medium Dense Density Index 35 - 6 D Dense Density Index 45 - 3 V/D Very Dense Density Index 45 - 3				dex 15 - 35% dex 35 - 65% dex 65 - 85% dex 85 - 100%			

				E	NGI	NEE	RIN	G LOG - T	TEST PI	т			Т	EST	PIT N	ю: Т	FP2
		REGION/	AL HNICA	a c		:		HDB Town	Planning a	ind Design			F	PAGE	:	1	of 1
		SOLUTIO	INS	P	ROJE	CT NA	ME:	Proposed F	Rezoning				J	ові	NO:	R	GS50006.1
				s		CATI	ON:	: Weemala Development Stage E2						.ogo	GED B	Y: L	D
				т	EST L	ОСАТ	ION:	Refer to Fig	gure 1				C	DATE	:	5	/4/22
F			F۰	15T F	vcavat	or				FASTING	37235	54 m	SURF	ACE	RI ·		
TE	TEST PIT LENGTH: 3.5 m WIDTH: 1									NORTHING:	635367	78 m	DATU	M:		AHD	
	Exca	ation and S	ampling	J			I	Material descrip	otion and prof	ile information				Fiel	d Test		
						NO							5				
员	LER		ы	DEPTH	UHC DHC	BOL	MA	ATERIAL DES	CRIPTION: S	Soil type, plastici	ty/particle	TURE	SITY	Type	sult	Structur ob	e and additional servations
MET	WA ⁻	SAIVIFLES	(Not measure	(m)	GRA	SYM		characteri	stics,colour,n	ninor componen	ts	SIOND	DENS	Test	Re		
													S				
ш				-	<u> </u>	СН		Silty CLAY: N	ledium to hig	h plasticity, grey	/	×	F	HP	60	RESIDUAL	-
				-	×	1						Σ					
				-		CL	0.30m	Sandy CLAY:	. Medium plas	sticity, grey, fine			St				
				0.5		-		medium graine	ed sand			v ≥			120		
				-											-		
				-											100		
				-			0.80m	Sandy CLAY:	Medium plas				H/Fr			EXTREME	LYWEATHERED
				10	<u> </u>			••••••••••••••••••••••••••••••••••••••	, moulain pla	stienty, groy, part	9.07					SANDSTO	NE
						-											
						-											
				-	<u></u> .	 	1.30m	CANDSTONE						-		SUGHTIV	
				-				pale brown, fra	actures space	ed at 20-200mm	n, with clay	,				SANDSTO	
				1.5				coating								STRENGT	H H
				-												1.5m	water innow at
				-		L	1.80m										
				-				SANDSTONE	: Fine to med	lium grained, pa	le grey					TOFRESH	SANDSTONE
				2.0												TRENGTH	
				-													
							2.30m										
				-	-			Hole Terminat Practical Refu	ted at 2.30 m Isal								
				2.5	-												
				-	-												
				-	1												
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				3.0	-												
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				3.5]												
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				-	-												
				-	1												
LE	GEND:	-		Notes, Sa	mples a	nd Tes	ts				Consis VS	tency Verv Sof	t.	<u>U</u>	CS (kPa 25	a) <u>Moisture</u>	Condition Drv
	Vater ✓ Water Level U₅₀ 50mm Diameter tu CPD Dull samete fa 0						ter tube	e sample			S F	Soft		25	5 - 50	M	Voist
	(Date and time shown) CBR Bulk sample for E Environmental s					al samp	រR testing F Firm រple St Stiff						50 10) - 100 00 - 200	W _p F	Plastic Limit	
►	▶ Water Inflow ASS Acid Sulfate Soil Sa → Water Outflow B Bulk Sample						Soil Sar	mple			VSt H	Very Stif Hard	f	20 >4)0 - 400 100	W _L I	_iquid Limit
Str	rata Ch	anges		Field Tool	•						Fb	Friable		en/le	050	Density 4	ndex <15%
-	Gradational or Field (BSts transitional strata PID Photoionisation de							ector reading (ppr	n)			L	L	ony LC 00se	~~~~	Density In	ndex 15 - 35%
_	— D st	efinitive or dis rata change	stict	DCP(x-y) HP	Dynai Hand	mic pen Penetro	etrome ometer	eter test (test dept test (UCS kPa)	h interval show	/n)		MI D	א ט ם	1ediun Iense	n Dense	 Density Ir Density Ir 	ndex 35 - 65% ndex 65 - 85%
		5										V	o v	erv De	ense	Density Ir	ndex 85 - 100%

				F	NGI	NEE	RING LOG - TEST PIT			-	FST		
		REGIONAL	-			•	HDB Town Planning and Design			r			
		GEOTECHI	NICA	L		~T NIA				ſ		<u>.</u>	
		SULUTION	13	۲ م							IOR I		RGS50006.1
				о т			ON. Weemala Development Stage E2					9ED E	
				I	ESIL	JCAI	ION: Refer to Figure 1				DATE		5/4/22
E T		IENT TYPE:		15T E	xcavato w	or IDTH·	EASTING:	372 6353	364 m 721 m		ACE	RL:	AHD
H	Exca	vation and Sar	mplinc	1			Material description and profile information	. 0000	721 III	DATE	Fiel	d Test	
			1 0	,		z				~			-
METHOD	WATER	SAMPLES	RL (Not leasured	DEPTH (m)	GRAPHIC LOG	CLASSIFICATIC SYMBOL	MATERIAL DESCRIPTION: Soil type, plasti characteristics,colour,minor compone	city/partic nts	MOISTURE	CONSISTENC	Test Type	Result	Structure and additional observations
Ш	Not Encountered			- - - - - - - - - - -		СН	Silty CLAY: Medium to high plasticity, gr with some sandstone gravel, fine to medi angular	əy-brown um graine	l, ≱ ed, v ≥	St			COLLUVIAL
				1. <u>0</u> - - 1. <u>5</u>		СН	1.00m COAL: Dark brown 1.20m CLAY: Medium to high plasticity, grey-bi brown 1.60m	 own, pale	 e e		HP	140 200	COAL EXTREMELY LOW STRENGTH RESIDUAL
				- - 2. <u>0</u> - -			COAL: Dark brown/black						LOW STRENGTH
				2.5			TUFFACEOUS SANDSTONE: Fine grain grey 2.90m COAL: Black	ed, pale					MODERATELY WEATHERED TUFFACEOUS SANDSTONE VERY LOW TO LOW STRENGTH
				-									LOW STRENGTH
				3.5		•	3.20m TUFFACEOUS SANDSTONE: Fine grain grey 3.50m	ed, pale					MODERATELY WEATHERED TUFFACEOUS SANDSTONE LOW STRENGTH
				-			Hole Terminated at 3.50 m						
	GEND:			Notes, Sa	nples a	nd Test	<u> </u>	<u>Con</u> :	sistency		U	CS (kP	a) Moisture Condition
	ater Vat (Dat – Wat ■ Wat	er Level ie and time show er Inflow er Outflow anges	wn)	U₅₀ CBR E ASS B	50mm Bulk s Enviro Acid S Bulk \$	i Diame ample f onmenta Sulfate S Sample	ter tube sample or CBR testing al sample Soil Sample	VS S St VSt H Fb	Very So Soft Firm Stiff Very St Hard Friable	oft	<: 2: 50 10 20 >4	25 5 - 50 0 - 100 00 - 200 00 - 400 400	D Dry M Moist W Wet D W _p Plastic Limit D W _L
	G tra Do	radational or ansitional strata efinitive or distic rata change	ı ct	Field Test PID DCP(x-y) HP	<u>s</u> Photoi Dynar Hand	ionisatic nic pene Penetro	on detector reading (ppm) etrometer test (test depth interval shown) ometer test (UCS kPa)	Dens	sity \ L N C	/ \ . L /ID N /D \	/ery Lo .oose /lediun)ense /ery D	n Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%

Γ					E	INGI	NEE	RIN	G LOG - TE	ST PIT			т	EST	PIT N	io: TP4
	1		REGIONA		. 0		:		HDB Town Pla	nning and Design			P	AGE	:	1 of 1
			SOLUTIO	INS INS	P	ROJE	CT NA	ME:	Proposed Rezo	oning			J	OB I	NO:	RGS50006.1
					s	ITE LC	CATI	ON:	Weemala Deve	elopment Stage E2			L	.OGC	GED B	Y: LD
					т	EST L	OCAT	ION:	Refer to Figure	e 1			D	ATE		5/4/22
╞		IPM		F۰	15T F	vcavat	or			FASTING	37234	4 m 9	SURF	ACE	RI ·	
7	EST	r Pľ	T LENGTI	н:	4.0 m	W	IDTH:		1.5 m	NORTHING	: 635373	2 m 1	DATU	M:		AHD
	E>	xcav	ation and S	ampling]				Material description	and profile information				Fiel	d Test	
							NO						5			
	2	RE			DEPTH		ICATI BOL	м	ATERIAL DESCRIF	PTION: Soil type, plastic	;ity/particle	TURE	SITY	Type	int	Structure and additional observations
UE H		WA	SAIVIFLES	(Not measure	(m)	GRA	ASSIF SYM		characteristics	,colour,minor compone	nts	SION	DEN	Test	Re	
					, 		CLZ					-0	8	Ľ		
	- L D	ered			-		CI		TOPSOIL: Silty CL with rootlets	_AY, medium plasticity,	brown,	<				TOPSOIL
		sount			-	×///>	СН	0.20m	Silty CLAY: Mediu			<u>Σ</u>	St	-		
	1	t End			-	×			trace of sand, fine	grained	, ,	× ×		HP	120	
	:	2			0.5	É_*						2		HP	120	
					-	<u>×</u>										
					-	×										
					-	<u></u>	+	0.80m	SANDSTONE: Fin	 e to medium grained. pa		+		-		HIGHLY TO MODERATELY
					10				orange-brown, frac	ctures spaced at 10-50r	nm, with					WEATHERED SANDSTONE
									dant groy only on i	laolaroo						VERY LOW TO LOW STRENGTH
]:::::										
					-											
					-		+	1.40m				-				MODERATELY TO
					1.5				pale brown	ie to medium grained, p	ale grey,					SLIGHTLY WEATHERED SANDSTONE
					-											LOW TO MEDIUM STRENGTH
]:::::										
	+					::::		1.90m	Holo Torminated a	t 1 00 m						
					2.0	-			Practical Refusal	a 1.90 m						
					-	-										
2					-											
					-	-										
					2.5	-										
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2					-	-										
					3.5	-										
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					-	-										
					-	-										
F	EGE	ND:			Notes, Sa	mples a	nd Tes	ts			Consist	ency	I	U	CS (kPa	a) Moisture Condition
<u>⊻</u>	Vater	Wot	er evel		U ₅₀	50mm	n Diame	eter tub	e sample		vs s	very Soft Soft		<2 25	∠5 5 - 50	M Moist
	-	(Date	e and time sh	nown)	CBR E	Bulk s Enviro	ample onmenta	for CBF al sam	R testing ble		F St	Firm Stiff		50 10) - 100)0 - 200	W Wet W _n Plastic Limit
►		Wate	er Inflow		ASS	Acid S	Sulfate S	Soil Sa	mple		VSt	Very Stiff		20	00 - 400	W _L Liquid Limit
s	strata	vvate Cha	anges		D	BUIKS	ainpie				Fb	Friable		>/	+00	
- 18		Gr	adational or	ta	Field Test PID	<u>ts</u> Photo	ionisati	on dete	ector reading (ppm)		Density	V L	V Le	ery Lo oose	ose	Density Index <15% Density Index 15 - 35%
		tra De	efinitive or dis	stict	DCP(x-y)	Dynar	nic pen	etrome	ter test (test depth inte	erval shown)		ME) M	lediun	n Dense	e Density Index 35 - 65%
24		str	ata change		пΡ	r⊓and	renetro	JIIIE(Eľ	iesi (UCS KPa)				ם ע ו	ense erv De	ense	Density index 65 - 85% Density Index 85 - 100%

				E	NGI	NEE	RIN	G LOG - TEST F	PIT			Т	EST	PIT N	o: TP5
	4	REGION				:		HDB Town Planning	g and Design			Р	AGE		1 of 1
		SOLUTIO)NS	ν ι Ρ	ROJE	CT NA	ME:	Proposed Rezoning				J	ові	NO:	RGS50006.1
				s	ITE LC	CATIO	ON:	Weemala Developm	nent Stage E2			L	OGO	ED B	Y: LD
				т	EST L	OCAT	ION:	Refer to Figure 1	-			D	ATE	:	5/4/22
			E .	16T E	voovot	or			EASTINC	27054	0 m (<u>ы.</u>	
	EST P		E. H:	5.0 m	W	IDTH:	1	1.5 m	NORTHING:	635374	5 m i		ACE M:	RL.	AHD
	Exca	vation and S	Sampling	9				Material description and p	rofile information				Fiel	d Test	
						z		<u> </u>				~			
8	۲ ۳			ПЕРТИ	UH UH UH UH UH	CATIC			· Soil type plasticit	v/particla	ION NOI	ENC.	ype	ŧ	Structure and additional
<u> </u>	NAT	SAMPLES	RL (Not	(m)	LOC	SSIFIC		characteristics,colou	r,minor component	S	OIST OND	NSIST	est T	Res	Observations
2			measure	d)	0	CLAS					ŏ≤	10 CO	-		
ш						СН		Gravelly CLAY: Mediun	n to high plasticity,	grey, with	× ⊲	St			COLLUVIAL
						-		cobbles and boulders up		elei	Š		HP	140	
				-		-									
				-		1									
				0.5		-									
				-]									
							0.80m								
				-				SANDSTONE: Fine grain fractured, with a 30mm of	ned, dark grey, higl coal seam at 0.9m c	hly dipping					MODERATELY WEATHERED
				1.0				east							SANDSTONE LOW TO MEDIUM
				-			1.10m	TUFFACEOUS SANDS	ONE: Fine grained	d, pale	-				STRENGTH TUFFACEOUS
				-			1.30m	grey, pale brown, fragme	ented	<i>,</i> ,					SANDSTONE VERY LOW STRENGTH
				-			1.40m	COAL: Dark brown/black	(COAL
8				1.5	-			Hole Terminated at 1.40 Practical refusal on Sand	m dstone						
				-	-										
				-	-										
5				-	-										
				2.0	1										
]										
					-										
2				-	-										
				-	-										
				2.5	+										
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				-	1										
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8				3.0	-										
				-	-										
				-	-										
2				-	1										
				3.5	-										
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				-	-										
					-										
	GEND	I		Notes, Sa	mples a	nd Test	<u>s</u>			Consist	ency	L	U	CS (kPa	a) Moisture Condition
<u>w</u>	ater	4		U ₅₀	50mm	n Diamel	ter tub	e sample		VS S	Very Soft Soft		<2 25	25 5 - 50	D Dry M Moist
	v⊈ Wa (Da	ter Level te and time s	hown)	CBR	Bulk s	ample f	or CBF	R testing		F	Firm Stiff		50) - 100	W Wet
►	— Wa	ter Inflow	Í	ASS	Acid S	Sulfate S	i samp ioil San	mple		VSt	Very Stiff		20	,0 - 200)0 - 400	W _L Liquid Limit
	◀ Wa rata CH	ter Outflow		В	Bulk S	Sample				H Fb	Hard Friable		>2	100	
	(Gradational or		Field Test	5 Dh-+	ionia-"	نه ما م	ator roading (new)		Density	V	V	ery Lo	ose	Density Index <15%
	tr Г	ansitional stra efinitive or di	ata stict	DCP(x-y)	Pnoto Dynar	nonisation mic pene	n aete etrome	ector reading (ppm) ter test (test depth interval sh	iown)		L ME	Lo D M	oose lediun	n Dense	Density Index 15 - 35% Density Index 35 - 65%
	s	trata change		HP	Hand	Penetro	meter	test (UCS kPa)				D Vi	ense erv De	ense	Density Index 65 - 85% Density Index 85 - 100%

Γ				E	NGI	NEE	RIN	G LOG - TES	T PIT			Т	EST	PIT N	IO: TP6
		REGION		. 0		:		HDB Town Plan	ining and Design			Р	AGE	:	1 of 1
		SOLUTIO)NS	P	ROJE	CT NA	ME:	Proposed Rezo	ning			J	ові	NO:	RGS50006.1
				s	ITE LO	CATI	ON:	Weemala Devel	lopment Stage E2			L	OGO	GED B	Y: LD
				т	EST L	ОСАТ	ION:	Refer to Figure	1			D	ATE		5/4/22
╞				15T E	vcavat	or			EASTING	37000)2 m (DI ·	
1	EST F	PIT LENGT	н:	5.0 m	W	IDTH:		1.5 m	NORTHING:	635375	55 m I	DATU	M:	T.L.	AHD
F	Exca	avation and S	Sampling	1				Material description a	and profile information				Fiel	d Test	
						NO						č			
	2 H		ы	DEPTH	UHC DH	BOL	M	ATERIAL DESCRIPT	TION: Soil type, plastici	ty/particle	TURE	SITY	Type	sult	Structure and additional observations
	A A	SAWFLES	(Not measured	(m)	GRA	SYM		characteristics,	colour,minor componen	ts	SION	DENS	Test	Res	
				-/		S C C						00	Ċ		
"	ered n			-		СН		CLAY: Medium to h fine to coarse graine	igh plasticity, grey, with ed, angular	n gravel,	× ∧	F			COLLUVIAL
	sount	0.20m	-	-		-		-	-		Σ		HP	80	
	t Enc			-	<u> </u>										
	Ž	В		0.5	<u>[</u> -	-									
		0.60m				<u> </u>	0.60m								
				-		CL		Gravelly CLAY: Me brown	edium plasticity, pale gr	ey, pale	≥ ×	H/Fr			EXTREMELY WEATHERED TUFFACEOUS
				-							Σ				SANDSTONE
				10											
							1.10m								
				_				SANDSTONE: Fine fractured to fragmer	grained, dark grey, hig nted, laminated	hly					MODERATELY WEATHERED
				-											SANDSTONE LOW TO MEDIUM
3				1.5		2	1.40m	COAL: Dark brown/	black		_				STRENGTH COAL
202 202				1.5			1.60m								EXTREMELY LOW STRENGTH
0.00.4				-				Hole Terminated at Practical Refusal	1.60 m						
				-	-										
				20	-										
				2.0	1										
				-]										
202				-	-										
1001				-	-										
2				2.5	1										
				-	1										
00]										
00.00.0					-										
8-2				3.0	+										
				-	-										
				-	1										
R IIII II				-]										
				3.5	-										
200				-	-										
				-	-										
				-	1										
			<u> </u>		<u> </u>	<u> </u>								<u> </u>	
l L V	EGEND			Notes, Sa	mples a	nd Tes	<u>ts</u>			VS	tency Very Soft		<u>U</u> <2	CS (kPa 25	a) <u>Moisture Condition</u> D Dry
	y w	ater Level		U₅₀ CBR	50mm Bulk s	n Diame sample f	ter tub for CBF	e sample R testing		S F	Soft Firm		25 50	5 - 50 0 - 100	M Moist W Wet
	(D	ate and time s ater Inflow	hown)	E	Enviro		al samp	ble		St	Stiff		1(00 - 200	W _p Plastic Limit
	- 4 W	ater Outflow		B	Bulk S	Sample	JUI Sal	IIIhie		H	Hard		20	400 - 400 400	
- <u>S</u>	Strata C	<u>hanges</u> Gradational or		Field Test	s					Fb Density	Friable V	V	ery Lo	ose	Density Index <15%
		ransitional stra	ata		Photo	ionisatio	on dete	ector reading (ppm) ster test (test denth inter	val shown)		L	Lo J M	oose ledium	n Dense	Density Index 15 - 35%
C 100 72 00	I	Jetinitive or distrata change	stict	HP	Hand	Penetro	ometer	test (UCS kPa)				D	ense env D4	ense	Density Index 65 - 85%

					E	NGI	NEE	RIN	G LOG	- TEST	PIT				TE	EST	PIT N	0:	TP7
			REGION/		, c	LIENT	:		HDB Tov	vn Plannin	g and Design				P	AGE	:		1 of 1
	á		SOLUTIO	INS	P	ROJE		ME:	Propose	d Rezoning	g				JC		NO:		RGS50006.1
					s	ITE LC	CATI	ON:	Weemal	a Developi	ment Stage E2				LC	OGG	ED B	Y:	LD
					т	EST L	OCAT	ION:	Refer to	Figure 1					D	ATE			5/4/22
F		IPM		F۰	15T F	vcavat	or				FASTING	3723	01 m	SU		CF	RI ·		
т	EST	ΓΡΓ	LENGTI	H:	5.0 m	W	IDTH:	: 1	1.5 m		NORTHING	6 3537	77 m	DA	TUN	N:		AHD	
	E>	xcava	ation and S	ampling				I	Material des	cription and	profile information	l				Field	d Test		
							NO								5				
L D H		TER	SAMPI ES	RI	DEPTH	BHIC	ICAT BOL	MA	ATERIAL DI	SCRIPTION	N: Soil type, plasti	city/particle	TURE		SITY	Type	sult	Structu o	ure and additional observations
MET		MA.	SAMPLES	(Not measured	(m)	GRA	ASSIF SYM		charac	teristics,colo	ur,minor compone	ents	MOIS			Test	Re		
					,		CLZ								5				
"	-	ered			-	<u> </u>	СН		CLAY: Me fine to med	dium to high ium grained,	plasticity, grey, w angular	ith gravel,	×	F	- St			COLLUVI	AL
		count			-	<u> </u>							≥						
	I	t End			-	EE		0.40m											
	:	2			0.5	, 	CL	0.4011	Gravelly C	LAY: Mediu	m plasticity, pale	grey, pale		} H	/Fr			EXTREM	ELY WEATHERED
					-				DIOWI				Σ					SANDST	ONE
								0.80m	SHALE: Fi		ark arev, highly fi	ractured	- +					MODERA	
					10			1.00m		ire grainea, e		aotaroa						WEATHE	RED SHALE
					1.0		— — ·	1.10m	COAL: Bla	ck									
								1.20m	SANDSTO	NE: Fine gra	ined, grey							SLIGHTL	Y WEATHERED
					-	-			Hole Termi Practical R	nated at 1.20 efusal) m							MEDIUM	TO HIGH
2					-	-												STRENG	ІН
2-00-1 20					1.5	-													
20.00.	-				-	-													
Pou fi																			
0-01-																			
7707 01					2.0	-													
0.7 0.4					-	-													
						-													
- 6					-	1													
					2.5]													
					-	-													
narger					-	-													
60.00.1					-	-													
2					30	1													
0					0.0	1													
7741]													
- Line -					-	-													
/Di awi					-	-													
					3.5	-													
2001					-														
- innor																			
6002					_	-													
	EGF	ND.			Notes Sa	mples a	nd Tee	ts				Consis	stency			110	CS (kP	a) Moistu	re Condition
<u>w</u>	later	:				a		<u></u>				VS	Very S	oft		<2	25	D	Dry
		Wate	r Level		U ₅₀ CBR	50mm Bulk s	ample i	ner tube for CBF	e sample R testing			F	Soft Firm			25 50	9 - 50) - 100	W	Wet
		(Date Wate	⇒ and time sh ∋r Inflow	nown)	E ASS	Enviro Acid S	onmenta Sulfate S	al samp Soil Sar	ole mple			St VSt	Stiff Verv S	tiff		10 20	0 - 200 0 - 400	W _p W.	Plastic Limit Liquid Limit
	-	Wate	er Outflow		В	Bulk S	Sample	J ui	r			H	Hard			>4	100		
<u>St</u>	trata	Gr	<u>nges</u> adational or		Field Test	<u>is</u>						⊡ Densit	Friadle Y	; V	Ve	ry Lo	ose	Density	Index <15%
		tra	nsitional stra	ata	PID DCP(x-v)	Photoi Dvnar	ionisatio nic pen	on dete etrome	ector reading (eter test (test d	ppm) epth interval s	hown)			L MD	Lo Me	ose edium	n Dense	Density Density	Index 15 - 35% Index 35 - 65%
C 700 7 6		str	ata change	SUCE	HP	Hand	Penetro	ometer	test (UCS kPa	a)	,			D VD	De	ense erv De	ense	Density	Index 65 - 85%

				E	INGI	NEE	RIN	G LOG	- TEST P	IT			т	EST	PIT N	IO: TP8
		REGION/	AL HNIC/					HDB Tov	vn Planning	and Design			P	AGE	:	1 of 1
		SOLUTIO)NS	P	ROJE	CT NA	ME:	Propose	d Rezoning				J	ОΒΙ	NO:	RGS50006.1
				S	ITE LO	CATI	ON:	Weemal	a Developme	ent Stage E2			L	.OGC	GED E	SY: LD
				т	EST LO	CAT	ION:	Refer to	Figure 1				D	DATE		5/4/22
E	JUIPN	IENT TYP	E:	15T E	xcavate	or				EASTING:	372321	m	SURF	ACE	RL:	
TE	ST PI	T LENGTI	H:	5.0 m	W	IDTH:	: 1	1.5 m		NORTHING:	6353767	m I	DATU	M:		AHD
	Excav	vation and S	Samplin	g				Material des	cription and pro	ofile information				Fiel	d Test	
					0	NOI							с			
님	TER	SAMPLES	RI	DEPTH	HES	IICAT IBOL	MA	ATERIAL DE	ESCRIPTION:	Soil type, plasticit	y/particle	TURE	SITY	Type	sult	Structure and additional observations
MET	MA		(Not measure	(m)	GRA	ASSIF SYM		charac	teristics,colour,	minor component,	s	MOIS	DEN	Test	Re	
						CL							ö			
"	ered			-	<u> </u>	СН		CLAY: Me fine to med	dium to high pla ium grained, ar	asticity, grey, with ngular	gravel,	≥ ^	St			COLLUVIAL
	count			-								Σ				
	t Enc			-	EE		0.40m									
	l			0.5		CL		Gravelly C	LAY: Medium	plasticity, pale gre	ey, fine to	Š	H/Fr			
								coarse grai	neu, angular g	lavel		× Σ				
				-	<u></u>		0.80m			ONE: Fine grained						
				10				brown, pale	grey	<u>-</u>	., [
					······································									1		
																TUFFACEOUS
				-												VERY LOW STRENGTH
8				-												
021-06-				1.5												
2.00.02				-												
Prj: RG																
2-03-03				-												
0.3 202				2.0												
: RG 2.0				-												
GD Lib				-			2.30m									
Tool - [پنۍنې: نړي د د د			TUFFACE dark grev	OUS SANDSTO	ONE: Fine grained	l, grey,					MODERATELY WEATHERED
d In Situ				2.5				uun groj								TUFFACEOUS SANDSTONE
l Lab an				-												LOW STRENGTH
9 Datge				-	بن ⁷ .ن.: 											
03.00.05				-												
10 10				3.0			3.00m									
4/2022 1				-	-			Hole Termi	nated at 3.00 n	n						
ie>> 11.				-	-											
rawingF				-	1											
D>> L4				3.5												
OGS.GF				-	-											
6.1 TP L				-	-											
GS5000				-	-											
T PIT R					1											
	GEND:	-		Notes, Sa	mples a	nd Tes	ts				Consister	icy arv Soff		<u>U</u>	CS (kP 25	a) Moisture Condition
	wat	er Level		U ₅₀	50mm	Diame	eter tub	e sample			S So	oft		25	5 - 50	M Moist
RED BC	. (Dat	e and time sł	hown)	E	Bulk s Envirc	ample f nmenta	tor CBF al samp	≺ testing ole			F Fi St St	rm iff		50 10) - 100)0 - 200	W Wet W _p Plastic Limit
NON-CO	– Wat ∎ Wat	er Inflow er Outflow		ASS B	Acid S	Sulfate Sample	Soil Sar	mple			VSt Ve	ery Stiff ard		20	00 - 400 100	W _L Liquid Limit
Sti	ata Cha	anges		_	Duik C	anple					Fb Fr	iable				
- CGLB Lc	Gi	radational or	ata	Field Test PID	<u>ts</u> Photoi	ionisatio	on dete	ctor reading (ppm)		<u>Density</u>	V L	V L	ery Lo oose	ose	Density Index <15% Density Index 15 - 35%
00.3 LIB.	De	efinitive or dis	stict	DCP(x-y) нР	Dynar Hand	nic pen Penetro	etrome	ter test (test d	epth interval sho	own)		ME	D M	lediun	n Dense	e Density Index 35 - 65%
3G 2.0	st	rata change		nr	rand	renetro	Jineteľ		a)			D VE	ט ע נ	ense ery De	ense	Density Index 65 - 85% Density Index 85 - 100%

Γ					E	NGI	NEE	RIN	G LOG -	TEST	PIT				т	EST	PIT N	o: TP9
	-1		REGIONA	AL HNICA	u c		:		HDB Tow	n Planning	g and Design				Р	AGE		1 of 1
	ź		SOLUTIO	INS	P	ROJE	CT NA	ME:	Proposed	Rezoning					J	ОΒΙ	NO:	RGS50006.1
					S	ITE LO	CATI	ON:	Weemala	a Developn	nent Stage E	2			L	OGO	ED B	Y: LD
					т	EST LO	OCAT	ION:	Refer to I	Figure 1					D	ATE	:	5/4/22
╞	-01	JIPM		E:	15T E	xcavat	or				EASTING	:	372348	m	SURF	ACE	RL:	
1	TES	ST PI	T LENGTI	H:	3.0 m	W	IDTH:	1	1.5 m		NORTHIN	I G : 6	353745	m I	DATU	M:		AHD
	F	Excav	ation and S	ampling	9				Material desc	ription and p	rofile informatio	n				Fiel	d Test	
						0	NOL							шz	₹	e		
		VATER	SAMPLES	RL (Not	DEPTH (m)	LOG	SIFICAT	MA	ATERIAL DE characte	SCRIPTION eristics,colou	: Soil type, plas r,minor compor	sticity/p nents	particle		ISISTEN DENSITY	est Typ	Result	observations
	Σ	>		measure	1)	0	CLAS							žΫ	00	Ĕ		
	ц	ntered			-	X	CI	0.20m	TOPSOIL: Some grave	Silty CLAY, r I, fine to med	nedium plasticit <u>;</u> ium grained	y, grey	y, with					TOPSOIL
		ncon			-			0.2011	TUFFACEO	OUS SANDS	ONE: Fine grai	ined, p	pale					MODERATELY
		Not E			-				brown, paio	gi oy, mgi ny	nuolaroa							TUFFACEOUS SANDSTONE
					0.5													LOW STRENGTH
					-													
					-													
					1.0		+	0.90m	SANDSTON	NE: Fine to c	 parse grained, g	grey, b	 prown	-				MODERATELY
					-													WEATHERED SANDSTONE MEDIUM STRENGTH
⊢	-	_						1.20m	Hole Termir	nated at 1.20	m							
					-				Practical Re	etusal								
00-00-					1.5	-												
02.0.00					-													
					-													
200					-	-												
					2.0	-												
					-													
200					-													
					-	1												
					2.5													
and a land					-													
-					-	1												
2					3.0	-												
10																		
					-	-												
Rimo					-													
					3.5	-												
2000					-	-												
0000					-													
100V					-													
╞	EG	END:			Notes, Sa	mples a	nd Test	l ts					Consiste	ncy		U	CS (kPa	a) Moisture Condition
V	Vate	<u>۲</u>	or o:!		U ₅₀	50mm	n Diame	ter tub	e sample				VS V S S	'ery Soft Soft		<2 25	25 5 - 50	D Dry M Moist
	≝	vvate (Dat	∋r ∟evel e and time sł	nown)	CBR	Bulk s	ample f	or CBF	R testing				F F St S	irm Stiff		50) - 100	W Wet W Plastic Limit
	-	Wate	er Inflow	Í	ASS	Acid S	Sulfate S	Soil Sar	mple				VSt V	/ery Stiff		20)0 - 400	W _L Liquid Limit
S S	Strat	vvate ta Cha	er Outflow		в	Bulk S	sample						Fb F	riable		>2	ŧUU	
		Gr trs	adational or	ata	Field Test PID	: <u>s</u> Photoi	ionisatio	on dete	ector reading (p	pm)			<u>Density</u>	V L	Vi Lo	ery Lo bose	ose	Density Index <15% Density Index 15 - 35%
		– De str	finitive or dis	stict	DCP(x-y) HP	Dynar Hand	nic pen Penetro	etrome ometer	eter test (test de test (UCS kPa)	epth interval sł)	iown)			ME D) M D	ediun ense erv Dé	n Dense	e Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%

Γ					E	ENGI	NEE	RING LOG - TEST PIT				т	EST		IO: TP10
	1	E F	REGIONA		N (LIENT	:	HDB Town Planning and Des	ign			Р	AGE	:	1 of 1
	_	5	OLUTIO	NS	NL F	ROJE	CT NA	ME: Proposed Rezoning	-			J	ови	NO:	RGS50006.1
					S		CATI	ON: Weemala Development Stage	e E2			L	OGO	GED B	SY: LD
					т	EST L	OCAT	ION: Refer to Figure 1				D	ATE	:	5/4/22
										070077					
	ES	IPME F PIT		E: H:	151 E 5.0 m	xcavat. W	or IDTH:	1.5 m NORTI	NG: HING:	6535737	m t	DATU	ACE M:	RL:	AHD
	E	kcava	tion and S	amplin	q			Material description and profile inform	ation				Fiel	d Test	
							z					~			
METHOD		WATER	SAMPLES	RL (Not measure	(m)	GRAPHIC LOG	CLASSIFICATIC SYMBOL	MATERIAL DESCRIPTION: Soil type, characteristics,colour,minor com	plasticity ponents	//particle s	MOISTURE	CONSISTENC DENSITY	Test Type	Result	Structure and additional observations
ш	ı					U 0		TUFFACEOUS CLAYSTONE: Grey	, fractur	ed					
]0:									TUFFACEOUS
															LOW STRENGTH
						0~									
					0.5										
						0:		0.70							
								COAL: Dark brown			1				
								0.90m							STRENGTH
					1.0			TUFFACEOUS SANDSTONE: Fine	grained	, pale	1				
								giey							
						- <u></u>									
e,					15			4.50							
90-1.702					1.9			COAL: Black			1				
Z.00.0															VERY LOW STRENGTH
PN: IL		_													
cncn															Minor groundwater inflow
0.3 202					2.0					- <u> </u>	-				
עפייח								grey	graineu	, pale					SANDSTONE
					2.5										
,						بن: بن. 									
						<u></u>									
					20	نې آنې ا									
					3.0	- 									
						<u></u>									
- Diawii						``````````									
CPJ <	-	┝			3.5		+	3.50m Hole Terminated at 3.50 m			<u> </u>				
LOG						1									
1000						1									
RGS5f]									
				L_,	Notes C		nd T	to.	——	Constat				Ce //-F	
	later	ND:			NOLES, SE	anipies a	nu res	<u>19</u>		VS V	ery Soft		<2	25 25	D Dry
		Water	Level		U₅₀ CBR	50mm Bulk s	n Diame ample f	eter tube sample for CBR testing		S S F Fi	oft irm		25 50	5 - 50) - 100	M Moist W Wet
		(Date	and time sh	nown)	E	Enviro	onmenta	al sample		St S	tiff		10	00 - 200	W _p Plastic Limit
	-	Water	Outflow		ASS B	Acid S Bulk S	Sample	Son Sample		VSt V H H	ery Stiff ard		20 >4	JU - 400 400	VV _L Liquid Limit
<u>S</u>	trata	Char	ges		Field Toe	ts				Fb Fi Density	riable V	\/4	ervio	ose	Density Index <15%
- 6		Gra tran	aational or sitional stra	ita	PID	Photo	ionisatio	on detector reading (ppm)		<u>Bonolty</u>	Ľ	Lc	oose		Density Index 15 - 35%
e 2.00.3 L		Defi stra	nitive or dis ta change	stict	DCP(x-y) HP	Dynar Hand	nic pen Penetro	etrometer test (test depth interval shown) ometer test (UCS kPa)			ME D VD	De M	ediun ense erv De	n Dense	 Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%

Γ					E	INGI	NEE	RIN	G LOG - TES	T PIT			т	EST	PIT N	IO: TP11
			REGION/		vi C		:		HDB Town Plan	ning and Design			Р	AGE		1 of 1
	ź		SOLUTIO	NS NS	۹L P	ROJE		ME:	Proposed Rezor	ning			J	ові	NO:	RGS50006.1
					s	ITE LO		ON:	Weemala Devel	opment Stage E2			L	OGO	SED B	SY: LD
					т	EST L	ОСАТ	ION:	Refer to Figure	1			D	ATE	:	5/4/22
╞	=0U	IIPM	FNT TYP	F.	15T F	xcavat	or			FASTING	37237	9 m .	SURF	ACF	RI ·	
1	TES	T PI	T LENGTI	H:	3.5 m	W	IDTH:	1	1.5 m	NORTHING:	653576	1 m [DATU	M:		AHD
	E	xcav	ation and S	amplin	g				Material description a	nd profile information				Fiel	d Test	
							NOI						ς	0		
		TER	SAMPLES	RI	DEPTH	HES	FICAT IBOL	MA	ATERIAL DESCRIPT	ION: Soil type, plasticit	ty/particle	TURE	SITY	Type	sult	Structure and additional observations
		MA		(Not measure	d) (m)	GRA	ASSIF		characteristics,c	olour,minor component	ts	MOIS	DEN	Test	Re	
L						<u></u>	- C C		<u> </u>				ŏ			
'		tered			-		CI		Sandy CLAY: Media orange-brown, with s	um plasticity, grey, some sandstone gravel						COLLUVIAL
		coun			-]									
		ot En			-		1									
		z			0.5	 										
					-		-									
					-	<u> </u>	+	0.70m	TUFFACEOUS SAN	IDSTONE: Fine grained	d, pale	-				HIGHLY TO MODERATELY
									grey, grey, orange-b	rown, highly fractured						
					1.0_											VERY LOW TO LOW
					-											STRENGTH
					-											
					-		L	1.40m								
00-00-					1.5				SANDSTONE: Fine orange-brown, fractu	to coarse grained, pale ured	e grey,					MODERATELY WEATHERED
202 0.0					-											SANDSTONE MEDIUM STRENGTH
17 02 1					-											
1 00-00					-											
-2202 6					2.0			2.00m								
00.2 02					-	-			Hole Terminated at 2	2.00 m						
20 CIN.					-	-										
- 00-					-											
					2.5	-										
I LaU all					-	-										
a naide					-	-										
0.00.00					-	1										
2					3.0											
7707/4					-	+										
					-	-										
awiigr					-											
					3.5											
2					-	-										
					-	-										
h					-	-										
				L_,	Notes C	male-	nd T				Cometer					
<u>v</u>	Nate	-ND: 1			NUCES, SA	inples a		<u>15</u>			VS	Very Soft		<u>U</u> <2	сэ (кРа 25	D Dry
	Y	Wate	er Level		U₅₀ CBR	50mm Bulk s	n Diame sample f	ter tub for CBF	e sample R testing		S F	Soft Firm		25 50	5 - 50) - 100	M Moist W Wet
	-	(Dat Wate	e and time sł er Inflow	nown)	E ASS	Enviro Acid S	onmenta Sulfate S	al samp Soil Sar	ble mple		St VSt	Stiff Verv Stiff		10 20)0 - 200)0 - 400	W _p Plastic Limit
	-	Wate	er Outflow		В	Bulk S	Sample	50	1:-		H	Hard		>2	100	
	otrata	a Cha Gr	a nges adational or		Field Test	s					Density	V	V	ery Lo	ose	Density Index <15%
		tra	insitional stra	ata	PID DCP(x-y)	Photo Dynar	ionisatio nic pen	on dete etrome	ector reading (ppm) eter test (test depth interv	val shown)		L ME	Lo D M	oose ledium	n Dense	Density Index 15 - 35% Density Index 35 - 65%
100.7 00		str	ata change	Salot	HP	Hand	Penetro	ometer	test (UCS kPa)	-		D VD	D	ense erv De	ense	Density Index 65 - 85% Density Index 85 - 100%

ſ					E	INGI	NEE	RING LC	G - TEST	PIT			Т	EST	PIT N	o: TP12
	-		REGION					HDB	Town Plannin	ig and Design			Р	AGE	:	- 1 of 1
	Ź		SOLUTIO)NS	F	ROJE	CT NA	ME: Prop	osed Rezonin	g			J	овι	NO:	RGS50006.1
					S	ITE LO	CATI	ON: Wee	mala Develop	ment Stage E2			L	OGC	GED B	Y: LD
					т	EST LO	CAT	ON: Refe	r to Figure 1				D	ATE	:	5/4/22
ł	EQ	UIPM	ENT TYP	E:	15T E	xcavate	or			EASTING:	372367	m \$	SURF	ACE	RL:	
	TES	ST PI	T LENGT	H:	3.5 m	w	IDTH:	1.5 m		NORTHING:	6353778	m I	DATU	M:		AHD
		Excav	ation and S	Samplin	g			Material	description and	profile information			1	Fiel	d Test	
		~				U	TION					шZ	ζų	e		Structure and additional
	<u>H</u>	ATEF	SAMPLES	RL	DEPTH	APHI 0G	IFICA.	MATERIA	L DESCRIPTIO	N: Soil type, plasticit	ty/particle	STUR	ISTEN NSIT	t Typ	esult	observations
	Β	Ŵ		(Not measure	d)	GR/	LASSI SY	Ch			13	MOI	CONS	Tes	Ř	
╞	ш	q				L	о Сн	CLAY:	Medium to high	plasticity grev with	some					COLLUVIAL
		ntere						gravel,	fine to coarse g	ained, angular						
		ncon														
		Not E				[- <u>-</u>										
		~			0.5											
					-			0.60m TUFFA	CEOUS CLAYS	TONE: Fine grained	d, grey,					
						0~		pale gr	ey, fragmented							LOW STRENGTH
					1.0	<u>0</u>										
								1.10m COAL	CLAYSTONE:							
					-			1.30m								STRENGTH
						-		Hole T Practic	erminated at 1.3 al refusal on Cla	0 m iystone						
21-06-3(1.5	-										
.00.0 20					-	-										
Prj: RG 2																
2-03-03						-										
0.3 2022					2. <u>0</u>	-										
: RG 2.0						-										
GD Lib						-										
Tool - D]										
d In Situ					2.5	-										
I Lab an						-										
9 Datge						-										
03.00.0																
6:10 10					3.0											
4/2022 1					-	-										
9> 11/						-										
awingFile						-										
JO >> Lo					3.5											
OGS.GF						_										
6.1 TP L						-										
GS5000						-										
ST PIT F						1										
LE - TES	LEG	END: er		Τ	Notes, Sa	mples a	nd Test	<u>s</u>			Consister VS Ve	ncy ery Soft		<u>U</u> <2	CS (kPa 25	a) Moisture Condition D Dry
OREHO	<u> </u>	 Wat	er Level		U₅₀ CBR	50mm Bulk s	Diame	er tube sample			S So	oft rm		25	5 - 50) - 100	M Moist W Wet
ORED B		(Dat	e and time sl	hown)	E	Enviro	nmenta	I sample			St St	tiff		10)0 - 200	W _p Plastic Limit
O-NON-C		vvat Wat	er millow er Outflow		ASS B	Acid S Bulk S	sulfate S Sample	oil Sample			VSt Ve H Ha	ery Stiff ard		20 >4)0 - 400 100	W _L Liquid Limit
Log RG	<u>Stra</u>	ta Cha	anges vedetions		Field Tes	ts					Fb Fr Densitv	riable V	V	ervic	ose	Density Index <15%
B.GLB		Gi tra	adational or Insitional stra	ata	PID	Photoi	ionisatio	n detector read	ing (ppm)	abour a)	_ onony	Ĺ	Lo	DOSE		Density Index 15 - 35%
1 2.00.3 L		— De sti	efinitive or dis rata change	stict	HP	Dynar Hand	Penetro	meter test (UCS	esi depin interval s S kPa)	SHOW[1]		IVIL D		ense	Dense	Density Index 35 - 65%

				E	ENGI	NEE	RIN	g log - Bof	REHOLE			В	ORE	HOLI	E NO: BH1
	4	REGION			LIENT	:		HDB Town Plan	ning and Design			Р	AGE		1 of 3
		SOLUTIO	INICA	F	ROJE		ME:	Proposed Rezor	ning			J	ови	NO:	RGS50006.1
				S	SITE LO	CATI	ON:	Weemale Devel	opment			L	OGO	GED B	Y: LD
				т	EST L	OCAT	ION:	Ch530				D	ATE	:	19/4/22
DF	RILL T	YPE:	Track	ed Drill F	Ria				EASTING:	373288	m	SURF	ACE	RL:	
BC	OREH	OLE DIAN	IETER	: 100 r	nm	IN		ATION: 90°	NORTHING:	6353844	m I	DATU	M:		AHD
	Dril	ling and Sar	npling					Material description a	nd profile information				Fiel	d Test	
					0	NOL					шz	Υ	0		
ЬН	TER	SAMPLES	RI	DEPTH	HEB	FICAT	MA	ATERIAL DESCRIPT	ION: Soil type, plasticit	y/particle	TURI	STEN	Type	sult	Structure and additional observations
MET	MA		(Not measured	(m)	GRA	ASSIF		characteristics, c	olour,minor component	ts	MOIS	ONSI	Test	Re	
	-				×777	5 C	0.10m		V			U			TOPSOIL
AD/	Iterec							Silty CLAY: Medium	n plasticity, dark brown,	with	Å.	F - St			
	Icoun							some sand, fine grai	ined		Σ				
	ot En														
	z	1.00m		1.0	<u> </u>										
		SPT		1.0	- <u>-</u> ×		1.10m								
		4,25/100mn N=R	n I					SANDSTONE: Fine	grained, grey						SANDSTONE
		1.25m													LOW STRENGTH
				-											
				2.0]:::::										
_		-					2.15m	Continued as Cored	Drill Hole		-				
					-				Diminiole						
:					-										
4					-										
2				3. <u>0</u>	-										
1					-										
					-										
					-										
					1										
2				4.0	1										
8					1										
23					1										
2					1										
2				5.0											
-															
-															
2400					4										
2					-										
2				6. <u>0</u>	-										
5					-										
					-										
					-										
					-										
LE	GEND:			Notes, Sa	amples a	Ind Tes	ts.			Consiste	ncy		U	CS (kPa	a) Moisture Condition
Wa	ter	hard and		U ₅₀	50mm	n Diame	eter tube	e sample		VS V S S	'ery Soft Soft		<2 25	25 5 - 50	D Dry M Moist
	- Wat (Da	ter Level te and time s	hown)	CBR	Bulk s	ample f	for CBF	R testing		F F	irm stiff		50) - 100)0 - 200	W Wet
- I	– Wat	ter Inflow		ASS	Acid	Sulfate S	Soil Sar	mple		VSt V	/ery Stiff		20)0 - 400	W_L Liquid Limit
Str	◄ Wat ata Ch	ter Outflow anges		в	Bulk S	sample				Fb F	iard riable		>/	+00	
	G	radational or	ata	Field Tes PID	<u>ts</u> Phota	ionisatio	on dete	ctor reading (ppm)		Density	V	Ve	ery Lo bose	oose	Density Index <15% Density Index 15 - 35%
	tra D	efinitive or di	ata stict	DCP(x-y)	Dynai	nic pen	etrome	ter test (test depth inter	rval shown)		ME) M	ediun	n Dense	e Density Index 35 - 65%
	st	trata change		٦٢	Hand	renetro	Jineter	เธรเ (UGS KPa)			D VD	ים V V	ense ery De	ense	Density index 65 - 85% Density Index 85 - 100%

					ENGINEERIN	G LOG - CORED BO	REH	OLE			BORE	HOLE NO: BH1
	4	REGIO	NAL		CLIENT:	HDB Town Planning and D	Design				PAGE	Page 2 of 3
	-	SOLUT	TIONS	AL	PROJECT NAME:	Proposed Rezoning	•				JOB N	IO: RGS50006.1
					SITE LOCATION:	Weemale Development					LOGG	ED BY: LD
					TEST LOCATION:	Ch530					DATE:	19/4/22
	RILLI	TYPE.	Tr	acked	Drill Rig		FAS		373288	m	SUR	FACE RI ·
B	OREH	OLE DI	AMETE	R: 10	0 mm INCLIN	ATION: 90°	NOR	THING	6353844	m	DAT	UM: AHD
	Drilling	and Sam	pling		Material des	cription and profile information			Testing			Rock Mass Defects
METHOD	WATER	RL Not measured	DEPTH (m)	GRAPHIC LOG	Material De particle ch minor cor	escription: Rock type, aracteristics, colour, nponents, structure	WEATHERING	ESTIMATED STRENGTH	I _{s(50)} D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
			- - - 1. <u>0</u> - - - 2. <u>0</u>		START CORING AT 2	15m						
			-		SANDSTONE: Fine gr laminated	ained, grey, orange-brown,	MW	L		35	25 50	JT 80° RO PL SN SM 50° CLAY 5mm
			-							55	140	Highly fractured core
			-								150	JT 5° RO PL SN JT 5° RO PL SN
			3.0									— JT 40° RO PL SN
					SANDSTONE: Fine to	medium grained, pale grey,	1	L			75	
			-		with orange-brown star	ning, indistinctly bedded		M			250	JT 5° RO PL CN
			-							40		── JT 5° RO PL SN ── JT 10° RO CU SN
]:::::							150	
			4.0				4	VL			50	JT 70° RO PL SN JT 5° RO PL SN
			_		grey, with orange-brow	n staining, laminated		L			30	Highly fractured core
			-								150	
NMLC			-	بېې بېې				L			30	Highly fractured core
			- 5.0_					M				
0			-	.ب. 							60	L JT 10° RO PL SN Rehealed joint
			-									JT 45° RO PL SN
			-							0		JT 35° RO PL SN
			- 60								30	
			0.0									Highly fractured core
,			_									
			-								20	
			-	نې ب						45	125	└── JT 90° RO PL CN └── CS 0° 20mm
	GEND:			Beddi	ing	Weathering		<u>Stre</u>	ength		30 <u>I_{s(50}</u>	<u>Defect Type</u>
Me W	e rnod B	Wash I	Bore	Lamin Thinnl	ated <20mm y Bedded 20-200mm	EW Extremely Wea HW Highly Weather	thered ed		Very Lov Low	V	<0. 0.1	.1 JT Joint - 0.3 PT Parting
RF CE	२ ३	Rock F Claw o	Roller r Blad Bit	Mediu Thick	m Bedded 200-600mn v Bedded 600-2000m	m MW Moderately Weathern SW Slightly Weathern	athered red	M H	Medium Hiah		0.3 1 -	- 1 SM Seam 3 SZ Shear Zone
NN N/		NMLC 0 Wirelin	Core e Coring	Very 1	Thickly Bedded 2000mm	FR Fresh			Very Hig	h	3-	10 CS Crushed Seam
	κ,⊓Q,Ρ	vvirelin	e conng	Massi	ve No Visible I	seaaing			Extreme	ıy Hig	n >1(U
				Degre Fragm	e of Fracturing nented <20mm			Roi VR	ighness Very Ro	ugh	Coatin CN	ng <u>Planarity</u> Clean PL Planar
				Highly	Fractured 20mm to 40)mm)0mm		RO	Rough Smooth	-	SN VN	Stained CU Curved Veneer(<1mm) ST Stepped
				Slight	y Fractured 200mm to 2	000mm		SL	Slickens	ided	CO	Coating(1-5mm) IR Irregular

					ENGINEERIN	G LOG - CORED BO	REH	OLE			BORE	HOLE NO: BH1
		REGIO	NAL	241	CLIENT:	HDB Town Planning and	Design				PAGE	Page 3 of 3
		SOLUT	TIONS		PROJECT NAME:	Proposed Rezoning					JOB N	IO: RGS50006.1
					SITE LOCATION:	Weemale Development					LOGG	ED BY: LD
					TEST LOCATION:	Ch530					DATE:	19/4/22
	RILL 1	YPE:	Tr	acked	Drill Rig		EAS	TING:	373288	3 m	SUR	FACE RL:
В	OREH	ole di	AMETE	E R: 10	00 mm INCLIN	ATION: 90°	NOR	THING	6353844	4 m	DAT	UM: AHD
	Drilling	and Sam	pling		Material des	cription and profile information		1	Testing			Rock Mass Defects
	~			U			UNG N	₽Ħ			icing	Defect Description: Type
L H	ATEF	RL	DEPTH	APH 0G	Material De	escription: Rock type, aracteristics. colour.	HER	MAT	I _{s(50)} D/A	D2 %	nm Spa	inclination, planarity,
M	Ň	Not measured	(11)	GR.	minor cor	nponents, structure	VEAT	ESTI		м М	lefect	thickness
_				:.;.·	TUFFACEOUS SAND	STONE: Fine grained nale	S MW					
			-		grey, with orange-brow	n staining, laminated		- -			30	Highly fractured core
			-	······································						17.5	50	↓ JT 50° RO IR CN ↓ JT 5° RO PL CN
			-								150	JT 5° RO PL CN
			- 80		NO CORE							L JT 5° SO PL CN JT 5° SO PL SN
			0.0		TUFFACEOUS SAND	STONE: Fine grained, pale	XW	VL			220	^L JT 5° RO PL CN
Z			-		grey, pale brown, lamir	nated	MW	L		45	80	└── JT RO PL SN
	8		-	× × × × × ×	SILTSTONE: Dark gre	y, laminated	SW	М			50	Highly fractured core
	ĽŐ		-	$ \times \times \times$ $ \times \times \times$				H			20	┘ ── JT 15° RO IR SN
	100%	_	9.0	×. ×. ×	SANDSTONE: Fine to	medium grained, grey, with				62	400	─ JT 10° RO PL SN
			-		orange-brown staining,	, indistinctly bedded					50	
			-		Hole Terminated at 9.3	60 m						JIS RUPLON
			-	-								
			-	-								
			10. <u>0</u>	-								
			-	-								
			-	-								
			-	-								
			- 110	1								
				1								
			-	1								
5]								
			-									
			12. <u>0</u>	-								
6			-									
			-	-								
			-	-								
			-	-								
			13. <u>0</u>	-								
B			-	-								
			-	-								
			-	1								
			-	1								
L	EGEND: ethod		•	Beddi	ing nated <20mm	Weathering FW Extremely We	athered	Stre	ngth Verv Lov	N	<u> </u> s(50 <0	<u>Defect Type</u>
W	'B R	Wash I	Bore	Thinnl	ly Bedded 20-200mm	HW Highly Weather	red		Low		0.1	- 0.3 PT Parting
C	В	Claw o	r Blad Bit	Thick	y Bedded 200-600mm	m SW Slightly Weath	eatnered ered	М Н	Medium High		0.3 1 -	3 SZ Shear Zone
N N	MLC Q,HQ,P	NMLC Q Wirelin	Core e Coring	Very T Massi	Thickly Bedded 2000mm ive No Visible E	FR Fresh Bedding		VH EH	Very Hig Extreme	gh ely Hi <u>a</u> l	3- 1 >10	10 CS Crushed Seam
n				Deare	e of Fracturing			Roi	ahness		Coati	ng Planarity
				Fragm	nented <20mm	lmm		VR	Very Ro	ugh	CN	Clean PL Planar
				Fractu	ured 40mm to 20)0mm		SO	Smooth		VN	Veneer(<1mm) ST Stepped
				Slightl	ly ⊢ractured 200mm to 1	UUUmm		SL	Slickens	lided	CO	Coating(1-5mm) IR Irregular

RGSSC	DOGI DI	1 CTURT (DRF AT 2 IT		
19300		II START WHE HI 2.15m	i /	
2 2.15	m		W. Sala	
3.		· · · · · · · · · · · · · · · · · · ·		
4768	COL P		A DEAL	
5	A CF	TIMALIA	THE CAL	
	W ATP			
6			- ACABLE -	
7			(ORE LOSS	
8	AT HIT E		1 Miled - G Rais	
O Margaret and		END BHAT 93-		
7 Contraction				
	Client	HDB Town Planning and Design	Job No.	RGS500
	Project	Proposed Rezoing	Drawn By	LD
SOLUTIONS		Weemala Development Boolaroo Stage E2	Date	11/05/2
	Title	Core Photograph - BH1	Drawing No.	Core Pho

Γ					E	ENGI	NEE	RING LC	G - BOR	EHOLE			В	ORE	HOLI	E NO: BH2
			REGION/		м (LIENT	:	HDB	Town Planr	ning and Design			Р	AGE	:	1 of 3
	ź		SOLUTIO)NS	F	ROJE	CT NA	ME: Prop	osed Rezon	ing			J	ові	NO:	RGS50006.1
					5	SITE LO	CATI	ON: Wee	male Develo	opment			L	OGO	GED B	Y: LD
					٦	EST L	OCAT	ION: Ch5	70				D	ATE		20/4/22
	DRI	LL T	YPE:	Track	ed Drill I	Ria				EASTING:	372399	m \$	SURF	ACE	RL:	
	BO	REH	OLE DIAN	NETER	R: 100 i	nm	IN	CLINATION	: 90°	NORTHING:	6353899	m I	DATU	M:		AHD
		Drill	ing and Sar	npling				Materia	description an	d profile information				Fiel	d Test	
L						0	TION .					щZ	ζ	e		Structure and additional
		VTER	SAMPLES	RL	DEPTH	HH BO	FICA.	MATERIA		ON: Soil type, plasticit	ty/particle	STUR	STEN	t Typ	esult	observations
	ME	W		(Not measure	d)	GR	ASSI SYI		aracteristics,co	iour,minor componen	115	MOI	DEI	Tes	Ř	
	F	q					U U	TOPS	OII · Silty CLA	Y medium plasticity o	lark					TOPSOIL
	AD	ntere						0.20m brown			⁄	-				HIGHLY TO MODERATELY
		Inoor						SAND	STONE: Fine (grained, grey						WEATHERED SANDSTONE VERY LOW TO LOW
		ot Er														STRENGTH
		z	1.00		10											
			SPT	-	1.0											
		4	1,25/100mn N=R													
			1.25m													
					2.0	:::::										
					_											
]										
2-00-12																
2.00.2					3.0			3.00m				-				
2 E						-		Contin	ued as Cored I	Drill Hole						
m-m-77						-										
07 000						-										
202.0						-										
					4.0	-										
- 100 - 11						-										
						1										
del ren s						1										
ing an					5.0	1										
00.60.0					0.0	1										
10.0						1										
202/0/0						1										
1 and																
					6.0	1										
202						4										
L LOGG						4										
						4										
1000L						4										
	LEG	END.		<u> </u>	Notes S	amples a	nd Tee	ts			Consister				CS (kP	a) Moisture Condition
	Wate	er er				E0	Dia				VS V	ery Soft		<2	25 5 50	D Dry
	Ŧ	Wat	er Level	ho)	U₅₀ CBR	50mm Bulk s	ample i	or CBR testing	:		F Fi	uit irm		25 50	5 - 50) - 100	W Wet
	-	(Dat Wat	e and ume s er Inflow	nown)	E ASS	Enviro Acid S	onmenta Sulfate \$	al sample Soil Sample			St Si VSt V	tiff ery Stiff		10 20)0 - 200)0 - 400	W _p Plastic Limit W ₁ Liquid Limit
	-	Wat	er Outflow		В	Bulk S	Sample					ard		>4	400	
n ron	otrat	Gi	anges radational or		Field Tes	its			P ()		Density	V	V	ery Lo	ose	Density Index <15%
o L D. GL		tra D	ansitional stra efinitive or di	ata stict	PID DCP(x-y)	Photo Dynar	ionisati nic pen	on detector rea etrometer test	ding (ppm) test depth interv	val shown)		L ME	Lo D M	oose ediun	n Dense	Density Index 15 - 35% Density Index 35 - 65%
2002 01	-	sti	rata change	Juot	HP	Hand	Penetro	ometer test (UC	S kPa)			D VD	D V	ense ery De	ense	Density Index 65 - 85% Density Index 85 - 100%

		PFCIO	ΝΛΙ		ENGINEERING LO	G - CORED BO	REH	OLE			BORE	HOLE NO: BH2
		GEOTE	ECHNIC	AL	CLIENT: HDB	Town Planning and D	esign				PAGE	Page 2 of 3
-		SOLUT	TIONS		PROJECT NAME: Prope	osed Rezoning					JOB N	O: RGS50006.1
					SITE LOCATION: Weer	male Development					LOGG	ED BY: LD
					TEST LOCATION: Ch57	0					DATE:	20/4/22
DF	RILL T	YPE:	Tr	acked	Drill Rig		EAST	ING:	372399	m	SUR	FACE RL:
BC	OREH	ole di	AMETE	R: 10	0 mm INCLINATION	: 90°	NOR	THING:	6353899	m	DAT	UM: AHD
	Drilling	and Sam	npling		Material description	and profile information	1		Testing		1	Rock Mass Defects
METHOD	WATER	RL Not measured	DEPTH (m)	GRAPHIC LOG	Material Description particle characteria minor component	n: Rock type, stics, colour, is, structure	WEATHERING	ESTIMATED STRENGTH	I _{s(50)} D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
			- - 1. <u>0</u> - - - 2. <u>0</u> - - - -									
2			3.0	\times	START CORING AT 3.00m NO CORE							
202 0			-		SANDSTONE: Fine grained, g	rey, pale brown,	HW	L		_20	80	
2000 LJ. 10 2000			-		annialeu		MW	L - M		25	30 100 20	JT 5° RO PL SN JT 50° RO PL SN PT RO PL SN PT RO PL SN
2707 C.007 DVI			4. <u>0</u> -							25	100 100 30	Fragmented core Highly fractured core JT 5° RO PL SN
- 000			-							50	170	Highly fractured core
			-	· · · · · · · · · · · · · · · · · · ·							50	── JT 10° SP PL SN ⊐─ Highly fractured core └─ PT PL VN
NML			5.0_				xw	VL		60		— JT IR VN ∼ JT PL CO
			-		NO CORE		MW	L -			100	└ JT 10° RO CU CN ── JT 10° RO ST SN
6000			_		SANDSTONE: Eine groined	rev with pole brown	N.M.A./					Π
			- 6. <u>0</u>		staining, laminated	rey, wur pale brown		VL		0		Highly fractured core
* B			-		SANDSTONE: Fine grained, b orange-brown staining, laminat	rown, with ied	HW	VL - L			50	 → SM CLAY 5mm → JT 15° RO IR SN → JT 35° RO PL SN → JT 30° RO ST SN
3			-	×××	NO CORE	/	sw				1	Highly fractured core
	GEND.			X X X	SILTSTONE: Dark grey, with p	oink/brown staining Weathering		Stro	nath	65	100	E-JT RO PL SN
Me	thod	Mark	Porc	Lamin	ated <20mm	EW Extremely Weat	thered	VL	Very Lov	v	<u>s(50</u> <0.	1 JT Joint
	2	vvash I Rock F	ore Coller	Thinnly Mediu	y Bedded 20-200mm m Bedded 200-600mm	HW Highly Weather MW Moderately Wea	ed athered	L M	Low Medium		0.1 0.3	- 0.3 PT Parting - 1 SM Seam
CB		Claw o	r Blad Bit	Thickly	y Bedded 600-2000mm	SW Slightly Weathe	red	Н	High		1 -	3 SZ Shear Zone
	ilu),HQ,P(ואועובC Wirelin ב	core e Coring	Very T Massiv	nickly Bedded 2000mm ve No Visible Bedding	FR Fresh		VH EH	Very Hig Extreme	n Iy Hial	3- h >10	10 CS Crushed Seam
2			-	Dec	- of Erosturi						0	Diana (f
d d				Fragm	nented <20mm			VR	ynness Very Ro	ugh	Coatin CN	ig <u>Pianarity</u> Clean PL Planar
222				Highly	Fractured 20mm to 40mm			RO	Rough		SN \/N	Stained CU Curved
77 07				Slighth	y Fractured 200mm to 1000mm			SL	Slickens	ided	CO	Coating(1-5mm) IR Irregular

					ENGINEER	NG LC)G - C(ORED BO	REH	OLE			BORE	HOLE N	o: BH2	
	4	REGIO		201	CLIENT:	HDB	Town Pla	anning and D	esign				PAGE	:	Page	3 of 3
		SOLUT	TIONS		PROJECT NAME	: Prop	osed Rez	zoning					JOB N	IO:	RGS5	0006.1
					SITE LOCATION	: Wee	male Dev	/elopment					LOGG	ED BY:	LD	
					TEST LOCATIO	I: Ch57	70						DATE		20/4/2	2
	л п	YPE	Tr	acked	Drill Ria				FAST		372399) m	SUR	FACE R	· ·	
BC	DREH	OLE DI	AMETE	R: 10	0 mm INCL	INATION	l: 90°		NOR	THING	6353899) m	DAT	UM:	AHD	
0	Drilling	and Sam	pling		Material	lescription	and profile	information			Testing			Rock N	lass Defects	
METHOD	WATER	RL Not measured	DEPTH (m)	GRAPHIC LOG	Material particle minor	Descriptic character componen	on: Rock ty istics, colou its, structur	pe, Jr, e	EATHERING	STIMATED STRENGTH	I _{s(50)} D/A	RQD %	fect Spacing mm	Det i	fect Description nclination, plar oughness, coa thickness	n: Type, iarity, ating,
				× × >		arev with	nink/brown	staining	SW	шо			De		PL SN	
			-	× × > <u>*. *. </u>					- 300	- H				_ ^{_} JT RC _`-JT 5°) IR SN RO PL SN	
			-		veins, thinly bedded	grained, g	grey, with a	ark grey					350	└JT 5°	RO PL SN	
			-		SANDSTONE: Fine	to mediur	m grained,	grey,				65	50	PT RC) PL SN	
			- 80		SANDSTONE: Fine	grained, g	grey, with d	ark grey and					150	L └ PT RC C └ JT 5°) PL SN RO PL SN	
			0.0		brown veins, thinly i	beadea								_	° RO PL SN ° RO PL SN	
			-										300			
NMLC			-	× × > × × >	SILTSTONE: Dark	grey, lamir	nated		XW	VL				- Highly	fractured core	;
			-	\mathbf{X}	NO CORE: Inferred	coal sean	n					0				
			9.0_	$\times \times \times$	SILTSTONE: Grey,	laminated	I		HW				-			
			-	łΧ	NOCORE											
			-						-			0		 ∏— Fragm	nented core	
			-	× × × × × ×	SILTSTONE: Dark	grey, lamir	nated	/	MW	L) PL SN	
			- 10.0) PL CN	
			10.0		Hole Terminated at	10.00 m) PL SN	ſ
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			11.0													
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			-	+												
			13.0_	-												
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			-	1												
			-	1												
LE	GEND: thod	•	•	Bedd	ing ated <20mm		Weatheri	ng Extremely West	hered	<u>Stre</u>	ngth		<u><u>l</u>s(5)</u>	<u>n</u> 1	Defect Type	
WE	3	Wash B	Bore	Thinn	ly Bedded 20-200n	ım	HW	Highly Weather	ed		Low		0.1	- 0.3	PT Parting	
CB		Claw of	r Blad Bit	Mediu Thickl	v Bedded 200-600 600-200	mm Omm	SW	Moderately Wea	athered red	М Н	Medium High		0.3 1 -	3	SM Seam SZ Shear	Zone
NM NQ	ILC (,HQ,PC	NMLC Wirelin	Core e Coring	Very Massi	Thickly Bedded 2000mn ve No Visih	ı le Beddina	FR	Fresh		VH EH	Very Hig Extreme	gh ely Hia	3- h >1	10 0	CS Crushe	ed Seam
			5	Door	e of Fracturing	saanig				Bott	Inches	, . "y	Conti		Diana	rity
				Fragn	nented <20mm	10				VR	Very Ro	ugh	CN	Clean	PL	Planar
				Highly Fractu	red Fractured 20mm to red 40mm to	o 40mm o 200mm				RO SO	Rough Smooth		SN VN	Stained Veneer(CU <1mm) ST	Curved Stepped
				Slight	ly Fractured 200mm	to 1000mm	ı			SL	Slickens	ided	CO	Coating	(1-5mm) IR	Irregular

RG550006.1_	BH2 5	TART LORE AT 2.5m		
3 CORE LOSS	6			
4		LACK ALL IT	26	
5	11.19	CORE LOSS	Thoms	
6	A. Street	LORE		
7.		Loss		
8	And			
q	r valet	COREL	.OSS	
	LORE LOSS		Alt + A & D Ball	
END OF BORE	HOLE AT :	10m		
	Client	HDB Town Planning and Design	Job No.	RG\$5000
GEOTECHNICAL	Project	Proposed Rezoing	Drawn By	LD
SOLUTIONS		Weemala Development Boolaroo Stage E	2 Date	11/05/20
	Title	Core Photograph - BH2	Drawing No.	Core Pho

				E	ENGI	NEE	RINC	G LO	G - BOI	REHO	LE				E	ORE	HOLI	E NO:	BH	3
	4	REGION/			LIENT	:		HDB ⁻	Town Plar	nning an	d Design				P	AGE	:		1 of	3
		SOLUTIO	INS NS	F	ROJE		ME:	Propo	sed Rezo	ning					J	ОΒΙ	NO:		RGS	50006.1
				s	SITE LO	CATI	ON:	Ween	nale Deve	lopment					L	OGO	GED B	Y:	LD	
				Т	EST L	OCAT	ION:	Ch400	C						C	ATE	:		21/4/	22
	דווא		Track	ed Drill I	Ria					F		3723	388 n	n (ACE	RI ·			
B	OREH	OLE DIAN	IETER	12 0 r	nm	IN		ATION:	90°	N	IORTHING:	63537	716 n	n E	DATU	M:	ILL.	AH	D	
	Dril	ling and Sar	npling				N	/laterial c	lescription a	and profile	information					Fiel	d Test			
						NOI									5			_		
HOL	TER	SAMPLES	RI	DEPTH	H H S	1ICAT	MA	TERIAL	DESCRIPT	TION: Soil	type, plasticity	y/particle	e	TURE	STEN	Type	sult	Stru	cture and observa	d additional ations
MET	MA	0, 111 220	(Not measured	(m)	GRA	ASSIF		char	racteristics,c	colour,min	or component	ts			DEN	Test	Re			
L					×	CL								-	ŏ			TODOC		
AD/T	ered					CI	0.15m	brown, v	IL: Sandy C with fine to n	CLAY, meo nedium gr	lium plasticity, ained gravel	, dark	7					MODE		
	count				00				OMERATE	: Fine to c	oarse grained	l, grey,						WEATH		TE
	t End				0 0		'											LOW S	TRENG	TH
	°Z				00															
				1. <u>0</u>			1 10m													
					$\overline{\mathbf{N}}$			Advance	ed with NML	C, no rec	overy									
					$\left \right\rangle /$															
					ΗŇ															
					$ / \rangle$															
				2.0	/	CI	2.00m	Sandy (CLAY: Medi	ium plastic	ity, pale brow	n, pale		۲ ۲	H / Fr			EXTRE	MELY TO	O HIGHLY
						-		grey						Ň				WEAT	HERED S	SANDSTONE
	-	2.50m	-		 													Unner	100mm c	f SPT was fall
M	1	591 5,25/120m	n			•												in		I OF I Was Idii
404		<u>N=R</u> 2.77m	1	3.0	1	-														
2						-														
-					[
					× × :	*	3.50m		ONE: Dark	arev						-		HIGHL	Y TO MC	DERATLEY
4						×××		0.2.101	CITE: Dank	gioy								WEATH	HERED S	SILTSTONE RENGTH
		4.00m		4.0	× × ×	×														
2		SPT				×														
		8,15,20 N=35			× × ×	×														
		4.45m				×														
50					× × ×	×														
2000				5. <u>0</u>	× × ×	×	5.00m											0041		
								COAL:	Dark brown									CUAL		
4		5.50m					5.50m													
		SPT	1		×				EDDED SIL	LTSTONE	AND COAL:	Grey,						EXTRE	MELY TO	O HIGHLY SILTSTONE
D		3,7,13 N=20			×			uark gre	y and black	x								VERY I	OW TO	
		5.95m		6. <u>0</u>	×													WITH	COAL	
					× ×															
					××															
					×															
		7.00m			××	1														
LE	GEND:			Notes, Sa	amples a	nd Tes	ts						istenc	Y V Soft		U	CS (kPa 25) <u>Mois</u>	ture Con	dition
	ter Wat	ter Level		U ₅₀	50mn	n Diame	eter tube	sample				S	Sof	t son		25	5 - 50	м	Moist	
	(Da	te and time s	hown)	CBR E	Bulk s Envir	sample t onmenta	tor CBR al sampl	testing le				F St	Firn Stiff	n f		50 10) - 100)0 - 200	W Wp	Wet Plasti	c Limit
	- Wat ∢ Wat	ter Inflow ter Outflow		ASS B	Acid S Bulk S	Sulfate S Sample	Soil Sarr	nple				VSt H	Ver Har	y Stiff d		20 >4)0 - 400 100	W	Liquid	Limit
Str	ata Ch	anges		-	te							Fb	Fria	able		on / L	2.2	Der	ity Index	<15%
—	G	radational or ansitional stra	ata	PID	Photo	oionisati	on detec	ctor readi	ng (ppm)			Densi	<u>y</u>	L	L	ery LO 00se	-	Dens	sity Index	15 - 35%
	D	efinitive or di	stict	DCP(x-y) HP	Dyna Hand	mic pen Penetro	etromete ometer te	er test (te est (UCS	est depth inte S kPa)	erval showr	1)			MD D) N D	lediun ense	n Dense	e Dens Dens	sity Index sity Index	35 - 65% 65 - 85%
	31													VD	V	ery D	ense	Dens	ity Index	85 - 100%

Γ				E	INGI	NEE	RING LOG - BOREHOLE			В	ORE	HOLE	NO: BH3
	4	REGION		. 0	LIENT	:	HDB Town Planning and Design			Р	AGE	:	2 of 3
			HNICA DNS	NL P	ROJE	CT NA	ME: Proposed Rezoning			J		NO:	RGS50006 1
				s		CATI	ON : Weemale Development			1	0.00		Y • ID
				т	FSTI	ОСАТ				-			21/4/22
┝				•								•	
	ORILL BOREI	TYPE: HOLE DIAN	Track METER	ed Drill F L: 120 r	Rig nm	IN	EASTING: CLINATION: 90° NORTHING:	372388 6353716	m 5 m 1	DATU	ACE M:	RL:	AHD
	Dr	illing and Sa	mpling	_			Material description and profile information				Field	d Test	
						NOI			7	ζ			
	ATER	SAMPLES	RL	DEPTH (m)	APHIC LOG	SIFICAT	MATERIAL DESCRIPTION: Soil type, plasticit characteristics,colour,minor component	y/particle ts	NDITIO	SISTEN	st Type	Result	Structure and additional observations
Ň	\$		measure	d)	9 B	CLAS:			00 WC	DE CONS CONS CONS CONS CONS CONS CONS CONS	Te	LL.	
		SPT 1,13,20/100	nm		×		7.20m Continued as Cored Drill Hole						
		N-R		-									
				80	-								
				0.0									
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	EGEND):		Notes, Sa	imples a	Ind Tes	<u>is</u>	Consisten	су	l	<u> </u>	CS (kPa) Moisture Condition
Į ⊻	Vater			U ₅₀	50mn	n Diame	ter tube sample	VS Ve S So	ery Soft oft		<2 25	5 - 50	D Dry M Moist
	≝ Wa (D	ater Level ate and time s	shown)	CBR	Bulk s	sample f	or CBR testing	F Fi	rm iff		50	- 100	W Wet W Plastic Limit
	— w	ater Inflow	ĺ	ASS	Acid S	Sulfate S	Soil Sample	VSt Ve	ery Stiff		20	0 - 200 0 - 400	W _L Liquid Limit
s	trata C	ater Outflow h anges		В	Bulk \$	Sample		H Ha <u>F</u> b Fr	ard iable		>4	00	
	(Gradational or	.	Field Test	ts Photo	ionisativ	n detector reading (nom)	Density	V	V	ery Lo	ose	Density Index <15% Density Index 15 - 35%
-	1 I	ransitional str Definitive or d	ata istict	DCP(x-y)	Dynai	mic pen	etrometer test (test depth interval shown)		ME) M	edium	n Dense	Density Index 15 - 65%
10-4 O	:	strata change		ΗP	Hand	Penetro	meter test (UCS KPa)		D VD	D V	ense ery De	ense	Density Index 65 - 85% Density Index 85 - 100%

						ENGINEERING LOG - COREI	D BOF	REHO	OLE			BORE	HOLE NO: BH3
			REGIO		A1	CLIENT: HDB Town Planning	g and De	esign				PAGE	Page 3 of 3
			SOLUT	IONS	AL	PROJECT NAME: Proposed Rezoning						JOB N	IO: RGS50006.1
						SITE LOCATION: Weemale Developm	nent					LOGG	ED BY: LD
						TEST LOCATION: Ch400						DATE:	21/4/22
ŀ	וחח		VDE.	T=	aakad			EACT		27220		eu D	
	BOI	REH	OLE DI		ackeu R: 12	0 mm INCLINATION: 90°		NORT	THING:	6353716	6 m	DAT	UM: AHD
F	Dr	illing a	and Sam	pling		Material description and profile informa	ation			Testing			Rock Mass Defects
								ŋ	Ωт			bu	
		ER		DEPTH	GHIC	Material Description: Rock type,		ERIN	ATE		% (spaci	Defect Description: Type,
Ē		MA	RL Not	(m)	SRAF	particle characteristics, colour, minor components, structure		ATH	STIM	I _{s(50)} D/A	RQI	ect (roughness, coating,
Ľ	_		measureu		0			WE	ы К С			Det	U IICKI 1655
						START CORING AT 7.20m							
				_	\times \times \times \times \times \times \times	SILTSTONE: Pale grey, indistinctly bedded		XW	VL		0		
				-	× × ×	COAL · Black						70	│ │── Highly fractured core
				_		TUFFACEOUS SANDSTONE: Fine grained, gre	ey,	xw	VL			200	
				8.0		with some orange-brown staining, laminated	-					<u> </u>	J- Highly fractured core
				_				XVV	VL		75	200	JT 5° RO PL SN
				_									
				_								800	
				-									
				9.0_								30	│ │── Highly fractured core
				-		TUFFACEOUS SANDSTONE: Fine grained, gre	ey,						
				-		with orange-brown staining, indistinctly bedded							
ļ	n N			-									
-	_			-									
				10.0_							90		
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				11.0									
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2				-								100	
				-	· · · · · ·	SANDSTONE: Fine grained, pale grey, with orange-brown staining, laminated						100	PT RO PL CN
				- 12 0	· · · · · ·						80	150	JT 5° RO PL SN
_				.2.9		Hole Terminated at 12 10 m							JT 60° RO PL SN JT 20° RO ST SN
ľ				-		THOS TERMINALEY AL 12. IV III							
				13.0									
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P				_									
				-									
				-									
L	FC	END.			Boddi	na Montharina			 	nath		L	Defect Type
	Meth	nod	10/	Parc	Lamin	ated <20mm EW Extrem	ely Weath	ered	VL	Very Lov	v	<u> s(50</u> <0.	1 JT Joint
\ F	/VB RR		vvash f Rock R	ore Ioller	Thinnly Mediu	y Bedded 20-200mm HW Highly ¹ m Bedded 200-600mm MW Modera	Weathered ately Weat	d hered	L M	Low Medium		0.1 0.3	- 0.3 PT Parting 3 - 1 SM Seam
(CB NMI	.C	Claw of NMI C	r Blad Bit Core	Thickly	y Bedded 600-2000mm SW Slightly	Weathere	ed	H	High Very Hig	ıh	1 - 2	3 SZ Shear Zone
ľ	NQ,I	- HQ,PC	Q Wirelin	e Coring	Massiv	ve No Visible Bedding			EH	Extreme	ly Hig	h >10	
R					Degre	e of Fracturing			Rou	ighness		Coati	ng Planarity
					Fragm Highly	ented <20mm Fractured 20mm to 40mm			VR RO	Very Ro Rough	ugh	CN SN	Clean PL Planar Stained CU Curved
					Fractu	red 40mm to 200mm			SO	Smooth	ided	VN	Veneer(<1mm) ST Stepped

RGS500	206.1 BH3	START CORE AT 7.0m	all a	
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9 4 600				
10				
11	and the			
12 0 E	ND BH AT	12.Im	•	
and the second sec				
	Client	HDB Town Planning and Design	Job No.	RGS500
REGIONAL	Client Project	HDB Town Planning and Design Proposed Rezoing	Job No. Drawn By	RGS500 LD



Appendix B

Laboratory Test Result Sheets

Regional Geotechnical Solutions RGS50006.1 - AC 5 May 2022



Materia	l Test Report	Rep	ort No: MAT:NEW22W-1088-S01 Issue No: 1
Client:	Regional Geotechnical Solutions Pty Ltd 44 Bent Street Wingham NSW 2429	NATA	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.
Project No.:	MNC16P-0001		B. Call
Project Name: Project Locatio	Various Testing n :Boolaroo, NSW	WORLD RECOGNISED	Approved Signatory: Brent Cullen (Engineering Geologist) NATA Accredited Laboratory Number: 18686 Date of Issue: 3/05/2022

Sample ID:	NEW22W-1088-S01
Date Sampled:	14/04/2022
Date Received:	19/04/2022
Source:	On-Site
Material:	Insitu
Specification:	No Specification
TRN: Sample Location:	The results outlined below apply to the sample as received RGS50006.1 TP3 - (1.4 - 1.5m)

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	13.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	62	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	24	
Plasticity Index (%)	AS 1289.3.3.1	38	
Date Tested		29/04/2022	



Material Test Report		Repo	Report No: MAT:NEW22W-1088-S02 Issue No: 1	
Client:	Regional Geotechnical Solutions Pty Ltd 44 Bent Street Wingham NSW 2429	NATA	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.	
Project No.:	MNC16P-0001		Approved Signatory: Brent Cullen	
Project Name:	Various Testing	WORLD RECOGNISED	(Engineering Geologist)	
Project Location	n:Boolaroo, NSW	ACCREDITATION	NATA Accredited Laboratory Number: 18686 Date of Issue: 3/05/2022	

Sample Details

Sample ID:	NEW22W-1088-S02
Date Sampled:	14/04/2022
Date Received:	19/04/2022
Source:	On-Site
Material:	Insitu
TRN: Sample Location:	The results outlined below apply to the sample as received RGS50006.1 TP4 - (0.4 - 0.5m)

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	18.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		Yes	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	73	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	25	
Plasticity Index (%)	AS 1289.3.3.1	48	
Date Tested		29/04/2022	



Material Test Report		Rep	Report No: MAT:NEW22W-1088-S03 Issue No: 1	
Client:	Regional Geotechnical Solutions Pty Ltd 44 Bent Street Wingham NSW 2429	NATA	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.	
Project No.:	MNC16P-0001		D · UUUUU	
Project Name: Project Locatio	Various Testing n:Boolaroo, NSW	WORLD RECOGNISED	(Engineering Geologist) NATA Accredited Laboratory Number: 18686 Date of Issue: 3/05/2022	

Sample ID: Date Sampled: Date Received: Source: Material:	NEW22W-1088-S03 14/04/2022 19/04/2022 On-Site Insitu
Specification:	No Specification
TRN: Sample Location:	The results outlined below apply to the sample as received RGS50006.1 TP5 - (0.4 - 0.5m)

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	14.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	73	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	29	
Plasticity Index (%)	AS 1289.3.3.1	44	
Date Tested		29/04/2022	



Report No: MAT:NEW22W-1088-S04

Client: Regional Geotechnical Solutions Pty Ltd 44 Bent Street Wingham NSW 2429 Project No.: MNC16P-0001 Project Name: Various Testing Project Location:Boolaroo, 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. UULU Approved Signatory: Brent Cullen (Engineering Geologist) NATA Accredited Laboratory Number: 18686 Date of Issue: 3/05/2022

Sample ID: Date Sampled: Date Received: Source: Material:	NEW22W-1088-S04 14/04/2022 19/04/2022 On-Site Insitu
Specification:	No Specification
TRN: Sample Location:	The results outlined below apply to the sample as received RGS50006.1 TP6 - (0.4 - 0.6m)

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	21.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		Yes	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	82	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	24	
Plasticity Index (%)	AS 1289.3.3.1	58	
Date Tested		29/04/2022	



Material Test Report		Rep	Report No: MAT:NEW22W-1088-S05 Issue No: 1	
Client:	Regional Geotechnical Solutions Pty Ltd 44 Bent Street Wingham NSW 2429	NATA	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.	
Project No.:	MNC16P-0001		D · Ulle C	
Project Name:	Various Testing	WORLD RECOGNISED	(Engineering Geologist)	
Project Location	n:Boolaroo, NSW	ACCREDITATION	NATA Accredited Laboratory Number: 18686 Date of Issue: 3/05/2022	

Sample ID:	NEW22W-1088-S05
Date Sampled:	14/04/2022
Date Received:	19/04/2022
Source:	On-Site
Material:	Insitu
Specification:	
TRN:	RGS50006.1
Sample Location:	TP11 - (0.2 - 0.5m)

Test Results

lootitoodito			
Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	15.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	65	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	27	
Plasticity Index (%)	AS 1289.3.3.1	38	
Date Tested		29/04/2022	

Point Load Strength Report - Diametral and Axial Testing of Rock Core



AL	Client:	HDB Town Planning and Design	Job Number:	RGS50006.1		
	Project:	Proposed Rezoning	Date:	28/04/2022		
	Location:	Weemala Development	By:	TMc		

Date Sampled: Date Tested: 28-Apr-22 Test Method: AS4133.4.1 - 2007

Date of Calibration: 18-Aug-20

HMA 6510

Test Machine:

	Test Depth		Moisture	Diametral Test					Axial Test										
Borehole	(m)	Rock Type	Condition	Length L (mm)	Diameter D	Load P (kN)	l _s (Mna)	Size Correction	l _{s(50)} (Mna)	Strength Classification	Width W (diameter)	Platen Separation	Load P (kN)	l _s (Mna)	Size Correction	l _{s(50)} (Mpa)	Strength Classification	UCS (Mpa)	Anisotropy
BH1	2.81-2.94		N	130.0	52.0	0.22	0.08	1.02	0.08	VL	52	37	0.29	0.12	0.995	0.12	L	2.35682	0.70
BH1	3.43-3.55		N	120.0	52.0	1.67	0.62	1.02	0.63	М	52	48	1.99	0.63	1.055	0.66	М	13.2183	0.95
BH1	5.0-5.07		Ν	70.0	52.0	1.64	0.61	1.02	0.62	М	52	39	0.63	0.24	1.007	0.25	L	4.91531	2.51
BH1	7.66-7.75		Ν	90.0	52.0	0.19	0.07	1.02	0.07	VL	52	34	0.24	0.11	0.977	0.10	L	2.08257	0.69
BH1	8.73-8.81		Ν	80.0	52.0	6.01	2.22	1.02	2.26	Н	52	40	6.68	2.52	1.013	2.56	Н	51.1053	0.89
BH1	8.92-9.0		Ν	80.0	52.0	6.07	2.24	1.02	2.28	Н									
BH2	5.25-5.35		Ν	100.0	52.0	0.49	0.18	1.02	0.18	L	52	50	0.88	0.27	1.065	0.28	L	5.66326	0.65
BH2	7.05-7.2		Ν	110.0	52.0	5.26	1.95	1.02	1.98	Н	52	51	9.73	2.88	1.070	3.08	VH	61.664	0.64
BH2	7.64-7.7		Ν	60.0	52.0	1.50	0.55	1.02	0.56	М	52	29	5.32	2.77	0.942	2.61	Н	52.2202	0.22
BH2	9.8-9.88		Ν	80.0	52.0	0.12	0.04	1.02	0.05	VL	52	42	0.40	0.14	1.024	0.15	L	2.94664	0.31
BH3	8.46-8.58		Ν	120.0	52.0	0.30	0.11	1.02	0.11	L	52	40	0.16	0.06	1.013	0.06	VL	1.22408	1.85
BH3	10.86-10.95		Ν	90.0	52.0	0.13	0.05	1.02	0.05	VL	52.0	34.0	0.42	0.19	0.977	0.18	L	3.64451	0.27
BH3	12.0-12.1		Ν	100.0	52.0	0.30	0.11	1.02	0.11	L	52	40	0.16	0.06	1.013	0.06	VL	1.22408	1.85
Moisture Co	ondition:	D = Dry N = Natural S = Saturated		<u>Strength C</u>	lassification:	I _{s(50)} M > 10 3 to 10 1 to 3	pa Te Exi Ve Hiq	rm tremely High Str ry High Strength gh Strength	rength 1	Abbreviation EH VH H									
		0.3 to 1 Medium Strength M				M													

VL

Very Low Strength

< 0.1

Template Revision: B



Appendix C

Landslide Risk Management Risk Matrix

Examples of Good & Poor Hillside Practice

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007 APPENDIX C: LANDSLIDE RISK ASSESSMENT QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

QUALITATIVE MEASURES OF LIKELIHOOD

Approximate Annual ProbabilityImplied IndicativeIndicativeNotionalRecurrence IValueBoundaryIndicative		ve Landslide Interval	Description	Descriptor	Level	
10 ⁻¹	5x10 ⁻²	10 years		The event is expected to occur over the design life.	ALMOST CERTAIN	A
10 ⁻²	5.10 ⁻³	100 years	20 years	The event will probably occur under adverse conditions over the design life.	LIKELY	в
10-3	5X10	1000 years	200 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10 ⁻⁴	5x10"	10,000 years	2000 vears	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10-5	5x10 ⁻⁶	100,000 years		The event is conceivable but only under exceptional circumstances over the design life.	RARE	Е
10-6	5X10	1,000,000 years	200,000 years	The event is inconceivable or fanciful over the design life.	BARELY CREDIBLE	F

Note: (1) The table should be used from left to right; use Approximate Annual Probability or Description to assign Descriptor, not vice versa.

QUALITATIVE MEASURES OF CONSEQUENCES TO PROPERTY

Approximate Cost of Damage Indicative Notional Value Boundary		Description	Descriptor	Level
200%	1000/	Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequence damage.	CATASTROPHIC	1
60%	100%	Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequence damage.	MAJOR	2
20%	10%	Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequence damage.	MEDIUM	3
5%	10%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	MINOR	4
0.5%	170	Little damage. (Note for high probability event (Almost Certain), this category may be subdivided at a notional boundary of 0.1%. See Risk Matrix.)	INSIGNIFICANT	5

Notes: (2) The Approximate Cost of Damage is expressed as a percentage of market value, being the cost of the improved value of the unaffected property which includes the land plus the unaffected structures.

(3) The Approximate Cost is to be an estimate of the direct cost of the damage, such as the cost of reinstatement of the damaged portion of the property (land plus structures), stabilisation works required to render the site to tolerable risk level for the landslide which has occurred and professional design fees, and consequential costs such as legal fees, temporary accommodation. It does not include additional stabilisation works to address other landslides which may affect the property.

(4) The table should be used from left to right; use Approximate Cost of Damage or Description to assign Descriptor, not vice versa

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: - QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY (CONTINUED)

LIKELIHOOD CONSEQUENCES TO PROPERTY (With Indicative Approximate Cost of Damage) 1: CATASTROPHIC 3: MEDIUM Indicative Value of 2: MAJOR 4: MINOR 5: Approximate Annual 200% 60% 20% 5% INSIGNIFICANT Probability 0.5% 10^{-1} A - ALMOST CERTAIN Η M or L(5) 10^{-2} B - LIKELY Η Μ L 10^{-3} Η C - POSSIBLE Μ Μ VL 10^{-4} UNLIKELY H Μ L L VL D -10-5 Μ L VL E -RARE L VL 10-6 L VL F - BARELY CREDIBLE VL VL VL

QUALITATIVE RISK ANALYSIS MATRIX - LEVEL OF RISK TO PROPERTY

Notes: (5) For Cell A5, may be subdivided such that a consequence of less than 0.1% is Low Risk.

(6) When considering a risk assessment it must be clearly stated whether it is for existing conditions or with risk control measures which may not be implemented at the current time.

Risk Level **Example Implications** (7) Unacceptable without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low: may be too expensive and not practical. Work likely to cost more than value of the property. Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce Н HIGH RISK risk to Low. Work would cost a substantial sum in relation to the value of the property. May be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be Μ MODERATE RISK implemented as soon as practicable. Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is L LOW RISK required. Acceptable. Manage by normal slope maintenance procedures. VL VERY LOW RISK

RISK LEVEL IMPLICATIONS

Note: (7) The implications for a particular situation are to be determined by all parties to the risk assessment and may depend on the nature of the property at risk; these are only given as a general guide.

EXAMPLES OF GOOD HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE

