



GEO_LOGIX



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GEOTECHNICAL REPORT

Proposed Masters Home Improvement Store
5-7 Hilton Street and 7 Scott Road, South Tamworth NSW

Hydrox Nominees P/L – March 2013

DOCUMENT CONTROL

GEOTECHNICAL REPORT

Proposed Masters Home Improvement Store
 5-7 Hilton Street and 7 Scott Road
 South Tamworth, NSW

PREPARED FOR

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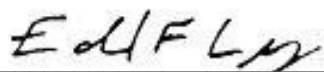
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EXECUTIVE SUMMARY

Geo-Logix Pty Ltd (Geo-Logix) was engaged by Hydrox Nominees Pty Ltd to conduct a geotechnical investigation of the site located at 5-7 Hilton Street and 7 Scott Road, South Tamworth, NSW.

Hydrox plans to develop the site as a Masters Home Improvement Store with two pad ready out parcels including surrounding car parks, two bridges spanning the onsite creek and stabilisation of the creek banks. The total development area encompasses 46,500m². At the time of the Geo-Logix investigation the site was largely vacant grassed rural blocks.

Geo-Logix completed a field investigation of the proposed site on 9-11 January 2013 consisting of fifteen borings to a maximum depth of 8.7 mbg at locations proposed by Geo-Logix and approved by Henry and Hymas the Structural Engineer. Soils encountered across the site included:

- The site surface was primarily grassed with a thin layer of topsoil;
- Underlying the surficial Topsoil layer, the natural stratigraphy of the western portion of the site comprised approximately 1-2m of dark yellowish orange stiff to very stiff residual CLAY underlain by Shale bedrock;
- In the eastern portion of the site the residual soil is overlain by brownish grey stiff to very stiff alluvial CLAY increasing in depth towards the east; and
- Areas of Fill are located across the site; these are delineated on Figure 4. The deepest Fill is located on Lot C3. The onsite Fill appeared to be uncontrolled, significant debris was particularly evident in the Lot C3 Fill.

The results of the investigation indicate the following geotechnical conditions:

- For temporary excavations, batters should be 2H:1V for alluvial soils, 1H:1.5V for residual soils and 1H:1V for fill soils;
- For permanent batters along the creek banks 4H:1V is recommended. Steeper batters may be achieved using geotextile stabilisation, gabions, or other stabilisation techniques;
- Due to the extent of Fill onsite, the site classification in accordance with AS 2870-2011 is 'P'. Following earthworks, the fill and natural soil profile is expected to be equivalent to a Class 'M', with a characteristic free surface movement (y_s) of 20-40mm with changes in moisture;
- The recommended Design CBR for pavements and slabs is 5%;
- For the purpose of buildings, structures may be founded on shallow foundations with an allowable bearing capacity of 100kPa;
- Concrete structures in contact with natural soils should be designed based on moderately aggressive B1 exposure. Steel structures in contact with natural soils should be designed based on severely aggressive B2 exposure;
- Concrete structures in contact with fill soils should be designed based on severely aggressive B2 exposure. Steel structures in contact with fill soils should be designed based very severely aggressive C2 exposure; and
- The recommended earthquake design class for the site is C_e.



This report is based on limited information on the soil profile and soil moisture conditions at selected locations at the time of the investigation. Subsurface conditions may vary elsewhere across the site.

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1. INTRODUCTION

Geo-Logix Pty Ltd (Geo-Logix) was engaged by Hydrox Nominees Pty Ltd (Hydrox) to conduct a geotechnical investigation of the site located at 5-7 Hilton Street and 7 Scott Road, South Tamworth, NSW (Figure 1).

The objective of the geotechnical investigation is to assess the subsurface soil strata in order to provide soil parameters and engineering recommendations for site earthwork and construction.

1.1 Proposed Development

Based on plans provided by Henry Hymas (Attachment A), Hydrox plans to develop the site as a Masters Home Improvement Store with two pad ready out parcels including surrounding car parks, two bridges spanning the onsite creek and stabilisation of the creek banks. The total development area encompasses 46,500m².

1.2 Objectives and Scope of Work

The objective of the geotechnical investigation was to provide an assessment of subsurface conditions to assist with planning of the proposed development, including depth to groundwater if encountered.

To satisfy the above objectives Geo-Logix completed the following scope of work:

- Visual appraisal of the site conditions and locality;
- Review of the geological maps for the area;
- Drilling of fifteen borings (B1 to B15) at locations approved by the structural engineer for the project (Henry & Hymas Pty Ltd);
- The performance of Standard Penetrometer Tests (SPTs) at regular intervals in each boring location to assess the relative density and/or consistency of the subsurface soils;
- Logging of the borings by a geotechnical engineer;
- Collection of representative soil samples for selective geotechnical and chemical laboratory testing;
- Backfilling of the borings with on-site soils;
- Review of test pit logs recorded by Geo-Logix environmental investigations of this site; and
- Provision of this report detailing the results of the above investigation, recommendations for design and construction of the proposed development.

The field investigations were conducted in January 2013.

2. SITE INFORMATION

2.1 Site Identification and Description

The investigation area comprises the following properties:

Street Address	Lot and Deposited Plan (DP)	Report Reference	Approximate Area (m ²)
5 Hilton Street, South Tamworth NSW 2340	Part Lot C3 DP 160164	Lot C3	46,500
7 Hilton Street, South Tamworth NSW 2340	Part Lot 1 DP 196665	Northern Lot	
7 Scott Road, South Tamworth NSW 2340	Part Lot 1 DP 797999	Southern Lot	

Notes

Property information sourced from Title Deed information and Hydrox Nominees Pty Ltd.

The site is located within a rural/residential area of Tamworth, is largely rectangular shaped and occupies an area of approximately 46,500m². At the time of Geo-Logix investigation the site was largely vacant grassed rural blocks (Figure 2).

2.2 Topography

The western site slopes moderately towards the east-northeast. The eastern portion of the site lies in a flood plain and is generally level in elevation. Regional topography slopes gently to the north.

2.3 Regional Geology

Review of the NSW 1:250,000 Tamworth Geological Map (Geological Survey of NSW, 1971) indicates:

- The western portion of the site is underlain by Upper Devonian age argillite and greywacke of the Baldwin Formation; and
- The eastern portion of the site is underlain by Quaternary age alluvium comprising clay, silt, sand and gravel.

2.4 Regional Hydrology

It is expected that groundwater would follow the natural regional topography and generally flow to the east – northeast.

Reference to the NSW Natural Resource Atlas (NSW Government, 2012) indicates there are 18 registered groundwater bores within a 500m radius of the site. The closest registered bore GW969381 is privately owned and located on a property south of the site, directly across Scott Road. The bore logs recorded water bearing zones were encountered between 12m and 18m. The lithology was logged a 0-0.3m brown topsoil overlying 0.3-18m brown heavily broken shale.

A group of monitoring bores (GW969607, GW969608 and GW969609) are located on a Shell Service Station approximately 280m upgradient southwest of the site. Bore logs indicate water bearing zones were encountered between 11m and 13.5m. Lithology was logged as 0-0.8m fill, overlying 0.8-10.5m light brown dry sandstone, 10.50m – 11.50m fractured sandstone and 11.5-13.5m water-bearing fractured sandstone.

3. METHOD OF INVESTIGATION

Fieldwork was undertaken on 18 January 2013 by Edward Lilly, an experienced geotechnical engineer, and comprised:

- Drilling and logging of fifteen borings (B1 to B15) across the site, using a ute mounted drill rig;
- The performance of Standard Penetrometer Tests (SPTs) at regular intervals in each boring location to assess the relative density and/or consistency of the subsurface soils;
- Collection of soil samples for selective geotechnical and chemical laboratory testing to assist with soil classification and assessment; and
- Backfilling of the borings at the conclusion of the sampling and logging.

3.1 Investigation Methods

Prior to commencement of the borings each location was scanned for underground services and utilities by an independent utility locator and cross-checked with the results of a Dial Before You Dig (DBYD) search.

Borings were completed using a ute mounted drill rig and positioned at locations approved by the structural engineer for the project (Henry & Hymas Pty Ltd). The borings generally provide systematic site coverage and were drilled to a maximum depth of 8.7 mbg.

During drilling the encountered Fill material and natural soils were logged in accordance with the Unified Soil Classification System (USCS). Representative samples of soil were submitted to SGS Australia Pty Ltd (SGS) for selective characterisation tests and chemical tests.

The location of each boring was estimated using measurements from existing features as depicted in Figure 2. A copy of the boring logs and SPT results are provided in Attachment B.

4. INVESTIGATION RESULTS

4.1 Subsurface Conditions

The site surface was primarily grassed with a thin layer of topsoil. The natural stratigraphy of the western portion of the site comprised approximately 1-2m of stiff to very stiff Sandy CLAY underlain by Shale bedrock. The site slopes down to a flood plain in the eastern portion of the site. The alluvial soils of the flood plain primarily comprised stiff Heavy CLAY, the depth of the alluvium increases further eastwards on the site. Boring B15, in the northeast corner of the site, contained Clayey GRAVEL alluvium underlying the upper CLAY alluvium.

Areas of Fill are located across the site; these are delineated on Figure 3. The deepest Fill is located on Lot C3. The onsite Fill appeared to be uncontrolled, significant debris was particularly evident in Fill on Lot C3.

Detailed descriptions of each boring are contained within the attached boring logs (Attachment B).

4.2 Groundwater

During the geotechnical investigation groundwater was encountered at 5.8 mbg at boring location B15 in the northeast corner of the site. Groundwater was not encountered within the maximum depth of exploration elsewhere across the site.

4.3 Laboratory Results

Representative samples of soil were collected during the fieldwork and submitted to SGS for NATA accredited testing. Tests included:

- Atterberg Limit and Linear Shrinkage tests to assess the plasticity and reactivity of a specific soil sample to assist with classification and description;
- California Bearing Ratio (CBR) testing to assist with pavement design; and
- Electrical conductivity, sulphate, chloride and pH testing to assess the exposure classification of the soil with respect to buried structural concrete and/or exposed steel.

The laboratory test results are presented in Attachment C. A summary of the results is provided in the following sections.

4.4 USCS Classification Testing

Three samples –B4/1.2, B7/0.0 and B13/1.3 – were submitted to SGS for NATA accredited Atterberg Limit and Linear Shrinkage tests. The samples were selected to confirm the field classification of natural soils across the site. Linear Shrinkage tests were completed in order to calculate the free surface movement of the on-site soils for site classification in accordance with AS2870-2011. A summary of the results is provided below.

Location/ Depth (m)	Sample Description	Liquid Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)
B4/1.2	Dark yellowish orange Clayey SAND with Gravel	49	30	13.5
B7/0.0	Dark yellowish orange Clayey SAND with Gravel	61	38	15.0
B13/1.3	Greyish brown Heavy CLAY	73	55	15.0

The Atterberg Limit test results indicate whether the fine grained component of the samples is classified as Silt or Clay as well as the reactivity of the material. The Linear Shrinkage results indicate the soil potential for movement with changes in moisture content. The potential for surface movement with changes in moisture is discussed in Section 5.7.

4.5 Californian Bearing Ratio (CBR)

Bulk samples from locations B5, B7, B8, B10, B11 and B12 were selected in order to generate a site-wide understanding of CBR values for use in pavement design. These samples were submitted to SGS for NATA accredited testing of the CBR. These samples are representative samples of the soil which are expected to serve as subgrades for pavement and floor slabs.

The CBR samples were remoulded in the laboratory and compacted to 100% standard maximum dry density at optimum moisture content. Prior to testing, the samples were soaked for three to four days under a surcharge load of 4.5kg. The soaked CBR values are provided in the following table.

Location/ Depth (m)	Sample Description	CBR Value
B5/0.0	Dark yellowish brown Clayey SAND with Gravel	5.0
B7/0.0	Dark yellowish orange Clayey SAND with Gravel	8.0
B8/0.0	Moderate brown Silty SAND with Gravel	6.0
B10/0.0	Yellowish grey Clayey SAND with Gravel	8.0
B11/0.0	Pale yellowish brown Sandy CLAY	7.0
B12/0.0	Pale yellowish brown Sandy CLAY	5.0

Pavement design based on these CBR results is discussed in Section 5.8.

4.6 Exposure Classification Tests

Four soil samples – B2/1.2, B8/2.7, B12/1.3 and B14/4.3 – were submitted to SGS for NATA accredited testing of pH, sulphate, chloride and electrical conductivity to determine the exposure classification (or aggressiveness/corrosiveness potential of the soil) with respect to buried steel and/or concrete. The samples were selected as representative soil samples in which shallow foundations are expected.

To determine the aggressiveness of the soil and water environment on concrete or steel, the chemical test results are compared to Tables 6.1 and 6.3 from Section 6 of the Australian Standard AS2159 – 2009. This section provides assessment criteria to assess the ‘exposure classification’ for a concrete or steel pile. The Standard has two classes of soil conditions:

- (A) high permeability soils below groundwater; and
- (B) low permeability soils and all soils above groundwater.

Based on the chemical testing results, the Standard provides a range of ‘exposure classifications’ from non-aggressive to very severe. For the range of chemical conditions in the soil surrounding the structure, the condition leading to the most severe aggressive conditions is adopted. A summary of the soil results is provided in the following table.

Location/ Depth (m)	Soil Condition	Electrical Conductivity (EC) dS/m	Soil Texture Factor	Extract Electrical Conductivity (ECe) dS/m	Electrical Resistivity Ω -cm	pH	Chloride mg/kg	Sulphate mg/kg
B2/1.2	B	1.700	9	15.3	588	6.7	25	4400
B8/2.7	B	0.510	9	4.59	1,960	9.9	68	190
B12/1.3	B	0.880	7	6.16	1,136	9.3	200	760
B14/4.3	B	0.160	9	1.44	6,250	8.8	63	71

The potential aggressivity of an environment towards concrete and steel is dependent on the sulphate, chloride and pH levels of the soil. Soil aggressivity is discussed in Section 5.10. Site Salinity is discussed in Section 5.11.

5. DISCUSSION

5.1 Earthworks

The subject site should be prepared in accordance with AS3798-2009 Section 6.1 and filled in accordance with AS3798-2009 Section 6.2.

Initially topsoil and other surface features such as pavements should be stripped from the site, including an area extending at least 1.5m laterally beyond any planned structures or improvements. Utilities should be located and rerouted as necessary and any abandoned pipes or utility conduits should be removed or filled with grout. Utility trench excavations must be cut to competent bearing soils and backfilled with properly compacted Structural Fill.

Where the above site preparation procedures create excavations below the proposed final grade, the excavations should be backfilled with properly compacted Structural Fill. Under no circumstances should topsoil or other organic-laden soils be placed as Fill beneath or within 1.5 horizontal metres of building, car park, or other structural areas.

Once final grade is reached in cut areas, and prior to Fill placement in areas of the site that will receive new Fill, the subgrade should be evaluated by a geotechnical engineer or their representative. Following subgrade evaluation the exposed subgrade should be test-rolled in accordance with AS3798-2009.

The Clayey soils currently comprising the site surface, particularly in the eastern portion of the site, are very moisture sensitive and will degrade rapidly under construction traffic particularly when wet. Geo-Logix recommends providing positive drainage to the site in order to prevent localised ponding of water, especially where these soils have been exposed. Test rolling of wet surficial soils is likely to cause pumping, and unsuitable soil conditions may require over-excavation and replacement with suitable soils to achieve compaction.

Materials selected for use as Structural Fill should not contain more than three per cent by weight of organic matter, waste construction debris, or deleterious materials. Fill materials should have a Standard Maximum Dry Density (AS1289.5.1.1-2003) greater than 1.5 t/m^3 , and be granular material or be of low or medium plasticity. The residual Clay SAND and Sandy CLAY soils and Shale may be used as Structural Fill. The alluvial greyish brown CLAY found in the eastern portion of the site is not expected to meet these criteria; its reuse in structural areas should be avoided. Clean onsite Fill meets the above criteria may be used as Structural Fill. Debris laden onsite Fill, such as that found in lot C3, may be reused only in accordance with Section 5.2.

Prior to Fill placement the native soil should be densified with a 10 tonne roller. Fill materials should be placed in individual lifts of 300mm or less loose measurement and compacted using a sheep's foot roller for cohesive soils and a smooth drum roller for cohesionless soils. Fill should be compacted to a minimum of 98% of standard compaction with a moisture ratio of $\pm 2\%$ of the optimum moisture content.

Test rolling and Fill placement is to be undertaken under Level 1 Supervision.

5.2 Reuse of Debris Laden Fill

Lot C3 contains Uncontrolled Fill to depths of up to 4 metres below grade (mbg). In its current state the Fill in this area is unsuitable for use geotechnically, either in situ beneath the proposed Masters Store and car park or as Structural Fill; however it is Geo-Logix' opinion that much of this Fill can be made suitable. The following recommendations are made for the reuse of this Fill onsite:

- Consideration of special requirements for handling/sieving asbestos containing material – spraying, air monitoring, PPE;
- A white “gyprock” material was found within the fill often in a layer about 200mm thick; where a layer of gyprock is encountered this material should be stockpiled separately for offsite disposal. Incidental gyprock is expected to be present in quantities below the 3% threshold of acceptable deleterious material;
- Debris larger than 75mm within the Fill should be sieved out and stockpiled separately for offsite disposal;
- After sieving Fill from this area should be used in non-structural or carpark areas away from proposed building foundations. In carpark areas the Fill should be placed 1.5m beneath finished subgrade;
- Additionally, the Fill should be placed in a single lift less than 300mm height prior to compaction;
- Following Fill placement, and prior to compaction the Fill should be “hen pecked” for debris or other deleterious material; and
- A competent geotechnical engineer should be present during stockpiling, sieving, and placement of Fill from Lot C3.

5.3 Waste Disposal

Any soil removed from site will require waste classification in accordance with the Department of Environment and Climate Change Waste classification guidelines – Part 1 classifying waste, revision 2009.

5.4 Groundwater Inflow

Groundwater was encountered only in B15 at 5.8 mbg. Significant groundwater inflow is not expected in cut areas of the site. If perched water is encountered during excavation it can be managed by sump pump.

5.5 Excavation Induced Vibrations

If percussive excavation equipment (e.g. rock hammer) is used consideration must be given to possible construction induced ground vibration. Construction induced ground vibration is unlikely to be an issue at the site unless heavy impact tools are required for excavation. The use of other techniques which do not involve impact (e.g. rock saws), although less productive, would reduce or possibly eliminate risks of damage due to vibrations.

If adopting a rock hammer or similar, on-site guidance by a vibration specialist is recommended during the early part of excavation. This should include vibration characterisation trials which are used to define vibration levels for the selected equipment.

Peak Particle Velocity (PPV) is usually the adopted measure of ground vibration and the safe limits depend on the sensitivity of the adjoining structures and services. There are a number of Australian and overseas publications which provide vibration velocity guideline levels (or safe limits) including:

- Australian Standard AS2187.2-2006 Explosives - Storage and use - Use of explosives - Appendix J: Ground Vibrations and Airblast Overpressure;
- DIN 4150 – Part 3 – 1999. Effects of Vibration on Structures;
- Department of Environment and Conservation NSW, 2006. Assessing Vibration: a technical guideline;
- British Standard BS 7385-1:1990. Evaluation and measurement for vibration in buildings. Guide for measurement of vibrations and evaluation of their effects on buildings;
- British Standard BS 7385-2:1993. Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration.

The most appropriate guidelines levels for the proposed excavation work are provided in AS2187.2-2006, which refers to guideline values from BS7385-2 for the prevention of minor or cosmetic damage occurring in structures from ground vibration. Additionally, the guideline levels provided in DIN 4150 Part 3 is considered an appropriate source for guideline levels.

Ideally, safe limits should be determined by a specialist vibration consultant. However, as a preliminary guide, and considering the above guidelines and the type of adjoining structures present, Cottier recommend a maximum PPV of 10mm/sec (measured at the foundations of adjoining structures) to prevent cosmetic and structural damage.

The PPV limits of 10mm/sec are expected to be achievable if rock breaker equipment or other excavation methods are restricted as indicated in the following table:

Distance from Adjoining structure (m)	Maximum Peak Particle Velocity 10mm/sec*	
	Equipment	Operating Limit (% of Maximum Capacity)
1.5 to 2.5	300 kg rock hammer	50
2.5 to 5.0	300 kg rock hammer	100
	or 600 kg rock hammer	50
5.0 to 10.0	600 kg rock hammer	100
	Or 900 kg rock hammer	50

Geo-Logix notes human discomfort levels caused by vibration are typically less than the levels that are likely to cause cosmetic or structural damage to structures. Therefore complaints may be lodged by neighbours before any cosmetic or structural damage occurs.

Vibration monitoring is not considered to be necessary so long as only non-percussive excavation techniques are used and no complaints are lodged.

5.6 Temporary and Permanent Batter Slopes and Shoring

Any temporary excavations must be designed and constructed in a stable manner. The sides of the excavation should be shored or battered so as to maintain stability of both the excavation sides and bottom. Assuming that excavations are undertaken prior to any other construction works and provided all surcharge loads, including plant and stockpiled material are kept well clear of the top of the batters, minimum temporary batter slopes are recommended as 1H:1.5V for excavations of native soils and 1H:1V for excavations of fill soils.

For permanent batters along the creek banks 4H:1V is recommended. Steeper batters may be achieved using geotextile stabilisation, gabions, or other stabilisation techniques.

The following earth pressure coefficients are recommended for use in design of temporary and permanent retaining structures.

Retained Material	Bulk Density (kN/m ³)	K ₀	K _a
Fill	18	0.60	0.45
Clayey Alluvium	20	0.60	0.45
Clayey Residuum	20	0.55	0.40
Weathered Shale	22	0.25	0.10

The contractor is solely responsible for temporary excavation design and should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench depth, exceed those specified in local, state, and national safety regulations.

5.7 Site Classification

Considering that the proposed depth of controlled fill to be placed beneath the proposed structures, the appropriate geotechnical site classification is Class 'P' in accordance with AS2870-2011.

Free surface movement of the site has been calculated based on the results of Linear Shrinkage testing (Cameron, 1989). The natural soil profile is equivalent to a Class 'M', with a characteristic free surface movement (y_s) of 20-40mm with changes in moisture (AS2870-2011).

Geo-Logix notes that this site classification has not included the effects of trees, poor site drainage, leaking plumbing, and exceptional moisture.

5.8 Pavement

Pavement designs are based on the CBR and modulus of the subgrade materials encountered after any excavation or re-grading has taken place. The principal aim of the subgrade preparation is to provide a

uniform foundation over the entire pavement formation which will not give rise to unevenness in the pavement surface under the design loads. The final subgrade below pavements following the earthworks recommended in Section 5.1 should comprise native soils or controlled Fill. Both are considered to be suitable as a subgrade provided the material performs satisfactorily under test-rolling as detailed in AS3798-2007. In pavement areas the native soils and existing Fills should be densified with a 10 tonne roller prior to Fill or Aggregate Base Course placement.

Provided the final subgrade performs under test-rolling and is compacted to at least 98% standard compaction, the pavements and ground floor slabs may be designed based on a CBR of 7%.

5.9 Foundations

Geo-Logix recommends that footings for the proposed new Masters Home Improvement Store and outparcel structures be founded on consistent mediums to minimise any potential differential settlements. However, depending on the building loads and whether the structures are designed to be relatively flexible, this may not be significant.

Masters Home Improvement Store

Beneath the Masters Home Improvement Store, the ground conditions following the proposed earthworks are expected to comprise both new Fill and residual soils. The existing Fill is not considered a suitable founding medium.

Provided all new Fill is placed in a controlled manner as advised above, then this layer would be capable of supporting shallow footings which may be designed based on an allowable bearing capacity of 100kPa.

Alternatively, for higher bearing capacity and to ensure a consistent founding medium, bored piles may be adopted. It is recommended that the piles be founded within the underlying shale layer (the minimum recommended embedment depth is 3 mbg) and may be designed based on a serviceability end-bearing pressure of 700kPa and allowable shaft adhesion of 50kPa.

Outparcel Structures

Beneath the out parcel structures, the ground conditions following the proposed earthworks will comprise newly placed Fill overlying alluvial clay.

Provided the upper fill layer is placed in a controlled manner, then this layer would be capable of supporting shallow footings which may be designed based on an allowable bearing capacity of 100kPa.

Bridge Structures

The recommended foundation type for the bridge structures is bored piles may be adopted. It is recommended that the piles be founded within the residual soil layer (the minimum recommended embedment depth is 3 mbg) and may be designed based on a serviceability end-bearing pressure of 400kPa and allowable shaft adhesion of 20kPa.

All Foundation systems should be designed and constructed in accordance with the recommendations contained in AS2870-2011 and AS2159-2009 by a suitably qualified and experienced structural engineer.

5.10 Aggressivity/Exposure Classification

Based on the preliminary exposure classification test results (Section 4.5), and in accordance with AS3600-2009, concrete structures in contact with natural soils should be designed based on moderately aggressive B1 exposure. Steel structures in contact with natural soils should be designed based on severely aggressive B2 exposure. Concrete structures in contact with fill soils should be designed based on severely aggressive B2 exposure. Steel structures in contact with fill soils should be designed based on very severely aggressive C2 exposure.

5.11 Salinity Risk

Soil salinity risk is based on extract electrical conductivity (EC_e), the product of electrical conductivity of soil measured in solution and a multiplication factor based on soil texture. Based on the range of soil electrical conductivities between 0.160 and 1.700 dS/m encountered and multiplication factors of 7 and 9 for Medium Clay and Clay Loam, the site soils have extract electrical conductivities between 1.44 and 15.3 dS/m. These results indicate that much of the onsite soil is saline (EC_e>4) (Department of Land and Water Conservation NSW, 2002). Management strategies for saline soils include minimising disturbance of saline soils (e.g. cut and fill); prevention of infiltration (proper grading during construction and use of non-permeable pavements), and the use of salt tolerant landscaping vegetation.

5.12 Earthquake Design

Structural design for earthquake loads should be carried out in accordance with the relevant provisions in AS1170.4–2007. At this preliminary stage, based on the subsurface soil profile encountered during this investigation, and with reference to Table 4.1 of AS1170.4, the site subsoil class is considered to be C_e.

6. CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the investigation, Geo-Logix considers there to be no significant geotechnical constraint which would prevent construction of the proposed development as described in preliminary plans provided in Attachment A. However, the following conditions require consideration during construction of the proposed development:

- Deep Uncontrolled Fill on Lot C3;
- Excavation of Shale bedrock; and
- Varying bearing capacities of newly placed fill, alluvium, residuum, and rock.

These conditions may be addressed by the following measures:

- Treatment of the uncontrolled fill in accordance with Section 5.2;
- The Shale bedrock is generally expected to be rippable, assistance of a rock hammer may be required; and
- Founding of each structure on a consistent medium or allowing for differential bearing capacity across the structure.

7. LIMITATIONS

The recommendations submitted are based on the available project information and the subsurface information obtained by Geo-Logix. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, Geo-Logix should be notified immediately to determine if there are consequences to the recommendations provided in this report. If Geo-Logix is not retained to perform these functions, Geo-Logix cannot be responsible for the impact of those conditions on the performance of the project.

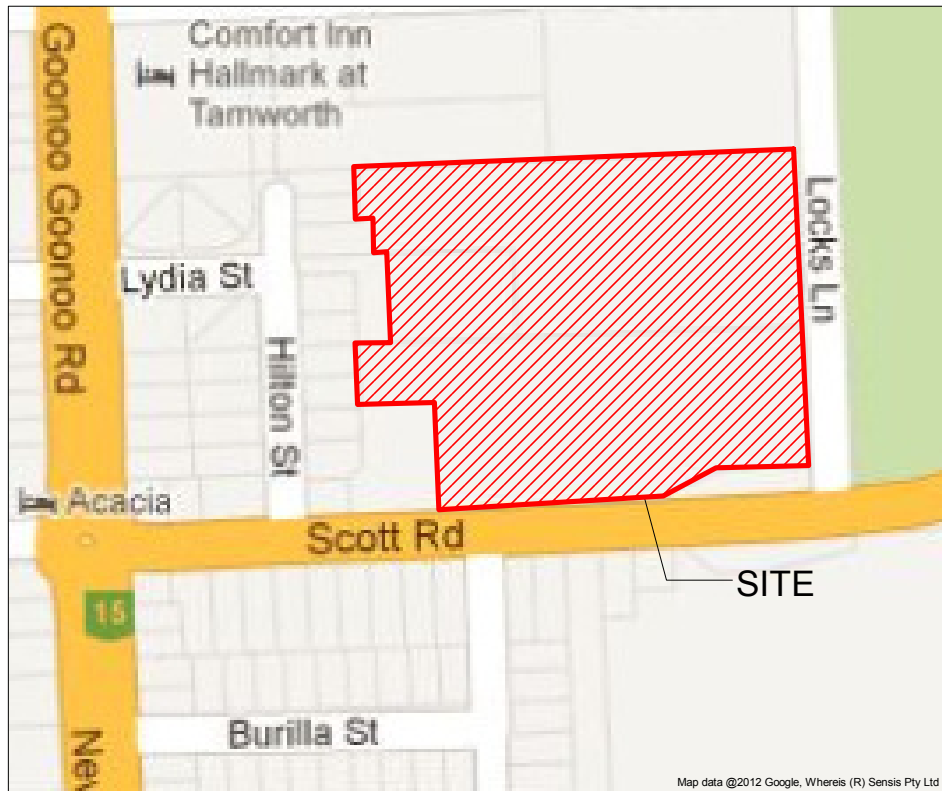
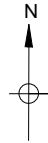
The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area at the time of this report. No other warranties are implied or expressed.

After the plans and specifications are more complete the geotechnical engineer should be provided with the opportunity to review the final design plans and specifications to assess whether our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of Hydrox Nominees Pty Ltd and their consultants for the specific application to the proposed construction of the proposed Masters Home Improvement Store at 5-7 Hilton Street and 7 Scott Road, South Tamworth, NSW.

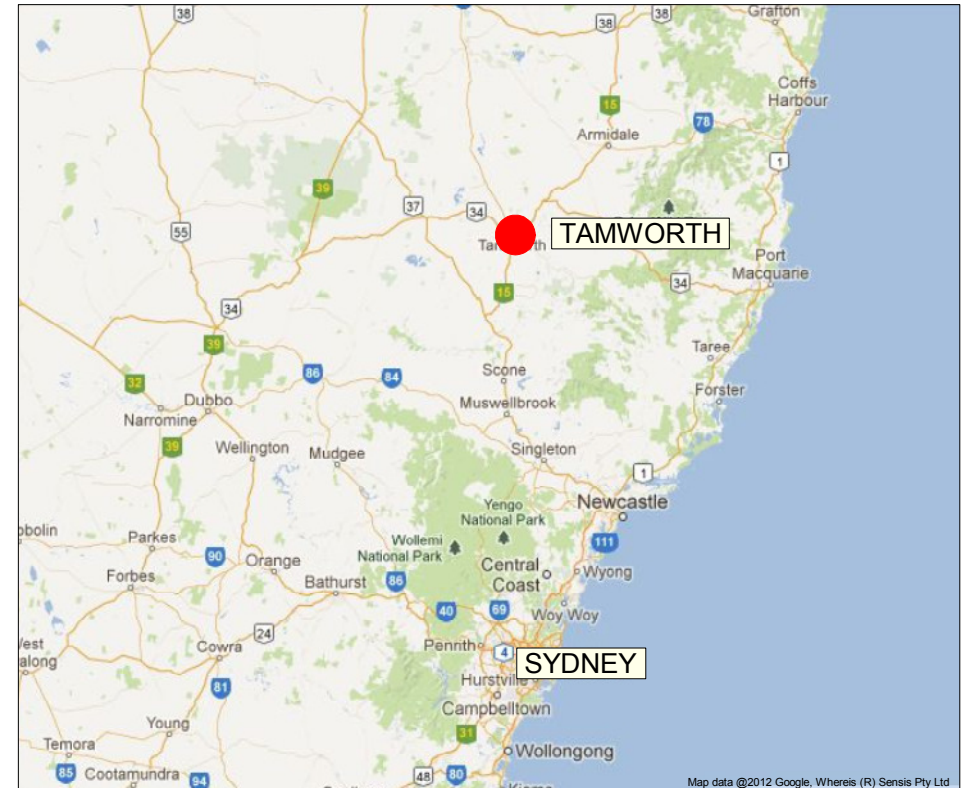
8. REFERENCES

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FIGURES

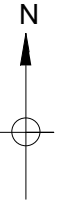
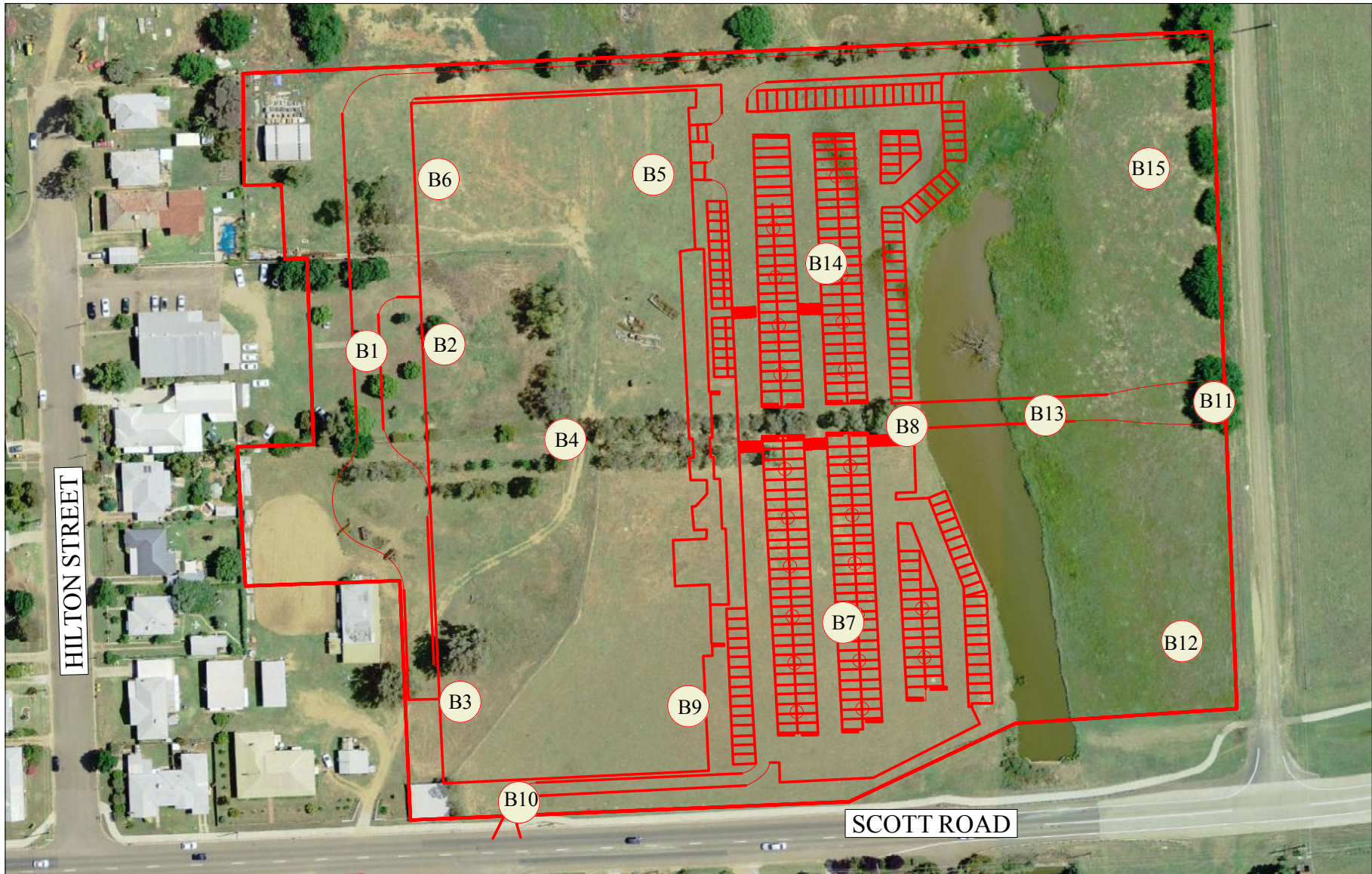


PART MAP SOUTH TAMWORTH



PART MAP NSW

					COPYRIGHT This Figure can only be used, reproduced or published (whether in whole or in part) for the sole purpose of work associated with the Geotechnical Investigation Report 5 - 7 Hilton Street & 7 Scott Road STH TAMWORTH NSW 2340 and any such use, reproduction or publication must acknowledge Geo-Logix as the author of the Figure.	 GEO-LOGIX PTY LTD UNIT 2309, 4 DAYDREAM STREET, WARRIEWOOD NSW 22102 Ph: (02) 9979 1722 Fax: (02) 9979 1222	DRAWN: M G	CHECKED: T L	SITE LOCATION MAP GEOTECHNICAL INVESTIGATION REPORT 5 - 7 Hilton Street and 7 Scott Road STH TAMWORTH NSW 2340				
							APPROVED: D G						
							DATE: 05/02/2013	SHEET SIZE: A4	PROJECT NO: 1201085	REV: 01	FIGURE 1		
ISSUE	DATE	AMENDMENTS	DRAWN	CHECKED									



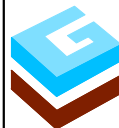
B1
Boring
Location



31° 06' 38" S / 150° 55' 33" E

ISSUE	DATE	AMENDMENTS	DRAWN	CHECKED

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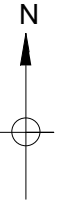
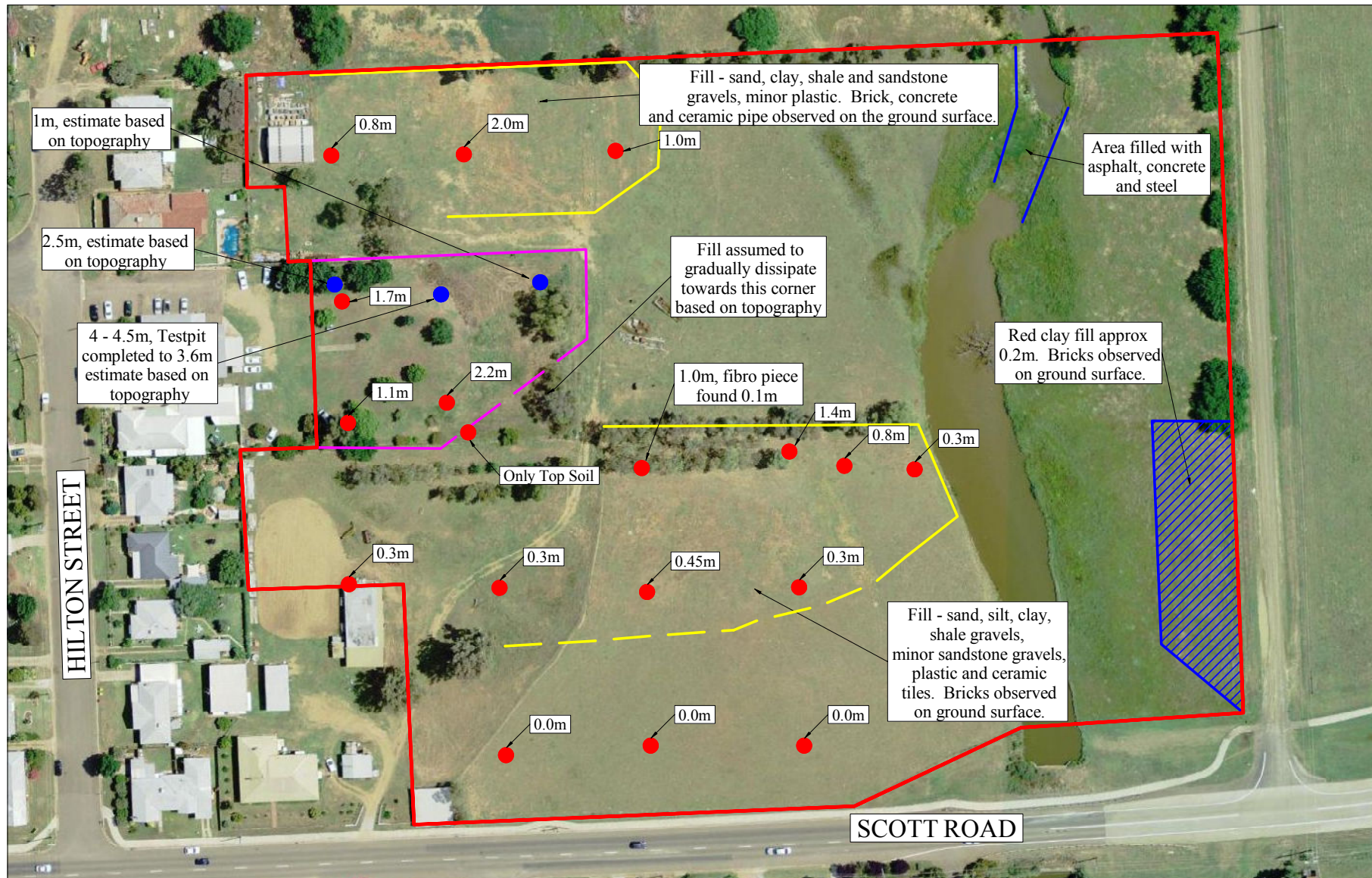


GEO-LOGIX PTY LTD
UNIT 2309, 4 DAYDREAM STREET,
WARRIEWOOD NSW 22102
Ph: (02) 9979 1722
Fax: (02) 9979 1222

DRAWN: M G	CHECKED: T L
APPROVED: D G	
DATE: 05/02/2013	SHEET SIZE: A4

BORING LOCATION MAP
GEOTECHNICAL INVESTIGATION REPORT
5 - 7 Hilton Street and 7 Scott Road SOUTH TAMWORTH NSW 2340

PROJECT NO: 1201085 REV: 01 **FIGURE 2**



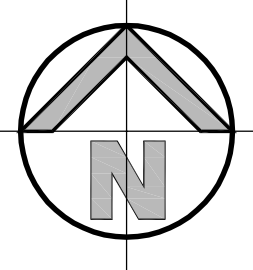
- 0.0m FILL DEPTH
- ESTIMATED FILL DEPTH



31° 06' 38" S / 150° 55' 33" E

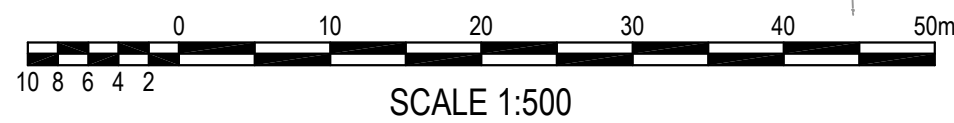
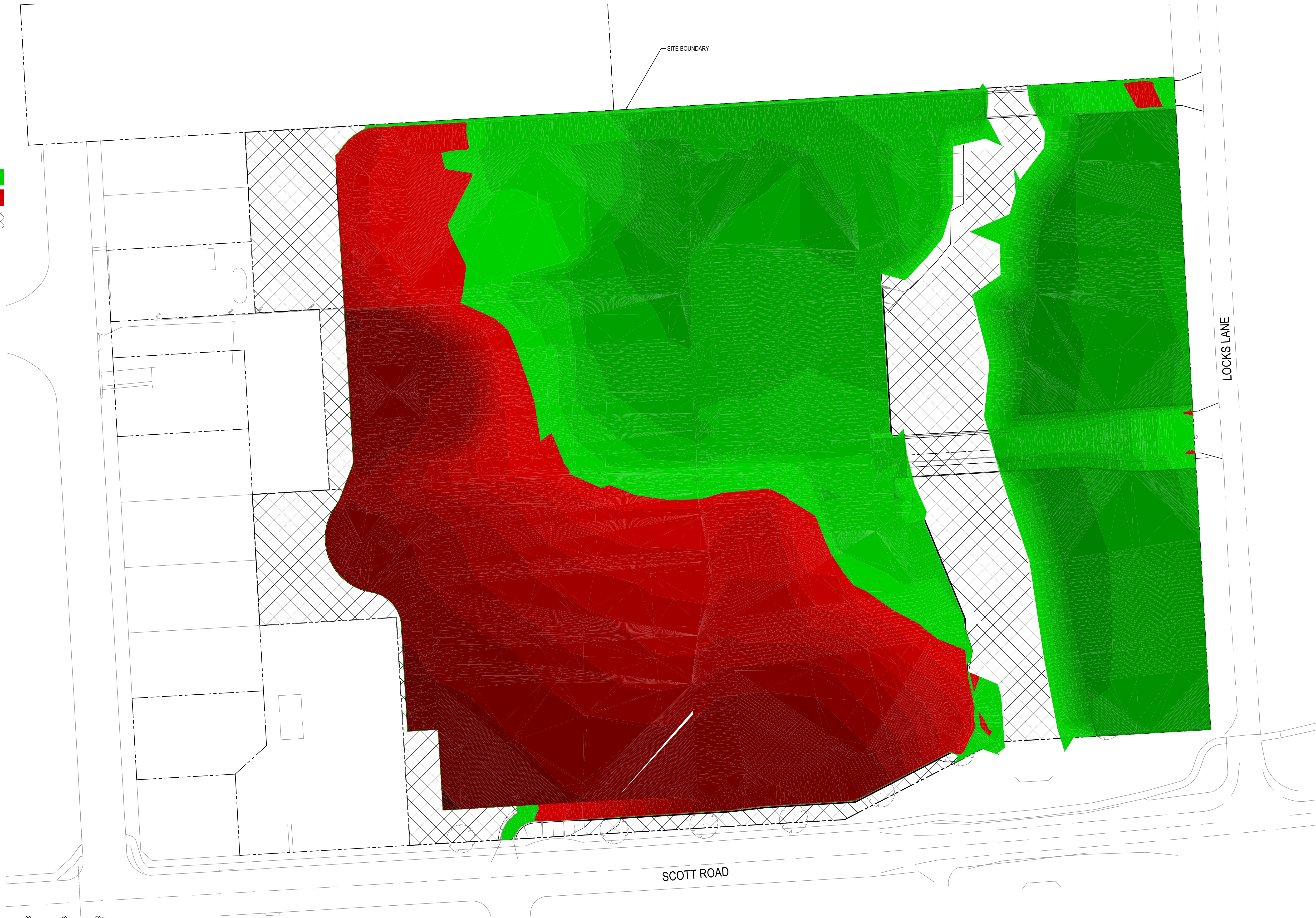
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ISSUE	DATE	AMENDMENTS	DRAWN	CHECKED	APPROVED: D G	DATE: 26/02/2013	SHEET SIZE: A4	PROJECT NO: 1201085	REV: 01	FIGURE 3

ATTACHMENT A



LEGEND

- EXTENT OF FILL 
- EXTENT OF CUT 
- NO EARTHWORKS 



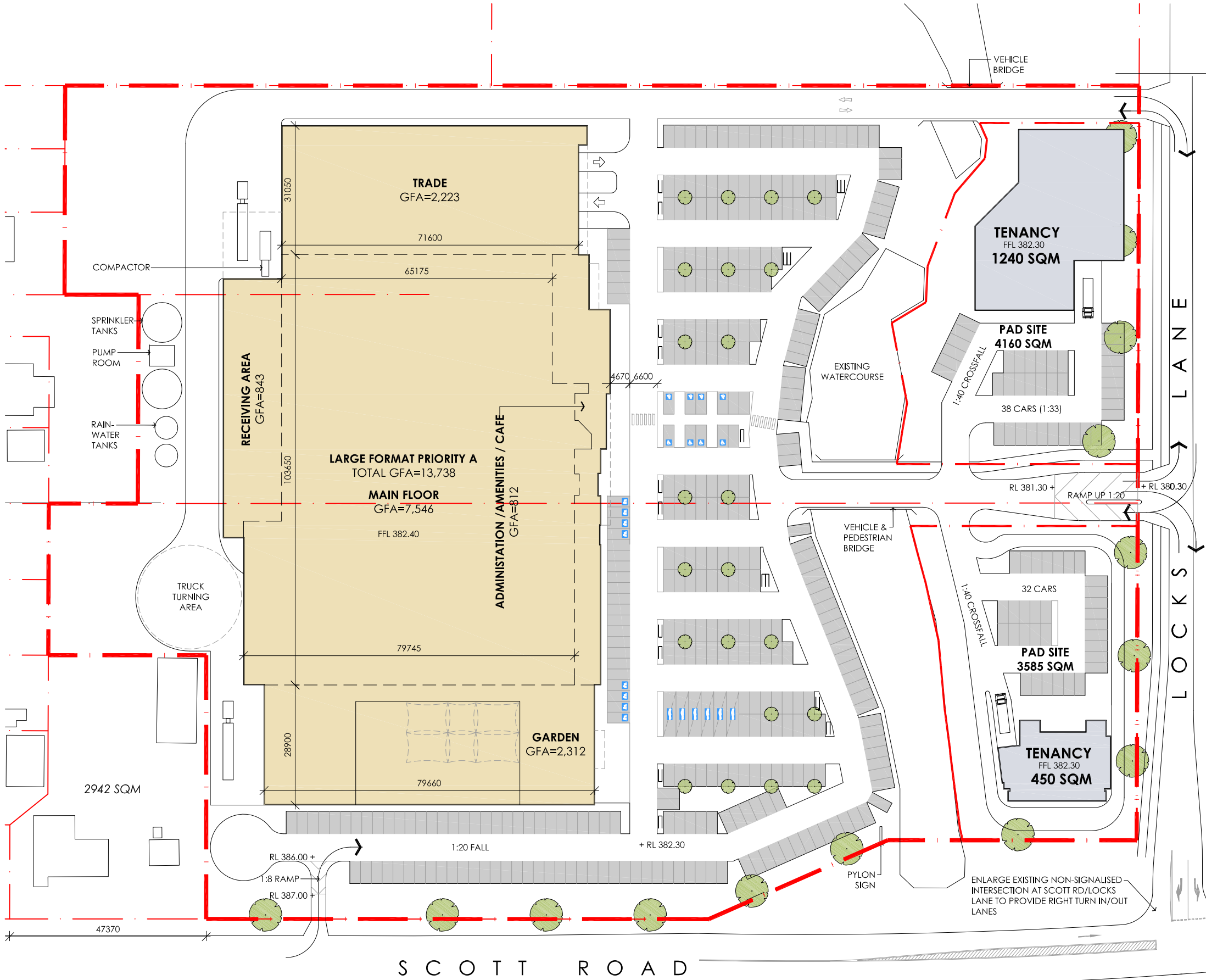
CUT AND FILL EXTENT

FOR INFORMATION ONLY

SURVEY INFORMATION										Client										Level 5, 79 Victoria Avenue Chatswood NSW 2067										Telephone +61 2 9417 8400 Facsimile +61 2 9417 8337 Email email@hthconsult.com.au Web www.henryandhymas.com.au																				Project PROPOSED DEVELOPMENT SCOTT ROAD, TAMWORTH (NSW)										Drawn LC Designed LC Date JUNE 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PROPOSED DEVELOPMENT
SCOTT ROAD, TAMWORTH (NSW)

DATE: NOVEMBER 2012



SITE AREA:	= 47,400 SQM
HARDWARE GFA:	= 13,738 SQM
TENANCY GFA	= 1,690 SQM
SITE COVERAGE	= 32.5%
CARSPACES (MASTERS)	= 369 (1:37)
CARSPACES (TENANTS)	= 70 (1:24)

NO PLANNING ADVICE HAS BEEN SOURCED FROM COUNCIL AND LOCAL AUTHORITIES IN THE PREPARATION OF THIS SITE MASTERPLAN.

ALL SETBACKS, PLOT RATIOS, LANDSCAPE AREAS, CAR PARKING NUMBERS AND THE LIKE ARE SUBJECT TO COUNCIL APPROVAL.

ENTRIES, EXITS & CAR PARKING LAYOUTS ARE PRELIMINARY ONLY AND SUBJECT TO TRAFFIC ENGINEER'S DESIGN.

SITE BOUNDARIES AND SITE AREAS INDICATIVE ONLY & SUBJECT TO CONFIRMATION BY LICENSED SURVEYOR.

3366 - SK21A

0 10 20 30 SCALE : 1:1000 @ A3



LEVEL 2, 18 OLIVER LANE,
MELBOURNE, VIC 3000. Tel. +61 3 9654 6344

2/290 BOUNDARY ST, SPRING HILL,
BRISBANE, QLD 4000. Tel. +61 7 3123 5544

7 YOUNG STREET, NEUTRAL BAY,
SYDNEY, NSW 2089. Tel. +61 2 9909 3344

LEFFLER SIMES ARCHITECTS

ATTACHMENT B

Borehole Log



Geo-Logix Pty Ltd

Building Q2, Level 3
Unit 2309 / 4 Daydream Street, Warriewood NSW 2102
Ph: (02) 9979 1722 | Fax: (02) 9979 1222
www.geo-logix.com.au

Hole ID. **B1**
Project Number: **1201085**
Hole Depth: **2.10 m**
Sheet: **1 of 1**

Project Name: **Tamworth 1201085**
Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**
Client: **Hydrox Nominees Pty Ltd**
Contractor: **Aimil Pty Ltd**
Method: **Solid Stem Auger (Ute Mounted)**

Date Started: **9/01/2013**
Date Completed: **9/01/2013**
Level: -----
Easting: -----
Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
Solid Stem Auger		0.2							FILL - Clayey Gravelly SAND, moderate yellowish brown (10YR 5/4), 30% clay, 40% sand, 30% gravel, medium dense.	damp		
		0.4										
		0.6										
		0.8										
		1.0										
		1.2	D	Z	B1 / 1.2	Fill						
		1.4									30/20 for 70mm	
		1.6										
		1.70										
		1.8										
		2.0	D	Z	B1 / 2.1	Residium	SC		Clayey SAND - moderate yellowish brown (10YR 5/4), 40% clay, 60% sand, dense.	damp		
		2.2							Refusal at 2.10 m on shale.		30 for 50mm	
		2.4										
		2.6										
		2.8										
		3.0										

Hydrocarbon Odour

H High
M Moderate
L Low
Z Zero

Sample Type

D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Ted Lilly**
Checked By: **Ted Lilly**

Date: **9/01/2013**
Date: **26/02/2013**

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL_GDT 26/2/13 2:25:57 PM

Borehole Log



Geo-Logix Pty Ltd

Building Q2, Level 3
Unit 2309 / 4 Daydream Street, Warriewood NSW 2102
Ph: (02) 9979 1722 | Fax: (02) 9979 1222
www.geo-logix.com.au

Hole ID. **B2**
Project Number: **1201085**
Hole Depth: **3.60 m**
Sheet: **1 of 1**

Project Name: **Tamworth 1201085**
Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**
Client: **Hydrox Nominees Pty Ltd**
Contractor: **Aimil Pty Ltd**
Method: **Solid Stem Auger (Ute Mounted)**

Date Started: **9/01/2013**
Date Completed: **9/01/2013**
Level: -----
Easting: -----
Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
Solid Stem Auger		0.5										
		1.0										
		1.5	D	Z	B2 / 1.2	Fill			FILL - Clayey SAND, moderate yellowish brown (10YR 5/4), 30% clay, 70% sand, medium dense, brick rubble.	damp		
		2.0										
		2.30										
		2.5										
		2.80	D	Z	B2 / 2.7	Fill			FILL - SAND with Clay, moderate brown (5YR 3/4), 20% clay, 70% sand, dense, tile pieces.	damp	8/7/5 N=12	
		3.0										
		3.5										
			D	Z	B2 / 3.6	Residium CL			Gravelly CLAY with Sand - dark yellowish orange (10YR 6/6), 50% clay, 20% sand, 30% gravel, hard, medium plasticity.	moist	19/17/17 N=34	
		4.0							Refusal at 3.60 m		5 bounc'g	

Hydrocarbon Odour

H High
M Moderate
L Low
Z Zero

Sample Type

D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Ted Lilly**
Checked By: **Ted Lilly**

Date: **9/01/2013**
Date: **26/02/2013**

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL_GDT 26/2/13 2:26:10 PM

Borehole Log



Geo-Logix Pty Ltd

Building Q2, Level 3
Unit 2309 / 4 Daydream Street, Warriewood NSW 2102
Ph: (02) 9979 1722 | Fax: (02) 9979 1222
www.geo-logix.com.au

Hole ID. **B3**
Project Number: **1201085**
Hole Depth: **1.60 m**
Sheet: **1 of 1**

Project Name: **Tamworth 1201085**
Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**
Client: **Hydrox Nominees Pty Ltd**
Contractor: **Aimil Pty Ltd**
Method: **Solid Stem Auger (Ute Mounted)**

Date Started: **9/01/2013**
Date Completed: **9/01/2013**
Level: -----
Easting: -----
Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
Solid Stem Auger		0.05							TOPSOIL.			
		0.2							Sandy CLAY - dark yellowish orange (10YR 6/6), 60% clay, 40% sand, hard, medium plasticity.	damp		
		0.4										
		0.6										
		0.8										
		1.0										
		1.2	D	Z	B3 / 1.2	Residuum	CL					
		1.4										
		1.6									30 bounc'g	
		1.8							Refusal at 1.60 m			
		2.0										
		2.2										
		2.4										
		2.6										
		2.8										
		3.0										

Hydrocarbon Odour

H High
M Moderate
L Low
Z Zero

Sample Type
D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Ted Lilly**
Checked By: **Ted Lilly**

Date: **9/01/2013**
Date: **26/02/2013**

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL_GDT_26/2/13 2:26:12 PM

Borehole Log



Geo-Logix Pty Ltd

Building Q2, Level 3
Unit 2309 / 4 Daydream Street, Warriewood NSW 2102
Ph: (02) 9979 1722 | Fax: (02) 9979 1222
www.geo-logix.com.au

Hole ID. **B4**Project Number: **1201085**Hole Depth: **1.90 m**Sheet: **1 of 1**Project Name: **Tamworth 1201085**Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**Client: **Hydrox Nominees Pty Ltd**Contractor: **Aimil Pty Ltd**Method: **Solid Stem Auger (Ute Mounted)**Date Started: **9/01/2013**Date Completed: **9/01/2013**

Level: -----

Easting: -----

Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
Solid Stem Auger		0.2				Fill			FILL - Clayey SAND, dark yellowish orange (10YR 6/6), 40% clay, 60% sand.	dry		
		0.4										
		0.50										
		0.6				CL			Sandy CLAY - dark yellowish orange (10YR 6/6), 60% clay, 40% sand, very stiff.	damp		
		0.8										
		1.00										
		1.2	D	Z	B4 / 1.2	Residuum			Clayey SAND with Gravel - dark yellowish orange (10YR 6/6), 30% clay, 45% sand, 25% gravel, very dense.	damp		
		1.4										
		1.6										
		1.8				SC						
		2.0	D	Z	B4 / 1.9							
		2.2							Refusal at 1.90 m on weathered shale.		30 for 50mm	
		2.4										
		2.6										
		2.8										
		3.0										

Hydrocarbon Odour

H High
M Moderate
L Low
Z Zero

Sample Type
D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Ted Lilly**
Checked By: **Ted Lilly**

Date: **9/01/2013**
Date: **26/02/2013**

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL_GDT_26/2/13 2:26:13 PM

Borehole Log



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Hole ID. **B5**
Project Number: **1201085**
Hole Depth: **4.50 m**
Sheet: **1 of 1**

Project Name: **Tamworth 1201085**
Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**
Client: **Hydrox Nominees Pty Ltd**
Contractor: **Aimil Pty Ltd**
Method: **Solid Stem Auger (Ute Mounted)**

Date Started: **9/01/2013**
Date Completed: **9/01/2013**
Level: -----
Easting: -----
Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
Solid Stem Auger		0.50	D	Z	B5 / 0.0		SC		SAND with Clay - dark yellowish brown (10YR 4/2), 25% clay, 60% sand, 15% gravel, medium dense.	dry	5/10/11 N=21	
		1.0										
		1.5	D	Z	B5 / 1.2				Sandy CLAY - 60% clay, 35% sand, 5% gravel, very stiff.	damp	6/11/18 N=29	
		2.0										
		2.5										
		3.0	D	Z	B5 / 2.7		CL				8/14/26 N=40	
		3.5										
		4.0										
		4.5	D	Z	B5 / 4.2					moist	27/30 for 80mm	
		5.0							Refusal at 4.50 m			

Hydrocarbon Odour
H High
M Moderate
L Low
Z Zero

Sample Type
D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Ted Lilly**
Checked By: **Ted Lilly**

Date: **9/01/2013**
Date: **26/02/2013**

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL GDT 26/2/13 2:26:15 PM

Borehole Log



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Hole ID. **B6**
Project Number: **1201085**
Hole Depth: **2.70 m**
Sheet: **1 of 1**

Project Name: **Tamworth 1201085**
Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**
Client: **Hydrox Nominees Pty Ltd**
Contractor: **Aimil Pty Ltd**
Method: **Solid Stem Auger (Ute Mounted)**

Date Started: **9/01/2013**
Date Completed: **9/01/2013**
Level: -----
Easting: -----
Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
Solid Stem Auger		0.2							FILL - Clayey SAND, greyish orange (10YR 7/4), 30% clay, 60% sand, 10% gravel, medium dense.	dry		
		0.4										
		0.6										
		0.8										
		1.0										
		1.20	D	Z	B6 / 1.2	Fill						
		1.4							Clayey SAND - dark yellowish orange (10YR 6/6), 30% clay, 60% sand, 10% gravel, medium dense.	dry		
		1.6										
		1.8										
		2.0										
		2.2										
		2.40										
		2.6	D	Z	B6 / 2.7	Residuum	SC		Clayey SAND - dark yellowish orange (10YR 6/6), 30% clay, 60% sand, 10% gravel, very dense.	dry	4/10/15 N=25	
		2.8										
		3.0							Refusal at 2.70 m on weathered shale.			
											30 for 20mm	

Hydrocarbon Odour

H High
M Moderate
L Low
Z Zero

Sample Type
D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Ted Lilly**
Checked By: **Ted Lilly**

Date: **9/01/2013**
Date: **26/02/2013**

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL_GDT_26/2/13 2:26:17 PM

Borehole Log



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Hole ID. **B7**
Project Number: **1201085**
Hole Depth: **1.50 m**
Sheet: **1 of 1**

Project Name: **Tamworth 1201085**
Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**
Client: **Hydrox Nominees Pty Ltd**
Contractor: **Aimil Pty Ltd**
Method: **Solid Stem Auger (Ute Mounted)**

Date Started: **10/01/2013**
Date Completed: **10/01/2013**
Level: -----
Easting: -----
Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
Solid Stem Auger		0.2	D	Z	B7 / 0.0	Residuum	SC		SAND with Clay - dark yellowish orange (10YR 6/6), 25% clay, 60% sand, 15% gravel, medium dense.	dry	10/13/14 N=27	
		0.4										
		0.6										
		0.8							Very dense below 1.0m.	damp		
		1.0	D	Z	B7 / 1.0						21/28/36 N=64	
		1.2										
		1.4										
		1.6							Refusal at 1.50 m			
		1.8										
		2.0										
		2.2										
		2.4										
		2.6										
		2.8										
		3.0										

Hydrocarbon Odour

H High
M Moderate
L Low
Z Zero

Sample Type
D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL_GDT 26/2/13 2:26:19 PM



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Ted Lilly**
Checked By: **Ted Lilly**

Date: **10/01/2013**
Date: **26/02/2013**

Borehole Log



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Hole ID. **B8**
Project Number: **1201085**
Hole Depth: **3.80 m**
Sheet: **1 of 1**

Project Name: **Tamworth 1201085**
Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**
Client: **Hydrox Nominees Pty Ltd**
Contractor: **Aimil Pty Ltd**
Method: **Solid Stem Auger (Ute Mounted)**

Date Started: **10/01/2013**
Date Completed: **10/01/2013**
Level: -----
Easting: -----
Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
Solid Stem Auger		0.5	D	Z	B8 / 0.6	Alluvium	SM		SAND with Clay & Gravel - moderate brown (5YR 4/4), 20% clay, 60% sand, 20% gravel, alluvial.	dry		
		0.70					CH		CLAY with Sand - greyish brown (5YR 3/2), 80% clay, 20% sand, very stiff, high plasticity.	moist	10/10/13 N=23	
		1.0	D	Z	B8 / 1.2							
		1.5									5/10/14 N=24	
		1.90										
		2.0					CH		Sandy CLAY - dark yellowish orange (10YR 6/6), 60% clay, 30% sand, 10% gravel, hard, high plasticity.	moist		
		2.30										
		2.5	D	Z	B8 / 2.7	Residium	SC		Clayey SAND - moderate yellow (5Y 7/6), 30% clay, 60% sand, 10% gravel, very dense, highly weathered shale.	moist		
		3.0									14/18/35 N=53	
		3.5							Partially Weathered Shale.			
		4.0	D	Z	B8 / 3.8							
									Refusal at 3.80 m		5 bounc'g	

Hydrocarbon Odour

H High
M Moderate
L Low
Z Zero

Sample Type

D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL_GDT 26/2/13 2:26:21 PM



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: Ted Lilly
Checked By: Ted Lilly

Date: 10/01/2013
Date: 26/02/2013

Borehole Log



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Hole ID. **B9**
Project Number: **1201085**
Hole Depth: **1.10 m**
Sheet: **1 of 1**

Project Name: **Tamworth 1201085**
Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**
Client: **Hydrox Nominees Pty Ltd**
Contractor: **Aimil Pty Ltd**
Method: **Solid Stem Auger (Ute Mounted)**

Date Started: **10/01/2013**
Date Completed: **10/01/2013**
Level: -----
Easting: -----
Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
Solid Stem Auger		0.2					SC		Clayey SAND - moderate reddish orange (10R 6/6), 40% clay, 60% sand, medium dense.	moist		
		0.4					SC		Clayey SAND - moderate yellow (5Y 7/6), 30% clay, 70% sand, dense to very dense, weathered shale.	moist		
		0.60	D	Z	B9 / 1.1						30 for 90mm	
		0.8										
		1.0										
		1.2							Refusal at 1.10 m			
		1.4										
		1.6										
		1.8										
		2.0										
		2.2										
		2.4										
		2.6										
		2.8										
		3.0										

Hydrocarbon Odour

H High
M Moderate
L Low
Z Zero

Sample Type
D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Ted Lilly**
Checked By: **Ted Lilly**

Date: **10/01/2013**
Date: **26/02/2013**

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL_GDT 26/2/13 2:26:22 PM

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Hole ID. **B10**
Project Number: **1201085**
Hole Depth: **1.40 m**
Sheet: **1 of 1**

Project Name: **Tamworth 1201085**
Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**
Client: **Hydrox Nominees Pty Ltd**
Contractor: **Aimil Pty Ltd**
Method: **Solid Stem Auger (Ute Mounted)**

Date Started: **10/01/2013**
Date Completed: **10/01/2013**
Level: -----
Easting: -----
Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments	
											SPT		
Solid Stem Auger		0.2	D	Z	B10 / 0.0	Residuum	SC		SAND with Clay & Gravel - yellowish grey (5Y 8/1), 20% clay, 60% sand, 20% gravel, dense.	moist	11/17/17 N=34		
		0.4											
		0.6											
		0.80											
		1.0				Residuum	SC		Clayey SAND - dark yellowish orange (10YR 6/6), 30% clay, 70% sand, dense.	moist			
	1.2												
		1.4	D	Z	B10 / 1.3						30 for 110mm		
		1.6											
		1.8											
		2.0											
		2.2											
		2.4											
		2.6											
		2.8											
		3.0											
									Refusal at 1.40 m				

Hydrocarbon Odour
H High
M Moderate
L Low
Z Zero

Sample Type
D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL_GDT 26/2/13 2:25:59 PM



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Ted Lilly**
Checked By: **Ted Lilly**

Date: **10/01/2013**
Date: **26/02/2013**

Borehole Log



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Hole ID. **B11**
Project Number: **1201085**
Hole Depth: **4.75 m**
Sheet: **1 of 1**

Project Name: **Tamworth 1201085**
Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**
Client: **Hydrox Nominees Pty Ltd**
Contractor: **Aimil Pty Ltd**
Method: **Solid Stem Auger (Ute Mounted)**

Date Started: **10/01/2013**
Date Completed: **10/01/2013**
Level: -----
Easting: -----
Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
Solid Stem Auger		0.5	D	Z	B11 / 0.0	CL			Sandy CLAY - 60% clay, 40% sand, stiff.	damp	6/5/5 N=10	
		0.70										
		1.0				CH			CLAY with Sand - 80% clay, 20% sand, very stiff, high plasticity.	damp		
		1.5	D	Z	B11 / 1.3						8/13/16 N=29	
		2.0										
		2.5				CH						
		3.0	D	Z	B11 / 2.8				Hard from 2.8mBGL.		10/17/23 N=40	
		3.5										
		4.0										
		4.5	D	Z	B11 / 4.3				Very stiff from 4.3mBGL.		6/14/15 N=29	
		5.0							End of Hole at 4.75 m			

Hydrocarbon Odour
H High
M Moderate
L Low
Z Zero
Sample Type
D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Ted Lilly**
Checked By: **Ted Lilly**

Date: **10/01/2013**
Date: **26/02/2013**

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL_GDT 26/2/13 2:26:00 PM

Borehole Log



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Hole ID. **B12**
Project Number: **1201085**
Hole Depth: **4.30 m**
Sheet: **1 of 1**

Project Name: **Tamworth 1201085**
Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**
Client: **Hydrox Nominees Pty Ltd**
Contractor: **Aimil Pty Ltd**
Method: **Solid Stem Auger (Ute Mounted)**

Date Started: **10/01/2013**
Date Completed: **10/01/2013**
Level: -----
Easting: -----
Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
Solid Stem Auger		0.30	D	Z	B12 / 0.0	Alluvium	CL		Sandy CLAY - pale yellowish brown (10YR 6/2), 60% clay, 40% sand, firm.	damp	5/4/3 N=7	
		0.5							CLAY with Sand - greyish brown (5YR 3/2), 80% clay, 20% sand, stiff, high plasticity.	moist		
		1.0										
		1.5	D	Z	B12 / 1.3	CH					3/5/7 N=12	
		2.0										
		2.50				Residuum						
		3.0	D	Z	B12 / 2.8		CL		Sandy CLAY - pale yellowish orange (10YR 8/6), 60% clay, 40% sand, very soft, medium plasticity.	moist	5/11/16 N=27	
		3.50										
		4.0					SC		SAND with Clay - pale yellowish orange (10YR 8/6), 20% clay, 80% sand, dense.	damp		
		4.5	D	Z	B12 / 4.3						5 bounc'g	
		5.0							Refusal at 4.30 m			

Hydrocarbon Odour

H High
M Moderate
L Low
Z Zero

Sample Type
D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL_GDT_26/2/13 2:26:02 PM



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Ted Lilly**
Checked By: **Ted Lilly**

Date: **10/01/2013**
Date: **26/02/2013**

Borehole Log



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Hole ID. **B13**
Project Number: **1201085**
Hole Depth: **6.80 m**
Sheet: **1 of 1**

Project Name: **Tamworth 1201085**
Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**
Client: **Hydrox Nominees Pty Ltd**
Contractor: **Aimil Pty Ltd**
Method: **Solid Stem Auger (Ute Mounted)**

Date Started: **10/01/2013**
Date Completed: **10/01/2013**
Level: -----
Easting: -----
Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
Solid Stem Auger		0.30	D	Z	B13 / 0.0	Alluvium	CL		CLAY with Sand - greyish brown (5YR 3/2), 80% clay, 20% sand, firm, medium plasticity.	damp	4/5/4 N=9	
									CLAY - greyish brown (5YR 3/2), 95% clay, 5% sand, firm, high plasticity.	moist		
		1	D	Z	B13 / 1.3	Alluvium	CH				2/4/5 N=9	
		2										
		3	D	Z	B13 / 2.8	Residium	SC				4/6/7 N=13	
		4										
		4.40	D	Z	B13 / 4.3	Residium	SC		Clayey SAND - dark yellowish orange (10YR 6/6), 40% clay, 60% sand, loose.	moist	4/8/12 N=20	
		5										
		6	D	Z	B13 / 5.8						6/4/6 N=10	
											15/21/24 N=45	
		7							Refusal at 6.80 m			

Hydrocarbon Odour

H High
M Moderate
L Low
Z Zero

Sample Type

D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: Ted Lilly
Checked By: Ted Lilly

Date: 10/01/2013
Date: 26/02/2013

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL_GDT_26/2/13 2:26:04 PM

Borehole Log



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Hole ID. **B14**
Project Number: **1201085**
Hole Depth: **4.75 m**
Sheet: **1 of 1**

Project Name: **Tamworth 1201085**
Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**
Client: **Hydrox Nominees Pty Ltd**
Contractor: **Aimil Pty Ltd**
Method: **Solid Stem Auger (Ute Mounted)**

Date Started: **11/01/2013**
Date Completed: **11/01/2013**
Level: -----
Easting: -----
Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
Solid Stem Auger		0.5	D	Z	B14 / 0.0	Alluvium	CL		Sandy CLAY - moderate brown (5YR 4/4), 60% clay, 40% sand, very stiff, medium plasticity.	damp	4/9/11 N=20	
		0.60										
		1.0							Sandy CLAY - moderate reddish orange (10R 6/6), 60% clay, 40% sand, hard, medium plasticity.	damp		
		1.5	D	Z	B14 / 1.3	Residuum	CL				8/14/23 N=37	
		2.0										
		2.5										
		3.0	D	Z	B14 / 2.8						9/17/22 N=39	
		3.5										
		4.0										
		4.5	D	Z	B14 / 4.3				Very hard below 4.3mbgl.		13/20/32 N=52	
		5.0							End of Hole at 4.75 m			

Hydrocarbon Odour

H High
M Moderate
L Low
Z Zero

Sample Type
D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: Ted Lilly
Checked By: Ted Lilly

Date: 11/01/2013
Date: 26/02/2013

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL GDT 26/2/13 2:26:06 PM

Borehole Log



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Hole ID. **B15**
Project Number: **1201085**
Hole Depth: **8.70 m**
Sheet: **1 of 1**

Project Name: **Tamworth 1201085**
Location / Site: **5-7 Hilton St & 7 Scott Rd, South Tamworth NSW**
Client: **Hydrox Nominees Pty Ltd**
Contractor: **Aimil Pty Ltd**
Method: **Solid Stem Auger (Ute Mounted)**

Date Started: **11/01/2013**
Date Completed: **11/01/2013**
Level: -----
Easting: -----
Northing: -----

Method	Water Level	Depth (m)	Sample Type	HC Odour	Sample ID	Material Type	USCS Symbol	Graphic Log	Material Description	Moisture	Tests	Observations / Comments
											SPT	
Solid Stem Auger			D	Z	B15 / 0.0	CL			Sandy CLAY - greyish brown (5YR 3/2), 65% clay, 35% sand, stiff, medium plasticity.	dry	4/5/7 N=12	
	1		D	Z	B15 / 1.3						6/13/16 N=29	
	2.00					CL			Sandy CLAY - pale reddish brown (10R 5/4), 60% clay, 40% sand, very stiff, medium plasticity.	damp		
	3		D	Z	B15 / 2.8						5/6/6 N=12	
	4					CH			CLAY - moderate reddish orange (10R 6/6), mottled medium grey (N5), 90% clay, 10% sand, very stiff, high plasticity.	moist	3/4/8 N=12	
	4.30		D	Z	B15 / 4.3							
	5					GC			Sandy GRAVEL with Clay - moderate reddish orange (10R 6/6), 20% clay, 30% sand, 50% gravel, dense.	wet	12/22/16 N=38	
	5.80		D	Z	B15 / 5.8							
	6					GC					11/14/18 N=32	
	7		D	Z	B15 / 7.3							
	8											
	9								End of Hole at 8.70 m			

Hydrocarbon Odour
H High
M Moderate
L Low
Z Zero

Sample Type
D Disturbed
U Undisturbed

Additional Comments

Donut hammer used for SPT's.



Log Drawn By: Laurie White
Contact: laurie.white@reumad.com.au

Logged By: **Ted Lilly**
Checked By: **Ted Lilly**

Date: **11/01/2013**
Date: **26/02/2013**

GL LOG 2 TAMWORTH 1201085_BOREHOLE LOGS.GPJ GL GDT 26/2/13 2:26:08 PM

ATTACHMENT C

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Unit 15, 33 Maddox Street
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Alexandria NSW 2015
Australia

SOIL CLASSIFICATION TEST DATA

CLIENT: Geo-Logix
Unit 2309 / 4 Daydream Street ☐ ☐ Bulding Q2 Level 3 ☐ ☐ Warriewood NSW 2102

PROJECT: 1201085 (1201085)

LOCATION: Tamworth

Lab Number	Sample Source	Sample Description	Moisture Content (%) 1	Dry Density (t/m ³)	Liquid Limit 2	Plastic Index 3	Preparation & History 4	Linear Shrink. (%) 5
13-AC-302	B4/1.2	SANDY CLAY:yellow	-	-	49	30	DS AD	13.5 Curling

NOTES TO TESTING

- | | | |
|---|--|-------------------------|
| 1 | Test Method: AS 1289 2.1.1 | Sampled By: Client |
| 2 | Test Method: AS 1289 3.1.2 | |
| 3 | Test Method: AS 1289 3.2.1, 3.3.1 | Job Number: 13-32-31 |
| 4 | Preparation: DS = Dry Sieved
WS = Wet Sieved
N = Natural State With No Sieving | Date Tested: 23/01/2013 |
| | Sample History: AD = Air Dried
OD = Oven Dried at 50°C
N = Natural State As Received | |
| 5 | Test Method: AS 1289 3.4.1 | |

Approved Signatory:

Aaron Lacey

Aaron Lacey

Date: 30/01/2013



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SOIL CLASSIFICATION TEST DATA

CLIENT: Geo-Logix
Unit 2309 / 4 Daydream Street ☐ Bulding Q2 Level 3 ☐ Warriewood NSW 2102
PROJECT: 1201085 (1201085)
LOCATION: Tamworth

Lab Number	Sample Source	Sample Description	Moisture Content (%) 1	Dry Density (t/m ³)	Liquid Limit 2	Plastic Index 3	Preparation & History 4	Linear Shrink. (%) 5
13-AC-303	B7/0.0	SANDY CLAY:yellow	-	-	61	38	DS AD	15.0 Curling

NOTES TO TESTING

- | | | |
|---|--|-------------------------|
| 1 | Test Method: AS 1289 2.1.1 | Sampled By: Client |
| 2 | Test Method: AS 1289 3.1.2 | |
| 3 | Test Method: AS 1289 3.2.1, 3.3.1 | Job Number: 13-32-31 |
| 4 | Preparation: DS = Dry Sieved
WS = Wet Sieved
N = Natural State With No Sieving | Date Tested: 23/01/2013 |
| | Sample History: AD = Air Dried
OD = Oven Dried at 50°C
N = Natural State As Received | |
| 5 | Test Method: AS 1289 3.4.1 | |

Approved Signatory:

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Date: 30/01/2013



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SOIL CLASSIFICATION TEST DATA

CLIENT: Geo-Logix
Unit 2309 / 4 Daydream Street ☐ Bulding Q2 Level 3 ☐ Warriewood NSW 2102
PROJECT: 1201085 (1201085)
LOCATION: Tamworth

Lab Number	Sample Source	Sample Description	Moisture Content (%) 1	Dry Density (t/m ³)	Liquid Limit 2	Plastic Index 3	Preparation & History 4	Linear Shrink. (%) 5
13-AC-304	B13/1.3	SILTY CLAY:black	-	-	73	55	DS AD	15.0 Linear

NOTES TO TESTING

- | | | |
|---|--|-------------------------|
| 1 | Test Method: AS 1289 2.1.1 | Sampled By: Client |
| 2 | Test Method: AS 1289 3.1.2 | |
| 3 | Test Method: AS 1289 3.2.1, 3.3.1 | Job Number: 13-32-31 |
| 4 | Preparation: DS = Dry Sieved
WS = Wet Sieved
N = Natural State With No Sieving | Date Tested: 23/01/2013 |
| | Sample History: AD = Air Dried
OD = Oven Dried at 50°C
N = Natural State As Received | |
| 5 | Test Method: AS 1289 3.4.1 | |

Approved Signatory:

Aaron Lacey

Aaron Lacey

Date: 30/01/2013



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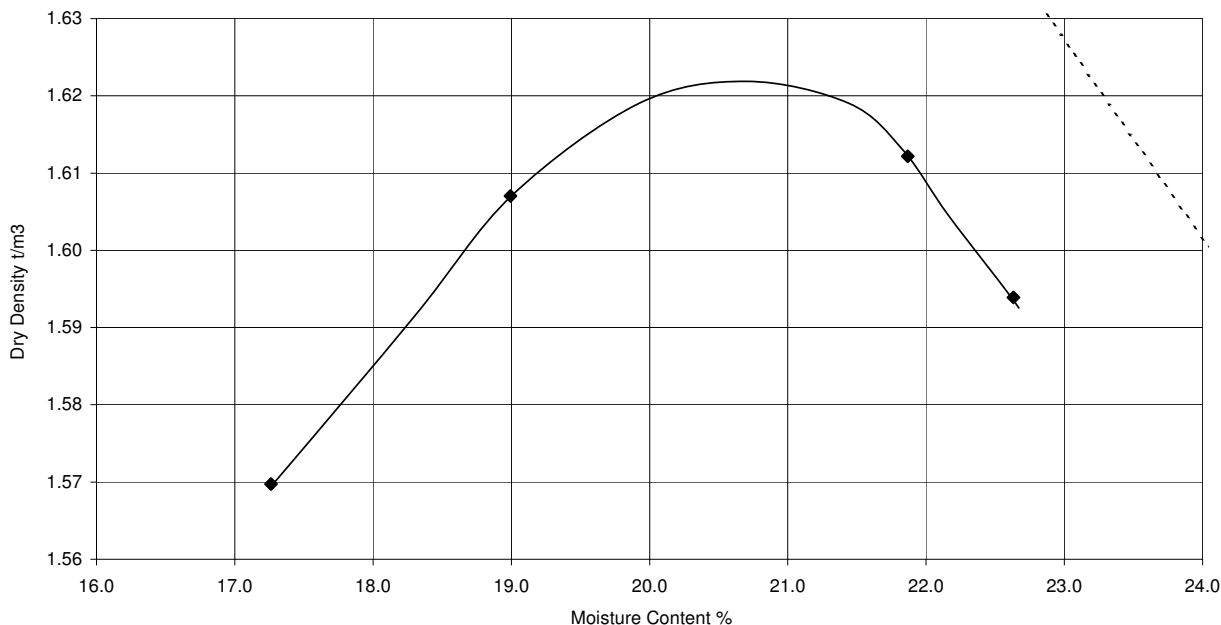
DRY DENSITY/MOISTURE CONTENT RELATION

CLIENT: Geo-Logix

Unit 2309 / 4 Daydream Street □ □ Building Q2 Level 3 □ □ Warriewood NSW 2102

PROJECT: 1201085 (1201085)

LOCATION: Tamworth



Job Number: 13-32-31
Laboratory Number: 13-AC-305
Sample Source: B5/0.0
Sample Description: SANDY GRAVELLY SILT: brown

Maximum Dry Density:	1.62	t/m ³
Optimum Moisture Content:	20.5	%
Oversize Material:	19	mm
% Oversize:	0	%
Date Tested:	21/1/13	
Sampled By:	Client	
Compactive Effort:	Standard	
Test Method:	AS 1289 5.1.1	
Mould Type:	A	
Number of Layers:	3	
Blows per Layer:	25	
Mass of Rammer:	2.7	kg
Drop of Rammer:	300	mm
Zero Air Voids Line - Particle Density:	2.60	t/m ³
Comments:		

Approved Signatory: 

Aaron Lacey

Date: 30/01/2013



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CALIFORNIA BEARING RATIO

CLIENT: Geo-Logix
Unit 2309 / 4 Daydream Street ☐ Bulding Q2 Level 3 ☐ Warriewood NSW 2102
PROJECT: 1201085 (1201085)
LOCATION: Tamworth

Sample Source:	B5/0.0	
Sample Description:	SANDY GRAVELLY SILT:brown	
Job Number:	13-32-31	
Laboratory Number:	13-AC-305	
CBR Value @ 2.5mm	6.0	(%)
CBR Value @ 5.0mm	5.0	(%)

Sample Data

Compaction Specification	100% of MDD at OMC	
Maximum Dry Density (MDD)	1.62	(t/m ³)
Optimum Moisture Content (OMC)	20.5	(%)
Mass of Surcharges	4.5	(kg)
Number of Days Soaked	4	

Sample Preparation

Dry Density - Before Soaking	1.62	(t/m ³)
Dry Density - After Soaking	1.61	(t/m ³)
Retained on 19mm Sieve	0% excluded	(%)
Moisture Content - Before Soaking	20.9	(%)
Laboratory Density Ratio	100.0	(%)
Laboratory Moisture Ratio	102.0	(%)
Moisture Content - After Soaking		
Top 30mm of Test Sample	22.1	(%)
Remainder of Test Sample	21.6	(%)
Swell After Soaking	0.5	(%)
Compactive Effort	Standard	
Number of Layers	3	
Blows per Layer	53	
Mass of Rammer	2.7	(kg)
Drop of Rammer	300	(mm)

Comments

Date Tested: 29/01/2013
Tested in accordance with AS1289.6.1.1 Determination of the California Bearing Ratio of a soil Standard Laboratory Method for a remoulded specimen.

Approved Signatory: 

Aaron Lacey

Date: 30/01/2013



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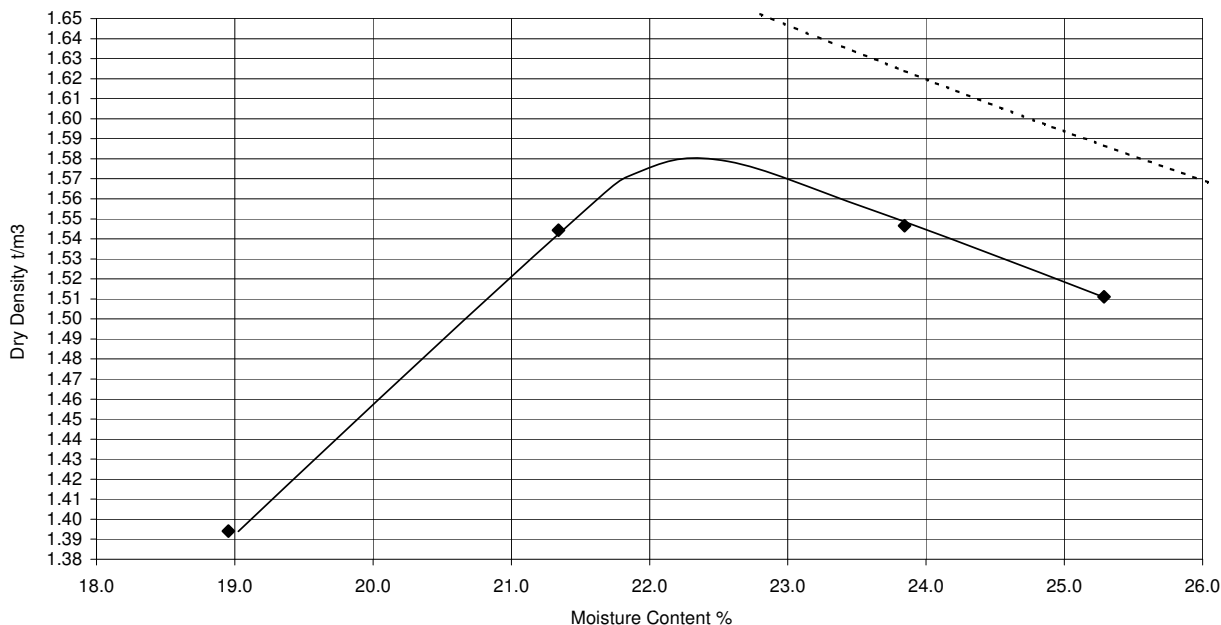
DRY DENSITY/MOISTURE CONTENT RELATION

CLIENT: Geo-Logix

Unit 2309 / 4 Daydream Street □□ Building Q2 Level 3 □□ Warriewood NSW 2102

PROJECT: 1201085 (1201085)

LOCATION: Tamworth



Job Number: 13-32-31

Laboratory Number: 13-AC-306

Sample Source: B7/0.0

Sample Description: GRAVELLY SANDY CLAY: light brown.

Maximum Dry Density: 1.58 t/m³

Optimum Moisture Content: 22.0 %

Oversize Material: 19 mm

% Oversize: 6 %

Date Tested: 23.01.13

Sampled By: Client

Compactive Effort: Standard

Test Method: **AS 1289 5.1.1**

Mould Type: A

Number of Layers: 3

Blows per Layer: 25

Mass of Rammer: 2.7 kg

Drop of Rammer: 300 mm

Zero Air Voids Line - Particle Density: 2.65 t/m³

Comments:

Approved Signatory: 

Aaron Lacey

Date: 30/01/2013



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CALIFORNIA BEARING RATIO

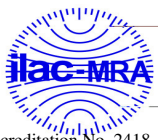
CLIENT: Geo-Logix
Unit 2309 / 4 Daydream Street ☐ Bulding Q2 Level 3 ☐ Warriewood NSW 2102
PROJECT: 1201085 (1201085)
LOCATION: Tamworth

Sample Source:	B7/0.0	
Sample Description:	GRAVELLY SANDY CLAY: light brown.	
Job Number:	13-32-31	
Laboratory Number:	13-AC-306	
CBR Value @ 2.5mm	10.0	(%)
CBR Value @ 5.0mm	8.0	(%)
<u>Sample Data</u>		
Compaction Specification	100% of MDD at OMC	
Maximum Dry Density (MDD)	1.58	(t/m ³)
Optimum Moisture Content (OMC)	22.0	(%)
Mass of Surcharges	4.5	(kg)
Number of Days Soaked	4	
<u>Sample Preparation</u>		
Dry Density - Before Soaking	1.57	(t/m ³)
Dry Density - After Soaking	1.56	(t/m ³)
Retained on 19mm Sieve	5.7% excluded	(%)
Moisture Content - Before Soaking	23.0	(%)
Laboratory Density Ratio	100.0	(%)
Laboratory Moisture Ratio	104.0	(%)
Moisture Content - After Soaking		
Top 30mm of Test Sample	25.6	(%)
Remainder of Test Sample	25.3	(%)
Swell After Soaking	0.7	(%)
Compactive Effort	Standard	
Number of Layers	3	
Blows per Layer	53	
Mass of Rammer	2.7	(kg)
Drop of Rammer	300	(mm)
Comments		
Date Tested:	29.01.13	
Tested in accordance with AS1289.6.1.1 Determination of the California Bearing Ratio of a soil		
Standard Laboratory Method for a remoulded specimen.		

Approved Signatory: 

Aaron Lacey

Date: 30/01/2013



Accreditation No. 2418



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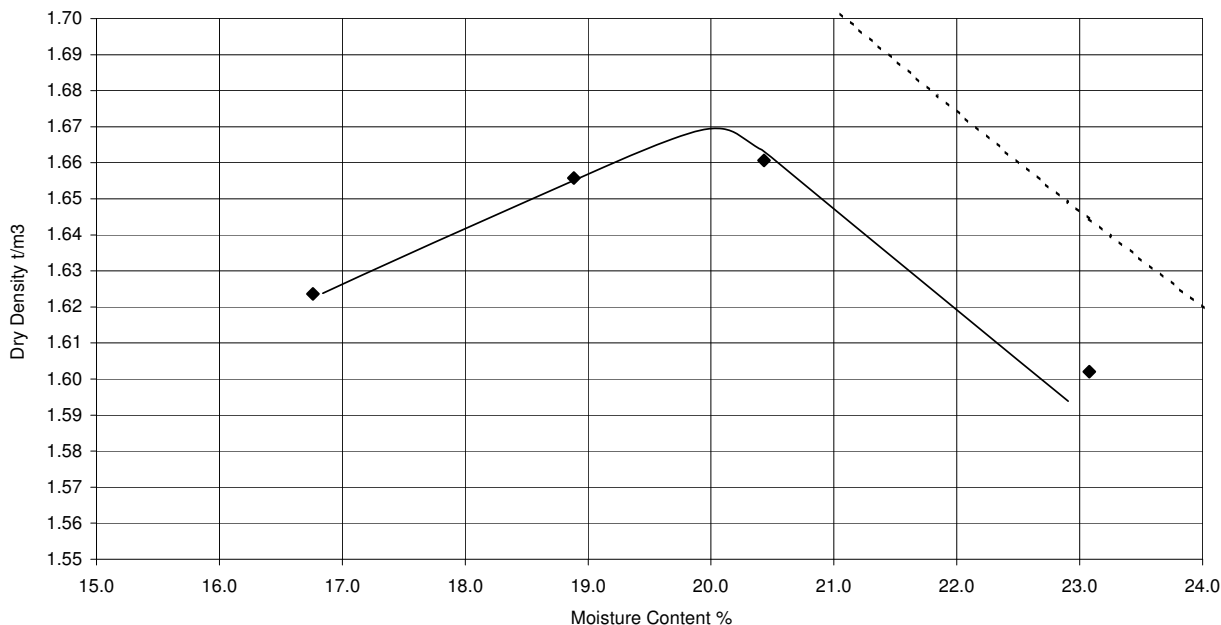
DRY DENSITY/MOISTURE CONTENT RELATION

CLIENT: Geo-Logix

Unit 2309 / 4 Daydream Street □ □ Building Q2 Level 3 □ □ Warriewood NSW 2102

PROJECT: 1201085 (1201085)

LOCATION: Tamworth



Job Number: 13-32-31

Laboratory Number: 13-AC-307

Sample Source: B8/0.0

Sample Description: GRAVELLY SANDY SILT: grey/brown.

Maximum Dry Density:	1.67	t/m ³
Optimum Moisture Content:	20.0	%
Oversize Material:	19	mm
% Oversize:	0	%
Date Tested:	23.01.13	
Sampled By:	Client	
Compactive Effort:	Standard	
Test Method:	AS 1289 5.1.1	
Mould Type:	A	
Number of Layers:	3	
Blows per Layer:	25	
Mass of Rammer:	2.7	kg
Drop of Rammer:	300	mm
Zero Air Voids Line - Particle Density:	2.65	t/m ³
Comments:		

Approved Signatory: 

Aaron Lacey

Date: 30/01/2013



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CALIFORNIA BEARING RATIO

CLIENT: Geo-Logix
Unit 2309 / 4 Daydream Street ☐ Bulding Q2 Level 3 ☐ Warriewood NSW 2102
PROJECT: 1201085 (1201085)
LOCATION: Tamworth

Sample Source:	B8/0.0	
Sample Description:	GRAVELLY SANDY SILT: grey/brown.	
Job Number:	13-32-31	
Laboratory Number:	13-AC-307	
CBR Value @ 2.5mm	8.0	(%)
CBR Value @ 5.0mm	6.0	(%)
<u>Sample Data</u>		
Compaction Specification	100% of MDD at OMC	
Maximum Dry Density (MDD)	1.67	(t/m ³)
Optimum Moisture Content (OMC)	20.0	(%)
Mass of Surcharges	4.5	(kg)
Number of Days Soaked	4	
<u>Sample Preparation</u>		
Dry Density - Before Soaking	1.68	(t/m ³)
Dry Density - After Soaking	1.67	(t/m ³)
Retained on 19mm Sieve	0% excluded	(%)
Moisture Content - Before Soaking	19.5	(%)
Laboratory Density Ratio	100.0	(%)
Laboratory Moisture Ratio	97.0	(%)
Moisture Content - After Soaking		
Top 30mm of Test Sample	21.1	(%)
Remainder of Test Sample	20.3	(%)
Swell After Soaking	0.3	(%)
Compactive Effort	Standard	
Number of Layers	3	
Blows per Layer	53	
Mass of Rammer	2.7	(kg)
Drop of Rammer	300	(mm)
Comments		
Date Tested:	29/01/2013	
Tested in accordance with AS1289.6.1.1 Determination of the California Bearing Ratio of a soil		
Standard Laboratory Method for a remoulded specimen.		

Approved Signatory: 

Aaron Lacey

Date: 30/01/2013



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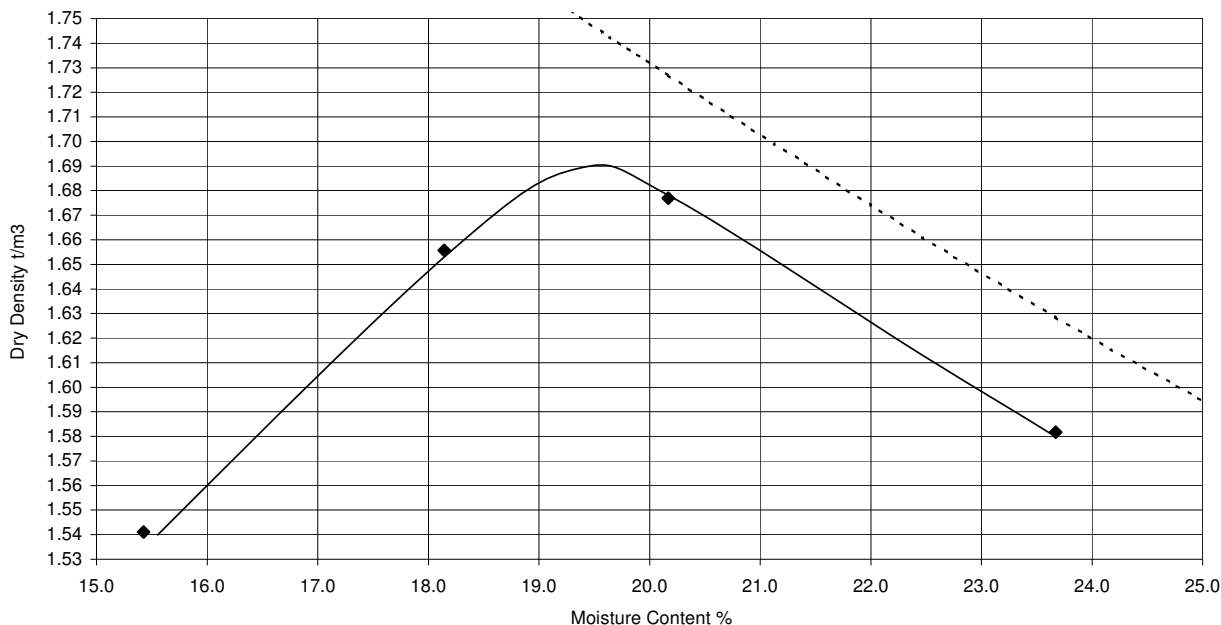
DRY DENSITY/MOISTURE CONTENT RELATION

CLIENT: Geo-Logix

Unit 2309 / 4 Daydream Street □ □ Building Q2 Level 3 □ □ Warriewood NSW 2102

PROJECT: 1201085 (1201085)

LOCATION: Tamworth



Job Number: 13-32-31

Laboratory Number: 13-AC-308

Sample Source: B10/0.0

Sample Description: GRAVELLY SILTY CLAY: yellow/brown.

Maximum Dry Density: 1.69 t/m³

Optimum Moisture Content: 19.5 %

Oversize Material: 19 mm

% Oversize: 6 %

Date Tested: 23.01.13

Sampled By: Client

Compactive Effort: Standard

Test Method: **AS 1289 5.1.1**

Mould Type: A

Number of Layers: 3

Blows per Layer: 25

Mass of Rammer: 2.7 kg

Drop of Rammer: 300 mm

Zero Air Voids Line - Particle Density: 2.65 t/m³

Comments:

Approved Signatory: 

Aaron Lacey

Date: 30/01/2013



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CALIFORNIA BEARING RATIO

CLIENT: Geo-Logix
Unit 2309 / 4 Daydream Street ☐ Bulding Q2 Level 3 ☐ Warriewood NSW 2102
PROJECT: 1201085 (1201085)
LOCATION: Tamworth

Sample Source:	B10/0.0	
Sample Description:	GRAVELLY SILTY CLAY: yellow/brown.	
Job Number:	13-32-31	
Laboratory Number:	13-AC-308	
CBR Value @ 2.5mm	10.0	(%)
CBR Value @ 5.0mm	8.0	(%)
<u>Sample Data</u>		
Compaction Specification	100% of MDD at OMC	
Maximum Dry Density (MDD)	1.69	(t/m ³)
Optimum Moisture Content (OMC)	19.5	(%)
Mass of Surcharges	4.5	(kg)
Number of Days Soaked	4	
<u>Sample Preparation</u>		
Dry Density - Before Soaking	1.69	(t/m ³)
Dry Density - After Soaking	1.69	(t/m ³)
Retained on 19mm Sieve	6% excluded	(%)
Moisture Content - Before Soaking	21.0	(%)
Laboratory Density Ratio	100.0	(%)
Laboratory Moisture Ratio	107.0	(%)
Moisture Content - After Soaking		
Top 30mm of Test Sample	21.1	(%)
Remainder of Test Sample	21.5	(%)
Swell After Soaking	0.3	(%)
Compactive Effort	Standard	
Number of Layers	3	
Blows per Layer	53	
Mass of Rammer	2.7	(kg)
Drop of Rammer	300	(mm)
Comments		
Date Tested:	29/01/2013	
Tested in accordance with AS1289.6.1.1 Determination of the California Bearing Ratio of a soil Standard Laboratory Method for a remoulded specimen.		

Approved Signatory: 

Aaron Lacey

Date: 30/01/2013



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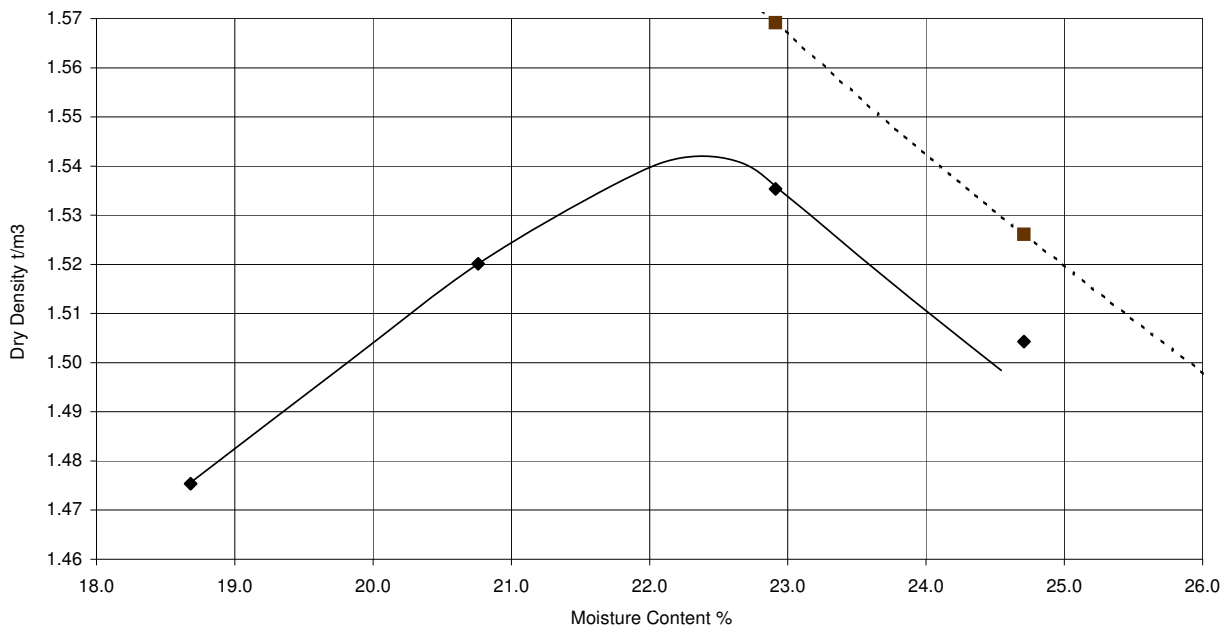
DRY DENSITY/MOISTURE CONTENT RELATION

CLIENT: Geo-Logix

Unit 2309 / 4 Daydream Street □ □ Building Q2 Level 3 □ □ Warriewood NSW 2102

PROJECT: 1201085 (1201085)

LOCATION: Tamworth



Job Number: 13-32-31

Laboratory Number: 13-AC-309

Sample Source: B11/0.0

Sample Description: GRAVELLY SILT:grey brown

Maximum Dry Density:	1.54	t/m ³
Optimum Moisture Content:	22.5	%
Oversize Material:	19	mm
% Oversize:	0	%
Date Tested:	21/1/13	
Sampled By:	Client	
Compactive Effort:	Standard	
Test Method:	AS 1289 5.1.1	
Mould Type:	A	
Number of Layers:	3	
Blows per Layer:	25	
Mass of Rammer:	2.7	kg
Drop of Rammer:	300	mm
Zero Air Voids Line - Particle Density:	2.45	t/m ³
Comments:		

Approved Signatory: 

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Date: 30/01/2013



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SGS Australia Pty Ltd
Unit 15, 33 Maddox Street
(PO Box 6432)
Alexandria NSW 2015
Australia

CALIFORNIA BEARING RATIO

CLIENT: Geo-Logix
Unit 2309 / 4 Daydream Street ☐ Bulding Q2 Level 3 ☐ Warriewood NSW 2102
PROJECT: 1201085 (1201085)
LOCATION: Tamworth

Sample Source:	B11/0.0	
Sample Description:	GRAVELLY SILTY CLAY: yellow/brown.	
Job Number:	13-32-31	
Laboratory Number:	13-AC-309	
CBR Value @ 2.5mm	7.0	(%)
CBR Value @ 5.0mm	7.0	(%)
<u>Sample Data</u>		
Compaction Specification	100% of MDD at OMC	
Maximum Dry Density (MDD)	1.54	(t/m ³)
Optimum Moisture Content (OMC)	22.5	(%)
Mass of Surcharges	4.5	(kg)
Number of Days Soaked	4	
<u>Sample Preparation</u>		
Dry Density - Before Soaking	1.53	(t/m ³)
Dry Density - After Soaking	1.52	(t/m ³)
Retained on 19mm Sieve	0% excluded	(%)
Moisture Content - Before Soaking	23.4	(%)
Laboratory Density Ratio	100.0	(%)
Laboratory Moisture Ratio	104.0	(%)
Moisture Content - After Soaking		
Top 30mm of Test Sample	26.3	(%)
Remainder of Test Sample	24.9	(%)
Swell After Soaking	0.8	(%)
Compactive Effort	Standard	
Number of Layers	3	
Blows per Layer	53	
Mass of Rammer	2.7	(kg)
Drop of Rammer	300	(mm)
Comments		
Date Tested:	29/01/2013	
Tested in accordance with AS1289.6.1.1 Determination of the California Bearing Ratio of a soil Standard Laboratory Method for a remoulded specimen.		

Approved Signatory: 

Aaron Lacey

Date: 30/01/2013



Accreditation No. 2418



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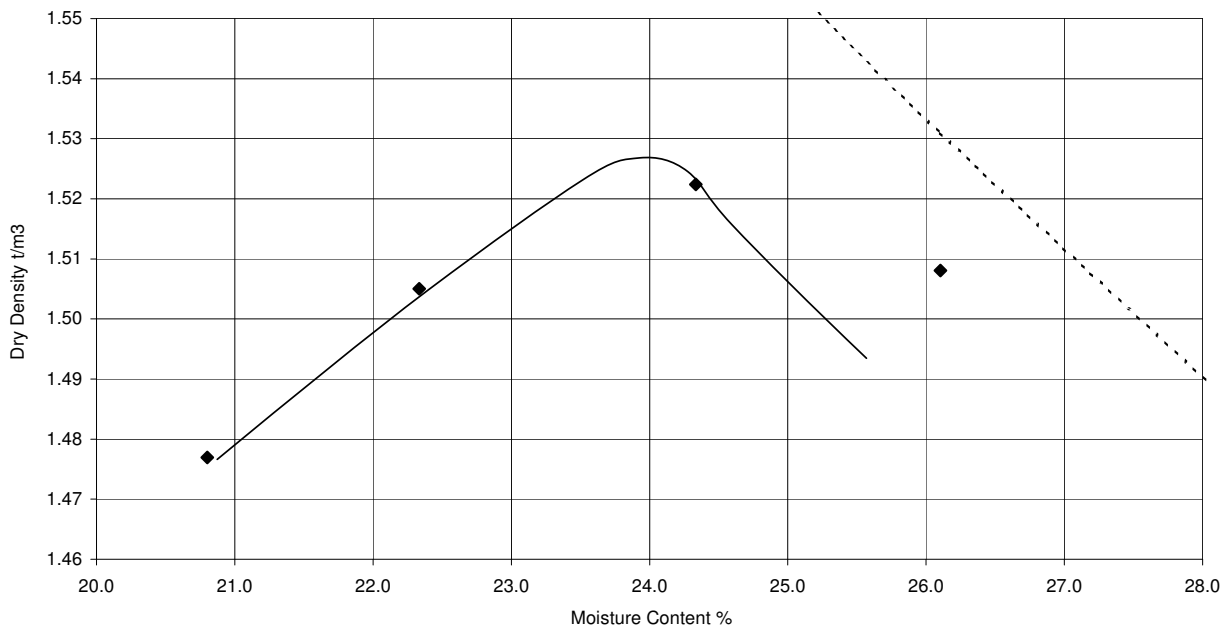
DRY DENSITY/MOISTURE CONTENT RELATION

CLIENT: Geo-Logix

Unit 2309 / 4 Daydream Street □□ Building Q2 Level 3 □□ Warriewood NSW 2102

PROJECT: 1201085 (1201085)

LOCATION: Tamworth



Job Number: 13-32-31

Laboratory Number: 13-AC-310

Sample Source: B12/0.0

Sample Description: SILTY CLAY: black.

Maximum Dry Density:	1.53	t/m ³
Optimum Moisture Content:	24.0	%
Oversize Material:	19	mm
% Oversize:	0	%
Date Tested:	23.01.12	
Sampled By:	Client	
Compactive Effort:	Standard	
Test Method:	AS 1289 5.1.1	
Mould Type:	A	
Number of Layers:	3	
Blows per Layer:	25	
Mass of Rammer:	2.7	kg
Drop of Rammer:	300	mm
Zero Air Voids Line - Particle Density:	2.55	t/m ³
Comments:		

Approved Signatory: 

Aaron Lacey

Date: 30/01/2013



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TEST CERTIFICATE



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CALIFORNIA BEARING RATIO

CLIENT: Geo-Logix
Unit 2309 / 4 Daydream Street ☐ Bulding Q2 Level 3 ☐ Warriewood NSW 2102
PROJECT: 1201085 (1201085)
LOCATION: Tamworth

Sample Source:	B12/0.0	
Sample Description:	SILTY CLAY: black.	
Job Number:	13-32-31	
Laboratory Number:	13-AC-310	
CBR Value @ 2.5mm	6.0	(%)
CBR Value @ 5.0mm	5.0	(%)
<u>Sample Data</u>		
Compaction Specification	100% of MDD at OMC	
Maximum Dry Density (MDD)	1.53	(t/m ³)
Optimum Moisture Content (OMC)	24.0	(%)
Mass of Surcharges	4.5	(kg)
Number of Days Soaked	4	
<u>Sample Preparation</u>		
Dry Density - Before Soaking	1.53	(t/m ³)
Dry Density - After Soaking	1.50	(t/m ³)
Retained on 19mm Sieve	0% excluded	(%)
Moisture Content - Before Soaking	24.8	(%)
Laboratory Density Ratio	100.0	(%)
Laboratory Moisture Ratio	103.0	(%)
Moisture Content - After Soaking		
Top 30mm of Test Sample	29.0	(%)
Remainder of Test Sample	25.2	(%)
Swell After Soaking	1.5	(%)
Compactive Effort	Standard	
Number of Layers	3	
Blows per Layer	53	
Mass of Rammer	2.7	(kg)
Drop of Rammer	300	(mm)
Comments		
Date Tested:	29/01/2013	
Tested in accordance with AS1289.6.1.1 Determination of the California Bearing Ratio of a soil Standard Laboratory Method for a remoulded specimen.		

Approved Signatory: 

Aaron Lacey

Date: 30/01/2013



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ANALYTICAL REPORT



CLIENT DETAILS

Contact **Simon Rosam**
Client **SGS Industrial CMT Eastern Sydney**
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ALEXANDRIA NSW 2015**

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Facsimile **02 8594 0499**
Email **simon.rosam@sgs.com**

Project **13-32-31**
Order Number **(Not specified)**
Samples **4**

LABORATORY DETAILS

Manager **Huong Crawford**
Laboratory **SGS Alexandria Environmental**
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Alexandria NSW 2015**

Telephone **+61 2 8594 0400**
Facsimile **+61 2 8594 0499**
Email **au.environmental.sydney@sgs.com**

SGS Reference **SE114794 R0**
Report Number **0000049175**
Date Reported **29 Jan 2013**
Date Received **21 Jan 2013**

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

SIGNATORIES

Andy Sutton
Organics Chemist

Dong Liang
Inorganics Metals Team Leader

Snezana Kostoska
Inorganics Chemist



ANALYTICAL REPORT

SE114794 R0

Parameter	Sample Number	SE114794.001	SE114794.002	SE114794.003	SE114794.004
	Sample Matrix	Soil	Soil	Soil	Soil
	Sample Date	21 Jan 2013	21 Jan 2013	21 Jan 2013	21 Jan 2013
	Sample Name	1. B2/1.2	2. B8/2.7	3. B12/1.3	4. B14/4.3
	Units	LOR			

pH in soil (1:5) Method: AN101

pH	No unit	-	6.7	9.9	9.3	8.8
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Conductivity and TDS by Calculation - Soil Method: AN106

Conductivity of Extract (1:5 dry sample basis)	µS/cm	1	1700	510	880	160
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Soluble Anions (1:5) in Soil by Ion Chromatography Method: AN245

Chloride	mg/kg	0.25	25	58	200	63
Sulphate	mg/kg	0.5	4400	190	750	71

Moisture Content Method: AN002

% Moisture	%	0.5	7.7	9.9	19	18
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MB blank results are compared to the Limit of Reporting

LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.

DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula: *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA', the results are less than the LOR and thus the RPD is not applicable.

Conductivity and TDS by Calculation - Soil Method: ME-(AU)-[ENV]AN106

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Conductivity of Extract (1:5 dry sample basis)	LB032536	µS/cm	1	<1	6 - 7%	103%

pH in soil (1:5) Method: ME-(AU)-[ENV]AN101

Parameter	QC Reference	Units	LOR	DUP %RPD	LCS %Recovery
pH	LB032544	No unit	-	0 - 1%	101%

Soluble Anions (1:5) in Soil by Ion Chromatography Method: ME-(AU)-[ENV]AN245

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Chloride	LB032500	mg/kg	0.25	<0.25	94%
Sulphate	LB032500	mg/kg	0.5	<0.5	89%

METHOD

METHODOLOGY SUMMARY

AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water (or 0.01M CaCl ₂) is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity and TDS by Calculation: Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2520 B.
AN245	Anions by Ion Chromatography: A water sample is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO ₂ , NO ₃ and SO ₄ are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B

FOOTNOTES

IS	Insufficient sample for analysis.	QFH	QC result is above the upper tolerance
LNR	Sample listed, but not received.	QFL	QC result is below the lower tolerance
*	This analysis is not covered by the scope of accreditation.	-	The sample was not analysed for this analyte
^	Performed by outside laboratory.	NVL	Not Validated
LOR	Limit of Reporting		
↑↓	Raised or Lowered Limit of Reporting		

Samples analysed as received.

Solid samples expressed on a dry weight basis.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here:
<http://www.sgs.com.au/pv.sgs.v3/~media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf>

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