Macksville Hospital Development

Structural Report

Revision: 3

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Issued For: State Significant Development

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Report Amendment Register

Rev. No.	Issue/Amendment	Author	Reviewer	Date
1	SSD	TU	JW	6/04/18
2	SSD	BI	JW	17/04/18
3	SSD	TU	JW	04/05/18

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1. EXECUTIVE SUMMARY

Structural Works

This structural report has been prepared by Bonacci Group (NSW) Pty Ltd to describe the structural works associated with the State Significant Development Application (SSDA) for the new Level 3 Rural Hospital in North Macksville.

A new multi-storey concrete and steel framed building is to be constructed to the north of an old precast yard, and adjacent to the new Pacific Highway alignment. The new hospital building contains a basement level, ground level and first floor level. Single-storey in patient units (IPUs) are to be of lightweight construction.

The column grid for the new structure is generally in accordance with the Health Infrastructure (HI) guidelines, spaced at 8.4 metres in each direction. The columns are to be supported on shallow footings that bear on highly weathered Phyllite or via piles socketed into the Phyllite. The ground level raft slab and basement raft slab can bear on natural residual soil (clay) and highly weathered Phyllite respectively. This structure can likely be supported on a raft slab.

The suspended slabs are proposed to be post-tensioned banded slabs with the bands orientated to suit the reticulation of major ductwork where possible. The floors have been designed to accommodate all the design requirements in the HI guidelines with respect to vibration performance and future flexibility (creation of set downs and additional risers adjacent to columns). No vertical expansion has been allowed for in the design, however, future horizontal expansion have been identified.

Lateral loads are to be resisted by in situ concrete shear walls and the central lift and stair cores. The structure is considered to be Importance Level 4 for the determination of design return periods.

2. EXISTING CONDITIONS

2.1. Location

The proposed development is located in North Macksville NSW. The development site is part of the old pre-cast yard for the construction of the Pacific Highway upgrade project. The site is bordered by the Pacific Highway to the west, farmland fronting Watt Creek to the east, farmland fronting Mattick Road to the north, and vacant Lots fronting a new road providing access to Letitia Close to the south.

Figure 2.1 – Aerial view of the proposed Macksville Hospital site.

The location for the site is to the north of an old precast yard, and adjacent to the new Pacific Highway alignment. This northern site option comprises an elevated hillside area, which has been used for temporary stockpiling of earthfill. This hillside slopes away towards the north at approximately 10 degrees. The fill in this area is up to 3m in depth. The central portion of the site contains an existing farm house, and the southern portion contains a site compound.

2.2. Geotechnical

2.2.1. Geology

A geotechnical investigation for the site has been undertaken by Regional Geotechnical Solutions with the findings presented in the Geotechnical and Phase 1 Site Contamination and Assessment Report on 17th November 2017 (Report No. RGS31237.1 – AE). Refer Appendix C.

The subsurface conditions comprise:

- 0.2m -1.4m fill (gravelly silty clay); overlying
- Residual soil (very stiff to hard clay); overlying
- Extremely weathered Phyllite.

2.2.2. Soil Contamination

Based on the results of the soil contamination assessment (Refer Appendix C), no soil contamination was identifiable and therefore no remedial works are likely to be required.

2.2.3. Groundwater

As noted in the Geotechnical and Phase 1 Site Contamination and Assessment Report (Report No. RGS31237.1 – AE), no groundwater was encountered during the excavation of the test pits. It should be noted however that no long term monitoring of groundwater was carried out. Ground water levels may fluctuate seasonally due to periods of heavy rainfall.

3. PROPOSED DEVELOPMENT

3.1. General Description

The proposed development comprises the construction of a new multi-level regional hospital building on a predominantly greenfield site. As part of the development, an access road will need to be constructed from Letitia Rd to the south, which is subject to a separate planning approval (DA).

3.2. Structural Works

3.2.1. Foundations

Based on the advice provided within the Geotechnical and Phase 1 Site Contamination and Assessment Report on 17th November 2017 (Report No. RGS31237.1 – AE), the columns for the main building are to be supported on shallow footings that bear on highly weathered Phyllite, which provides a bearing capacity of 300kPa. The ground level raft slab and basement raft slab can bear on natural residual soil (clay) and highly weathered Phyllite respectively.

3.2.2. Lower Ground Floor

The slab on ground at basement has been designed as a raft slab in accordance with the geotechnical report and the site classification provided within the report.

3.2.3. Ground Floor

The slab on ground at ground floor level has been designed as a raft slab in accordance with the geotechnical report and the site classification provided within the report. Refer Appendix C.

3.2.4. Superstructure

The superstructure is to be a braced frame with columns placed on a 8.4m x 8.4m grid in accordance with the HI Design Guidelines. Lateral resistance is to be provided by in situ shear walls and the central lift shaft. Generally, column sizes are 400x400.

3.2.5. Floor Systems

A number of suspended floor systems have been considered and are shown in Table 3.3.5 below. As noted in the table, flat plate, flat slab and banded slab floor options have been developed to assist with preliminary costing. The thickness of these options vary based on the required vibration criteria set out in HI guidelines. Once clinical planning has been completed, the thicknesses can be rationalised.

FLOOR	USE	DESIGN PARAMETERS	STRUCTURAL SYSTEM		Reinforcement Rates (kg/m^3)	Post Tensioning Rates (kg/m^3)	Concrete
GROUND FLOOR	ED IPU Maternity Gym Community Health (over basement)	RF=2 (Future flexibility) 40mm sacrificial cover	**Option 1 - Flat Plate**	280mm thick slab 800W x 400D edge beams	50	26	S40
			Option 2 - Flat Slab	280mm thick slab 800W x 400D edge beams	50	26	S40
			Option 3 - Banded Slab	240mm thick slab (end bays) 240mm thick slab (int. bays) 2200W x 400D internal beams 1100W x 400D edge beams	60	24	S40
FIRST FLOOR	Admin	RF=2 (Future flexibility) 40mm sacrificial cover	**Option 1 - Flat Plate**	280mm thick slab 800W x 400D edge beams	50	26	S40
			Option 2 - Flat Slab	280mm thick slab 800W x 400D edge beams	50	26	S40
			Option 3 - Banded Slab	240mm thick slab (end bays) 240mm thick slab (int. bays) 2200W x 400D internal beams 1100W x 400D edge beams	60	24	S40
FIRST FLOOR	Theatres	RF=1 1-2.2Hz 75kg 100 Steps 40mm sacrificial cover	**Option 1 - Flat Plate**	350mm thick slab 800W x 450D edge beams	50	26	S40
			Option 2 - Flat Slab	280mm thick slab 2800sq. X 450D drop panels 800W x 450D edge beams	50	26	S40
			Option 3 - Banded Slab	260mm thick slab (end bays) 260mm thick slab (int. bays) 2200W x 450D internal beams 1100W x 450D edge beams	60	24	S40
ROOF	Roof over Theatres	RF=1 1-1.8Hz 75kg 100 Steps 40mm sacrificial cover	**Option 1 - Flat Plate**	300mm thick slab 800W x 450D edge beams Possible column capital required	50	28	S40
			Option 2 - Flat Slab	260mm thick slab 2800sq. X 450D drop panels 800W x 450D edge beams	60	26	S40
			Option 3 - Banded Slab	240mm thick slab (end bays) 240mm thick slab (int. bays) 2200W x 400D internal beams 1100W x 400D edge beams	60	24	S40
ROOF	General Roof zones		**Lightweight steel structure**	Allow 30kg/sqm steelwork 250 deep purlins on top of steel Cantilever concrete columns if fire rating required	0	0	

Table 3.3.5 – Suspended floor system summary

3.2.6. Roof Structure

The roof structure is to be steel-framed metal deck roof supported on concrete columns. Extra allowance should be made for steel grillages to support pendants and equipment within the theatres. Steelwork will need to achieve the required fire rating.

3.2.7. Spandrel Panels

The building is to be sprinklered, therefore spandrel panels which comply with Clause C2.6 of the NCC will not be required in the façade.

3.2.8. Future Flexibility

The floor slabs are to be provided with a 40mm sacrificial cover zone as per the HI Design Guidelines. Structural details are shown below in Figure 3.3.9a-c. The reinforcement and post tensioning tendons are set down sufficiently so that they maintain the minimum cover when the 40mm sacrificial topping has been removed. This is in accordance with HI Design Guidelines.

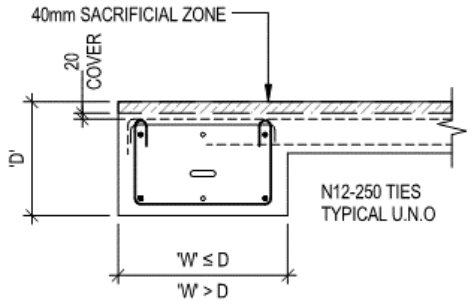


Figure 3.3.9a – Typical edge beam detail with sacrificial topping.

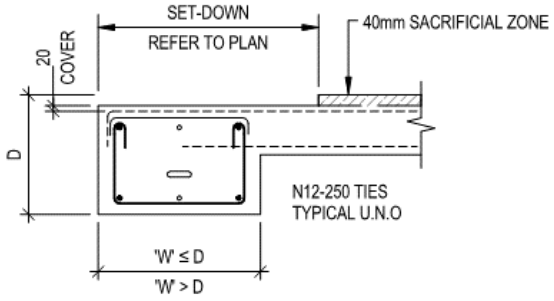


Figure 3.3.9b – Typical edge beam detail at set-down.

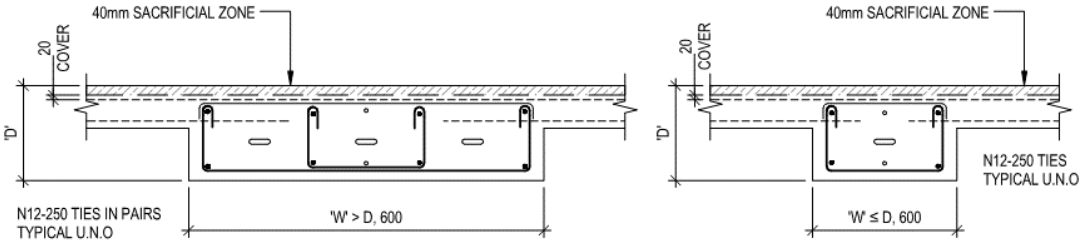


Figure 3.3.9c – Typical internal beam detail with sacrificial topping.

Allowance for additional service risers at each internal column is to be made in the design in accordance with HI Design Guidelines. This will require the reinforcement at the column lines to be displaced so that penetrations can be cut in the future and not require any associated strengthening works to the slab. Refer Figure 3.3.9d and Figure 3.3.9e.

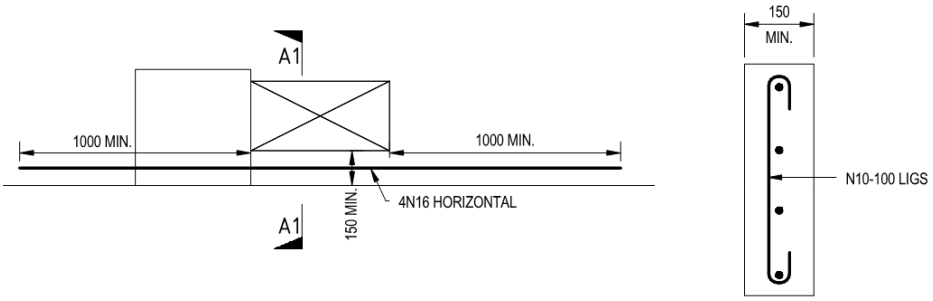


Figure 3.3.9d – Allowance for future service riser zone adjacent to column.

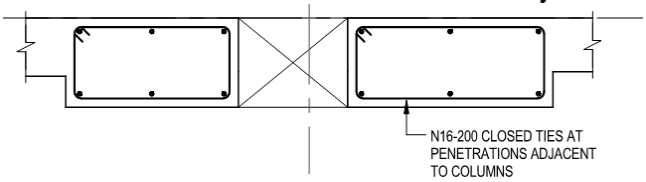


Figure 3.3.9e - Allowance for future service riser zone adjacent to column – Alternative detail.

4. PERFORMANCE PARAMETERS

4.1. Importance Factor

As the building is to accommodate medical emergency and surgical facilities, it has Importance Level 4 and will be designed to fulfil a post disaster function. This is in accordance with HI Design Guidance Note No. 024.

4.2. Design Loads

Table 4.2a: Floor & Roof Loads

Floor Type	Uniform Imposed Load (kPa)	Imposed Point Load (kN)	Superimposed Dead Load (kPa)	40mm Sacrificial Topping (kPa)
Stairs, ramps	4.0	4.5	0.0	0.0
Corridors, circulation areas and foyer spaces	5.0	4.5	1.3	1.0
Wards typically	2.0	1.8	1.8	1.0
Clinical areas	3.0	4.5	1.8	1.0
Plant rooms	7.5	4.5	2.4	0.0
Roof typically	0.25	1.4	0.75	0.0
Shell space future expansion	4.0	4.5	3.0	0.0

Table 4.2b: Wind Load Parameters

Item	Value
Location	Region A2
Importance Level	4
V_u	48m/s
V_s	37m/s
M_s	1.0
M_t	1.0
M_d	1.0
Terrain Category	2.5

Table 4.2c: Earthquake Load Parameters

Item	Value
Importance Level	4
Probability Factor, K_p	1.8
Hazard Factor, Z	0.05
Sub-Soil Class	C_e
Earthquake Design Category	II*
Structural Ductility Factor, μ	2**
Structural Performance Factor, S_p	0.67

**Structure height < 25m*
***This assumes that limited ductile shear walls are to be utilised.*

4.3. Floor Vibration

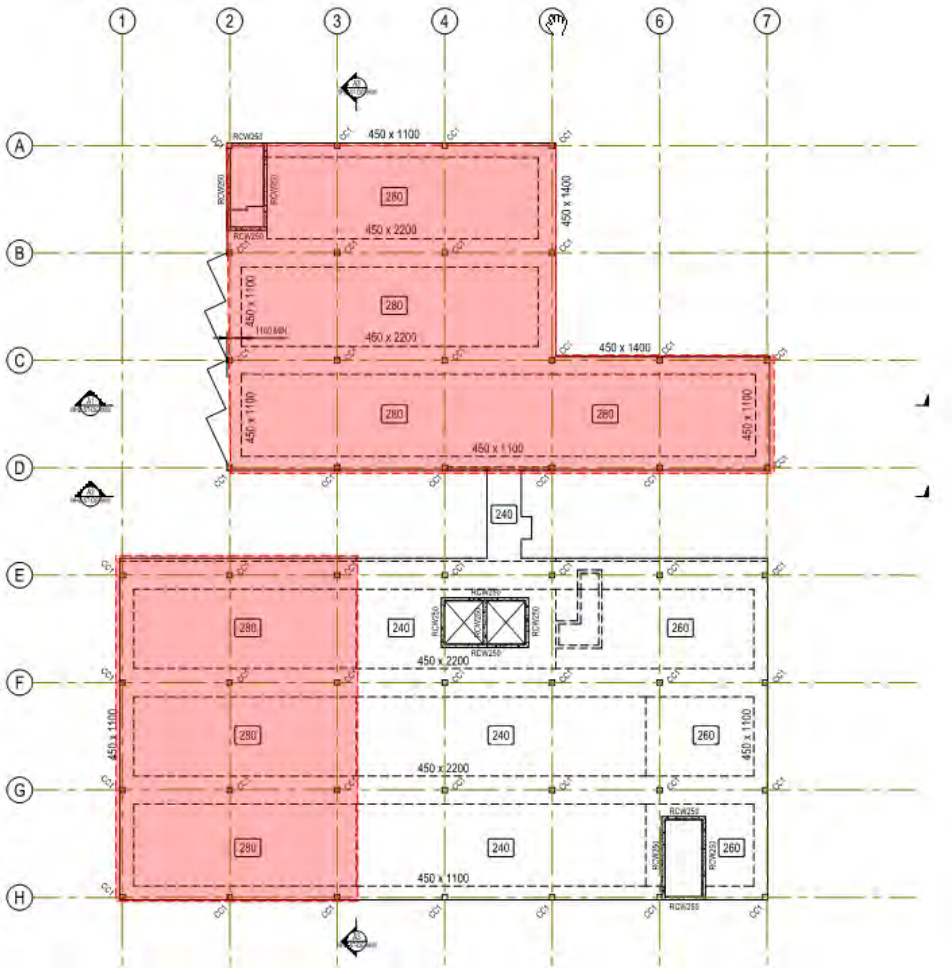
Footfall response will be calculated using the Concrete Centre Design Guide. The response will also be checked against the recommendations made within and Murray, Allen and Ungar in the AISC, 2003.

The footfall frequencies and corresponding response factors defined within the NSW Health Design Guidance Note No. 1 (refer Table 4.3) will be checked for compliance with the Concrete Centre Design Guide.

Once clinical planning has been completed, thicknesses of beams and slabs can be rationalised to meet the required vibration criteria. The current response factors are shown in Table 4.3 and Figure 4.3, both below.

Table 4.3: Footfall Response Factor Design Parameters – Concrete Centre Method

Facility/Equipment/Use	Design Response Factor	Footfall Frequency (Hz)
Generally procedure rooms, laboratories and general surgery	2	2.2
Corridors, circulation spaces, offices and other non-vibration sensitive areas	4	2.2
Imaging Suite and operating theatres	1	1.8
Plant areas	N/A	N/A
Roof areas	N/A	N/A



Level 1

Figure 4.3 – Required response factors for each floor zone.

4.3.1. Robot Analysis

Autodesk Robot 2016 was used for the concept design stage vibration analysis. The parameters for both analyses carried out include:

- Dynamic Young's Modulus of Concrete = 38GPa
- Person mass = 75kg;
- Footfall frequency = 1-2.2 Hz;
- Footfall repetitions = 25 steps;
- Damping = 3.5%;
- Superimposed dead load = 1.5kPa; and
- Vertical support to slab is assumed to be provided by the perimeter curtain wall and riser shaft walls.

A flat plate, flat slab and banded slab system were all considered in the schematic design stage vibration analysis. As stipulated in the HI Design Guidelines, the response factor for a particular slab zone is required for the slab directly above and below. A summary of these analyses, design parameters and corresponding slab thicknesses can be seen in Table 3.3.5.

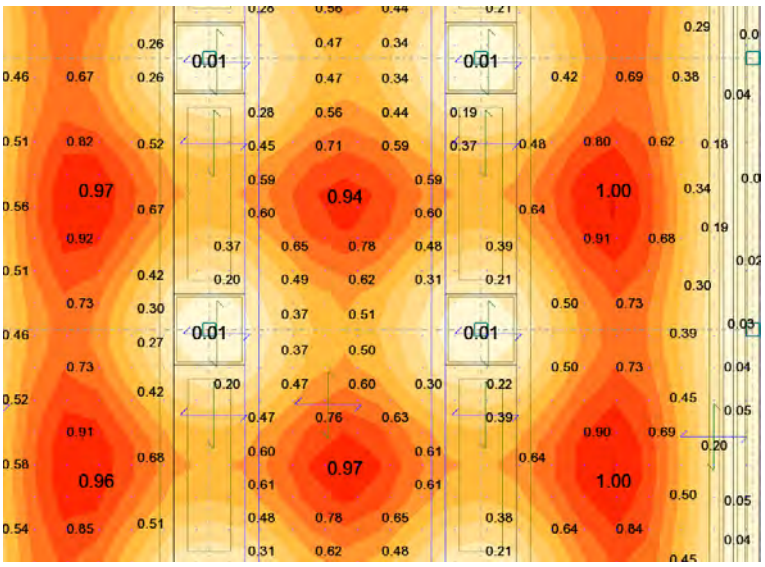


Figure 4.3.1 – Response factors for a banded floor slab system.

4.4. Fire Rating

Building Element	FRL (Type 9a)
External Walls (Load Bearing)	120/60/30
External Columns	120/-/-
Load Bearing Fire Walls	120/120/120
Shafts (Non-load Bearing)	-/-/-
Other Load Bearing Walls, Beams, Trusses, Columns	120/-/-
Floors	120/120/120
Steel Framed and Metal Sheeted Roofs Not Providing Fire Separating Function	No FRL*
Steel Columns Supporting Steel Framed and Metal Sheeted Roofs Not Providing Fire Separating Function	120/-/- (TBC)

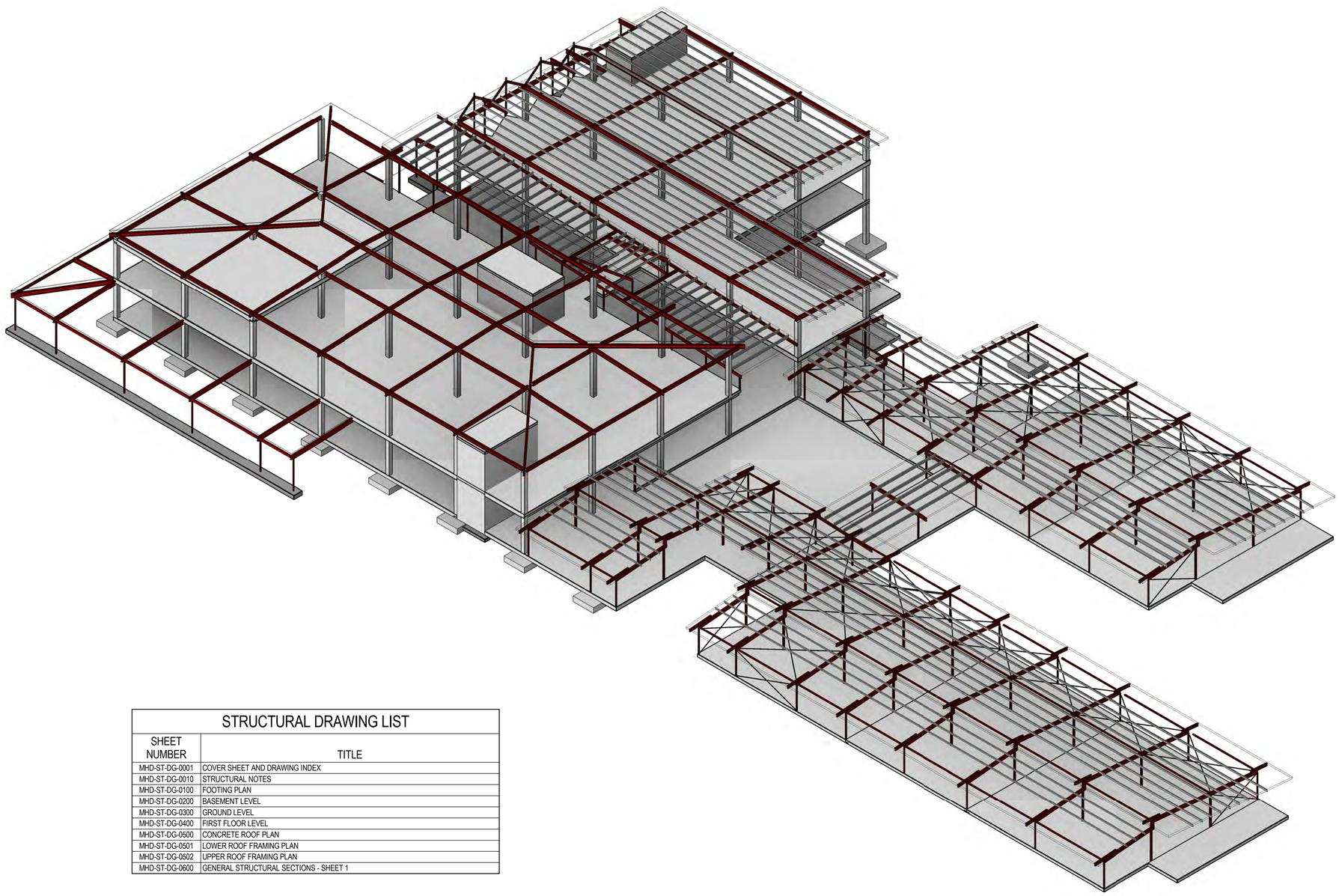
**This concession is gained as the building is to be fully sprinklered*

APPENDIX A. STRUCTURAL DRAWINGS

MACKSVILLE HOSPITAL REDEVELOPMENT

MACKSVILLE NSW 2447

STRUCTURAL DRAWINGS



STRUCTURAL DRAWING LIST	
SHEET NUMBER	TITLE
MHD-ST-DG-0001	COVER SHEET AND DRAWING INDEX
MHD-ST-DG-0010	STRUCTURAL NOTES
MHD-ST-DG-0100	FOOTING PLAN
MHD-ST-DG-0200	BASEMENT LEVEL
MHD-ST-DG-0300	GROUND LEVEL
MHD-ST-DG-0400	FIRST FLOOR LEVEL
MHD-ST-DG-0500	CONCRETE ROOF PLAN
MHD-ST-DG-0501	LOWER ROOF FRAMING PLAN
MHD-ST-DG-0502	UPPER ROOF FRAMING PLAN
MHD-ST-DG-0600	GENERAL STRUCTURAL SECTIONS - SHEET 1

NORTH:

LEGEND:

No	Initial	DATE	REVISION DETAILS
P2	DG	04.05.18	ISSUED FOR SCHEMATIC DESIGN
P1	TU	29.03.18	DRAFT SD

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PROJECT:

MACKSVILLE HOSPITAL REDEVELOPMENT

MACKSVILLE NSW 2447

DRAWING TITLE:

COVER SHEET AND DRAWING INDEX

SCALE:	DRAWN:	DESIGNED:	QA:	APPROVED:	ISSUE DATE:
1 : 100@A1	DG	TU			

PROJECT NUMBER:	DRAWING NUMBER:	ISSUE:
10459	MHD-ST-DG-0001	P2

SCHEMATIC DESIGN

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STRUCTURAL NOTES

STANDARD NOTES:

GENERAL

G1 THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ARCHITECTURAL AND OTHER CONSULTANTS DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS OR SKETCHES AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ANY DISCREPANCY SHALL BE REFERRED TO THE SUPERINTENDENT BEFORE PROCEEDING WITH WORK.
G2 MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE SPECIFICATION, CURRENT SAA CODES, BUILDING REGULATIONS AND THE REQUIREMENTS OF ANY OTHER RELEVANT STATUTORY AUTHORITIES.
G3 THESE DRAWINGS MUST NOT BE SCALED. ALL DIMENSIONS ARE IN mm. ALL SET OUT DIMENSIONS AND LEVELS, INCLUDING THOSE SHOWN ON THESE DRAWINGS SHALL BE IN ACCORDANCE WITH THE ARCHITECT'S DRAWINGS AND VERIFIED ON SITE.
G4 THE CONSULTING ENGINEER HAS DESIGNED THE PERMANENT STRUCTURE. THE CONTRACTOR IS RESPONSIBLE FOR THE DESIGN, IMPLEMENTATION AND CERTIFICATION OF ALL TEMPORARY WORKS, PROPPING, NEEDLING, FALSE WORK, BRACING, BACK-PROPPING, AND SO FORTH, NECESSARY TO COMPLETE THE WORK.
G5 DURING CONSTRUCTION THE STRUCTURE SHALL BE MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVERSTRESSED. THE CONTRACTOR SHALL ALLOW TO ENGAGE A CHARTERED (NPER-3) ENGINEER TO DESIGN, INSPECT THE TEMPORARY WORKS AND VERIFY THE TEMPORARY STABILITY OF THE STRUCTURE.
G6 THE APPROVAL OF A SUBSTITUTION SHALL BE SOUGHT FROM THE SUPERINTENDENT BUT IS NOT AN AUTHORIZATION OF A COST VARIATION. THE SUPERINTENDENT MUST APPROVE ANY COST VARIATION INVOLVED BEFORE ANY
G7 WORK STARTS.
THESE DRAWINGS SHALL NOT BE USED FOR CONSTRUCTION UNTIL ISSUED AS "FOR
G8 CONSTRUCTION" BY THIS OFFICE.
THE CONTRACTOR RETAINS RESPONSIBILITY OF THE WORKS EVEN IF THE
G9 ENGINEER HAS INSPECTED THE WORKS DURING CONSTRUCTION.
WHERE ADDITIONAL CONSTRUCTION LOADS, SUCH AS TEMPORARY SHORING, MOBILE CRANES, ETC. ARE TO BE IMPOSED ON THE STRUCTURE, THE CONTRACTOR SHALL SUBMIT FULL DETAILS OF THE PROPOSED TEMPORARY SUPPORTS TO THE ENGINEER FOR REVIEW. SUCH INFORMATION MUST BE PROVIDED A MINIMUM OF 7
G10 WORKING DAYS PRIOR TO THE PROPOSED WORKS COMMENCING.
IF THE CONTRACTOR INTENDS TO VARY THE SCOPE OR METHOD OF WORKS OR MATERIALS USED, THE CONTRACTOR SHALL SUBMIT FULL DETAILS OF THE
G11 PROPOSAL TO THE DESIGN SUPERINTENDENT FOR DESIGN CHECK.
ALL PROPRIETARY PRODUCTS SHALL BE INSTALLED STRICTLY IN ACCORDANCE
G12 WITH MANUFACTURER'S RECOMMENDATIONS.
ALL REQUIRED TESTS TO COMPLETE THE WORKS SHALL BE AT THE CONTRACTOR'S EXPENSE.

HEALTH AND SAFETY

H1 THE OBLIGATION OF BONACCI GROUP PTY LTD [OR OTHER RELEVANT BONACCI ENTITY] (BONACCI) AS THE DESIGN ENGINEER IS LIMITED TO ENSURING THAT THOSE PARTS OF THE STRUCTURE THAT ARE TO BE USED AS A WORKPLACE ARE, AS FAR AS REASONABLY PRACTICABLE, DESIGNED TO BE SAFE AND WITHOUT RISKS TO THE HEALTH OF THOSE PERSONS USING THE STRUCTURE AS A WORKPLACE FOR THE PURPOSE FOR WHICH IT WAS DESIGNED IN ACCORDANCE WITH SECT. 28 OF THE OCCUPATIONAL HEALTH AND SAFETY ACT 2004 (VIC).
H2 BONACCI IS NOT RESPONSIBLE FOR THE OCCUPATIONAL HEALTH AND SAFETY OF PERSONS AT THE SITE AS THOSE OBLIGATIONS RESIDE WITH THE CONTRACTORS AND/OR SUBCONTRACTORS WHO OCCUPY OR HAVE CONTROL OF THE SITE IN ACCORDANCE WITH APPLICABLE OCCUPATIONAL HEALTH AND SAFETY LEGISLATION, CODES OR PRACTICE, GUIDANCE NOTES, AUSTRALIAN STANDARDS AND OTHER RELEVANT DOCUMENTATION.
H3 ANY ADVICE OR GUIDANCE CONCERNING OCCUPATIONAL HEALTH AND SAFETY ISSUES ARISING AT THE SITE SHOULD BE DIRECTED TO THE HEALTH AND SAFETY EXECUTIVE OR OFFICER NOMINATED FOR THE PROJECT.

FOUNDATIONS

F1 REFER TO THE GEOTECHNICAL REPORT FOR A DESCRIPTION OF THE ANTICIPATED SITE CONDITIONS. THE BUILDER IS TO STUDY THE REPORT AND MAKE HIS OWN EVALUATION ON THE SITE CONDITIONS. ANY ADDITIONAL COSTS INCURRED SHALL BE BORNE BY THE BUILDER.
F2 ALL FOOTINGS SHALL BE FOUNDED AT THE RECOMMENDED DEPTH AND INTO THE APPROPRIATE MATERIAL AS SPECIFIED IN THE GEOTECHNICAL REPORT. THE ALLOWABLE BEARING CAPACITY SHALL BE AS SPECIFIED IN THE FOOTING SCHEDULE. THE TOPS OF FOOTINGS SHALL BE A MINIMUM OF 300mm BELOW THE LOWEST ADJACENT STRUCTURAL FLOOR LEVEL UNLESS NOTED OTHERWISE.
F3 THE ALLOWABLE BEARING CAPACITY SHALL BE VERIFIED BY GEOTECHNICAL ENGINEER, WHO SHALL BE EMPLOYED BY THE BUILDER, BEFORE ANY CONCRETE IS PLACED. WHEREVER THE BEARING CAPACITY AT THE FOOTING BASE IS INADEQUATE, EXCAVATION SHALL CONTINUE UNTIL SUITABLE MATERIAL IS FOUND OR THE FOOTING IS ENLARGED TO THE ENGINEER DETAILS.
F4 BASES OF ALL FOOTINGS SHALL BE CLEANED OF ALL LOOSE MATERIAL PRIOR TO POURING OF CONCRETE. IN WET CONDITIONS, A 300 x 300 x 300 PIT SHALL BE DUG AT THE CORNER OF THE FOOTING FOR DEWATERING THE EXCAVATION BEFORE CONCRETING. A 50mm MINIMUM BLINDING LAYER OF N15 GRADE CONCRETE SHALL BE USED, UNLESS OTHERWISE APPROVED BY THE ENGINEER.
F5 WHENEVER A FOOTING IS LOCATED CLOSE TO A BATTER , AN EXISTING FOOTING, EXISTING OR NEW SERVICES, A LINE DRAWN AT THE BOTTOM OF THE FOOTING AT 40 DEGREES TO THE HORIZONTAL SHALL FALL BELOW THE BATTER, EXISTING FOOTING OR SERVICES. IF THIS DOES NOT HAPPEN THE FOOTING BASE SHALL BE DEEPENED AS REQUIRED TO ACHIEVE THE FORMER.
F6 THE OVER BREAK BETWEEN THE APPROVED FOUNDING LEVEL AND THE UNDERSIDE OF THE FOOTING SHALL BE FILLED WITH GRADE N15 CONCRETE. ANY OVER BREAK AT THE SIDES OF THE FOOTING SHALL BE FILLED WHEN
F7 CONCRETING THE FOOTING.
THE BUILDER SHALL REMOVE ALL SPOIL FROM THE SITE, AND DEWATER THE EXCAVATION AS REQUIRED.

CONCRETE GRADE
PAD AND STRIP FOOTINGS: N40

FOUNDATION DESIGN CRITERIA
BEARING CAPACITY OF PADS ON CLASS IV SANDSTONE - 1000 kPa (WORKING)
BEARING CAPACITY OF PADS ON CLASS HEAVILY WEATHERED SANDSTONE - 400 kPa (WORKING)\
BEARING CAPACITY OF STRIP AND PAD FOOTINGS ON NATURAL CLAY - 100 kPa (WORKING)

STRUCTURAL DESIGN BASED ON GEOTECHNICAL REPORT No:
?????

BORED PILES

BP1 REFER TO THE GEOTECHNICAL REPORT FOR A DESCRIPTION OF THE ANTICIPATED SITE CONDITIONS. THE PILING CONTRACTOR IS TO STUDY THE REPORT AND MAKE HIS OWN EVALUATION OF THE SITE CONDITIONS. ANY ADDITIONAL COSTS INCURRED SHALL BE BORNE BY THE PILING CONTRACTOR.
BP2 THE BORED PILES ARE PROPORTIONED FOR THE SCHEDULED LOADS WITH ALLOWABLE SOCKET SKIN FRICTION AND END BEARING CAPACITY AS INDICATED IN THE REPORT. THE DEPTHS AND LENGTHS NOMINATED IN THE SCHEDULE ARE INDICATIVE ONLY. THEY MAY NEED TO BE VARIED DEPENDING ON THE SITE CONDITIONS ENCOUNTERED. THE PILING CONTRACTOR NEEDS TO INCORPORATE ANY DESIGN CHANGES REQUIRED.
BP3 THE BORED PILES SHALL BE INSTALLED TO A MAXIMUM TOLERANCE OF ±75mm FROM THAT REQUIRED IN PLAN AND INCLINED AT NOT MORE THAN 1 IN 75 FROM THE VERTICAL OR SPECIFIED RAKE.
BP4 ALL WORKMANSHIP AND MATERIAL SHALL BE IN ACCORDANCE WITH AS 2159.
BP5 THE BORED PILES SHALL BE LOCATED CONCENTRIC WITH THE COLUMNS AND WALLS UNLESS NOTED OTHERWISE.
BP6 DRILL AND INSTALL THE BORED PILES IN THE LOCATIONS SHOWN ON THE DRAWINGS AND THE ABOVE REQUIREMENTS.
BP7 BEFORE ANY CONCRETE IS POURED, ALL ROCK SOCKETS SHALL BE DEWATERED AND INSPECTED BY THE GEOTECHNICAL ENGINEER , WHO SHALL BE EMPLOYED BY THE BUILDER, TO VERIFY THE SOIL PARAMETERS. THE SOCKET BASE AND WALLS MUST BE CLEAN AND FREE FROM CLAY.
BP8 IF THE CONCRETE NEEDS TO BE TREMIED, SUPER PLASTICIZER MUST BE ADDED TO THE MIX AND THE CONCRETE GRADE INCREASED BY 30% . REFER TO THE SPECIFICATIONS FOR THE INSPECTION OF THE HOLE PRIOR TO CONCRETING.
BP9 THE PILING CONTRACTOR SHALL ALLOW FOR THE COST INTEGRITY TESTING OF ALL BORED PILES.
BP10 ANY ALTERNATIVE DESIGN SHALL MEET THE ABOVE REQUIREMENTS AND THE SCHEDULED LOADS. THE PILING CONTRACTOR SHALL OBTAIN CERTIFICATION FOR THE CALCULATIONS OF THE ALTERNATIVE SYSTEM. THE DETAILS AND CALCULATIONS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR THE PERFORMANCE OF THE ALTERNATIVE BORED PILES.

CONCRETE GRADE
BORED CAISSONS: N50 MINIMUM OR AS STATED IN THE SCHEDULE.
75mm COVER.

FOUNDATION DESIGN CRITERIA
REFER TO ______________ REPORT No. __________ DATED __________
____________ FOR RECOMMENDED FOUNDATION DESIGN CRITERIA

SLAB ON GROUND NOTES

SOG1 ALL CONCRETE WORK TO COMPLY WITH AS 3600 CONCRETE CODE, AND BCA SECTIONS 3.1 AND 3.2
SOG2 CONCRETE GRADE N20 MINIMUM (RESIDENTIAL)
CONCRETE GRADE N32 MINIMUM (ALL OTHER STRUCTURES)
SOG3 ALL VEGETATION SHALL BE STRIPPED TO A MINIMUM DEPTH OF 150mm. ANY SOFT SPOTS OR DELETERIOUS MATERIAL SHALL BE REMOVED AND REPLACED WITH APPROVED GRANULAR FILLING COMPACTED TO 100% AS. STANDARD COMPACTION. MINOR FILLING (800 MAXIMUM) SHALL BE PROVIDED WHERE REQUIRED TO BRING SUB GRADE TO REQUIRED LEVEL IN ACCORDANCE WITH LIMITS STATED IN AS 2870 AND BCA. FILLING SHALL BE APPROVED GRANULAR MATERIAL PLACED IN 150mm AND COMPACTED TO 100% AS. STANDARD
SOG4 COMPACTION.
A 0.2mm VAPOUR BARRIER SHALL BE USED, LAPPED A MINIMUM OF 200mm AT JOINTS AND TAPED AROUND SERVICES FITTINGS WITH ADHESIVE TAPE NOT INFERIOR TO DOUBLE SIDED BUTYL ADHESIVE TAPE. THE VAPOUR BARRIER SHALL BE PLACED ON A 50mm MINIMUM SAND BED OR SIMILAR APPROVED
SOG5 MATERIAL. PROTECT MEMBRANE FROM DAMAGE.
TRENCH MESH IN BEAMS SHALL BE OVERLAPPED BY THE WIDTH OF FABRIC AT 'T' AND 'L' INTERSECTIONS AND SPLICED WITH A LAP OF 500mm. RANDOM LAP N12 BARS BY 500mm STAGGERED. THE OUTER BAR AT 'L' INTERSECTION MUST BE
SOG6 BENT AND CONTINUED FOR 500mm AROUND THE CORNER.
SLAB FABRIC TO BE LAPPED SUCH THAT THE TWO OUTERMOST TRANSVERSE WIRE OF ONE SHEET OF MESH OVERLAP THE TWO OUTERMOST TRANSVERSE WIRES OF THE SHEET BEING LAPPED BY A MINIMUM OF 25mm AND BE SUPPORTED
SOG7 ON BAR CHAIRS AT 800mm MAXIMUM CENTERS.
THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE SITE INVESTIGATION
SOG8 REPORT TO DETERMINE FOUNDING DEPTHS.
SITE CLASSIFICATION TO AS 2870 CLASS H ENGINEERING PRINCIPLES TO
SOG9 SECTIONS 4 OF AS 2870.
LOAD BEARING EXTERNAL AND INTERNAL BEAMS AND LOAD SUPPORT THICKENINGS ARE TO BE FOUNDED ON NATURAL SOIL WITH AN ALLOWABLE
SOG10 BEARING PRESSURE OF NOT LESS THAN 100 kPa.
SLAB PANELS ARE TO BE FOUNDED ON NATURAL SOIL WITH AN ALLOWABLE
SOG11 BEARING PRESSURE OF NOT LESS THAN 50 kPa.
SOG12 TOP OF SLAB SHALL BE 150mm MINIMUM ABOVE THE FINAL GROUND LEVEL.
DRAINAGE AND GRADING AWAY FROM SLAB SHALL BE PROVIDED TO PREVENT WATER COLLECTING ADJACENT TO SLAB. TREATMENT OF AREAS SURROUNDING SLAB SHALL ALSO BE IN ACCORDANCE WITH RECOMMENDATIONS BY THE HOUSING GUARANTEE FUND AND THE OWNER/OCCUPIER SHALL BE PROVIDED
SOG13 WITH A COPY OF CSIRO INFORMATION SHEET No. 10-19.
BRICKWORK CONTROL JOINTS ARE TO BE PROVIDED ON SIDES EXCEEDING 6000mm IN LENGTH OR THROUGH LARGE OPENINGS FROM EAVES TO SLAB OR
SOG14 THROUGH FULL HEIGHT WINDOWS AND DOORS.
WHERE REQUIRED BY COUNCIL PROTECT THE STRUCTURE FROM SUBTERRANEAN TERMITES IN ACCORDANCE WITH AS 3660 AND BCA

STRUCTURAL DESIGN BASED ON GEOTECHNICAL REPORT No:________
BY: ???
DATED: _____

SUSPENDED SLAB ON GROUND NOTES

SSG1 ALL CONCRETE WORK TO COMPLY WITH AS 3600 CONCRETE CODE, AND BCA VOLUME 1, SECTIONS 3.1 AND 3.2
SSG2 CONCRETE GRADE N32 MINIMUM
SSG3 ALL VEGETATION SHALL BE STRIPPED TO A MINIMUM DEPTH OF 150mm.
SSG4 ALLOW FOR COMPACTION OF EXISTING GROUND SURFACE OR FILL SUFFICIENT TO SUPPORT WET WEIGHT OF SUSPENDED SLAB ON GROUND PLUS FORMWORK AND PROPPED STRUCTURE ABOVE, AS ADVISED BY GEOTECHNICAL CONSULTANT
SSG5 ANY SOFT SPOTS OR DELETERIOUS MATERIAL SHALL BE REMOVED AND REPLACED WITH SELECTED FILL COMPACTED IN ACCORDANCE WITH NOTE SSG4.
SSG6 PROVIDE SELECTED FILL TO ACHIEVE REQUIRED SUB-GRADE R.L., COMPACTED IN ACCORDANCE WITH NOTE SSG4.
SSG7 A 0.2mm VAPOUR BARRIER SHALL BE USED, LAPPED A MINIMUM OF 200mm AT JOINTS AND TAPED AROUND SERVICES FITTINGS WITH ADHESIVE TAPE NOT INFERIOR TO DOUBLE SIDED BUTYL ADHESIVE TAPE. THE VAPOUR BARRIER SHALL BE PLACED ON A 50mm MINIMUM SAND BED OR SIMILAR APPROVED MATERIAL TO PROTECT MEMBRANE FROM DAMAGE.
SSG8 TOP OF SLAB SHALL BE 150mm MINIMUM ABOVE THE FINAL GROUND LEVEL.
SSG9 DRAINAGE AND GRADING AWAY FROM SLAB SHALL BE PROVIDED TO PREVENT WATER COLLECTING ADJACENT TO SLAB.
SSG10 WHERE REQUIRED BY COUNCIL PROTECT THE STRUCTURE FROM SUBTERRANEAN TERMITES IN ACCORDANCE WITH AS 3660 AND BCA
SSG11 BAR CHAIR BASES ARE TO BE PROVIDED BENEATH ALL REINFORCING BAR CHAIRS TO ENSURE NO SETTLEMENT TO REINFORCEMENT OR DAMAGE TO VAPOUR
SSG12 BARRIER.
SUB-GRADE AND SAND LAYER TO BE PREPARED SUCH THAT A STABLE AND LEVEL PLATFORM IS CONSTRUCTED ENSURING UNIFORM COVER TO REINFORCEMENT IS ACHIEVED ACROSS THE ENTIRE EXTENT OF THE SLAB.

POST TENSIONED CONCRETE SHALL COMPLY T0 AS3600 AND AS3610

PT1 FULL COMPUTATIONS AND DETAILS OF PROPOSED SYSTEM SHALL BE SUBMITTED TO THE ENGINEERS FOR APPROVAL, INCLUDING DEAD, LIVE ANCHORAGE DETAILS AND LOSSES OCCURRING THROUGHOUT THE ANCHOR AND ATTACHMENTS.
ANY POST TENSIONING MATERIALS AND OPERATIONS SHALL COMPLY WITH THE REQUIREMENTS OF THE SPECIFICATION AND WITH AS 3600.
PT2 CONCRETE: f'c = 32 MPa
SLUMP = 60mm ± 15mm
BASIC SHRINKAGE STRAIN = 700 x 10ˉ6/ AT 56 DAYS.
PT3 TENDONS SHALL COMPRISE OF A NUMBER OF STRANDS AS NOTED ON THE DRAWINGS. STRANDS SHALL BE 7 WIRE STRESS RELIEVED LOW RELAXATION 12.7mm DIAMETER SUPERGRADE STRAND OF 184kN MINIMUM BREAKING LOAD. WHERE 15.2mm DIAMETER STRANDS ARE SPECIFIED THEY SHALL BE SUPERGRADE STRANDS OF 250kN MINIMUM BREAKING LOAD.
STEEL PRESTRESSING MATERIALS FOR CONCRETE SHALL COMPLY WITH AS/NZS 4672.
WHERE APPLICABLE, MATERIALS SHALL BE CUT AND BENT IN ACCORDANCE WITH AS 3600, AS 5100 OR AS 2870.
ACCEPTABLE MANUFACTURERS AND PROCESSORS OF STEEL REINFORCING AND PRESTRESSING MATERIALS MUST ALSO HOLD A VALID CERTIFICATE OF APPROVAL, ISSUED BY THE AUSTRALIAN CERTIFICATION AUTHORITY FOR REINFORCING STEELS LTD (ACRS). MATERIALS CERTIFIED TO AN ALTERNATIVE SYSTEM SHALL NOT BE USED WITHOUT DEMONSTRATED EQUIVALENCE AND SUBSEQUENT WRITTEN APPROVAL FROM THE SPECIFIER.
EVIDENCE OF COMPLIANCE WITH THIS CLAUSE MUST BE OBTAINED WHEN
PT4 CONTRACT BIDS ARE RECEIVED.
THE CONTRACTOR MUST SUBMIT FOR APPROVAL SHOP DRAWINGS OF THE TENDON LAYOUT SHOWING TENDON PROFILES, ANCHOR DETAILS AND PROPOSED
PT5 STRESSING SEQUENCE.
THE CONTRACTOR SHALL SUBMIT FOR APPROVAL CALIBRATION DATA FOR EVERY
PT6 JACK TO BE USED ON THE JOB.
THE POST TENSIONED STRUCTURE SHALL BE CAST AS INDICATED ON THE PLAN WITH 25% PARTIAL TENSIONING APPLIED AT NOT MORE THAN 24 HOURS AFTER CASTING.
PT7 AND WHEN fcp = 7 MPa (FOR 12.7mm DIA. STRANDS), OR WHEN fcp = 9 MPa (FOR 15.2mm DIA. STRANDS).
FINAL TENSIONING SHALL BE APPLIED NOT LESS THAN 4 DAYS AFTER FINAL
PT8 CASTING AND WHEN fcp = 20 MPa (BY TEST). THE NEW FLOOR OVER SHALL NOT BE POURED UNTIL FINAL TENSIONING HAS BEEN APPLIED TO THE FLOOR BELOW.
TENDONS SHALL BE STRESSED TO A MAXIMUM OF 85 % OF THE TENSILE STRENGTH OF THE STRAND. RESTRESSING OF TENDON (AFTER INITIAL STRESSING) SHALL BE
PT9 CARRIED OUT WHERE NECESSARY TO MAINTAIN "DESIGN" PRESTRESSING FORCES AT ANCHORAGES AT THE LEVELS SPECIFIED.
PT10 THE FLOOR DESIGN ASSUMES A 75mm WIDE x 19mm DEEP DUCT OF ZINC COATED STEEL HAVING A CURVATURE COEFFICIENT (u) = 0.20 AND AN ANGULAR COEFFICIENT (B) = 0.02
DRAPED DIMENSIONS ARE MEASURED FROM THE CONCRETE SOFFIT TO UNDERSIDE OF DUCT. ANCHORAGE DIMENSIONS ARE FROM CONCRETE SOFFIT TO CENTRE LINE OF DUCT. TENDON DRAPE BETWEEN POINTS NOMINATED ARE PARABOLIC WITH SHALLOW CURVATURE AT CHANGE OF GRADE AS REQUIRED. THE SLAB TENDON
PT11 PROFILES SHALL BE KEPT HORIZONTAL ACROSS THE WIDTH OF THE BEAMS UNLESS OTHERWISE NOTED. THE TOLERANCE ON THE TENDON PROFILE IS TO BE ± 3mm.
TENDON SETOUTS SHALL TAKE PRECEDENCE OVER NON-TENSIONED
PT12 REINFORCEMENT.
ENSURE MINIMUM 50mm SPACING BETWEEN BARS AND TENDONS FOR CONCRETE PLACING. PROVIDE SPECIAL CARE TO ENSURE PLACEMENT AND PROPER COMPACTION OF CONCRETE AROUND TENDONS AND ANCHORAGES.
ALL STRESSING EXTENSIONS RESULTS ARE TO BE SUBMITTED FOR APPROVAL BEFORE ANY STRANDS ARE CUT. TENDONS SHALL BE FULLY GROUTED AFTER APPROVAL OF STRAND EXTENSION RESULTS AND WITHIN 4 WEEKS OF POURING IN A MANNER APPROVED BY THE ENGINEER.

CONCRETE SHALL COMPLY TO AS3600 AND AS 3610

C1 CONCRETE SIZES DO NOT INCLUDE FINISHES.
C2 NO HOLES, CHASES OR EMBEDMENTS OTHER THAN THOSE SHOWN ON THE DRAWINGS SHALL BE MADE IN CONCRETE ELEMENTS WITHOUT ENGINEER'S
C3 APPROVAL.
DEPTHS OF BEAMS ARE GIVEN FIRST AND INCLUDE SLAB THICKNESS, SLABS AND
C4 BEAMS SHALL BE CAST TOGETHER UNLESS OTHERWISE NOTED.
CONCRETE SHALL BE KEPT FREE OF SUPPORTING MASONRY WITH TWO LAYERS OF SUITABLE MEMBRANE (MALTHOID OR EQUAL). VERTICAL FACES SHALL BE SEPARATED BY 12mm BITUMINOUS CANEITE. ALL NON - LOAD BEARING WALLS SHALL BE KEPT 20 mm CLEAR OF THE UNDERSIDE OF SLABS AND BEAMS UNLESS
C5 NOTED OTHERWISE.
CONSTRUCTION JOINTS SHALL BE PROPERLY FORMED AND LOCATED TO THE SATISFACTION OF THE ENGINEER. BUILDER SHALL ALLOW FOR ALL NECESSARY
C6 CONSTRUCTION JOINTS.
WHERE NOTED ON DRAWINGS CAMBER TO SUSPENDED SLABS AND BEAMS SHALL BE 5 FOR EVERY 2500 OF SPAN UNLESS OTHERWISE NOTED. WHERE THE CONCRETE SOFFITS ARE CAMBERED, THE UPPER SURFACE SHALL BE SIMILARLY CAMBERED.
C7 DEPTH GAUGES SHALL BE USED TO VERIFY THE SLAB THICKNESS.
REINFORCEMENT IS SHOWN DIAGRAMATICALLY AND IS NOT NECESSARILY IN TRUE PROJECTION. SPLICES TO REINFORCEMENT SHALL BE MADE ONLY AT THE LOCATION SHOWN OR AS OTHERWISE APPROVED BY THE ENGINEER. WELDING OF REINFORCEMENT SHALL BE CARRIED OUT BY A QUALIFIED WELDER IN ACCORDANCE WITH AS/NZS 1554 AND THE REINFORCEMENT SUPPLIER RECOMMENDATIONS. THE INTERPASS TEMPERATURE SHALL BE LESS THAN 200 DEGREES IN ACCORDANCE WITH
C8 AS/NZS 1554 PART 3.
THE REINFORCEMENT SYMBOLS ARE:
N NORMAL DUCTILITY CLASS HOT ROLLED 500N DEFORMED BARS WITH fsy = 500 MPa.
R NORMAL DUCTILITY CLASS 250N PLAIN ROUND BARS WITH fsy = 250 MPa.
L LOW DUCTILITY CLASS HARD DRAWN 500L WIRE REINFORCING MESH WITH fsy = 5OOMPa.
DO NOT USE LOW DUCTILITY CLASS L REINFORCEMENT UNLESS SHOWN ON THE DRAWINGS.
THE NUMBER FOLLOWING THE REINFORCEMENT SYMBOL IS THE NOMINAL BAR DIAMETER IN MILLIMETERS. ALL REINFORCEMENT SHALL COMPLY WITH AS/NZS 4671.
STEEL REINFORCING MATERIALS FOR CONCRETE SHALL COMPLY WITH AS/NZS 4671. WHERE APPLICABLE, MATERIALS SHALL BE CUT AND BENT IN ACCORDANCE WITH AS 3600, AS 5100 OR AS 2870.
ACCEPTABLE MANUFACTURERS AND PROCESSORS OF STEEL REINFORCING AND PRESTRESSING MATERIALS MUST ALSO HOLD A VALID CERTIFICATE OF APPROVAL, ISSUED BY THE AUSTRALIAN CERTIFICATION AUTHORITY FOR REINFORCING STEELS LTD (ACRS). MATERIALS CERTIFIED TO AN ALTERNATIVE SYSTEM SHALL NOT BE USED WITHOUT DEMONSTRATED EQUIVALENCE AND SUBSEQUENT WRITTEN APPROVAL FROM THE SPECIFIER.
C9 EVIDENCE OF COMPLIANCE WITH THIS CLAUSE MUST BE OBTAINED WHEN CONTRACT BIDS ARE RECEIVED.
HOOKS AND COGS SHALL COMPLY WITH AS3600 UNLESS NOTED OTHERWISE. ALL PULL OUT BARS SHALL BE TEMPCORE BARS OR APPROVED EQUIVALENT.
BENDING AND REBENDING OF BARS SHALL BE CARRIED OUT IN ACCORDANCE WITH AS3600, AS/NZS 4671, THE SPECIFICATIONS AND THE REINFORCEMENT SUPPLIER RECOMMENDATIONS. BARS SHALL NOT BE HEATED ABOVE 400 DEGREES WITHOUT
C10 THE ENGINEER'S WRITTEN APPROVAL. THERMAL CRAYONS SHALL BE USED TO ENSURE COMPLIANCE WITH THIS TEMPERATURE LIMIT.
COVER TO REINFORCEMENT (IN mm) AND CONCRETE GRADES SHALL BE AS FOLLOWS UNLESS NOTED OTHERWISE: THE COVER SHALL NOT BE LESS THAN THE BAR DIAMETER AND:

ELEMENT	FORMED AND INTERNAL	FORMED AND EXPOSED TO WEATHER (1.)	NOT FORMED CAST AGAINST GROUND (2.)
FOOTINGS, PILE CAPS	-	60	75
COLUMNS, PEDESTALS	40	50	75
SLABS, BAND BEAMS	20(3.)	40	60
BEAMS	30	40	60
WALLS			
HORIZONTAL BARS	30	40	60
VERTICAL BARS	40	50	60
MINIMUM CONCRETE GRADE	N25	N32	N25 (4.)

(1) FOR EXPOSURE CLASSIFICATION B2 ADD 5mm TO THE COVER AND THE CONCRETE GRADE SHALL BE N40 MINIMUM.
(2) IF THE ELEMENT IS CAST ON A DAMP PROOF MEMBRANE, DECREASE THE COVER BY 20mm.
(3) FOR PRESTRESSING TENDONS THE MINIMUM COVER SHALL BE 25mm.
(4) IN CORROSIVE SOILS AND WATER: N50

NOTES:
(i) COVER IS THE CLEAR DISTANCE BETWEEN ANY REINFORCING (INCLUDING FITMENTS) AND THE FACE OF THE STRUCTURAL ELEMENT.
(ii) FOR ALL EXTERNAL SURFACES, PROVIDE FULLY PLASTIC BAR CHAIRS. TIE WIRE SHALL NOT BE NAILED TO THE FORMS, REINFORCING BARS SHALL NOT BE USED TO KEEP FORMS APART AND A THROUGH TIE SYSTEM SHALL BE USED TO TIE FORMS.
(iii) PROVIDE AN APPROVED VAPOUR BARRIER FOR SLABS, BEAMS AND THICKENING CASTAGAINST THE GROUND.
(iv) THE COVERS SHALL BE MAINTAINED USING APPROVED BAR CHAIRS. BAR CHAIRS SUPPORTING MESH SHALL BE AT 800 x 800mm MAXIMUM CENTRES. BAR CHAIRS SUPPORTING BARS SHALL BE AT 60 BAR DIAMETERS OR 1500 MAXIMUM CENTRES WHICHEVER IS THE LESSER. BAR CHAIRS SHALL BE PROVIDED ALONG THE EDGES OF ALL CONSTRUCTION JOINTS. STOP ENDS SHALL NOT BE USED TO MAINTAIN THE COVERS.
(v) EXTERNAL ELEMENTS ARE THOSE EXPOSED TO WEATHER, RAIN AND WATER PENETRATION AND ARE CLASSIFIED B1 UNLESS NOTED OTHERWISE.

C11 EXTERNAL CONCRETE ELEMENTS ABOVE GROUND SHALL MEET THE FOLLOWING REQUIREMENTS: MINIMUM PORTLAND CEMENT CONTENT 330 kg/m3/, MAXIMUM WATER/CEMENT RATIO 0.5, AND THE CHLORIDE CONTENT RESTRICTED AS PER CLAUSE 4.9
C12 OF AS3600.
ALL CONCRETE SUPPLIED SHALL HAVE A SLUMP OF 80mm AND A MAXIMUM NOMINAL
C13 AGGREGATE SIZE OF 20mm. VARIATIONS FROM THESE SHALL BE APPROVED BY THE ENGINEER.
THE MIX DESIGN WITH THE 7 AND 28 DAYS TARGET STRENGTHS AND THE BASIC SHRINKAGE STRAIN AT 56 DAYS SHALL BE SUBMITTED FOR REVIEW PRIOR TO POURING ANY CONCRETE.
C14 ALL CONCRETE IN CONTACT WITH AGGRESSIVE SOIL SHALL HAVE SULPHATE RESISTING CEMENT. THE C3A CONTENT OF THE CEMENT SHALL BE LESS THAN 5%.
CONDUITS AND PIPES WHEN CAST IN SLABS OR WALLS ARE TO BE PLACED BETWEEN THE
C15 TWO REINFORCEMENT LAYERS. WHERE THERE IS ONLY ONE LAYER OF REINFORCEMENT, PROVIDE 50mm COVER TO CONDUIT. THE CONDUIT LOCATIONS ARE TO BE APPROVED BY
C16 THE ENGINEER.
WHERE DISTRIBUTION BARS TO MAIN REINFORCEMENT ARE NOT SHOWN ON DRAWINGS PROVIDE MINIMUM N16 AT 400 CENTRES, LAPPED 500mm AT SPLICES.
C17 FORMWORK SHALL BE DESIGNED, CONSTRUCTED AND SUPPLIED IN ACCORDANCE WITH AS 3610. REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR CLASSES OF SURFACE FINISHES.
STRIPPING AND BACKPROPPING OF SOFFITS SHALL NOT OCCUR UNTIL CONCRETE HAS REACHED 75% OF SPECIFIED STRENGTH. BACK PROPPING (OR A SECOND SET OF TABLE FORMS) IS TO EXTEND DOWN SO THAT EACH NEW FLOOR IS SUPPORTED BY AT LEAST 3
C18 FINISHED FLOORS OR AS CALCULATED. DO NOT STRIP BAYS ADJACENT CONSTRUCTION JOINTS UNTIL THE ADJACENT BAYS ARE AT LEAST 3 DAYS OLD. CALCULATIONS ON THE
C19 BACKPROPPING REQUIREMENTS SHALL BE SUBMITTED FOR APPROVAL.
CURING OF THE CONCRETE ELEMENTS SHALL BE STARTED AS SOON AS THE CONCRETE HAS HARDENED AND SHALL COMPLY WITH THE SPECIFICATIONS.
PROVIDE A 25mm x 25mm CHAMFER TO ALL CORBELS, UNLESS OTHERWISE INDICATED ON
C20 THE DRAWING. ENSURE THAT POLYSTYRENE IS PLACED AROUND THE BEARING, SO THAT THE CONCRETE SURFACES ARE NOT IN CONTACT. SUBMIT CONFIRMATION OF THE SPECIFICATIONS OF ALL BEARING MATERIALS TO THE ENGINEER.
ENSURE ALL MOVEMENT JOINTS ARE INSTALLED WITH THE SPECIFIED ARCHITECTURAL FINISH, INCLUDING SEALANT, FILLERS, EXPANSION MATERIALS AND REBATES AS REQUIRED.

STRUCTURAL MASONRY

M1 ALL BLOCKWORK WALLS SHALL BE CONSTRUCTED IN UNITS WITH A MINIMUM CHARACTERISTIC UNCONFINED COMPRESSIVE STRENGTH f'cu = 15 MPa.
ALL BRICKS SHALL HAVE A MINIMUM CHARACTERISTIC UNCONFINED COMPRESSIVE STRENGTH f'cu = 25 MPa.
THE MAXIMUM UNRESTRAINED FIVE YEAR EXPANSION OF BRICKS SHALL BE 0.7mm/m IN ACCORDANCE WITH NATA REGISTERED TEST BO1.
M2 UNLESS NOTED OTHERWISE THE NOMINAL PROPORTIONS BY VOLUME OF MORTAR SHALL BE CLASS M3 AND HAVE NOMINAL PROPERTIES OF 1 : 1 : 6 OF CEMENT, LIME, SAND. NO PLASTICISERS SHALL BE USED IN THE MIX.
M3 GROUT USED TO FILL CAVITIES AND CORES IN REINFORCED MASONRY SHALL HAVE A MINIMUM 28 COMPRESSIVE STRENGTH f'c OF 20 MPa AND A SLUMP OF 225 ±25mm. MAXIMUM AGGREGATE SHALL BE OF 10mm ROUNDED GRAVEL. NOMINAL PROPORTIONS SHALL BE 1 : 0.1 : 3 : 2 OF CEMENT, LIME, SAND, AGGREGATE AND 3 WITH A MINIMUM CEMENT CONTENT OF 300 kg/m3/ . PROVIDE CLEAN OUT HOLES AT BASE OF PILASTERS AND EVERY CORE OF REINFORCED WALLS. CLEAN OUT AND WET DOWN CORES BEFORE GROUTING. ALL CORES CONTAINING VERTICAL AND HORIZONTAL REINFORCEMENT ARE TO BE GROUTED.
M4 HORIZONTAL JOINT REINFORCEMENT CONSISTING OF GALVANISED WOVEN WIRE MESH OR WELDED WIRE SHALL BE PROVIDED. THE WIDTH SHALL BE SUCH THAT 15mm COVER FROM THE MORTAR FACE IS PROVIDED. THE MESH SHALL BE PLACED IN THE FIRST THREE COURSES AT THE TOP AND BOTTOM OF THE WALL AND AT A MAXIMUM 600 mm VERTICAL SPACING IN BETWEEN, FOR ALL CONCRETE BLOCKWORK, CONCRETE BRICKWORK AND CALCIUM SILICATE BRICKWORK. THE MESH SHALL BE LAPPED 450mm AT SPLICES AND FOLDED AND BENDED AT THE CORNERS SO THAT THE LONGITUDINAL WIRES ARE CONTINUOUS. THE MESH IS STOPPED 100mm SHORT OF CONTROL JOINTS OR ENDS OF WALLS.
M5 FULLY BED FACE SHELLS AND CROSS WEBS IN HOLLOW BLOCK WALLS. SOLID OR CORED UNITS SHALL BE LAID ON A FULL BED OF MORTAR.
M6 HOLLOW BLOCKWORK OPENINGS GREATER THAN 600mm VERTICALLY OR HORIZONTALLY SHALL BE TRIMMED AT THE SIDES AND BOTTOM BY FILLING ONE CORE AND REINFORCED WITH 1N12 EXTENDING 600mm PAST OPENING. THE TOP OF THE OPENING SHALL HAVE A REINFORCED LINTEL BEAM, ARCH BAR OR STEEL ANGLE SUPPORT AS DETAILED.
M7 ALL TIES AND REINFORCEMENT SHALL HAVE MINIMUM CLEAR COVER OF 50mm TO EXTERNAL FACE OF MASONRY. TIES SHALL CONFORM TO AS 2699. ALL TIES SHALL BE BY "CERRA METALWORKS" OR APPROVED EQUIVALENT. THE TIES SHALL BE FIXED TO THE MANUFACTURER'S RECOMMENDATIONS BUT WITH A MINIMUM OF 2 No. RAMSET 3.8mm DIAMETER DRIVE PINS. ALL TIES SHALL BE AT 400mm MAXIMUM CENTRES UNLESS NOTED OTHERWISE.
M8 NO CAVITY OR CORE SHALL BE FILLED TO A HEIGHT GREATER THAN 12OOmm WITHOUT SUITABLE SHORING.
M9 NO CHASES OR HOLES SHALL BE MADE WITHOUT PRIOR APPROVAL OF THE ENGINEER. CONDUITS AND THE LIKE SHALL NOT BE PLACED INSIDE CORES CONTAINING REINFORCEMENT.
M10 VERTICAL JOINTS SHALL BE AT THE LESSER OF 6000mm OR TWICE THE HEIGHT OF THE WALL AND AT THE FOLLOWING LOCATIONS:
- AT MAJOR CHANGES IN WALL HEIGHT
- AT CHANGES IN WALL THICKNESSES OTHER THAN PIERS OR BUTTRESSES
- AT CONTROL JOINTS IN THE ADJACENT STRUCTURAL ELEMENTS
- AT CHASES AND RECESSES FOR PIPING, COLUMNS FIXTURES ETC.
- AT ONE OR BOTH SIDES OF WALL OPENINGS
- NEAR WALL INTERSECTIONS
- NEAR RETURN ANGLES IN L, T AND U SHAPED STRUCTURES
- WHERE SHOWN IN THE ARCHITECTURAL DRAWINGS
THE CONTRACTOR IS TO OBTAIN APPROVED DRAWINGS SHOWING THE CONTROL JOINTS PRIOR TO BUILDING ANY WALLS.
M11 ALL INTERSECTIONS THAT DON'T HAVE A CONTROL JOINT SHALL BE OF BONDED CONSTRUCTION OR TIED WITH HEAVY DUTY TIES AT 400mm MAXIMUM VERTICAL CENTRES.
M12 ALL CAVITY WALLS ARE TO BE CONSTRUCTED USING MEDIUM DUTY MASONRY TIES AT 600mm MAXIMUM CENTRES BOTH WAYS AND 300mm AVERAGE CENTRES EACH SIDE OF OPENINGS. THE TIES SHALL BE EMBEDDED 50mm MINIMUM INTO EACH LEAF, WITH A 30mm COVER TO THE EXPOSED FACES.
M13 WHERE A CONCRETE SLAB IS SUPPORTED ON MASONRY WALLS, THE TOP COURSE OF BLOCKS SHALL BE SOLID OR HOLLOW BLOCKS WITH CAVITIES FILLED TO A SMOOTH SURFACE OR A REINFORCED BOND BEAM. IN THE CASE OF BRICKS THE UPPER COURSE SHALL BE FROGS DOWN, OR HOLES FILLED WITH MORTAR TO A SMOOTH SURFACE. FOR NON-LOAD BEARING WALLS, LEAVE A 20mm GAP TO THE UNDERSIDE OF THE STRUCTURE.
M14 BONDING SHALL BE STRETCHER BOND UNLESS NOTED OTHERWISE.
M15 WHEN CONSTRUCTING MASONRY WALLS ON SUSPENDED SLABS, ALL MASONRY UNITS SHALL BE STACKED NEAR THE FINAL LOCATION BEFORE BUILDING THE WALL. THE SUPPORTING ELEMENT MUST NOT BE PROPPED AND MUST HAVE ACHIEVED ITS DESIGN STRENGTH.
M16 FOR AREAS OF THE STRUCTURAL FLOOR SYSTEM WHICH SUPPORT MASONRY WALLS/ PARTITIONS OR OTHER SENSITIVE ATTACHMENTS AT THE TIME OF THE INITIAL DESIGN, THE FLOOR SYSTEM HAS BEEN DESIGNED FOR NOT LESS THAN THE REQUIREMENTS OF AS 3600 TABLE 2.4.2 " WHERE PROVISION IS MADE TO MINIMISE THE EFFECT OF MOVEMENT".
M17 GENERIC JOINT DETAILS ARE INDICATED ON THESE DRAWINGS FOR INFORMATION, BUT IT IS THE ARCHITECT'S RESPONSIBILITY TO IDENTIFY JOINT LOCATIONS AND TYPES WHERE APPROPRIATE ON ARCHITECTURAL DRAWINGS, AND TO PROVIDE DETAILS OF NON-STANDARD ELEMENTS TO ACCOMMODATE ANTICIPATED MOVEMENTS.
M18 OBSERVATION OF CONSTRUCTION OF NON-LOAD BEARING MASONRY WALLS/PARTITIONS AND OTHER NON-LOAD BEARING ELEMENTS IS NOT INCLUDED IN THE STRUCTURAL ENGINEER'S SCOPE OF WORKS.
M19 STACKING OF BLOCKWORK:
GENERALLY, ON SUSPENDED SLABS AND SLABS ON GROUND, BLOCKS SHALL BE STACKED ONE PALLET HIGH (MAXIMUM PALLET MASS 1300kg) WITH 1200mm CLEARANCE BETWEEN ADJACENT PALLETS ON ALL SIDES. THE WEIGHT OF STACKED BLOCKS SHALL NOT EXCEED THE DESIGN LIVE LOAD FOR THE FLOOR. REFER PLANS FOR DESIGN LOADS.

STEELWORK SHALL COMPLY T0 AS 4100, AS/NZS 4600 AND AS/NZS 3828

S1 THE FABRICATOR SHALL BE RESPONSIBLE FOR SUBMITTING SHOP DRAWINGS, WHICH SHALL COMPLY WITH THE CONTRACT DRAWINGS AND SPECIFICATIONS, FOR REVIEW BEFORE FABRICATION IS STARTED. REVIEW DOES NOT INCLUDE CHECKING OF DIMENSIONS, NOR TAKE RESPONSIBILITY FOR CONTRACTORS OBLIGATIONS. ALLOW 3 WORKING DAYS MINIMUM FOR REVIEW.
S2 WHERE CONNECTION FORCES (IN KILONEWTONS) ARE SHOWN ON THE DRAWINGS, CONNECTIONS SHALL BE PROVIDED TO TRANSMIT THESE FORCES. CONNECTIONS SHALL PROVIDE FOR A MINIMUM FORCE OF 40kN.
S3 ALL DETAILS, GAUGE LINES, ETC. WHERE NOT SPECIFICALLY SHOWN SHALL BE IN ACCORDANCE WITH AISC DESIGN CAPACITY TABLES FOR STRUCTURAL STEEL AND AISC STANDARDIZED STRUCTURAL CONNECTIONS.
S4 UNLESS OTHERWISE NOTED: WELDS TO BE 6mm CONTINUOUS FILLETS LAID DOWN WITH APPROVED COVERED ELECTRODES. ALL WELDS SHALL BE CATEGORY SP UNLESS OTHERWISE NOTED. WELDS SHALL CONFORM TO AS/NZS 1554 AND ELECTRODES TO AS/NZS 1553. GUSSET PLATES TO BE 10mm THICK. BOLTS TO BE M20-8.8/S IN 22mm DIAMETER HOLES. PROVIDE A MINIMUM OF TWO BOLTS PER CONNECTION.
S5 FABRICATOR SHALL PROVIDE ALL FIXINGS FOR ARCHITECTURAL ELEMENTS ETC. WITHOUT WEAKENING STRUCTURAL MEMBER IN ANY WAY.
S6 CAMBER SHALL BE PROVIDED TO ALL ROOF BEAMS, TRUSSES, AND PORTALS ETC. AT 5 PER 2000 OF SPAN UNLESS OTHERWISE NOTED, FOR ALL MEMBERS SPANNING IN EXCESS OF 6m. NO MEMBER SHALL BE ERECTED WITH NEGATIVE CAMBER, UNLESS SPECIFICALLY NOTED. FOR CONCRETE SLABS ON TOP OF STEELWORK DEPTH GAUGES SHALL BE USED TO VERIFY THE SLAB THICKNESS.
S7 ALL STEELWORK BELOW GROUND SHALL BE ENCASED BY CONCRETE WITH MIN. COVER OF 75mm. CONCRETE ENCASED STRUCTURAL STEEL TO BE WRAPPED WITH PRE-GALVANIZED G444HS MESH PLACED 25mm CLEAR OF STEEL. PROVIDE 50mm MINIMUM COVER.
S8 ALL STEELWORK NOT TO BE ENCASED IN CONCRETE OR GALVANIZED SHALL BE GIVEN ONE SHOP COAT OF AN APPROVED PRIMER UNLESS OTHERWISE NOTED. FACES OF FRICTION GRIP CONNECTIONS SHALL NOT BE PAINTED.
S9 THE BOLTING PROCEDURE IS DESIGNATED AS FOLLOWS:
- 4.6/S REFERS TO COMMERCIAL BOLTS OF STRENGTH GRADE 4.6 TO AS/NZS 1111 TIGHTENED USING A STANDARD WRENCH TO A SNUG-TIGHT CONDITION.
- 8.8/S REFERS TO HIGH STRENGTH BOLTS OF STRENGTH GRADE 8.8 TO AS/NZS 1252 TIGHTENED USING A STANDARD WRENCH TO A SNUG-TIGHT CONDITION.
- 8.8/TF REFERS TO HIGH STRENGTH BOLTS OF STRENGTH GRADE 8.8 TO AS/NZS 1252 FULLY TENSIONED TO AS 1511, DESIGNED AS A FRICTION TYPE JOINT.
- 8.8/TB REFERS TO HIGH STRENGTH BOLTS OF STRENGTH GRADE 8.8 TO AS/NZS 1252 FULLY TENSIONED TO AS 1511, DESIGNED AS A BEARING TYPE JOINT.
S10 LOAD INDICATING WASHERS SHALL BE USED TO VERIFY TIGHTENING OF BOLTS IN TF AND TB CONNECTIONS. A HARDENED WASHER SHALL BE USED UNDER THE BOLT HEAD OR NUT, WHICHEVER IS ROTATED. FULLY TENSIONED BOLTS SHALL NOT BE RE-USED. WELDING OF CAPTIVE NUTS TO STEELWORK SHALL BE GRADE 4.6S, CLASS 5 NUTS. THE ELECTRODES USED SHALL BE COMPATIBLE WITH THE CHEMISTRY OF THE STEEL INVOLVED (MEMBER OR CONNECTION COMPONENT AND NUT). ALL SUCH WELDS SHALL HAVE 100% VISUAL INSPECTION. GRADE 4.6S BOLTS TO BE USED.
S11 ALL BOLTS SHALL BE OF SUCH LENGTH THAT AT LEAST ONE FULL THREAD IS EXPOSED BEYOND THE NUT AFTER THE NUT HAS BEEN TIGHTENED.
MINIMUM ONE WASHER SHALL BE USED UNDER THE NUT IN ALL SITUATIONS. IF TIGHTENING IS CARRIED OUT AT THE HEAD, AN ADDITIONAL WASHER SHALL BE USED UNDER THE HEAD. FOR SLOTTED HOLES, SHORTER THAN THE LESSER OF 1.33 TIMES THE BOLT DIAMETER OR (BOLT DIAMETER + 10mm) AND NOT WIDER THAN THE BOLT DIAMETER PLUS 2mm, USE HARDENED WASHER UNDER THE NUT AND BOLT HEAD.
S12 UNLESS NOTED OTHERWISE, ALL MATERIAL TO BE:
- GRADE 250 HOT ROLLED PLATES, FLATS
GRADE 300PLUS UB, UC, PFC,TFB AND ANGLES
- GRADE 300 WB, WC;
- GRADE 350 RHS, CHS.
- STRUCTURAL STEEL SHALL COMPLY WITH AS/NZS 1163, AS/NZS 3678, AS/NZS 3679.1 OR AS/NZS 3679.2. TEST CERTIFICATES RELATING TO THE STRUCTURAL STEEL SUPPLIED, SHALL BE MADE AVAILABLE TO THE SPECIFIER.
ACCEPTABLE MANUFACTURERS OF STRUCTURAL STEEL MUST ALSO HOLD A VALID CERTIFICATE OF APPROVAL, ISSUED BY THE AUSTRALIAN CERTIFICATION AUTHORITY FOR REINFORCING STEELS LTD (ACRS). MATERIALS CERTIFIED TO AN ALTERNATIVE SYSTEM SHALL NOT BE USED WITHOUT DEMONSTRATED EQUIVALENCE AND SUBSEQUENT WRITTEN APPROVAL FROM THE SPECIFIER.
EVIDENCE OF COMPLIANCE WITH THIS CLAUSE MUST BE OBTAINED WHEN CONTRACT BIDS ARE RECEIVED.
S13 HOT DIPPED GALVANIZING SHALL BE IN ACCORDANCE WITH AS 4680 MINIMUM COATING THICKNESS OF 85 MICRONS. PROVIDE MEMBERS TO BE GALVANIZED WITH VENT AND DRAINAGE HOLES IN ACCORDANCE TO THE GALVANISER'S RECOMMENDATIONS AND THE ACCEPTANCE OF THE ENGINEER.
S14 THE ENDS OF TUBULAR MEMBERS SHALL BE SEALED WITH NOMINAL THICKNESS PLATES AND CONTINUOUS FILLET WELDED UNLESS NOTED OTHERWISE.
S15 WHERE MEMBERS SHOWN ON THE STRUCTURAL OR ARCHITECTURAL DRAWINGS ARE REQUIRED TO BE CURVED, BENT OR ROLLED, THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE METHODS REQUIRED TO ACHIEVE THE REQUIRED SHAPES WITHOUT LOCALIZED DISTORTION OF THE MEMBERS.
S16 THE CONTRACTOR SHALL PROVIDE AND LEAVE IN PLACE, UNTIL PERMANENT BRACING ELEMENTS ARE CONSTRUCTED, SUCH TEMPORARY BRACING AS IS NECESSARY TO STABILIZE THE STRUCTURE DURING ERECTION. REFER TO NOTES G4 AND G5.
S17 SUBMIT DETAILS OF THE MANUFACTURER, MATERIAL AND SECTION PROPERTIES OF THE PURLINS AND GIRTS TO BE USED FOR APPROVAL. PURLIN AND GIRT BOLTS AND BRIDGING SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S DETAILS UNLESS SHOWN OTHERWISE.
S18 TRIMMING MEMBERS FOR MECHANICAL/HYDRAULIC PENETRATIONS, DRAINAGE GUTTERS, SUMPS ETC., ARE NOT NECESSARILY SHOWN. SUPPORT OF HEAVY PIPES AND DUCTS IS TO BE APPROVED BY THE ENGINEER. SERVICES SHALL BE HUNG FROM THE WEB OF PURLINS NOT FLANGES.
S19 THE DESIGN, SUPPLY AND INSTALLATION OF SECONDARY STEELWORK REQUIRED TO SUPPORT/CONNECT THE FACADE TO BASE STRUCTURE IS THE RESPONSIBILITY OF THE CONTRACTOR.
CERTIFICATION OF ARCHITECTURAL FIXINGS/BRACING OF CEILINGS AND NON-STRUCTURAL WALLS TO THE BASE STRUCTURE IS THE RESPONSIBILITY OF THE CONTRACTOR. FORWARD TO THE ENGINEER A CERTIFICATE OF SUFFICIENCY BY THE SUPPLIER FOR THE ARCHITECTURAL FIXTURES/PANELS/DRY-WALL TO RESIST THE PRESSURES DESIGNATED IN THE DESIGN DOCUMENTS.

UNDERPINNING NOTES

GENERAL

U1 THESE NOTES MUST BE READ IN CONJUNCTION WITH RELATIVE SECTIONS OF THE SPECIFICATIONS.
U2 CONCRETE STRENGTH FOR THE UNDERPINS SHALL BE f'c = 25MPa. CONCRETE SHALL BE SAMPLED AND TESTED IN ACCORDANCE WITH AS 1480 - CONCRETE STRUCTURES CODE.
U3 THE BUILDERS SHALL PROVIDE ANY PROPPING, SHORING ETC. NECESSARY TO SAFELY SUPPORT SIDES OF EXCAVATION SO AS TO PREVENT MOVEMENT AND ENSURE THE SAFETY OF PERSONNEL.
U4 ANY VARIATION IN FOOTINGS OF ADJACENT BUILDING TO THOSE ON THIS DRAWING IS TO BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE ENGINEER.

CONSTRUCTION PROCEDURE

U5 UNDERPINNING SHALL BE CARRIED OUT IN SECTIONS NOT EXCEEDING 1200mm IN LENTGH AND TO THE FULL THICKNESS OF THE FOOTING BEING UNDERPINNED AS INDICATED ON THE DRAWING.
U6 UNDERPINS SHALL BE CONSTRUCTED IN THE NUMBERED SEQUENCE, STARTING WITH SECTIONS NOTED 1. THEN 2 & 3 PROGRESSIVELY.
U7 THE FOOTING TO BE UNDERPINNED SHALL BE EXPOSED ONLY FOR THE WIDTH OF THE PIN.
U8 THE BOTTOM 300mm (MIN.) OF THE UNDERPINNING IS TO BE EMBEDDED IN UNDISTRIBUTED MATERIAL. THOROUGHLY CLEAN OUT ALL LOOSE MATERIAL BEFORE PLACING CONCRETE.
U9 CONCRETE UNDERPINNING SHALL BE BUILT TO WITHIN 500mm MIN. AND 100mm MAX OF THE UNDERSIDE OF THE EXISTING FOOTING. ALL CLAY, LOOSE AGGREGATE ETC. SHALL BE REMOVED FROM THE EXISTING FOOTING BEFORE GROUTING COMMENCES.
U10 CONCRETE PLACED SHALL BE LEFT AT LEAST 4 DAYS BEFORE ANY ADJACENT SECTIONS ARE EXCAVATED. FACES OF CONCRETE IN ADJACENT SECTIONS SHALL BE THOROUGHLY CLEANED BEFORE PLACING THE NEW SECTIONS.
U11 EXCAVATION FOR SECTION 2 SHALL NOT BE STARTED UNTIL SECTION 1 IS COMPLETE, WITH TRANSFER OF LOADING. BALANCE OF UNDERPINS - SIMILAR PROCEDURE.

TRANSFER OF LOADING

U12 THE SPACE BETWEEN THE TOP OF THE CONCRETE UNDERPINNING AND THE UNDERSIDE OF THE EXISTING FOOTING SHALL BE FILLED WITH NON-SHRINK
U13 GROUT.
THE GROUT MIX SHALL BE 3:1 GRADED COARSE SAND TO CEMENT WITH 'EXPANDITE' USED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
U14 MINIMUM STRENGTH OF GROUT TO BE f'c = 25 MPa AT TIME OF LOAD TRANSFER.
THE GROUT MIX SHALL BE OF DRY CONSISTENCY, RAM PACKED OVER THE FULL WIDTH AND DEPTH OF THE UNDERPINNING AND SHALL BE A MINIMUM OF 2 DAYS OLD BEFORE EXCAVATING THE NEXT PIN IN SEQUENCE.

DISCLAIMER:

NORTH:

LEGEND:

No	Initial	DATE	REVISION DETAILS
P2	DG	04.05.18	ISSUED FOR SCHEMATIC DESIGN
P1	TU	29.03.18	DRAFT SD

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PROJECT:
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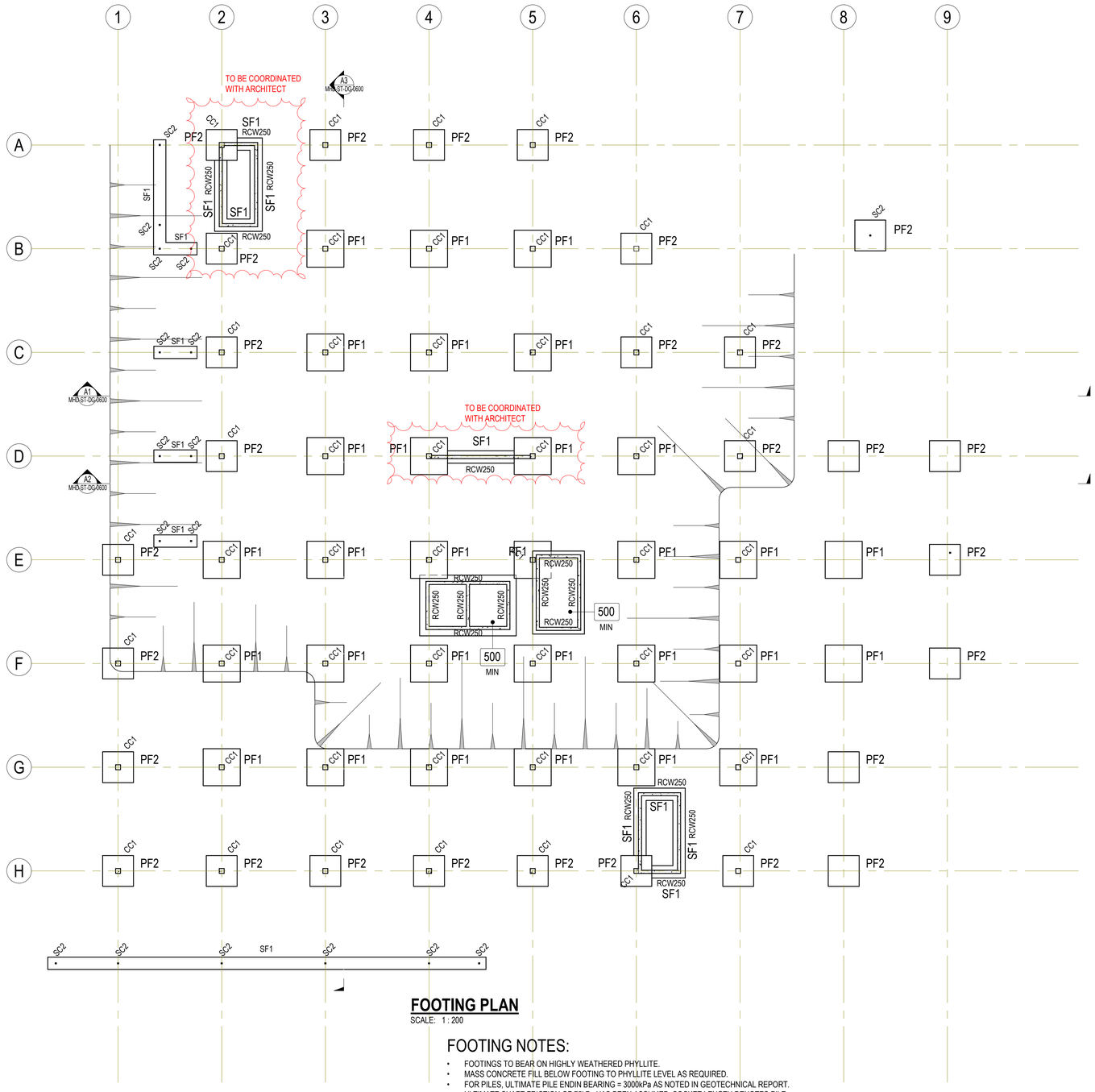
MACKSVILLE NSW 2447

DRAWING TITLE:
STRUCTURAL NOTES

SCALE:	DRAWN:	DESIGNED:	QA:	APPROVED:	ISSUE DATE:
1 : 100@A1	DG	TU			

PROJECT NUMBER:	DRAWING NUMBER:	ISSUE:
10459	MHD-ST-DG-0010	P2

SCHEMATIC DESIGN



FOOTING PLAN

SCALE: 1 : 200

FOOTING NOTES:

- FOOTINGS TO BEAR ON HIGHLY WEATHERED PHYLLITE.
- MASS CONCRETE FILL BELOW FOOTING TO PHYLLITE LEVEL AS REQUIRED.
- FOR PILES, ULTIMATE PILE ENDIN BEARING = 3000kPa AS NOTED IN GEOTECHNICAL REPORT. ULTIMATE SHAFT FRICTION OF 75kPa HAS BEEN ASSUMED. SOCKET LENGTH DENOTES PILE EMBEDMENT INTO HIGHLY WEATHERED PHYLLITE.

PAD FOOTING SCHEDULE.

MARK	DIMENSIONS			REMARKS
	WIDTH	LENGTH	DEPTH	
PF1	3000	3000	700	ALTERNATIVE: 900Ø PILE - 20000 SOCKET LENGTH
PF2	2500	2500	600	ALTERNATIVE: 900Ø PILE - 14000 SOCKET LENGTH

CONCRETE COLUMN SCHEDULE

MARK	SIZE	REMARKS
CC1	400 x 400	R.C. COLUMN

STRUCTURAL WALL SCHEDULE

MARK	TYPE	THICKNESS	REINFORCEMENT		REMARKS
			VERT.	HORIZ.	
RCW250	INSITU	250			R.C. WALL

STRIP FOOTING SCHEDULE

MARK	DIMENSIONS		REMARKS
	WIDTH	DEPTH	
SF1	1000	400	CONCRETE STRIP FOOTING

NOTE:

- REFER TO DRAWING MHD-ST-DG-0001 FOR DRAWING LIST
- REFER TO DRAWING MHD-ST-DG-0010 FOR ALL GENERAL AND STRUCTURAL NOTES
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE DRAWINGS LISTED ON DRAWING ST-MHR-0001

NORTH:

LEGEND:

No	Initial	DATE	REVISION DETAILS
P1			

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MACKSVILLE NSW 2447

DRAWING TITLE:

FOOTING PLAN

SCALE:	DRAWN:	DESIGNED:	QA:	APPROVED:	ISSUE DATE:
As indicated@A1	DG	TU			

PROJECT NUMBER: 10459 DRAWING NUMBER: MHD-ST-DG-0100 ISSUE: P2

SCHEMATIC DESIGN

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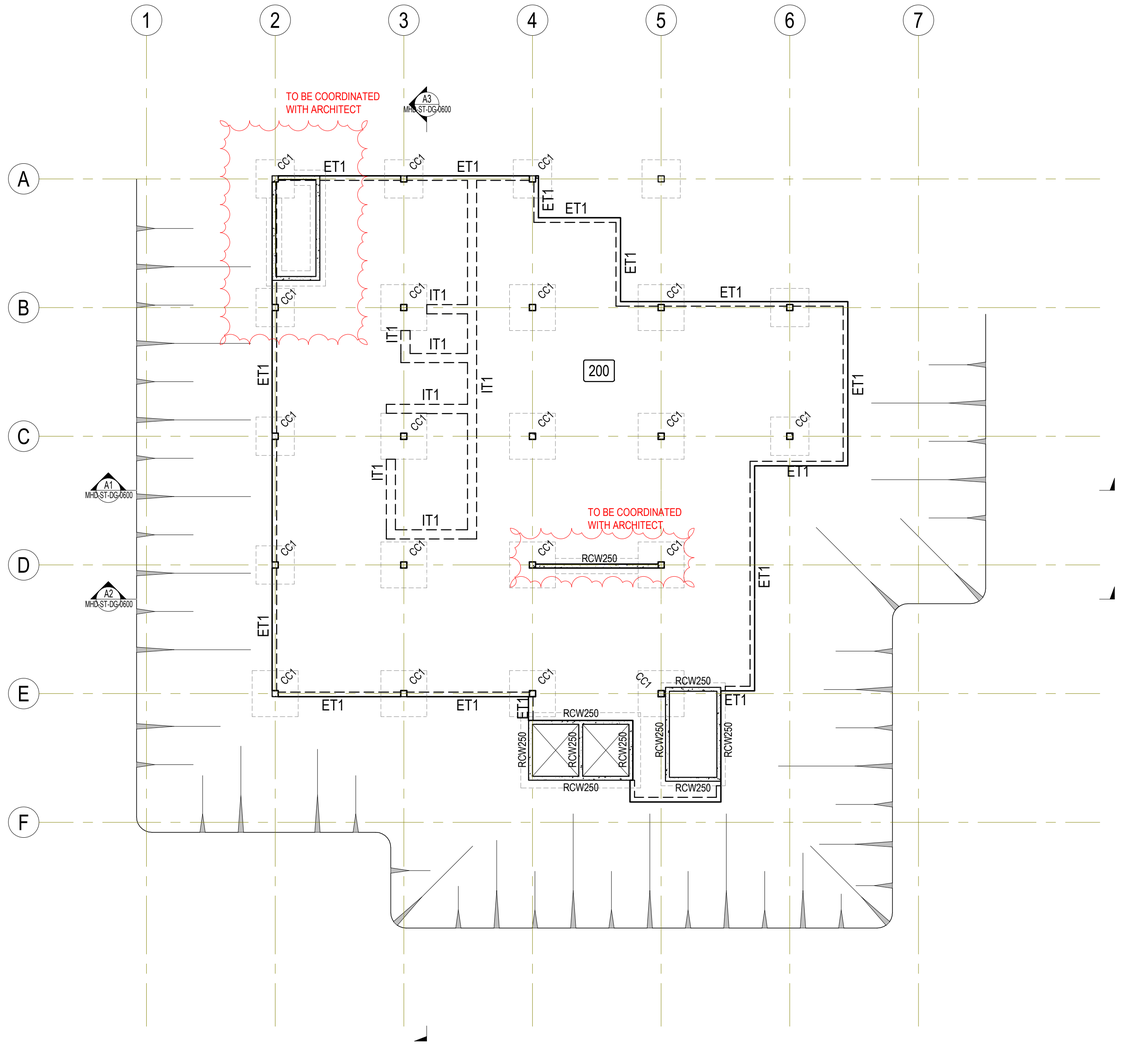

BASEMENT PLAN

SCALE: 1 : 200

STRUCTURAL WALL SCHEDULE

MARK	TYPE	THICKNESS	REINFORCEMENT		REMARKS
			VERT.	HORIZ.	
RCW250	INSITU	250			R.C. WALL

CONCRETE COLUMN SCHEDULE

MARK	SIZE	REMARKS
CC1	400 x 400	R.C. COLUMN

CONCRETE FOOTING SCHEDULE

MARK	DIMENSIONS		REMARKS
	WIDTH	DEPTH	
ET1	300	300	CONCRETE EDGE THICKENING
IT1	600	300	CONCRETE INTERNAL THICKENING
IT2	300	300	CONCRETE INTERNAL THICKENING

NOTE:

- REFER TO DRAWING MHD-ST-DG-0001 FOR DRAWING LIST
- REFER TO DRAWING MHD-ST-DG-0010 FOR ALL GENERAL AND STRUCTURAL NOTES
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE DRAWINGS LISTED ON DRAWING ST-MHR-0001

LEGEND (UNLESS OTHERWISE NOTED)

250 CF	DENOTES THICKNESS OF SLAB
CJ	DENOTES CONSTRUCTION JOINT
KCJ	DENOTES KEYED CONSTRUCTION JOINT
SC	DENOTES SAW CUT JOINT
STEP	DENOTES SLAB STEP REFER TO ARCHITECTUAL DRAWINGS FOR SETOUT AND DIMENSIONS
	DENOTES CONCRETE ELEMENT OVER
	DENOTES PRECAST ELEMENT OVER
	DENOTES LOAD-BEARING ELEMENT UNDER
	DENOTES LOAD-BEARING ELEMENT UNDER AND CONCRETE ELEMENT OVER
	DENOTES BLOCKWORK WALL OVER
	DENOTES COMPACTUS LOADING ZONE

FLOOR DESIGN LOADS (UNLESS OTHERWISE NOTED)

GENERAL WARD	SDL -	1.8 kPa
	LL -	3.0 kPa
STAIRS	SDL -	0.5 kPa
	LL -	4.0 kPa
TERRACE	SDL -	5.0 kPa
	LL -	5.0 kPa
STEEL ROOF	SDL -	0.5 kPa (OVER WARDS, 1.0 kPa OVER PLANT ROOMS)
	LL -	0.25 kPa
LOBBY/CORRIDOR	SDL -	5.0 kPa
	LL -	3.0 kPa
PLANT	SDL -	2.0 kPa
	LL -	7.5 kPa
STORAGE	SDL -	1.8 kPa
	LL -	5.0 kPa

STRUCTURAL SIZES (UNLESS OTHERWISE NOTED)

SLAB	GENERALLY 200mm THICK SLAB ON GROUND SL82 MESH TOP & BOTTOM POURED ON VAPOUR BARRIER OVER 50mm THICK SAND BLINDING LAYER OF 20mm SINGLE SIZED FREE DRAINING MATERIAL OVER ENGINEERED COMPACTED FILL, OR FIRM NATURAL GROUND. ALLOW FOR JOINTS AT 6m CTS BOTH WAYS

SCHEMATIC DESIGN

NORTH:

LEGEND:

No	Initial	DATE	REVISION DETAILS
P1	TI	29.03.18	DRAFT SD

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PROJECT:
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MACKSVILLE NSW 2447

DRAWING TITLE:
BASEMENT LEVEL

SCALE:	DRAWN:	DESIGNED:	QA:	APPROVED:	ISSUE DATE:
As indicated@A1	DG	TU			

PROJECT NUMBER: **10459** DRAWING NUMBER: **MHD-ST-DG-0200** ISSUE: **P2**

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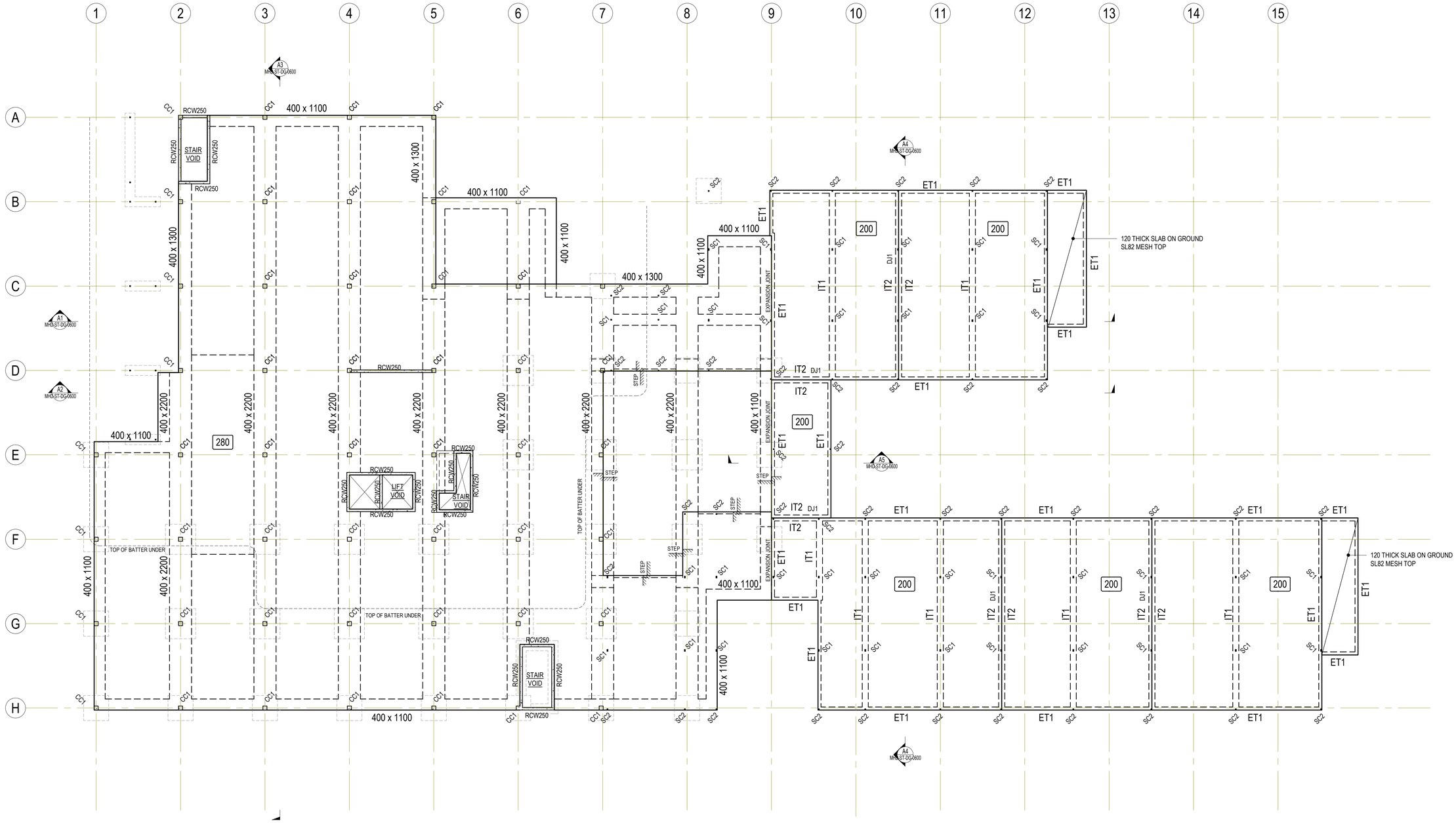

GROUND FLOOR PLAN

SCALE: 1 : 200

STRUCTURAL WALL SCHEDULE					
			REINFORCEMENT		
MARK	TYPE	THICKNESS	VERT.	HORIZ.	REMARKS
RCW250	INSITU	250			R.C. WALL

CONCRETE COLUMN SCHEDULE		
MARK	SIZE	REMARKS
CC1	400 x 400	R.C. COLUMN

STRUCTURAL SIZES

(UNLESS OTHERWISE NOTED)

SLAB	GENERALLY 240mm THICK POST TENSIONED SLAB TO BE DESIGNED AND CERTIFIED BY D&C CONTRACTOR
STAIRS	REFER TO PART PLANS & DETAILS ON DRAWINGS S------

CONCRETE GRADE

PT SLABS	40 MPa

LEGEND

(UNLESS OTHERWISE NOTED)

	DENOTES SPAN DIRECTION OF METAL TRAY
200	DENOTES THICKNESS OF SLAB
DJ1	DENOTES DOWEL JOINT (DANLEY PLATE DOWEL ?)
CJ	DENOTES CONSTRUCTION JOINT
EJ	DENOTES EXPANSION JOINT
STEP	DENOTES SLAB STEP REFER TO ARCHITECTUAL DRAWINGS FOR SETOUT AND DIMENSIONS
	DENOTES CONCRETE ELEMENT OVER
	DENOTES LOAD-BEARING ELEMENT UNDER
	DENOTES LOAD-BEARING ELEMENT UNDER AND CONCRETE ELEMENT OVER
	DENOTES BLOCKWORK WALL OVER

FLOOR DESIGN LOADS

(UNLESS OTHERWISE NOTED)

GENERAL WARD	SDL -	1.8 kPa
	LL -	3.0 kPa
STAIRS	SDL -	0.5 kPa
	LL -	4.0 kPa
TERRACE	SDL -	5.0 kPa
	LL -	5.0 kPa
STEEL ROOF	SDL -	0.5 kPa (OVER WARDS, 1.0 kPa OVER PLANT ROOMS)
	LL -	0.25 kPa
LOBBY/CORRIDOR	SDL -	5.0 kPa
	LL -	3.0 kPa
PLANT	SDL -	2.0 kPa
	LL -	7.5 kPa
STORAGE	SDL -	1.8 kPa
	LL -	5.0 kPa

NOTE:

- REFER TO DRAWING MHD-ST-DG-0001 FOR DRAWING LIST
- REFER TO DRAWING MHD-ST-DG-0010 FOR ALL GENERAL AND STRUCTURAL NOTES
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SCHEMATIC DESIGN

NORTH:

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MACKSVILLE NSW 2447

DRAWING TITLE:

GROUND LEVEL

SCALE:	DRAWN:	DESIGNED:	QA:	APPROVED:	ISSUE DATE:
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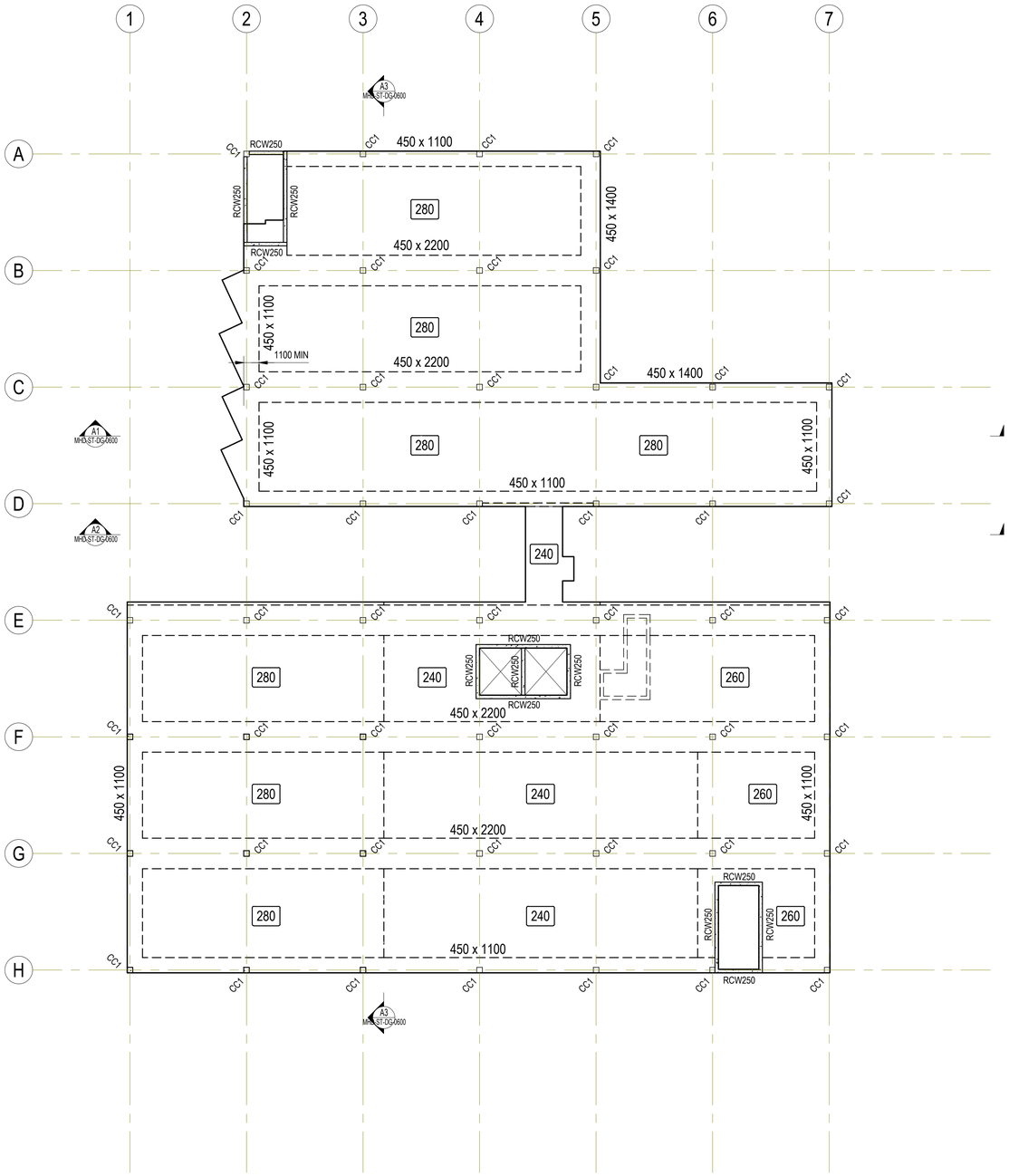

FIRST FLOOR PLAN

SCALE: 1 : 200

STRUCTURAL WALL SCHEDULE					
			REINFORCEMENT		
MARK	TYPE	THICKNESS	VERT.	HORIZ.	REMARKS
RCW250	INSITU	250			R.C. WALL

CONCRETE COLUMN SCHEDULE		
MARK	SIZE	REMARKS
CC1	400 x 400	R.C. COLUMN

NOTE:

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- REFER TO DRAWING MHD-ST-DG-0010 FOR ALL GENERAL AND STRUCTURAL NOTES
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LEGEND (UNLESS OTHERWISE NOTED)

- DENOTES SPAN DIRECTION OF METAL TRAY
- 200 — DENOTES THICKNESS OF SLAB
- DJ1 — DENOTES DOWEL JOINT (DANLEY PLATE DOWEL ?)
- CJ — DENOTES CONSTRUCTION JOINT
- EJ — DENOTES EXPANSION JOINT
- STEP — DENOTES SLAB STEP REFER TO ARCHITECTUAL DRAWINGS FOR SETOUT AND DIMENSIONS
- DENOTES CONCRETE ELEMENT OVER
- DENOTES LOAD-BEARING ELEMENT UNDER
- DENOTES LOAD-BEARING ELEMENT UNDER AND CONCRETE ELEMENT OVER
- DENOTES BLOCKWORK WALL OVER

FLOOR DESIGN LOADS (UNLESS OTHERWISE NOTED)

GENERAL WARD	SDL -	1.8 kPa
	LL -	3.0 kPa
STAIRS	SDL -	0.5 kPa
	LL -	4.0 kPa
TERRACE	SDL -	5.0 kPa
	LL -	5.0 kPa
STEEL ROOF	SDL -	0.5 kPa (OVER WARDS, 1.0 kPa OVER PLANT ROOMS)
	LL -	0.25 kPa
LOBBY/CORRIDOR	SDL -	5.0 kPa
	LL -	3.0 kPa
PLANT	SDL -	2.0 kPa
	LL -	7.5 kPa
STORAGE	SDL -	1.8 kPa
	LL -	5.0 kPa

SCHEMATIC DESIGN

NORTH:

LEGEND:

No	Initial	DATE	REVISION DETAILS
P1	TU	29.03.18	DRAFT SD

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DRAWING TITLE:
FIRST FLOOR LEVEL

SCALE:	DRAWN:	DESIGNED:	QA:	APPROVED:	ISSUE DATE:
As indicated@A1	DG	TU			

PROJECT NUMBER: 10459 DRAWING NUMBER: MHD-ST-DG-0400 ISSUE: P2

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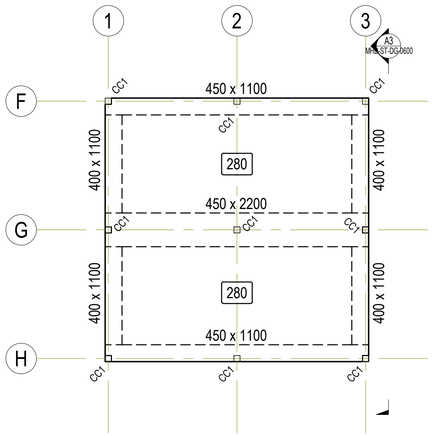
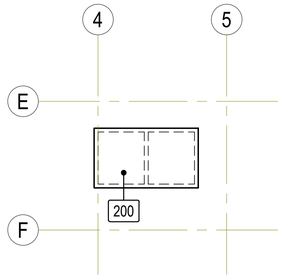


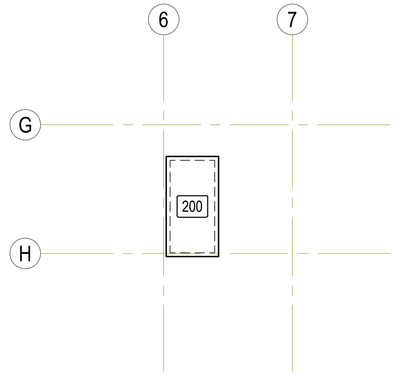
ROOF SLAB PLAN

SCALE: 1 : 200



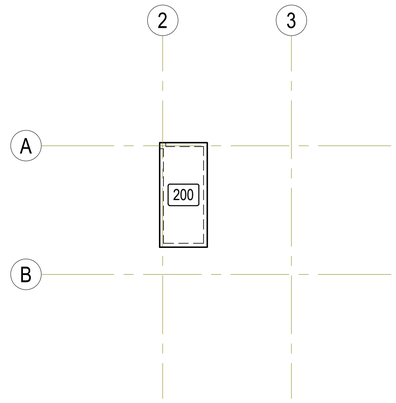
LIFT ROOF SLAB PLAN

SCALE: 1 : 200



STAIR 3 ROOF SLAB PLAN

SCALE: 1 : 200



STAIR 4 ROOF SLAB PLAN

SCALE: 1 : 200

NOTE:

- REFER TO DRAWING MHD-ST-DG-0001 FOR DRAWING LIST
- REFER TO DRAWING MHD-ST-DG-0010 FOR ALL GENERAL AND STRUCTURAL NOTES
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE DRAWINGS LISTED ON DRAWING ST-MHR-0001

LEGEND

(UNLESS OTHERWISE NOTED)

	DENOTES SPAN DIRECTION OF METAL TRAY
200	DENOTES THICKNESS OF SLAB
DJ1	DENOTES DOWEL JOINT (DANLEY PLATE DOWEL ?)
CJ	DENOTES CONSTRUCTION JOINT
EJ	DENOTES EXPANSION JOINT
STEP	DENOTES SLAB STEP REFER TO ARCHITECTUAL DRAWINGS FOR SETOUT AND DIMENSIONS
	DENOTES CONCRETE ELEMENT OVER
	DENOTES LOAD-BEARING ELEMENT UNDER
	DENOTES LOAD-BEARING ELEMENT UNDER AND CONCRETE ELEMENT OVER
	DENOTES BLOCKWORK WALL OVER

FLOOR DESIGN LOADS

(UNLESS OTHERWISE NOTED)

GENERAL WARD	SDL -	1.8 kPa
	LL -	3.0 kPa
STAIRS	SDL -	0.5 kPa
	LL -	4.0 kPa
TERRACE	SDL -	5.0 kPa
	LL -	5.0 kPa
STEEL ROOF	SDL -	0.5 kPa (OVER WARDS, 1.0 kPa OVER PLANT ROOMS)
	LL -	0.25 kPa
LOBBY/CORRIDOR	SDL -	5.0 kPa
	LL -	3.0 kPa
PLANT	SDL -	2.0 kPa
	LL -	7.5 kPa
STORAGE	SDL -	1.8 kPa
	LL -	5.0 kPa

SCHEMATIC DESIGN

DISCLAIMER:

NORTH:

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MACKSVILLE HOSPITAL REDEVELOPMENT

MACKSVILLE NSW 2447

DRAWING TITLE:

CONCRETE ROOF PLAN

SCALE:	DRAWN:	DESIGNED:	QA:	APPROVED:	ISSUE DATE:
As indicated@A1	DG	TU			

PROJECT NUMBER:	DRAWING NUMBER:	ISSUE:
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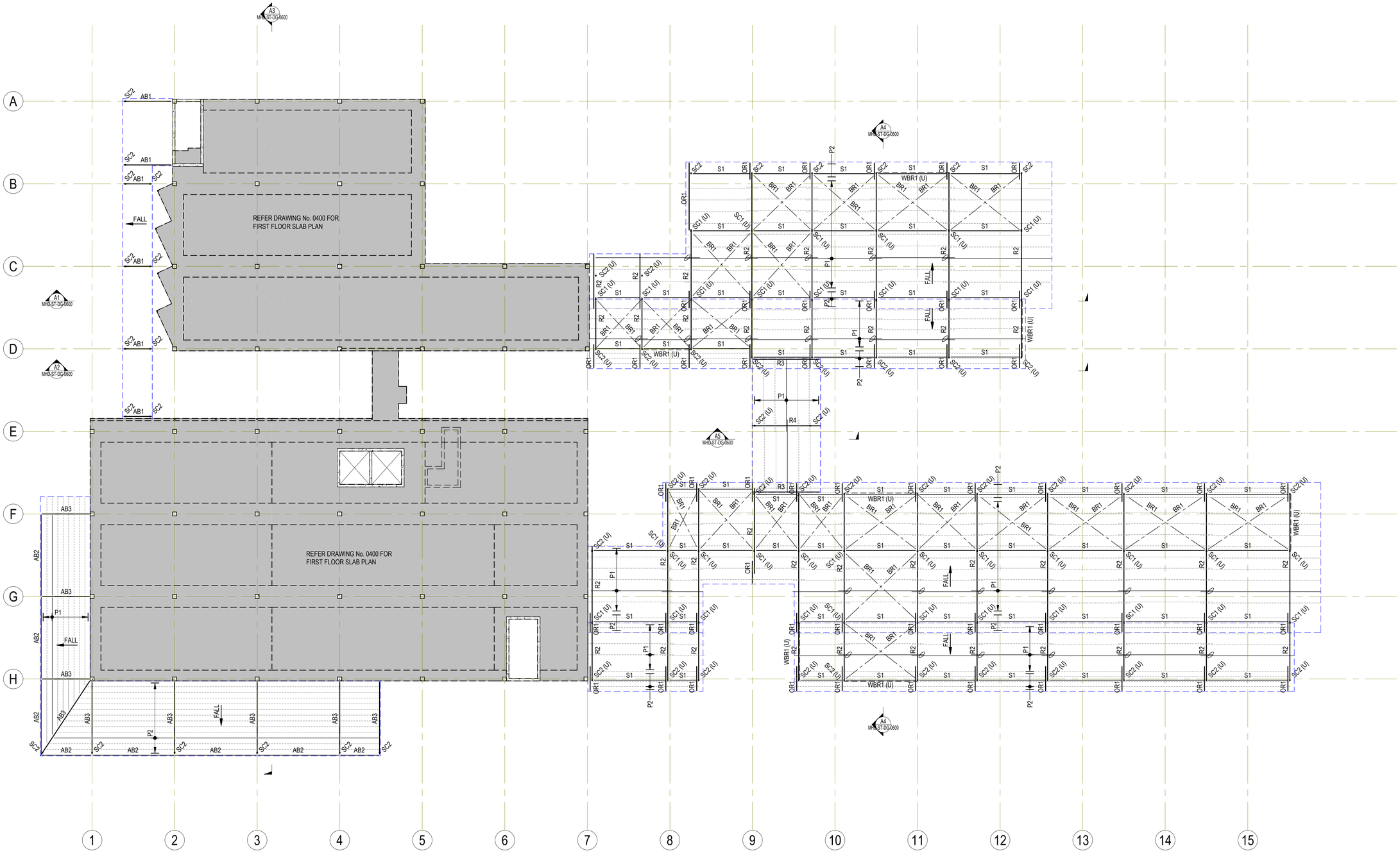

LOWER ROOF FRAMING AND AWNING PLAN

SCALE: 1 : 200

STEEL FRAMING SCHEDULE		
MARK	SIZE	REMARKS
AB1	360 UB 45	STEEL AWNING BEAM
AB2	250 PFC	STEEL AWNING BEAM
AB3	410 UB 54	STEEL
B1	360 UB 45	STEEL BEAM
BR1	M20 DIA. ROD	ROOF BRACING (GRADE 4.6/s)
OR1	250 UB 31	STEEL OUTRIGGER
P1	Z25019	PURLIN - AT 1200 MAX. CRS, LAP 900 (2 ROWS BRIDGING EACH BAY)
P2	C25019	PURLIN - AT 1200 MAX. CRS, (2 ROWS BRIDGING EACH BAY)
R1	360 UB 45	STEEL RAFTER
R2	310 UB 40	STEEL RAFTER
R3	250 PFC	STEEL RAFTER
S1	100 x 100 x 6 SHS	STEEL STRUT
SC1	89 x 89 x 6 SHS (2-off)	STEEL COLUMN
SC2	89 x 89 x 6 SHS	STEEL COLUMN
WBR1	M20 DIA. ROD	WALL BRACING

NOTE:

- REFER TO DRAWING MHD-ST-DG-0001 FOR DRAWING LIST
- REFER TO DRAWING MHD-ST-DG-0010 FOR ALL GENERAL AND STRUCTURAL NOTES
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MACKSVILLE NSW 2447

DRAWING TITLE:
LOWER ROOF FRAMING PLAN

SCALE:	DRAWN:	DESIGNED:	QA:	APPROVED:	ISSUE DATE:
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PROJECT NUMBER: 10459 DRAWING NUMBER: MHD-ST-DG-0501 ISSUE: P2

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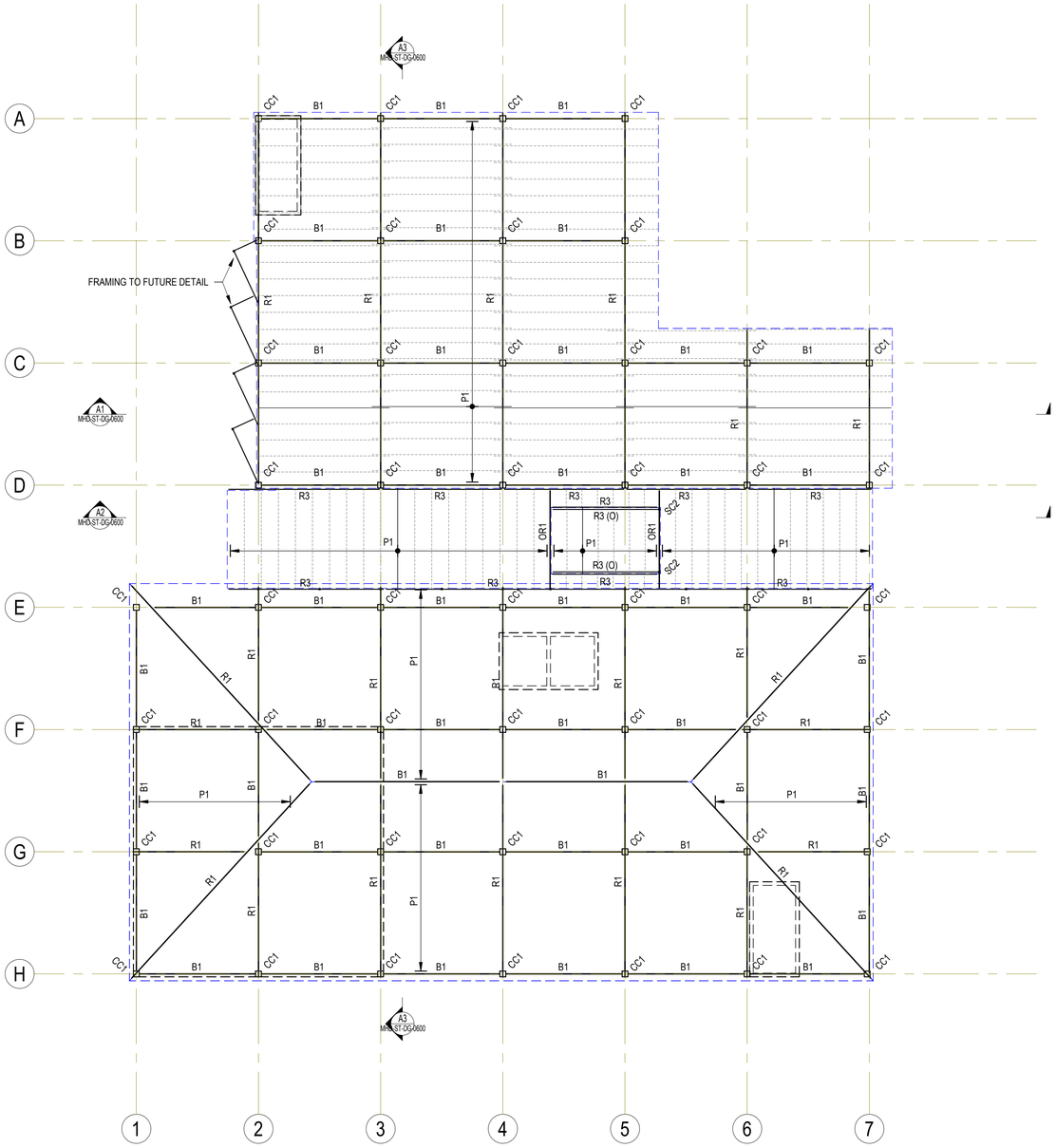

UPPER ROOF FRAMING PLAN

SCALE: 1 : 200

CONCRETE COLUMN SCHEDULE		
MARK	SIZE	REMARKS
CC1	400 x 400	R.C. COLUMN

STEEL FRAMING SCHEDULE		
MARK	SIZE	REMARKS
AB1	360 UB 45	STEEL AWNING BEAM
AB2	250 PFC	STEEL AWNING BEAM
AB3	410 UB 54	STEEL
B1	360 UB 45	STEEL BEAM
BR1	M20 DIA. ROD	ROOF BRACING (GRADE 4.6/s)
OR1	250 UB 31	STEEL OUTRIGGER
P1	Z25019	PURLIN - AT 1200 MAX. CRS, LAP 900 (2 ROWS BRIDGING EACH BAY)
P2	C25019	PURLIN - AT 1200 MAX. CRS, (2 ROWS BRIDGING EACH BAY)
R1	360 UB 45	STEEL RAFTER
R2	310 UB 40	STEEL RAFTER
R3	250 PFC	STEEL RAFTER
S1	100 x 100 x 6 SHS	STEEL STRUT
SC1	89 x 89 x 6 SHS (2-off)	STEEL COLUMN
SC2	89 x 89 x 6 SHS	STEEL COLUMN
WBR1	M20 DIA. ROD	WALL BRACING

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MACKSVILLE HOSPITAL REDEVELOPMENT

MACKSVILLE NSW 2447

DRAWING TITLE:

UPPER ROOF FRAMING PLAN

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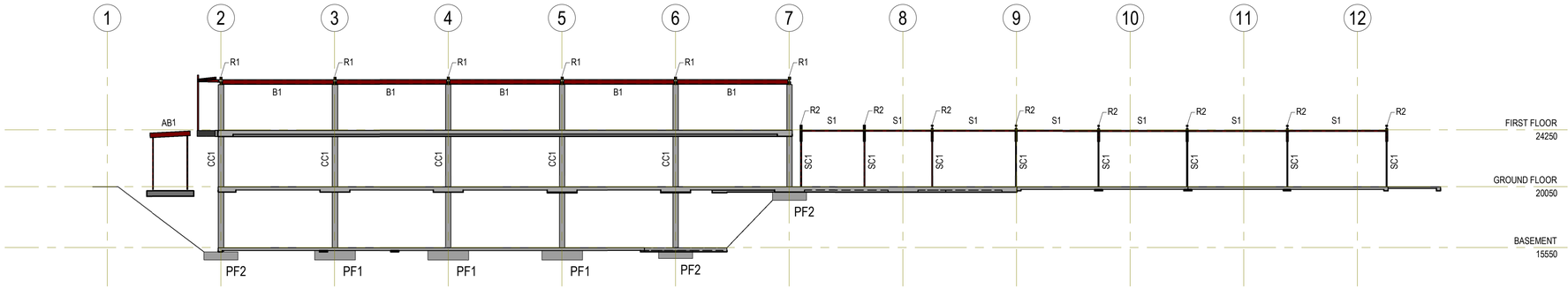

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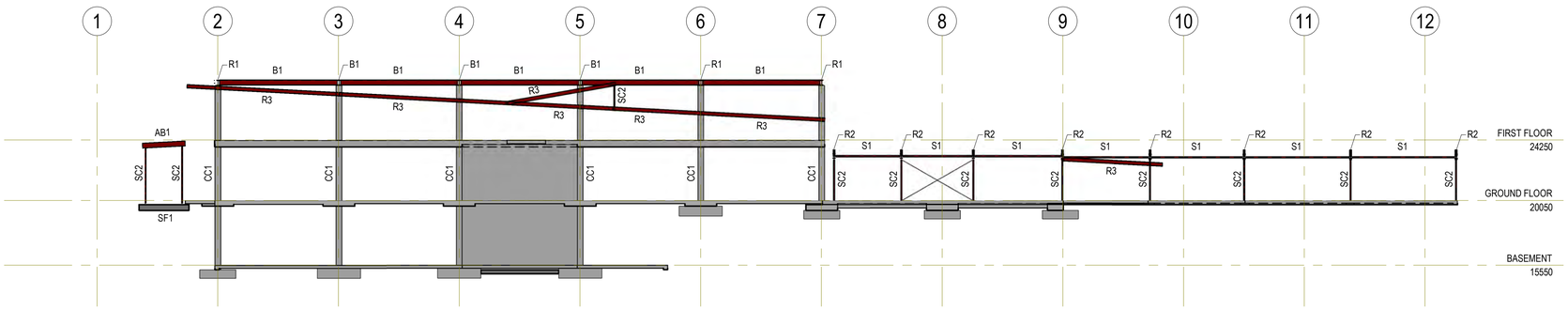

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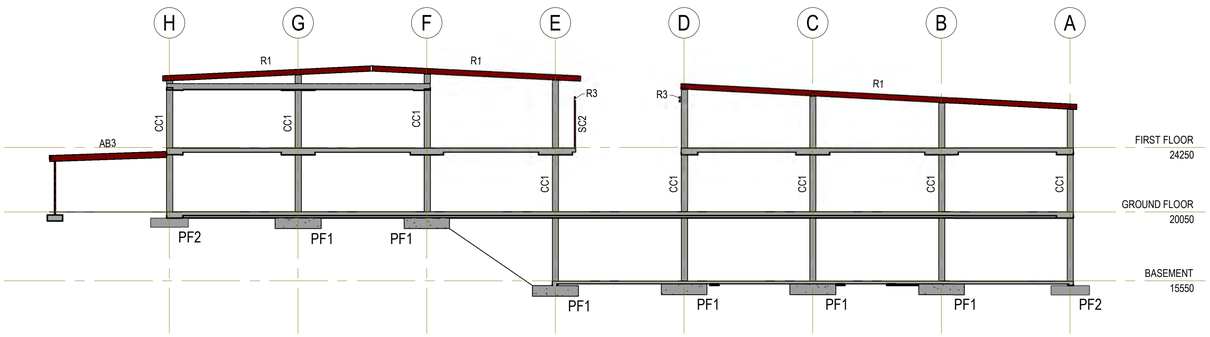

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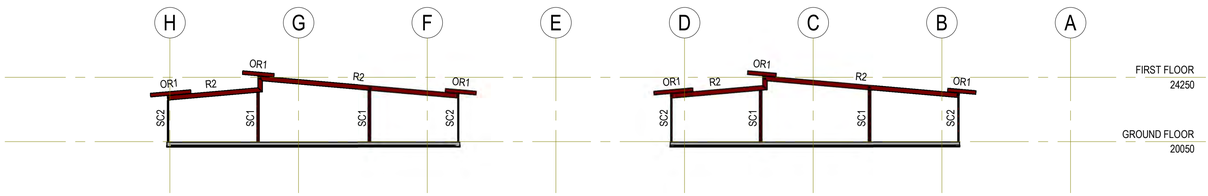

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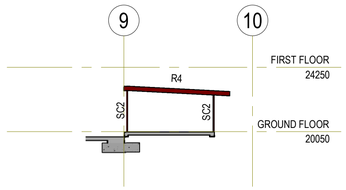

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PROJECT:
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MACKSVILLE NSW 2447

DRAWING TITLE:
GENERAL STRUCTURAL SECTIONS - SHEET 1

SCALE:	DRAWN:	DESIGNED:	QA:	APPROVED:	ISSUE DATE:
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PROJECT NUMBER: 10459 DRAWING NUMBER: MHD-ST-DG-0600 ISSUE: P2

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APPENDIX B. GEOTECHNICAL REPORT

Health Infrastructure

Detailed Geotechnical Assessment

Proposed Macksville Hospital

Report No. RGS31237.1-AH (Rev 1)

2 May 2018

REGIONAL
GEOTECHNICAL SOLUTIONS

Manning-Great Lakes

Port Macquarie

Coffs Harbour

RGS31237.1 – AH (Rev 1)

2 May 2018

Health Infrastructure
C/O – PricewaterhouseCoopers Australia
One International Towers
Watermans Quay Barangaroo SYDNEY NSW 2000

Attention: Mr Alexander Wilson

Dear Alex

RE: Detailed Geotechnical Assessment
Proposed Macksville Hospital

Regional Geotechnical Solutions are pleased to provide this report providing a Geotechnical Assessment for the proposed Macksville Hospital Development at North Macksville.

If you require any further information regarding the report, please do not hesitate to contact the undersigned.

For and on behalf of

Regional Geotechnical Solutions Pty Ltd

Matt Rowbotham

Associate Engineering Geologist

Regional Geotechnical Solutions Pty Ltd
ABN 51141848820

Unit 14, 25 to 27 Hurley Drive
Coffs Harbour NSW 2450
Ph. (02) 6650 0010

Email matt.r@regionalgeotech.com.au
Web: www.regionalgeotech.com.au

CONTENTS

Figures

Appendices

1 INTRODUCTION

Regional Geotechnical Solutions (RGS) has conducted a geotechnical assessment of the proposed site of the new Macksville Hospital to be constructed off Letitia Close in North Macksville.

Based on the plans provided, the new hospital will involve the construction of new building structures and car parking facilities in the northern part of the site (which comprises a low rise hill). For the design to be achieved cuts up to approximately 5m to 6m and filling up to 3m are proposed for the building and car parking areas respectively. To access the new hospital a road approximately 800m in length is to be constructed south of the hillslope from Letitia Close across the alluvial floodplain. It is proposed to undertake cut and fill earthworks using the materials available on site to form the building pads and construct the car park and access road.

The aims of the study, which was commissioned by Pricewaterhouse Coopers on behalf of Health Infrastructure, were to address the following:

- General site conditions and geology including an assessment of the depth of existing filling and manner of fill placement including compaction;
- Preliminary assessment of site classification to AS2870 – 2011 for foundation design of buildings;
- Site earthworks requirements for the hillslope area including:
    - Site preparation;
    - Assessment of unsuitable materials;
    - Stripping and foundation preparation;
    - Fill material requirements, including suitability of site won materials for reuse;
    - Fill placement and compaction control; and
    - Site drainage requirements.
- Site earthworks requirements for the access road including:
    - Site preparation;
    - Assessment of foundation treatments, (i.e. bridging layers and removal and replacement of unsuitable materials);
    - Assessment of potential settlements beneath embankments associated with soft soils;
    - Fill placement and compaction control; and
    - Site drainage requirements.
- Recommendations on excavation and fill retention including retaining wall and permanent and temporary batter slopes;
- Assessment of excavatability for areas of cut in the hillslope area;
- Suitable footing types and founding materials, including foundation design parameters for buildings and culverts;
- Assessment of soil aggressivity;
- Assessment for the Presence of Acid Sulfate Soils (ASS); and

- Pavement design parameters (CBR values) and flexible pavement thickness design for the access road and car parking areas.

RGS conducted the work in general accordance with proposal nos. RGS31237.1-AF and RGS31237.1-AG. This report presents the results of the site investigation.

2 EXISTING DATA AND INFORMATION

In producing this report the following available geotechnical data was reviewed:

- Coffey Geotechnics Letter GEOTLCOV24043AL-AP dated 29 January 2015 - Investigation logs undertaken for the precast yard and batch plant areas. Six CPT logs CPY-CPT01 to CPY-CPT06 and four test pit logs WC2NH-TP402 to WCNH-TP04 and WC2NH-TP09 and lab test results.
- Regional Geotechnical Solutions Report Ref RGS31237.-AE dated 27 November 2017. The investigation comprised eight test pits (TP1 to TP8) and three shrink swell tests over the hillslope area of the proposed hospital and car park area. Two boreholes were also drilled in the low lying floodplain area through the laydown working platform to assess the depth of soft soils.

3 SITE DESCRIPTION

The site is located on the eastern side of the recently completed Pacific Highway and north of Letitia Close, North Macksville.

Regionally the site is situated within gently undulating topography. Locally the site can be separated into two zones being:

- The Hospital and Car Park Area - located on the hillslope in the northern part of the site; and
- The Access Road Area - located in the area of the low lying alluvial floodplain (southern area of the site) between the hillslope and Letitia Close.

The hospital and car park area is located over a small low rise hill, the ground surface is generally gently to moderately sloping, with surface slopes falling towards the north, east and south away from the crest of the hill. A large proportion of the hill area has been modified by cut and fill earthworks associated with the former use of the site as a storage compound and precast yard for the highway works. Existing development on the site comprises gravel and earthfill laydown areas along the crest of the hill along the southern portion of the site, a earthfill borrow and stockpile area located on the north northern area of the site and an existing farm house, sheds and stockyards located along the eastern portion of the site. Vegetation has been stripped over most of the site apart from the grassed and treed areas around the old farmers residence. A water bore is located near the centre of the site on the northern side of the hill. Photos of the area are presented below.

Photo 1: Looking Towards North West From Hillslope Over Proposed Car Park Area

Photo 2: Looking Towards South East From Hillslope Across the Former Precast and Batch Plant Area

The ground surface around the access road is generally flat. Existing developments to the northern area of the access road comprise the construction of an all weather laydown area which was used for the precast concrete yard, the batch plant and earthfill stockpile area. A significant proportion of the laydown area was constructed over the alluvial floodplain comprising soft to firm clay soils. The foundation for the laydown area was constructed using rockfill as the ground improvement technique. Some sedimentation ponds also exist around the laydown area which were used to manage surface runoff.

In the southern area of the access road alignment, the majority of the alignment is greenfield with vegetation on the site consisting mainly of grasses. During periods of heavy rainfall, water stands in this area. Some minor earthworks have occurred in this area associated with the highway. At the time of the investigation a permanent sedimentation pond had been constructed adjacent to and on the eastern side of the proposed access road alignment.

4 PROPOSED DEVELOPMENT

The new hospital complex will involve the construction of new building structures and car parking facilities in the northern part of the site (which comprises a low rise hill). For the design to be achieved cuts up to approximately 5m to 6m and filling up to 3m are proposed for the building and car parking areas respectively. Materials from the hillside cuttings are proposed to be used for filling of the car park and building areas.

To access the new hospital, a road approximately 800m in length is to be constructed south of the hillslope from Letitia Close across the alluvial floodplain. The alluvial floodplain area is underlain by soft to firm alluvial clays and a shallow groundwater table. For construction of the access, a bridging layer will be required for construction purposes. For construction of the bridging layer, it is proposed to reuse the rockfill material which exists beneath the precast yard and batch plant areas.

5 SCOPE OF WORK

5.1 Fieldwork

Fieldwork in this scope of work comprised:

- A walk over assessment of the site which involved mapping surface features, surface slope angles, drainage lines, wet and low lying ground conditions and other site features considered of relevance;
- Drilling of nine boreholes (BH4 to BH12), four of the boreholes were drilled to depths of 5.88m in the area of the hillslope and five boreholes drilled to depths of up to 13.45m in the area of the floodplain. Boreholes were initially progressed through soil strength materials by auger/rotary drilling methods. Standard penetration tests were conducted at about 1.5m intervals; and
- Excavation of sixteen test pits (TP1 to TP16) which were excavated to depths of up to 3.3m.

Fieldwork was conducted by a Geotechnical Engineer from RGS who, logged the materials observed, took samples and recorded results of in-situ testing. Figures 4a to 4c show the investigation locations. Engineering Logs are presented in Appendix A, with explanation sheets defining the terms and symbols used in their preparation.

5.2 Laboratory Testing

Laboratory testing as follows was conducted on samples recovered during fieldwork:

- 3 shrink swell tests to assess clay reactivity for footing design;
- 4 Atterberg limits and linear shrinkage tests to confirm the soil plasticity classification;
- 6 standard compaction and soaked CBR tests on samples of materials expected to be encountered at subgrade level of the proposed pavements;
- 4 aggressivity tests for the assessment of corrosivity protection to buried structural elements.
- 18 ASS field screening tests and
- 6 Chromium Reducible Sulfur (CRS) tests to assess for the presence of Potential Acid Sulfate Soils (PASS)or Actual Acid Sulfate Soils (AASS).

Laboratory test result sheets are presented in Appendix B. Results of the lab testing for this scope of works and lab testing provided by previous investigations are summarised in the tables below.

Table 1: Results from Shrink Swell Testing

Location	Investigation Phase	Material Description	Sample Depth (m)	Field Moisture Content (%)	Shrink / Swell (%)
TP1	RGS31237.1-AE	Clay	1.2-1.5	24.9	2.1
TP5	RGS31237.1-AE	Clay	0.4-0.85	26.9	3.1
TP10	RGS31237.1-AE	Clay	0.3-0.75	29.4	2.8
TP13	RGS31237.1-AH	Clay	0.3 to 0.5	26.9	3.5
TP13	RGS31237.1-AH	EW Phyllite	1.0 to 1.2	15.6	1.3
TP14	RGS31237.1-AH	EW Phyllite	2.0 to 2.2	27.0	1.9

Table 2: Results from Atterberg Limits Testing

Location	Investigation Phase	Material Description	Sample Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
TP402	GEOTLCOV24043AL-AP	Alluvial Silty Clay	1.4 to 1.6	46	22	24
TP403	GEOTLCOV24043AL-AP	Alluvial Silty Clay	1.4-1.6	44	24	20
TP404	GEOTLCOV24043AL-AP	Alluvial Silty Clay	1.4-1.6	27	21	6
TP409	GEOTLCOV24043AL-AP	Alluvial Silty Clay	1.4-1.6	46	22	24
TP14	RGS31237.1-AH	EW Phyllite	2.0 to 2.2	43	28	15
BH8	RGS31237.1-AH	Alluvial Clayey Silt	5.0 to 5.45	32	23	9
BH10	RGS31237.1-AH	Alluvial Clayey Silt	1.5 to 1.6	54	31	23
BH10	RGS31237.1-AH	Alluvial Silty Clay	2.4 to 2.5	44	25	19

Table 3: Results of Aggressivity Testing

Location	Investigation Phase	Material Description	Sample Depth (m)	Soluble Sulphate (mg/Kg)	Chloride (mg/Kg)	Ph	Conductivity (Ohm.cm)
BH4	RGS31237.1-AH	Extremely Weathered Phyllite	2.5 to 2.95	26	38	5.1	6900
BH8	RGS31237.1-AH	Alluvial Clayey Silt	6.5 to 6.9	377	70	3.8	920
BH10	RGS31237.1-AH	Alluvial Clayey Silt	1.0 to 1.45	88	175	4.9	1700

Location	Investigation Phase	Material Description	Sample Depth (m)	Soluble Sulphate (mg/Kg)	Chloride (mg/Kg)	Ph	Conductivity (Ohm.cm)
BH12	RGS31237.1-AH	Alluvial Clayey Silt	1.3-1.45	116	215	5.2	2100

Table 4: Summary of Compaction and CBR Test Results

Location	Investigation Phase	Material Description	Sample Depth (m)	Field Moisture Content (%)	Optimum Moisture Content (%)	CBR (%)
TP4	RGS31237.1-AH	Fill - Clayey Gravel	0 to 0.4	11.6	12.5	2.5
TP6	RGS31237.1-AH	Fill - Clayey Gravel	0 to 0.4	9.9	10.9	4.5
TP8	RGS31237.1-AH	Fill - Silty Clay	0.1 to 0.4	15.4	13.8	5.5
TP13	RGS31237.1-AH	Residual Silty Clay	0.3 to 0.5	22.9	19.8	3.5
TP13	RGS31237.1-AH	Extremely Weathered Phyllite	1.0 to 1.2	15.6	14.1	3.5
TP14	RGS31237.1-AH	Extremely Weathered Phyllite	2.0 to 2.2	17.5	16.0	6.5

6 SUB-SURFACE CONDITIONS

6.1 Stratigraphy

The Dorrigo Coffs Harbour 1:250,000 geological map sheet shows that the site is underlain by undifferentiated schist and phyllite.

Hillslope Areas (Northern Area of Site)

The stratigraphy interpreted from the boreholes and test pits undertaken in the hillslope area is summarised as follows:

Filled Areas

- Fill (Encountered in Localised Test Pits): Mainly soil materials comprising gravelly silty clay, medium plasticity, between 0.4m and 1.4m thick; overlying
- Residual Soil: Silty clay, medium plasticity, orange brown, very stiff; grading into
- Extremely Weathered Phyllite: Clayey silty gravel, friable, to beyond the depth of investigation (5.88m).

Non Filled Areas (Greenfield Areas)

- Topsoil: Silt, low plasticity, dark brown to depths of 0.2m, overlying;
- Residual Soil: Silty clay, medium plasticity, orange/brown, very stiff; grading into
- Extremely Weathered Phyllite: Clayey silty gravel, friable, to beyond the depth of investigation (5.88m).

No groundwater was observed in any of the test pits or boreholes. Ground water levels may fluctuate after rain or as a consequence of other climatic effects.

Alluvial Floodplain Areas (Southern Area of Site)

The stratigraphy interpreted from the boreholes and test pits undertaken in the hillslope area is summarised as follows:

Filled Laydown and Batch Plant Areas

- Fill: comprising clayey gravel, medium grained, between 0.3m and 1m depth; overlying
- Fill (Rockfill): gravel and cobbles, dense, to 1.6m depth; overlying
- Alluvial Soil (Upper Crust): generally comprising stiff silty clay to 3m depth, underlain by;
- Alluvial Soil (Soft to Firm): comprising silty clay to 6m depth, underlain by;
- Alluvial Soil (Stiff): comprising stiff silty clay to 13m depth, underlain by;
- Extremely Weathered Argillite: comprising silty clay, hard and friable, to beyond the depth of investigation.

Non Filled Areas

- Alluvial Soil (Upper Crust): generally comprising stiff silty clay to 1m depth, underlain by;
- Alluvial Soil (Soft to Firm): comprising silty clay to 4m depth, underlain by;
- Alluvial Soil (Stiff): comprising stiff silty clay to 9m depth, underlain by;
- Extremely Weathered Argillite: comprising silty clay, hard and friable, to beyond the depth of investigation.

Note the depths of soft clay soils decrease in the direction south away from the laydown and batch plant areas.

The groundwater levels were measured at natural ground surface level on completion of test pitting and drilling. Ground water levels are expected to fluctuate after rain, during flooding or as a consequence of other climatic effects.

7 CONSIDERATIONS FOR DESIGN & CONSTRUCTION (NORTHERN AREA OF SITE – HOSPITAL BUILDINGS AND CAR PARK AREA)

7.1 Preliminary Site Classification

The preliminary site classification presented herein is provided on the basis that the performance expectations of AS2870 - 2011 are acceptable.

Based on the presence of fill materials over the area of the hospital buildings to depths in excess of 0.4m, the site is classified as Class 'P' in accordance with Australian Standard AS2870 - 2011. Should the fill materials be removed and replaced with level 1 fill. Then the footings for the structures could be founded in the fill or the natural clay soils, with a Class 'M' site conditions with a shrink swell related characteristic free surface movement (ys) in the order of 20 to 40mm estimated for the site in its existing condition. This assessment is based on the soil and weathered rock materials profile encountered and should be reviewed following earthworks and laboratory shrink swell testing.

This classification is based on site conditions at the time of the assessment. Changes to the existing profile, in particular filling can have significant impacts on shrink swell related ground surface movements and subsequently the site classification. Any fill should therefore comprise non-reactive materials such as sands and gravel. The use of clay soils will result in higher shrink swell related surface movements.

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

The classification presented above assumes that:

- All footings are founded in controlled fill (if applicable or in the residual clay soils or rock below all uncontrolled fill, topsoil material and root zones and fill under slab panels meets the requirements of AS2870-2011, in particular the root zone must be removed prior to placement of fill materials beneath slabs;
- Footings are to be founded outside of or below all zones of influence resulting from existing or future services trenches;

7.2 Founding Conditions & Parameters

Based on the cut and fill works proposed at the site of the hospital complex the foundation for the hospital building is expected to comprise residual clay soils and extremely weathered phyllite, we consider that there are several suitable options for support of the proposed structures depending on the magnitude of loads and the required founding levels. These options include:

- Shallow footings; and
- End-bearing piles founded within residual clays or the weathered phyllite bedrock.

Discussion of the options and design parameters for the relevant materials is provided in the following sections.

7.3 Shallow Footings

High level footings may comprise pad or strip footings supporting column loads or a raft slab. For pad or strip footings an allowable bearing pressure of 100kPa may be adopted for the residual clay soils and 300kPa adopted for the extremely weathered phyllite. The assessment of serviceability beneath shallow footings founded in clay and extremely weathered phyllite may be undertaken assuming an elastic modulus of E = 15MPa and E = 70MPa respectively.

High level footings are to be founded outside or below all zones of existing or future services trenches.

7.4 Piles

End bearing piles may be adopted to support the structures forming the development. Open bored piles are considered a suitable pile type.

Design parameters for end bearing piles founded at least 4 pile diameters below the excavation level are shown in Table 5

Table 5: Geotechnical Strength Parameters for Pile Design

Material Description	Elastic Modulus Vertical Response (MPa)	Elastic Modulus Horizontal Response (MPa)	Ultimate Skin Friction (MPa)	Ultimate End Bearing (MPa)
Level 1 Engineered Fill or Residual Soil: Silty Clay, medium plasticity, orange brown, very stiff.	20	15	50	1000
Extremely Weathered Phyllite: pale grey with orange / brown iron oxide staining, estimated low to medium strength.	70	2200	70	3000

For pile design in accordance with AS2159-2009, '*Piling-Design and installation*', the ultimate geotechnical strength ($Rd,_{ug}$) can be calculated using the shaft capacity and ultimate end bearing capacity values provided in Table 5. Calculation of the design geotechnical strength (Rd,g) requires an assessment of the geotechnical strength reduction factor (Φg), which is based on a series of project specific variables. When assessing the geotechnical reduction factor (Φ_g) an assignment of an Average Risk Rating (ARR) is required which takes into account the redundancy of the pile system and the quantity and type of pile testing. In assessing the ARR and a suitable geotechnical strength reduction factor for this project, the following assumptions have been made:

- Design of piles and pile groups will be undertaken in accordance with the recommendations presented in this report;
- Limited geotechnical involvement will occur during pile installation;

- No performance monitoring of the supported structure will occur during or after construction; and
- The foundations will be designed by a designer of at least moderate experience in similar geotechnical profiles and pile design;
- Well established pile design methods will be adopted.

Based on the above and in accordance with AS2159-2009, a risk rating of 1.76 is estimated. Therefore, assuming the pile configuration will have low redundancy a Geotechnical Strength Reduction Factor of Φ_g=0.61 would be appropriate for the site if no static load testing is undertaken. This could be increased to 0.75 if a reasonable proportion of the piles are statically or dynamically tested.

In the event that any of the assumptions outlined above are not correct, the Geotechnical Strength Reduction Factor may change and further advice should be sought.

7.5 Aggressivity to Buried Structural Elements – Residual Soil and Weathered Phyllite

Based on the recommendations provided in the Australian Standard "AS2159-2009, *Piling Design and Installation*", the following exposure classifications should be adopted for buried structural elements founded in the residual clay soils and weathered phyllite:

- Concrete Elements Soil Conditions – Mildly Aggressive exposure classification.
- Steel Elements in Soil Conditions – Non Aggressive exposure classification.

Based on the above exposures, the below design criteria should be adopted for structures with a 50 year design life:

- Cast in-situ concrete - Minimum concrete strength of 32MPa and steel cover of 60mm;
- Precast concrete - Minimum concrete strength of 50MPa and steel cover of 20mm;

Steel elements in the above environment should be designed with a uniform corrosion allowance of <0.01mm/year.

7.6 Excavation Conditions

The cut/fill sections indicate that excavations of up to 5.7m depth are proposed across the crest of the hillslope area. At this depth, excavations will extend through the residual clay soils and into the extremely to highly weathered phyllite.

Based on experience with similar conditions, excavation could be conducted using tracked, hydraulic excavators of 20 tonne capacity or larger or with the use of scrappers or bulldozers of D6 Capacity or larger. It is possible excavations may encounter localised zones of rock that is stronger, than that intersected in the boreholes and test pits. Such zones may require heavier ripping prior to general bulk excavation.

Groundwater was not encountered above 5.88m depth at the time of the investigation.

7.7 Site and Excavation Retention

7.7.1 Retaining Wall Options

On the basis of the available subsurface information, excavation will be within the residual clay and extremely to highly weathered phyllite which will require support if cut vertically to the levels proposed.

Suitable retaining walls for the site are likely to comprise relatively simple gravity of cantilever walls. These may be designed using the parameters given below. Design should include assessment of the global stability of the wall.

7.7.2 Retaining Wall Drainage

The wall backfill should be free draining, granular material. Drainage behind the wall should comprise a geocomposite drain or geotextile wrapped gravel drain at the back of the wall that drains to a geotextile wrapped subsoil drain along the wall toe. The toe drain should discharge to the site stormwater system to provide long term drainage behind excavation walls. Flushing points should be incorporated into the design of the perimeter drain to allow periodic maintenance.

7.7.3 Retaining Wall Design Parameters

Cantilevered or gravity walls may be designed based on a triangular stress distribution using the following parameters in Table 6.

Table 6: Retaining Wall Design Parameters

Unit	**Effective Cohesion (c')**	Friction Angle (Degrees)	Saturated Bulk Unit Weight (kN/m^3)
Topsoil / Uncontrolled Fill	4	25	18
Residual Clay and Extremely Weathered Phyllite	7	29	20
Highly Weathered Phyllite	12	30	22

Design of the walls must take into account any surcharge from sloping ground or other loadings behind the wall. Drainage measures as described above, if properly maintained, should reduce pore pressures at the back of the wall to zero, however pore pressures may still be generated at other points behind the wall. The design should incorporate an allowance for such pressures. A typical allowance of potential water pressure build-up equivalent to one-third the wall height is considered to be reasonable with such drainage measures installed.

7.8 Temporary & Permanent Batter Slopes

Where space permits, temporary batter slopes may be constructed to simplify retaining wall construction and conventional concrete panel or similar walls adopted. Temporary batter slopes may be cut in soil strength materials and weathered phyllite down to about 4m depth at 1H:1V. Permanent batter slopes in the same materials to 6m depth should be no steeper than 2H:1V and should be protected against erosion. Adequate drainage should be provided for all batter slopes. As a minimum during rainfall, temporary slopes should have surface water on the high side should diverted away from the slope face.

7.9 Reuse of Site Won Materials

The following comments are made regarding the suitability of the site materials for reuse in filled areas:

For site regard works, topsoil or other potentially deleterious material should be removed to spoil or stockpiled for reuse as landscaping materials only. Topsoil depths are presented on the engineering logs in Appendix B. Stripping of topsoil is expected to be required to depths of up to 0.20m.

The uncontrolled fill materials placed across the crest of the hillslope area (former site compound area) and the underlying residual clays and weathered rock are suitable for re-use as general engineered fill subject to appropriate moisture conditioning.

7.10 Compaction Control Beneath Structures

Site preparation and earthworks suitable for structure support should be undertaken as follows:

- Prior to construction of pavements and placement of any fill, the proposed areas should be stripped to remove all vegetation, topsoil, root affected or other potentially deleterious material;
- Following stripping, the exposed subgrade materials should be proof rolled in the presence of a suitably qualified and experienced geotechnical practitioner to identify any wet or excessively deflecting material. Any such areas should be over excavated and backfilled with an approved material;
- Approved fill beneath structures should be placed in layers not exceeding 300mm loose thickness and compacted to a minimum density ratio of 98% Standard Compaction in accordance with AS1289 5.1.1 or equivalent. Clay fill should be placed and maintained at ±2% of Optimum Moisture Content.

8 CONSIDERATIONS FOR DESIGN & CONSTRUCTION (SOUTHERN AREA OF SITE – ACCESS ROAD AND REUSE OF FILL FROM PRECAST AND BATCH PLANT AREA)

8.1 Shallow Footings Beneath Culvert Structures

Based on the concept plans provided for the development three flood culvert locations have been nominated along the access road alignment. The culvert locations are located at the following chainages:

- 290m
- 460m
- 600m

Due to the presence of soft to firm clay soils at the site, the culverts and access road alignment are expected to experience some long term settlements over the lifetime of the road associated with primary and secondary "creep" settlements. For design of the culverts and embankments, consideration needs to be given to designing the foundations for the culverts which manage the potential for differential settlements over the design life. Due to the thin nature of the soft soils in this area (less than 2.5m in thickness) the ground conditions are not expected to require the use of construction methods which result in ground improvement (such as preloading etc) or piling the culvert structures. Therefore to manage the potential for different settlements, high level footings comprising preformed box culverts founded on reinforced concrete base slabs could be used for the site. For the preliminary assessment of footings and assuming an allowable bearing pressure of 50kPa will required for the reinforced concrete slab. A 0.6m thick rockfill platform will be required over the soft to firm clay foundation

An assessment of the estimated settlements to the structures associated with the above footing loads is discussed below.

8.2 Estimated Settlements Beneath Culvert Structures and Access Road Embankment

The design parameters for the assessment of settlements beneath culverts and the access road embankment are provided in Table 7 below.

Table 7: Summary of Geotechnical Parameters

Unit	Bulk Unit Weight (kN/m^3)	Elastic Modulus (MPa)	Undrained Shear Strength (kPa)	$Cc/1+e^0$	$C\alpha\varepsilon$	Cv (m^2/yr
Embankment Fill	20	15	100	-	-	-
Stiff Alluvial Clay (Upper Crust)	18	10	50	-	-	-
Soft to Firm Alluvial Clay	16.5		20 to 45	0.2	0.015	6 to 20
Stiff Alluvial Clay (Lower)	18	12	75	-	-	-

Presented in Table 8 and Table 9 are summaries of the estimated settlements likely to occur to embankments and culverts over a 50 year design period.

Table 8: Summary of Estimated Embankment Settlements

Chainage	Fill / Cut Level From Existing	Thickness of Soft to Firm Clay Soil	Primary Settlement Estimated	Secondary Settlement Expected for 50 Year Design Period	Elastic Settlement Expected (Internal Embankment Settlement)	Total Settlement Expected for 50 Year Design Period
100m	2.2 Fill	1.5m	<90mm	<60mm	<10mm	<160mm
200m	2.0 Fill	2.0m	<100mm	<50mm	<10mm	<160mm
300m	1.5 Fill	2.5m	<80mm	<50mm	<10mm	<140mm
400m	0.6 Fill	2.5m	<20mm	<50mm	<5mm	<75mm
500m	5m Cut Through Fill Stockpile	Not Encountered	0mm	0mm	0mm	0mm
600m	1.5m Fill	None	0mm	50mm	<10mm	<60mm
700m	2.5m Fill	None	0mm	0mm	25mm	<25mm
800m	6m Fill	None	0mm	0mm	40mm	<40mm

Table 9: Summary of Estimated Culvert Settlements

Chainage	Design Bearing Pressure (kPa)	Thickness of Soft Soil	Primary Settlement Estimated	Secondary Settlement Expected for 50 Year Design Period	Elastic Settlement Expected (Internal Embankment Settlement)	Total Settlement Expected for 50 Year Design Period
290m	50	2.5 (20kPa)	100mm	50mm	<10mm	<180mm
460m	50	2.0m (40kPa)	60mm	50mm	<10mm	<120mm
600m	50	2.0m (40kPa)	70mm	50mm	<10mm	<130mm

It should be noted that the parameters used to assess the settlements have been adopted based on experience with soils of similar properties on nearby projects and are not based on lab testing undertaken during this scope of work. Primary settlements are expected to occur within the first 8 months of construction. It is recommended that an allowance be made to undertake settlement monitoring during construction of the fill embankments.

8.3 Batter Design Recommendations for Access Road Embankments Placed Over Soft Soils

For construction of fill batters for the access road and to maintain stability of the embankment, design batters should not exceed grades of 2H to 1V.

8.4 Aggressivity to Buried Structural Elements – Alluvial Soil Areas

Based on the recommendations provided in the Australian Standard "AS2159-2009, *Piling Design and Installation*", the following exposure classifications should be adopted for buried structural elements in the alluvial soils:

- Concrete Elements Soil Conditions –Severe exposure classification.
- Steel Elements in Soil Conditions – Moderate exposure classification.

Based on the above exposures, the below design criteria should be adopted for structures with a 50 year design life:

- Cast in-situ concrete - Minimum concrete strength of 50MPa and steel cover of 70mm;
- Precast concrete - Minimum concrete strength of 50MPa and steel cover of 40mm;

Steel elements in the above environment should be designed with a uniform corrosion allowance of 0.02 to 0.04mm/year.

8.5 Excavation Conditions

Based on the available concept design information, excavations within the alluvial clay soils are only expected to occur for the provision of buried services and to construct rockfill bridging layers for the foundations of flood culvert structures.

For these types of construction works, excavations to depths of between 0.5m and 1.5m may be expected.

Temporary excavations such as utility trenches up to about 1m deep could be cut vertically through the clay soils encountered and should be self-supporting for short periods (i.e. several hours while the service is laid and backfilled). Lengths of open excavation should be limited to no greater than 10m. Large lengths of open unsupported trenching should be supported by trenching shields/ shoring boxes.

Larger temporary excavations in the firm to soft clay soils which will remain open for extended periods should be benched at 2H:1V or flatter if they are to remain open for extended periods of time and protected against erosion or supported by trenching shields/ shoring boxes.

Groundwater was encountered at the natural surface level at the time of the investigation Based on our experience at the site water levels experienced are well above natural groundwater level during periods of increased rainfall.

8.6 Site and Excavation Retention

8.6.1 Retaining Wall Options

Suitable retaining walls for the retention of embankment fill behind culverts are likely to comprise relatively simple gravity of cantilever walls. These may be designed using the parameters given below. Design should include assessment of the global stability of the wall.

8.6.2 Retaining Wall Drainage

The wall backfill should be free draining, granular material. Drainage behind the wall should comprise a geocomposite drain or geotextile wrapped gravel drain at the back of the wall that drains to a geotextile wrapped subsoil drain along the wall toe. The toe drain should discharge to the site stormwater system to provide long term drainage behind excavation walls. Flushing points should be incorporated into the design of the perimeter drain to allow periodic maintenance.

8.6.3 Retaining Wall Design Parameters

Cantilevered or gravity walls may be designed on the basis of a triangular stress distribution using the following parameters in Table 10.

Table 10: Retaining Wall Design Parameters

Unit	**Effective Cohesion (c')**	Friction Angle (Degrees)	Saturated Bulk Unit Weight (kN/m³)
Topsoil / Uncontrolled Fill	4	25	18
Rockfill Bridging	0	43	23
Engineered Embankment Fill	7	29	20

Design of the walls must take into account any surcharge from sloping ground or other loadings behind the wall. Drainage measures as described above, if properly maintained, should reduce pore pressures at the back of the wall to zero, however pore pressures may still be generated at other points behind the wall. The design should incorporate an allowance for such pressures. A typical allowance of potential water pressure build-up equivalent to one-third the wall height is considered to be reasonable with such drainage measures installed.

8.7 Reuse of Site Won Materials from Precast and Batch Plant Borrow Area

The following comments are made regarding the suitability of the site materials for reuse in the site access road area:

The general fill materials placed across the bridging layer in the precast and batch plant areas will be suitable for re-use as general engineered fill subject to appropriate moisture conditioning. Based on the test pits undertaken in the area, the layer of general fill ranges between 0.4m and 1.8m in thickness with depths typically in the range of 0.5 to 0.8m

The rockfill bridging layer materials generally comprised a mixture of gravel and cobbles of high strength rock. Therefore from a geotechnical viewpoint the materials will be suitable for reuse as a bridging layer material for the new road alignment. It should be noted that a number of the test pits encountered high silt and clay contents which may affect the performance of the bridging layer materials. Should it be proposed to use all of the rockfill materials in construction of the road then an allowance should be made to process (screen) some of the gravel materials with high silt/clay content.

The presence of the geofabric layers above and below the bridging layer, means that some of the generall fill and rockfill bridging materials will be affected by geofabric inclusions. Allowance should be made for a proportion of wastage of the borrow material where the geofabric material cannot be practically removed.

From a construction viewpoint the contractor should assess the viability of reusing the materials in construction of the access road.

9 PAVEMENT DESIGN

9.1 Design Subgrade

Based on the CBR testing results and our experience with these materials on the Pacific Highway Upgrade projects a design CBR of 3.5% should be adopted for design of flexible pavements.

9.2 Design Traffic

Based on information provided for the project we understand that an indicative design traffic figure of $8x10^5$ ESA's is to be used to design of the access road. A summary of the pavement design is provided in Table 11 below.

Table 11: Pavement Design Summary for Design CBR 3%

Pavement Location	Spray Seal type	Base Layer	Subbase Layer	Total Pavement Thickness
Access Road	2 Coat Seal 14/7	140mm	320mm	460mm

9.3 General Pavement Design Parameters and Compaction Control Beneath Pavement and Car Parks

The following scope of work is required as a minimum to enable the design CBR of 3.5% to be achieved.

Site preparation and earthworks suitable for pavement and structure support should comprise:

- Prior to construction of pavements and placement of any fill, the proposed areas should be stripped to remove all vegetation, topsoil, root affected or other potentially deleterious material;
- Following stripping, the exposed subgrade materials should be proof rolled in the presence of a suitably qualified and experienced geotechnical practitioner to identify any wet or excessively deflecting material. Any such areas should be over excavated and backfilled with an approved select material;
- Approved fill beneath pavements should be placed in layers not exceeding 300mm loose thickness and compacted to a minimum density ratio of 95% Standard Compaction in accordance with AS1289 5.1.1 or equivalent. Clay subgrade fill should be placed and maintained at 60% to 90% of Optimum Moisture Content;
- The top 300mm of natural subgrade below pavements or the final 300mm of road subgrade replaced should be compacted to a minimum density ratio of 100% Standard Compaction or equivalent within the above stated moisture range.

The following construction methodology is recommended for the pavements:

- Place new pavement over prepared subgrade as per design requirements as specific in pavement thickness design sheet presented in Appendix D.
- Where final sealing cannot be undertaken within a few days of completion of the base course, a primer seal should be used to protect the pavement and maintain equilibrium moisture content;
- Traffic should be prevented from travelling on partially completed pavement sections.
- Where a two coat seal is adopted, sealing should be avoided during winter months or at times when pavement temperatures of less than 15 degrees are likely, due to the potential for microcracking of the pavement surface, which can lead to water ingress, pumping of fines, and flushing or embedment of aggregate within wheel paths within a very short time frame. If sealing during winter or cold weather is required, consideration should be given to placing a 7mm primer seal that can remain in place for several weeks, with placement of the two-coat seal then able to be undertaken at a time when the pavement can be dried to remove excess moisture from the upper part of the base course and the microcracking in the primer can be sealed over.

Pavement construction, including sealing, should extend well beyond the outer wheel path of the pavement to provide lateral restraint to the outer wheel path and to assist in preventing ingress of moisture through the road shoulder.

9.4 Bridging Layer Construction Over the Alluvial Floodplain

For construction of the access road across the alluvial floodplain the following is recommended. It should be noted that the thickness of the bridging layer required will be dependent on the prevailing weather and site conditions at the time of construction. For costing purposes, the following is recommended:

- Placement of A39 Geofabric or equivalent across the footprint area of the embankment. A minimum overlap of 600mm between rolls of geofabric should be allowed for during construction; followed by
- Placement of a rockfill bridging layer over the geofabric. The rockfill bridging layer should be placed and pushed out over the geofabric layer. The rockfill bridging layer should comprise high strength angular rock free of fines which once compacted forms a strong mechanical interlock. The rockfill layer should have a minimum compacted layer thickness of 600mm. Rockfill should be sized so that no individual particles are greater than two thirds the compacted layer thickness. Once placed the bridging layer should be proof rolled to assess for any excessive deflections. Areas of excessive deflection noted should be treated at the time of construction.
- Following acceptance of the proof roll assessment, allowance should be made to cover the bridging layer with a layer of A39 geofabric or equivalent with a minimum 300mm overlap between rolls.

9.5 Assessment of Acid Sulfate Soils

A review of the 1: 25,000 Acid Sulfate Soil Risk Map of Macksville indicates the access road is located in an area of potentially high risk of acid sulfate soils within 1m of the ground surface.

Acid Sulfate Soils (ASS) produce sulphuric acid when exposed to oxygen due to the presence of iron sulphides in the form of pyrite within the soil matrix. These soils form when iron-rich sediments are deposited in saltwater or brackish water environments. Prior to oxidation, these pyritic soils are referred to as Potential ASS. ASS that have produced acid because of oxidation are referred to as Actual ASS. They typically occur in natural, low-lying coastal depositional environments below approximately 5m AHD. In the field ASS are generally identified as saline sediments such as alluvial or estuarine soils or bottom sediments in creeks and estuaries.

It is understood that excavations for the development will typically be associated with the construction of culvert structures and service lines, therefore it has been assumed that less than 1000 tonnes of material will be disturbed during the development.

Eighteen samples were submitted to a contract laboratory for ASS screening. The results are summarised below:

- The samples revealed pH_f values between 4.3 and 5.6 in distilled water. In this test, pH less than 4 is an indicator of Actual ASS;
- The samples revealed pH_{Fox} values between 1.9 and 4.1 in hydrogen peroxide. Values less than 3 in this test can be an indicator of Potential ASS.

To provide a more comprehensive assessment, seven samples were submitted for Chromium Reducible Sulphur (CRS) analysis. A summary of the test results is presented in Table 12.

Table 12: Summary of ASS CRS Test Results

Test location	Depth (m)	Texture	Sulfur Trail (% S Oxidisable)	
			S_{cr}	Action Criteria(1)
BH8	6.5 to 6.9	Fine	0.12	0.1
BH9	5.5 to 5.95	Fine	0.82	0.1
BH10	1.0 to 1.45	Fine	0.15	0.1
BH11	1.0 to 1.45	Fine	0.29	0.1
BH12	0.4 to 0.5	Fine	0.08	0.1
TP15	1.0 to 1.1	Fine	0.02	0.1
TP16	0.9 to 1.0	Fine	0.15	0.1

Notes: *1. Action criteria is based on less than 1000 tonnes of soil being disturbed*

Based on Chromium Reducible Sulphur (CRS) analysis, the clay soils are assessed to be potential acid sulfate soils and therefore an Acid Sulfate Soil Management Plan will be required for the site. For excavations undertaken in the alluvial soils, a liming rate of 90kg per cubic meter of disturbed soil will be required.

10 LIMITATIONS

The findings presented in the report and used as the basis for 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. 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

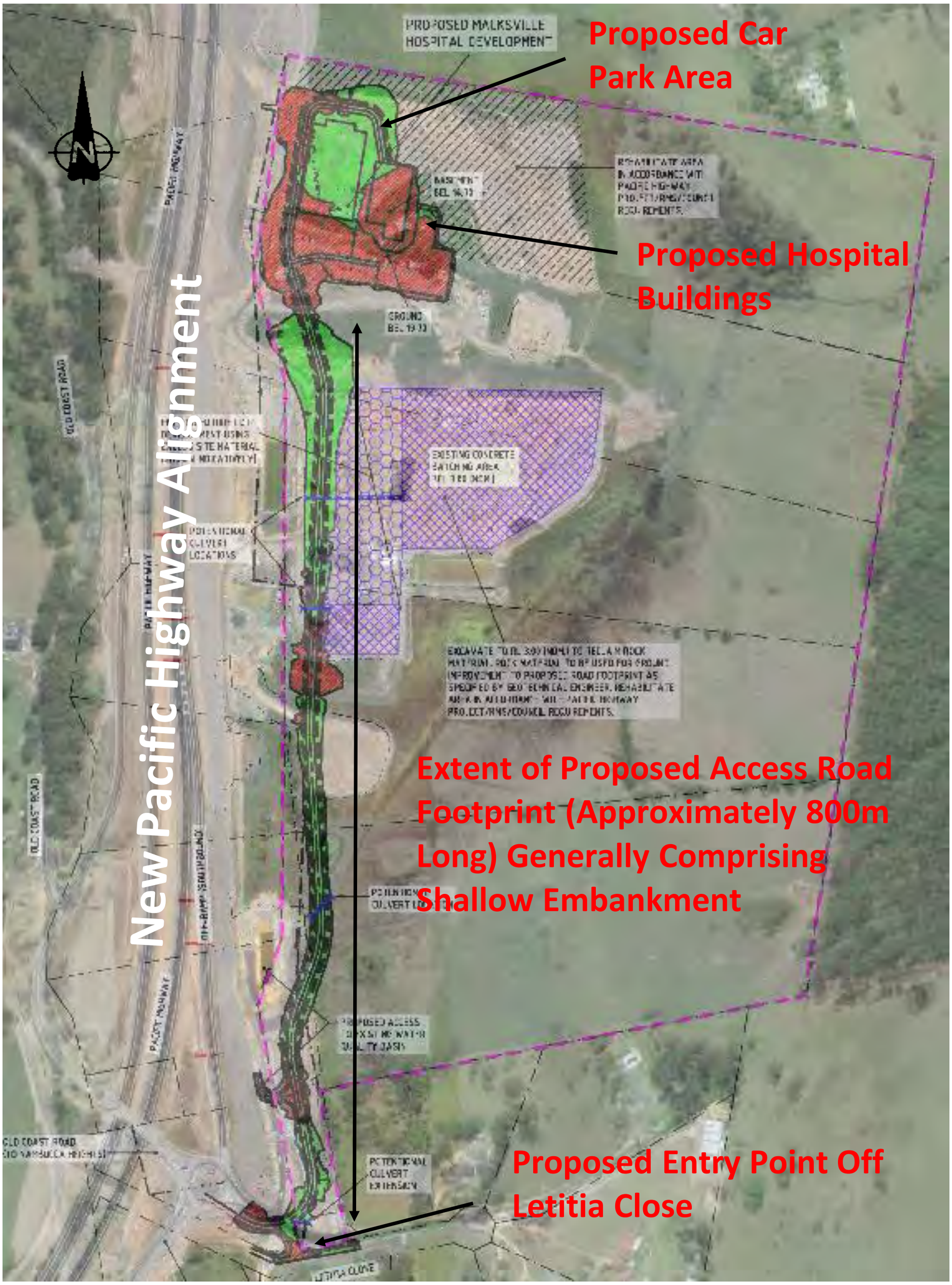
Matt Rowbotham

Associate Engineering Geologist

Figures

REGIONAL GEOTECHNICAL SOLUTIONS	Client:	Health Infrastructure	Job No. RGS31237.1
	Project:	Proposed Macksville Hospital	Drawn By: MR
			Date: 12-Apr-18
	Title:	Site Location Plan Indicating Geology	Drawing No. Figure 1

REGIONAL GEOTECHNICAL SOLUTIONS	Client:	Health Infrastructure	Job No.	RGS31237.1
	Project:	Proposed Macksville Hospital	Drawn By:	MR
			Date:	12-Apr-18
	Title:	Site Plan Indicating Areas Affected by Filling	Drawing No.	Figure 2



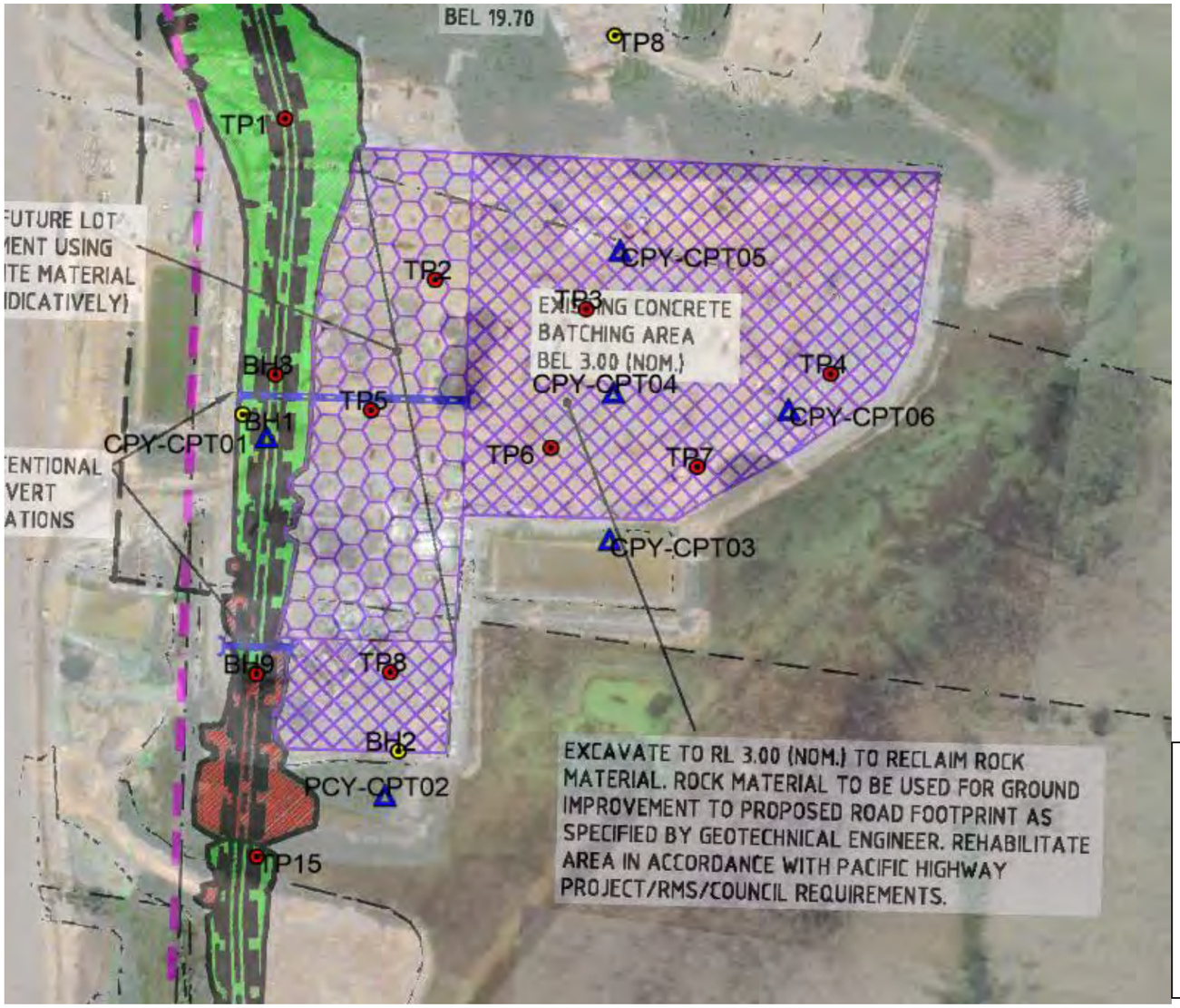
REGIONAL GEOTECHNICAL SOLUTIONS	Client:	Health Infrastructure	Job No. RGS31237.1
	Project:	Proposed Macksville Hospital	Drawn By: MR
			Date: 12-Apr-18
	Title:	Site Plan With Hospital Plan Layout	Drawing No. Figure 3

Legend

- Investigation Locations RGS31237.1-AE Report
- Investigation Locations GEOTLCOV24043AL-AP
- Investigation Locations RGS31237.1-AH

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Health Infrastructure	Job No.	RGS31237.1
Project:	Proposed Macksville Hospital	Drawn By:	MR
		Date:	12-Apr-18
Title:	Test Pit and Borehole Location Plan	Drawing No.	Figure 3a



Legend

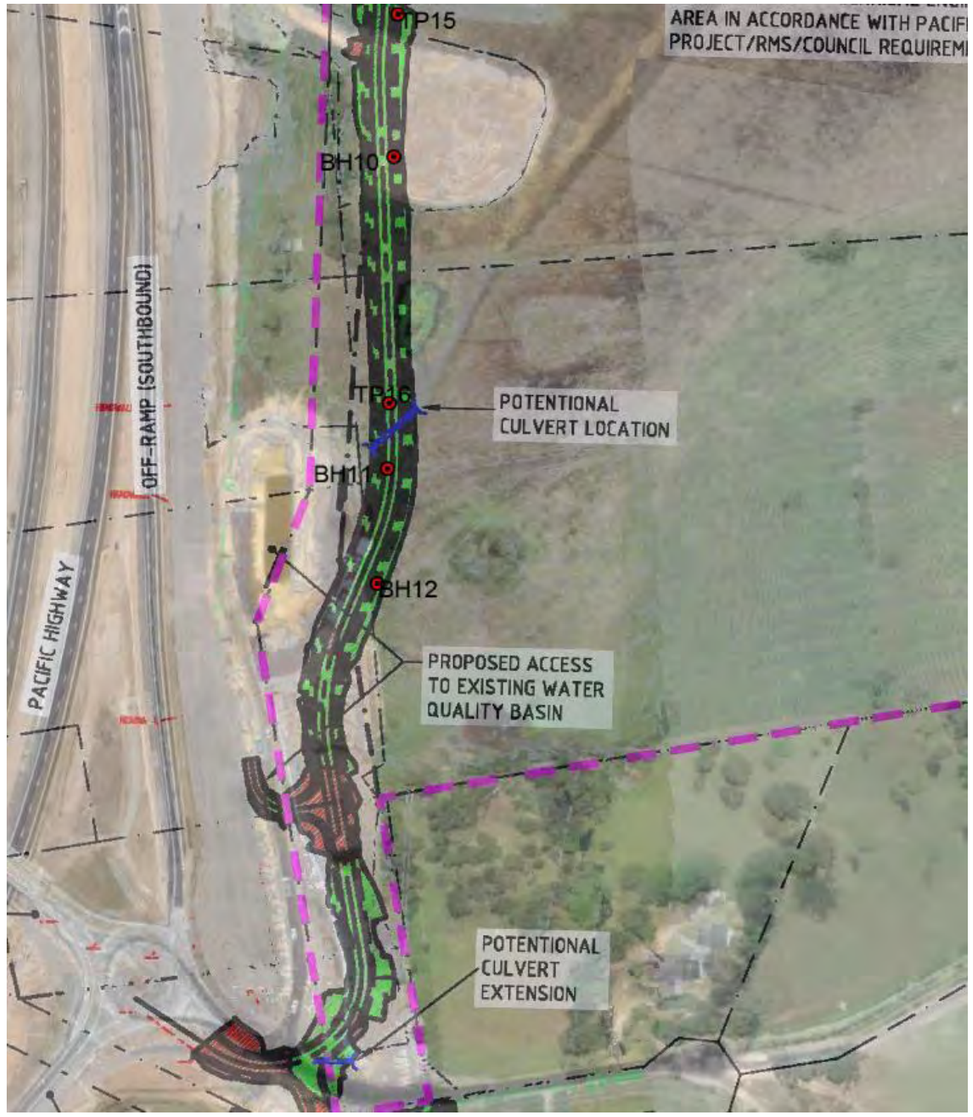
Investigation Locations RGS31237.1-AE Report

Investigation Locations GEOTLCOV24043AL-AP

Investigation Locations RGS31237.1-AH

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Health Infrastructure	Job No.	RGS31237.1
Project:	Proposed Macksville Hospital	Drawn By:	MR
		Date:	12-Apr-18
Title:	Test Pit and Borehole Location Plan	Drawing No.	Figure 4b



Legend

Investigation Locations RGS31237.1-AE Report

Investigation Locations GEOTLCOV24043AL-AP

Investigation Locations RGS31237.1-AH

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Health Infrastructure	Job No.	RGS31237.1
Project:	Proposed Macksville Hospital	Drawn By:	MR
		Date:	12-Apr-18
Title:	Test Pit and Borehole Location Plan	Drawing No.	Figure 4c

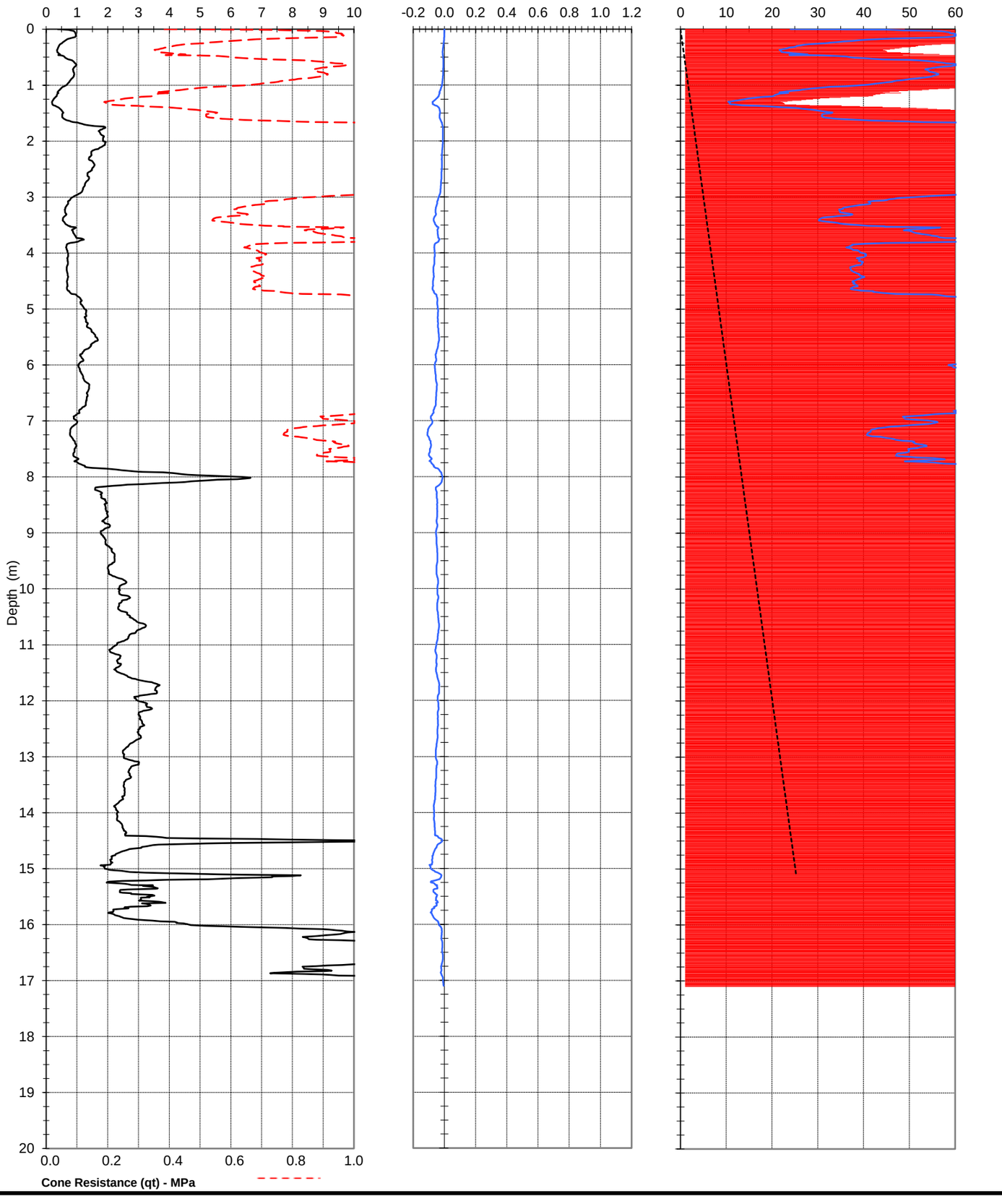
Appendix A
Investigation Logs (Previous Investigations)

Coffey Geotechnics Pty Ltd

Piezocone Penetrometer Test

Client:		Test No.:	PCY-CPT01
Principal:		Sheet:	1 of 1
Project:	*Macksville Hospital*	Project No.	*RGS31237.1*
Location:		Date tested :	*10-Feb-15*
		Tested by:	*IGS*

Cone Type: Geotech Piezocone	Easting: 9506 m	Elevation: 1.52 m AHD
	Northing: 172692 m	Depth to GW Table: .0m Estimated

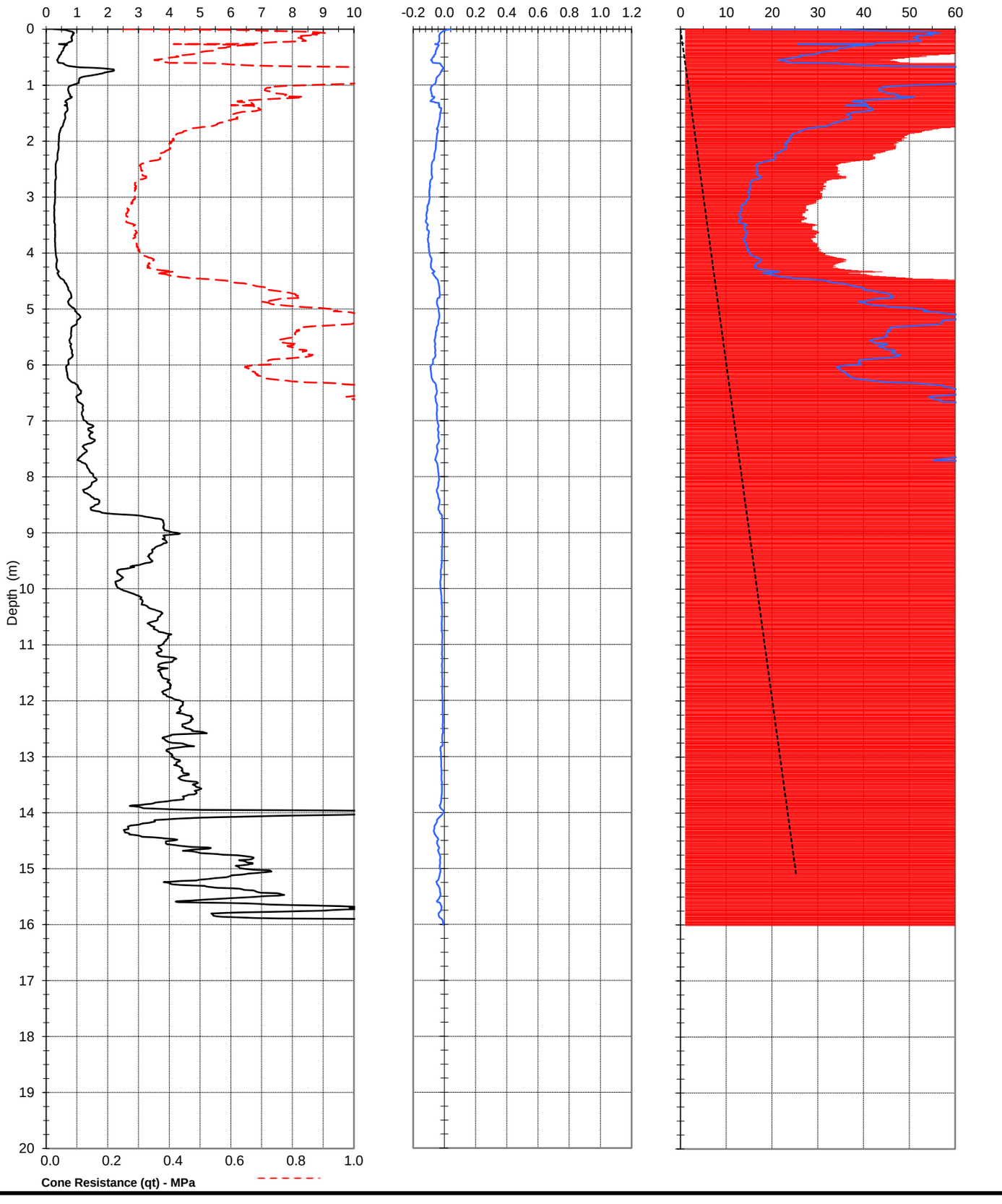


Coffey Geotechnics Pty Ltd

Piezocone Penetrometer Test

Client:		Test No.:	PCY-CPT02
Principal:		Sheet:	1 of 1
Project:	*Macksville Hospital*	Project No.	*RGS31237.1*
Location:		Date tested :	*10-Feb-15*
		Tested by:	*IGS*

Cone Type: Geotech Piezocone	Easting: 9506 m	Elevation: 1.52 m AHD
	Northing: 172692 m	Depth to GW Table: .0m Estimated

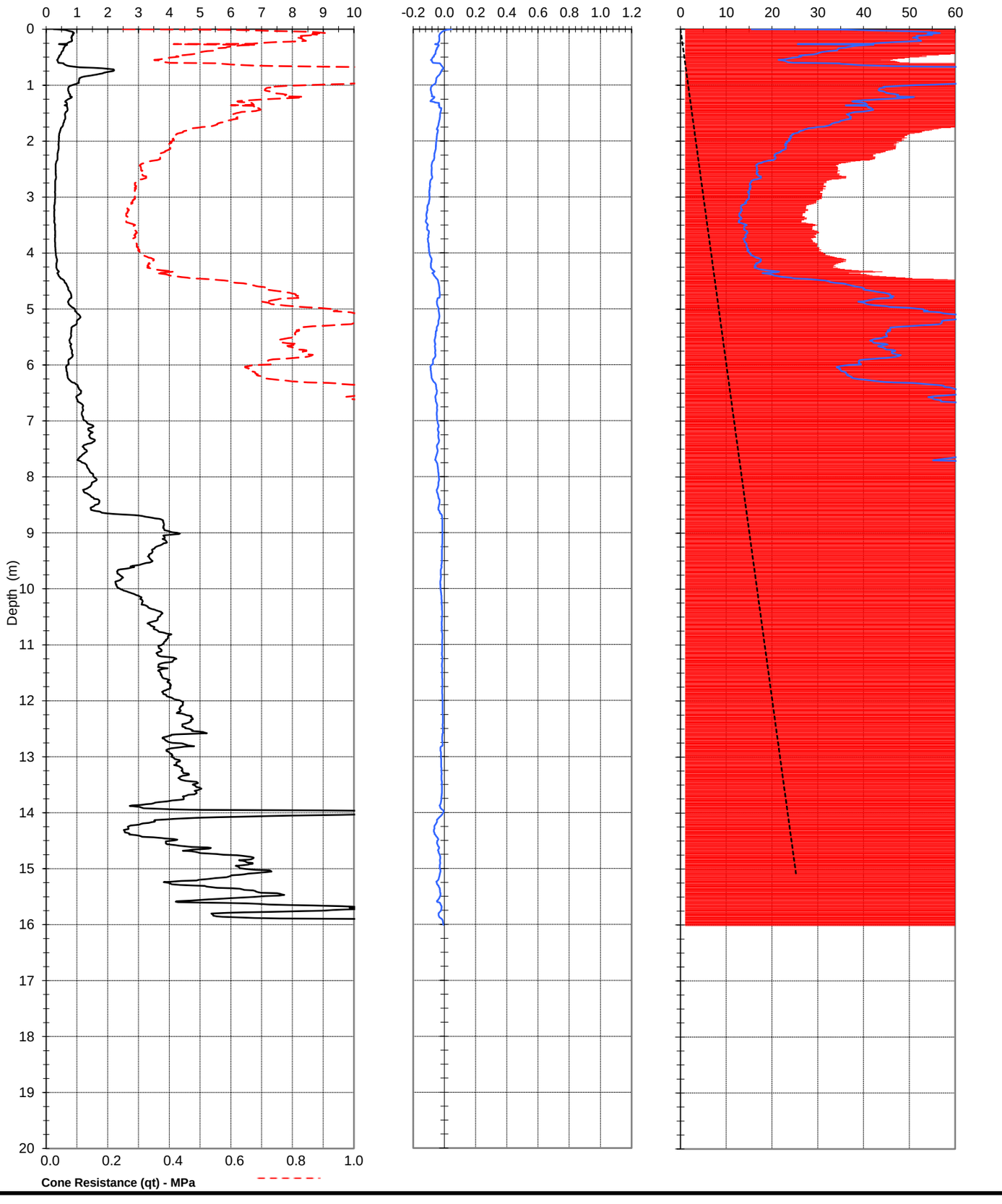


Coffey Geotechnics Pty Ltd

Piezocone Penetrometer Test

Client:		Test No.:	PCY-CPT03
Principal:		Sheet:	1 of 1
Project:	*Macksville Hospital*	Project No.	*RGS31237.1*
Location:		Date tested :	*10-Feb-15*
		Tested by:	*IGS*

Cone Type: Geotech Piezocone	Easting: 9506 m	Elevation: 1.52 m AHD
	Northing: 172692 m	Depth to GW Table: .0m Estimated



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH1

CLIENT: NSW Health
PAGE: 1 of 2
PROJECT NAME: Proposed New Hospital
JOB NO: RGS31237.1
SITE LOCATION: Precast Yard
LOGGED BY: DR
TEST LOCATION: As per GPS
DATE: 20/9/17

DRILL TYPE: P160 **EASTING:** 494536 m **SURFACE RL:**
BOREHOLE DIAMETER: 125 mm **INCLINATION:** 90° **NORTHING:** 6604089 m **DATUM:** WG584

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD						GW	**FILL:** Sandy GRAVEL, dark grey, brown, 40mm or similar	D				FILL
							0.70m					
RR		1.00m SPT 3,4,30/50 N=R 1.35m		1.0		GP	**FILL:** GRAVEL, fine to coarse grained, brown			HP	350	FILL - Building layer Rockfill
				2.0			2.30m					
	▶	2.50m SPT 2,9,3 N=12 2.95m				OH	**Clayey SILT:** Low plasticity, dark brown, trace of fine Sand	M > w_P	F	HP	120	ALLUVIUM
							2.80m					
				3.0		CH	**Silty CLAY:** Low plasticity, pale grey	M ~ w_P	St / VSt	HP	350	
		4.00m SPT 4,4,7 N=11 4.45m		4.0					VSt	HP	350	
				5.0								
		5.50m SPT 2,3,3 N=6 5.95m		6.0			6.00m					
						ML	**Clayey SILT:** Low to medium plasticity, pale grey	W	S			
		7.00m SPT 1,0,2 N=2 7.45m		7.0						HP	35	SPT falling with rod weight and hammer.
										HP	30	Minium return
				8.0			8.00m					
						CL	**Silty CLAY:** Low to medium plasticity, pale grey and brown mottle		St			RESIDUAL SOIL
		8.50m SPT 6,8,11 N=19 8.95m		9.0								HP = 250-300 kPa
		10.00m										

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

REGIONAL GEOTECHNICAL SOLUTIONS

BOREHOLE NO: BH1
PAGE: 2 of 2
CLIENT: NSW Health
JOB NO: RGS31237.1
PROJECT NAME: Proposed New Hospital
LOGGED BY: DR
SITE LOCATION: Precast Yard
DATE: 20/9/17
TEST LOCATION: As per GPS

DRILL TYPE: P160 **EASTING:** 494536 m **SURFACE RL:**
BORE HOLE DIAMETER: 125 mm **INCLINATION:** 90° **NORTHING:** 6604089 m **DATUM:** WG584

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
RR		SPT 8,10,11 N=21 10.45m				CL	**Silty CLAY:** Low to medium plasticity, pale grey and brown mottle *(continued)*	W	St			RESIDUAL SOIL
				11.0								HP = 200-280 kPa
		11.50m SPT 6,11,14 N=25 11.95m					Trace of relic rock structure		St / VSt			HP = 300-350 kPa
		13.00m SPT 2,3,4 N=7 13.45m		12.0 13.0			Grey		VSt			Drilling reported increase in resistance
		14.50m SPT 8,10,12 N=22 14.95m		14.0 15.0			Trace of relic rock structure			HP	300	HP = 450-550 kPa
		16.00m SPT 5,10,14 N=24 16.45m		16.0 17.0			Trace quartz Gravel (fine) and relic rock structure		VSt / H			HP = 300-500 kPa
		17.50m SPT 11,20,26 N=46 17.95m		18.0			17.50m **META SILTSTONE:** Green, grey, foliated, some parts weathered to Clay		Fb			EXTREMELY WEATHERED PHYLLITE
		19.00m SPT 20,30/100 N=R 19.25m		19.0			Increase in resistance 19.26m Hole Terminated at 19.25 m			HP	300	

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

REGIONAL GEOTECHNICAL SOLUTIONS

BOREHOLE NO: BH2

CLIENT: NSW Health | **PAGE:** 1 of 2

PROJECT NAME: Proposed New Hospital | **JOB NO:** RGS31237.1

SITE LOCATION: Precast Yard | **LOGGED BY:** DR

TEST LOCATION: As per GPS | **DATE:** 21/9/17

DRILL TYPE: P160 | **EASTING:** | **SURFACE RL:**

BOREHOLE DIAMETER: 125 mm | **INCLINATION:** 90° | **NORTHING:** | **DATUM:** WG584

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD	Not Encountered						**FILL:** Sandy GRAVE, dark grey, brown, 40mm material or similar	D				FILL
						CL	0.30m **FILL:** Sandy Silty CLAY, low plasticity, pale grey and brown, some Gravel	M				
		1.00m SPT 1,0,1 N=1 1.45m		1.0								
				2.0			2.00m					
RR						GP	**FILL:** GRAVEL, medium to coarse grained, brown	D				FILL Building layer Rockfill
				3.0			3.50m					
						ML	**Clayey SILT:** Low plasticity, dark brown	M	St			ALLUVIUM
		4.00m SPT 3,3,4 N=7 4.45m		4.0						HP	100	
				5.0			5.30m					
		5.50m SPT 0,0,0 N=0 5.95m		6.0		CL	**CLAY:** Medium plasticity, dark grey	M > w_P	S	HP	35	SPT falling on rod weight only
		7.00m SPT 0,0,0 N=0 7.45m		7.0						HP	30	SPT falling with rod and hammer weight only
				8.0			8.00m					
		8.50m SPT 0,3,3 N=6 8.95m		9.0		CL	**CLAY:** Medium plasticity, pale grey	M < w_P	St / VSt			
	Not Encountered	10.00m										

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

REGIONAL GEOTECHNICAL SOLUTIONS

BOREHOLE NO: BH2
PAGE: 2 of 2
JOB NO: RGS31237.1
LOGGED BY: DR
DATE: 21/9/17

CLIENT: NSW Health
PROJECT NAME: Proposed New Hospital
SITE LOCATION: Precast Yard
TEST LOCATION: As per GPS

DRILL TYPE: P160 **EASTING:** **SURFACE RL:**
BOREHOLE DIAMETER: 125 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** WG584

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
RR		SPT 2,4,4 N=8 10.45m				CL	**CLAY:** Medium plasticity, pale grey *(continued)*	M < w_P	St / VSt	HP	200	ALLUVIUM
				11.0								RESIDUAL SOIL
		11.50m SPT 2,2,4 N=6 11.95m					Becoming green/grey					HP = 100-120 kPa
		13.00m		12.0								
		SPT 14,7,10 N=17 13.45m		13.0			Some relic rock structure, fine angular, fine to medium quartz Gravel					HP = 120-200 kPa
		14.50m		14.0						HP	200	
		SPT 6,10,11 N=21 14.95m		15.0			Quartz and relic rock structure present, Clay has shell in some parts					
		16.00m SPT 7,9,11 N=20 16.45m		16.0			16.00m **META SILTSTONE:** Extremely weathered, trace foliations relic rock structure throughout, pale grey to brown		Fb			EXTREMELY WEATHERED META SILTSTONE HP = 100-200 kPa
		17.50m SPT 16,25,30/100 N=R		17.0								
				18.0						HP	300	
		19.00m SPT 30/130 N=R		19.0			19.13m					HP = 300-600 kPa
							Hole Terminated at 19.13 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT: NSW Health
PROJECT NAME: Proposed Hospital
SITE LOCATION:
TEST LOCATION: UTM56J

TEST PIT NO: TP01
PAGE: 1 of 1
JOB NO: RGS31237.1
LOGGED BY: MR
DATE: 18/10/17

EQUIPMENT TYPE: 5T Excavator
TEST PIT LENGTH: 2.5 m **WIDTH:** 0.5 m
EASTING: 494568 m **NORTHING:** 6604287 m
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
0.45m TOOTH BUCKET	Not Encountered	B		0.5		CL	**FILL:** Gravelly Silty CLAY, medium to low plasticity, pale grey and pale yellow/pale brown	M				FILL (Ripped and recompacted Phyllite)
		0.90m					0.90m					
				1.0		CL	**FILL:** Gravelly CLAY, medium plasticity, red/brown	M	H			FILL
		1.20m					1.20m					
		B				CL	**CLAY:** Medium plasticity, pale brown					RESIDUAL SOIL
		1.50m		1.5			1.50m					
					≈≈≈		**Extremely Weathered PHYLLITE:** Pale brown/pale grey, very low strength	M < w_P				EXTREMELY WEATHERED PHYLLITE
							1.80m					
							Hole Terminated at 1.80 m					
				2.0								
				2.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT: NSW Health
PROJECT NAME: Proposed Hospital
SITE LOCATION:
TEST LOCATION: UTM56J

TEST PIT NO: TP02
PAGE: 1 of 1
JOB NO: RGS31237.1
LOGGED BY: MR
DATE: 18/10/17

EQUIPMENT TYPE: 5T Excavator
TEST PIT LENGTH: 2.5 m **WIDTH:** 0.5 m
EASTING: 494577 m **NORTHING:** 6604316 m
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
0.45m TOOTH BUCKET	Not Encountered					GW	**FILL:** Sandy GRAVEL, fine to medium grained, brown	M	VD			FILL: Existing unsealed pavement
							0.20m					
						CL	**FILL:** CLAY, medium plasticity, brown, orange/brown and pale grey	M < w_P	VSt			FILL HP=200-240kPa
				0.5								
							0.80m					
						CL	**FILL:** CLAY, medium plasticity, brown and dark brown	M < w_P	VSt			FILL HP=210-240kPa
				1.0								
		1.40m					1.40m					
						CL	**CLAY:** Medium plasticity, orange/brown	M < w_P	VSt			RESIDUAL SOIL
		BS		1.5						HP	260	
		1.75m										
				2.0			2.00m					
							Hole Terminated at 2.00 m					
				2.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT: NSW Health
PROJECT NAME: Proposed Hospital
SITE LOCATION:
TEST LOCATION: UTM56J

TEST PIT NO: TP03
PAGE: 1 of 1
JOB NO: RGS31237.1
LOGGED BY: MR
DATE: 18/10/17

EQUIPMENT TYPE: 5T Excavator
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
EASTING: 494558 m **NORTHING:** 6604452 m
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
0.45m TOOTH BUCKET	Not Encountered			0.5		CL	**CLAY:** Medium plasticity, brown	M < w_P	H	HP	500	RESIDUAL SOIL
				1.0		CL	0.80m **CLAY:** Medium plasticity, pale grey and orange/brown mottle	M < w_P	H	HP	550	
		1.40m BS 1.70m		1.5			1.20m **Extremely Weathered PHYLLITE:** Pale grey with orange/brown and yellow iron oxide staining, estimated very low strength 1.75m		Fb			EXTREMELY WEATHERED PHYLLITE
				2.0			Hole Terminated at 1.75 m					
				2.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT: NSW Health
PROJECT NAME: Proposed Hospital
SITE LOCATION:
TEST LOCATION: UTM56J

TEST PIT NO: TP04
PAGE: 1 of 1
JOB NO: RGS31237.1
LOGGED BY: MR
DATE: 18/10/17

EQUIPMENT TYPE: 5T Excavator
TEST PIT LENGTH: 3.0 m **WIDTH:** 0.5 m
EASTING: 494638 m **NORTHING:** 6604438 m
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
0.45m TOOTH BUCKET	Not Encountered			0.5		CL	**FILL:** Silty CLAY, medium plasticity, brown to dark brown, (organic roots throughout)	M	H			FILL
				1.0		CL	**Silty CLAY:** Medium plasticity, orange/brown, trace of Gravel	M < w_P	H	HP	550	SLOPE WASH
				1.5								
				2.0			Hole Terminated at 2.00 m					
				2.5								

0.90m
2.00m

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

TEST PIT NO: TP05
CLIENT: NSW Health
PAGE: 1 of 1
PROJECT NAME: Proposed Hospital
JOB NO: RGS31237.1
SITE LOCATION:
LOGGED BY: MR
TEST LOCATION: UTM56J
DATE: 18/10/17

EQUIPMENT TYPE: 5T Excavator
EASTING: 494609 m
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.5 m
NORTHING: 6604371 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
0.45m TOOTH BUCKET	Not Encountered					GW	**FILL:** Sandy GRAVEL, fine to medium grained, brown/grey	M	VD			FILL
		0.40m					0.40m					
		BS		0.5		CL	**Silty CLAY:** Medium plasticity, orange/brown	M < w_P	VSt	HP	250	RESIDUAL SOIL
		0.85m										
				1.0				M < w_P	H	HP	450	
				1.5			1.50m					
							Hole Terminated at 1.50 m					
				2.0								
				2.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT: NSW Health
PROJECT NAME: Proposed Hospital
SITE LOCATION:
TEST LOCATION: UTM56J

TEST PIT NO: TP06
PAGE: 1 of 1
JOB NO: RGS31237.1
LOGGED BY: MR
DATE: 18/10/17

EQUIPMENT TYPE: 5T Excavator
TEST PIT LENGTH: 3.0 m **WIDTH:** 0.5 m
EASTING: 494537 m **NORTHING:** 6604355 m
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
0.45m TOOTH BUCKET	Not Encountered					GW	**FILL:** Sandy GRAVEL, fine to medium grained, brown	M	D			FILL
							0.20m					
						CL	**Silty CLAY:** Medium plasticity, orange/brown-red brown	M < w_P	H			RESIDUAL SOIL
				0.5						HP	400	
				1.0								
				1.5			Becoming red brown with yellow mottle					
										HP	600	
				2.0			2.00m					
							Hole Terminated at 2.00 m					
				2.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT: NSW Health
PROJECT NAME: Proposed Hospital
SITE LOCATION:
TEST LOCATION: UTM56J

TEST PIT NO: TP07
PAGE: 1 of 1
JOB NO: RGS31237.1
LOGGED BY: MR
DATE: 18/10/17

EQUIPMENT TYPE: 5T Excavator
TEST PIT LENGTH: 3.0 m **WIDTH:** 0.5 m
EASTING: 494672 m **NORTHING:** 6604294 m
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
0.45m TOOTH BUCKET	Not Encountered					GW	**FILL:** Sandy GRAVEL, fine to medium grained, brown	M	VD			FILL: Existing unsealed pavement
							0.20m					
						CL	**FILL:** Silty CLAY, Medium plasticity, pale yellow/pale brown	M < w_P	VSt			FILL
				0.5								
							0.70m					
						GC	**Clayey GRAVEL:** Fine to medium grained, pale brown	M	VD			FILL
							0.90m					
						CL	**CLAY:** Medium plasticity, orange/brown	M < w_P	VSt			RESIDUAL SOIL
				1.0						HP	20	
				1.5			Becoming pale grey and orange/brown mottle	M < w_P	H	HP	400	
		1.80m					1.80m					
		BS					**Extremely Weathered PHYLLITE:** Pale grey and orange/brown, estimated very low strength		Fb			EXTREMELY WEATHERED PHYLLITE
		2.00m		2.0			2.00m					
							Hole Terminated at 2.00 m					
				2.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT: NSW Health
PROJECT NAME: Proposed Hospital
SITE LOCATION:
TEST LOCATION: UTM56J

TEST PIT NO: TP08
PAGE: 1 of 1
JOB NO: RGS31237.1
LOGGED BY: MR
DATE: 18/10/17

EQUIPMENT TYPE: 5T Excavator
TEST PIT LENGTH: 3.0 m **WIDTH:** 0.5 m
EASTING: 494674 m **NORTHING:** 6604242 m
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
0.45m TOOTH BUCKET	Not Encountered					GW	**FILL:** Sandy GRAVEL, fine to medium grained, brown	M	VD			FILL
							0.20m					
						CL	**FILL:** Gravelly CLAY, medium plasticity, pale grey and brown/orange	M < w_P	VSt			FILL (Reworked Extremely Weathered PHYLLITE)
				0.5						HP	250	
		0.90m					0.90m					
		BS		1.0		CL	**Silty CLAY:** Medium plasticity, orange/brown	M < w_P	VSt / H			RESIDUAL SOIL HP=250-450kPa
		1.50m		1.5								
				2.0			2.00m					
							Hole Terminated at 2.00 m					
				2.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT: NSW Health
PROJECT NAME: Proposed Hospital
SITE LOCATION:
TEST LOCATION: UTM56J

TEST PIT NO: TP09
PAGE: 1 of 1
JOB NO: RGS31237.1
LOGGED BY: MR
DATE: 18/10/17

EQUIPMENT TYPE: 5T Excavator
TEST PIT LENGTH: 2.5 m **WIDTH:** 0.5 m
EASTING: 494725 m **NORTHING:** 6603629 m
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
0.45m TOOTH BUCKET	Not Encountered					ML	**TOPSOIL:** SILT, low plasticity, dark brown, trace organics	M	St			TOPSOIL
							0.20m					
						CL	**Silty CLAY:** Medium plasticity, orange/brown	M > w_P	VSt			RESIDUAL SOIL
				0.5						HP	250	
				1.0			Becoming pale grey with orange and yellow mottle					
										HP	350	
				1.5			1.60m					
							Hole Terminated at 1.60 m					
				2.0								
				2.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP10

CLIENT: NSW Health | **PAGE:** 1 of 1

PROJECT NAME: Proposed Hospital | **JOB NO:** RGS31237.1

SITE LOCATION: | **LOGGED BY:** MR

TEST LOCATION: UTM56J | **DATE:** 18/10/17

EQUIPMENT TYPE: 5T Excavator | **EASTING:** 494750 m | **SURFACE RL:**

TEST PIT LENGTH: 2.5 m | **WIDTH:** 0.5 m | **NORTHING:** 6603718 m | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
0.45m TOOTH BUCKET	Not Encountered	0.30m				ML	**TOPSOIL:** SILT, low plasticity, dark brown, some organics	M	St			TOPSOIL
							0.30m			HP	160	
		BS		0.5		CL	**Silty CLAY:** Medium plasticity, orange/brown	M > w_P	VSt			RESIDUAL SOIL
		0.75m								HP	250	
				1.0			Becoming pale grey/pale yellow with orange/brown mottle					
				1.5			1.80m					
							Hole Terminated at 1.80 m					
				2.0								
				2.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT: NSW Health
PROJECT NAME: Proposed Hospital
SITE LOCATION:
TEST LOCATION: UTM56J

TEST PIT NO: TP11
PAGE: 1 of 1
JOB NO: RGS31237.1
LOGGED BY: MR
DATE: 18/10/17

EQUIPMENT TYPE: 5T Excavator
TEST PIT LENGTH: 2.9 m **WIDTH:** 0.5 m
EASTING: 494788 m **NORTHING:** 6603749 m
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
0.45m TOOTH BUCKET	Not Encountered					ML	**TOPSOIL:** SILT, low plasticity, dark brown, some roots, some quartz Gravel	M	St	HP	160	TOPSOIL
							0.20m					
						CL	**Silty CLAY:** Medium plasticity, orange, brown, some quartz Gravel	$M > w_P$	VSt			RESIDUAL SOIL
				0.5								
				1.0			1.00m					
							Extremely Weathered PHYLLITE: Pale grey with yellow/brown, iron oxide staining, estimated very low strength, some quartz lenses throughout	M	Fb			EXTREMELY WEATHERED PHYLLITE Excavates as Sandy GRAVEL
				1.5			1.90m					
							Hole Terminated at 1.90 m					
				2.0								
				2.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT: NSW Health
PROJECT NAME: Proposed Hospital
SITE LOCATION:
TEST LOCATION: UTM56J

TEST PIT NO: TP12
PAGE: 1 of 1
JOB NO: RGS31237.1
LOGGED BY: MR
DATE: 18/10/17

EQUIPMENT TYPE: 5T Excavator
TEST PIT LENGTH: 3.0 m **WIDTH:** 0.5 m
EASTING: 494955 m **NORTHING:** 6603665 m
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
0.45m TOOTH BUCKET	Not Encountered					ML	**TOPSOIL:** SILT, low plasticity, dark brown, some quartz Gravel	M	St	HP	135	TOPSOIL
							0.25m					
						CL	**Silty CLAY:** Medium plasticity, orange/brown	M > w_P	VSt			RESIDUAL SOIL
				0.5						HP	250	
				1.0								
				1.5			Becoming pale grey with orange/brown mottle			HP	350	
				2.0			2.00m					
							Hole Terminated at 2.00 m					
				2.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT: NSW Health
PROJECT NAME: Proposed Hospital
SITE LOCATION:
TEST LOCATION: UTM56J

TEST PIT NO: TP13
PAGE: 1 of 1
JOB NO: RGS31237.1
LOGGED BY: MR
DATE: 18/10/17

EQUIPMENT TYPE: 5T Excavator
TEST PIT LENGTH: 3.0 m **WIDTH:** 0.5 m
EASTING: 494841 m **NORTHING:** 6603691 m
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
0.45m TOOTH BUCKET	Not Encountered					ML	**TOPSOIL:** SILT, low plasticity, dark brown, some organics and Gravel	M	St	HP	120	TOPSOIL
							0.25m					
						CL	**Silty CLAY:** Medium plasticity, orange/brown, some quartz Gravel throughout	M > w_P				RESIDUAL SOIL
		0.50m		0.5								
		BS										
		0.80m										
				1.0								
							1.40m					
				1.5			**Extremely to Highly Weathered PHYLLITE:** Yellow with orange/brown and pale grey, estimated very low strength, some quartz		Fb			EXTREMELY TO HIGHLY WEATHERED PHYLLITE
							1.80m					
							Hole Terminated at 1.80 m					
				2.0								
				2.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT: NSW Health
PROJECT NAME: Proposed Hospital
SITE LOCATION:
TEST LOCATION: UTM56J

TEST PIT NO: TP14
PAGE: 1 of 1
JOB NO: RGS31237.1
LOGGED BY: MR
DATE: 18/10/17

EQUIPMENT TYPE: 5T Excavator
TEST PIT LENGTH: 2.8 m **WIDTH:** 0.5 m
EASTING: 494813 m **NORTHING:** 6603652 m
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
0.45m TOOTH BUCKET	Not Encountered					ML	**TOPSOIL:** SILT, low plasticity, dark brown, (trace of roots), trace Gravel	M	St	HP	140	TOPSOIL
							0.20m					
						CL	**Silty CLAY:** Medium plasticity, orange/brown, some quartz Gravel throughout	M > w_P	St			RESIDUAL SOIL HP=180-200kPa
				0.5								
				1.0								
							1.40m					
				1.5			**Extremely to Highly Weathered PHYLLITE:** Pale red and yellow/orange, iron oxide stain, estimated very low strength					EXTREMELY TO HIGHLY WEATHERED PHYLLITE
							1.80m					
							Hole Terminated at 1.80 m					
				2.0								
				2.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Appendix B
Investigation Logs

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH4

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Macksville Hospital Redevelopment
JOB NO: RGS31237.1
SITE LOCATION: Macksville
LOGGED BY: LD
TEST LOCATION: Refer to figure 1
DATE: 3/4/18

DRILL TYPE: Truck Mounted (NCR Rig 7)
EASTING: 494619 m
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
INCLINATION: 90°
NORTHING: 6604358 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/TC	Not Encountered					ML	**TOPSOIL:** Clayey SILT, low plasticity, dark grey		St			TOPSOIL
							0.70m					
						CL	**Silty CLAY:** Medium plasticity, red-brown	$M < w_P$				RESIDUAL SOIL
		1.00m		1.0						HP	100	
		SPT 2,3,5 N=8								HP	150	
		1.45m							St	HP	160	
				2.0						HP	200	
							2.30m					
		2.50m				CL	**Silty CLAY:** Medium plasticity, pale brown, pale grey, red	$M < w_P$	VSt			EXTREMELY WEATHERED PHYLLITE
		SPT 3,6,8 N=14		3.0								
		2.95m										
							3.30m					
						CL	**Silty CLAY:** Medium plasticity, pale brown, pale grey, with some fine angular quartz Gravel					
		4.00m		4.0			4.00m					
		SPT 4,10,18 N=28				CL	**Silty CLAY:** Medium plasticity, pale grey, pale brown			HP	280	
		4.45m										
				5.0				M	Fb			
		5.50m										
		SPT 14,25/130 N=R					5.78m					
		5.80m					Hole Terminated at 5.78 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

REGIONAL GEOTECHNICAL SOLUTIONS

BOREHOLE NO: BH5

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Macksville Hospital Redevelopment
JOB NO: RGS31237.1
SITE LOCATION: Macksville
LOGGED BY: LD
TEST LOCATION: Refer to figure 1
DATE: 3/4/18

DRILL TYPE: Truck Mounted (NCR Rig 7)
EASTING: 494652 m
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
INCLINATION: 90°
NORTHING: 6604265 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/TC	Not Encountered					GC	**FILL:** Clayey GRAVEL, fine to medium grained, brown, angular Gravel	D	MD			FILL
								M < w_P				
							0.80m					
		1.00m		1.0		ML CL	0.90m **TOPSOIL:** Clayey SILT, medium plasticity, dark brown **Silty CLAY:** Medium plasticity, mottled red, brown, grey	M < w_P	F St	HP	180	OLD TOPSOIL RESIDUAL SOIL
		SPT 2,3,4 N=7										
		1.50m 1.45m										
		B										
		2.00m		2.0						HP	170	
		2.50m										
		SPT 2,5,14 N=19					2.60m					
		2.95m		3.0		CL	**Silty CLAY:** Medium plasticity, pale brown, pale grey	M < w_P	VSt / Fb			EXTREMELY WEATHERED PHYLLITE
		4.00m		4.0					H / Fb			
		SPT 13,22/50 N=R										
		4.30m										
				5.0								
		5.50m SPT 25/100 N=R					5.60m					
							Hole Terminated at 5.60 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH6

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Macksville Hospital Redevelopment
JOB NO: RGS31237.1
SITE LOCATION: Macksville
LOGGED BY: LD
TEST LOCATION: Refer to figure 1
DATE: 3/4/18

DRILL TYPE: Truck Mounted (NCR Rig 7) **EASTING:** 494531 m **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** 6604294 m **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/TC	Not Encountered					GP	0.10m **FILL:** GRAVEL, fine to medium grained, grey	D				FILL
						GW	**FILL:** Clayey Sandy GRAVEL, fine grained, dark grey, angular Gravel					
							0.70m					
		1.00m		1.0		CL	**Silty CLAY:** Medium plasticity, brown, with some fine angular Gravel	M < w_P	St / VSt			RESIDUAL SOIL
		SPT 7,14,15 N=29										
		1.45m										
				2.0			2.00m					
						CL	**Silty CLAY:** Medium plasticity, pale brown, pale grey	M < w_P	H / Fb			EXTREMELY WEATHERED PHYLLITE
		2.50m										
		SPT 16,27/90 N=R										
		2.65m		3.0								
		4.00m		4.0			4.00m					
		SPT 7,16,21 N=37					**Silty CLAY:** Medium plasticity, pale brown, pale grey, with some fine to medium angular quartz Gravel					
		4.45m										
				5.0								
		5.50m										
		SPT 12,30/110 N=R					5.76m					
		5.65m					Hole Terminated at 5.76 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

REGIONAL GEOTECHNICAL SOLUTIONS

BOREHOLE NO: BH7

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Macksville Hospital Redevelopment
JOB NO: RGS31237.1
SITE LOCATION: Macksville
LOGGED BY: LD
TEST LOCATION: Refer to figure 1
DATE: 3/4/18

DRILL TYPE: Truck Mounted (NCR Rig 7)
EASTING: 494613 m
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
INCLINATION: 90°
NORTHING: 6604286 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/TC	Not Encountered	SPT 30/70 N=R at 1.00m		1.0		CL	0.03m **FILL:** Clayey GRAVEL, fine to medium grained, pale brown, grey, angular Gravel **Silty CLAY:** Medium plasticity, pale brown	D M < w_P	H			FILL FILL
						CL	0.70m **FILL:** Gravelly CLAY, medium plasticity, pale brown, fine to medium angular Gravel	M < w_P				
						GC	1.00m **FILL:** Clayey GRAVEL, fine to coarse grained, dark grey, angular Gravel					
		1.50m B 2.00m		2.0		CL	1.30m **Silty CLAY:** Medium plasticity, brown	M < w_P	St / VSt			RESIDUAL SOIL
		2.50m SPT 4,10,21 N=31 2.95m		3.0		CL	2.30m **Silty CLAY:** Medium plasticity, pale grey, pale brown	M < w_P	H / Fb	HP	200	EXTREMELY WEATHERED PHYLLITE
		3.50m SPT 8,25 N=25/150mm 3.80m 4.00m		4.0			4.00m **Clayey SILT:** Medium plasticity, brown, pale brown, pale grey			HP	270	
		SPT 8,25,25/80 N=R 4.45m		5.0			5.88m Hole Terminated at 5.88 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH8

CLIENT: Health Infrastructure
PAGE: 1 of 2
PROJECT NAME: Macksville Hospital Redevelopment
JOB NO: RGS31237.1
SITE LOCATION: Macksville
LOGGED BY: LD
TEST LOCATION: Refer to figure 1
DATE: 4/4/18

DRILL TYPE: Truck Mounted (NCR Rig 7) **EASTING:** 494548 m **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** 6604105 m **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/TC	Not Encountered	0.50m				GW	**FILL:** Sandy GRAVEL, fine to medium grained, brown, angular Gravel	D				FILL
		SPT 3,6,5 N=11					0.50m					
		1.00m		1.0		CL	**FILL:** Silty CLAY, medium plasticity, pale brown, pale grey, with some fine to medium angular Gravel	M < w_P	F / St			
		0.95m					1.20m					
		SPT 3,13,18 N=31				GP	**FILL:** GRAVEL, fine to coarse grained, dark grey					GEOFAB - DRAINAGE LAYER ROCK FILL
WB-RR		1.45m					1.80m					
		2.00m		2.0		CH	**Silty CLAY:** High plasticity, dark grey, with rootlets	M > w_P	F	HP	100	GEOFAB - ALLUVIAL
		SPT 2,1,3 N=4								HP	90	
		2.45m										
				3.0			3.40m					
		3.50m				CH	**Silty CLAY:** Medium to high plasticity, pale grey, pale brown	M > w_P	F			
		SPT 3,5,6 N=11										
		3.95m		4.0			4.20m					
						ML	**Clayey SILT:** Low plasticity, grey, pale brown, with some medium grained Gravel		F			
		5.00m		5.0					S			
		SPT 1,0,1 N=1							VS	HP	0	
							5.40m			HP	10	
	Not Encountered	5.45m				ML	**Clayey SILT:** Low plasticity, dark grey					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH8

CLIENT: Health Infrastructure
PAGE: 2 of 2
PROJECT NAME: Macksville Hospital Redevelopment
JOB NO: RGS31237.1
SITE LOCATION: Macksville
LOGGED BY: LD
TEST LOCATION: Refer to figure 1
DATE: 4/4/18

DRILL TYPE: Truck Mounted (NCR Rig 7) **EASTING:** 494548 m **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** 6604105 m **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
WB-RR		6.50m				ML	**Clayey SILT:** Low plasticity, dark grey *(continued)*	M > w_P	VS			GEOFAB - ALLUVIAL
							6.50m					
		SPT 0,0,2 N=2				ML	**Clayey SILT:** Low plasticity, pale grey, grey					
		6.95m		7.0					S / F	HP	50	HP = 70-100kPa
							7.30m					
						ML	**Clayey SILT:** Low plasticity, grey, pale brown, with some fine grained Sand					
		8.00m		8.0						HP	60	
		SPT 1,3,4 N=7								HP	70	
		8.45m										
				9.0			9.00m					
						ML	**Clayey SILT:** Low plasticity, grey	M < w_P	VSt			RESIDUAL SOIL
		9.50m								HP	270	
		SPT 5,8,10 N=18								HP	300	
		9.95m		10.0						HP	300	
		11.00m		11.0						HP	140	
		SPT 8,7,10 N=17								HP	160	
							11.45m			HP	220	
		11.45m					Hole Terminated at 11.45 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

REGIONAL GEOTECHNICAL SOLUTIONS

BOREHOLE NO: BH9

CLIENT: Health Infrastructure | **PAGE:** 1 of 3

PROJECT NAME: Macksville Hospital Redevelopment | **JOB NO:** RGS31237.1

SITE LOCATION: Macksville | **LOGGED BY:** LD

TEST LOCATION: Refer to figure 1 | **DATE:** 4/4/18

DRILL TYPE: Truck Mounted (NCR Rig 7) **EASTING:** 494544 m **SURFACE RL:**

BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** 6603988 m **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/TC	Not Encountered					GP	0.10m **FILL:** GRAVEL, fine to medium grained, dark grey, angular	D	L			FILL
						CL	**FILL:** Silty CLAY, medium plasticity, brown	M < w_P	St			
		1.00m		1.0								
		SPT 2,3,7 N=10										
		1.45m										
							1.70m					
						GP	**FILL:** GRAVEL, fine to coarse grained, dark grey	D	D			GEOFAB - DRAINAGE LAYER ROCK FILL
				2.0								
							2.40m					
		2.50m				CL	**FILL:** Silty CLAY, medium plasticity, pale brown, pale grey, with some fine to medium angular Gravel		St			FILL
		SPT 3,4,3 N=7										
		3.00m 2.95m		3.0								
		SPT 2,5,7 N=12										
		3.45m										
		4.00m		4.0								
		SPT 2,1,2 N=3										
		4.45m										
				5.0			5.00m					
						ML	**Clayey SILT:** Low plasticity, dark grey, with some fine grained Sand	M > w_P	St			ALLUVIAL
		5.40m										
		5.50m								HP	120	
	Not Encountered	DS										
		SPT 1,2,2 N=4										

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH9

CLIENT: Health Infrastructure
PAGE: 2 of 3
PROJECT NAME: Macksville Hospital Redevelopment
JOB NO: RGS31237.1
SITE LOCATION: Macksville
LOGGED BY: LD
TEST LOCATION: Refer to figure 1
DATE: 4/4/18

DRILL TYPE: Truck Mounted (NCR Rig 7) **EASTING:** 494544 m **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** 6603988 m **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/TC		5.95m				ML	**Clayey SILT:** Low plasticity, dark grey, with some fine grained Sand *(continued)*	M > w_P	St			ALLUVIAL
							6.80m					
		7.00m		7.0		CH	**Silty CLAY:** Medium to high plasticity, grey					
		SPT 2,5,6 N=11										
		7.45m										
				8.0								
		8.50m										
		SPT 2,3,5 N=8										
		8.95m		9.0						HP	120	
		10.00m		10.0						HP	60	
		SPT 2,4,6 N=10								HP	80	
		10.45m								HP	80	
				11.0			11.00m					
	Not encountered					CH	**Silty CLAY:** Medium to high plasticity, pale grey, pale brown, with some fine grained Sand to some fine angular Gravel	M < w_P	St			RESIDUAL SOIL
		11.50m										
		SPT 3,5,10 N=15								HP	100	
										HP	140	

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH9

CLIENT: Health Infrastructure
PAGE: 3 of 3
PROJECT NAME: Macksville Hospital Redevelopment
JOB NO: RGS31237.1
SITE LOCATION: Macksville
LOGGED BY: LD
TEST LOCATION: Refer to figure 1
DATE: 4/4/18

DRILL TYPE: Truck Mounted (NCR Rig 7) **EASTING:** 494544 m **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** 6603988 m **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/TC		11.95m				CH	**Silty CLAY:** Medium to high plasticity, pale grey, pale brown, with some fine grained Sand to some fine angular Gravel *(continued)*	M < w_P	St			RESIDUAL SOIL
		13.00m SPT 5,8,9 N=17		13.0			13.45m			HP HP	100 110	
		13.45m					Hole Terminated at 13.45 m					
				14.0								
				15.0								
				16.0								
				17.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH10**

CLIENT: Health Infrastructure
PAGE: 1 of 2
PROJECT NAME: Macksville Hospital Redevelopment
JOB NO: RGS31237.1
SITE LOCATION: Macksville
LOGGED BY: LD
TEST LOCATION: Refer to figure 1
DATE: 5/4/18

DRILL TYPE: Truck Mounted (NCR Rig 7) **EASTING:** 494546 m **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** 6603852 m **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/TC		0.60m				CL	**FILL:** Silty CLAY, medium plasticity, brown, with some fine angular Gravel	M < w_P	St			FILL
		0.70m DS 0.90m				0.60m						
		1.00m DS SPT 1,0,0 N=0		1.0		ML	**Clayey SILT:** Low plasticity, dark brown	M > w_P	F	HP	70	ALLUVIAL
		1.50m 1.60m DS										
WB-RR		2.50m SPT 1,4,5 N=9		2.0		2.30m CH	**Silty CLAY:** High plasticity, grey with trace fine angular Gravel	M > w_P	St	HP	100	
		2.95m		3.0						HP	120	
		4.00m SPT 1,1,2 N=3		4.0					St	HP	30	
		4.45m								HP	60	
				5.0		5.00m CH	**Silty CLAY:** Medium plasticity, grey with trace fine grained Sand		St	HP	60	
		5.50m SPT 3,3,7 N=10								HP	200	
										HP	200	
										HP	100	

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH10

CLIENT: Health Infrastructure
PAGE: 2 of 2
PROJECT NAME: Macksville Hospital Redevelopment
JOB NO: RGS31237.1
SITE LOCATION: Macksville
LOGGED BY: LD
TEST LOCATION: Refer to figure 1
DATE: 5/4/18

DRILL TYPE: Truck Mounted (NCR Rig 7) **EASTING:** 494546 m **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** 6603852 m **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
WB-RR		5.95m				CH	**Silty CLAY:** Medium plasticity, grey with trace fine grained Sand *(continued)*	$M > w_P$	St			ALLUVIAL
							Colour becoming green					
		7.00m		7.0								
		SPT 2,4,6 N=10										
		7.45m										
				8.0			8.00m					
						CH	**Silty CLAY:** High plasticity, grey, with trace fine angular Gravel	$M < w_P$	St			
		8.50m										
		SPT 1,2,5 N=7										
		8.95m		9.0						HP	100	
		10.00m		10.0			10.00m					
		SPT 9,11,12 N=23				CL	**Silty CLAY:** Medium plasticity, pale grey and orange/brown, mottle		St			RESIDUAL SOIL
							10.45m					
		10.45m					Hole Terminated at 10.45 m					
				11.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH11

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Macksville Hospital Redevelopment
JOB NO: RGS31237.1
SITE LOCATION: Macksville
LOGGED BY: LD
TEST LOCATION: Refer to figure 1
DATE: 5/4/18

DRILL TYPE: Truck Mounted (NCR Rig 7)
EASTING: 494548 m
SURFACE RL:
BOREHOLE DIAMETER: 100 mm
INCLINATION: 90°
NORTHING: 6603692 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/TC						CL	**FILL:** Silty CLAY, low plasticity, brown with some fine grained Gravel					FILL
	▶						0.50m					
						ML	**Clayey SILT:** Low plasticity, dark brown	M > w_P	VS			ALLUVIAL
		0.90m										
		1.00m		1.0								
		DS										
		SPT 0,1,2 N=3										
WB-RR		1.45m										
							1.90m					
				2.0		CL	**Silty CLAY:** Medium to high plasticity, grey, pale grey	M > w_P	St			
		2.50m										
		SPT 2,4,6 N=10										
		2.95m		3.0								
		4.00m		4.0								
		SPT 3,6,7 N=13										
							4.45m					
		4.45m					Hole Terminated at 4.45 m					
				5.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH12

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Macksville Hospital Redevelopment
JOB NO: RGS31237.1
SITE LOCATION: Macksville
LOGGED BY: LD
TEST LOCATION: Refer to figure 1
DATE: 5/4/18

DRILL TYPE: Truck Mounted (NCR Rig 7) **EASTING:** 494552 m **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** 6603649 m **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/TC	Not Encountered	0.40m 0.50m DS 0.90m 1.00m DS SPT 1,3,3 N=6 1.45m		1.0		ML	**Clayey SILT:** Low plasticity, dark brown	$M > w_P$	F	HP	100	ALLUVIAL
							1.70m					
				2.0		CL	**Silty CLAY:** Medium to high plasticity, grey, orange, brown	$M > w_P$		HP HP HP	100 10 140	
		2.50m SPT 1,2,4 N=6 2.95m		3.0								
				4.0					St / VSt	HP	270	
							4.45m			HP	190	
							Hole Terminated at 4.45 m					
				5.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP1

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Proposed Macksville Hospital
JOB NO: RGS31237.1
SITE LOCATION:
LOGGED BY: DR
TEST LOCATION: Refer to Figure 1
DATE: 5/4/18

EQUIPMENT TYPE: 12T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.5 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR	Not Encountered			0.5		GP	**Clayey GRAVEL:** Medium grained, grey, angular Gravel, some Sand	M	D			PAVEMENT/FILL
							0.50m			HP	450	
						GP	**Clayey GRAVEL:** Medium grained, red-orange, trace Sand					FILL
				1.0			0.70m					
						CL	**Silty CLAY:** Medium plasticity, mottled red and pale brown, trace quartz Gravel	M < w_P	H			RESIDUAL SOIL
										HP	600	
							1.30m					
				1.5			Hole Terminated at 1.30 m					
				2.0								
				2.5								
				3.0								
				3.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT:	Health Infrastructure	**TEST PIT NO:**	**TP2**
PROJECT NAME:	Proposed Macksville Hospital	**PAGE:**	1 of 1
SITE LOCATION:		**JOB NO:**	RGS31237.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	DR
		DATE:	5/4/18

EQUIPMENT TYPE: 12T Excavator **EASTING:** **SURFACE RL:**

TEST PIT LENGTH: 3.0 m **WIDTH:** 0.5 m **NORTHING:** **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR	Not Encountered	CBR 0.50m		0.5		GP	**Clayey GRAVEL:** Medium grained, grey, brown	M	D			FILL/PAVEMENT
						CL	**Silty CLAY:** Medium plasticity, orange, some fine to coarse grained Gravel	M < w_P	VSt			FILL
				1.0		GP	**Clayey GRAVEL/COBBLES:** Medium to coarse grained, some cobble sized	M	D	HP	600	GEOFAB ROCK FILL
										HP	600	
						CL	**Silty CLAY:** Medium plasticity, dark brown	M > w_P	St	HP	120	GEOFAB - ALLUVIAL
				1.5			Hole Terminated at 1.30 m					
				2.0								
				2.5								
				3.0								
				3.5								

0.30m
0.50m
1.10m
1.30m

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

TEST PIT NO: TP3

CLIENT: Health Infrastructure | **PAGE:** 1 of 1

PROJECT NAME: Proposed Macksville Hospital | **JOB NO:** RGS31237.1

SITE LOCATION: | **LOGGED BY:** DR

TEST LOCATION: Refer to Figure 1 | **DATE:** 5/4/18

EQUIPMENT TYPE: 12T Excavator | **EASTING:** | **SURFACE RL:**

TEST PIT LENGTH: 3.0 m | **WIDTH:** 0.5 m | **NORTHING:** | **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR						GP	**Clayey GRAVEL:** Medium grained, grey, trace Sand	M	D			PAVEMENT / COARSE MATERIAL
							0.30m					
				0.5		CL	**Silty CLAY:** Medium plasticity, orange, some fine to medium grained Gravel	M < w_P	H	HP	600	GENERAL FILL
							0.80m					
				1.0		GP	**GRAVEL/COBBLES:** Coarse to cobble size up to 300mm in size, some fines	M	MD			GEOFAB - DRAINAGE LAYER ROCK FILL
	▽						1.40m					
				1.5			**Silty CLAY:** Medium plasticity, dark brown	M > w_P	St	HP	120	GEOFAB - ALLUVIAL
							1.50m					
							Hole Terminated at 1.50 m					
				2.0								
				2.5								
				3.0								
				3.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP4

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Proposed Macksville Hospital
JOB NO: RGS31237.1
SITE LOCATION:
LOGGED BY: DR
TEST LOCATION: Refer to Figure 1
DATE: 5/4/18

EQUIPMENT TYPE: 12T Excavator
EASTING: 494731 m
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.5 m
NORTHING: 6604133 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR		CBR 0.40m				GW	**Clayey GRAVEL:** Fine to medium grained, grey/brown, some fine Sand	M	D			PAVEMENT / WEARING COARSE
				0.5		CL	0.40m **Silty CLAY:** Medium plasticity, orange, some fine to medium Gravel	M < w_P	VSt / H	HP	600	FILL
				1.0		GP	1.00m **GRAVEL/COBBLES:** Coarse to cobble size up to 100mm, some fines	M	L			GEOFAB - DRAINAGE LAYER ROCK FILL
				1.5		CL	1.40m **Silty CLAY:** Medium plasticity, dark brown	M > w_P	St	HP	120	GEOFAB - ALLUVIAL
							1.50m Hole Terminated at 1.50 m					
				2.0								
				2.5								
				3.0								
				3.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT:	Health Infrastructure	**TEST PIT NO:**	**TP5**
PROJECT NAME:	Proposed Macksville Hospital	**PAGE:**	1 of 1
SITE LOCATION:		**JOB NO:**	RGS31237.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	DR
		DATE:	5/4/18

EQUIPMENT TYPE: 12T Excavator **EASTING:** **SURFACE RL:**

TEST PIT LENGTH: 3.0 m **WIDTH:** 0.5 m **NORTHING:** **DATUM:** AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR	▽			0.5		CL	**Clayey GRAVEL:** Fine to medium grained, orange/brown, Phyllite Gravel	M	MD			GENERAL FILL
							0.50m					
						GP	**GRAVEL/COBBLES:** Coarse grained, some cobbles and fines		D			GEOFAB - DRAINAGE LAYER ROCK FILL
				1.0			1.00m					
						CL	**Silty CLAY:** Medium plasticity, dark brown	M > w_P	F / St	HP	100	GEOFAB - ALLUVIAL
							1.40m					
				1.5			Hole Terminated at 1.40 m					
				2.0								
				2.5								
				3.0								
				3.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP6

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Proposed Macksville Hospital
JOB NO: RGS31237.1
SITE LOCATION:
LOGGED BY: DR
TEST LOCATION: Refer to Figure 1
DATE: 5/4/18

EQUIPMENT TYPE: 12T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m **WIDTH:** 0.5 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR		CBR 0.40m				GP	**Clayey GRAVEL:** Medium grained, grey, trace fines	M	D			PAVEMENT / WEARING COARSE
							0.20m					
						CL	**Silty CLAY:** Medium plasticity, orange, some medium Gravel	M < w_P	VSt			GENERAL GILL HP = 450-500kPa
							0.40m					
				0.5		GP	**GRAVEL/COBBLES:** Some fines	M	L			GEOFAB - DRAINAGE LAYER ROCK FILL
	▽			1.0			1.00m					
						CL	**Silty CLAY:** Medium plasticity, dark brown	M > w_P	F			GEOFAB - ALLUVIAL
							1.30m					
							Hole Terminated at 1.30 m					
				1.5								
				2.0								
				2.5								
				3.0								
				3.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT: Health Infrastructure
PROJECT NAME: Proposed Macksville Hospital
SITE LOCATION:
TEST LOCATION: Refer to Figure 1

TEST PIT NO: TP7
PAGE: 1 of 1
JOB NO: RGS31237.1
LOGGED BY: DR
DATE: 5/4/18

EQUIPMENT TYPE: 12T Excavator
TEST PIT LENGTH: 3.0 m **WIDTH:** 0.5 m
EASTING:
NORTHING:
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR	▽			0.5		GM	**Silty GRAVEL:** Fine to medium grained, orange, trace fine Sand	M	VSt / H			GENERAL FILL HP = 500-550kPa
							0.50m					
						GP	**GRAVEL/COBBLES:** Trace fines		L			GEOFAB - DRAINAGE LAYER ROCK FILL
				1.0			1.00m			HP	100	
						CL	**Silty CLAY:** Medium plasticity, dark brown, some organics	M > w_P	St			GEOFAB - ALLUVIAL
							1.40m					
				1.5			Hole Terminated at 1.40 m					
				2.0								
				2.5								
				3.0								
				3.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP8

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Proposed Macksville Hospital
JOB NO: RGS31237.1
SITE LOCATION:
LOGGED BY: DR
TEST LOCATION: Refer to Figure 1
DATE: 5/4/18

EQUIPMENT TYPE: 12T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.5 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR	Not Encountered	0.10m				GM	0.10m **Silty GRAVEL:** Medium grained, grey, trace Sand	M	D			PAVEMENT - WEARING COARSE
		CBR				CL	**Silty CLAY:** Medium plasticity, orange/pale grey, some medium sized Gravel	M < w_P	VSt			GENERAL FILL
		0.50m		0.5								
				1.0								
				1.5								
							1.80m					
						GP	1.90m **BOULDERS/COBBLES**	M	L			GEOFAB - DRAINAGE LAYER ROCK FILL
				2.0			Hole Terminated at 1.90 m					
				2.5								
				3.0								
				3.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT: Health Infrastructure
PROJECT NAME: Proposed Macksville Hospital
SITE LOCATION:
TEST LOCATION: Refer to Figure 1

TEST PIT NO: TP9
PAGE: 1 of 1
JOB NO: RGS31237.1
LOGGED BY: DR
DATE: 5/4/18

EQUIPMENT TYPE: 12T Excavator
TEST PIT LENGTH: 3.0 m **WIDTH:** 0.5 m
EASTING:
NORTHING:
SURFACE RL:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR	Not Encountered			0.5		CL	**Silty CLAY:** Medium plasticity, brown, trace Gravel and organics	M < w_P	St	HP	200	RESIDUAL SOIL
				1.0		CL	0.50m **Silty CLAY:** Medium plasticity, orange/pale grey, trace Phyllite Gravel					HP = 250-350kPa
							1.00m **Extremely to Highly Weathered PHYLLITE:** Foliated, brown, grey, low strength		H / Fb			EXTREMELY TO HIGHLY WEATHERED PHYLLITE
				1.5			1.40m Hole Terminated at 1.40 m					
				2.0								
				2.5								
				3.0								
				3.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

TEST PIT NO: **TP10**

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Proposed Macksville Hospital
JOB NO: RGS31237.1
SITE LOCATION:
LOGGED BY: DR
TEST LOCATION: Refer to Figure 1
DATE: 5/4/18

EQUIPMENT TYPE: 12T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m **WIDTH:** 0.5 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR	Not Encountered			0.5		GP	**Silty GRAVEL:** Fine to coarse grained, grey, brown, trace Sand	M	D			FILL
				1.0			1.00m					
				1.5		CL	**Silty CLAY:** Low plasticity, red/brown, some Gravel	M < w_P	VSt / H			RESIDUAL SOIL HP = 500-600kPa
				2.0								
				2.5			2.50m					
							Hole Terminated at 2.50 m					
				3.0								
				3.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP11

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Proposed Macksville Hospital
JOB NO: RGS31237.1
SITE LOCATION:
LOGGED BY: DR
TEST LOCATION: Refer to Figure 1
DATE: 5/4/18

EQUIPMENT TYPE: 12T Excavator
EASTING: 494581 m
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.5 m
NORTHING: 6604352 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR	Not Encountered					GM	**Silty GRAVEL:** Fine to coarse grained, trace Sand	M	D			FILL
							0.30m					
						ML	**Clayey SILT:** Low plasticity, dark brown, some organics	M	S			TOPSOIL
				0.5			0.50m					
						CL	**Silty CLAY:** Medium plasticity, brown, trace Gravel and relic Rock structure	M < w_P	VSt / H			RESIDUAL SOIL
				1.0								
								M < w_P		HP	600	HP = 600kPa
							1.20m					
							Hole Terminated at 1.20 m					
				1.5								
				2.0								
				2.5								
				3.0								
				3.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP12

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Proposed Macksville Hospital
JOB NO: RGS31237.1
SITE LOCATION:
LOGGED BY: DR
TEST LOCATION: Refer to Figure 1
DATE: 5/4/18

EQUIPMENT TYPE: 12T Excavator
EASTING: 494543 m
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.5 m
NORTHING: 6604362 m
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR	Not Encountered					GM	**Silty GRAVEL:** Fine to coarse grained, trace Sand	M	MD			FILL
							0.15m					
						CL	**Silty CLAY:** Medium plasticity, red/brown, some quartz Gravel	M < w_P	VSt			RESIDUAL SOIL
				0.5								
												HP = 500-550kPa
				1.0			1.10m					
							Hole Terminated at 1.10 m					
				1.5								
				2.0								
				2.5								
				3.0								
				3.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP13

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Proposed Macksville Hospital
JOB NO: RGS31237.1
SITE LOCATION:
LOGGED BY: DR
TEST LOCATION: Refer to Figure 1
DATE: 5/4/18

EQUIPMENT TYPE: 12T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 3.0 m
WIDTH: 0.5 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR	Not Encountered	0.30m				CL	**Silty CLAY:** Medium plasticity, orange/brown/grey, trace Gravel	M	H			RESIDUAL SOIL
		B 0.50m		0.5						HP	550	
		1.00m		1.0			1.00m Some Gravel					
		B 1.20m					**Extremely to Highly Weathered PHYLLITE:** Foliated, pale grey, low strength		Fb	HP	600	EXTREMELY TO HIGHLY WEATHERED PHYLLITE
							1.30m					
				1.5			Hole Terminated at 1.30 m					
				2.0								
				2.5								
				3.0								
				3.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP14

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Proposed Macksville Hospital
JOB NO: RGS31237.1
SITE LOCATION:
LOGGED BY: DR
TEST LOCATION: Refer to Figure 1
DATE: 5/4/18

EQUIPMENT TYPE: 12T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 4.0 m **WIDTH:** 0.5 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR	Not Encountered					GP	**Sandy GRAVEL:** Medium grained, grey, trace fines	M	D			PAVEMENT / WEAR COARSE
							0.25m					
				0.5		CL	**Silty CLAY:** Medium plasticity, orange/grey mottled, some medium grained size Gravel	M < w_P	VSt			GENERAL FILL HP = 300-350kPa
				1.0								
							1.15m					
						ML	**Clayey SILT:** Low plasticity, dark brown, some organics	M ~ w_P		HP	200	TOPSOIL
							1.40m					
		1.50m		1.5		CL	**Silty CLAY:** Medium plasticity, orange, grey, brown, trace Gravel	M < w_P	VSt			RESIDUAL SOIL HP = 500-600kPa
		B 1.70m										
		2.00m		2.0			2.00m					
		B 2.20m					**Extremely to Highly Weathered PHYLLITE:** Foliated, grey/brown	M	Fb			EXTREMELY TO HIGHLY WEATHERED PHYLLITE HP = 550-600kPa
							2.30m					
							Hole Terminated at 2.30 m					
				2.5								
				3.0								
				3.5								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP15

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Proposed Macksville Hospital
JOB NO: RGS31237.1
SITE LOCATION:
LOGGED BY: DR
TEST LOCATION: Refer to Figure 1
DATE: 5/4/18

EQUIPMENT TYPE: 12T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 4.0 m
WIDTH: 0.5 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR	Not Encountered	0.50m		0.5		CL	**Silty CLAY:** Low plasticity, dark brown, some organics	M	St	HP	120	ALLUVIAL
		ASS										
		1.00m		1.0			Becoming more Clayey					
		ASS										
		1.50m		1.5			1.50m					
		ASS				CL	**Silty CLAY:** Medium plasticity, mottled brown/pale grey	M < w_P	St / VSt			RESIDUAL SOIL
		2.00m		2.0						HP	200	
				2.5								
				3.0			Pale grey/orange, some relic Rock structure			HP	250	
							3.30m					
				3.5			Hole Terminated at 3.30 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - TEST PIT

TEST PIT NO: TP16

CLIENT: Health Infrastructure
PAGE: 1 of 1
PROJECT NAME: Proposed Macksville Hospital
JOB NO: RGS31237.1
SITE LOCATION:
LOGGED BY: DR
TEST LOCATION: Refer to Figure 1
DATE: 5/4/18

EQUIPMENT TYPE: 12T Excavator
EASTING:
SURFACE RL:
TEST PIT LENGTH: 4.0 m
WIDTH: 0.5 m
NORTHING:
DATUM: AHD

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
EXCAVATOR	▽	0.50m ASS 1.00m ASS 1.50m		0.5 1.0 1.5		ML	**Clayey SILT:** Low plasticity, dark brown, organics throughout	W	S			ALLUVIAL
						CL	1.30m **Silty CLAY:** Medium plasticity, grey 1.50m	M < W_P	VSt	HP	250	RESIDUAL SOIL
				2.0 2.5 3.0 3.5			Hole Terminated at 1.50 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample
ASS	Acid Sulfate Soil Sample
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Appendix C
Laboratory Test Results

AC TESTING SERVICES

AC Testing Services:Accreditation No.19604
2/1 Monro St, Nambucca Heads, NSW 2448
ABN: 38578525858
Ph:0438857377

Client:	Regional Geotechnical Solutions	Report No. ACTS-1739			
Address:	14,25-27 Hurley Drive,	Issue No. 1			
	Coffs Harbour, NSW, 2450	Date Sampled 11.04.18	By: Client		
Project:	RGS31237.1-Health Infrastructure	Date Tested: 26.04.18	Page: 1	of	1
	Proposed Macksville Hospital	Sample No ACTS18-04-031			
Location:	Macksville				

CALIFORNIA BEARING RATIO REPORT

Sample No.		ACTS18-04-031				
Location		TP 4 0.0 - 0.4m				
LABORATORY COMPACTION			**LABORATORY REPORT**			
Maximum Dry Density	t/m3	1.93				
Optimum Moisture Content	%	12.5				
Material Retained 19.0 mm sieve	%	15.8				
Compaction Specified	%	100.0				
Compaction Achieved	%	99.9				
SPECIMEN DRY DENSITY						
i At Compaction	t/m3	1.92				
ii After Soaking	t/m3	1.91				
SPECIMEN MOISTURE CONTENT						
Field / Initial	%	11.6				
i At Compaction	%	12.8				
ii After Soaking	%	17.8				
iii Top 30mm layer	%	20.1				
iv Rest of Sample	%	17.8				
CBR TEST DETAILS						
Soaking Period	days	4				
Swell	%	5.2				
Surcharge mass	kg	4.5				
CALIFORNIA BEARING RATIO	**%**	**2.5**				
Test Methods Used		F,H,I,J				

Test Methods

A. RMS T111 Dry Density/Moisture Relations of Road Materials (Standard Compaction).

C. RMS T120 Determination of Moisture Content of Road Materials (Standard Method).

D. RTA T117 Determination of the California Bearing Ratio of Remoulded Specimens of Road Materials (Standard Method).

F. AS 1289 5 1.1 Dry Density/Moisture Relationship (Standard Compaction).

H. AS 1289 2.1.1 Determination of Moisture Content (Standard Method).

I. AS 1289 6.1.1 Determination of the California Bearing Ratio of A Soil -Standard Method For a Remoulded Specimens .

J. 5.0 mm result reported, NO repeat test performed.

K. Sampled according to AS 1141.3.1

NATA

Accredited for compliance with ISO/IEC 17025-Testing.

Approved Signatory: Adam Crawford

Date: 02.05.18

Report Form No.3

AC TESTING SERVICES

AC Testing Services:Accreditation No.19604
2/1 Monro St, Nambucca Heads, NSW 2448
ABN: 38578525858
Ph:0438857377

Client:	Regional Geotechnical Solutions	Report No. ACTS-1740			
Address:	14,25-27 Hurley Drive,	Issue No. 1			
	Coffs Harbour, NSW, 2450	Date Sampled 11.04.18	By: Client		
Project:	RGS31237.1-Health Infrastructure	Date Tested: 26.04.18	Page: 1	of	1
	Proposed Macksville Hospital	Sample No ACTS18-04-032			
Location:	Macksville				

CALIFORNIA BEARING RATIO REPORT

Sample No.		ACTS18-04-032				
Location		TP 6 0.0 - 0.4m				
LABORATORY COMPACTION			**LABORATORY REPORT**			
Maximum Dry Density	t/m3	1.92				
Optimum Moisture Content	%	10.9				
Material Retained 19.0 mm sieve	%	0.0				
Compaction Specified	%	1.9				
Compaction Achieved	%	100.3				
SPECIMEN DRY DENSITY						
i At Compaction	t/m3	1.93				
ii After Soaking	t/m3	1.91				
SPECIMEN MOISTURE CONTENT						
Field / Initial	%	9.9				
i At Compaction	%	10.9				
ii After Soaking	%	16.4				
iii Top 30mm layer	%	17.0				
iv Rest of Sample	%	16.4				
CBR TEST DETAILS						
Soaking Period	days	4				
Swell	%	3.5				
Surcharge mass	kg	4.5				
CALIFORNIA BEARING RATIO	**%**	**4.5**				
Test Methods Used		F,H,I,J				

Test Methods

A. RMS T111 Dry Density/Moisture Relations of Road Materials (Standard Compaction).

C. RMS T120 Determination of Moisture Content of Road Materials (Standard Method).

D. RTA T117 Determination of the California Bearing Ratio of Remoulded Specimens of Road Materials (Standard Method).

F. AS 1289 5 1.1 Dry Density/Moisture Relationship (Standard Compaction).

H. AS 1289 2.1.1 Determination of Moisture Content (Standard Method).

I. AS 1289 6.1.1 Determination of the California Bearing Ratio of A Soil -Standard Method For a Remoulded Specimens .

J. 5.0 mm result reported, NO repeat test performed.

K. Sampled according to AS 1141.3.1

NATA

Accredited for compliance with ISO/IEC 17025-Testing.

Approved Signatory: Adam Crawford

Date: 02.05.18

Report Form No.3

AC TESTING SERVICES

AC Testing Services:Accreditation No.19604
2/1 Monro St, Nambucca Heads, NSW 2448
ABN: 38578525858
Ph:0438857377

Client:	Regional Geotechnical Solutions	Report No. ACTS-1741			
Address:	14,25-27 Hurley Drive,	Issue No. 1			
	Coffs Harbour, NSW, 2450	Date Sampled 11.04.18	By: Client		
Project:	RGS31237.1-Health Infrastructure	Date Tested: 26.04.18	Page: 1	of	1
	Proposed Macksville Hospital	Sample No ACTS18-04-033			
Location:	Macksville				

CALIFORNIA BEARING RATIO REPORT

Sample No.		ACTS18-04-033				
Location		TP 8 0.1 - 0.4m				
LABORATORY COMPACTION			**LABORATORY REPORT**			
Maximum Dry Density	t/m3	1.89				
Optimum Moisture Content	%	13.8				
Material Retained 19.0 mm sieve	%	0.7				
Compaction Specified	%	100.0				
Compaction Achieved	%	99.2				
SPECIMEN DRY DENSITY						
i At Compaction	t/m3	1.88				
ii After Soaking	t/m3	1.88				
SPECIMEN MOISTURE CONTENT						
Field / Initial	%	15.4				
i At Compaction	%	13.2				
ii After Soaking	%	19.2				
iii Top 30mm layer	%	16.5				
iv Rest of Sample	%	19.2				
CBR TEST DETAILS						
Soaking Period	days	4				
Swell	%	3.2				
Surcharge mass	kg	4.5				
CALIFORNIA BEARING RATIO	**%**	**5.5**				
Test Methods Used		F,H,I,J				

Test Methods

A. RMS T111 Dry Density/Moisture Relations of Road Materials (Standard Compaction).

C. RMS T120 Determination of Moisture Content of Road Materials (Standard Method).

D. RTA T117 Determination of the California Bearing Ratio of Remoulded Specimens of Road Materials (Standard Method).

F. AS 1289 5 1.1 Dry Density/Moisture Relationship (Standard Compaction).

H. AS 1289 2.1.1 Determination of Moisture Content (Standard Method).

I. AS 1289 6.1.1 Determination of the California Bearing Ratio of A Soil -Standard Method For a Remoulded Specimens .

J. 5.0 mm result reported, NO repeat test performed.

K. Sampled according to AS 1141.3.1

NATA

Accredited for compliance with ISO/IEC 17025-Testing.

Approved Signatory: Adam Crawford

Date: 02.05.18

Report Form No.3

AC TESTING SERVICES

AC Testing Services:Accreditation No.19604
2/1 Monro St, Nambucca Heads, NSW 2448
ABN: 38578525858
Ph:0438857377

Client:	Regional Geotechnical Solutions	Report No.	ACTS-1742		
Address:	14,25-27 Hurley Drive,	Issue No.	1		
	Coffs Harbour, NSW, 2450	Date Sampled	11.04.18	By:	Client
Project:	RGS31237.1-Health Infrastructure	Date Tested:	26.04.18	Page: 1	of 2
	Proposed Macksville Hospital	Sample No	ACTS18-04-034		
Location:	Macksville				

CALIFORNIA BEARING RATIO REPORT

Sample No.		ACTS18-04-034				
Location		TP 13 0.3 - 0.5m				
LABORATORY COMPACTION			**LABORATORY REPORT**			
Maximum Dry Density	t/m3	1.65				
Optimum Moisture Content	%	19.8				
Material Retained 19.0 mm sieve	%	0.0				
Compaction Specified	%	100.0				
Compaction Achieved	%	101.0				
SPECIMEN DRY DENSITY						
i At Compaction	t/m3	1.66				
ii After Soaking	t/m3	1.67				
SPECIMEN MOISTURE CONTENT						
Field / Initial	%	22.9				
i At Compaction	%	19.5				
ii After Soaking	%	26.1				
iii Top 30mm layer	%	28.5				
iv Rest of Sample	%	26.1				
CBR TEST DETAILS						
Soaking Period	days	4				
Swell	%	3.9				
Surcharge mass	kg	4.5				
CALIFORNIA BEARING RATIO	**%**	**3.5**				
Test Methods Used		F,H,I,J				

Test Methods

A. RMS T111 Dry Density/Moisture Relations of Road Materials (Standard Compaction).

C. RMS T120 Determination of Moisture Content of Road Materials (Standard Method).

D. RTA T117 Determination of the California Bearing Ratio of Remoulded Specimens of Road Materials (Standard Method).

F. AS 1289 5 1.1 Dry Density/Moisture Relationship (Standard Compaction).

H. AS 1289 2.1.1 Determination of Moisture Content (Standard Method).

I. AS 1289 6.1.1 Determination of the California Bearing Ratio of A Soil -Standard Method For a Remoulded Specimens .

J. 5.0 mm result reported, NO repeat test performed.

K. Sampled according to AS 1141.3.1

NATA

Accredited for compliance with ISO/IEC 17025-Testing.

Approved Signatory: Adam Crawford

Date: 02.05.18

Report Form No.3

AC TESTING SERVICES

AC Testing Services:Accreditation No.19604
2/1 Monro St, Nambucca Heads, NSW 2448
ABN: 38578525858
Ph. 0438857377

Client:	Regional Geotechnical Solutions	Report No.	ACTS-1742		
Address:	14/25-27 Hurley Drive	Issue No.	1		
	Coffs Harbour, NSW, 2450	Date Sampled:	11.04.18	By:	Client
Project:	RGS31237.1-RGS31237.1 - Health Infrastructure	Date Tested:	27.04.18	Page: 2	of 2
	Proposed Macksville Hospital	Sample No:	ACTS18-04-034		
Location:	Macksville				

SOIL REACTIVITY REPORT
SHRINK-SWELL INDEX
AS 1289 7.1.1

Sample No.		ACTS18-04-034			
Location		Macksville			
Test Pit No.		TP 13			
Test Depth	(m)	0.3 - 0.5			
U50 Recovery	(m)	0.3 - 0.5			
Shrink-Swell Index I_{ss}	**(%)**	**1.3**			
Moisture Content of Shrink Specimen	(%)	26.9			
Moisture Content of Swell Specimen Field	(%)	21.6			
After test	(%)	28.6			
Extent of Crumbling during Shrink test		0			
Extent of Cracking of the Shrink specimen		Minor			
Significant Inert Inclusions in the Soil Sample	(Estimated %)	0			

Accredited for compliance with ISO/IEC 17025 - Testing.

Approved Signatory: Adam Crawford

Date: 02.05.18

Report Form No.5

AC TESTING SERVICES

AC Testing Services:Accreditation No.19604
2/1 Monro St, Nambucca Heads, NSW 2448
ABN: 38578525858
Ph:0438857377

Client:	Regional Geotechnical Solutions	Report No. ACTS-1743			
Address:	14,25-27 Hurley Drive,	Issue No. 1			
	Coffs Harbour, NSW, 2450	Date Sampled 11.04.18	By: Client		
Project:	RGS31237.1-Health Infrastructure	Date Tested: 26.04.18	Page: 1	of	2
	Proposed Macksville Hospital	Sample No ACTS18-04-035			
Location:	Macksville				

CALIFORNIA BEARING RATIO REPORT

Sample No.		ACTS18-04-035				
Location		TP 13 1.0 - 1.2m				
LABORATORY COMPACTION			**LABORATORY REPORT**			
Maximum Dry Density	t/m3	1.81				
Optimum Moisture Content	%	14.1				
Material Retained 19.0 mm sieve	%	0.0				
Compaction Specified	%	100.0				
Compaction Achieved	%	99.2				
SPECIMEN DRY DENSITY						
i At Compaction	t/m3	1.81				
ii After Soaking	t/m3	1.78				
SPECIMEN MOISTURE CONTENT						
Field / Initial	%	15.6				
i At Compaction	%	13.7				
ii After Soaking	%	19.7				
iii Top 30mm layer	%	22.6				
iv Rest of Sample	%	19.7				
CBR TEST DETAILS						
Soaking Period	days	4				
Swell	%	2.7				
Surcharge mass	kg	4.5				
CALIFORNIA BEARING RATIO	**%**	**3.5**				
Test Methods Used		F,H,I,J				

Test Methods

A. RMS T111 Dry Density/Moisture Relations of Road Materials (Standard Compaction).

C. RMS T120 Determination of Moisture Content of Road Materials (Standard Method).

D. RTA T117 Determination of the California Bearing Ratio of Remoulded Specimens of Road Materials (Standard Method).

F. AS 1289 5 1.1 Dry Density/Moisture Relationship (Standard Compaction).

H. AS 1289 2.1.1 Determination of Moisture Content (Standard Method).

I. AS 1289 6.1.1 Determination of the California Bearing Ratio of A Soil -Standard Method For a Remoulded Specimens .

J. 5.0 mm result reported, NO repeat test performed.

K. Sampled according to AS 1141.3.1

NATA

Accredited for compliance with ISO/IEC 17025-Testing.

Approved Signatory: Adam Crawford

Date: 02.05.18

Report Form No.3

AC TESTING SERVICES

AC Testing Services:Accreditation No.19604
2/1 Monro St, Nambucca Heads, NSW 2448
ABN: 38578525858
Ph. 0438857377

Client:	Regional Geotechnical Solutions	Report No.	ACTS-1743		
Address:	14/25-27 Hurley Drive	Issue No.	1		
	Coffs Harbour, NSW, 2450	Date Sampled:	11.04.18	By:	Client
Project:	RGS31237.1-RGS31237.1 - Health Infrastructure	Date Tested:	27.04.18	Page: 2	of 2
	Proposed Macksville Hospital	Sample No:	ACTS18-04-035		
Location:	Macksville				

SOIL REACTIVITY REPORT
SHRINK-SWELL INDEX
AS 1289 7.1.1

Sample No.		ACTS18-04-035			
Location		Macksville			
Test Pit No.		TP 13			
Test Depth	(m)	1.0 - 1.2			
U50 Recovery	(m)	1.0 - 1.2			
Shrink-Swell Index I_{ss}	**(%)**	**1.4**			
Moisture Content of Shrink Specimen	(%)	15.7			
Moisture Content of Swell Specimen Field	(%)	16.5			
After test	(%)	20.8			
Extent of Crumbling during Shrink test		0			
Extent of Cracking of the Shrink specimen		Nil			
Significant Inert Inclusions in the Soil Sample	(Estimated %)	0			

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.

Approved Signatory: Adam Crawford

Date: 02.05.18

Report Form No.5

AC TESTING SERVICES

AC Testing Services:Accreditation No.19604
2/1 Monro St, Nambucca Heads, NSW 2448
ABN: 38578525858
Ph:0438857377

Client:	Regional Geotechnical Solutions	Report No. ACTS-1744			
Address:	14,25-27 Hurley Drive,	Issue No. 1			
	Coffs Harbour, NSW, 2450	Date Sampled 11.04.18	By: Client		
Project:	RGS31237.1-Health Infrastructure	Date Tested: 26.04.18	Page: 1	of	3
	Proposed Macksville Hospital	Sample No ACTS18-04-036			
Location:	Macksville				

CALIFORNIA BEARING RATIO REPORT

Sample No.		ACTS18-04-036				
Location		TP 14 2.0 - 2.2m				
LABORATORY COMPACTION			**LABORATORY REPORT**			
Maximum Dry Density	t/m3	1.77				
Optimum Moisture Content	%	16.0				
Material Retained 19.0 mm sieve	%	0.0				
Compaction Specified	%	100.0				
Compaction Achieved	%	98.5				
SPECIMEN DRY DENSITY						
i At Compaction	t/m3	1.74				
ii After Soaking	t/m3	1.74				
SPECIMEN MOISTURE CONTENT						
Field / Initial	%	17.5				
i At Compaction	%	17.0				
ii After Soaking	%	20.7				
iii Top 30mm layer	%	21.9				
iv Rest of Sample	%	20.7				
CBR TEST DETAILS						
Soaking Period	days	4				
Swell	%	2.3				
Surcharge mass	kg	4.5				
CALIFORNIA BEARING RATIO	**%**	**6.5**				
Test Methods Used		F,H,I,J				

Test Methods

A. RMS T111 Dry Density/Moisture Relations of Road Materials (Standard Compaction).

C. RMS T120 Determination of Moisture Content of Road Materials (Standard Method).

D. RTA T117 Determination of the California Bearing Ratio of Remoulded Specimens of Road Materials (Standard Method).

F. AS 1289 5 1.1 Dry Density/Moisture Relationship (Standard Compaction).

H. AS 1289 2.1.1 Determination of Moisture Content (Standard Method).

I. AS 1289 6.1.1 Determination of the California Bearing Ratio of A Soil -Standard Method For a Remoulded Specimens .

J. 5.0 mm result reported, NO repeat test performed.

K. Sampled according to AS 1141.3.1

NATA

Accredited for compliance with ISO/IEC 17025-Testing.

Approved Signatory: Adam Crawford

Date: 02.05.18

Report Form No.3

AC TESTING SERVICES

AC Testing Services:Accreditation No.19604
2/1 Monro St, Nambucca Heads, NSW 2448
ABN: 38578525858
Ph. 0438857377

Client:	Regional Geotechnical Solutions	Report No.	ACTS-1744		
Address:	14/25-27 Hurley Drive	Issue No.	1		
	Coffs Harbour, NSW, 2450	Date Sampled:	11.04.18	By:	Client
Project:	RGS31237.1-RGS31237.1 - Health Infrastructure	Date Tested:	27.04.18	Page: 2	of 3
	Proposed Macksville Hospital	Sample No:	ACTS18-04-036		
Location:	Macksville				

SOIL REACTIVITY REPORT
SHRINK-SWELL INDEX
AS 1289 7.1.1

Sample No.		ACTS18-04-036			
Location		Macksville			
Test Pit No.		TP 14			
Test Depth	(m)	2.0 - 2.2			
U50 Recovery	(m)	2.0 - 2.2			
Shrink-Swell Index I_{ss}	**(%)**	**1.9**			
Moisture Content of Shrink Specimen	(%)	27.0			
Moisture Content of Swell Specimen Field	(%)	28.0			
After test	(%)	29.7			
Extent of Crumbling during Shrink test		0			
Extent of Cracking of the Shrink specimen		Minor			
Significant Inert Inclusions in the Soil Sample	(Estimated %)	0			

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.

Approved Signatory: Adam Crawford

Date: 02.05.18

AC TESTING SERVICES

AC Testing Services:Accreditation No. 19604
2/1 Monro St, Nambucca Heads,NSW 2448
ABN: 38578525858
Ph:0438857377

Client:	Regional Geotechnical Solutions	Report No.	ACTS-1744				
Address:	14/25-27 Hurley Drive.	Issue No.	1				
	Coffs Harbour, NSW,2450	Date Sampled:	11.04.18	By:	Client		
	RGS31237.1-Health Infrastructure	Sample No:	ACTS18-04-036	Page:	3	of	3
	Proposed Macksville Hospital						
Location:	Macksville						

ATTERBERG LIMITS REPORT

Test Methods: **AS1289.3.1.1, 3.2.1, 3.3.1**

Location: TP 14, 2.0 - 2.2m **Date Tested:** 24.04.18

Sample No.	ACTS18-04-036
I.D.	TP 14, 2.0 - 2.2m
Liquid Limit(AS1289.3.1.1) - %	43
Plastic Limit(AS1289.3.2.1) -%	28
Plasitcity Index(AS1289.3.3.1) - %	15
Linear Shrinkage(AS1289.3.4.1) -%	-
Crumbling &/or Curling	-
Sample History	Oven Dried
Sample Preparation	Dry Sieved

Approved Signatory:

Name: **Adam Crawford**

Date of Issue 02.05.18

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Report Form No. 14

AC TESTING SERVICES

AC Testing Services:Accreditation No. 19604
2/1 Monro St, Nambucca Heads,NSW 2448
ABN: 38578525858
Ph:0438857377

Client:	Regional Geotechnical Solutions	Report No.	ACTS-1745				
Address:	14/25-27 Hurley Drive.	Issue No.	1				
	Coffs Harbour, NSW,2450	Date Sampled:	11.04.18	By:	Client		
	RGS31237.1-Health Infrastructure	Sample No:	ACTS18-04-037	Page:	1	of	1
	Proposed Macksville Hospital						
Location:	Macksville						

ATTERBERG LIMITS REPORT

Test Methods: **AS1289.3.1.1, 3.2.1, 3.3.1**

Location: BH 8, 5.0 - 5.45m **Date Tested:** 24.04.18

Sample No.	ACTS18-04-037
I.D.	BH 8, 5.0 - 5.45m
Liquid Limit(AS1289.3.1.1) - %	32
Plastic Limit(AS1289.3.2.1) -%	23
Plasitcity Index(AS1289.3.3.1) - %	9
Linear Shrinkage(AS1289.3.4.1) -%	-
Crumbling &/or Curling	-
Sample History	Oven Dried
Sample Preparation	Dry Sieved

Approved Signatory:

Name: **Adam Crawford**

Date of Issue 02.05.18

NATA

Accredited for compliance with ISO/IEC 17025-Testing.

Report Form No. 14

AC TESTING SERVICES

AC Testing Services:Accreditation No. 19604
2/1 Monro St, Nambucca Heads,NSW 2448
ABN: 38578525858
Ph:0438857377

Client:	Regional Geotechnical Solutions	Report No.	ACTS-1746				
Address:	14/25-27 Hurley Drive.	Issue No.	1				
	Coffs Harbour, NSW,2450	Date Sampled:	11.04.18	By:	Client		
	RGS31237.1-Health Infrastructure	Sample No:	ACTS18-04-038	Page:	1	of	1
	Proposed Macksville Hospital						
Location:	Macksville						

ATTERBERG LIMITS REPORT

Test Methods: **AS1289.3.1.1, 3.2.1, 3.3.1**

Location: BH 10, 1.5 - 1.6m **Date Tested:** 24.04.18

Sample No.	ACTS18-04-038
I.D.	BH 10, 1.5 - 1.6m
Liquid Limit(AS1289.3.1.1) - %	54
Plastic Limit(AS1289.3.2.1) -%	31
Plasitcity Index(AS1289.3.3.1) - %	23
Linear Shrinkage(AS1289.3.4.1) -%	-
Crumbling &/or Curling	-
Sample History	Oven Dried
Sample Preparation	Dry Sieved

Approved Signatory:

Name: **Adam Crawford**

Date of Issue 02.05.18

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Report Form No. 14

AC TESTING SERVICES

AC Testing Services:Accreditation No. 19604
2/1 Monro St, Nambucca Heads,NSW 2448
ABN: 38578525858
Ph:0438857377

Client:	Regional Geotechnical Solutions	Report No.	ACTS-1747				
Address:	14/25-27 Hurley Drive.	Issue No.	1				
	Coffs Harbour, NSW,2450	Date Sampled:	11.04.18	By:	Client		
	RGS31237.1-Health Infrastructure	Sample No:	ACTS18-04-039	Page:	1	of	1
	Proposed Macksville Hospital						
Location:	Macksville						

ATTERBERG LIMITS REPORT

Test Methods: **AS1289.3.1.1, 3.2.1, 3.3.1**

Location: BH 10, 2.4 - 2.5m **Date Tested:** 24.04.18

Sample No.	ACTS18-04-039
I.D.	BH 10, 2.4 - 2.5m
Liquid Limit(AS1289.3.1.1) - %	44
Plastic Limit(AS1289.3.2.1) -%	25
Plasitcity Index(AS1289.3.3.1) - %	19
Linear Shrinkage(AS1289.3.4.1) -%	-
Crumbling &/or Curling	-
Sample History	Oven Dried
Sample Preparation	Dry Sieved

Approved Signatory:

Name: **Adam Crawford**

Date of Issue 02.05.18

NATA

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Report Form No. 14

www.biotrack.com.au
781 Mt Glorious Rd Highvale 4520

Biotrack Certificate of Analysis

Signatory: Ph:+617 3289 7179 ABN 91 056 237 275

Test Code/Name	**[1] FIELD SCREEN SUITE**		
Lab Reference (LR)	**170418.711**	Client Name	Regional Geotechnical Solutions Pty Ltd (Wingham)
SampleID	**All Samples**	Client Contact	Matt Rowbotham
		Project Name	Proposed Machsville Hospital
Report Date	20/04/2018	Job Number	RGS31237.1
Sample Received Date	17/04/2018	Order Number	
Sample Disposal Date	16/06/2018	Chain of Custody	
Sample Packaging	Plastic Bag	Client Email	matt.r@regionalgeotech.com.au
Temperature	Ambient	Client Address	44 Bent Street Wingham New South Wales 2429

Analytical Method: Test Methodology for pH_f and pH_fox as per QASSIT 2004 Laboratory Methods. Indications based on pH data only.
RATE: 0 = No Reaction 2=Moderate 3=High 4=Very High (steam evolved).
TEMP: Surface temperature rise (C) oxidised sample at 5 minutes - cooling may occur for fast reaction.

S#	SampleID	pH_f	pH_Fox	Change	RATE	TEMP	Indication
1	BH8 5-5.45	4.5	3.3	-1.2	0	3	low TAA & moderate TPA
2	BH8 6.5-6.9	4.8	3.0	-1.8	2	7	low TAA & moderate TPA
3	BH9 5.5-5.95	4.3	1.9	-2.4	4	7	high TPA & sulphide possible
4	BH10 0.6-0.7	5.6	3.5	-2.1	4	0	low TAA & sulphide possible
5	BH10 0.9-1	5.4	3.6	-1.8	4	3	low TAA
6	BH10 1-1.45	5.3	3.5	-1.8	1	2	low TAA
7	BH10 2.5-2.95	4.8	2.7	-2.1	1	4	low TAA & moderate TPA & sulphide possible
8	BH10 4-4.45	4.8	2.9	-1.9	4	8	low TAA & moderate TPA
9	BH11 1-1.45	5.3	3.3	-2.0	1	3	low TAA & moderate TPA
10	BH12 0.4-0.5	5.0	3.0	-2.0	3	7	low TAA & moderate TPA
11	BH12 0.9-1	5.1	3.1	-2.0	3	5	low TAA & moderate TPA
12	TP15 0.4-0.5	5.5	4.0	-1.5	4	6	low TAA
13	TP15 1-1.1	5.4	4.1	-1.3	4	1	low TAA
14	TP15 1.4-1.5	4.9	3.6	-1.3	1	2	low TAA
15	TP16 0.4-0.5	4.9	3.2	-1.7	1	4	low TAA & moderate TPA
16	TP16 0.9-1	4.8	3.6	-1.2	1	0	low TAA
17	TP16 1.4-1.5	4.8	3.5	-1.3	1	4	low TAA

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781 Mt Glorious Rd Highvale 4520

Biotrack Certificate of Analysis

Signatory: Ph:+617 3289 7179 ABN 91 056 237 275

Test Code/Name	[1] FIELD SCREEN SUITE		
Lab Reference (LR)	**170418.711**	Client Name	Regional Geotechnical Solutions Pty Ltd (Wingham)
SampleID	**All Samples**	Client Contact	Matt Rowbotham
		Project Name	Proposed Machsville Hospital
Report Date	20/04/2018	Job Number	RGS31237.1
Sample Received Date	17/04/2018	Order Number	
Sample Disposal Date	16/06/2018	Chain of Custody	
Sample Packaging	Plastic Bag	Client Email	matt.r@regionalgeotech.com.au
Temperature	Ambient	Client Address	44 Bent Street Wingham New South Wales 2429

Analytical Method: Test Methodology for pH_f and pH_fox as per QASSIT 2004 Laboratory Methods. Indications based on pH data only.
RATE: 0 = No Reaction 2=Moderate 3=High 4=Very High (steam evolved).
TEMP: Surface temperature rise (C) oxidised sample at 5 minutes - cooling may occur for fast reaction.

S#	SampleID	pH_f	pH_Fox	Change	Rate	Indication
1	BH8 5-5.45	4.5	3.3	-1.2	0	low TAA & moderate TPA
2	BH8 6.5-6.9	4.8	3.0	-1.8	2	low TAA & moderate TPA
3	BH9 5.5-5.95	4.3	1.9	-2.4	4	high TPA & sulphide possible
4	BH10 0.6-0.7	5.6	3.5	-2.1	4	low TAA & sulphide possible
5	BH10 0.9-1	5.4	3.6	-1.8	4	low TAA
6	BH10 1-1.45	5.3	3.5	-1.8	1	low TAA
7	BH10 2.5-2.95	4.8	2.7	-2.1	1	low TAA & moderate TPA & sulphide possible
8	BH10 4-4.45	4.8	2.9	-1.9	4	low TAA & moderate TPA
9	BH11 1-1.45	5.3	3.3	-2.0	1	low TAA & moderate TPA
10	BH12 0.4-0.5	5.0	3.0	-2.0	3	low TAA & moderate TPA
11	BH12 0.9-1	5.1	3.1	-2.0	3	low TAA & moderate TPA
12	TP15 0.4-0.5	5.5	4.0	-1.5	4	low TAA
13	TP15 1-1.1	5.4	4.1	-1.3	4	low TAA
14	TP15 1.4-1.5	4.9	3.6	-1.3	1	low TAA
15	TP16 0.4-0.5	4.9	3.2	-1.7	1	low TAA & moderate TPA
16	TP16 0.9-1	4.8	3.6	-1.2	1	low TAA
17	TP16 1.4-1.5	4.8	3.5	-1.3	1	low TAA

DETERMINATION OF ACID SULFATE SOIL PROPERTIES

CERTIFICATE OF ANALYSIS

Analysis By: Bio-Track Pty Ltd ABN 91 056 237 275 781 Mt. Glorious Road Highvale, Brisbane, Australia, 4520 Ph. 07 3289 7179

LAB REFERENCE LR170418.712 DATE OF REPORT 20 APRIL 2018 @08:36:16 Page 1 of 1 Report Pages.
CLIENT NAME Matt Rowbotham c/o Regional Geotechnical Solutions Pty Ltd (Wingham) 44 Bent Street Wingham 2429
PROJECT NAME Proposed Machsville Hospital YOUR PROJECT/JOB REFERENCE RGS31237.1
SAMPLING DATE NUMBER OF SAMPLES 7 Samples supplied by client SAMPLE TYPE:Soil/Solid
DATE RECEIVED 17/04/2018 4:47:07 PM PACKAGING Plastic Bag Ground Oven Dry Samples DISPOSED ON 16/06/2018

Sample ID as received. METHODOLOGY: As per (DNR QASSIT May 2004), oven dried (85˚C), >1000 um shell removed, fine grind. All reported values gravimetric, dry mass.
%sEQ (equivalent sulphur) calculated as moles TAA/624 + %S Cr + %sNAS - sANC_BT (sNAS included irrespective of pH).
LIME1 rates calculated to neutralise TPA (or TAA if >TPA)+ aS_RAS -ANC_BT/1.5 LIME2 rates calculated to neutralise TAA + aS_POS or S_Cr + aS_RAS -ANC_BT/ 1.5
NB. Lime rates assume 97% lime neutralisation but DO NOT include any safety factors. Suggested factor=1.5-2. Rates are kg/ton. Multiply by bulk density to convert to kg/m3.
Fineness Factor (FF)=1.5 CBN POS= moles carbonate alkalinity released by oxidation assuming (Ca POS - Ca KCl) + (Mg POS - Mg KCl) is due to carbonate solution.
Blanks represent unmeasured values, zeros & <0.x represent measured values. If pH KCl>4.5 then s-RAS (calculated from acid extract) may be zero for undisturbed soil. Ca NAS is the acid reactive calcium calculated as the difference between 1 M KCl and 4 M HCl soluble Ca.

ID. DEPTH None	pH KCL	pH ox	TAA	TPA	TSA	S KCl	S P	S POS	S Cr	s-NAS	s EQ	Ca KCl	Ca P	Mg KCl	Mg P	CBN POS	LIME1	LIME2	sANC_BT	Ca NAS
	KCL	ox	m/t	m/t	m/t	%	%	%	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg	m/t	kg/t	kg/t	%	mg/kg
Analytical Method Codes	23A	23B	23F	23G	23H	23Ce	23De	23Ee	22B	s20Je	s	23Vh	23Wh	23Sm	23Tm	a23U&X			s19A2	20E
BH8 6.5-6.9	3.88		56			0.04			0.12	<0.01	0.215	442		285				7		<10
BH9 5.5-5.95	4.26		38			0.04			0.82	0.01	0.892	332		256				28		348
BH10 1-1.45	4.25		79			<0.01			0.15	<0.01	0.281	280		719				9		<10
BH11 1-1.45	4.38		94			<0.01			0.29	<0.01	0.445	264		599				14		<10
BH12 0.4-0.5	4.36		80			<0.01			0.08	<0.01	0.217	440		372				7		<10
TP15 1-1.1	4.61		58			<0.01			0.02	<0.01	0.124	220		204				4		24
TP16 0.9-1	4.77		97			0.02			0.15	0.04	0.340	179		227				11		<10

Signatory For and on behalf of Bio-Track Pty Ltd

CERTIFICATE OF ANALYSIS

Analysis By: Bio-Track Pty Ltd
ABN 91 056 237 275
Mt. Glorious Road
Highvale, Brisbane, Australia, 4520
Ph. 07 3289 7179 Fx. 07 3289 7155

DATE OF REPORT 26 APRIL 2018 Page 1 of 1 Report Pages.
CLIENT NAME Matt Rowbotham c/o Regional Geotechnical Solutions Pty Ltd (Wingham)
CLIENT ADDRESS 44 Bent Street Wingham 2429
PROJECT NAME Proposed Machsville Hospital YOUR PROJECT/JOB REFERENCE RGS31237.1
SAMPLING DATE NUMBER OF SAMPLES 3 SAMPLE TYPE:Soil/Solid
PACKAGING Plastic Bag ** SAMPLES DISPOSED ON 16/06/2018
DATE RECEIVED 17/04/2018 4:47:07 PM LAB REF. LR170418.713

METHODOLOGY: EC Cl as 1:5, pH 1:2.5; air dried soil in water, 30 minute rolling shake, Cl by ion selective electrode. S as 1:40 IN KCl extract measured by ICP OES. RESIS:soil resistivity per AS1289.4.4.1 SO4 calculated as S x 3 SO3 calculated as S x 2.5

SAMPLE ID	EC	pH	Cl	S	SO4	SO3	RESIS
None depth	dS/m		mg/kg	mg/kg	%	%	ohm-cm
BH4 2.5-2.95	0.04	5.1	38	26	<0.1	<0.1	6900
BH8 6.5-6.9	0.42	3.8	70	377	0.1	<0.1	920
BH10 1-1.45	0.19	4.9	175	88	<0.1	<0.1	1700

Signatory

For and behalf of Bio-Track Pty Ltd

CERTIFICATE OF ANALYSIS

Analysis By: Bio-Track Pty Ltd
ABN 91 056 237 275
Mt. Glorious Road
Highvale, Brisbane, Australia, 4520
Ph. 07 3289 7179 Fx. 07 3289 7155

DATE OF REPORT 26 APRIL 2018 Page 1 of 1 Report Pages.
CLIENT NAME Matt Rowbotham c/o Regional Geotechnical Solutions Pty Ltd (Wingham)
CLIENT ADDRESS 44 Bent Street Wingham 2429
PROJECT NAME Proposed Machsville Hospital YOUR PROJECT/JOB REFERENCE RGS31237.1
SAMPLING DATE NUMBER OF SAMPLES 1 SAMPLE TYPE:Soil/Solid
PACKAGING Plastic Bag ** SAMPLES DISPOSED ON 19/06/2018
DATE RECEIVED 20/04/2018 12:41:07 PM LAB REF. LR200418.529

METHODOLOGY: EC Cl as 1:5, pH 1:2.5; air dried soil in water, 30 minute rolling shake, Cl by ion selective electrode. S as 1:40 IN KCl extract measured by ICP OES. RESIS:soil resistivity per AS1289.4.4.1 SO4 calculated as S x 3 SO3 calculated as S x 2.5

SAMPLE ID	EC	pH	Cl	S	SO4	SO3	RESIS
None depth	dS/m		mg/kg	mg/kg	%	%	ohm-cm
BH12 1.3-1.45	0.21	5.2	215	116	<0.1	<0.1	2100

Signatory

For and behalf of Bio-Track Pty Ltd

Appendix D
Pavement Design Sheet

FLEXIBLE PAVEMENT THICKNESS DESIGN

CLIENT: NSW Health **Job No.:** RGS31237.1

PROJECT: Proposed New Macksville Hospital

LOCATION: North Macksville **Date:** 16-Apr-18

ROAD NAME:	**Access Road off Letitia Close**	**Refer to drawing:**	
Chainage Interval (m):	0m to 800m	**Road classification ref:**	N/A
Road Classification:	N/A	**Design Traffic:**	8.0x 10^5 ESAs

Subgrade Conditions

Expected subgrade:	Gravelly Silty Clay		
Adopted Subgrade CBR value:	3.5	Required subgrade compaction:	100% Standard Compaction
Potential construction or performance issues:	Proof roll to identify any areas showing evidence of deflection. Where identified, remove and replace with approved granular fill.		

Pavement Design

Recommended Pavement Layer Thickness:		**Recommended Material requirements**	**Required Compaction**
Wearing course thickness (mm):		14/7 two coat seal or to Council requirements. 30mm AC recomenedaed in areas of high screwing loads.	
Base thickness (mm):	140	DGB20 or equivalent	98% Modified Compaction
Sub-base thickness (mm):	320	Existing pavement gravel or imported DGS40.	97% Modified Compaction
Select thickness (mm):	0	Existing pavement gravel CBR>13, PI<15, or DGS40	100% Standard Compaction
Total thickness (mm):	460		

Definitions:

Design traffic loading:	The anticipated number of equivalent standard axles (ESA), as defined by AUSTROADS, in the design lane during the design life of the pavement.
Modified Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.2.1-2003 or equivalent.
Standard Compaction:	Minimum required dry density ratio (AS1289 5.4.1-2007) defined as the ratio of the calculated field dry density (AS1289 5.3.1-2004 or equivalent) to the maximum dry density obtained using AS1289 5.1.1-2003 or equivalent.
Density Index:	Minimum required Density Index AS1289 5.6.1-1998, defined as the ratio of field dry density determined by AS1289 5.3.1-2004 or equivalent to the laboratory values of maximum and minimum density obtained by AS1289 5.5.1-1998 or equivalent

Note: Pavement designs assume appropriate drainage is installed and maintained. Refer to Regional Geotechnical Solutions Report No. RGS31237.1-AH for recommendations regarding pavement construction and drainage.

Appendix E
Acid Sulfate Soil Management Plan

INTRODUCTION

This Acid Sulfate Soil Management Plan (ASSMP) has been prepared for the proposed Macksville Hospital Development and should be read in conjunction with the Geotechnical Report prepared for the project by Regional Geotechnical Solutions (Pty Ltd) (RGS) (Ref: RGS31237.1 – AH dated 2 May 2018).

In summary, the report indicates the soils encountered along the alluvial floodplain are potential acid sulfate soils (PASS). Therefore, where these soils will be disturbed as part of the development they should be treated and this ASSMP implemented.

This ASSMP has been prepared for the development and outlines the measures that must be implemented on site during excavation works to control, treat and manage ASS.

It is noted that validation testing of the treated ASS will be required and testing generally takes about 10 working days, therefore this should be allowed in the earthworks management plan to reduce the potential for delays during construction.

RESPONSIBILITIES

The project superintendent is responsible for implementing the ASS management protocols detailed within this ASSMP. Only a suitably experienced ASS consultant may vary the procedures detailed herein.

The superintendent shall:

- Record a daily log showing the volume of material that has been excavated, and treated;
- Ensure that validation testing is undertaken by an independent monitoring consultant on a regular basis.

The requirements of the ASSMP are in addition to, but do not override any other standard procedures such as safety considerations. Where conflict results, or may result from, the implementation of the ASS management as against other performance criteria, the project superintendent shall obtain directives from the project manager or the ASS consultant as appropriate.

NEUTRALISING MATERIALS

Fine Agricultural Lime (aglime) must be used for liming of excavated materials. Hydrated lime, Dolomatic aglime, or magnesium blend aglime, should not be used. The aglime grind shall have:

- At least 85% by weight passing 1mm, and 100% passing 2.5mm. In general a finer grind is better; and
- Aglime shall have a Neutralising Value (NV) of 90% or better (i.e. NV>90).

MANAGEMENT AND PROCESSING OF ASS

Treatment Area

ASS shall be placed in a prepared treatment area, be it onsite or at an approved offsite location. Preferably the treatment area should be located close to the area where the materials will be excavated. The treatment area shall be fully enclosed by a bund wall to prevent runoff to other areas of the site. The bund must have a height of at least 0.5m that comprises of soils that are not ASS or are treated ASS. The size of the treatment area should be of sufficient size to treat the excavated materials at the proposed excavation rate and to store material for the period required to undertake the verification testing. The treatment area should be lined with several layers of heavy duty plastic (HDPE). The lining should be replaced periodically as required, where it is damaged during the treatment process.

Alternatively, for small volumes of materials, treatment could be undertaken in a large skip.

The treatment area / skip should be covered with heave duty plastic at all times to prevent runoff, particularly when inclement weather is forecast.

Treatment

The ASS shall be placed in the treatment area and spread in a layer of not more than 300mm thick with lime being applied across the treatment area at the rate specific in the geotechnical report (90kg / cubic meter for the materials tested). The lime shall be evenly mixed and be applied within 8 hours of excavation.

Validation Testing

Validation testing shall be undertaken by an independent ASS consultant at the initial rate of two samples per 500m^3 or part thereof. The sample shall be submitted to a NATA accredited laboratory for testing by the Chromium Reducible Sulfur suite.

If testing indicates reducible sulphur values that exceed ASSMAC Action Criteria in the processed soil the material will require reprocessing (potentially requiring variation in the

processing methodology). Further validation testing should then be undertaken to assess that acceptable values have been obtained.

All records applicable to acid sulfate testing and treatment shall be collated to substantiate treatment.

Post Treatment

Once the ASS materials have been treated in accordance with this ASSMP, the materials may be reused onsite or disposed of in accordance with the relevant regulatory requirements. It is noted that additional testing may be required to appropriately classify the materials for offsite disposal or reuse on another approved site.