REPORT TO

DEPARTMENT OF EDUCATION

ON

SUPPLEMENTARY SALINITY AND ACID SULFATE SOIL ASSESSMENT & SALINITY MANAGEMENT PLAN

FOR

NORTHERN RIVERS FLOOD RECOVERY – RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

AT

163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Date: 18 July 2025
Ref: E36314PT3rpt3-SupSAL

JKEnvironments
www.jkenvironments.com.au

T: +61 2 9888 5000
JK Environments Pty Ltd
ABN 90 633 911 403

dlcs ISO 9001 certified ISO 45001 certified ISO 14001 certified

Report prepared by:

Katrina Taylor
Senior Associate | Environmental Scientist

Report reviewed by:

B Page

Brendan Page
Principal | Environmental Scientist
CEnvP SC

Financial Year 2025/2026
No. SC40059

For and on behalf of
JKE
PO BOX 976
NORTH RYDE BC NSW 1670

DOCUMENT REVISION RECORD

Report Reference	Report Status	Report Date
E36314PT3rpt3-SupSAL DRAFT	Draft Report	26 June 2025
E36314PT3rpt3-SupSAL	Final Report	18 July 2025

© Document Copyright of JK Environments (JKE)

This Report (which includes all attachments and annexures) has been prepared by JKE for the Client, and is intended for the use only by that Client.

This Report has been prepared pursuant to a contract between JKE and the Client and is therefore subject to:

a) JKE's proposal in respect of the work covered by the Report;
b) The limitations defined in the Client's brief to JKE; and
c) The terms of contract between JKE and the Client, including terms limiting the liability of JKE.

If the Client, or any person, provides a copy of this Report to any third party, such third party must not rely on this Report, except with the express written consent of JKE which, if given, will be deemed to be upon the same terms, conditions, restrictions and limitations as apply by virtue of (a), (b), and (c) above.

Any third party who seeks to rely on this Report without the express written consent of JKE does so entirely at their own risk and to the fullest extent permitted by law, JKE accepts no liability whatsoever, in respect of any loss or damage suffered by any such third party.

Table of Contents

List of Tables

Attachments

ABBREVIATIONS

Australian Height Datum	**AHD**
Acid Sulfate Soil	**ASS**
Below Ground Level	**BGL**
Borehole	**BH**
Cation Exchange Capacity	**CEC**
Calcium	**Ca**
Cement, Concrete and Aggregates Australia	**CCAA**
Chain of Custody	**COC**
Covered Outdoor Learning Area	**COLA**
Damp Proof Course	**DPC**
Department of Land and Water Conservation	**DLWC**
Dissolved Oxygen	**DO**
Electric Vehicle	**EV**
General Learning Space	**GLS**
International Organisation of Standardisation	**ISO**
JK Environments	**JKE**
Local Government Authority	**LGA**
Lismore South Public School	**LSPS**
Map Grid of Australia	**MGA**
Magnesium	**Mg**
National Association of Testing Authorities	**NATA**
Potassium	**K**
Polyvinyl Chloride	**PVC**
Practical Quantitation Limit	**PQL**
Redox Potential	**Eh**
Review of Environmental Factor	**REF**
Richmond River High Campus	**RRHC**
Site Assessment Criteria	**SAC**
Standard Penetration Test	**SPT**
Standard Sampling Procedure	**SSP**
Standing Water Level	**SWL**
Standard Sampling Procedure	**SSP**
Sodium	**Na**

Units

deci Siemens per Metre	**dS/m**
Electrical Conductivity	**EC**
Exchangeable Sodium Percentage (Sodicity)	**ESP%**
Litres	**L**
Metres	**m**
Metres Below Ground Level	**mBGL**
Milligrams per Litre	**mg/L**
Milligrams per Kilogram	**mg/kg**
ohm Centimetres	**ohm.cm**
Parts Per Million	**ppm**

1 CLIENT SUPPLIED INTRODUCTION

This Supplementary Salinity and Acid Sulfate Soil (ASS) Assessment and Salinity Management Plan has been prepared to support a Review of Environmental Factors (REF) for the rebuild of Richmond River High Campus (the activity) (RRHC). The REF has been prepared to support an approval for the RRHC development under Section 68 of the NSW Reconstruction Authority Act 2022 (RA Act).

The purpose of this report is to make an assessment of the salinity and ASS conditions likely to be disturbed during development.

1.1 Client Provided Site Description

The site is located at Dunoon Road, North Lismore, also known as 163 and 170 Alexandra Parade, North Lismore. The site comprises of three separate lots, located to the north of Alexandra Parade, with Dunoon Road running parallel to the eastern boundary of the site.

The site is legally described as:

- Lot 1 DP 539012
- Lot 2 DP 539012
- Lot 1 DP 376007

The site area is approximately 33.53 hectares. The proposed activity will be undertaken mainly within the south-eastern portion of the site. The site is outlined in Figure 1 below.

Figure 1 Aerial image of site (Source: Nearmap)

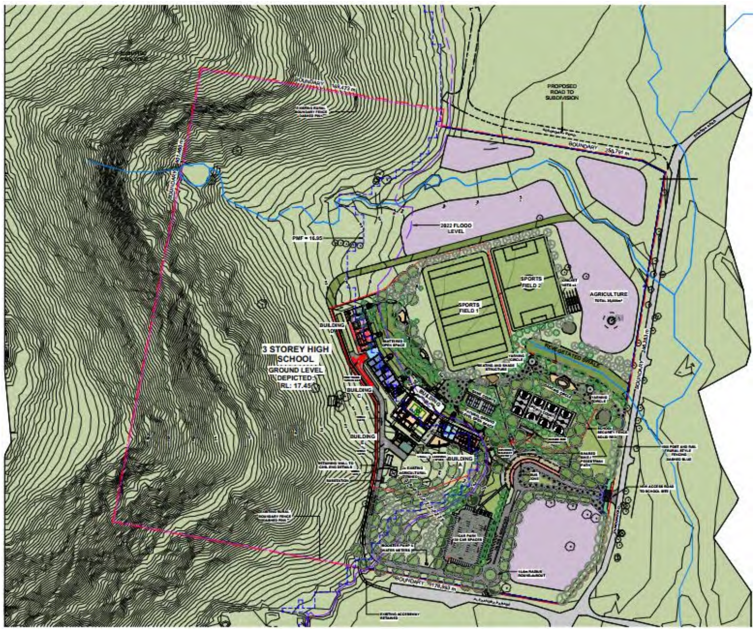
1.2 Proposed Activity Description

The proposed activity comprises the relocation and rebuild of the Richmond River High Campus from its existing temporary location alongside The Rivers Secondary College Lismore High Campus at East Lismore to the site at 163 and 170 Alexandra Parade, North Lismore.

The school will be delivered in one stage. A detailed description of the proposal is as follows:

1. Demolition of existing features including existing buildings, cattle drinking well, cattle sheds, and wire fencing, and removal of trees to accommodate school development.
2. Construction of new 3 storey buildings on the southeastern portion of the site for the proposed public secondary school including:
    a. General and Specialist Learning Spaces, and Workshops.
    b. Administration, and Staff facilities.
    c. Library, Hall, and Movement Studio.
    d. Construction, Hospitality, and Agricultural Learning Facilities.
    e. Amenity, Plant, Circulation, and Storage areas.
    f. Outdoor Learning Spaces and play spaces.
3. Landscaping including tree planting.
4. Public domain works comprising:
    - Access road off Dunoon Road, comprising a separate shared bicycle/pedestrian pathway, and internal access roundabout.
    - Kiss and ride drop-off and pick up zones.
    - Bus transport arrangements with a separate bus zone.
5. Outdoor spaces including assembly zones, agricultural spaces, sports fields, games courts, dancing circles, yarning and dancing circles, seating and shade structures.
6. On-site carparking, including accessible spaces and provision for EV charging spaces.

Figures 2 below shows the scope of works.



2 INTRODUCTION

Department of Education ('the client') commissioned JK Environments (JKE) to undertake a Supplementary Salinity and ASS Assessment, and prepare a Salinity Management Plan for the Northern Rivers Flood Recovery – Richmond River High Campus Redevelopment, at 163-170 Alexandra Parade, North Lismore, NSW. The site location is shown on Figure 1 and the investigation was confined to the nominated site boundaries (referred to herein as 'the site') as shown on Figure 2 attached in the appendices.

This report has been prepared to support a REF for the Richmond River High Campus– Flood Recovery Relocation.

A geotechnical investigation was undertaken in conjunction with this assessment by JK Geotechnics (JKG). The results of the geotechnical investigation are presented in a separate report (Project ref: 36314UOR). This report should be read in conjunction with the JKG report.

A Supplementary Investigation (relating to site contamination) was undertaken concurrently by JKE[1], and we have also previously undertaken a Preliminary (Desktop) Site Investigation (PSI) and Detailed Site Investigation (DSI) of a section of the north of the site and the wider property. Relevant information from these investigations has been included throughout this report. This supplementary investigation is required to address data gaps as a result of the proposed site location being relocated within the wider property.

Background information on salinity and ASS is included in the appendices (Appendix C and Appendix D).

2.1 Aim and Objectives

The primary aims of the assessment were to characterise the broad scale dryland salinity conditions at the site in the context of the activity and assessment previously undertaken, and make a preliminary assessment of the potential for ASS materials to be present. The assessment objectives were to:

- Assess the current site conditions via a site walkover inspection;
- Assess the soil and groundwater salinity conditions via implementation of a sampling and analysis program;
- Assess the potential for ASS to be disturbed during the activity and the need for an ASS management plan (ASSMP); and
- Provide salinity management recommendations, and if/where required, a Salinity Management Plan (SMP).

2.2 Scope of Work

The investigation was undertaken generally in accordance with the Scope of Services (SI-07798-25) as provided by the client in an email of 2 May 2025, and the agreement dated 15 May 2025. The scope of work included the following:

- Review site information including topography, soils maps, salinity risk maps, ASS risk maps; regional geology and hydrogeology in the vicinity of the site;

---

[1] JKE, (2025). *Report to Department of Education, on Supplementary Investigation for Richmond River High Campus – Flood Recovery at 163-170 Alexandra Parade, North Lismore, NSW*. (Report ref: E36314PT3rpt2-SI) (referred to as Supplementary Investigation)

- A walkover site inspection to identify obvious visual indicators of dryland salinity or potential problem areas;
- Design and implementation of a field sampling and laboratory analysis program (for salinity samples only);
- Interpretation of the analytical results based on established assessment criteria;
- Preparation of a report presenting the results of the assessment; and
- Preparation of a site-specific SMP for the activity.

The assessment was designed and the report was prepared with reference to regulations/guidelines outlined in the table below. Individual guidelines/documents are also referenced within the text of the report.

Table 2-1: Guidelines

Guidelines/Regulations/Documents
Site Investigations for Urban Salinity (2002)[2]
Salinity Code of Practice (2004)[3]
Managing Urban Stormwater – Soil and Construction (4th ed.) (2004)[4]
Salinity Potential in Western Sydney Map (2002)[5]
Piling – Design and Installation AS2159-2009 (2009)[6]
Industry Guide T56: Residential Slabs and Footings in Saline Environments (2018)[7]
National Acid Sulfate Soil Guidance (2018) documents and the Acid Sulfate Soil Management Advisory Committee (ASSMAC) Acid Sulfate Soil Manual (1998)[8] as applicable

---

[2] Department of Land and Water Conservation (DLWC), (2002). *Site Investigations for Urban Salinity,* (referred to as DLWC 2002)

[3] Western Sydney Regional Organisation of Councils (WSROC) and Department of Infrastructure, Planning and Natural Resources (DIPNR), (2003 amended 2004). *Western Sydney Salinity Code of Practice* (referred to as Salinity Code of Practice)

[4] NSW Government/Landcom, (2004). *Managing Urban Stormwater – Soil and Construction*, (4th ed.) (referred to as Blue Book)

[5] DIPNR, (2002). *1:100,000 Map – Salinity Potential in Western Sydney*, (referred to as Salinity Potential Map)

[6] Standards Australia, (2009). *Piling – Design and Installation, AS2159-2009* (referred to as AS2159-2009)

[7] Cement, Concrete and Aggregates Australia (CCAA), (2018). Industry Guide *T56: Residential Slabs and Footings in Saline Environments* (referred to as CCAA 2018)

[8] Acid Sulfate Soils Management Advisory Committee (ASSMAC), (1998). *Acid Sulfate Soils Manual* (ASS Manual 1998)

3 SITE INFORMATION

3.1 Site Identification

Table 3-1: Site Identification

Site Address:	163-170 Alexandra Parade, North Lismore, NSW
Lot & Deposited Plan:	Part of Lots 1 & 2 in DP539012
Current Land Use:	Rural residential and agricultural (grazing)
Proposed Land Use:	High school
Local Government Authority (LGA):	Lismore City Council
Site Area (m^2):	87,200
RL (AHD in m) (approx.):	10-40
Geographical Location (decimal degrees) (approx.):	Latitude: -28.7950695 Longitude: 153.2664283
Site Plans:	Appendix A

3.2 Site Location, Regional Setting and Topography

The site is located in a mixed use (rural residential/recreational/commercial) area of North Lismore and the wider property is bound by Dunoon Road to the east and Alexandra Parade to the south. The site is located approximately 830m to the north-west of Wilsons River at its closest point.

The site is located at a transition between undulating topography with rolling hills generally sloping down at approximately 5° to 15°, associated with the North Lismore Plateau, and the relatively level floodplain around Wilsons River and Leycester Creek.

3.3 Site Description

A walkover inspection of the site was undertaken by JKE on 29 May 2025 as part of the Supplementary Investigation. The inspection was limited to accessible areas of the site and was focussed on assessing the site conditions relevant to ASS and salinity-related factors only. Key observations are noted below:

- The main residence and associated outbuildings of the southern property (No.163 Alexandra Parade) was located in the central west of the site. The buildings were generally constructed on grade with timber and/or metal walls, metal rooves, and on concrete slab;
- A second residence (No. 170 Alexandra Parade) was located to the immediate west of the site boundary and comprised a main residence and several smaller sheds and outbuildings. Both properties

within the site and wider property were accessed via an unpaved driveway off Alexandra Parade to the south;

- The site predominantly comprised grassed paddocks with sparse tree cover in the eastern portion;
- The revegetated swale in the north-east corner of the site was dry at the time of the site inspection, however to the north of the site on the wider property two dams were visible along a creek which extended in an east-west direction to the north of the site; and
- All vegetation inspected appeared to be in good condition with no obvious evidence of phyto-toxic stress or die back.

There were no obvious indicators of ASS or salinity observed on structures or vegetation/ground surfaces during the site inspection.

3.4 Surrounding Land Use

During the inspection, JKE observed the following land uses in the immediate surrounds:

- North – rural residential and agricultural properties;
- South – Alexandra Parade with residential, agricultural (including cattle/sheep loading areas/yards) and commercial (Boral Concrete and a landscape supplies store) properties beyond;
- East – Dunoon Road with Lismore Showground and kart racing track/club beyond; and
- West – undeveloped scrubland and/or agricultural land.

4 GEOLOGY AND HYDROGEOLOGY

4.1 Regional Geology

Regional geological information previously reviewed indicated that the western section the site is underlain by Lismore Basalt which typically consists of predominantly tholeiitic with occasional alkaline types of formations. The eastern section of the site is underlain by Quaternary aged alluvial floodplain deposits, which typically consists of silt, very fine- to medium grained lithic to quartz-rich sand, and clay. A sliver through the central section of the site is underlain by Quaternary aged alluvial fan deposits, which typically consists of fluvially-deposited quartz-lithic sand, silt, gravel, and clay.

4.2 Soil Landscapes of Central and Eastern NSW

Soil Landscapes of Central and Eastern NSW information previously reviewed indicated that the site is located within the Coolamon, Disputed Plain and Leycester soil landscapes. Coolamon soils are generally characterised by moderate erodibility, and high to very high shrink-swell capacity. Disputed Plains soils are generally characterised by high erodibility. Leycester soils are generally characterised by moderate erodibility with some higher local occurrences, and high dispersivity.

4.3 Dryland Salinity – National Assessment

There was no dryland salinity national assessment data for the site.

4.4 Acid Sulfate Soil (ASS) Risk and Planning

ASS related information previously reviewed indicated that the site is not located in an ASS risk area.

A review of the Lismore Local Environmental Plan (LEP) 2012 indicates that the site is not mapped as being within an ASS risk area.

Based on the geology, site elevation and ASS risk mapping, intrusive investigation and sampling/analysis of soils for ASS characteristics was not deemed necessary and the intrusive investigation component of the assessment focussed on salinity only (as outlined in Section 5).

4.5 Hydrogeology

Hydrogeological information previously reviewed indicated that:

- There was a total of 38 registered bores within the buffer of 2,000m. In summary:
- The nearest registered bore was located approximately 630m to the south and down-gradient of the site and was registered for irrigation purposes;
- A number of the bores were registered for irrigation, water supply, and stock and domestic purposes; and
- Subsurface conditions at the site are expected to consist of variable soils, including alluvial soils. Abstraction and use of groundwater at the site or in the immediate surrounds may be viable under these conditions, however the use of groundwater is not proposed as part of the development and there were no registered groundwater bores in close proximity. We assume there is a reticulated water

supply in the area and consumption of groundwater is not expected to occur, although it cannot be ruled out given that some registered groundwater bores in the region are listed as water supply bores.

Considering the local topography and surrounding land features, JKE anticipate groundwater to generally flow towards the south-east overall. However, groundwater flows locally in the vicinity of the hillside (western part of the site) are expected to be in sympathy with the topography.

An unnamed tributary of Leycester Creek usually flows through the north-east corner of the site in an east-west orientation, commencing onsite. This water body was dry at the time of the site inspection. There is also another creek in the northern section of the wider property. Leycester Creek is located approximately 100m to the east of the site.

5 SAMPLING AND ANALYSIS PLAN

5.1 Soil Sampling Rationale

The salinity investigation included soil sampling from 20 locations (TP201 to TP210, BH213 to BH215, TP301, TP303, TP305, TP308, TP309, TP312 and TP315), placed on a judgemental sampling plan as shown on Figure 2. We note that Figure 2 also shows all locations drilled for the geotechnical investigation and the Supplementary Investigation. The salinity sampling density is equivalent to approximately two to three sampling points per hectare (the area of the site is approximately 8.72 hectares) and meets the requirements for an 'initial site investigation' recommended in the DLWC 2002 document for 'moderately intensive construction'. The density was considered adequate to identify large areas of salinity impacted soils at the site.

Soil sampling for this assessment was confined to a maximum depth of approximately 3.9m below ground level (BGL).

5.2 Soil Sampling Methods

Fieldwork for this investigation was undertaken from 19 to 30 May 2025. Sampling locations were set out using a hand-held GPS unit. Locations were marked using spray paint and were cleared for underground services prior to drilling.

The sample locations were drilled using a truck mounted hydraulically operated drill rig equipped with spiral flight augers and/or mechanical excavator. Soil samples collected using the rig were obtained from a Standard Penetration Test (SPT) sampler or directly from the auger when conditions did not allow use of the SPT sampler. Soil samples collected using the excavator were obtained from the test pit walls or directly from the bucket by hand. Where sampling occurred from the bucket, samples were collected from the central portion of large soil clods.

Soil samples were collected from the fill and natural profiles encountered during the investigation based on distinct change in lithology or field observations. All samples were recorded on the borehole logs attached in the appendices.

Samples were placed in plastic bags and sealed using twist ties. Sampling personnel used disposable nitrile gloves during sampling activities. The samples were labelled with the job number, sampling location, sampling depth and date.

On completion of the fieldwork, the samples were delivered in the insulated sample container to a NATA registered laboratory for analysis under standard COC procedures. Field sampling protocols adopted for this assessment are summarised in the appendices.

5.3 Surface and Groundwater Sampling Rationale

The assessment included the installation of three new monitoring wells in BH206 (MW206), BH212 (MW212) and BH214 (MW214) spread across the site as shown on Figure 2. The wells were positioned for site coverage. Existing monitoring well MW62 was also sampled for the assessment (refer to Figure 2).

A water sample was also obtained from the onsite creek as shown on Figure 2.

5.4 Monitoring Well Installation

The monitoring well construction details are documented on appropriate borehole logs presented in the appendices. The wells were installed to depths of between approximately 5.7mBGL to 11.29mBGL. The wells were generally constructed as follows:

- 50mm diameter Class 18 PVC (machine slotted screen) was installed in the lower section of the well to intersect groundwater;
- 50mm diameter Class 18 PVC casing was installed in the upper section of the well (screw fixed);
- A 2mm sand filter pack was used around the screen section for groundwater infiltration;
- A hydrated bentonite seal/plug was used on top of the sand pack to seal the well; and
- The wells were finished with a 1m stick up and concrete plug at surface level to limit the inflow of surface water, and the wells were sealed with an envirocap.

The well construction details are summarised in the following table:

Table 5-1: Monitoring Well Construction Details

Borehole / Well Number	Installation Depth (mBGL approx..)	Casing & Screen[1] Depths (mBGL)	Finishing Details (mBGL)
BH62/MW62	11.29	- Casing from 0 to 7.0. - Screen from 7.0 to 11.29.	- Sand filter pack from 6.0 to 11.29. - Bentonite seal/plug from 0 to 6.0. - Finished with 1m stick up.
BH206/MW206	5.7	- Casing from 0 to 1.5. - Screen from 1.5 to 5.7.	- Sand filter pack from 1.0 to 5.7. - Bentonite seal/plug from 0.1 to 1.0. - Finished with 1.05m stick up.
BH212/MW212	6.0	- Casing from 0 to 1.0. - Screen from 1.0 to 6.0.	- Sand filter pack from 1.0 to 6.0. - Bentonite seal/plug from 0 to 1.0. - Finished with 1m stick up.
BH214/MW214	6.3	- Casing from 0 to 1.3. - Screen from 1.3 to 6.3.	- Sand filter pack from 0.5 to 6.3. - Bentonite seal/plug from 0 to 0.5. - Finished with 1m stick up.

Notes:

[1] 50mm diameter Class 18 PVC has been used for the wells

5.4.1 Survey, Groundwater Depth and Flow

The relative heights for all monitoring wells were surveyed using a GPS unit on 29 May 2025. Standing water levels (SWLs) measured in the monitoring wells installed at the site ranged from 2.37mBGL to 6.78mBGL. Groundwater RLs calculated on these measurements ranged from 11.29mAHD to 17.29mAHD as summarised below.

Table 5-2: Summary of Groundwater RLs

MW reference	Reduced Level (mAHD)	SWLs (mBGL)	SWL (mAHD)
MW62	18.61	6.78	11.83
MW206	17.80	2.37	15.43
MW212	22.22	4.93	17.29
MW214	14.58	3.29	11.29

A contour plot was prepared for the groundwater levels as shown on Figure 3 in Appendix A. Groundwater flow generally occurs in a down gradient direction perpendicular to the groundwater elevation contours. The contour plot indicates that groundwater generally flows towards the north-east which is generally in sympathy with the topography (in the vicinity of the monitoring wells) and expectations.

5.5 Monitoring Well Development and Groundwater Sampling

MW62, MW206, MW212 and MW214 were developed between 28 and 30 May 2025. All wells were developed (i.e. water was pumped out) until they were effectively dry using a submersible electrical pump.

The monitoring wells were allowed to recharge for between 24 and 72 hours after development. Groundwater samples for the assessment were obtained on 30 to 31 May 2025 from all monitoring wells A grab sample was obtained from the onsite creek using a single use polythene bailer on 29 May 2025.

The pH, temperature, electrical conductivity (EC), dissolved oxygen (DO) and redox potential (Eh) were monitored during sampling of the wells using calibrated field instruments. The sampling data sheets and field calibration information are attached in the appendices. The samples were preserved in accordance with the requirements detailed in AS/NZS 5667.1-1998[9] and placed in an insulated container with ice.

On completion of the fieldwork, the samples were delivered in an insulated sample container to a NATA registered laboratory for analysis under standard chain of custody procedures.

5.6 Laboratory Analysis

Samples were analysed by Envirolab Services Pty Ltd (NATA accreditation number 2901). Reference should be made to the laboratory reports (Ref: 382346 and 382356) attached in the appendices for further details of the analytical methods.

5.7 Analytical Schedule

The analytical schedule is outlined in the following table:

---

[9] Standards Australia, (1998). *Water Quality – Part 1: Sampling, Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples,* (AS/NZS 5667.1:1998)

Table 5-3: Analytical Schedule

Analyte	Fill/Topsoil Samples (surface soil)	Natural Soil Samples (subsoil)	Bedrock Samples	Water Samples
pH	6	43	10	5
Electrical Conductivity (EC)	6	43	10	5
Resistivity	6	43	10	NA
Texture (used to determine EC extract – ECe)	6	43	10	NA
Cation Exchange Capacity (CEC)	3	17	1	NA
Sulphate	6	43	10	5
Chloride	6	43	10	5

It is noted that Envirolab reports 382346 and 382346-A includes additional groundwater data relevant to the Supplementary Investigation and surface and groundwater impact assessment. These items have not been discussed in this report and are to be reported under a separate cover. Only the salinity-related soil and groundwater data have been discussed in this report.

6 SITE ASSESSMENT CRITERIA (SAC)

6.1 Soil Salinity and Plant Growth

The EC of a 1:5 soil:water extract is commonly used as an indicator of soil salinity conditions as the reading is directly related to the electrolyte (salt) concentration of the extract. In order to compare the laboratory data with published salinity classes, the results are converted to equivalent saturated paste (ECe) using texture adjustment values presented in DLWC 2002.

The following table provides a summary of plant response with reference to salinity:

Table 6-1: Plant Response to Soil Salinity

ECe (dS/m)	Salinity Class	Plant Response[1]
<2	Non-saline	Salinity effects mostly negligible
2-4	Slightly saline	Yields of very sensitive crops may be affected
4-8	Moderately saline	Yield of many crops affected
8-16	Very saline	Only tolerant crops yield satisfactorily
>16	Highly saline	Only a few very tolerant crops yield satisfactorily

Note:

1 - Plant Response to Salinity Class has been adopted from DLWC 2002

6.2 Soil pH and Plant Growth

Soil pH is a measure of the acidity or alkalinity of the soils and values have been assessed as an indicator of soil fertility with respect to plant growth. The optimal pH for plant growth is between 5.5 and 7. Beyond this range, effective revegetation of exposed soil following disturbance is increasingly difficult and the potential for erosion is considered to increase.

Highly alkaline soils are commonly associated with saline and sodic soil conditions and can limit the ability of plants to take up water and nutrients. Highly acidic soils exhibit aluminium toxicity toward plants and can limit the ability of plants to take up other essential nutrients including molybdenum.

Interpretation of soil pH with respect to plant growth is undertaken using the ratings published in Bruce and Rayment (1982)[10] presented below:

Table 6-2: Plant Response to Soil pH

pH	Rating
<4.5	Extremely acidic
4.5-5.0	Very strongly acidic

---

[10] Bruce, R.C. and Rayment, G.E., (1982). *Analytical Methods and Interpretations used by the Agricultural Chemistry Branch for Soil and Land Use Surveys,* (referred to as Bruce and Rayment 1982)

pH	Rating
5.1-5.5	Strongly acidic
5.6 – 7.3	Optimal plant growth
7.4-7.8	Mildly alkaline
7.9-8.4	Moderately alkaline
8.5-9.0	Strongly alkaline
>9.1	Very strongly alkaline

6.3 Cation Exchange Capacity (CEC) in Soil

The ability of soils to attract, retain and exchange cations (positively charged ions) is estimated by the calculated CEC value. CEC represents the major controlling factor in stability of clay soil structure, nutrient availability for plant growth, soil pH and the reaction of the soil to chemical applications (fertilisers, conditioners etc.).

High CEC soils have a greater capacity to retain nutrients, however, deficient soils require greater applications of nutrients to correct imbalances. Low CEC soils have a reduced capacity to retain nutrients and may result in leaching of nutrients from the soil in the event of excess nutrient applications.

Metson (1961)[11] developed a set of ratings for effective CEC and the most abundant cations. These are summarised below (values are in meq/100g):

Table 6-3: CEC Rating

Rating	eCEC	Exch Na	Exch K	Exch Ca	Exch Mg
Very low	<6	0-0.1	0-0.2	0-2	0-0.3
Low	6-12	0.1-0.3	0.2-0.3	2-5	0.3-1
Moderate	12-25	0.3-0.7	0.3-0.7	5-10	1-3
High	25-40	0.7-2	0.7-2	10-20	3-8
Very high	>40	>2	>2	>20	>8

---

[11] Metson, A.J, (1961). *Methods of Chemical Analysis for Soil Survey Samples* (referred to as Metson 1961)

6.3.1 Ratio of Exchangeable Calcium to Magnesium

To maintain soil structure there should be a ratio of around 4:1 to 6:1 calcium to magnesium for a balanced soil (Eckert 1987)[12]. At ratios of less than 4:1 calcium is considered to be deficient, whilst at ratios of greater than 6:1 are considered to be magnesium deficient.

6.4 Exchangeable Sodium Percentage or Sodicity (ESP%)

Exchangeable sodium is an important soil stability and salinity parameter. Excessive exchangeable sodium leads to unstable soils, increased runoff, potential salinity, dispersivity and water logging problems.

Normally the sodium content is expressed as a percentage of the CEC as other cations counteract the negative effects of sodium (known as ESP% and termed sodicity). The effect of the exchangeable sodium (exchangeable sodium percentage, ESP) varies with other soil factors such as the type of clay, the relative quantity of magnesium and the quantity of organic matter. However, Charman & Murphy (2000[13]) indicate that a soil is generally considered sodic if the ESP exceeds 6% and extremely sodic if the ESP exceeds 15%.

6.5 Groundwater Salinity

EC values in groundwater are dependent on numerous factors and can vary with changes in temperature and pH conditions. Suttar (1990[14]) has classed water into different types based on EC values as outlined in the table below.

Table 6-4: EC Ranges in Water

Water Type	EC (µS/cm)
Deionised Water	0.5 – 3
Pure Rainwater	<15
Freshwater Rivers	0 – 800
Marginal River Water	800 – 1600
Brackish Water	1600 – 4800
Saline Water	>4800
Seawater	51,500
Industrial Waters	100 – 10,000

---

[12] Eckert, D.J, (1987) .*Soil Test Interpretation: Basic Cation Saturation Ratios and Sufficiency Levels* (referred to as Eckert 1987)

[13] Charman, P.E.V and Murphy, B.W (eds), (2000).*Soils: Their Management and Properties,* (referred to as Charman and Murphy 2000)

[14] Suttar, S., (1990). *Ribbons of Blue Handbook, Scitech*, Victoria (referred to as Suttar 1990)

6.6 Recommendations for Concrete Slabs and Footings in Saline Soils

In the absence of endorsed recommendations for buildings in saline environments, reference is made to the CCAA 2018. The guide provides recommendations on the minimum concrete grade/strength required for slabs and footings in saline soils. Reference should be made to the CCAA 2018 publication for further information:

Table 6-5: Minimum Concrete Grade for Slabs and Footings in Saline Soils

ECe (dS/m)	Salinity Class	Concrete Grade[1]
<2	Non-saline	N20
2-4	Slightly saline	N20
4-8	Moderately saline	N25
8-16	Very saline	N32
>16	Highly saline	≥N40

Note:

1 - Concrete Grade for Salinity Class has been adopted from CCAA 2018

6.7 Recommendations for Durability with Reference to AS2159-2009

In designing for durability, reference should be made to the requirements listed in the AS2159-2009. The exposure classification for concrete and steel piles and foundations is outlined in the following tables.

Table 6-6: Exposure Classification for Concrete Piles

Exposure Conditions				**Exposure Classification**	
Sulphate (expressed as SO_4)		pH	Chlorides in Groundwater (ppm)	Soil Conditions A[1]	Soil Conditions B[2]
In Soil (ppm)	In Groundwater (ppm)				
<5,000	<1,000	>5.5	<6,000	Mild	Non-aggressive
5,000-10,000	1,000-3,000	4.5-5.5	6,000-12,000	Moderate	Mild
10,000-20,000	3,000-10,000	4-4.5	12,000-30,000	Severe	Moderate
>20,000	>10,000	<4	>30,000	Very severe	Severe

Notes:

1 - High permeability soils (e.g. sands and gravels) which are in groundwater

2 – Low permeability soils (e.g. silts and clays) or all soils above groundwater

Table 6-7: Exposure Classification for Steel Piles

Exposure Conditions				**Exposure Classifications**	
pH	**Chlorides**		**Resistivity (ohm.cm)**	**Soil Conditions A**[1]	**Soil Conditions B**[2]
	In Soil (ppm)	**In Groundwater (ppm)**			
>5	<5,000	<1,000	>5,000	Non-aggressive	Non-aggressive
4-5	5,000-20,000	1,000-10,000	2,000-5,000	Mild	Non-aggressive
3-4	20,000-50,000	10,000-20,000	1,000-2,000	Moderate	Mild
<3	>50,000	>20,000	<1,000	Severe	Moderate

Notes:

1 - High permeability soils (e.g. sands and gravels) which are in groundwater

2 – Low permeability soils (e.g. silts and clays) or all soils above groundwater

7 INVESTIGATION RESULTS

7.1 Subsurface Conditions

A summary of the subsurface conditions encountered during the investigation is presented in the table below. Reference should be made to the borehole/test pit logs attached in the appendices for further details.

Table 7-1: Summary of Subsurface Conditions

Profile	Description (metres below ground level - mBGL)
Fill/Topsoil (surface soils)	Fill or topsoil was encountered at the surface in all boreholes and test pits and extended to depths of approximately 0.1mBGL to 0.6mBGL. The fill/topsoil typically comprised silty clay, with inclusions of basalt cobbles, basalt and siltstone and igneous gravel, organics, ash, sand, roots and root fibres.
Natural Soil (subsoil)	Natural alluvial, colluvial and residual clayey or gravelly soils were encountered beneath the fill/topsoil in all locations and extended to depths of approximately 0.6m to 4.0mBGL.
Bedrock	Siltstone or basalt bedrock was encountered beneath the natural soils in TP202, TP205, TP206, TP207, TP209, and TP210 from depths of between 0.3mBGL to 4.0mBGL. Neither odours nor staining were recorded in the bedrock during fieldwork.
Groundwater	Groundwater seepage was encountered in TP202, TP210 TP303, TP308, TP309, and TP312 at depths of between 0.1mBGL to 2.6mBGL This was likely a result of recent rains.

7.2 Laboratory Results

A summary of the results is presented below.

Table 7-2: Summary of Laboratory Results

Analyte	Results
Soils	
EC & ECe	The EC results ranged from 13µS/m to 1,800µS/m. The ECe results ranged from less than the practical quantitation limit (PQL) to 16dS/m.
Resistivity	Resistivity values were calculated based on the raw EC values. The resistivity values for the soil samples ranged from 556 ohm.cm to 76,923 ohm.cm.
pH	The results of the analysis ranged from 4.5 to 8.7.
CEC	The results of the analysis ranged from: • CEC – 11meq/100g to 45meq/100g; • Exchangeable Na – less than the PQL to 2.4meq/100g; • Exchangeable K – less than the PQL to 2.1meq/100g; • Exchangeable Ca – 4.9meq/100g to 28meq/100g; and • Exchangeable Mg – 4.5meq/100g to 21meq/100g.
Sulphate	The results ranged from less than the PQL to 810mg/kg.
Chloride	The results ranged from less than the PQL to 3,500mg/kg.

Analyte	Results
Water	
Groundwater	Results of the analysis ranged from: - pH – 7.1 to 7.4; - EC – 340µS/cm to 3,700µS/cm; - Chloride – 17mg/L to 710mg/L; and - Sulphate – 8mg/L to 130mg/L.
Surface water	Results of the creek sample analysis were: - pH – 6.6; - EC – 210µS/cm; - Chloride – 18mg/L; and - Sulphate – 1mg/L.

Note:

Na – Sodium, K – Potassium, Ca – Calcium, Mg – Magnesium

8 RESULTS INTERPRETATION

The laboratory results are compared to the relevant SAC in the attached report tables. Interpretation of the results against the SAC is provided in the following table.

Table 8-1: Interpretation of Laboratory Results

Parameter	Notes
Soil Salinity and Plant Growth	The EC results ranged from 13µS/m to 1,800µS/m. The ECe results ranged from non-saline to highly saline. The salinity of the soils generally increased with depth (although this increase was less apparent in the subsoils at some locations). The surficial soil in TP204 was highly saline.
Soil pH and Plant Growth	The soil pH results ranged from 4.5 to 8.7 and are classed as very strongly acidic to strongly alkaline. There was no obvious pattern with regards to acidic conditions increasing with depth. The works at the site will generally expose acidic soils in some areas and may require treatment with lime or gypsum in order to make the soils suitable for plant growth.
CEC in Soil	The CEC values ranged from 11meq/100g to 45meq/100g in the low to very high range which is typical of the soil formation encountered at the site and are generally indicative of the levels of organic matter within the soils.
Ratio of Calcium to Magnesium	The results indicate that the soils have similar concentrations of calcium and magnesium and were therefore calcium deficient.
ESP%	The ESP% values of the samples ranged from 0.4% to 17.3%. The topsoil/natural soil ESP results at TP201, TP203, TP204 and TP303 were within the sodic range of 5%-15%. The natural soil ESP result in TP207 was within the highly sodic range of >17%.
Surface and Groundwater Salinity	The EC laboratory results indicate that the groundwater ranges between non-saline and saline, with MW206 within the 'freshwater rivers' water type, MW62 and MW212 within the 'marginal river waters' water type and MW214 within the 'brackish water' water type. The EC laboratory results indicate that the surface water in the creek is not saline and within the 'freshwater rivers' water type.
Concrete Slabs and Footings in Saline Soils (CCAA 2018)	The proposed earthworks are anticipated to expose soils generally classed as non-saline to moderately saline from the existing ground surface, and moderately to highly saline at greater depth in areas of cut. The CCAA 2018 minimum recommended concrete grades for slabs and footings in very to, highly saline soils are N32 to ≥N40 respectively. Reference should also be made to AS2159-2009 for minimum concrete strengths and reinforcement cover for concrete piles/foundations.

Parameter	Notes
Soil Conditions for Exposure Classification (AS2159-2009)	The boreholes drilled for the investigation have indicated that the subsurface conditions at the site generally comprise of low permeability soils (i.e. silts and clays). Based on this, the exposure classification outlined under 'Soil Conditions B' has been adopted for the assessment. The results should be assessed by the project design team as applicable for the activity.
Exposure Classification for Concrete Piles/Foundations (AS2159-2009)	The soil pH and sulphate results indicate that the soils are largely non-aggressive towards buried concrete. Except for samples reported from TP203, TP204, TP303, TP305, TP308, TP309, TP312 and TP315 which were mildly to moderately aggressive towards buried concrete due to low pH results. The pH, sulphate and chloride results indicate that the surface water and groundwater is non-aggressive towards buried concrete. We note that these criteria are not intended to apply to surface water. The results should be assessed by the project design team as applicable for the activity.
Exposure Classification for Steel Piles/Foundations (AS2159-2009)	The soil resistivity, pH and chloride results indicate that the soils are variably aggressive towards buried steel across the site due to low resistivity. The surface and groundwater pH and chloride results indicate that the groundwater is non-aggressive towards buried steel. The results should be assessed by the project design team as applicable for the activity.

9 CONCLUSION

9.1 ASS Conditions

Based on the information reviewed for the ASS assessment, JKE is of the opinion that there is a relatively low potential for ASS materials to be disturbed during the activity works described in Section 1.2 of this report. This conclusion is based on the following:

- The Lismore LEP 2012 does not map the site as being within an ASS risk area;
- The geological information indicates that the site is underlain by Lismore Basalt and Quaternary aged alluvial floodplain deposits. The borehole/test pit logs for the investigation indicate high plasticity silty clay alluvial, colluvial and residual soils; and
- The site is located at approximately 10m – 40m AHD. ASS materials are not usually associated with soil horizons above 5m AHD.

Based on this information, an intrusive investigation with sampling/analysis and/or an ASSMP is not considered necessary for the activity.

9.2 Salinity Conditions

The investigation identified the following salinity conditions:

- The soils are classed as very strongly acidic to strongly alkaline;
- The soils are generally classed as non-saline to highly saline;
- The soils are predominantly non-sodic, with sodic soils identified in the vicinity of TP201, TP203, TP204, and TP303 and highly sodic soils identified in the vicinity of TP207;
- The soils are generally non-aggressive to moderately aggressive towards buried concrete;
- The soils are generally non-aggressive to moderately aggressive towards buried steel; and
- The groundwater is non-aggressive towards buried concrete and buried steel.

Based on the results of this investigation, JKE is of the opinion that a SMP is required for the activity. The SMP is presented in Section 10 of this report.

10 SALINITY MANAGEMENT PLAN (SMP)

Salinity management recommendations outlined in this section have been designed generally in accordance with the amended Salinity Code of Practice. These recommendations should be reviewed (and if necessary, revised) in the event of any changes to the activity at the site. The recommendations should be assessed by the project design team as applicable for the activity.

Reference should also be made to the recommendations outlined in other relevant documentation, including but not limited to the local council salinity control/management plan, development consent conditions, geotechnical reports and landscape design documentation.

10.1 Earthwork Recommendations

The earthwork recommendations are summarised in the table below:

Table 10-1: Earthwork Recommendations

Aspect	Recommendations
Earthworks Contractor	The salinity conditions and recommendations outlined in this section of the report should be reviewed by the earthworks contractor prior to the commencement of development works.
Earthwork Overview	Cut and fill earthworks are anticipated for the activity. JKE anticipate that cut material will be used as fill in order to minimise the amount of material required for importation from an external source. It is noted that minimal filling is anticipated. Final earthworks plans are yet to be provided.
Cuts	Cuts through the surficial soils will generally expose saline soils of which the salinity increases with depth. Where cut material is to be re-used as fill, the material is to be assessed by the earthworks contractor in relation to its suitability to meet the relevant earthworks specification. The salinity conditions must also be considered in the context of any future landscaping or built structures that occur in the areas of cut/fill.
Filling	Filling of the site in the east may occur to achieve the final development level. Minor filling across other portions of the site is also anticipated to achieve the final development level. The salinity conditions must also be considered in the context of any future landscaping or built structures that occur in the areas of cut/fill. Fill material imported onto the site (from off-site areas) should preferably meet the importation criteria for salinity as outlined in Section 11 (unless the materials are assessed as being fit for purpose by others, even if they do not meet these salinity-related criteria), or alternatively if the fill has already been imported it should be assessed for aggressivity and salinity parameters to establish if any additional management or risk mitigation measures are necessary.
Staging of Works	Earthworks, including the stripping of vegetation and root affected surficial soils should be staged (where possible) to reduce the time of exposure of subsoils to erosion by wind and rain.

Aspect	Recommendations
Erosion and Sediment Control	An erosion and sediment control plan should be prepared prior to the commencement of earthworks. The plan should be implemented during the development to manage and control sediment discharge from the site. The plan should remain in place during the earthworks phase until the pavement construction works are completed. All batter slopes should be stabilised to control erosion during development and post earthworks (refer to the Blue Book 2004). Erosion control for stockpiles and disturbed areas should be planned during the development including the grading and sealing of partially completed earthwork surfaces during construction (refer to the Blue Book 2004).
Gypsum and/or Lime Treatment	Sodic soils can be treated by gypsum and/or lime. This will increase the proportion of exchangeable calcium in the soil and reduce the degree of sodicity (and thereby dispersivity) in areas where cut faces will be exposed. The amount of lime/gypsum to be added will vary with the soil and tests should be undertaken prior to, and during, the proposed earthworks to assess the appropriate quantity of lime/gypsum. Additional advice must be sought from the project geotechnical engineer and earthworks technicians if this is to occur.

10.2 Site Drainage, Surface Water and Storm Water Run-off

The recommendations for site drainage are summarised in the table below:

Table 10-2: Recommendations for Site Drainage

Aspect	Recommendations
Earthworks/civil Contractor	The salinity conditions and recommendations outlined in this section of the report should be reviewed by the earthworks/civil contractor prior to the commencement of development works.
Drainage Patterns	The proposed earthworks/civil works should be designed to minimise disturbance of the existing site drainage patterns. Where these patterns are altered, appropriate artificial drainage should be installed in order to minimise water logging and localised flooding.
Installation of Sub-soil Drains	Subsoil drains should be provided in areas where seepage discharge from the underlying natural soil may occur, such as retained cuts, cut slopes, significant changes in grade, etc (as applicable). Slabs, foundations and retaining walls should be designed with subsoil drains and good drainage to avoid water logging.
Surface water and Storm water run-off	Stormwater should be managed appropriately in order to reduce infiltration. Stormwater infrastructure should be designed to minimise leakage. Guttering and down pipes should be properly connected and maintained at all times.

Aspect	Recommendations
	Surface water runoff should be directed around all stockpiles and work areas.

10.3 Design of Built Structures

The design of built structures should incorporate the following:

Table 10-3: Recommendations for Built Structures

Aspect	Recommendations
Structural Advice	The salinity conditions and recommendations outlined in this section of the report should be reviewed by a qualified structural/civil engineer during the early design phase of the project, prior to the commencement of development.
Damp Proof Course (DPC)	Appropriate damp proof course (DPC) and moisture barriers should be used as outlined in relevant building codes and industry standards as applicable.
Exposure Class Masonry and Admixtures	Where required under the relevant building codes and standards, exposure class masonry must be used below the DPC. This is especially important in areas where landscaping is located adjacent to built structures. An appropriate mortar and mixing ratio must be used with exposure class masonry. Admixtures for waterproofing and/or corrosion prevention should be used where necessary.
Adequate Drainage around Built Structures	Care should be taken to check that the infrastructure design process considers the existing patterns of surface and subsurface water movement through the site during both dry and wet periods. Construction of infrastructure, which may cause an increase in areas of surficial water logging through poor surface drainage, may cause the groundwater table to rise.
Durability of Concrete Piles/Foundations	The soils are classed as non-aggressive to moderately aggressive towards buried concrete. The groundwater at the site are classed as non-aggressive towards buried concrete. The appropriate concrete strength and corrosion allowance outlined in the AS2159-2009 should be adopted. If deeper piling is proposed (i.e. piling deeper than the depth of the salinity investigation), there will be a need to consider the exposure classification in the deeper soils either via further investigation, or by the structural team using conservative assumptions relating to aggressivity). The CCAA 2018 publication recommends a minimum concrete grade of N32 and ≥N40 respectively for slabs and footings exposed to very to highly saline soils are. These guidelines however are for residential scenarios and therefore they must be considered further by the design team (i.e. the qualified structural/civil engineer). The results should be assessed by the project design team as applicable for the activity.

Aspect	Recommendations
Durability of Steel Piles/Foundations	The soils are classed as non-aggressive to moderately aggressive towards buried steel due to the low resistivity, and the groundwater at the site is classed as non-aggressive towards steel. Appropriate corrosion allowance for steel outlined in the AS2159-2009 should be adopted. If deeper piling is proposed (i.e. piling deeper than the depth of the salinity investigation), there will be a need to consider the exposure classification in the deeper soils either via further investigation, or by the structural team using conservative assumptions relating to aggressivity). The results should be assessed by the project design team as applicable for the activity.

10.4 Gardens and Landscaped Areas

The recommendations for the design of gardens and landscaped areas are summarised in the table below:

Table 10-4: Recommendations for Gardens and Landscaped Areas

Aspect	Recommendations
Arborist Advice	The salinity conditions and recommendations outlined in this section of the report should be reviewed by a qualified arborist/landscape consultant and factored into the landscape design.
Selection of Plants and Topsoil	The fill at the site is generally extremely acidic to strongly alkaline. Cuts proposed for the development may expose extremely acidic to strongly alkaline soils. These conditions are not considered favourable for plant growth. Nutrient rich topsoil should be used to promote plant growth in landscaped areas. Special attention should be paid to soil fertility to promote optimal conditions for successful revegetation. Suitable native plant species which require minimal watering should be established in landscaped areas. Topsoil imported onto the site should, as a minimum, meet the importation criteria for salinity as outlined in Section 11.
Landscape Design	Landscaped areas and garden beds should not be located adjacent to built structures unless they are appropriately designed to mitigate moisture impacts. Excessive watering of such areas can lead to rising damp in the adjacent structures resulting in potential damage to bricks, concrete, steel etc. In the event this is unavoidable, the landscaped areas and garden beds should be lowered such that soil in contact with built structures is below the damp proof course (DPC). Exposure grade bricks should be used below the DPC to minimise damp rise and potential damage.
Irrigation of Landscaped and Garden Areas	The use of potable water for irrigation should be kept to a minimum. This can be achieved by incorporating ‘waterwise’ gardening principles which include using sprinklers and drip irrigation system activated by timers etc. Irrigation systems should be periodically checked to ensure there is no leakage.

Aspect	Recommendations
Subsoil Drains	Subsoil drains should be installed beneath playing field/ovals and other areas which require intense irrigation to maintain grass/turf cover (i.e. lawns and open play areas). Such facilities should be designed with adequate grading to prevent water ponding and to channel excess run-off into the subsoil drains. Water collected in the drains should be disposed of appropriately. Alternatively, it can be collected in water retention facilities and re-used on site.

10.5 Footpaths and Hardstand Areas

The recommendations for the design of footpaths and hardstand areas are summarised in the table below:

Table 10-5: Recommendations for Footpaths and Hardstand Areas

Aspect	Recommendations
Earthworks Contractor	The salinity conditions and recommendations outlined in this section of the report should be reviewed by the earthworks contractor prior to the commencement of development works.
Graded Surfaces	All pavements, footpaths and hardstand areas should be graded to prevent surface water ponding. Subsoil drains should be provided in all such areas to collect stormwater and surface water run-off.
Corrosion of Concrete and Steel	Concrete and steel used in footpaths, carpark kerbs, gutters etc should be designed to withstand the saline and soil aggression conditions encountered at the site. Reference should be made to Section 10.3 for further information.
Installation of Services	Services should be installed in joint trenches and conduits. The conduits should be installed under hardstand areas at the time of construction.
Design of Landscaped Areas	The design of landscaped areas in the vicinity of car parks, footpaths and other hardstand areas should consider the recommendations outlined in Section 10.4.

10.6 Ongoing Management

Salinity is a natural phenomenon which can change over time especially during extreme dry and wet periods. Regular inspections and maintenance of facilities should be undertaken in order to identify issues at an early stage. Early detection and prevention of adverse salinity conditions is important to ongoing management. A few key ongoing management aspects are discussed in the table below.

Table 10-6: Key Ongoing Management Aspects

Aspect	Recommendations
Groundwater Management	A rising groundwater table may lead to adverse salinity conditions as the groundwater is considered to be saline. Planning and design should involve management of factors that could lead to a rise in the groundwater table level. Such measures include reducing the irrigation requirements and avoiding the use of infiltration pits to disperse surface water.

Aspect	Recommendations
	Watering activities associated with the proposed landscaped/playing field areas will tend to increase groundwater recharge. Subsoil drains should be installed in these areas where deemed necessary by the design team so as to avoid excessive recharge of the groundwater system, reduce the potential for water logging and also increase the potential for on-site water re-cycling.
Salinity Compliance	Compliance documentation is recommended to verify that the management recommendations outlined in this report are implemented. If compliance input/documentation is required from JKE, we would need to be engaged for this work at the commencement of the development. At this time, a site-specific compliance checklist would be provided. The checklist should be completed by the relevant contractors (i.e. earthworks, structural design, landscape, architects etc) after the completion of each stage of the development. JKE would typically not be in a position to provide a compliance 'sign-off' if we were not involved during the earthworks and construction phases of the project. In the event that an alternative consultant is selected to provide compliance documentation, we would strongly recommend that the consultant is engaged prior to the commencement of works.
Routine Inspections	Routine inspections, during construction, of drainage facilities, landscaped areas, batter slopes, cut faces, walkways, pavements and hardstand areas should be undertaken by maintenance staff. A checklist of adverse salinity indicators should be maintained during the inspections. A qualified environmental consultant should be contacted in the event any of the salinity indicators are identified at the site.

11 SOIL SALINITY IMPORTATION CRITERIA

Where the activity includes importation of fill to achieve the desired finished levels, the salinity, corrosion and contamination conditions of the material should be checked prior to importation. The recommended salinity importation criteria are outlined in the following table:

Table 11-1: Salinity Importation Criteria

Parameter (units)	Acceptable Range	Potential Re-use Implications
pH	>5.5 - 7	Material in this range will generally be non-aggressive towards built structures and within the optimal range for plant growth.
ECe (dS/m)	<2 - 4	Material in this range is non-saline to slightly saline and generally considered acceptable for plant growth. This salinity range also correlates with the soils encountered on site during the salinity assessment.
CEC (meq/100g)	12 - 25	Material in this range is generally considered acceptable for plant growth.
ESP (%)	<5	Material in this range is generally less dispersive.
Sulphate and Chloride (mg/kg)	<5,000	Material in this range will generally be non-aggressive towards piles/foundations.
Resistivity (ohm.cm)	>5,000	Material in this range will generally be non-aggressive towards piles/foundations.

The acceptable ranges provided above are a guide only, relating to salinity impacts. A specific assessment is to occur on a case-by-case basis depending on the type of material being imported and the proposed use of each material type.

12 LIMITATIONS

The report limitations are outlined below:

- Salinity is a natural phenomenon and can change over time based on site conditions and climatic variations. Changes to existing drainage patters can also impact the salinity at the site. The results outlined in this report are a snap shot of conditions present at the time of the investigation and is bound to change over time;
- JKE accepts no responsibility for any unidentified salinity issues at the site. Any unexpected problems/subsurface features that may be encountered during development works should be inspected by an environmental consultant as soon as possible;
- JKE accepts no responsibility for non-compliance of salinity management recommends outlined in this report;
- This report has been prepared based on site conditions which existed at the time of the investigation; scope of work and limitation outlined in the JKE proposal; and terms of contract between JKE and the client (as applicable);
- The conclusions presented in this report are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes;
- The investigation and preparation of this report have been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, JKE has not undertaken any verification process, except where specifically stated in the report;
- JKE has not undertaken any assessment of off-site areas that may be potential salinity sources or may have been impacted by adverse salinity conditions, except where specifically stated in the report;
- JKE accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- JKE have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or land use. JKE should be contacted immediately in such circumstances;
- Material considered to be suitable from a geotechnical point of view may be unsatisfactory from a salinity viewpoint, and vice versa;
- This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose;
- Copyright in this report is the property of JKE. JKE has used a degree of care, skill and diligence normally exercised by consulting professionals in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report;

- If the client, or any person, provides a copy of this report to any third party, such third party must not rely on this report except with the express written consent of JKE; and
- Any third party who seeks to rely on this report without the express written consent of JKE does so entirely at their own risk and to the fullest extent permitted by law, JKE accepts no liability whatsoever, in respect of any loss or damage suffered by any such third party.

Important Information About This Report

These notes have been prepared by JKE to assist with the assessment and interpretation of this report.

The Report is based on a Unique Set of Project Specific Factors
This report has been prepared in response to specific project requirements as stated in the JKE proposal document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

- The proposed land use is altered;
- The defined subject site is increased or sub-divided;
- The proposed development details including size, configuration, location, orientation of the structures or landscaped areas are modified;
- The proposed development levels are altered, e.g. addition of basement levels, or deeper filling/cut excavations; or
- Ownership of the site changes.

JKE will not accept any responsibility whatsoever for situations where one or more of the above factors have changed since completion of the assessment. If the subject site is sold, ownership of the assessment report should be transferred by JKE to the new site owners who will be informed of the conditions and limitations under which the assessment was undertaken. No person should apply an assessment for any purpose other than that originally intended without first conferring with the consultant.

Changes in Subsurface Conditions
Subsurface conditions are influenced by natural geological and hydrogeological process and human activities. Groundwater conditions are likely to vary over time with changes in climatic conditions and human activities within the catchment (e.g. water extraction for irrigation or industrial uses, subsurface waste water disposal, construction related dewatering). Soil and groundwater salinity concentrations may also vary over time through migration and accumulation of salts, importation of materials, construction and landscaping. The conclusions of an assessment report may have been affected by the above factors if a significant period of time has elapsed prior to commencement of the proposed development.

This Report is based on Professional Interpretations of Factual Data
Site assessments identify actual subsurface conditions at the actual sampling locations at the time of the investigation. Data obtained from the sampling and subsequent laboratory analyses, available site history information and published regional information is interpreted by geologists, engineers or environmental scientists and opinions are drawn about the overall subsurface conditions, the nature and extent of salinity, the likely impact on the proposed development and appropriate management measures.

Actual conditions may differ from those inferred, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise the impact. For this reason, site owners should retain the services of their consultants throughout the development stage of the project, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

Assessment Limitations
The assessment is designed to identify major salinity risks at the site. Implementing the management recommends can minimise the risks. No assessment can identify all risks as salinity is a natural phenomenon which can change over time. Even a rigorous professional assessment may not detect all potential salinity impacts on a site. Salinity may be present in areas that were not surveyed or sampled, or may accumulate in areas which showed no signs of salinity when sampled.

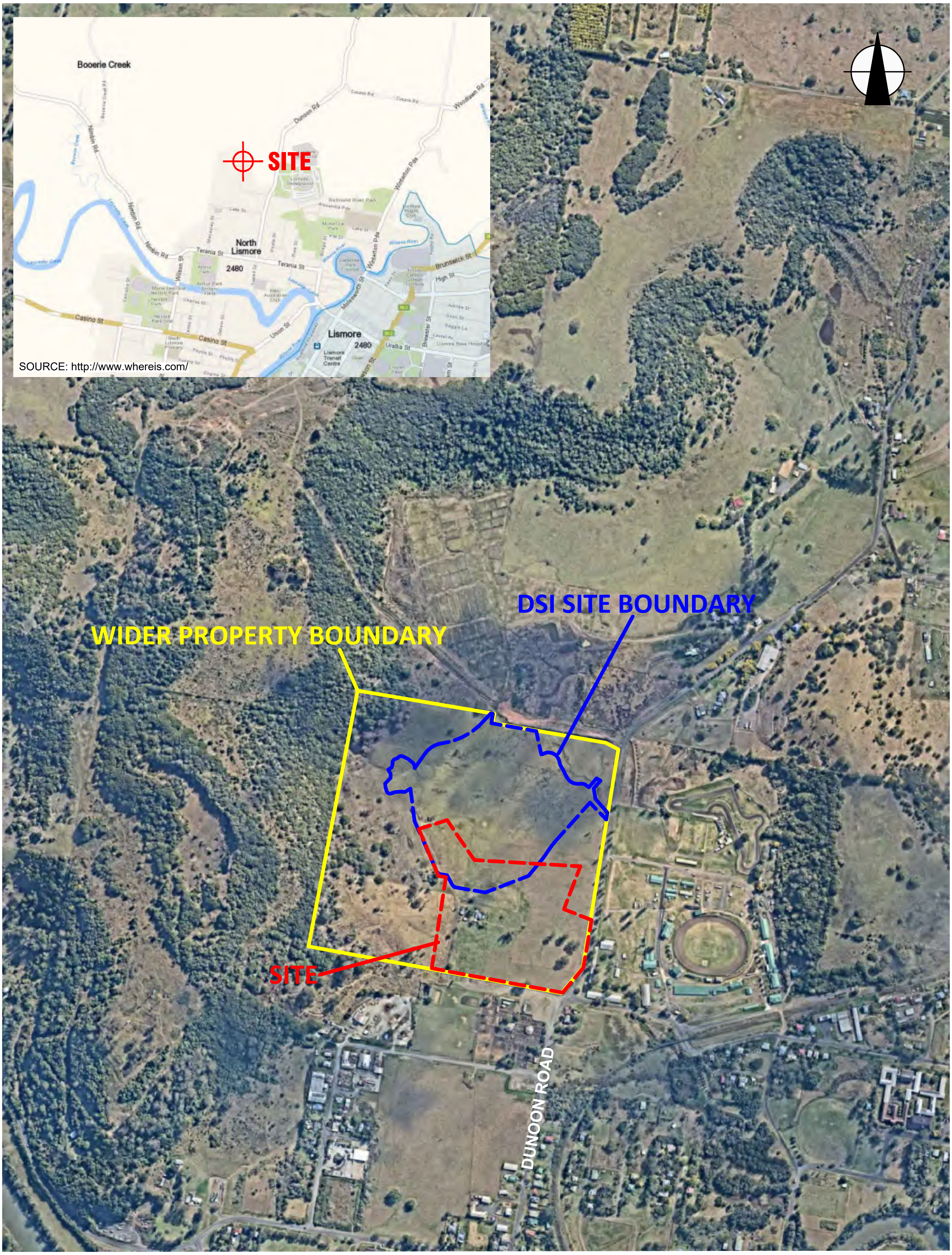
Misinterpretation of Site Assessments by Design Professionals
Costly problems can occur when other design professionals develop plans based on misinterpretation of an assessment report. To minimise problems associated with misinterpretations, the environmental consultant should be retained to work with appropriate professionals to explain relevant findings and to review the adequacy of plans and specifications relevant to contamination issues.

Logs Should not be Separated from the Assessment Report
Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site management or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however contractors can still misinterpret the logs during bid preparation if separated from the text of the assessment. If this occurs, delays, disputes and unanticipated costs may result. In all cases it is necessary to refer to the rest of the report to obtain a proper understanding of the assessment. Please note that logs with the 'Environmental Log' header are not suitable for geotechnical purposes as they have not been peer reviewed by a Senior Geotechnical Engineer.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of subsurface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations such as contractors.

Read Responsibility Clauses Closely
Because an environmental site assessment is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are definitive clauses designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to any questions.

Appendix A: Report Figures



SOURCE: http://www.whereis.com/

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

This plan should be read in conjunction with the Environmental report.

Title:

SITE LOCATION PLAN

Location:

163 &170 ALEXANDRA PARADE,
NORTH LISMORE, NSW

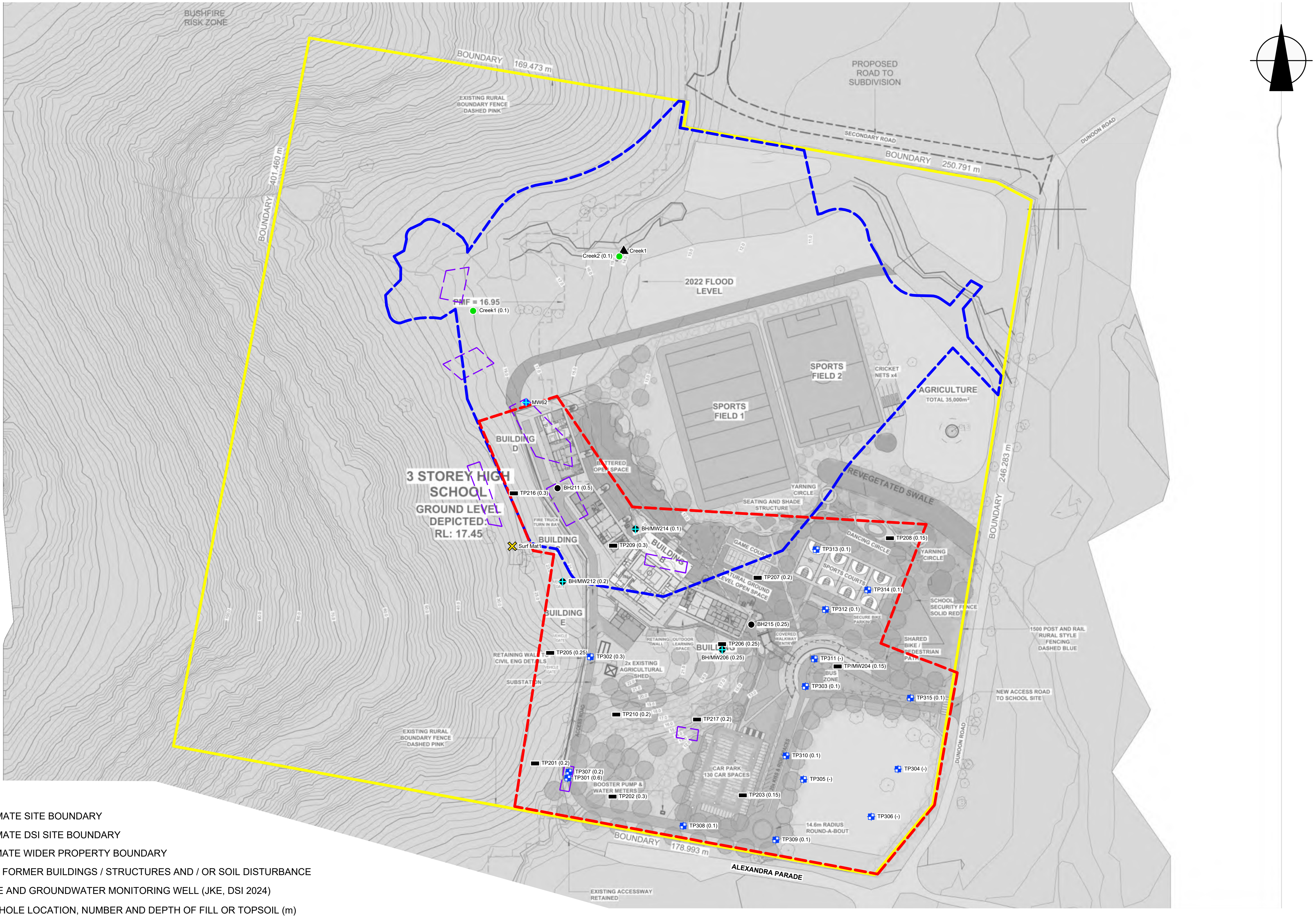
Report Ref: E36314PT3

Figure No: 1

JKEnvironments

PLOT DATE: 25/06/2025 10:59:35 AM DWG FILE: K:\5C EIS JOBS\36000'S\E36314PT LISMORE (SHOWGROUND)\CAD\E36314PT3.DWG

© JK ENVIRONMENTS



LEGEND

🟥 — —	APPROXIMATE SITE BOUNDARY
🟦 — —	APPROXIMATE DSI SITE BOUNDARY
🟨 ——	APPROXIMATE WIDER PROPERTY BOUNDARY
🟪 — —	AREAS OF FORMER BUILDINGS / STRUCTURES AND / OR SOIL DISTURBANCE
⊕ MW62	BOREHOLE AND GROUNDWATER MONITORING WELL (JKE, DSI 2024)
● BH211	JKG BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL OR TOPSOIL (m)
⊕ BH/MW212	JKG BOREHOLE AND GROUNDWATER MONITORING WELL (m)
▬ TP201	JKG TEST PIT LOCATION, NUMBER AND DEPTH OF FILL OR TOPSOIL (m)
▣ TP301	JKE TEST PIT LOCATION, NUMBER AND DEPTH OF FILL OR TOPSOIL (m)
▲	SURFACE WATER SAMPLE LOCATION
✕ Surf Mat1 (SURFACE)	FIBRE CEMENT SHEETING LOCATION, NUMBER AND DEPTH
● Creek1	SEDIMENT SAMPLE LOCATION (m)

0 30 60 90 120 150

SCALE 1:3000 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title:
SAMPLE LOCATION PLAN

Location: 163 &170 ALEXANDRA PARADE,
NORTH LISMORE, NSW

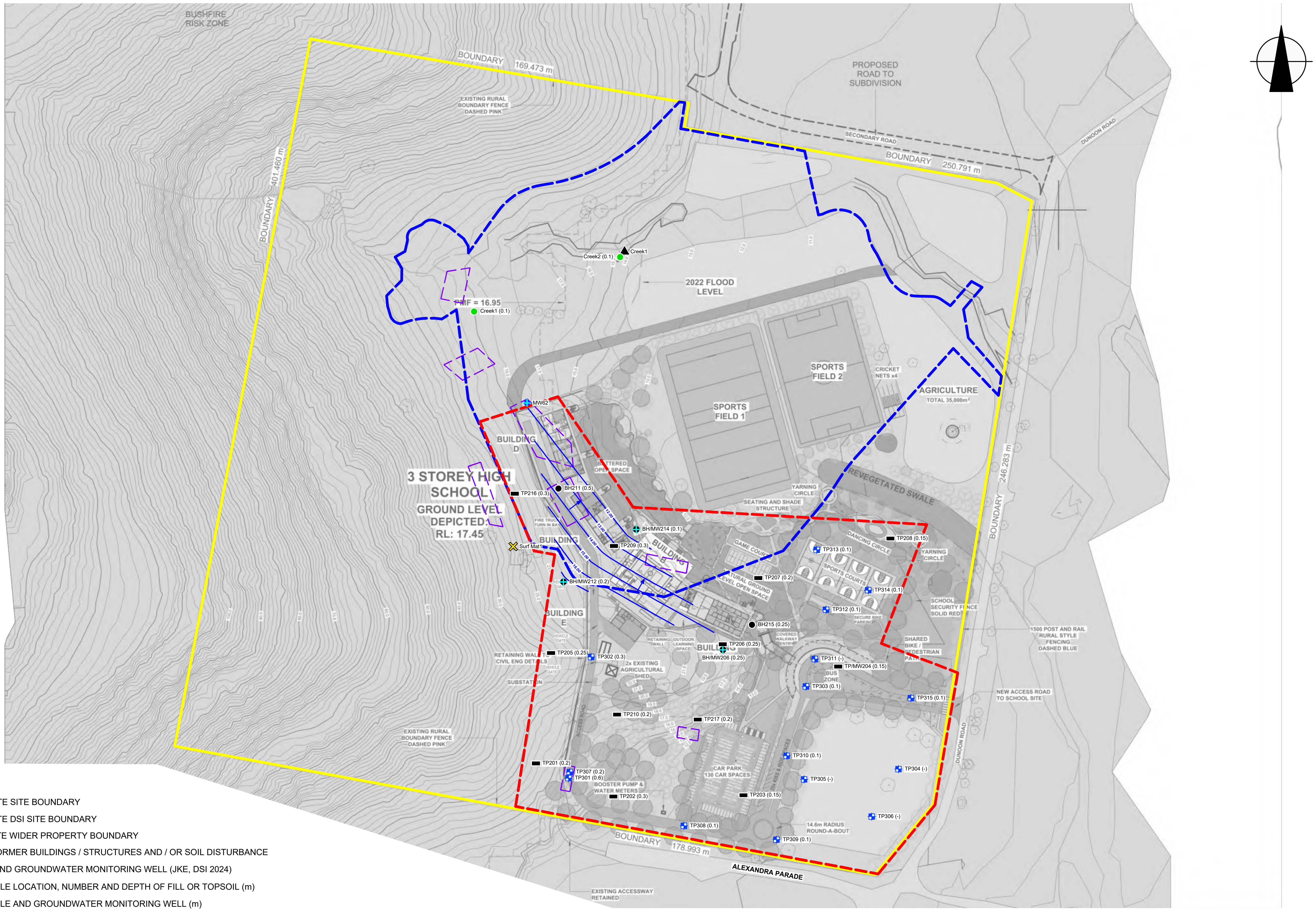
Report Ref: E36314PT3

Figure No: 2

JKEnvironments

PLOT DATE: 16/07/2025 9:04:49 AM   DWG FILE: K:\5C EIS JOBS\36000'S\E36314PT LISMORE (SHOWGROUND)\CAD\E36314PT3.DWG

© JK ENVIRONMENTS



LEGEND

🟥 – –	APPROXIMATE SITE BOUNDARY
🟦 – –	APPROXIMATE DSI SITE BOUNDARY
🟨 —	APPROXIMATE WIDER PROPERTY BOUNDARY
🟪 – –	AREAS OF FORMER BUILDINGS / STRUCTURES AND / OR SOIL DISTURBANCE
⊕ MW62	BOREHOLE AND GROUNDWATER MONITORING WELL (JKE, DSI 2024)
● BH211	JKG BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL OR TOPSOIL (m)
⊕ BH/MW212	JKG BOREHOLE AND GROUNDWATER MONITORING WELL (m)
▬ TP201	JKG TEST PIT LOCATION, NUMBER AND DEPTH OF FILL OR TOPSOIL (m)
▨ TP301	JKE TEST PIT LOCATION, NUMBER AND DEPTH OF FILL OR TOPSOIL (m)
▲	SURFACE WATER SAMPLE LOCATION
✕ Surf Mat1 (SURFACE)	FIBRE CEMENT SHEETING LOCATION, NUMBER AND DEPTH
● Creek1	SEDIMENT SAMPLE LOCATION (m)
14.00	GROUNDWATER CONTOUR INTERVALS (m)
→	INFERRED GROUNDWATER FLOW DIRECTION

PLOT DATE: 16/07/2025 9:03:00 AM DWG FILE: K:\5C EIS JOBS\36000'S\E36314PT LISMORE (SHOWGROUND)\CAD\E36314PT3.DWG

© JK ENVIRONMENTS

0 30 60 90 120 150
SCALE 1:3000 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title:
GROUNDWATER CONTOUR PLOT

Location: 163 &170 ALEXANDRA PARADE,
NORTH LISMORE, NSW

Report Ref: E36314PT3

Figure No: 3

JKEnvironments

Appendix B: Laboratory Results Summary Tables

ABBREVIATIONS AND EXPLANATIONS FOR SALINITY TABLES

Abbreviations used in the Tables:

Ca	Calcium
CEC	Cation Exchange Capacity
DO	Dissolved Oxygen
EC	Electrical Conductivity
ECe	Extract Electrical Conductivity
Eh	Redox Potential
ESP	Exchangeable Sodium Percentage (Each Na/CEC)
K	Potassium
Mg	Magnesium
Na	Sodium
SWL	Standing Water Level

Units used in the Tables

°C	Degrees Celsius
dS/m	deciSiemens per metre
m	meters
meq/100g	milliequivalents per 100 grams
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
mV	millivolts
ohm.cm	ohm centimetre
µS/cm	microSiemens per centimetre

Notes on Specific Tables

SUMMARY OF SOIL LABORATORY RESULTS - EC and ECe

- The salinity Class has been adopted from 'Site Investigations for Urban Salinity' DLWC 2002.
- The chart function assumes an ECe value of 1.9 for values that are less than the practical quatitation limit.

SUMMARY OF RESISTIVITY CALCULATION ON SOIL EC RESULTS

- The resistivity values have been calculated on the laboratory EC values.
- The classification has been derived from the Australian Standard 2159-2009 Piling Design and Installation (Table 6.5.2 [A] & [C])
- Table 6.5.2 [A] of Australian Standard 2159-2009 recommends using a Moderate Exposure Classification for Steel Piles in Fresh Water - Soft Running Water

SUMMARY OF SOIL LABORATORY RESULTS - pH

- The pH Classification has been derived from the Australian Standard 2159-2009 Piling Design and Installation (Tables 6.4.2 [C] & 6.5.2 [C])
- Table 6.5.2 [A] of Australian Standard 2159-2009 recommends using a Moderate Exposure Classification for Steel Piles in Fresh Water - Soft Running Water

SUMMARY OF SOIL LABORATORY RESULTS - SULFATE & CHLORIDES

- The classification has been derived from the Australian Standard 2159-2009 Piling Design and Installation (Table 6.5.2 [A] & [C])
- The chart function assumes an concentration of 0.5mg/kg for values that are less than the practical quatitation limit.

SUMMARY OF SOIL LABORATORY RESULTS - CEC & ESP

- The Sodicity rating has been adopted from the publication 'Site Investigations for Urban Salinity' DLWC 2002.

SUMMARY OF GROUNDWATER LABORATORY RESULTS

- The classification has been derived from the Australian Standard 2159-2009 Piling Design and Installation (Table 6.5.2 [A] & [C]) .
- Table 6.4.2 [A] recommends using a Mild Exposure Classification for Concrete Piles in Fresh Water - Treat as in Soil Condition 'A'.
- Table 6.5.2 [A] recommends using a Moderate Exposure Classification for Steel Piles in Fresh Water - Soft Running Water.

Copyright JK Environments

TABLE A
SUMMARY OF SOIL LABORATORY RESULTS - EC and ECe

Borehole Number	Sample Depth (m)	Sample Description	EC (µS/cm)	ECe (dS/m)	Salinity Class
TP201	0-0.2	Silty Clay	77	<2	NON SALINE
TP201	0-0.2	LAB DUPLICATE	68	<2	NON SALINE
TP201	0.4-0.5	Silty Clayey Gravel	64	<2	NON SALINE
TP202	0-0.1	Silty Clay	140	<2	NON SALINE
TP202	0.9-1	Silty Clay	430	3.5	SLIGHTLY SALINE
TP202	2-2.1	Silty Clay	1500	13	VERY SALINE
TP202	3-3.1	Silty Clay	930	7.4	MODERATELY SALINE
TP202	3.5-3.6	Siltstone	58	<2	NON SALINE
TP203	0-0.1	Silty Clay	710	6.1	MODERATELY SALINE
TP203	1-1.1	Silty Clay	290	2.5	SLIGHTLY SALINE
TP203	2-2.1	Silty Clay	410	3.3	SLIGHTLY SALINE
TP203	3-3.1	Silty Clay	200	<2	NON SALINE
TP204	0-0.1	Silty Clay	1800	16	HIGHLY SALINE
TP204	1-1.1	Silty Clay	610	5.2	MODERATELY SALINE
TP204	2.1-2.2	Silty Clay	290	2.5	SLIGHTLY SALINE
TP204	3-3.1	Silty Clay	310	2.5	SLIGHTLY SALINE
TP205	0-0.2	Silty Clay	120	<2	NON SALINE
TP205	1-1.1	Silty Clay	22	<2	NON SALINE
TP205	2-2.1	XW Tuff	31	<2	NON SALINE
TP205	2.6-2.8	Basalt	43	<2	NON SALINE
TP206	0-0.1	Silty Clay	150	<2	NON SALINE
TP206	0.4-0.5	Silty Clay	51	<2	NON SALINE
TP206	0.4-0.5	LAB DUPLICATE	51	<2	NON SALINE
TP206	0.9-1	HW Basalt	13	<2	NON SALINE
TP207	0-0.1	Silty Clay	190	<2	NON SALINE
TP207	0.5-0.6	Silty Clay	560	4.7	MODERATELY SALINE
TP207	1-1.1	Silty Clay	430	3.7	SLIGHTLY SALINE
TP207	1.4-1.5	XW Siltstone	110	<2	NON SALINE
TP207	2-2.1	Siltstone	50	<2	NON SALINE
TP207	2.5-2.6	Siltstone	88	<2	NON SALINE
TP208	0-0.1	Silty Clay	530	4.5	MODERATELY SALINE
TP208	1-1.1	Silty Clay	1600	14	VERY SALINE
TP208	1.6-1.7	Silty Clay	1400	11	VERY SALINE
TP208	2.3-2.4	Silty Clay	1100	9.2	VERY SALINE
TP208	3-3.1	Silty Clay	970	8.7	VERY SALINE
TP209	0-0.2	Silty Clay	130	<2	NON SALINE
TP209	1-1.1	Silty Clay	390	3.1	SLIGHTLY SALINE
TP209	1.9-2	Silty Clay	1400	12	VERY SALINE
TP209	2.8-2.9	XW Siltstone	1100	7.7	MODERATELY SALINE
TP209	3.7-3.9	Siltstone	180	<2	NON SALINE
TP210	0-0.1	Silty Clay	370	3.3	SLIGHTLY SALINE
TP210	0.5-0.6	Silty Clay	330	3	SLIGHTLY SALINE
TP210	0.7-0.8	XW Siltstone	81	<2	NON SALINE
BH213	0-0.1	Topsoil: Silty Clay	320	2.8	SLIGHTLY SALINE
BH213	0.5-0.6	Gravelly Clay	48	<2	NON SALINE
BH214	0-0.1	Topsoil: Silty Clay	250	2.3	SLIGHTLY SALINE
BH214	1-1.1	Silty Clay	490	3.9	SLIGHTLY SALINE
BH214	2-2.1	Silty Clay	1400	13	VERY SALINE
BH215	0-0.1	Topsoil: Silty Clay	490	4.4	MODERATELY SALINE
TP301	0-0.1	F: Silty Clay	230	2	SLIGHTLY SALINE
TP301	0.9-1	Silty Clay	44	<2	NON SALINE
TP303	0-0.1	Topsoil: Silty Clay	1300	12	VERY SALINE
TP303	0.1-0.2	Silty Clay	1300	12	VERY SALINE
TP305	0-0.1	Silty Clay	140	<2	NON SALINE
TP308	0-0.1	Topsoil: Silty Clay	1100	10	VERY SALINE
TP308	0.4-0.5	Silty Clay	1100	9.5	VERY SALINE
TP309	0-0.1	Topsoil: Silty Clay	740	6.7	MODERATELY SALINE
TP309	0.4-0.5	Silty Clay	250	2.1	SLIGHTLY SALINE
TP312	0-0.1	Topsoil: Silty Clay	1800	15	VERY SALINE
TP312	0.4-0.5	Silty Clay	1300	11	VERY SALINE
TP315	0-0.1	Topsoil: Silty Clay	260	2.4	SLIGHTLY SALINE
TP315	0.3-0.4	Silty Clay	450	3.6	SLIGHTLY SALINE
Total Number of Samples			62	62	-
Minimum Value			13	<PQL	-
Maximum Value			1800	16	-

ECe Values (dS/m)	Salinity Class
<2	NON SALINE
2 to 4	SLIGHTLY SALINE
4 to 8	MODERATELY SALINE
8 to 16	VERY SALINE
>16	HIGHLY SALINE

Copyright JK Environments

TABLE B
SUMMARY OF RESISTIVITY CALCULATION ON SOIL EC RESULTS

Borehole Number	Sample Depth (m)	Sample Description	EC (µS/cm)	Resistivity (ohm.cm)	Classification Condition B
TP201	0-0.2	Silty Clay	77	12,987	Non Aggressive
TP201	0-0.2	LAB DUPLICATE	68	14,706	Non Aggressive
TP201	0.4-0.5	Silty Clayey Gravel	64	15,625	Non Aggressive
TP202	0-0.1	Silty Clay	140	7,143	Non Aggressive
TP202	0.9-1	Silty Clay	430	2,326	Non Aggressive
TP202	2-2.1	Silty Clay	1500	667	Moderately Aggressive
TP202	3-3.1	Silty Clay	930	1,075	Mildly Aggressive
TP202	3.5-3.6	Siltstone	58	17,241	Non Aggressive
TP203	0-0.1	Silty Clay	710	1,408	Mildly Aggressive
TP203	1-1.1	Silty Clay	290	3,448	Non Aggressive
TP203	2-2.1	Silty Clay	410	2,439	Non Aggressive
TP203	3-3.1	Silty Clay	200	5,000	Non Aggressive
TP203	3-3.1	Silty Clay	200	5,000	Non Aggressive
TP204	0-0.1	Silty Clay	1800	556	Moderately Aggressive
TP204	1-1.1	Silty Clay	610	1,639	Mildly Aggressive
TP204	2.1-2.2	Silty Clay	290	3,448	Non Aggressive
TP204	3-3.1	Silty Clay	310	3,226	Non Aggressive
TP205	0-0.2	Silty Clay	120	8,333	Non Aggressive
TP205	1-1.1	Silty Clay	22	45,455	Non Aggressive
TP205	2-2.1	XW Tuff	31	32,258	Non Aggressive
TP205	2.6-2.8	Basalt	43	23,256	Non Aggressive
TP206	0-0.1	Silty Clay	150	6,667	Non Aggressive
TP206	0.4-0.5	Silty Clay	51	19,608	Non Aggressive
TP206	0.4-0.5	LAB DUPLICATE	51	19,608	Non Aggressive
TP206	0.9-1	HW Basalt	13	76,923	Non Aggressive
TP207	0-0.1	Silty Clay	190	5,263	Non Aggressive
TP207	0.5-0.6	Silty Clay	560	1,786	Mildly Aggressive
TP207	1-1.1	Silty Clay	430	2,326	Non Aggressive
TP207	1.4-1.5	XW Siltstone	110	9,091	Non Aggressive
TP207	2-2.1	Siltstone	50	20,000	Non Aggressive
TP207	2.5-2.6	Siltstone	88	11,364	Non Aggressive
TP208	0-0.1	Silty Clay	530	1,887	Mildly Aggressive
TP208	1-1.1	Silty Clay	1600	625	Moderately Aggressive
TP208	1.6-1.7	Silty Clay	1400	714	Moderately Aggressive
TP208	2.3-2.4	Silty Clay	1100	909	Moderately Aggressive
TP208	3-3.1	Silty Clay	970	1,031	Mildly Aggressive
TP209	0-0.2	Silty Clay	130	7,692	Non Aggressive
TP209	1-1.1	Silty Clay	390	2,564	Non Aggressive
TP209	1.9-2	Silty Clay	1400	714	Moderately Aggressive
TP209	2.8-2.9	XW Siltstone	1100	909	Moderately Aggressive
TP209	3.7-3.9	Siltstone	180	5,556	Non Aggressive
TP210	0-0.1	Silty Clay	370	2,703	Non Aggressive
TP210	0.5-0.6	Silty Clay	330	3,030	Non Aggressive
TP210	0.7-0.8	XW Siltstone	81	12,346	Non Aggressive
BH213	0-0.1	Topsoil: Silty Clay	320	3,125	Non Aggressive
BH213	0.5-0.6	Gravelly Clay	48	20,833	Non Aggressive
BH214	0-0.1	Topsoil: Silty Clay	250	4,000	Non Aggressive
BH214	1-1.1	Silty Clay	490	2,041	Non Aggressive
BH214	2-2.1	Silty Clay	1400	714	Moderately Aggressive
BH215	0-0.1	Topsoil: Silty Clay	490	2,041	Non Aggressive
TP301	0-0.1	F: Silty Clay	230	4,348	Non Aggressive
TP301	0.9-1	Silty Clay	44	22,727	Non Aggressive
TP303	0-0.1	Topsoil: Silty Clay	1300	769	Moderately Aggressive
TP303	0.1-0.2	Silty Clay	1300	769	Moderately Aggressive
TP305	0-0.1	Silty Clay	140	7,143	Non Aggressive
TP308	0-0.1	Topsoil: Silty Clay	1100	909	Moderately Aggressive
TP308	0.4-0.5	Silty Clay	1100	909	Moderately Aggressive
TP309	0-0.1	Topsoil: Silty Clay	740	1,351	Mildly Aggressive
TP309	0.4-0.5	Silty Clay	250	4,000	Non Aggressive
TP312	0-0.1	Topsoil: Silty Clay	1800	556	Moderately Aggressive
TP312	0.4-0.5	Silty Clay	1300	769	Moderately Aggressive
TP315	0-0.1	Topsoil: Silty Clay	260	3,846	Non Aggressive
TP315	0.3-0.4	Silty Clay	450	2,222	Non Aggressive
Total Number of Samples			63	63	-
Minimum Value			13	556	-
Maximum Value			1800	76,923	-

Classification is based on Soil condition 'B' - low permeability soils (e.g. silts & clays) or all soils above groundwater.

Resistivity Values (ohm.cm)	**Classification for Steel Piles**
>5,000	Non-Aggressive
2,000 - 5,000	Non-Aggressive
1,000 - 2,000	Mildly Aggressive
<1,000	Moderately Aggressive

TABLE C
SUMMARY OF SOIL LABORATORY RESULTS - pH

Borehole Number	Sample Depth (m)	Sample Description	pH	Classification for Concrete Piles	Classification for Steel Piles
				Condition B	Condition B
TP201	0-0.2	Silty Clay	7.4	Non-Aggressive	Non-Aggressive
TP201	0-0.2	LAB DUPLICATE	7.2	Non-Aggressive	Non-Aggressive
TP201	0.4-0.5	Silty Clayey Gravel	6.7	Non-Aggressive	Non-Aggressive
TP202	0-0.1	Silty Clay	6.3	Non-Aggressive	Non-Aggressive
TP202	0.9-1	Silty Clay	7.3	Non-Aggressive	Non-Aggressive
TP202	2-2.1	Silty Clay	7.7	Non-Aggressive	Non-Aggressive
TP202	3-3.1	Silty Clay	7.7	Non-Aggressive	Non-Aggressive
TP202	3.5-3.6	Siltstone	8.6	Non-Aggressive	Non-Aggressive
TP203	0-0.1	Silty Clay	5.3	Mildly Aggressive	Non-Aggressive
TP203	1-1.1	Silty Clay	7.1	Non-Aggressive	Non-Aggressive
TP203	2-2.1	Silty Clay	7.8	Non-Aggressive	Non-Aggressive
TP203	3-3.1	Silty Clay	7.3	Non-Aggressive	Non-Aggressive
TP203	3-3.1	Silty Clay	7.5	Non-Aggressive	Non-Aggressive
TP204	0-0.1	Silty Clay	6.2	Non-Aggressive	Non-Aggressive
TP204	1-1.1	Silty Clay	5	Mildly Aggressive	Non-Aggressive
TP204	2.1-2.2	Silty Clay	7.1	Non-Aggressive	Non-Aggressive
TP204	3-3.1	Silty Clay	7.8	Non-Aggressive	Non-Aggressive
TP205	0-0.2	Silty Clay	5.9	Non-Aggressive	Non-Aggressive
TP205	1-1.1	Silty Clay	6.9	Non-Aggressive	Non-Aggressive
TP205	2-2.1	XW Tuff	6.6	Non-Aggressive	Non-Aggressive
TP205	2.6-2.8	Basalt	6.7	Non-Aggressive	Non-Aggressive
TP206	0-0.1	Silty Clay	5.8	Non-Aggressive	Non-Aggressive
TP206	0.4-0.5	Silty Clay	6.3	Non-Aggressive	Non-Aggressive
TP206	0.4-0.5	LAB DUPLICATE	6.3	Non-Aggressive	Non-Aggressive
TP206	0.9-1	HW Basalt	7.2	Non-Aggressive	Non-Aggressive
TP207	0-0.1	Silty Clay	5.8	Non-Aggressive	Non-Aggressive
TP207	0.5-0.6	Silty Clay	6.4	Non-Aggressive	Non-Aggressive
TP207	1-1.1	Silty Clay	8	Non-Aggressive	Non-Aggressive
TP207	1.4-1.5	XW Siltstone	8.3	Non-Aggressive	Non-Aggressive
TP207	2-2.1	Siltstone	8.6	Non-Aggressive	Non-Aggressive
TP207	2.5-2.6	Siltstone	8.7	Non-Aggressive	Non-Aggressive
TP208	0-0.1	Silty Clay	5.8	Non-Aggressive	Non-Aggressive
TP208	1-1.1	Silty Clay	6.1	Non-Aggressive	Non-Aggressive
TP208	1.6-1.7	Silty Clay	7	Non-Aggressive	Non-Aggressive
TP208	2.3-2.4	Silty Clay	7.2	Non-Aggressive	Non-Aggressive
TP208	3-3.1	Silty Clay	7.3	Non-Aggressive	Non-Aggressive
TP209	0-0.2	Silty Clay	6.1	Non-Aggressive	Non-Aggressive
TP209	1-1.1	Silty Clay	6.8	Non-Aggressive	Non-Aggressive
TP209	1.9-2	Silty Clay	7.6	Non-Aggressive	Non-Aggressive
TP209	2.8-2.9	XW Siltstone	7.7	Non-Aggressive	Non-Aggressive
TP209	3.7-3.9	Siltstone	8.1	Non-Aggressive	Non-Aggressive
TP210	0-0.1	Silty Clay	6.5	Non-Aggressive	Non-Aggressive
TP210	0.5-0.6	Silty Clay	6.6	Non-Aggressive	Non-Aggressive
TP210	0.7-0.8	XW Siltstone	6.9	Non-Aggressive	Non-Aggressive
TP210	0.7-0.8	LAB DUPLICATE	6.8	Non-Aggressive	Non-Aggressive
BH213	0-0.1	Topsoil: Silty Clay	6.2	Non-Aggressive	Non-Aggressive
BH213	0.5-0.6	Gravelly Clay	6.7	Non-Aggressive	Non-Aggressive
BH214	0-0.1	Topsoil: Silty Clay	6.3	Non-Aggressive	Non-Aggressive
BH214	1-1.1	Silty Clay	6.6	Non-Aggressive	Non-Aggressive
BH214	2-2.1	Silty Clay	7.2	Non-Aggressive	Non-Aggressive
BH215	0-0.1	Topsoil: Silty Clay	6.4	Non-Aggressive	Non-Aggressive
TP301	0-0.1	F: Silty Clay	6.2	Non-Aggressive	Non-Aggressive
TP301	0.9-1	Silty Clay	7.2	Non-Aggressive	Non-Aggressive
TP303	0-0.1	Topsoil: Silty Clay	6	Non-Aggressive	Non-Aggressive
TP303	0.1-0.2	Silty Clay	5.1	Mildly Aggressive	Non-Aggressive
TP303	0.1-0.2	LAB DUPLICATE	5.2	Mildly Aggressive	Non-Aggressive
TP305	0-0.1	Silty Clay	5.2	Mildly Aggressive	Non-Aggressive
TP308	0-0.1	Topsoil: Silty Clay	4.9	Mildly Aggressive	Non-Aggressive
TP308	0.4-0.5	Silty Clay	5	Mildly Aggressive	Non-Aggressive
TP309	0-0.1	Topsoil: Silty Clay	5.3	Mildly Aggressive	Non-Aggressive
TP309	0.4-0.5	Silty Clay	5.6	Non-Aggressive	Non-Aggressive
TP312	0-0.1	Topsoil: Silty Clay	5	Mildly Aggressive	Non-Aggressive
TP312	0.4-0.5	Silty Clay	4.5	Moderately Aggressive	Non-Aggressive
TP315	0-0.1	Topsoil: Silty Clay	5.1	Mildly Aggressive	Non-Aggressive
TP315	0.3-0.4	Silty Clay	5.4	Mildly Aggressive	Non-Aggressive
Total Number of Samples			65	-	-
Minimum Value			4.5	-	-
Maximum Value			8.7	-	-

Classification is based on Soil condition 'B' - low permeability soils (e.g. silts & clays) or all soils above groundwater.

	Classification for Concrete Piles	**pH Value**	**Classification for Steel Piles**
>5.5	Non-Aggressive	>5	Non-Aggressive
4.5 - 5.5	Mildly Aggressive	4.0 - 5.0	Non-Aggressive
4 - 4.5	Moderately Aggressive	3.0 - 4.0	Mildly Aggressive
<4	Severely Aggressive	<3	Moderately Aggressive

Copyright JK Environments

TABLE D
SUMMARY OF SOIL LABORATORY RESULTS - SULPHATE & CHLORIDES

Borehole Number	Sample Depth (m)	Sample Description	Chloride (mg/kg)	Sulphate (mg/kg)	Classification for Concrete Piles	Classification for Steel Piles
					Sulfate - Condition B	**Chloride - Condition B**
TP201	0-0.2	Silty Clay	22	30	Non-Aggressive	Non-Aggressive
TP201	0.4-0.5	LAB DUPLICATE	36	25	Non-Aggressive	Non-Aggressive
TP202	0-0.1	Silty Clayey Gravel	10	51	Non-Aggressive	Non-Aggressive
TP202	0.9-1	Silty Clay	290	200	Non-Aggressive	Non-Aggressive
TP202	2-2.1	Silty Clay	1500	810	Non-Aggressive	Non-Aggressive
TP202	3-3.1	Silty Clay	890	230	Non-Aggressive	Non-Aggressive
TP202	3.5-3.6	Silty Clay	28	10	Non-Aggressive	Non-Aggressive
TP203	0-0.1	Siltstone	560	230	Non-Aggressive	Non-Aggressive
TP203	1-1.1	Silty Clay	170	250	Non-Aggressive	Non-Aggressive
TP203	2-2.1	Silty Clay	170	180	Non-Aggressive	Non-Aggressive
TP203	3-3.1	Silty Clay	120	130	Non-Aggressive	Non-Aggressive
TP203	3-3.1	Silty Clay	110	130	Non-Aggressive	Non-Aggressive
TP204	0-0.1	Silty Clay	3500	410	Non-Aggressive	Non-Aggressive
TP204	1-1.1	Silty Clay	390	440	Non-Aggressive	Non-Aggressive
TP204	2.1-2.2	Silty Clay	170	190	Non-Aggressive	Non-Aggressive
TP204	3-3.1	Silty Clay	170	100	Non-Aggressive	Non-Aggressive
TP205	0-0.2	Silty Clay	10	39	Non-Aggressive	Non-Aggressive
TP205	1-1.1	Silty Clay	<10	<10	Non-Aggressive	Non-Aggressive
TP205	2-2.1	Silty Clay	28	48	Non-Aggressive	Non-Aggressive
TP205	2.6-2.8	XW Tuff	20	<10	Non-Aggressive	Non-Aggressive
TP206	0-0.1	Basalt	<10	43	Non-Aggressive	Non-Aggressive
TP206	0.4-0.5	Silty Clay	<10	20	Non-Aggressive	Non-Aggressive
TP206	0.4-0.5	Silty Clay	<10	20	Non-Aggressive	Non-Aggressive
TP206	0.9-1	LAB DUPLICATE	<10	<10	Non-Aggressive	Non-Aggressive
TP207	0-0.1	HW Basalt	96	42	Non-Aggressive	Non-Aggressive
TP207	0.5-0.6	Silty Clay	490	390	Non-Aggressive	Non-Aggressive
TP207	1-1.1	Silty Clay	210	200	Non-Aggressive	Non-Aggressive
TP207	1.4-1.5	Silty Clay	40	41	Non-Aggressive	Non-Aggressive
TP207	2-2.1	XW Siltstone	<10	<10	Non-Aggressive	Non-Aggressive
TP207	2.5-2.6	Siltstone	<10	<10	Non-Aggressive	Non-Aggressive
TP208	0-0.1	Siltstone	410	260	Non-Aggressive	Non-Aggressive
TP208	1-1.1	Silty Clay	1800	290	Non-Aggressive	Non-Aggressive
TP208	1.6-1.7	Silty Clay	1500	220	Non-Aggressive	Non-Aggressive
TP208	1.6-1.7	Silty Clay	1400	220	Non-Aggressive	Non-Aggressive
TP208	2.3-2.4	Silty Clay	1300	180	Non-Aggressive	Non-Aggressive
TP208	3-3.1	Silty Clay	1000	180	Non-Aggressive	Non-Aggressive
TP209	0-0.2	Silty Clay	20	32	Non-Aggressive	Non-Aggressive
TP209	1-1.1	Silty Clay	290	160	Non-Aggressive	Non-Aggressive
TP209	1.9-2	Silty Clay	1300	480	Non-Aggressive	Non-Aggressive
TP209	2.8-2.9	XW Siltstone	1100	410	Non-Aggressive	Non-Aggressive
TP209	3.7-3.9	Siltstone	170	95	Non-Aggressive	Non-Aggressive
TP210	0-0.1	Silty Clay	<10	23	Non-Aggressive	Non-Aggressive
TP210	0.5-0.6	Silty Clay	<10	<10	Non-Aggressive	Non-Aggressive
TP210	0.7-0.8	XW Siltstone	<10	<10	Non-Aggressive	Non-Aggressive
TP210	0.7-0.8	LAB DUPLICATE	<10	<10	Non-Aggressive	Non-Aggressive
BH213	0-0.1	Topsoil: Silty Clay	20	25	Non-Aggressive	Non-Aggressive
BH213	0.5-0.6	Gravelly Clay	<10	10	Non-Aggressive	Non-Aggressive
BH214	0-0.1	Topsoil: Silty Clay	10	20	Non-Aggressive	Non-Aggressive
BH214	1-1.1	Silty Clay	450	180	Non-Aggressive	Non-Aggressive
BH214	2-2.1	Silty Clay	1500	390	Non-Aggressive	Non-Aggressive
BH215	0-0.1	Topsoil: Silty Clay	68	70	Non-Aggressive	Non-Aggressive
TP301	0-0.1	F: Silty Clay	10	20	Non-Aggressive	Non-Aggressive
TP301	0.9-1	Silty Clay	<10	<10	Non-Aggressive	Non-Aggressive
TP303	0-0.1	Topsoil: Silty Clay	1000	140	Non-Aggressive	Non-Aggressive
TP303	0.1-0.2	Silty Clay	1100	690	Non-Aggressive	Non-Aggressive
TP303	0.1-0.2	LAB DUPLICATE	970	670	Non-Aggressive	Non-Aggressive
TP305	0-0.1	Silty Clay	20	63	Non-Aggressive	Non-Aggressive
TP308	0-0.1	Topsoil: Silty Clay	650	320	Non-Aggressive	Non-Aggressive
TP308	0.4-0.5	Silty Clay	950	560	Non-Aggressive	Non-Aggressive
TP309	0-0.1	Topsoil: Silty Clay	150	70	Non-Aggressive	Non-Aggressive
TP309	0.4-0.5	Silty Clay	82	190	Non-Aggressive	Non-Aggressive
TP312	0-0.1	Topsoil: Silty Clay	2000	710	Non-Aggressive	Non-Aggressive
TP312	0.4-0.5	Silty Clay	1300	630	Non-Aggressive	Non-Aggressive
TP315	0-0.1	Topsoil: Silty Clay	77	44	Non-Aggressive	Non-Aggressive
TP315	0.3-0.4	Silty Clay	98	65	Non-Aggressive	Non-Aggressive
Total Number of Samples			65	65	-	-
Minimum Value			<PQL	<PQL	-	-
Maximum Value			3500	810	-	-

Classification is based on Soil condition 'B' - low permeability soils (e.g. silts & clays) or all soils above groundwater.

Sulfate Values	Classification for Concrete Piles	Chloride Values	Classification for Steel Piles
<5,000	Non-Aggressive	<5,000	Non-Aggressive
5,000 - 10,000	Mildly Aggressive	5,000 - 20,000	Non-Aggressive
10,000 - 20,000	Moderately Aggressive	20,000 - 50,000	Mildly Aggressive
>20,000	Severely Aggressive	>50,000	Moderately Aggressive

TABLE E
SUMMARY OF SOIL LABORATORY RESULTS - CEC & ESP

Borehole Number	**Sample Depth (m)**	**Sample Description**	Exchangeable Ca	Exchangeable K	Exchangeable Mg	Exchangeable Na	CEC	ESP	Ca:Mg
			(meq/100g)					%	
TP201	0.4-0.5	Silty Clayey Gravel	17	0.1	8	1.9	27	7.0%	2.13:1
TP202	0-0.1	Silty Clay	15	0.9	6.7	0.1	23	0.4%	2.24:1
TP203	1-1.1	Silty Clay	7.1	<0.1	5.5	1.3	14	9.3%	1.29:1
TP204	0-0.1	Silty Clay	13	0.8	14	2.4	31	7.7%	0.93:1
TP205	0-0.2	Silty Clay	17	1.7	7.3	0.1	26	0.4%	2.33:1
TP205	0-0.2	LAB DUPLICATE	16	1.7	7	<0.1	25	0.4%	2.29:1
TP206	0-0.1	Silty Clay	17	1.4	8.5	<0.1	27	0.4%	2.0:1
TP207	0.5-0.6	Silty Clay	4.9	<0.1	4.5	1.9	11	17.3%	1.09:1
TP208	0-0.1	Silty Clay	16	0.1	14	1.4	32	4.4%	1.14:1
TP209	0-0.2	Silty Clay	19	0.2	8.4	0.4	28	1.4%	2.26:1
TP210	0-0.1	Silty Clay	15	2.1	7.1	<0.1	24	0.4%	2.11:1
BH213	0.5-0.6	Gravelly Clay	28	<0.1	8.5	0.3	36	0.8%	3.29:1
BH214	1-1.1	Silty Clay	21	<0.1	13	1.4	36	3.9%	1.62:1
BH215	0-0.1	Topsoil: Silty Clay	19	0.9	9.6	0.2	30	0.7%	1.98:1
TP301	0-0.1	F: Silty Clay	18	0.2	7.9	<0.1	26	0.4%	2.28:1
TP303	0-0.1	Topsoil: Silty Clay	13	0.8	12	2.1	27	7.8%	1.08:1
TP305	0-0.1	Silty Clay	19	0.2	16	0.7	35	2.0%	1.19:1
TP308	0.4-0.5	Topsoil: Silty Clay	17	0.2	11	0.9	30	3.0%	1.55:1
TP309	0-0.1	Topsoil: Silty Clay	17	0.9	9.7	0.7	28	2.5%	1.75:1
TP312	0-0.1	Topsoil: Silty Clay	22	0.2	21	1.9	45	4.2%	1.05:1
TP315	0-0.1	Topsoil: Silty Clay	23	0.2	18	0.9	42	2.1%	1.28:1
Total Number of Samples			21	21	21	21	21	21	21
Minimum Value			4.9	<PQL	4.5	<PQL	11.0	0.4%	0.93 :1
Maximum Value			28.0	2.1	21.0	2.4	45.0	17.3%	3.29 :1

ESP Value	**Sodicity Rating**
< 5%	Non-Sodic
5% to 15%	Sodic
> 15%	Highly Sodic

Copyright JK Environments

TABLE F
SUMMARY OF GROUNDWATER LABORATORY RESULTS

	Field Measurements						Laboratory Results				Classification for Concrete Piles Soil Condition B	Classification for Steel Piles Soil Condition B
Sample Reference	**SWL (m)**	**pH**	**EC (µS/cm)**	**Temp (°C)**	**Eh (mV)**	**DO (mg/L)**	**pH**	**EC (µS/cm)**	**Sulfate (mg/L)**	**Chloride (mg/L)**		
MW62	6.78	7.0	1,432	21	107.1	1.69	7.1	1,400	31	150	Non-Aggressive	Non-Aggressive
MW206	2.37	7.4	322	19	34.4	5.28	7.3	340	8	17	Non-Aggressive	Non-Aggressive
MW212	4.93	7.7	1,188	20.3	-98.9	1.23	7.4	1,200	84	140	Non-Aggressive	Non-Aggressive
MW212 - LAB DUPLICATE	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	84	150	Non-Aggressive	Non-Aggressive
MW214	3.29	7.1	3,661	21.4	70.8	3.87	7.1	3,700	130	710	Non-Aggressive	Non-Aggressive
Creek1	3.29	7.1	3,661	21.4	70.8	3.87	6.6	210	1	18	Non-Aggressive	Non-Aggressive
Total Number of Samples	5	5	5	5	5	5	5	5	5	5	-	-
Minimum Value	2.37	7.0	322	19	-98.9	1.23	6.6	210	1	17	-	-
Maximum Value	6.78	7.7	3,661	21.4	107.1	5.28	7.4	3,700	130	710	-	-

Exposure Classification for Concrete Piles

Classification is based on Soil condition 'B' - low permeability soils (e.g. silts and clays) or all soils above groundwater.

pH	Sulfate (mg/L)	Chloride (mg/L)	Classification B
> 5.5	<1,000	<6,000	Non-Aggressive
4.5 - 5.5	1,000 - 3,000	6,000 - 12,000	Mildly Aggressive
4.0 - 4.5	3,000 - 10,000	12,000 - 30,000	Moderately Aggressive
< 4	>10,000	>30,000	Severely Aggressive

Exposure Classification for Steel Piles

Classification is also based on Soil condition 'B' - low permeability soils (e.g. silts and clays) or all soils above groundwater.

pH	Chloride (mg/L)	Classification B
> 5	<1,000	Non-Aggressive
4.0 - 5.0	1,000 - 10,000	Non-Aggressive
3.0 - 4.0	10,000 - 20,000	Mildly Aggressive
<3	>20,000	Moderately Aggressive

Copyright JK Environments

Appendix C: Background on Salinity

Background on Salinity

A. General Information on Salinity

Salinity is the accumulation and concentration of salt at or near the ground surface or within surface water bodies. Salt is naturally present in the landscape through deposition of salt from the ocean in coastal areas and through weathering of bedrock that contains salt, accumulated during deposition of original sediments in a prehistoric marine environment. The salts are commonly soluble chlorides, sulphates or carbonates of sodium and magnesium.

In Sydney, salinity issues are typically associated with the Wianamatta Group shales and their derived soil landscapes. The natural vegetation of western Sydney is dominated by large isolated trees with deep root systems that remove subsurface moisture. Slow rates of percolation through the relatively impermeable clay soil and uptake of a large proportion of rainfall by the trees results in limited recharge of the groundwater system by rainfall. The depth to groundwater has developed a natural equilibrium and there is little tendency for salt contained in the groundwater or subsoils to rise to the surface.

B. Salinity and Urban Development

Salinity becomes a problem in urban areas when changes in the land use result in changes to the way water moves through the environment. This can result in vegetation die-back, decrease in water quality and damage to urban infrastructure.

Removal of deep rooted tree species during development and replacement with urban infrastructure, houses and industrial developments reduces the mechanism for the removal of subsurface moisture.

The development of urban salinity is commonly associated with changes in the hydrological cycle through the environment (rainfall, surface run-off, water infiltration and groundwater system). An increase in the quantity of water reaching the groundwater table as a result of vegetation clearance, irrigation of parklands, leaking water infrastructure and changes in drainage patterns, can cause a relatively rapid rise in the groundwater table. Earthworks that include excavation of natural soil profiles and exposure of more saline subsurface soils or shale bedrock may also result in an increase in salt concentrations at the ground surface.

Construction of roads, pipelines and buildings commonly results in removal of topsoil leading to exposure of the subsoils and interception of surficial and shallow subsurface drainage. In addition, over-irrigation of urban gardens, leaking water infrastructure and concentrated drainage patterns can result in increased water movement through the subsoil to the groundwater system leading to a relatively rapid rise in the groundwater table.

A rise in groundwater levels and impediments to subsurface drainage patterns can transport salt formerly stored in the bedrock to the surficial soil profile. This may result in salt encrustation of exposed soils, building foundations, roads, drainage infrastructure and corrosion of metal, concrete and other building materials. Increasing salt concentrations in surficial soils (and consequently in surface waters) may also result in die-off of the existing vegetation, further reducing the hydrological load on the groundwater system and resulting in further groundwater table rises.

C. Potential Salinity Impacts on Urban Development

Some of the adverse impacts that can arise from saline conditions include:

- Salt scalds caused by a rise in the subsoil moisture content that mobilises salt to the ground surface;
- Salt scalds caused by modification of former drainage patterns which leads to the day lighting of subsurface seepage (either perched water or groundwater) in areas lower in the catchment, either at breaks in the slope or within drainage lines;
- A rise in groundwater table or accumulation of salt rich seepage leading to corrosion of subsurface facilities including concrete structures, metal pipework, cables, foundations, underground services, etc;
- Rising damp, where salt rich moisture is drawn into building and pavement materials by capillary action leading to deterioration of brick, mortar and concrete;
- Structural cracking, damage or building collapse which may occur as a result of shifting and or sinking foundations;
- Plant die-back associated with a rise in groundwater table level that mobilises excess salt to the plant root zone; and
- Subsurface water discharge and subsequent pollution of streams and drainage channels.

D. Soils and Groundwater Planning Strategy in Western Sydney

The aim of the DLWC 2002 document is to provide a framework for the sustainable development and management of new developments in the western region of Sydney. In relation to salinity management, the development should be designed and constructed such that there is no significant increase in the water table level and no adverse salinity impacts.

The proposed development controls that relate to soils and groundwater issues are summarised below:

1. A water management strategy should be prepared to address the following:
    - Reduction of potable water usage onsite;
    - Development of best practice measures for stormwater reuse for open space irrigation;
    - Reduction of potable water demand;
    - Reduction of adverse impacts on local groundwater regimes;
    - Reduction of change in local flow regimes; and
    - Preparation of water maintenance and a monitoring management system.
2. A salinity management plan should be prepared that includes a groundwater management strategy related to:
    - Adoption of small landscaped areas to reduce irrigation requirements;
    - Use of native and other low water requirement plants;
    - Use of mulch cover (not in drainage lines);
    - Use of low flow watering facilities for landscaped areas;
    - Implementation of a tree planting program, especially in high recharge areas, of native, deep rooted, large growing species to assist retention of the groundwater at existing levels;
    - Retention of existing native tree cover where possible; and
    - Not permitting infiltration pits or tanks to disperse surface water.
3. An assessment of soil and rock conditions at the site, including erosion, expansive and dispersive soil conditions, and plant growth potential should be undertaken.

4. Use of the Blue Book (2004) as a guide to prepare soil and water management plans. The approved plan and subsequent works are to be supervised by appropriately qualified experienced personnel.

Appendix D: Information on ASS

A. Background

Acid Sulfate Soil (ASS) is formed from iron rich alluvial sediments and sulfate (found in seawater) in the presence of sulfate reducing bacteria and plentiful organic matter. These conditions are generally found in mangroves, salt marsh vegetation or tidal areas and at the bottom of coastal rivers and lakes. ASS materials are distinguished from other soil or sediment materials (referred to as 'soil materials' throughout the National Acid Sulfate Soils Guidance) by having properties and behaviour that have either:

1) Been affected considerably by the oxidation of Reduced Inorganic Sulfur (RIS), or
2) The capacity to be affected considerably by the oxidation of their RIS constituents.

Acid sulfate soil materials include potential acid sulfate soils (PASS or sulfidic soil materials) and actual acid sulfate soils (AASS or sulfuric soil materials). These are often found in the same profile, with AASS overlying PASS. PASS and AASS are defined further below:

- PASS are soil materials which contain RIS such as pyrite. The field pH of these soils in their undisturbed state is usually more than pH 4 and is commonly neutral to alkaline (pH 7–9). These soil materials are invariably saturated with water in their natural state. Their texture may be peat, clay, loam, silt or sand and is often dark grey in colour and soft in consistence, but these materials may also exhibit colours that are dark brown, or medium to pale grey to white; and
- AASS are soil materials which contained RIS such as pyrite that have undergone oxidation. This oxidation results in low pH (that is pH less than 4) and often a yellow (jarosite) and/or orange to red mottling (ferric iron oxides) in the soil profile. Actual ASS contains Actual Acidity, and commonly also contains RIS (the source of Potential Sulfuric Acidity) as well as Retained Acidity.

B. The ASS Planning Maps

The ASS planning maps provide an indication of the relative potential for disturbance of ASS to occur at locations within the council area. These maps do not provide an indication of the actual occurrence of ASS at a site or the likely severity of the conditions.

The maps are divided into five classes dependent upon the type of activities/works that if undertaken, may represent an environmental risk through the development of acidic conditions associated with ASS:

Table 1: Risk Classes

Risk Class	Description
Class 1	All works.
Class 2	All works below existing ground level and works by which the water table is likely to be lowered.
Class 3	Works at depths beyond 1m below existing ground level or works by which the water table is likely to be lowered beyond 1m below existing ground level.
Class 4	Works at depths beyond 2m below existing ground level or works by which the water table is likely to be lowered beyond 2m below existing ground level.
Class 5	Works within 500m of adjacent Class 1, 2, 3, 4 land which are likely to lower the water table below 1m AHD on the adjacent land.

C. The ASS Risk Maps

The ASS risk maps provide an indication of the probability of occurrence of ASS materials at a particular location based on interpretation from geological and soil landscape maps. The maps provide classes based on high probability, low probability, no known occurrence and areas of disturbed terrain (site specific assessment necessary) and the likely depth at which ASS materials are likely to be encountered.

D. Interpretation of ASS Field Tests

Tables A1 and A2 below provide some guidance on the interpretation of pHF and pHFOX test results, as detailed in the National Acid Sulfate Soil Guidance: National acid sulfate soils sampling and identification methods manual (2018). Field tests are typically only carried out on soil in risk areas or on sites that are close to risk areas, and they occur as an initial step to inform more detailed acid-base accounting analysis.

Table A1: Interpretation of some pH_F test ranges

pH value	Result	Comments
$pH_F \leq 4$, jarosite not observed in the soil layer/horizon	May indicate an AASS indicating previous oxidation of RIS or may indicate naturally occurring, non ASS soils.	Generally not conclusive as naturally occurring, non ASS soils, such as many organic soils (for example peats) and heavily leached soils, often also return $pH_F \leq 4$.
$pH_F \leq 4$, jarosite observed in the soil layer/horizon	The soil material is an AASS.	Jarosite and other iron precipitate minerals in ASS such as schwertmannite require a pH < 4 to form and indicate prior oxidation of RIS.
$pH_F > 7$	Expected in waterlogged, unoxidised, or poorly drained soils.	Marine muds commonly have a pH > 7 which reflects a seawater (pH 8.2) influence. Oxidation of samples with H_2O_2 can help indicate if the soil materials contain RIS.

Source: Adapted from DER (2015a).

Table A2: Interpretation of pH_{FOX} test results

pH value and reaction	Result	Comments
Strong reaction of soil with H_2O_2 (that is X or V)	Useful indicator of the presence of RIS but cannot be used alone	Organic rich substrates such as peat and coffee rock, and soil constituents like manganese oxides, can also cause a reaction. Care must be exercised in interpreting these results. Laboratory analyses are required to confirm if appreciable RIS is present.
pH_{FOX} value at least one unit below field pH_F and strong reaction with H_2O_2 (that is X or V)	May indicate PASS	The difference between pH_F and pH_{FOX} is termed the ΔpH. Generally the larger the ΔpH the more indicative of PASS. The lower the final pH_{FOX} the better the likelihood of an appreciable RIS content. For example, a change from pH_F of 8 to pH_{FOX} of 7 (that is a ΔpH of 1) would not indicate PASS, however, a unit change from pH_F of 3.5 to pH_{FOX} of 2.5 would be indicative of PASS. Laboratory analyses are required to confirm if appreciable RIS is present.

pH value and reaction	Result	Comments
pH_{FOX} < 3, large ΔpH and a strong reaction with H_2O_2 (that is X or V)	Strongly indicates PASS	The lower the pH_{FOX} below 3, the greater the likelihood that appreciable RIS is present. A combination of all three parameters – pH_{FOX}, ΔpH and reaction strength – gives the best indication of PASS. Laboratory analyses are required to confirm that appreciable RIS is present.
A pH_{FOX} 3–4 and Low, Medium or Strong reaction with H_2O_2	Inconclusive	RIS may be present; however, organic matter may also be responsible for the decrease in pH. Laboratory analyses are required to confirm the presence of RIS.
pH_{FOX} 4–5	Inconclusive	RIS may be present in small quantities, or poorly reactive under rapid oxidation, or the sample may contain shell/ carbonate which neutralises some or all acid produced on oxidation. Equally, the pH_{FOX} value may be due to the production of organic acids with no RIS present. Laboratory analyses are required to confirm if appreciable RIS is present.
pH_{FOX} > 5, small or no ΔpH, but Low, Medium or Strong reaction with H_2O_2	Inconclusive	For neutral to alkaline pHF with shell or white concretions, the fizz test with 1 M HCl can be used to identify the presence of carbonates. Laboratory analyses are required to confirm if appreciable RIS is present and further testing is required to confirm that effective self-neutralising materials are present.

Source: Adapted from DER (2015a).

Appendix E: Borehole/Test Pit Logs

JKGeotechnics

BOREHOLE LOG

Borehole No.
62
1 / 2

Client: SCHOOL INFRASTRUCTURE NSW
Project: PROPOSED HIGH SCHOOL
Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 36314LT **Method:** SPIRAL AUGER **R.L. Surface:** 18.61 m
Date: 11/10/24 **Datum:** AHD
Plant Type: JK309 **Logged/Checked By:** A.G./A.B.

Groundwater Record	Field Tests	RL (m AHD)	Depth (m)	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING					TOPSOIL: Silty clay, high plasticity, dark brown, with root fibres.				SCREEN: 11.65kg 0-0.1m, NO FCF
	N = 13 3,5,8	18		CH	Silty CLAY: high plasticity, dark brown, with fine grained, brown and dark grey, rounded basalt gravel, fine grained ironstone gravel, fine grained, grey to light grey quartz gravel, and root fibres.	w>PL	St	110 120 140	COLLUVIAL HP TESTING ON REMOULDED SAMPLE
			1				Hd	440 400 500	ORGANIC ODOUR HP TESTING ON REMOULDED SAMPLE
	N = 14 4,7,7	17	2					600 590 >600	
	N=SPT 10/ 150mm REFUSAL	16 15	3		Gravelly silty CLAY: high plasticity, light brown, fine to coarse grained, dark grey, rounded to sub-rounded basalt gravel, trace of fine grained ironstone gravel.	w<PL		>600 >600 >600	RESIDUAL POSSIBLY COLLUVIAL
		14 13	4 5 6						VERY LOW 'TC' BIT RESISTANCE GROUNDWATER MONITORING WELL INSTALLED TO 11.29m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 7.0m TO 11.29m. CASING 0m TO 7.0m. 2mm SAND FILTER PACK 6.0m TO 11.29m. BENTONITE SEAL 0m TO 6.0m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH A CONCRETED GALVANISED MONUMENT.
		12		-	BASALT: fine grained, dark grey.	SW	H		LISMORE BASALT HIGH RESISTANCE
					REFER TO CORED BOREHOLE LOG				

COPYRIGHT

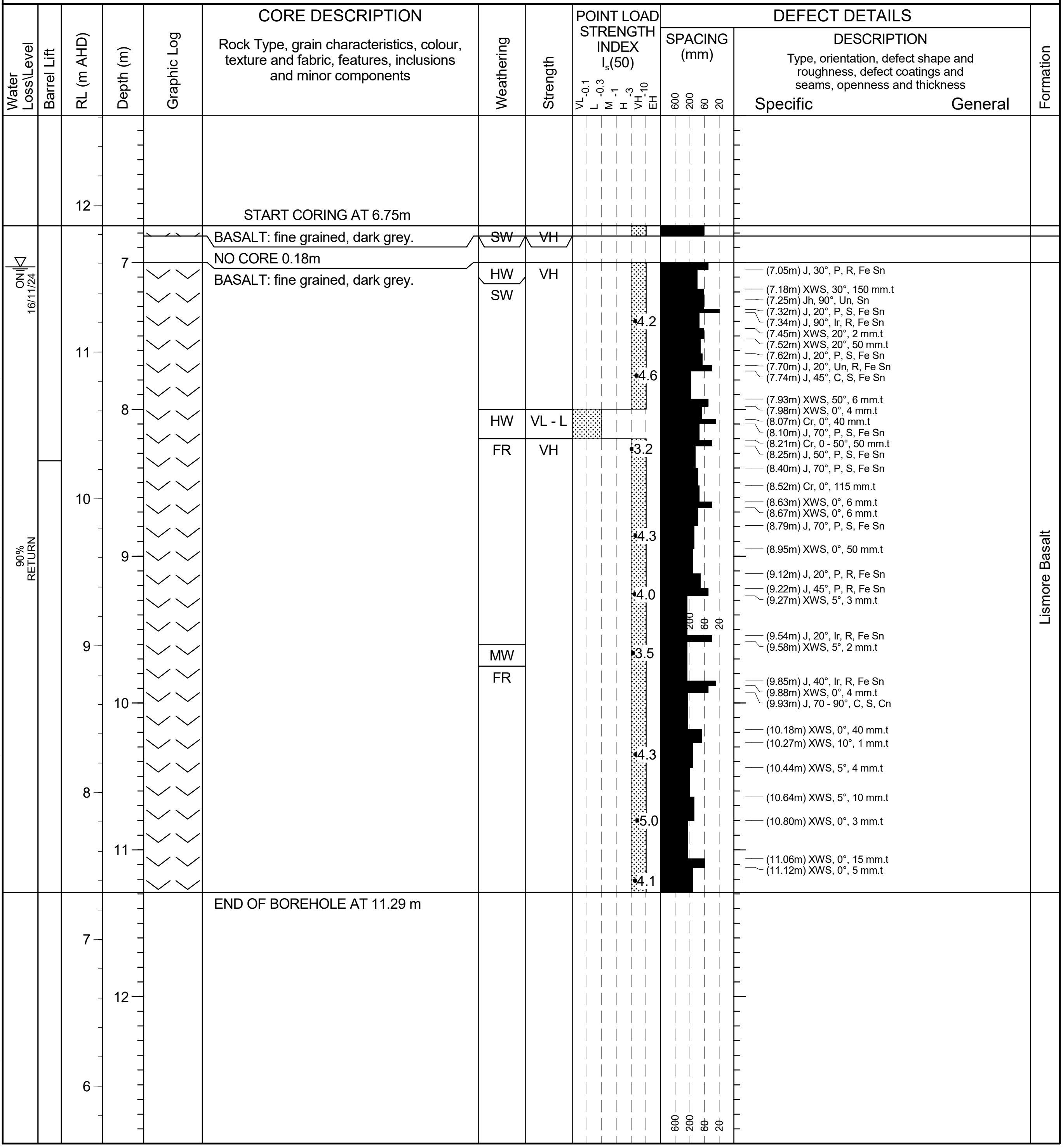
JK 9.02.4 LIB.GLB Log JK AUGERHOLE - MASTER 36314LT NORTH LISMORE.GPJ <<DrawingFile>> 20/11/2024 16:22 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

CORED BOREHOLE LOG

Borehole No.
62

Client: SCHOOL INFRASTRUCTURE NSW
Project: PROPOSED HIGH SCHOOL
Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 36314LT	**Core Size:** NMLC	**R.L. Surface:** 18.61 m
Date: 11/10/24	**Inclination:** VERTICAL	**Datum:** AHD
Plant Type: JK309	**Bearing:** N/A	**Logged/Checked By:** A.G./A.B.



CORE DESCRIPTION	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$
START CORING AT 6.75m			
BASALT: fine grained, dark grey.	SW	VH	
NO CORE 0.18m			
BASALT: fine grained, dark grey.	HW SW	VH	4.2 4.6
	HW	VL - L	
	FR	VH	3.2 4.3 4.0
	MW FR		3.5 4.3 5.0 4.1
END OF BOREHOLE AT 11.29 m			

(7.05m) J, 30°, P, R, Fe Sn
(7.18m) XWS, 30°, 150 mm.t
(7.25m) Jh, 90°, Un, Sn
(7.32m) J, 20°, P, S, Fe Sn
(7.34m) J, 90°, Ir, R, Fe Sn
(7.45m) XWS, 20°, 2 mm.t
(7.52m) XWS, 20°, 50 mm.t
(7.62m) J, 20°, P, S, Fe Sn
(7.70m) J, 20°, Un, R, Fe Sn
(7.74m) J, 45°, C, S, Fe Sn
(7.93m) XWS, 50°, 6 mm.t
(7.98m) XWS, 0°, 4 mm.t
(8.07m) Cr, 0°, 40 mm.t
(8.10m) J, 70°, P, S, Fe Sn
(8.21m) Cr, 0 - 50°, 50 mm.t
(8.25m) J, 50°, P, S, Fe Sn
(8.40m) J, 70°, P, S, Fe Sn
(8.52m) Cr, 0°, 115 mm.t
(8.63m) XWS, 0°, 6 mm.t
(8.67m) XWS, 0°, 6 mm.t
(8.79m) J, 70°, P, S, Fe Sn
(8.95m) XWS, 0°, 50 mm.t
(9.12m) J, 20°, P, R, Fe Sn
(9.22m) J, 45°, P, R, Fe Sn
(9.27m) XWS, 5°, 3 mm.t
(9.54m) J, 20°, Ir, R, Fe Sn
(9.58m) XWS, 5°, 2 mm.t
(9.85m) J, 40°, Ir, R, Fe Sn
(9.88m) XWS, 0°, 4 mm.t
(9.93m) J, 70 - 90°, C, S, Cn
(10.18m) XWS, 0°, 40 mm.t
(10.27m) XWS, 10°, 1 mm.t
(10.44m) XWS, 5°, 4 mm.t
(10.64m) XWS, 5°, 10 mm.t
(10.80m) XWS, 0°, 3 mm.t
(11.06m) XWS, 0°, 15 mm.t
(11.12m) XWS, 0°, 5 mm.t

COPYRIGHT

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKEnvironments

ENVIRONMENTAL LOG

Log No.
TP201
1/1

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** 22.07m
Date: 19/5/25 **Datum:** AHD
Plant Type: EXCAVATOR **Logged/Checked by:** J.T./B.P.

Groundwater Record	SAMPLES					Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	ES	ASS	ASB	SAL	DB									
DRY ON COMPLETION	■		■	■	■		0	▨		TOPSOIL: Silty clay, medium plasticity, dark brown, with fine to coarse grained sub-angular siltstone and basalt gravel, and root fibres.	w>PL			SCREEN: 10.3kg 0-0.2m, NO FCF
	■ ■		■					▨	CI	Gravelly silty CLAY: medium plasticity, grey, fine to coarse grained sub-rounded basalt gravel, trace of root fibres.	w>PL			COLLUVIAL
							0.5	▨	GC	Silty clayey GRAVEL: orange brown and brown, fine to medium grained sand, trace of basalt gravel (some vesicles).				COLLUVIAL
										END OF TEST PIT AT 0.9m				
							1							
							1.5							
							2							
							2.5							
							3							
							3.5							

COPYRIGHT

JKEnvironments

ENVIRONMENTAL LOG

Log No.
TP202
1/2

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** 13.56m

Date: 20/5/25 **Datum:** AHD

Plant Type: EXCAVATOR **Logged/Checked by:** J.T./B.P.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	●		●	●	●		0			TOPSOIL: Silty clay, medium plasticity, dark grey, trace of fine grained sub-rounded basalt gravel, organics and root fibres.	w>PL			SCREEN: 11.1kg 0-0.1m, NO FCF
	● ● ●			● ●			0.5 1 1.5 2 2.5		CI	Silty CLAY: medium plasticity, dark grey, trace of basalt gravel, basalt cobbles and root fibres.	w>PL			ALLUVIAL
										Silty CLAY: medium plasticity, brown, fine to coarse grained sub-angular basalt and ferricrete gravel.	w≈PL			RESIDUAL
				●			3			Silty CLAY: medium plasticity, orange brown and grey, fine to coarse grained sub-angular basalt gravel and basalt cobbles.	w≈PL			RESIDUAL
							3.5		-	SILTSTONE: as below.				

COPYRIGHT

ENVIRONMENTAL LOG

Log No.
TP202
2/2

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** 13.56m

Date: 20/5/25 **Datum:** AHD

Plant Type: EXCAVATOR **Logged/Checked by:** J.T./B.P.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
				■						SILTSTONE: light brown, moderately weathered, thinly laminated, with ferricrete bands, highly fractured.				
							4							
							4.5							
▶														
										END OF TEST PIT AT 4.7m				
							5							
							5.5							
							6							
							6.5							
							7							

COPYRIGHT

ENVIRONMENTAL LOG

Log No. TP203
1/1

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** 10.61m
Date: 20/5/25 **Datum:** AHD
Plant Type: EXCAVATOR **Logged/Checked by:** J.T./B.P.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■	■	■		0			TOPSOIL: Silty clay, medium plasticity, dark brown, with root fibres.	w>PL			SCREEN: 9.6kg (<10L) 0-0.1m, NO FCF
									CI-CH	Silty CLAY: medium to high plasticity, dark grey mottled orange brown, trace of ferricrete gravel and root fibres.	w>PL			ALLUVIAL
	■						0.5							
	■			■			1							
							1.5							
				■			2							
									CI	Silty CLAY: medium plasticity, grey, trace of fine grained sub-rounded and sub-angular ferricrete and basalt gravel.	w≈PL			ALLUVIAL SOUTHERN PIT WALL COLLAPSE AT 2.3m
							2.5							
				■			3							
										END OF TEST PIT AT 3.4m				
							3.5							

COPYRIGHT

JKEnvironments

ENVIRONMENTAL LOG

Log No.
TP204
1/1

Environmental logs are not to be used for geotechnical purposes

SDUPA: 0-0.1m

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** 10.75m

Date: 20/5/25 **Datum:** AHD

Plant Type: EXCAVATOR **Logged/Checked by:** J.T./B.P.

Groundwater Record	SAMPLES					Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	ES	ASS	ASB	SAL	DB									
▶	●		●	●	●		0			TOPSOIL: Silty clay, medium plasticity, dark brown, with organics and root fibres, trace of ash.	w>PL			SCREEN: 10.1kg 0-0.1m, NO FCF
DRY ON COMPLETION									CI-CH	Silty CLAY: medium to high plasticity, grey mottled orange brown, trace of root fibres.	w>PL			ALLUVIAL
	●		●				0.5							
	●			●			1							
							1.5							
				●			2							
										Silty CLAY: medium plasticity, grey.	w≈PL			ALLUVIAL
							2.5							
				●			3							
										END OF TEST PIT AT 3.2m				NORTHERN AND SOUTHERN WALL COLLAPSE AT 2.3m
							3.5							

COPYRIGHT

ENVIRONMENTAL LOG

Log No.
TP205
1/1

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** 29.32m

Date: 19/5/25 **Datum:** AHD

Plant Type: EXCAVATOR **Logged/Checked by:** J.T./B.P.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■	■	■		0			TOPSOIL: Silty clay, medium plasticity, brown, with root fibres and organics, trace of sand.	w>PL			SCREEN: 10.1kg 0-0.2m, NO FCF
	■ ■			■			0.5		CI	Silty CLAY: medium plasticity, brown, with fine grained, sub-rounded and sub-angular siltstone and basalt gravel, trace of root fibres.	w>PL			COLLUVIAL
	■			■			1			Silty CLAY: medium plasticity, brown and orange brown mottled grey, with fine to medium grained, sub-angular basalt gravel and fine to medium grained sand, trace of root fibres.	w>PL			RESIDUAL
				■ ■			1.5 2 2.5		-	Extremely Weathered tuff: sandy GRAVEL, medium to coarse grained, brown, red brown and grey, with low strength bands.	XW			
				■						BASALT: red brown, with fine to medium grained vesicles.	MW			
							3 3.5			END OF TEST PIT AT 2.9m				

COPYRIGHT

JKEnvironments

ENVIRONMENTAL LOG

Log No.
TP206
1/1

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** 17.80m

Date: 20/5/25 **Datum:** AHD

Plant Type: EXCAVATOR **Logged/Checked by:** J.T./B.P.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■	■	■		0			TOPSOIL: Clayey silt/Silty clay, low to medium plasticity, dark brown, with root fibres, trace of basalt gravel.	w>PL			SCREEN: 9.6kg (<10L) 0-0.1m, NO FCF
	■			■			0.5		CI	Silty CLAY: medium plasticity, dark grey, trace of basalt gravel, basalt cobbles, sand, gravelly clay lenses and root fibres.	w<PL			RESIDUAL
	■			■					-	BASALT: highly weathered, with clay bands, highly fractured.				
							1			BASALT: dark grey, moderately weathered, fractured blocky.				
										END OF TEST PIT AT 1.3m				
							1.5							
							2							
							2.5							
							3							
							3.5							

COPYRIGHT

JKGeotechnics

BOREHOLE LOG

Borehole No.
206
1 / 3

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY-RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163 AND 170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 37635UOR
Method: SPIRAL AUGER
R.L. Surface: 17.8 m
Date: 28/5/25 TO 29/5/25
Datum: AHD
Plant Type: JK300
Logged/Checked By: A.G./P.R.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
ON COMPLETION OF CORING DRY ON COMPLETION OF AUGERING										TOPSOIL: Silty clay, medium plasticity, dark brown, with root fibres.	w>PL			
									CI	Silty CLAY: medium plasticity, dark brown, with fine to coarse grained, sub-angular basalt gravel.	w>PL	St - VSt		RESIDUAL
						17	1		-	BASALT: grey, highly fractured, with numerous clay bands.	HW - MW	L - M		LISMORE BASALT LOW BUCKET RESISTANCE
						16	2			BASALT: dark grey.	MW	H		HIGH 'TC' BIT RESISTANCE
						15 14 13 12 11	3 4 5 6			REFER TO CORED BOREHOLE LOG				GROUNDWATER MONITORING WELL INSTALLED TO 5.7m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 5.7m TO 1.5m. CASING +1.05m TO 1.5m. 2mm SAND FILTER PACK 5.7m TO 1.0m. BENTONITE SEAL 1.0m TO 0.1m. BACKFILLED WITH SAND AND CUTTINGS TO THE SURFACE. COMPLETED WITH A CONCRETED MONUMENT.

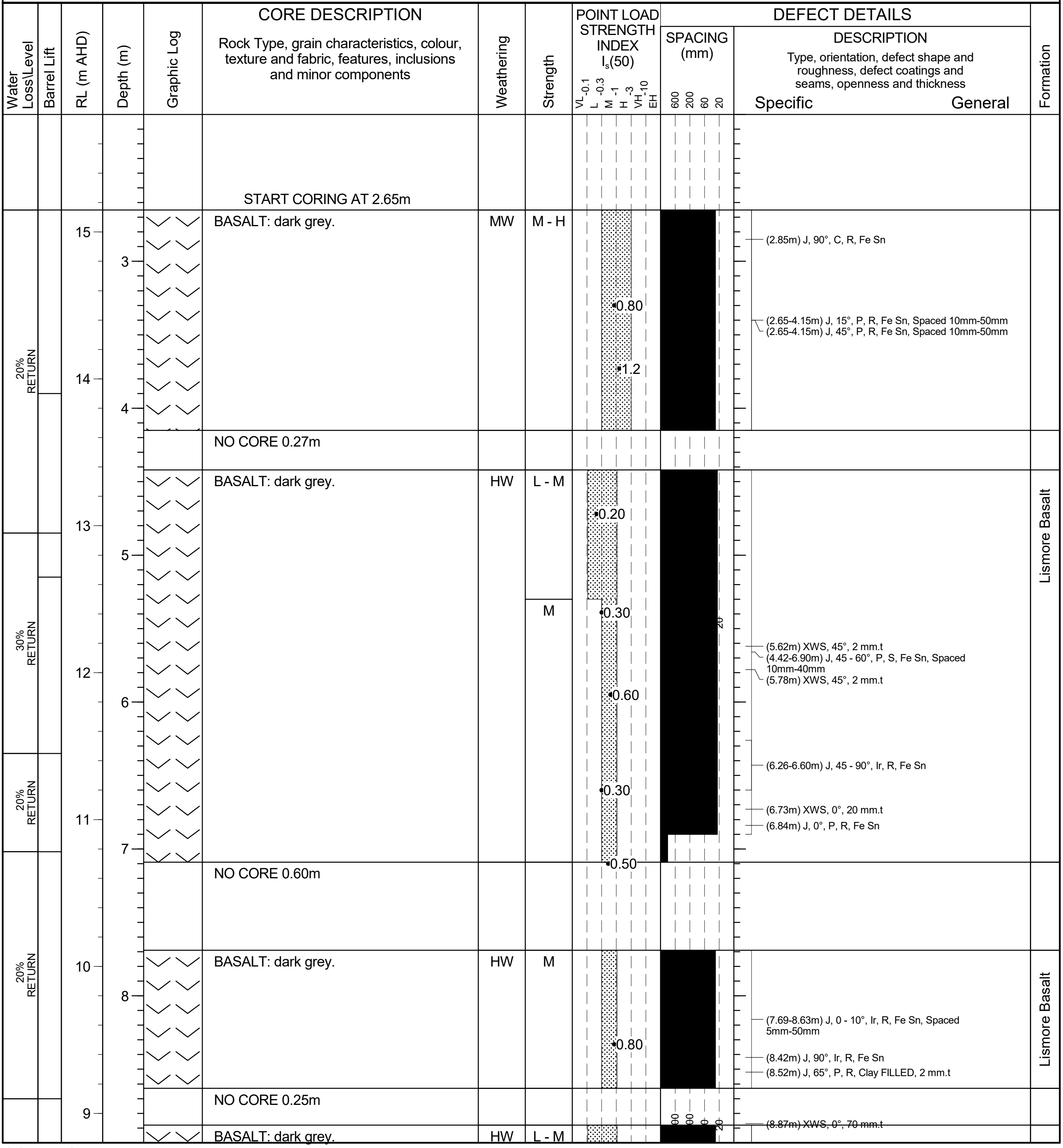
COPYRIGHT

CORED BOREHOLE LOG

Borehole No.
206
2 / 3

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY-RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163 AND 170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 37635UOR
Core Size: NMLC
R.L. Surface: 17.8 m
Date: 28/5/25 TO 29/5/25
Inclination: VERTICAL
Datum: AHD
Plant Type: JK300
Bearing: N/A
Logged/Checked By: A.G./P.R.



Water Loss\Level	RL (m AHD)	Depth (m)	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS – DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
			START CORING AT 2.65m					
20% RETURN	15 14	3 4	BASALT: dark grey.	MW	M - H	0.80 1.2	(2.85m) J, 90°, C, R, Fe Sn (2.65-4.15m) J, 15°, P, R, Fe Sn, Spaced 10mm-50mm (2.65-4.15m) J, 45°, P, R, Fe Sn, Spaced 10mm-50mm	
			NO CORE 0.27m					
30% RETURN 20% RETURN	13 12 11	5 6 7	BASALT: dark grey.	HW	L - M M	0.20 0.30 0.60 0.30 0.50	(5.62m) XWS, 45°, 2 mm.t (4.42-6.90m) J, 45 - 60°, P, S, Fe Sn, Spaced 10mm-40mm (5.78m) XWS, 45°, 2 mm.t (6.26-6.60m) J, 45 - 90°, Ir, R, Fe Sn (6.73m) XWS, 0°, 20 mm.t (6.84m) J, 0°, P, R, Fe Sn	Lismore Basalt
			NO CORE 0.60m					
20% RETURN	10	8	BASALT: dark grey.	HW	M	0.80	(7.69-8.63m) J, 0 - 10°, Ir, R, Fe Sn, Spaced 5mm-50mm (8.42m) J, 90°, Ir, R, Fe Sn (8.52m) J, 65°, P, R, Clay FILLED, 2 mm.t	Lismore Basalt
	9		NO CORE 0.25m				(8.87m) XWS, 0°, 70 mm.t	
			BASALT: dark grey.	HW	L - M			

JK 9.02.4 LIB.GLB Log JK CORED BOREHOLE - MASTER 37635UOR NORTHLISMORE.GPJ <<DrawingFile>> 25/06/2025 16:11 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

COPYRIGHT

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

CORED BOREHOLE LOG

Borehole No.
206
3 / 3

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY-RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163 AND 170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 37635UOR
Core Size: NMLC
R.L. Surface: 17.8 m
Date: 28/5/25 TO 29/5/25
Inclination: VERTICAL
Datum: AHD
Plant Type: JK300
Bearing: N/A
Logged/Checked By: A.G./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1, L 0.3, M 1, H 3, VH 10, EH	SPACING (mm) 600 200 60 20	DEFECT DETAILS – DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific General	Formation
80% RETURN		8	10		BASALT: dark grey. *(continued)*	HW	L - M	0.30 0.10		(9.09m) XWS, 0°, 30 mm.t (9.24m) XWS, 0°, 5 mm.t (9.55m) J, 0°, P, R, Fe FILLED (9.85m) XWS, 0°, 10 mm.t (10.11m) XWS, 30°, 8 mm.t	Lismore Basalt
80% RETURN		7	11				M	0.70 0.60		(8.88-11.65m) J, 15 - 90°, P or Ir, R, Fe Sn, Spaced 10mm-150mm (8.88-12.95m) Ji, 15 - 90°, Ir, Fe FILLED, Spaced 1mm-50mm	
						SW	VH	4.3 3.3		(11.12m) J, 5°, Ir, R, Fe Sn (11.17m) J, 0°, Ir, R, Fe Sn (11.42m) J, 90°, Un, R, Fe Sn	
		6 5	12			HW	M	0.60 0.70 0.70	20		
					NO CORE 0.15m						
			13		VOLCANIC BRECCIA: grey and light grey brown, fine to coarse grained angular basalt gravel.	HW	VL - L	0.070		(13.00m) XWS, 0°, 100 mm.t (13.19m) XWS, 20°, 18 mm.t (13.40m) XWS, 0°, 140 mm.t	Lismore Basalt
		4	14				M	0.20			
					as above, but fine grained and dark grey.			0.40		(14.05m) J, 55°, Ir, R, Fe Sn (14.11m) J, 45°, P, S, Fe Sn (14.15m) J, 45°, P, R, Fe Sn (14.21m) Cr, 0°, 35 mm.t (14.36m) XWS, 70°, 40 mm.t (14.48m) J, 70°, P, R, Clay Vn	
		3 2	15		END OF BOREHOLE AT 14.55 m				600 200 60 20		

JK 9.02.4 LIB.GLB Log JK CORED BOREHOLE - MASTER 37635UOR NORTHLISMORE.GPJ <<DrawingFile>> 25/06/2025 16:11 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

COPYRIGHT

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

ENVIRONMENTAL LOG

Log No.
TP207
1/1

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3
Method: TEST PIT
R.L. Surface: 11.11m
Date: 21/5/25
Datum: AHD
Plant Type: EXCAVATOR
Logged/Checked by: J.T./B.P.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■	■	■		0			TOPSOIL: Silty clay, low to medium plasticity, dark brown, with organics and root fibres.	w>PL			SCREEN: 10.3kg 0-0.1m, NO FCF
	■			■			0.5		CI	Silty CLAY: medium plasticity, grey mottled red brown, with fine grained sub-angular ferricrete and basalt gravel, trace of basalt gravel and cobbles, and root fibres.	w>PL			ALLUVIAL
	■			■			1			Silty CLAY: medium plasticity, grey mottled red brown, trace of basalt gravel and root fibres.	w>PL			ALLUVIAL
				■			1.5		-	Extremely Weathered siltstone: gravelly CLAY/clayey GRAVEL, red brown and grey, with lightly weathered, highly fractured ferricrete bands.				
				■ ■			2 2.5			SILTSTONE: red brown, with high strength ferricrete bands and nodules.				
							3 3.5			END OF TEST PIT AT 2.8m				

COPYRIGHT

JKEnvironments

ENVIRONMENTAL LOG

Log No. **TP208** **1/2**

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** 9.40m

Date: 21/5/25 **Datum:** AHD

Plant Type: EXCAVATOR **Logged/Checked by:** J.T./B.P.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■	■	■		0			TOPSOIL: Silty clay, low to medium plasticity, dark brown, with organics and root fibres.	w>PL			SCREEN: 9.9kg (<10L) 0-0.1m, NO FCF
									CI-CH	Silty CLAY: medium to high plasticity, grey mottled red brown, with root fibres.	w>PL			MINOR SURFACE WATER SEEPAGE ALLUVIAL
	■						0.5							
	■			■			1							
							1.5							
				■										
									CI	Silty CLAY: medium plasticity, grey.	w≈PL			ALLUVIAL
							2							SOUTHERN AND NORTHERN PIT WALL COLLAPSE AT ≈2.0m
				■										
							2.5							
				■			3							
							3.5							

COPYRIGHT

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** 9.40m

Date: 21/5/25 **Datum:** AHD

Plant Type: EXCAVATOR **Logged/Checked by:** J.T./B.P.

Groundwater Record	SAMPLES					Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	ES	ASS	ASB	SAL	DB									
									CI	Silty CLAY: medium plasticity, grey.	w≈PL			
							4 4.5 5 5.5 6 6.5 7			END OF TEST PIT AT 4.0m				

COPYRIGHT

JKEnvironments

ENVIRONMENTAL LOG

Log No. TP209
1/2

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** 16.67m

Date: 19/5/25 **Datum:** AHD

Plant Type: EXCAVATOR **Logged/Checked by:** J.T./B.P.

Groundwater Record	Depth (m)	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	0		TOPSOIL: Silty clay, medium plasticity, dark brown, with organics and root fibres.	w>PL			SCREEN: 9.6kg (<10L) 0-0.1m, NO FCF
	0.5 1 1.5	CI-CH	Silty CLAY: medium to high plasticity, dark brown and grey, trace of ferricrete and basalt gravel and basalt cobbles.	w>PL			ALLUVIAL
	2 2.5		as above, but with fine to coarse grained sub-rounded ferricrete and basalt gravel.	w>PL			ALLUVIAL
		-	Extremely Weathered siltstone: clayey gravelly SILT, medium plasticity, orange brown and grey, fine to medium grained siltstone gravel.	w<PL			
	3 3.5		SILTSTONE: red brown, thinly laminated and lightly fractured, with medium strength ferricrete bands and nodules.				

Samples columns: ES, ASS, ASB, SAL, DB. Field Tests. Graphic Log.

COPYRIGHT

JKEnvironments

ENVIRONMENTAL LOG

Log No.
TP209
2/2

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** 16.67m

Date: 19/5/25 **Datum:** AHD

Plant Type: EXCAVATOR **Logged/Checked by:** J.T./B.P.

Groundwater Record	SAMPLES					Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	ES	ASS	ASB	SAL	DB									
										SILTSTONE: red brown, thinly laminated and lightly fractured, with medium strength ferricrete bands and nodules.				
							4 4.5 5 5.5 6 6.5 7			END OF TEST PIT AT 3.9m				

COPYRIGHT

ENVIRONMENTAL LOG

Log No.
TP210
1/1

Environmental logs are not to be used for geotechnical purposes

SDUP: 0.5-0.6m

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** 18.81m

Date: 20/5/25 **Datum:** AHD

Plant Type: EXCAVATOR **Logged/Checked by:** J.T./B.P.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	■		■	■	■		0			TOPSOIL: Silty clay, low to medium plasticity, dark brown, with organics and root fibres, trace of basalt gravel and basalt cobbles.	w≈PL			SCREEN: 9.15kg (<10L) 0-0.1m, NO FCF
									CI	Silty CLAY: medium plasticity, dark brown, with fine to coarse grained sub-rounded basalt gravel and sub-rounded basalt cobbles, trace of root fibres.	w≈PL			RESIDUAL
	■			■			0.5							
				■					-	Extremely Weathered siltstone: clayey GRAVEL/gravelly CLAY, fine to coarse grained siltstone and ferricrete gravel, medium plasticity, highly fractured, very low strength ferricrete bands.				
							1			SILTSTONE: red brown, thinly laminated and high strength ferricrete bands and nodules, moderately weathered.				
▶														
										END OF TEST PIT AT 1.25m				
							1.5							
							2							
							2.5							
							3							
							3.5							

COPYRIGHT

JKGeotechnics

BOREHOLE LOG

Borehole No.
212
1 / 3

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY-RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163 AND 170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 37635UOR **Method:** SPIRAL AUGER **R.L. Surface:** 22.2 m
Date: 27/5/25 **Datum:** AHD
Plant Type: JK300 **Logged/Checked By:** C.S./P.R.

Groundwater Record	SAMPLES ES	U50	DB	DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING	■									FILL: Gravel, fine to coarse grained, angular, grey.	D			
	■					22			CH	FILL: Sandy gravel, fine to medium grained, angular, brown, fine to coarse grained sand.	M	St		ALLUVIAL
				■	N = 6 2,3,3					Gravelly CLAY: high plasticity, dark grey mottled brown, fine to medium grained angular gravel,, trace of roots.	w~PL		240 220 160 190	
						21	1		GC	Clayey GRAVEL: fine to medium grained, angular, dark grey mottled dark red, orange, grey and brown, with clay bands, some shear planes in clay bands.	M	(VD)		COLLUVIAL
				■	N=SPT 20/ 120mm REFUSAL						D			
						20	2							
ON COMPLETION OF CORING ▽				■	N=SPT 20/ 100mm REFUSAL	19	3							
				■	N=SPT 10/ 50mm REFUSAL	18	4							
						17	5		-	BASALT: brown mottled grey.	HW	(L)		POSSIBLE BOULDER
				■	N=SPT 15/ 100mm REFUSAL	16	6		GC	Clayey GRAVEL:fine to coarse grained angular, brown mottled orange, grey and yellow.	D	(VD)		POSSIBLE EXTREMELY WEATHERED BASALT

JK 9.02.4 LIB.GLB Log JK AUGERHOLE - MASTER 37635UOR NORTHLISMORE.GPJ <<DrawingFile>> 25/06/2025 16:12 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

COPYRIGHT

BOREHOLE LOG

Borehole No.
212
2 / 3

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY-RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163 AND 170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 37635UOR
Method: SPIRAL AUGER
R.L. Surface: 22.2 m
Date: 27/5/25
Datum: AHD
Plant Type: JK300
Logged/Checked By: C.S./P.R.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
						15			GC	Clayey GRAVEL:fine to coarse grained angular, brown mottled orange, grey and yellow. *(continued)*	D	(VD)		
						14	8		-	BASALT: grey.	HW	(L)		LISMORE BASALT
						13 12 11 10 9	9 10 11 12 13			REFER TO CORED BOREHOLE LOG				GROUNDWATER MONITORING WELL INSTALLED TO 6.0m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 6.0m TO 1.0m. CASING 0m TO 1.0m. 2mm SAND FILTER PACK 6.0m TO 1.0m. BENTONITE SEAL 1.0m TO 0.1m. STEEL COVER INSTALLED FLUSH WITH GROUND AND CONCRETED.

COPYRIGHT

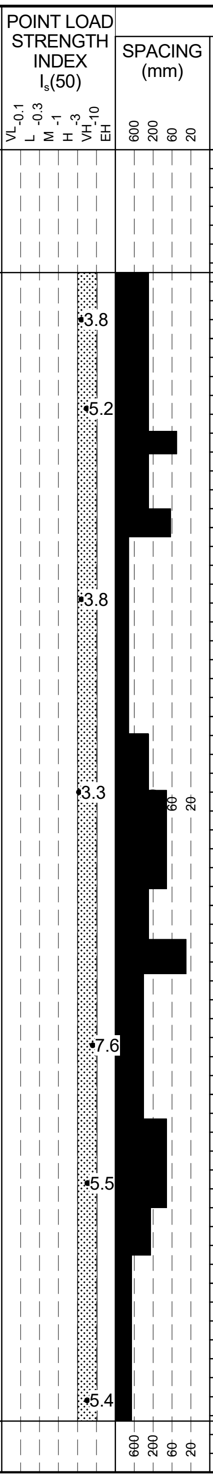
CORED BOREHOLE LOG

Borehole No.
212
3 / 3

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY-RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163 AND 170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 37635UOR	**Core Size:** NMLC	**R.L. Surface:** 22.2 m
Date: 27/5/25	**Inclination:** VERTICAL	**Datum:** AHD
Plant Type: JK300	**Bearing:** N/A	**Logged/Checked By:** C.S./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific General	Formation
		14			START CORING AT 8.65m				
100% RETURN		13 12 11 10 9 8	9 10 11 12 13 14		BASALT: dark grey, trace of chlorite seams.	FR	VH	(8.90m) XWS, 5°, 1 mm.t (9.14m) J, 15°, P, S, Cn (9.49m) XWS, 5°, 2 mm.t (9.56m) J, 40°, P, S, Cn (9.61m) XWS, 0°, 2 mm.t (9.90m) J, 0°, Ir, R, Fe Sn (9.98m) J, 45°, St, R, Ca Vn (10.05m) J, 5°, P, S, Chlorite Vn (11.09m) J, 15°, P, S, Fe Sn, x 2, and Chlorite Veneer (11.39-11.91m) Numerous J's, 0 - 30°, P and C, S, Chlorite Vn, Spaced ~100mm (12.18m) J, 0°, P, S, Chlorite Vn (12.20m) J, 0°, P, S, Chlorite Vn (12.26m) J, 0°, P, S, Chlorite Vn (12.73m) J, 30°, P, S, Chlorite Vn (13.13-13.60m) J, 5°, P, S, Chlorite Vn, Spaced 60mm-180mm (13.85m) J, 35°, P, R, Cn	Lismore Basalt
					END OF BOREHOLE AT 14.73 m				



COPYRIGHT

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JK 9.02.4 LIB.GLB Log JK CORED BOREHOLE - MASTER 37635UOR NORTHLISMORE.GPJ <<DrawingFile>> 25/06/2025 16:12 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

JKGeotechnics

BOREHOLE LOG

Borehole No.
213
1 / 3

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY-RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163 AND 170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 37635UOR
Method: SPIRAL AUGER
R.L. Surface: 19.6 m
Date: 3/6/25 TO 4/6/25
Datum: AHD
Plant Type: JK309
Logged/Checked By: A.G./P.R.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
▼ DRY ON COMPLETION OF AUGERING	■									FILL: Sand	M			BACKFILLED ARCHAEOLOGIST TEST PIT EXCAVATED TO 0.4m DEPTH
	■			■	N > 28 5,12,16/ 100mm REFUSAL	19	1		CL	Silty gravelly CLAY: medium plasticity, brown and grey mottled, fine to coarse grained angular basalt.	w>PL	(Hd)		RESIDUAL TOO GRAVELLY FOR HP TESTING
				■		18			-	BASALT: dark grey.	SW	H		LISMORE BASALT HIGH 'TC' BIT RESISTANCE
						17 16 15 14 13	2 3 4 5 6			REFER TO CORED BOREHOLE LOG				

JK 9.02.4 LIB.GLB Log JK AUGERHOLE - MASTER 37635UOR NORTHLISMORE.GPJ <<DrawingFile>> 25/06/2025 16:12 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

COPYRIGHT

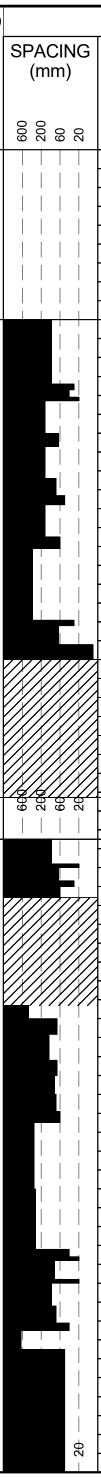
CORED BOREHOLE LOG

Borehole No.
213
2 / 3

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY-RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163 AND 170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 37635UOR
Core Size: NMLC
R.L. Surface: 19.6 m
Date: 3/6/25 TO 4/6/25
Inclination: VERTICAL
Datum: AHD
Plant Type: JK309
Bearing: N/A
Logged/Checked By: A.G./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1 – L 0.3 – M 1 – H 3 – VH 10 – EH	DEFECT DETAILS – DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
		18			START CORING AT 1.90m					
20% RETURN		17	2 3		BASALT: dark grey.	SW	VH	•3.9 •3.9	(2.12m) J, 25°, P, R, Cn (2.24m) J, 65°, P, R, Cn (2.27m) J, 30°, P, R, Cn (2.31m) J, 45°, P, R, Cn (2.33m) J, 0°, P, S, Cn (2.50m) J, 0°, P, S, Cn (2.57m) J x 2, 0°, P, R, Cn (2.74m) J, 90°, Un, R, Fe Sn (2.83m) J, 45°, P, R, Fe Ct (2.88m) XWS, 0°, 120 mm.t	Lismore Basalt
90% RETURN		16					H	•1.8	(3.05m) J, 5°, P, S, Cn (3.11m) XWS, 5°, 120 mm.t (3.49m) J, 5°, P, R, Cn (3.52m) J, 0°, Ir, R, Cn (3.59m) J, 45°, Ir, R, Fe Vn (3.62-3.70m) Ji, 45°, P, Fe FILLED, Spaced 5mm	
			4		Extremely Weathered basalt: silty clayey GRAVEL, fine to medium grained, dark brown, with medium and high strength basalt bands up to 80mm.t.	XW	(VD)	•2.1 •0.60		
		15			NO CORE 0.22m					
					BASALT: dark grey.	MW	M	•0.60	(4.66m) J, 45°, P, R, Cn (4.78m) J, 0°, P, R, Cn (4.80m) Ji x 2, 45°, P, R, Cn (4.87m) J, 45°, P, R, Cn	Lismore Basalt
			5		Extremely Weathered basalt: silty clayey GRAVEL, fine to medium grained, dark brown, with basalt bands up to 80mm.t.	XW	(Hd)		(4.90m) J, 10°, P, R, Fe Sn (4.96m) J, 10°, P, R, Fe Sn (5.14m) J, 45°, P, R, Fe Sn	
		14 13 12	6 7		BASALT: dark grey.	SW	VH	•3.9 •3.5 •3.9 •3.8 •4.3	(5.60m) J, 90°, P, R, Fe Vn (5.68m) J, 45°, C, R, Cn (5.82m) J, 45°, Ir, R, Fe Sn (5.90m) J, 90°, Un, R, Fe Sn (6.00m) XWS, 15°, 20 mm.t (6.09m) J, 0°, P, S, Cn (6.15m) XWS, 0°, 5 mm.t (6.50m) J, 90°, Un, Fe Ct (6.82m) J, 45°, P, R, Fe Sn (6.86m) J, 45°, P, R, Cn (6.88m) J, 0°, P, R, Cn (6.98m) J, 80°, P, R, Fe Sn (7.00m) XWS, 0°, 60 mm.t (7.12m) J, 45°, C, R, Fe Sn (7.21m) J, 90°, Ir, R, Fe Sn (7.25m) J, 45°, C, R, Fe Sn (7.59m) J, 45°, Ir, R, Cn (7.61m) J, 30°, P, R, Cn (7.65m) J, 90°, P, R, Fe Sn (7.70m) J, 10°, P, S, Cn (7.80m) J, 45°, Ir, R, Fe Sn (7.87m) J, 60°, Ir, R, Fe Sn	Lismore Basalt



JK 9.02.4 LIB.GLB Log JK CORED BOREHOLE - MASTER 37635UOR NORTHLISMORE.GPJ <<DrawingFile>> 25/06/2025 16:12 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

COPYRIGHT

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

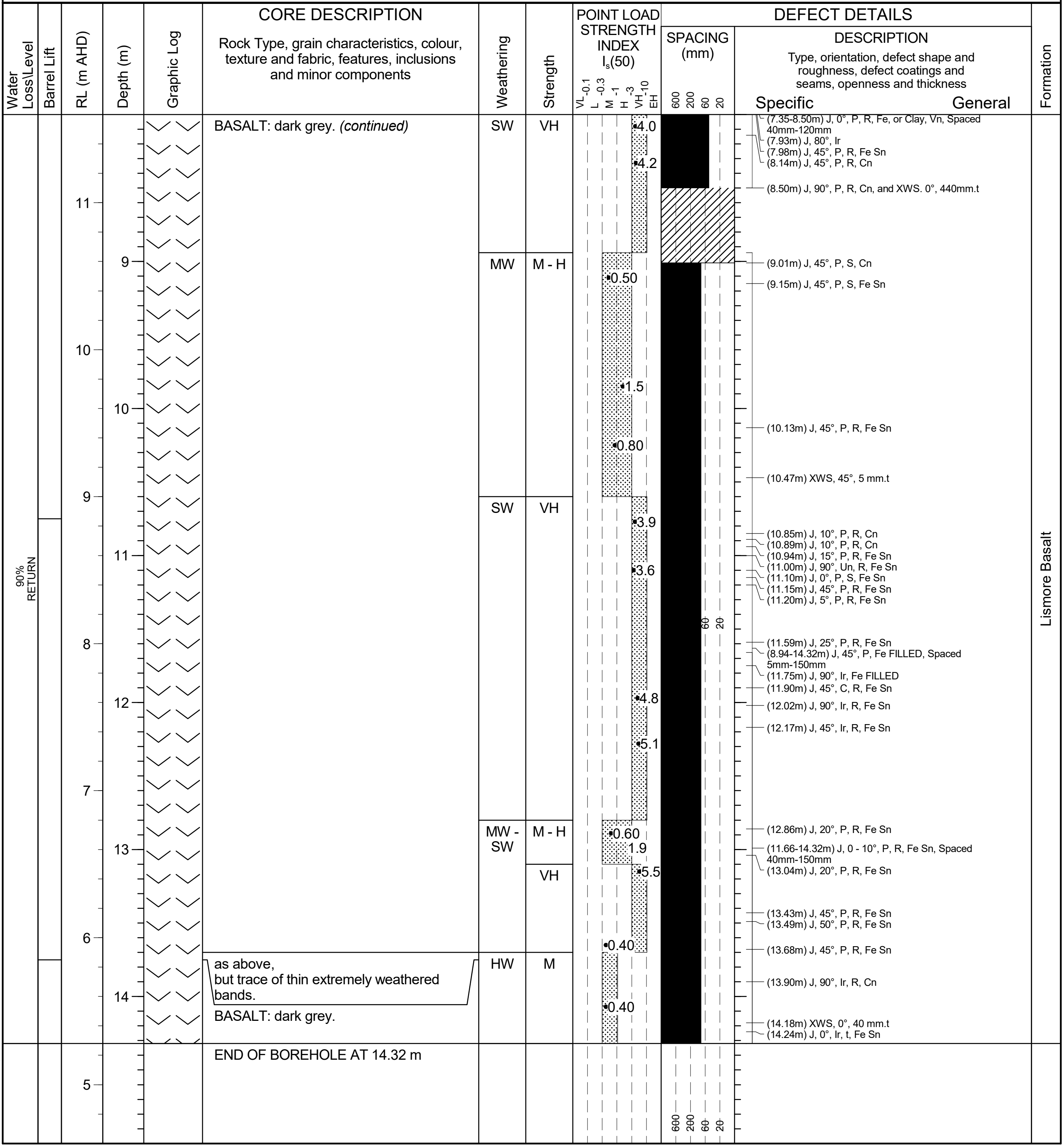
JKGeotechnics

CORED BOREHOLE LOG

Borehole No.
213
3 / 3

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY-RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163 AND 170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 37635UOR
Core Size: NMLC
R.L. Surface: 19.6 m
Date: 3/6/25 TO 4/6/25
Inclination: VERTICAL
Datum: AHD
Plant Type: JK309
Bearing: N/A
Logged/Checked By: A.G./P.R.



Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness (Specific / General)	Formation
90% RETURN		11		BASALT: dark grey. *(continued)*	SW	VH	4.0 4.2	(7.35-8.50m) J, 0°, P, R, Fe, or Clay, Vn, Spaced 40mm-120mm (7.93m) J, 80°, Ir (7.98m) J, 45°, P, R, Fe Sn (8.14m) J, 45°, P, R, Cn (8.50m) J, 90°, P, R, Cn, and XWS. 0°, 440mm.t	Lismore Basalt
		10 9	9 10		MW	M - H	0.50 1.5 0.80	(9.01m) J, 45°, P, S, Cn (9.15m) J, 45°, P, S, Fe Sn (10.13m) J, 45°, P, R, Fe Sn (10.47m) XWS, 45°, 5 mm.t	
		8 7	11 12		SW	VH	3.9 3.6 4.8 5.1	(10.85m) J, 10°, P, R, Cn (10.89m) J, 10°, P, R, Cn (10.94m) J, 15°, P, R, Fe Sn (11.00m) J, 90°, Un, R, Fe Sn (11.10m) J, 0°, P, S, Fe Sn (11.15m) J, 45°, P, R, Fe Sn (11.20m) J, 5°, P, R, Fe Sn (11.59m) J, 25°, P, R, Fe Sn (8.94-14.32m) J, 45°, P, Fe FILLED, Spaced 5mm-150mm (11.75m) J, 90°, Ir, Fe FILLED (11.90m) J, 45°, C, R, Fe Sn (12.02m) J, 90°, Ir, R, Fe Sn (12.17m) J, 45°, Ir, R, Fe Sn	
			13		MW - SW	M - H	0.60 1.9	(12.86m) J, 20°, P, R, Fe Sn (11.66-14.32m) J, 0 - 10°, P, R, Fe Sn, Spaced 40mm-150mm (13.04m) J, 20°, P, R, Fe Sn	
		6				VH	5.5 0.40	(13.43m) J, 45°, P, R, Fe Sn (13.49m) J, 50°, P, R, Fe Sn (13.68m) J, 45°, P, R, Fe Sn	
			14	as above, but trace of thin extremely weathered bands. BASALT: dark grey.	HW	M	0.40	(13.90m) J, 90°, Ir, R, Cn (14.18m) XWS, 0°, 40 mm.t (14.24m) J, 0°, Ir, t, Fe Sn	
		5		END OF BOREHOLE AT 14.32 m					

JK 9.02.4 LIB.GLB Log JK CORED BOREHOLE - MASTER 37635UOR NORTHLISMORE.GPJ <<DrawingFile>> 25/06/2025 16:12 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

COPYRIGHT

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

BOREHOLE LOG

Borehole No.
214
1 / 3

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY-RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163 AND 170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 37635UOR **Method:** SPIRAL AUGER **R.L. Surface:** 14.6 m
Date: 4/6/25 **Datum:** AHD
Plant Type: JK309 **Logged/Checked By:** A.G./P.R.

Groundwater Record	Field Tests	RL (m AHD)	Depth (m)	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING					TOPSOIL: Silty clay, high plasticity, dark brown, trace of root fibres.	w>PL			
				CH	Silty CLAY: high plasticity, dark brown, trace of fine to medium grained basalt and ironstone gravel.	w>PL	St	110 130 190	ALLUVIAL
	N = 5 2,2,3	14	1					160 190 210	
	N = 8 2,3,5	13 12	2				St - VSt	270 340 340 370	
ON COMPLETION OF CORING	N > 13 3,8,5/ 50mm REFUSAL		3		Silty CLAY: high plasticity, light brown and brown, trace of fine to medium grained ironstone gravel.		VSt - Hd	360 360 420	RESIDUAL
		11	4	-	Extremely Weathered BASALT: Silty gravelly clay, low plasticity, brown, fine to medium grained basalt and ironstone gravel.	XW	(Hd)		LISMORE BASALT
	N=SPT 6/ 50mm REFUSAL	10 9	5 6		Extremely Weathered BASALT: Clayey GRAVEL, fine grained, brown, basalt and ironstone gravel.		(VD)		LOW 'TC' BIT RESISTANCE GROUNDWATER MONITORING WELL INSTALLED TO 6.3m DEPTH IN ADJACENT BOREHOLE. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 6.3m TO 1.3m. CASING 0m TO 1.3m. 2mm SAND FILTER PACK 6.3m TO 0.5m. BENTONITE SEAL 0.5m TO 0m.
		8			Extremely Weathered BASALT: Clayey GRAVEL, fine grained, brown, basalt and ironstone gravel, with low to high strength bands of basalt and ironstone.				LOW RESISTANCE WITH OCCASIONAL HIGH RESISTANCE BANDS

SAMPLES: ES U50 DB DS

Graphic Log

JK 9.02.4 LIB.GLB Log JK AUGERHOLE - MASTER 37635UOR NORTHLISMORE.GPJ <<DrawingFile>> 25/06/2025 16:12 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

COPYRIGHT

BOREHOLE LOG

Borehole No.
214
2 / 3

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY-RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163 AND 170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 37635UOR
Method: SPIRAL AUGER
R.L. Surface: 14.6 m
Date: 4/6/25
Datum: AHD
Plant Type: JK309
Logged/Checked By: A.G./P.R.

Groundwater Record	SAMPLES				Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
	ES	U50	DB	DS										
									-	Extremely Weathered BASALT: Clayey GRAVEL, fine grained, brown, basalt and ironstone gravel, with low to high strength bands of basalt and ironstone. *(continued)*	XW	(VD)		LOW RESISTANCE WITH OCCASIONAL HIGH RESISTANCE BANDS
						7								
							8							
						6								
							9							
						5								
							10							
						4								
							11							
						3								
							12							
						2								
							13							HIGH RESISTANCE
						1								

COPYRIGHT

REFER TO CORED BOREHOLE LOG

'TC' BIT REFUSAL

CORED BOREHOLE LOG

Borehole No.
214
3 / 3

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY-RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163 AND 170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 37635UOR
Core Size: NMLC
R.L. Surface: 14.6 m
Date: 4/6/25
Inclination: VERTICAL
Datum: AHD
Plant Type: JK309
Bearing: N/A
Logged/Checked By: A.G./P.R.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL -0.1, L -0.3, M -1, H -3, VH -10, EH	DEFECT DETAILS SPACING (mm) 600 200 60 20	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific General	Formation
		1			START CORING AT 13.95m						
90% RETURN		0	14		BASALT: dark grey, trace of rounded gravel sized green chlorite inclusions.	SW	VH	4.3		(14.03m) J, 45°, P, R, Fe Sn (14.08m) J, 30°, P, R, Fe Sn (14.16m) J, 90°, Un, R, Cn (14.26m) XWS, 20°, 100 mm.t (14.40m) Jh, 85°, P, Chlorite FILLED (14.48m) Jh, 45°, P, Chlorite FILLED (14.53m) J, 45°, P, Chlorite FILLED	Lismore Basalt
						HW	L	0.10		(14.60-14.90m) J, 0 - 45°, P, Fe Sn, Spaced 5mm-40mm	
		-1 -2	15 16			SW	VH	3.6 4.1 4.6 4.1 4.3		(15.14m) J, 35°, P, R, Fe Sn (15.42m) J, 45°, P, R, Cn (16.07m) J, 65°, P, R, Cn (16.30m) J, 15°, P, R, Cn	
		-3 -4 -5	17 18 19		END OF BOREHOLE AT 16.90 m						

JK 9.02.4 LIB.GLB Log JK CORED BOREHOLE - MASTER 37635UOR NORTHLISMORE.GPJ <<DrawingFile>> 25/06/2025 16:12 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

COPYRIGHT

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

BOREHOLE LOG

Borehole No.
215
1 / 1

Client: DEPARTMENT OF EDUCATION
Project: NORTHERN RIVERS FLOOD RECOVERY-RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT
Location: 163 AND 170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: 37635UOR
Method: SPIRAL AUGER
R.L. Surface: 14.568 m
Date: 30/5/25
Datum: AHD
Plant Type: JK300
Logged/Checked By: O.B./K.T.

Groundwater Record	SAMPLES				Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
	ES	U50	DB	DS										
DRY ON COMPLETION	■									TOPSOIL: Silty clay, medium plasticity, dark brown, with root fibres.	w>PL			
	■								CI	Silty CLAY: medium plasticity, dark brown, with numerous clay bands.	w>PL	St		RESIDUAL
										END OF BOREHOLE AT 0.45 m				

JK 9.02.4 LIB.GLB Log JK AUGERHOLE - MASTER 37635UOR NORTHLISMORE.GPJ <<DrawingFile>> 25/06/2025 16:12 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

COPYRIGHT

ENVIRONMENTAL LOG

Log No.
TP303
1/1

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** N/A

Date: 27/5/25 **Datum:** -

Plant Type: - **Logged/Checked by:** O.B./B.P.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	■		■	■	■		0			TOPSOIL: Silty clay, high plasticity, grey brown mottled orange brown, with roots and root fibres.	w>PL			GRASS COVER SCREEN: 10.40kg 0-0.1m, NO FCF
▼	■		■	■					CH	Silty CLAY: high plasticity, grey brown mottled orange brown, trace of roots and root fibres.	w>PL			ALLUVIAL
										END OF TEST PIT AT 0.2m				
							0.5							
							1							
							1.5							
							2							
							2.5							
							3							
							3.5							

COPYRIGHT

JKEnvironments

ENVIRONMENTAL LOG

Log No.
TP305
1/1

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT / SHOVEL **R.L. Surface:** N/A

Date: 27/5/25 **Datum:** -

Plant Type: - **Logged/Checked by:** O.B./B.P.

Groundwater Record	SAMPLES					Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	ES	ASS	ASB	SAL	DB									
DRY ON COMPLETION	■		■	■			0	▨	CH	Silty CLAY: high plasticity, grey brown mottled orange brown, trace of root fibres.	w≈PL			GRASS COVER ALLUVIAL
										END OF TEST PIT AT 0.2m				
							0.5							
							1							
							1.5							
							2							
							2.5							
							3							
							3.5							

COPYRIGHT

JKEnvironments

ENVIRONMENTAL LOG

Log No.
TP308
1/1

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** N/A

Date: 27/5/25 **Datum:** -

Plant Type: EXCAVATOR **Logged/Checked by:** O.B./B.P.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
▶	■		■	■	■		0			TOPSOIL: Silty clay, high plasticity, grey, trace of igneous gravel, roots and root fibres.	w>PL			GRASS COVER
									CH	Silty CLAY: high plasticity, grey brown, trace of roots and root fibres.	w>PL			SCREEN: 10.33kg 0-0.1m, NO FCF ALLUVIAL
▼	■		■	■										
							0.5			END OF TEST PIT AT 0.5m				
							1							
							1.5							
							2							
							2.5							
							3							
							3.5							

COPYRIGHT

JKEnvironments

ENVIRONMENTAL LOG

Log No.
TP309
1/1

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** N/A

Date: 27/5/25 **Datum:** -

Plant Type: EXCAVATOR **Logged/Checked by:** O.B./B.P.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	■		■	■	■		0			TOPSOIL: Silty clay, high plasticity, grey, with roots and root fibres.	w>PL			GRASS COVER SCREEN: 11.76kg 0-0.1m, NO FCF
▼	■		■	■				▨	CH	Silty CLAY: high plasticity, grey brown mottled orange brown, trace of root fibres.	w>PL			ALLUVIAL
							0.5			END OF TEST PIT AT 0.5m				
							1							
							1.5							
							2							
							2.5							
							3							
							3.5							

COPYRIGHT

JKEnvironments

ENVIRONMENTAL LOG

Log No.
TP312
1/1

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** N/A

Date: 27/5/25 **Datum:** -

Plant Type: EXCAVATOR **Logged/Checked by:** O.B./B.P.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	■		■	■	■		0			TOPSOIL: Silty clay, high plasticity, grey brown mottled orange brown, with roots and root fibres.	w>PL			GRASS COVER
▼	■		■	■					CH	Silty CLAY: high plasticity, grey brown mottled orange brown.	w>PL			SCREEN: 11.40kg 0-0.1m, NO FCF ALLUVIAL
							0.5			END OF TEST PIT AT 0.5m				
							1							
							1.5							
							2							
							2.5							
							3							
							3.5							

COPYRIGHT

JKEnvironments

ENVIRONMENTAL LOG

Log No.
TP315
1/1

Environmental logs are not to be used for geotechnical purposes

Client: DEPARTMENT OF EDUCATION

Project: NORTHERN RIVERS FLOOD RECOVERY - RICHMOND RIVER HIGH CAMPUS REDEVELOPMENT

Location: 163-170 ALEXANDRA PARADE, NORTH LISMORE, NSW

Job No.: E36314PT3 **Method:** TEST PIT **R.L. Surface:** N/A

Date: 27/5/25 **Datum:** -

Plant Type: EXCAVATOR **Logged/Checked by:** O.B./B.P.

Groundwater Record	SAMPLES					Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	ES	ASS	ASB	SAL	DB									
DRY ON COMPLETION	■		■	■	■		0			TOPSOIL: Silty clay, high plasticity, grey brown, with roots and root fibres.	w≈PL			GRASS COVER
	■		■	■					CH	Silty CLAY: high plasticity, grey brown and orange brown, trace of roots and root fibres.	w≈PL			SCREEN: 10.90kg 0-0.1m, NO FCF ALLUVIAL
										END OF TEST PIT AT 0.4m				
							0.5							
							1							
							1.5							
							2							
							2.5							
							3							
							3.5							

COPYRIGHT

ENVIRONMENTAL LOGS EXPLANATION NOTES

INTRODUCTION

These notes have been provided to amplify the environmental report in regard to classification methods, field procedures and certain matters relating to the logging of soil and rock. Not all notes are necessarily relevant to all reports.

Where geotechnical borehole logs are utilised for environmental purpose, reference should also be made to the explanatory notes included in the geotechnical report. Environmental logs are not suitable for geotechnical purposes.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Environmental studies include gathering and assimilating limited facts about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and time when the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726:2017 *'Geotechnical Site Investigations'*. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geoenvironmental practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached soil classification table qualified by the grading of other particles present (eg. sandy clay) as set out below:

Soil Classification	Particle Size
Clay	< 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2.36mm
Gravel	2.36 to 63mm
Cobbles	63 to 200mm
Boulders	> 200mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose (VL)	< 4
Loose (L)	4 to 10
Medium dense (MD)	10 to 30
Dense (D)	30 to 50
Very Dense (VD)	> 50

Cohesive soils are classified on the basis of strength (consistency) either by use of a hand penetrometer, vane shear, laboratory testing and/or tactile engineering examination. The strength terms are defined as follows.

Classification	Unconfined Compressive Strength (kPa)	Indicative Undrained Shear Strength (kPa)
Very Soft (VS)	≤ 25	≤ 12
Soft (S)	> 25 and ≤ 50	> 12 and ≤ 25
Firm (F)	> 50 and ≤ 100	> 25 and ≤ 50
Stiff (St)	> 100 and ≤ 200	> 50 and ≤ 100
Very Stiff (VSt)	> 200 and ≤ 400	> 100 and ≤ 200
Hard (Hd)	> 400	> 200
Friable (Fr)	Strength not attainable – soil crumbles	

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'shale' is used to describe fissile mudstone, with a weakness parallel to bedding. Rocks with alternating inter-laminations of different grain size (eg. siltstone/claystone and siltstone/fine grained sandstone) are referred to as 'laminite'.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application. All methods except test pits, hand auger drilling and portable Dynamic Cone Penetrometers require the use of a mechanical rig which is commonly mounted on a truck chassis or track base.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils and 'weaker' bedrock if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for a large excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Refusal of the hand auger can occur on a variety of materials such as obstructions within any fill, tree roots, hard clay, gravel or ironstone, cobbles and boulders, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of limited reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock cuttings. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be assessed from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term 'mud' encompasses a range of products ranging from bentonite to polymers. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (eg. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, NMLC or HQ triple tube core barrels, which give a core of about 50mm and 61mm diameter, respectively, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as NO CORE. The location of NO CORE recovery is determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the bottom of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils, as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289.6.3.1–2004 (R2016) *'Methods of Testing Soils for Engineering Purposes, Soil Strength and Consolidation Tests – Determination of the Penetration Resistance of a Soil – Standard Penetration Test (SPT)'*.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63.5kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In the case where full penetration is obtained with successive blow counts for each 150mm of, say, 4, 6 and 7 blows, as

  N = 13
  4, 6, 7
- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm, as

  N > 30
  15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

A modification to the SPT is where the same driving system is used with a solid 60° tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as 'N_c' on the borehole logs, together with the number of blows per 150mm penetration.

LOGS

The borehole or test pit logs presented herein are an interpretation of the subsurface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will enable the most reliable assessment, but is not always practicable or possible to justify on economic grounds. In any case, the boreholes or test pits represent only a very small sample of the total subsurface conditions.

The terms and symbols used in preparation of the logs are defined in the following pages.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than 'straight line' variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

Where groundwater levels are measured in boreholes, there are several potential problems:

- Although groundwater may be present, in low permeability soils it may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction.
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole or 'reverted' chemically if reliable water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after the groundwater level has stabilised at intervals ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (eg. bricks, steel, etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably assess the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse environmental characteristics or behaviour. If the volume and nature of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing has not been undertaken to confirm the soil classification and rock strengths indicated on the environmental logs unless noted in the report.

SYMBOL LEGENDS

SOIL

- ▩ FILL
- ≋ TOPSOIL
- ▨ CLAY (CL, CI, CH)
- ▥ SILT (ML, MH)
- ░ SAND (SP, SW)
- ⬚ GRAVEL (GP, GW)
- ▨ SANDY CLAY (CL, CI, CH)
- ▨ SILTY CLAY (CL, CI, CH)
- ▨ CLAYEY SAND (SC)
- ▥ SILTY SAND (SM)
- ▨ GRAVELLY CLAY (CL, CI, CH)
- ▨ CLAYEY GRAVEL (GC)
- ▥ SANDY SILT (ML, MH)
- ⁂ PEAT AND HIGHLY ORGANIC SOILS (Pt)

ROCK

- ⬚ CONGLOMERATE
- ░ SANDSTONE
- ▤ SHALE/MUDSTONE
- ▥ SILTSTONE
- ▤ CLAYSTONE
- ■ COAL
- ▥ LAMINITE
- ▦ LIMESTONE
- ≋ PHYLLITE, SCHIST
- ▤ TUFF
- ░ GRANITE, GABBRO
- ✚ DOLERITE, DIORITE
- ∨ BASALT, ANDESITE
- ≈ QUARTZITE

OTHER MATERIALS

- ▦ BRICKS OR PAVERS
- ░ CONCRETE
- ■ ASPHALTIC CONCRETE

CLASSIFICATION OF COARSE AND FINE GRAINED SOILS

Major Divisions		Group Symbol	Typical Names	Field Classification of Sand and Gravel	Laboratory Classification	
Coarse grained soil (more than 65% of soil excluding oversize fraction is greater than 0.075mm)	GRAVEL (more than half of coarse fraction is larger than 2.36mm	GW	Gravel and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 4$ $1 < C_c < 3$
		GP	Gravel and gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		GM	Gravel-silt mixtures and gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	Fines behave as silt
		GC	Gravel-clay mixtures and gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	Fines behave as clay
	SAND (more than half of coarse fraction is smaller than 2.36mm)	SW	Sand and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 6$ $1 < C_c < 3$
		SP	Sand and gravel-sand mixtures, little or no fines	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		SM	Sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	N/A
		SC	Sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	

Major Divisions		Group Symbol	Typical Names	Field Classification of Silt and Clay			Laboratory Classification
				Dry Strength	Dilatancy	Toughness	% < 0.075mm
ine grained soils (more than 35% of soil excluding oversize fraction is less than 0.075mm)	SILT and CLAY (low to medium plasticity)	ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity	None to low	Slow to rapid	Low	Below A line
		CL, CI	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay	Medium to high	None to slow	Medium	Above A line
		OL	Organic silt	Low to medium	Slow	Low	Below A line
	SILT and CLAY (high plasticity)	MH	Inorganic silt	Low to medium	None to slow	Low to medium	Below A line
		CH	Inorganic clay of high plasticity	High to very high	None	High	Above A line
		OH	Organic clay of medium to high plasticity, organic silt	Medium to high	None to very slow	Low to medium	Below A line
	Highly organic soil	Pt	Peat, highly organic soil	–	–	–	–

Laboratory Classification Criteria

A well graded coarse grained soil is one for which the coefficient of uniformity $Cu > 4$ and the coefficient of curvature $1 < C_c < 3$. Otherwise, the soil is poorly graded. These coefficients are given by:

$$C_U = \frac{D_{60}}{D_{10}} \quad and \quad C_C = \frac{(D_{30})^2}{D_{10}\,D_{60}}$$

Where D_{10}, D_{30} and D_{60} are those grain sizes for which 10%, 30% and 60% of the soil grains, respectively, are smaller.

NOTES:

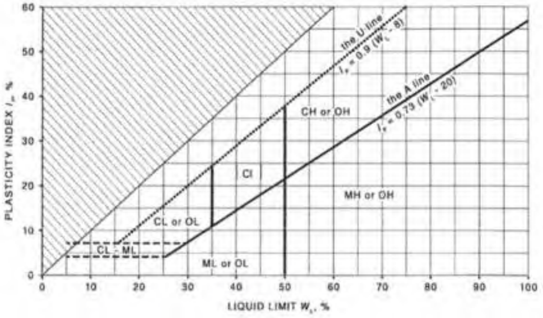
1 For a coarse grained soil with a fines content between 5% and 12%, the soil is given a dual classification comprising the two group symbols separated by a dash; for example, for a poorly graded gravel with between 5% and 12% silt fines, the classification is GP-GM.

2 Where the grading is determined from laboratory tests, it is defined by coefficients of curvature (C_c) and uniformity (C_u) derived from the particle size distribution curve.

3 Clay soils with liquid limits > 35% and ≤ 50% may be classified as being of medium plasticity.

4 The U line on the Modified Casagrande Chart is an approximate upper bound for most natural soils.

Modified Casagrande Chart for Classifying Silts and Clays according to their Behaviour



LOG SYMBOLS

Log Column	Symbol	Definition		
Groundwater Record	─▼─	Standing water level. Time delay following completion of drilling/excavation may be shown.		
	─C─	Extent of borehole/test pit collapse shortly after drilling/excavation.		
	▶─	Groundwater seepage into borehole or test pit noted during drilling or excavation.		
Samples	ES	Sample taken over depth indicated, for environmental analysis.		
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.		
	DB	Bulk disturbed sample taken over depth indicated.		
	DS	Small disturbed bag sample taken over depth indicated.		
	ASB	Soil sample taken over depth indicated, for asbestos analysis.		
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.		
	SAL	Soil sample taken over depth indicated, for salinity analysis.		
	PFAS	Soil sample taken over depth indicated, for analysis of Per- and Polyfluoroalkyl Substances.		
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration. 'Refusal' refers to apparent hammer refusal within the corresponding 150mm depth increment.		
	N_c = 5 7 3R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60° solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.		
	VNS = 25	Vane shear reading in kPa of undrained shear strength.		
	PID = 100	Photoionisation detector reading in ppm (soil sample headspace test).		
Moisture Condition (Fine Grained Soils)	*w* > PL	Moisture content estimated to be greater than plastic limit.		
	w ≈ PL	Moisture content estimated to be approximately equal to plastic limit.		
	w < PL	Moisture content estimated to be less than plastic limit.		
	w ≈ LL	Moisture content estimated to be near liquid limit.		
	w > LL	Moisture content estimated to be wet of liquid limit.		
(Coarse Grained Soils)	D	DRY – runs freely through fingers.		
	M	MOIST – does not run freely but no free water visible on soil surface.		
	W	WET – free water visible on soil surface.		
Strength (Consistency) Cohesive Soils	VS	VERY SOFT – unconfined compressive strength ≤ 25kPa.		
	S	SOFT – unconfined compressive strength > 25kPa and ≤ 50kPa.		
	F	FIRM – unconfined compressive strength > 50kPa and ≤ 100kPa.		
	St	STIFF – unconfined compressive strength > 100kPa and ≤ 200kPa.		
	VSt	VERY STIFF – unconfined compressive strength > 200kPa and ≤ 400kPa.		
	Hd	HARD – unconfined compressive strength > 400kPa.		
	Fr	FRIABLE – strength not attainable, soil crumbles.		
	( )	Bracketed symbol indicates estimated consistency based on tactile examination or other assessment.		
Density Index/ Relative Density (Cohesionless Soils)			**Density Index (I_D) Range (%)**	**SPT 'N' Value Range (Blows/300mm)**
	VL	VERY LOOSE	≤ 15	0 – 4
	L	LOOSE	> 15 and ≤ 35	4 – 10
	MD	MEDIUM DENSE	> 35 and ≤ 65	10 – 30
	D	DENSE	> 65 and ≤ 85	30 – 50
	VD	VERY DENSE	> 85	> 50
	( )	Bracketed symbol indicates estimated density based on ease of drilling or other assessment.		

Log Column	Symbol	Definition
Hand Penetrometer Readings	300 250	Measures reading in kPa of unconfined compressive strength. Numbers indicate individual test results on representative undisturbed material unless noted otherwise.
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Twin pronged tungsten carbide bit.
	T_{60}	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.
	Soil Origin	The geological origin of the soil can generally be described as: RESIDUAL – soil formed directly from insitu weathering of the underlying rock. No visible structure or fabric of the parent rock. EXTREMELY WEATHERED – soil formed directly from insitu weathering of the underlying rock. Material is of soil strength but retains the structure and/or fabric of the parent rock. ALLUVIAL – soil deposited by creeks and rivers. ESTUARINE – soil deposited in coastal estuaries, including sediments caused by inflowing creeks and rivers, and tidal currents. MARINE – soil deposited in a marine environment. AEOLIAN – soil carried and deposited by wind. COLLUVIAL – soil and rock debris transported downslope by gravity, with or without the assistance of flowing water. Colluvium is usually a thick deposit formed from a landslide. The description 'slopewash' is used for thinner surficial deposits. LITTORAL – beach deposited soil.

Classification of Material Weathering

Term		Abbreviation		Definition
Residual Soil		RS		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered		XW		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly Weathered	Distinctly Weathered (Note 1)	HW	DW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered		MW		The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered		SW		Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh		FR		Rock shows no sign of decomposition of individual minerals or colour changes.

NOTE 1: The term 'Distinctly Weathered' is used where it is not practicable to distinguish between 'Highly Weathered' and 'Moderately Weathered' rock. 'Distinctly Weathered' is defined as follows: *'Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores'*. There is some change in rock strength.

Rock Material Strength Classification

			Guide to Strength	
Term	**Abbreviation**	**Uniaxial Compressive Strength (MPa)**	**Point Load Strength Index $Is_{(50)}$ (MPa)**	**Field Assessment**
Very Low Strength	VL	0.6 to 2	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30mm thick can be broken by finger pressure.
Low Strength	L	2 to 6	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium Strength	M	6 to 20	0.3 to 1	Scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High Strength	H	20 to 60	1 to 3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High Strength	VH	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High Strength	EH	> 200	> 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Appendix F: Laboratory Report/s & COC Documents

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200   fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 382356

Client Details

Client	JK Environments
Attention	C Ridley
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E36314PT North Lismore**
Number of Samples	81 Soil
Date samples received	03/06/2025
Date completed instructions received	03/06/2025

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	11/06/2025
Date of Issue	11/06/2025

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Nick Sarlamis, Assistant Operation Manager
Tabitha Roberts, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

Texture and Salinity*						
Our Reference		382356-1	382356-2	382356-3	382356-4	382356-5
Your Reference	UNITS	TP201	TP201	TP202	TP202	TP202
Depth		0-0.2	0.4-0.5	0-0.1	0.9-1	2-2.1
Date Sampled		19/05/2025	19/05/2025	20/05/2025	20/05/2025	20/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Date analysed	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Electrical Conductivity 1:5 soil:water	µS/cm	77	64	140	430	1,500
Texture Value	-	9.0	9.0	9.0	8.0	9.0
Texture	-	CLAY LOAM	CLAY LOAM	CLAY LOAM	LIGHT MEDIUM CLAY	CLAY LOAM
ECe	dS/m	<2	<2	<2	3.5	13
Class	-	NON SALINE	NON SALINE	NON SALINE	SLIGHTLY SALINE	VERY SALINE

Texture and Salinity*						
Our Reference		382356-6	382356-7	382356-8	382356-9	382356-10
Your Reference	UNITS	TP202	TP202	TP203	TP203	TP203
Depth		3-3.1	3.5-3.6	0-0.1	1-1.1	2-2.1
Date Sampled		20/05/2025	20/05/2025	20/05/2025	20/05/2025	20/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Date analysed	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Electrical Conductivity 1:5 soil:water	µS/cm	930	58	710	290	410
Texture Value	-	8.0	9.0	8.5	8.5	8.0
Texture	-	LIGHT MEDIUM CLAY	CLAY LOAM	LIGHT CLAY	LIGHT CLAY	LIGHT MEDIUM CLAY
ECe	dS/m	7.4	<2	6.1	2.5	3.3
Class	-	MODERATELY SALINE	NON SALINE	MODERATELY SALINE	SLIGHTLY SALINE	SLIGHTLY SALINE

Texture and Salinity*						
Our Reference		382356-11	382356-12	382356-13	382356-14	382356-15
Your Reference	UNITS	TP203	TP204	TP204	TP204	TP204
Depth		3-3.1	0-0.1	1-1.1	2.1-2.2	3-3.1
Date Sampled		20/05/2025	20/05/2025	20/05/2025	20/05/2025	20/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Date analysed	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Electrical Conductivity 1:5 soil:water	µS/cm	200	1,800	610	290	310
Texture Value	-	8.0	9.0	8.5	8.5	8.0
Texture	-	LIGHT MEDIUM CLAY	CLAY LOAM	LIGHT CLAY	LIGHT CLAY	LIGHT MEDIUM CLAY
ECe	dS/m	<2	16	5.2	2.5	2.5
Class	-	NON SALINE	HIGHLY SALINE	MODERATELY SALINE	SLIGHTLY SALINE	SLIGHTLY SALINE

Texture and Salinity*						
Our Reference		382356-16	382356-18	382356-19	382356-20	382356-21
Your Reference	UNITS	TP205	TP205	TP205	TP205	TP206
Depth		0-0.2	1-1.1	2-2.1	2.6-2.8	0-0.1
Date Sampled		19/05/2025	19/05/2025	19/05/2025	19/05/2025	20/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Date analysed	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Electrical Conductivity 1:5 soil:water	µS/cm	120	22	31	43	150
Texture Value	-	9.0	9.0	9.0	14	9.0
Texture	-	CLAY LOAM	CLAY LOAM	CLAY LOAM	SANDY LOAM	CLAY LOAM
ECe	dS/m	<2	<2	<2	<2	<2
Class	-	NON SALINE	NON SALINE	NON SALINE	NON SALINE	NON SALINE

Texture and Salinity*						
Our Reference		382356-22	382356-23	382356-24	382356-25	382356-26
Your Reference	UNITS	TP206	TP206	TP207	TP207	TP207
Depth		0.4-0.5	0.9-1	0-0.1	0.5-0.6	1-1.1
Date Sampled		20/05/2025	20/05/2025	21/05/2025	21/05/2025	21/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Date analysed	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Electrical Conductivity 1:5 soil:water	µS/cm	51	13	190	560	430
Texture Value	-	9.0	6.0	8.5	8.5	8.5
Texture	-	CLAY LOAM	HEAVY CLAY	LIGHT CLAY	LIGHT CLAY	LIGHT CLAY
ECe	dS/m	<2	<2	<2	4.7	3.7
Class	-	NON SALINE	NON SALINE	NON SALINE	MODERATELY SALINE	SLIGHTLY SALINE

Texture and Salinity*						
Our Reference		382356-27	382356-28	382356-29	382356-30	382356-31
Your Reference	UNITS	TP207	TP207	TP207	TP208	TP208
Depth		1.4-1.5	2-2.1	2.5-2.6	0-0.1	1-1.1
Date Sampled		21/05/2025	21/05/2025	21/05/2025	21/05/2025	21/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Date analysed	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Electrical Conductivity 1:5 soil:water	µS/cm	110	50	88	530	1,600
Texture Value	-	6.0	6.0	6.0	8.5	8.5
Texture	-	HEAVY CLAY	HEAVY CLAY	HEAVY CLAY	LIGHT CLAY	LIGHT CLAY
ECe	dS/m	<2	<2	<2	4.5	14
Class	-	NON SALINE	NON SALINE	NON SALINE	MODERATELY SALINE	VERY SALINE

Texture and Salinity*						
Our Reference		382356-32	382356-33	382356-34	382356-35	382356-36
Your Reference	UNITS	TP208	TP208	TP208	TP209	TP209
Depth		1.6-1.7	2.3-2.4	3-3.1	0-0.2	1-1.1
Date Sampled		21/05/2025	21/05/2025	21/05/2025	19/05/2025	19/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Date analysed	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Electrical Conductivity 1:5 soil:water	µS/cm	1,400	1,100	970	130	390
Texture Value	-	8.0	8.5	9.0	8.5	8.0
Texture	-	LIGHT MEDIUM CLAY	LIGHT CLAY	CLAY LOAM	LIGHT CLAY	LIGHT MEDIUM CLAY
ECe	dS/m	11	9.2	8.7	<2	3.1
Class	-	VERY SALINE	VERY SALINE	VERY SALINE	NON SALINE	SLIGHTLY SALINE

Texture and Salinity*						
Our Reference		382356-37	382356-38	382356-39	382356-40	382356-41
Your Reference	UNITS	TP209	TP209	TP209	TP210	TP210
Depth		1.9-2	2.8-2.9	3.7-3.9	0-0.1	0.5-0.6
Date Sampled		19/05/2025	19/05/2025	19/05/2025	20/05/2025	20/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/06/2025	04/06/2025	04/06/2025	10/06/2025	10/06/2025
Date analysed	-	04/06/2025	04/06/2025	04/06/2025	10/06/2025	10/06/2025
Electrical Conductivity 1:5 soil:water	µS/cm	1,400	1,100	180	370	330
Texture Value	-	9.0	7.0	6.0	9.0	9.0
Texture	-	CLAY LOAM	MEDIUM CLAY	HEAVY CLAY	CLAY LOAM	CLAY LOAM
ECe	dS/m	12	7.7	<2	3.3	3.0
Class	-	VERY SALINE	MODERATELY SALINE	NON SALINE	SLIGHTLY SALINE	SLIGHTLY SALINE

Texture and Salinity*						
Our Reference		382356-42	382356-48	382356-49	382356-50	382356-51
Your Reference	UNITS	TP210	BH213	BH213	BH214	BH214
Depth		0.7-0.8	0-0.1	0.5-0.6	0-0.1	1-1.1
Date Sampled		20/05/2025	29/05/2025	29/05/2025	30/05/2025	30/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Date analysed	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Electrical Conductivity 1:5 soil:water	µS/cm	81	320	48	250	490
Texture Value	-	6.0	9.0	9.0	9.0	8.0
Texture	-	HEAVY CLAY	CLAY LOAM	CLAY LOAM	CLAY LOAM	LIGHT MEDIUM CLAY
ECe	dS/m	<2	2.8	<2	2.3	3.9
Class	-	NON SALINE	SLIGHTLY SALINE	NON SALINE	SLIGHTLY SALINE	SLIGHTLY SALINE

Texture and Salinity*						
Our Reference		382356-52	382356-54	382356-67	382356-68	382356-69
Your Reference	UNITS	BH214	BH215	TP301	TP301	TP303
Depth		2-2.1	0-0.1	0-0.1	0.9-1	0-0.1
Date Sampled		30/05/2025	30/05/2025	27/05/2025	27/05/2025	27/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Date analysed	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Electrical Conductivity 1:5 soil:water	µS/cm	1,400	490	230	44	1,300
Texture Value	-	9.0	9.0	9.0	6.0	9.0
Texture	-	CLAY LOAM	CLAY LOAM	CLAY LOAM	HEAVY CLAY	CLAY LOAM
ECe	dS/m	13	4.4	2.0	<2	12
Class	-	VERY SALINE	MODERATELY SALINE	SLIGHTLY SALINE	NON SALINE	VERY SALINE

Texture and Salinity*						
Our Reference		382356-70	382356-71	382356-73	382356-74	382356-75
Your Reference	UNITS	TP303	TP305	TP308	TP308	TP309
Depth		0.1-0.2	0-0.1	0-0.1	0.4-0.5	0-0.1
Date Sampled		27/05/2025	27/05/2025	27/05/2025	27/05/2025	27/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Date analysed	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Electrical Conductivity 1:5 soil:water	µS/cm	1,300	140	1,100	1,100	740
Texture Value	-	9.0	9.0	9.0	9.0	9.0
Texture	-	CLAY LOAM	CLAY LOAM	CLAY LOAM	CLAY LOAM	CLAY LOAM
ECe	dS/m	12	<2	10	9.5	6.7
Class	-	VERY SALINE	NON SALINE	VERY SALINE	VERY SALINE	MODERATELY SALINE

Texture and Salinity*						
Our Reference		382356-76	382356-77	382356-78	382356-79	382356-80
Your Reference	UNITS	TP309	TP312	TP312	TP315	TP315
Depth		0.4-0.5	0-0.1	0.4-0.5	0-0.1	0.3-0.4
Date Sampled		27/05/2025	27/05/2025	27/05/2025	27/05/2025	27/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Date analysed	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Electrical Conductivity 1:5 soil:water	µS/cm	250	1,800	1,300	260	450
Texture Value	-	8.5	8.0	8.0	9.0	8.0
Texture	-	LIGHT CLAY	LIGHT MEDIUM CLAY	LIGHT MEDIUM CLAY	CLAY LOAM	LIGHT MEDIUM CLAY
ECe	dS/m	2.1	15	11	2.4	3.6
Class	-	SLIGHTLY SALINE	VERY SALINE	VERY SALINE	SLIGHTLY SALINE	SLIGHTLY SALINE

Misc Inorg - Soil						
Our Reference		382356-1	382356-2	382356-3	382356-4	382356-5
Your Reference	UNITS	TP201	TP201	TP202	TP202	TP202
Depth		0-0.2	0.4-0.5	0-0.1	0.9-1	2-2.1
Date Sampled		19/05/2025	19/05/2025	20/05/2025	20/05/2025	20/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
pH 1:5 soil:water	pH Units	7.4	6.7	6.3	7.3	7.7
Chloride, Cl 1:5 soil:water	mg/kg	22	36	10	290	1,500
Sulphate, SO4 1:5 soil:water	mg/kg	30	25	51	200	810
Resistivity in soil*	ohm m	130	160	74	23	6.7

Misc Inorg - Soil						
Our Reference		382356-6	382356-7	382356-8	382356-9	382356-10
Your Reference	UNITS	TP202	TP202	TP203	TP203	TP203
Depth		3-3.1	3.5-3.6	0-0.1	1-1.1	2-2.1
Date Sampled		20/05/2025	20/05/2025	20/05/2025	20/05/2025	20/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
pH 1:5 soil:water	pH Units	7.7	8.6	5.3	7.1	7.8
Chloride, Cl 1:5 soil:water	mg/kg	890	28	560	170	170
Sulphate, SO4 1:5 soil:water	mg/kg	230	10	230	250	180
Resistivity in soil*	ohm m	11	170	14	34	24

Misc Inorg - Soil						
Our Reference		382356-11	382356-12	382356-13	382356-14	382356-15
Your Reference	UNITS	TP203	TP204	TP204	TP204	TP204
Depth		3-3.1	0-0.1	1-1.1	2.1-2.2	3-3.1
Date Sampled		20/05/2025	20/05/2025	20/05/2025	20/05/2025	20/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
pH 1:5 soil:water	pH Units	7.3	6.2	5.0	7.1	7.8
Chloride, Cl 1:5 soil:water	mg/kg	120	3,500	390	170	170
Sulphate, SO4 1:5 soil:water	mg/kg	130	410	440	190	100
Resistivity in soil*	ohm m	50	5.5	16	34	32

Misc Inorg - Soil						
Our Reference		382356-16	382356-18	382356-19	382356-20	382356-21
Your Reference	UNITS	TP205	TP205	TP205	TP205	TP206
Depth		0-0.2	1-1.1	2-2.1	2.6-2.8	0-0.1
Date Sampled		19/05/2025	19/05/2025	19/05/2025	19/05/2025	20/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
pH 1:5 soil:water	pH Units	5.9	6.9	6.6	6.7	5.8
Chloride, Cl 1:5 soil:water	mg/kg	10	<10	28	20	<10
Sulphate, SO4 1:5 soil:water	mg/kg	39	<10	48	<10	43
Resistivity in soil*	ohm m	86	450	320	230	65

Misc Inorg - Soil						
Our Reference		382356-22	382356-23	382356-24	382356-25	382356-26
Your Reference	UNITS	TP206	TP206	TP207	TP207	TP207
Depth		0.4-0.5	0.9-1	0-0.1	0.5-0.6	1-1.1
Date Sampled		20/05/2025	20/05/2025	21/05/2025	21/05/2025	21/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
pH 1:5 soil:water	pH Units	6.3	7.2	5.8	6.4	8.0
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	96	490	210
Sulphate, SO4 1:5 soil:water	mg/kg	20	<10	42	390	200
Resistivity in soil*	ohm m	200	780	53	18	23

Misc Inorg - Soil						
Our Reference		382356-27	382356-28	382356-29	382356-30	382356-31
Your Reference	UNITS	TP207	TP207	TP207	TP208	TP208
Depth		1.4-1.5	2-2.1	2.5-2.6	0-0.1	1-1.1
Date Sampled		21/05/2025	21/05/2025	21/05/2025	21/05/2025	21/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
pH 1:5 soil:water	pH Units	8.3	8.6	8.7	5.8	6.1
Chloride, Cl 1:5 soil:water	mg/kg	40	<10	<10	410	1,800
Sulphate, SO4 1:5 soil:water	mg/kg	41	<10	<10	260	290
Resistivity in soil*	ohm m	87	200	110	19	6.3

Misc Inorg - Soil						
Our Reference		382356-32	382356-33	382356-34	382356-35	382356-36
Your Reference	UNITS	TP208	TP208	TP208	TP209	TP209
Depth		1.6-1.7	2.3-2.4	3-3.1	0-0.2	1-1.1
Date Sampled		21/05/2025	21/05/2025	21/05/2025	19/05/2025	19/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
pH 1:5 soil:water	pH Units	7.0	7.2	7.3	6.1	6.8
Chloride, Cl 1:5 soil:water	mg/kg	1,500	1,300	1,000	20	290
Sulphate, SO4 1:5 soil:water	mg/kg	220	180	180	32	160
Resistivity in soil*	ohm m	7.3	9.2	10	76	26

Misc Inorg - Soil						
Our Reference		382356-37	382356-38	382356-39	382356-40	382356-41
Your Reference	UNITS	TP209	TP209	TP209	TP210	TP210
Depth		1.9-2	2.8-2.9	3.7-3.9	0-0.1	0.5-0.6
Date Sampled		19/05/2025	19/05/2025	19/05/2025	20/05/2025	20/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
pH 1:5 soil:water	pH Units	7.6	7.7	8.1	6.5	6.6
Chloride, Cl 1:5 soil:water	mg/kg	1,300	1,100	170	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	480	410	95	23	<10
Resistivity in soil*	ohm m	7.4	9.1	57	27	30

Misc Inorg - Soil						
Our Reference		382356-42	382356-48	382356-49	382356-50	382356-51
Your Reference	UNITS	TP210	BH213	BH213	BH214	BH214
Depth		0.7-0.8	0-0.1	0.5-0.6	0-0.1	1-1.1
Date Sampled		20/05/2025	29/05/2025	29/05/2025	30/05/2025	30/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
pH 1:5 soil:water	pH Units	6.9	6.2	6.7	6.3	6.6
Chloride, Cl 1:5 soil:water	mg/kg	<10	20	<10	10	450
Sulphate, SO4 1:5 soil:water	mg/kg	<10	25	10	20	180
Resistivity in soil*	ohm m	120	32	210	40	20

Misc Inorg - Soil						
Our Reference		382356-52	382356-54	382356-67	382356-68	382356-69
Your Reference	UNITS	BH214	BH215	TP301	TP301	TP303
Depth		2-2.1	0-0.1	0-0.1	0.9-1	0-0.1
Date Sampled		30/05/2025	30/05/2025	27/05/2025	27/05/2025	27/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
pH 1:5 soil:water	pH Units	7.2	6.4	6.2	7.2	6.0
Chloride, Cl 1:5 soil:water	mg/kg	1,500	68	10	<10	1,000
Sulphate, SO4 1:5 soil:water	mg/kg	390	70	20	<10	140
Resistivity in soil*	ohm m	7.1	21	44	230	7.5

Misc Inorg - Soil						
Our Reference		382356-70	382356-71	382356-73	382356-74	382356-75
Your Reference	UNITS	TP303	TP305	TP308	TP308	TP309
Depth		0.1-0.2	0-0.1	0-0.1	0.4-0.5	0-0.1
Date Sampled		27/05/2025	27/05/2025	27/05/2025	27/05/2025	27/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
pH 1:5 soil:water	pH Units	5.1	5.2	4.9	5.0	5.3
Chloride, Cl 1:5 soil:water	mg/kg	1,100	20	650	950	150
Sulphate, SO4 1:5 soil:water	mg/kg	690	63	320	560	70
Resistivity in soil*	ohm m	7.5	72	8.7	9.4	13

Misc Inorg - Soil						
Our Reference		382356-76	382356-77	382356-78	382356-79	382356-80
Your Reference	UNITS	TP309	TP312	TP312	TP315	TP315
Depth		0.4-0.5	0-0.1	0.4-0.5	0-0.1	0.3-0.4
Date Sampled		27/05/2025	27/05/2025	27/05/2025	27/05/2025	27/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
pH 1:5 soil:water	pH Units	5.6	5.0	4.5	5.1	5.4
Chloride, Cl 1:5 soil:water	mg/kg	82	2,000	1,300	77	98
Sulphate, SO4 1:5 soil:water	mg/kg	190	710	630	44	65
Resistivity in soil*	ohm m	40	5.4	7.6	38	22

CEC						
Our Reference		382356-2	382356-3	382356-9	382356-12	382356-16
Your Reference	UNITS	TP201	TP202	TP203	TP204	TP205
Depth		0.4-0.5	0-0.1	1-1.1	0-0.1	0-0.2
Date Sampled		19/05/2025	20/05/2025	20/05/2025	20/05/2025	19/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Date analysed	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Exchangeable Ca	meq/100g	17	15	7.1	13	17
Exchangeable K	meq/100g	0.1	0.9	<0.1	0.8	1.7
Exchangeable Mg	meq/100g	8.0	6.7	5.5	14	7.3
Exchangeable Na	meq/100g	1.9	0.1	1.3	2.4	0.1
Cation Exchange Capacity	meq/100g	27	23	14	31	26

CEC						
Our Reference		382356-21	382356-25	382356-30	382356-35	382356-40
Your Reference	UNITS	TP206	TP207	TP208	TP209	TP210
Depth		0-0.1	0.5-0.6	0-0.1	0-0.2	0-0.1
Date Sampled		20/05/2025	21/05/2025	21/05/2025	19/05/2025	20/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Date analysed	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Exchangeable Ca	meq/100g	17	4.9	16	19	15
Exchangeable K	meq/100g	1.4	<0.1	0.1	0.2	2.1
Exchangeable Mg	meq/100g	8.5	4.5	14	8.4	7.1
Exchangeable Na	meq/100g	<0.1	1.9	1.4	0.4	<0.1
Cation Exchange Capacity	meq/100g	27	11	32	28	24

CEC						
Our Reference		382356-49	382356-51	382356-54	382356-67	382356-69
Your Reference	UNITS	BH213	BH214	BH215	TP301	TP303
Depth		0.5-0.6	1-1.1	0-0.1	0-0.1	0-0.1
Date Sampled		29/05/2025	30/05/2025	30/05/2025	27/05/2025	27/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Date analysed	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Exchangeable Ca	meq/100g	28	21	19	18	13
Exchangeable K	meq/100g	<0.1	<0.1	0.9	0.2	0.8
Exchangeable Mg	meq/100g	8.5	13	9.6	7.9	12
Exchangeable Na	meq/100g	0.3	1.4	0.2	<0.1	2.1
Cation Exchange Capacity	meq/100g	36	36	30	26	27

CEC						
Our Reference		382356-71	382356-74	382356-75	382356-77	382356-79
Your Reference	UNITS	TP305	TP308	TP309	TP312	TP315
Depth		0-0.1	0.4-0.5	0-0.1	0-0.1	0-0.1
Date Sampled		27/05/2025	27/05/2025	27/05/2025	27/05/2025	27/05/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Date analysed	-	10/06/2025	10/06/2025	10/06/2025	10/06/2025	10/06/2025
Exchangeable Ca	meq/100g	19	17	17	22	23
Exchangeable K	meq/100g	0.2	0.2	0.9	0.2	0.2
Exchangeable Mg	meq/100g	16	11	9.7	21	18
Exchangeable Na	meq/100g	0.7	0.9	0.7	1.9	0.9
Cation Exchange Capacity	meq/100g	35	30	28	45	42

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA 22nd ED 2510 and Rayment & Lyons. Resistivity is calculated from Conductivity (non NATA). Resistivity (calculated) may not correlate with results otherwise obtained using Resistivity-Current method, depending on the nature of the soil being analysed.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
INORG-123	Determined using a "Texture by Feel" method.
Metals-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-OES analytical finish.

QUALITY CONTROL: Texture and Salinity*					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			04/06/2025	1	04/06/2025	04/06/2025		04/06/2025	[NT]
Date analysed	-			04/06/2025	1	04/06/2025	04/06/2025		04/06/2025	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	77	68	12	101	[NT]
Texture Value	-		INORG-123	[NT]	1	9.0	9.0	0	[NT]	[NT]

QUALITY CONTROL: Texture and Salinity*					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			[NT]	11	04/06/2025	04/06/2025		04/06/2025	[NT]
Date analysed	-			[NT]	11	04/06/2025	04/06/2025		04/06/2025	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	[NT]	11	200	200	0	101	[NT]
Texture Value	-		INORG-123	[NT]	11	8.0	[NT]		[NT]	[NT]

QUALITY CONTROL: Texture and Salinity*					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date prepared	-			[NT]	22	04/06/2025	04/06/2025		04/06/2025	[NT]
Date analysed	-			[NT]	22	04/06/2025	04/06/2025		04/06/2025	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	[NT]	22	51	51	0	102	[NT]
Texture Value	-		INORG-123	[NT]	22	9.0	9.0	0	[NT]	[NT]

Client Reference: E36314PT North Lismore

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	382356-2
Date prepared	-			04/06/2025	1	05/06/2025	05/06/2025		04/06/2025	04/06/2025
Date analysed	-			04/06/2025	1	05/06/2025	05/06/2025		04/06/2025	04/06/2025
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	7.4	7.2	3	98	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	22	[NT]		92	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	30	[NT]		109	[NT]
Resistivity in soil*	ohm m	1	Inorg-002	<1	1	130	150	14	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	382356-23
Date prepared	-			[NT]	11	05/06/2025	05/06/2025		04/06/2025	04/06/2025
Date analysed	-			[NT]	11	05/06/2025	05/06/2025		04/06/2025	04/06/2025
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	11	7.3	7.5	3	100	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	11	120	110	9	100	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	11	130	130	0	99	[NT]
Resistivity in soil*	ohm m	1	Inorg-002	[NT]	11	50	47	6	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	382356-40
Date prepared	-			[NT]	22	05/06/2025	05/06/2025		04/06/2025	04/06/2025
Date analysed	-			[NT]	22	05/06/2025	05/06/2025		04/06/2025	04/06/2025
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	22	6.3	6.3	0	101	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	22	<10	<10	0	97	102
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	22	20	20	0	96	98
Resistivity in soil*	ohm m	1	Inorg-002	[NT]	22	200	200	0	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	382356-48
Date prepared	-			[NT]	32	05/06/2025	05/06/2025		[NT]	04/06/2025
Date analysed	-			[NT]	32	05/06/2025	05/06/2025		[NT]	04/06/2025
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	32	7.0	[NT]		[NT]	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	32	1500	1400	7	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	32	220	220	0	[NT]	[NT]
Resistivity in soil*	ohm m	1	Inorg-002	[NT]	32	7.3	[NT]		[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	382356-54
Date prepared	-			[NT]	42	05/06/2025	10/06/2025		[NT]	04/06/2025
Date analysed	-			[NT]	42	05/06/2025	10/06/2025		[NT]	04/06/2025
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	42	6.9	6.8	1	[NT]	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	42	<10	<10	0	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	42	<10	<10	0	[NT]	[NT]
Resistivity in soil*	ohm m	1	Inorg-002	[NT]	42	120	270	77	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	382356-67
Date prepared	-			[NT]	70	05/06/2025	10/06/2025		[NT]	04/06/2025
Date analysed	-			[NT]	70	05/06/2025	10/06/2025		[NT]	04/06/2025
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	70	5.1	5.2	2	[NT]	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	70	1100	970	13	[NT]	82
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	70	690	670	3	[NT]	85
Resistivity in soil*	ohm m	1	Inorg-002	[NT]	70	7.5	9.2	20	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	382356-78
Date prepared	-			[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	04/06/2025
Date analysed	-			[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	04/06/2025
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	#
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	#

QUALITY CONTROL: CEC					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	382356-40
Date prepared	-			10/06/2025	16	10/06/2025	10/06/2025		10/06/2025	10/06/2025
Date analysed	-			10/06/2025	16	10/06/2025	10/06/2025		10/06/2025	10/06/2025
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	16	17	16	6	100	104
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	16	1.7	1.7	0	103	77
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	16	7.3	7.0	4	97	81
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	16	0.1	<0.1	0	93	84

QUALITY CONTROL: CEC					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	54	10/06/2025	10/06/2025		[NT]	[NT]
Date analysed	-			[NT]	54	10/06/2025	10/06/2025		[NT]	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-020	[NT]	54	19	18	5	[NT]	[NT]
Exchangeable K	meq/100g	0.1	Metals-020	[NT]	54	0.9	0.8	12	[NT]	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-020	[NT]	54	9.6	9.0	6	[NT]	[NT]
Exchangeable Na	meq/100g	0.1	Metals-020	[NT]	54	0.2	0.2	0	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Air volumes are typically provided by customers (often as flow rate(s) and sampling time(s) and/or simply volumes) sampled or exposure times (determines 'volume' passive badges are exposed to)). Hence in such circumstances the volume measurement is inevitably not covered by Envirolab's NATA accreditation. An exception may occur where Envirolab Newcastle does the sampling where accreditation exists for certain types of sampling and hence volume determination(s). Note air volumes are often used to determine concentrations for dust and/or analyses on filters, sorbents and in impingers. For canister sampling, the air volume is covered by Envirolab's NATA accreditation.

Urine Analysis - The BEI values listed are taken from the 2022 edition of "TLVs and BEIs Threshold Limits" by ACGIH.

Report Comments

MISC_INORG_DRY: # Percent recovery is not applicable due to the high concentration of the analyte/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Samples were out of the recommended holding time for this analysis pH/EC.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200   fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	JK Environments
Attention	C Ridley

Sample Login Details

Your reference	E36314PT North Lismore
Envirolab Reference	382356
Date Sample Received	03/06/2025
Date Instructions Received	03/06/2025
Date Results Expected to be Reported	11/06/2025

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	81 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	10
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Sample ID	Texture and Salinity*	Misc Inorg - Soil	CEC	On Hold
TP201-0-0.2	✓	✓		
TP201-0.4-0.5	✓	✓	✓	
TP202-0-0.1	✓	✓	✓	
TP202-0.9-1	✓	✓		
TP202-2-2.1	✓	✓		
TP202-3-3.1	✓	✓		
TP202-3.5-3.6	✓	✓		
TP203-0-0.1	✓	✓		
TP203-1-1.1	✓	✓	✓	
TP203-2-2.1	✓	✓		
TP203-3-3.1	✓	✓		
TP204-0-0.1	✓	✓	✓	
TP204-1-1.1	✓	✓		
TP204-2.1-2.2	✓	✓		
TP204-3-3.1	✓	✓		
TP205-0-0.2	✓	✓	✓	
TP205-0.4-0.5				✓
TP205-1-1.1	✓	✓		
TP205-2-2.1	✓	✓		
TP205-2.6-2.8	✓	✓		
TP206-0-0.1	✓	✓	✓	
TP206-0.4-0.5	✓	✓		
TP206-0.9-1	✓	✓		
TP207-0-0.1	✓	✓		
TP207-0.5-0.6	✓	✓	✓	
TP207-1-1.1	✓	✓		
TP207-1.4-1.5	✓	✓		
TP207-2-2.1	✓	✓		
TP207-2.5-2.6	✓	✓		
TP208-0-0.1	✓	✓	✓	
TP208-1-1.1	✓	✓		
TP208-1.6-1.7	✓	✓		

Sample ID	Texture and Salinity*	Misc Inorg - Soil	CEC	On Hold
TP208-2.3-2.4	✓	✓		
TP208-3-3.1	✓	✓		
TP209-0-0.2	✓	✓	✓	
TP209-1-1.1	✓	✓		
TP209-1.9-2	✓	✓		
TP209-2.8-2.9	✓	✓		
TP209-3.7-3.9	✓	✓		
TP210-0-0.1	✓	✓	✓	
TP210-0.5-0.6	✓	✓		
TP210-0.7-0.8	✓	✓		
BH211-0-0.1				✓
BH212-0.05-0.2				✓
BH212-1-1.1				✓
BH212-2-2.1				✓
BH212-3-3.1				✓
BH213-0-0.1	✓	✓		
BH213-0.5-0.6	✓	✓	✓	
BH214-0-0.1	✓	✓		
BH214-1-1.1	✓	✓	✓	
BH214-2-2.1	✓	✓		
BH214-3-3.1				✓
BH215-0-0.1	✓	✓	✓	
TP216-0-0.1				✓
TP216-0.5-0.6				✓
TP216-1-1.2				✓
TP216-1.8-1.9				✓
TP217-0-0.1				✓
TP217-0.5-0.6				✓
TP217-0.9-1				✓
TP217-1.2-1.3				✓
BH218-0-0.1				✓
BH218-1-1.1				✓

Sample ID	Texture and Salinity*	Misc Inorg - Soil	CEC	On Hold
BH218-2-2.1				✓
BH218-2.9-3				✓
TP301-0-0.1	✓	✓	✓	
TP301-0.9-1	✓	✓		
TP303-0-0.1	✓	✓	✓	
TP303-0.1-0.2	✓	✓		
TP305-0-0.1	✓	✓	✓	
TP306-0-0.1				✓
TP308-0-0.1	✓	✓		
TP308-0.4-0.5	✓	✓	✓	
TP309-0-0.1	✓	✓	✓	
TP309-0.4-0.5	✓	✓		
TP312-0-0.1	✓	✓	✓	
TP312-0.4-0.5	✓	✓		
TP315-0-0.1	✓	✓	✓	
TP315-0.3-0.4	✓	✓		
BH211-0.1-0.2				✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Loc 3/6/25, 1455

SAMPLE AND CHAIN OF CUSTODY FORM

TO: ENVIROLAB SERVICES PTY LTD 12 ASHLEY STREET CHATSWOOD NSW 2067 P: (02) 99106200 F: (02) 99106201 Attention: Aileen Lab Ref:	JKE Job Number: E36314PT Date Results Required: STANDARD Page: 1 of 4	**FROM:** JKEnvironments REAR OF 115 WICKS ROAD MACQUARIE PARK, NSW 2113 P: 02-9888 5000 F: 02-9888 5001 Attention: Craig Ridley

Location:	North Lismore	Sample Preserved in Esky on Ice
Sampler:	Jessica Thornton	Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	Sample Description	pH	EC	ECe (texture)	Sulphate	Chloride	Resistivity	CEC					
19/05/2025	1	TP201	0-0.2	P	Silty Clay	X	X	X	X	X	X						
19/05/2025	2	TP201	0.4-0.5	P	Silty Clayey Gravel	X	X	X	X	X	X	X					
20/05/2025	3	TP201	0-0.2	P	Silty Clay	X	X	X	X	X	X	X					
20/05/2025	4	TP202	0.9-1	P	Silty Clay	X	X	X	X	X	X						
20/05/2025	5	TP202	2-2.1	P	Silty Clay	X	X	X	X	X	X						
20/05/2025	6	TP202	3-3.1	P	Silty Clay	X	X	X	X	X	X						
20/05/2025	7	TP202	3.5-3.6	P	Siltstone	X	X	X	X	X	X						
20/05/2025	8	TP203	0-0.2	P	Silty Clay	X	X	X	X	X	X						
20/05/2025	9	TP202	1-1.1	P	Silty Clay	X	X	X	X	X	X	X					
20/05/2025	10	TP202	2-2.1	P	Silty Clay	X	X	X	X	X	X						
20/05/2025	11	TP201	3-3.1	P	Silty Clay	X	X	X	X	X	X						
20/05/2025	12	TP202	0-0.1	P	Silty Clay	X	X	X	X	X	X	X					
20/05/2025	13	TP204	1-1.1	P	Silty Clay	X	X	X	X	X	X						
20/05/2025	14	TP202	2.1-2.2	P	Silty Clay	X	X	X	X	X	X						
20/05/2025	15	TP204	3-3.1	P	Silty Clay	X	X	X	X	X	X						
19/05/2025	16	TP201	0-0.2	P	Silty Clay	X	X	X	X	X	X	X					
19/05/2025	17	TP205	0.4-0.5	P	Silty Clay												
19/05/2025	18	TP203	1-1.1	P	Silty Clay	X	X	X	X	X	X						
19/05/2025	19	TP205	2-2.1	P	XW Tuff	X	X	X	X	X	X						
19/05/2025	20	TP205	2.6-2.8	P	Basalt	X	X	X	X	X	X						
20/05/2025	21	TP204	0-0.1	P	Silty Clay	X	X	X	X	X	X	X					
20/05/2025	22	TP206	0.4-0.5	P	Silty Clay	X	X	X	X	X	X						
20/05/2025	23	TP206	0.9-1	P	HW Basalt	X	X	X	X	X	X						
21/05/2025	24	TP207	0-0.2	P	Silty Clay	X	X	X	X	X	X						
21/05/2025	25	TP207	0.5-0.6	P	Silty Clay	X	X	X	X	X	X	X					

ENVIROLAB GROUP
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 382356
Date Received: 03/06/25
Time Received: 1500
Received By: DW
Temp: [✓ Cool]/Ambient 0°C
Cooling: Ice/[✓ Icepack]
Security: [✓ Intact]/Broken/None

Remarks (comments/detection limits required):	Sample Containers: P - Plastic Bag

Relinquished By:	Date:	Time:	Received By: Danni	Date: 03/06/25

SAMPLE AND CHAIN OF CUSTODY FORM

TO:
ENVIROLAB SERVICES PTY LTD
12 ASHLEY STREET
CHATSWOOD NSW 2067
P: (02) 99106200
F: (02) 99106201

Attention: Aileen
Lab Ref:

JKE Job Number: E36314PT

Date Results Required: STANDARD

Page: 2 of 4

FROM:
JKEnvironments
REAR OF 115 WICKS ROAD
MACQUARIE PARK, NSW 2113
P: 02-9888 5000 F: 02-9888 5001
Attention: Craig Ridley

Location: North Lismore
Sampler: Jessica Thornton

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	Sample Description	pH	EC	ECe (texture)	Sulphate	Chloride	Resistivity	CEC					
21/05/2025	26	TP207	1-1.1	P	Silty Clay	X	X	X	X	X	X						
21/05/2025	27	TP207	1.4-1.5	P	XW Siltstone	X	X	X	X	X	X						
21/05/2025	28	TP207	2-2.1	P	Siltstone	X	X	X	X	X	X						
21/05/2025	29	TP207	2.5-2.6	P	Siltstone	X	X	X	X	X	X						
21/05/2025	30	TP208	0-0.1	P	Silty Clay	X	X	X	X	X	X	X					
21/05/2025	31	TP208	1-1.1	P	Silty Clay	X	X	X	X	X	X						
21/05/2025	32	TP208	1.6-1.7	P	Silty Clay	X	X	X	X	X	X						
21/05/2025	33	TP208	2.3-2.4	P	Silty Clay	X	X	X	X	X	X						
21/05/2025	34	TP208	3-3.1	P	Silty Clay	X	X	X	X	X	X						
19/05/2025	35	TP209	0-0.2	P	Silty Clay	X	X	X	X	X	X	X					
19/05/2025	36	TP209	1-1.1	P	Silty Clay	X	X	X	X	X	X						
19/05/2025	37	TP209	1.9-2	P	Silty Clay	X	X	X	X	X	X						
19/05/2025	38	TP208	2.8-2.9	P	XW Siltstone	X	X	X	X	X	X						
19/05/2025	39	TP209	3.7-3.9	P	Siltstone	X	X	X	X	X	X						
20/05/2025	40	TP210	0-0.1	P	Silty Clay	X	X	X	X	X	X	X					
20/05/2025	41	TP210	0.5-0.6	P	Silty Clay	X	X	X	X	X	X						
19/05/2025	42	TP210	0.7-0.8	P	XW Siltstone	X	X	X	X	X	X						
29/05/2025	43	BH211	0-0.1	P	F: Sandy Clay												
27/05/2025	44	BH212	0.05-0.2	P	Soil												
27/05/2025	45	BH212	1-1.1	P	Soil												
27/05/2025	46	BH212	2-2.1	P	Soil												
27/05/2025	47	BH212	3-3.1	P	Soil												
29/05/2025	48	BH213	0-0.2	P	Topsoil: Silty Clay	X	X	X	X	X	X						
29/05/2025	49	BH213	0.5-0.6	P	Gravelly Clay	X	X	X	X	X	X	X					
30/05/2025	50	BH214	0-0.1	P	Topsoil: Silty Clay	X	X	X	X	X	X						

Remarks (comments/detection limits required):

Sample Containers:

P - Plastic Bag

Relinquished By:
Date:
Time:
Received By:
Date:

#382356
03/06/25

SAMPLE AND CHAIN OF CUSTODY FORM

TO:
ENVIROLAB SERVICES PTY LTD
12 ASHLEY STREET
CHATSWOOD NSW 2067
P: (02) 99106200
F: (02) 99106201

Attention: Aileen
Lab Ref:

JKE Job Number: E36314PT

Date Results Required: STANDARD

Page: 3 of 4

FROM:
JKEnvironments
REAR OI
MACQUARIE PARK, NSW 2113
P: 02-9888 5000 F: 02-9888 5001
Attention: Craig Ridley

Location: North Lismore

Sampler: Jessica Thornton

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	Sample Description	pH	EC	ECe (texture)	Sulphate	Chloride	Resistivity	CEC					
30/05/2025	51	BH214	1-1.1	P	Silty Clay	X	X	X	X	X	X	X					
30/05/2025	52	BH214	2-2.1	P	Silty Clay	X	X	X	X	X	X						
30/05/2025	53	BH214	3-3.1	P	Silty Clay												
30/05/2025	54	BH215	0-0.1	P	Topsoil: Silty Clay	X	X	X	X	X	X	X					
20/05/2025	55	TP216	0-0.1	P	Silty Clay												
20/05/2025	56	TP216	0.5-0.6	P	Silty Clay												
20/05/2025	57	TP216	1-1.2	P	Sitlstone												
20/05/2025	58	TP216	1.8-1.9	P	Basalt/Tuff												
20/05/2025	59	TP217	0-0.1	P	Silty Clay												
20/05/2025	60	TP217	0.5-0.6	P	Silty Clay												
20/05/2025	61	TP217	0.9-1	P	Basalt												
20/05/2025	62	TP217	1.2-1.3	P	Siltstone												
30/05/2025	63	BH218	0-0.1	P	Soil												
30/05/2025	64	BH218	1-1.1	P	Soil												
30/05/2025	65	BH218	2-2.1	P	Soil												
30/05/2025	66	BH218	2.9-3	P	Soil												
27/05/2025	67	TP301	0-0.1	P	F: Silty Clay	X	X	X	X	X	X	X					
27/05/2025	68	TP301	0.9-1	P	Silty Clay	X	X	X	X	X	X						
27/05/2025	69	TP303	0-0.1	P	Topsoil: Silty Clay	X	X	X	X	X	X	X					
27/05/2025	70	TP303	0.1-0.2	P	Silty Clay	X	X	X	X	X	X						
27/05/2025	71	TP305	0-0.1	P	Silty Clay	X	X	X	X	X	X	X					
28/05/2025	72	TP306	0-0.1	P	Silty Clay												
27/05/2025	73	TP308	0-0.1	P	Topsoil: Silty Clay	X	X	X	X	X	X						
27/05/2025	74	TP308	0.4-0.5	P	Silty Clay	X	X	X	X	X	X	X					
27/05/2025	75	TP309	0-0.1	P		X	X	X	X	X	X	X					

Remarks (comments/detection limits required):

Sample Containers:
P - Plastic Bag

Relinquished By:	**Date:**	**Time:**	**Received By:**	**Date:**

#382356
03/06/25
DUR

SAMPLE AND CHAIN OF CUSTODY FORM

TO:
ENVIROLAB SERVICES PTY LTD
12 ASHLEY STREET
CHATSWOOD NSW 2067
P: (02) 99106200
F: (02) 99106201

Attention: Aileen
Lab Ref:

JKE Job Number: E36314PT

Date Results Required: STANDARD

Page: 4 of 4

FROM:
JKEnvironments
REAR OI
MACQUARIE PARK, NSW 2113
P: 02-9888 5000 **F: 02-9888 5001**
Attention: Craig Ridley

Location: North Lismore
Sampler: Jessica Thornton

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	Sample Description	pH	EC	ECe (texture)	Sulphate	Chloride	Resistivity	CEC					
27/05/2025	76	TP309	0.4-0.5	P	Silty Clay	X	X	X	X	X	X						
27/05/2025	77	TP312	0-0.1	P	Topsoil: Silty Clay	X	X	X	X	X	X	X					
27/05/2025	78	TP312	0.4-0.5	P	Silty Clay	X	X	X	X	X	X						
27/05/2025	79	TP315	0-0.1	P	Topsoil: Silty Clay	X	X	X	X	X	X	X					
27/05/2025	80	TP315	0.3-0.4	P	Silty Clay	X	X	X	X	X	X						
	81	BH211	0.1-0.2														

Remarks (comments/detection limits required):

Sample Containers:

P - Plastic Bag

Relinquished By:	**Date:**	**Time:**	**Received By:**	**Date:**

#382356
03/06/25

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200   fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 382346

Client Details

Client	JK Environments
Attention	Oisin Butler
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E36314PT Lismore**
Number of Samples	10 Water
Date samples received	03/06/2025
Date completed instructions received	03/06/2025

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	11/06/2025
Date of Issue	11/06/2025

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Diego Bigolin, Inorganics Supervisor
Dragana Tomas, Senior Chemist
Giovanni Agosti, Group Technical Manager
Stuart Chen, Asbestos Approved Identifier/Report coordinator
Tabitha Roberts, Senior Chemist

Authorised By
Nancy Zhang, Laboratory Manager

Client Reference: E36314PT Lismore

vTRH(C6-C10)/BTEXN in Water						
Our Reference		382346-1	382346-2	382346-3	382346-4	382346-5
Your Reference	UNITS	MW62	MW206	MW212	MW214	Creek1
Date Sampled		30/05/2025	30/05/2025	30/05/2025	31/05/2025	29/05/2025
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	06/06/2025	06/06/2025	06/06/2025	06/06/2025	06/06/2025
TRH C_6 - C_9	µg/L	<10	<10	14	12	19
TRH C_6 - C_{10}	µg/L	<10	12	16	46	20
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	12	13	41	11
Benzene	µg/L	<1	<1	<1	<1	<1
Toluene	µg/L	<1	<1	3	<1	9
Ethylbenzene	µg/L	<1	<1	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2	3	<2
o-xylene	µg/L	<1	<1	<1	3	<1
Naphthalene	µg/L	<1	<1	<1	2	<1
Surrogate Dibromofluoromethane	%	103	103	102	103	102
Surrogate Toluene-d8	%	98	99	100	100	99
Surrogate 4-Bromofluorobenzene	%	96	99	97	100	98

vTRH(C6-C10)/BTEXN in Water						
Our Reference		382346-6	382346-7	382346-8	382346-9	382346-10
Your Reference	UNITS	GWDUP301	GWDUP302	FR302-IP	TB301	TS301
Date Sampled		30/05/2025	30/05/2025	30/05/2025	27/05/2025	27/05/2025
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	06/06/2025	06/06/2025	06/06/2025	06/06/2025	06/06/2025
TRH C_6 - C_9	µg/L	<10	<10	84	<10	[NA]
TRH C_6 - C_{10}	µg/L	<10	12	87	<10	[NA]
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	12	87	<10	[NA]
Benzene	µg/L	<1	<1	<1	<1	110%
Toluene	µg/L	<1	<1	<1	<1	107%
Ethylbenzene	µg/L	<1	<1	<1	<1	102%
m+p-xylene	µg/L	<2	<2	<2	<2	103%
o-xylene	µg/L	<1	<1	<1	<1	105%
Naphthalene	µg/L	<1	<1	<1	<1	[NA]
Surrogate Dibromofluoromethane	%	101	103	101	103	101
Surrogate Toluene-d8	%	99	100	100	100	100
Surrogate 4-Bromofluorobenzene	%	94	98	98	95	99

svTRH (C10-C40) in Water						
Our Reference		382346-1	382346-2	382346-3	382346-4	382346-5
Your Reference	UNITS	MW62	MW206	MW212	MW214	Creek1
Date Sampled		30/05/2025	30/05/2025	30/05/2025	31/05/2025	29/05/2025
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
TRH C_{10} - C_{14}	µg/L	<50	78	170	350	<50
TRH C_{15} - C_{28}	µg/L	<100	<100	380	220	<100
TRH C_{29} - C_{36}	µg/L	<100	<100	<100	<100	<100
Total +ve TRH (C10-C36)	µg/L	<50	80	550	570	<50
TRH >C_{10} - C_{16}	µg/L	<50	110	420	450	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50	110	420	450	<50
TRH >C_{16} - C_{34}	µg/L	<100	<100	110	100	<100
TRH >C_{34} - C_{40}	µg/L	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	µg/L	<50	110	540	560	<50
Surrogate o-Terphenyl	%	134	106	130	116	102

svTRH (C10-C40) in Water					
Our Reference		382346-6	382346-7	382346-8	382346-9
Your Reference	UNITS	GWDUP301	GWDUP302	FR302-IP	TB301
Date Sampled		30/05/2025	30/05/2025	30/05/2025	27/05/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025
TRH C_{10} - C_{14}	µg/L	<50	78	<50	<50
TRH C_{15} - C_{28}	µg/L	<100	<100	<100	<100
TRH C_{29} - C_{36}	µg/L	<100	<100	<100	<100
Total +ve TRH (C10-C36)	µg/L	<50	80	<50	<50
TRH >C_{10} - C_{16}	µg/L	<50	120	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50	120	<50	<50
TRH >C_{16} - C_{34}	µg/L	<100	<100	<100	<100
TRH >C_{34} - C_{40}	µg/L	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	µg/L	<50	120	<50	<50
Surrogate o-Terphenyl	%	105	108	109	112

PAHs in Water						
Our Reference	UNITS	382346-1	382346-2	382346-3	382346-4	382346-5
Your Reference		MW62	MW206	MW212	MW214	Creek1
Date Sampled		30/05/2025	30/05/2025	30/05/2025	31/05/2025	29/05/2025
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Naphthalene	µg/L	<0.1	0.1	<0.1	0.4	<0.1
Acenaphthylene	µg/L	<0.1	<0.1	<0.1	0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1	0.3	<0.1
Phenanthrene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	<0.1	0.11	<0.1	0.79	<0.1
Surrogate p-Terphenyl-d14	%	104	99	99	100	90

PAHs in Water					
Our Reference		382346-6	382346-7	382346-8	382346-9
Your Reference	UNITS	GWDUP301	GWDUP302	FR302-IP	TB301
Date Sampled		30/05/2025	30/05/2025	30/05/2025	27/05/2025
Type of sample		Water	Water	Water	Water
Date extracted	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	10/06/2025
Naphthalene	µg/L	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	µg/L	<0.1	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	<0.1	<0.1	<0.1	<0.1
Surrogate p-Terphenyl-d14	%	100	98	99	112

Organochlorine Pesticides in Water						
Our Reference		382346-1	382346-2	382346-3	382346-4	382346-6
Your Reference	UNITS	MW62	MW206	MW212	MW214	GWDUP301
Date Sampled		30/05/2025	30/05/2025	30/05/2025	31/05/2025	30/05/2025
Type of sample		Water	Water	Water	Water	Water
Date extracted	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
alpha-BHC	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
HCB	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
beta-BHC	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
gamma-BHC	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Heptachlor	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
delta-BHC	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Aldrin	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Heptachlor Epoxide	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
gamma-Chlordane	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
alpha-Chlordane	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Endosulfan I	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
pp-DDE	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Dieldrin	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Endosulfan II	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
pp-DDD	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin Aldehyde	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
pp-DDT	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Endosulfan Sulphate	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Methoxychlor	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2
Mirex	ug/L	<0.2	<0.2	<0.2	<0.2	<0.2
Surrogate 4-Chloro-3-NBTF	%	67	63	67	70	67

Organochlorine Pesticides in Water		
Our Reference		382346-7
Your Reference	UNITS	GWDUP302
Date Sampled		30/05/2025
Type of sample		Water
Date extracted	-	04/06/2025
Date analysed	-	05/06/2025
alpha-BHC	µg/L	<0.2
HCB	µg/L	<0.2
beta-BHC	µg/L	<0.2
gamma-BHC	µg/L	<0.2
Heptachlor	µg/L	<0.2
delta-BHC	µg/L	<0.2
Aldrin	µg/L	<0.2
Heptachlor Epoxide	µg/L	<0.2
gamma-Chlordane	µg/L	<0.2
alpha-Chlordane	µg/L	<0.2
Endosulfan I	µg/L	<0.2
pp-DDE	µg/L	<0.2
Dieldrin	µg/L	<0.2
Endrin	µg/L	<0.2
Endosulfan II	µg/L	<0.2
pp-DDD	µg/L	<0.2
Endrin Aldehyde	µg/L	<0.2
pp-DDT	µg/L	<0.2
Endosulfan Sulphate	µg/L	<0.2
Methoxychlor	µg/L	<0.2
Mirex	ug/L	<0.2
Surrogate 4-Chloro-3-NBTF	%	68

All metals in water-dissolved						
Our Reference	UNITS	382346-1	382346-2	382346-3	382346-4	382346-5
Your Reference		MW62	MW206	MW212	MW214	Creek1
Date Sampled		30/05/2025	30/05/2025	30/05/2025	31/05/2025	29/05/2025
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Date analysed	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025	04/06/2025
Aluminium-Dissolved	µg/L	<10	20	<10	<10	30
Silver-Dissolved	µg/L	<1	<1	<1	<1	<1
Antimony-Dissolved	µg/L	<1	<1	<1	<1	<1
Barium-Dissolved	µg/L	10	19	24	59	49
Beryllium-Dissolved	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Boron-Dissolved	µg/L	<20	20	<20	<20	<20
Cobalt-Dissolved	µg/L	<1	<1	2	<1	9
Iron-Dissolved	µg/L	<10	60	<10	20	190
Lithium-Dissolved	µg/L	5	4	2	6	<1
Manganese-Dissolved	µg/L	<5	47	240	53	840
Molybdenum-Dissolved	µg/L	<1	6	14	2	<1
Selenium-Dissolved	µg/L	<1	<1	11	<1	<1
Strontium-Dissolved	µg/L	650	130	440	2,200	100
Uranium-Dissolved	µg/L	<0.5	<0.5	1.2	1.2	<0.5
Vanadium-Dissolved	µg/L	2	1	2	3	3
Arsenic-Dissolved	µg/L	<1	<1	<1	<1	<1
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium-Dissolved	µg/L	<1	<1	<1	<1	<1
Copper-Dissolved	µg/L	<1	<1	<1	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	<1	2	3	2	4
Lead-Dissolved	µg/L	<1	<1	<1	<1	<1
Zinc-Dissolved	µg/L	<1	1	8	<1	2

All metals in water-dissolved				
Our Reference		382346-6	382346-8	382346-9
Your Reference	UNITS	GWDUP301	FR302-IP	TB301
Date Sampled		30/05/2025	30/05/2025	27/05/2025
Type of sample		Water	Water	Water
Date prepared	-	04/06/2025	04/06/2025	04/06/2025
Date analysed	-	04/06/2025	04/06/2025	04/06/2025
Arsenic-Dissolved	µg/L	<1	<1	<1
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1
Chromium-Dissolved	µg/L	<1	<1	<1
Copper-Dissolved	µg/L	<1	310	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	<1	1	<1
Lead-Dissolved	µg/L	<1	<1	<1
Zinc-Dissolved	µg/L	<1	11	<1

Client Reference: E36314PT Lismore

Metals in Waters - Acid extractable						
Our Reference		382346-1	382346-2	382346-3	382346-4	382346-5
Your Reference	UNITS	MW62	MW206	MW212	MW214	Creek1
Date Sampled		30/05/2025	30/05/2025	30/05/2025	31/05/2025	29/05/2025
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Date analysed	-	05/06/2025	05/06/2025	05/06/2025	05/06/2025	05/06/2025
Phosphorus - Total	mg/L	0.05	0.63	8.5	12	2.0

Miscellaneous Inorganics						
Our Reference		382346-1	382346-2	382346-3	382346-4	382346-5
Your Reference	UNITS	MW62	MW206	MW212	MW214	Creek1
Date Sampled		30/05/2025	30/05/2025	30/05/2025	31/05/2025	29/05/2025
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	03/06/2025	03/06/2025	03/06/2025	03/06/2025	03/06/2025
Date analysed	-	03/06/2025	03/06/2025	03/06/2025	03/06/2025	03/06/2025
Electrical Conductivity	μS/cm	1,400	340	1,200	3,700	210
pH	pH Units	7.1	7.3	7.4	7.1	6.6
Redox Potential*	mV	198	178	184	182	157
Dissolved Oxygen*	mg/L	8.6	7.2	8.5	8.3	8.4
Turbidity	NTU	<0.1	420	540	0.1	550
Total Dissolved Solids (grav)	mg/L	770	[NA]	1,300	2,300	120
Total Suspended Solids	mg/L	<5	[NA]	2,700	22,000	820
Total Organic Carbon	mg/L	1	4	18	2	20
Sodium Adsorption Ratio	-	3.4	2.7	5.2	5.2	1.4
Silica (Reactive - SiO_2)	mg/L	52	54	20	43	28
Ammonia as N in water	mg/L	<0.005	0.02	<0.005	<0.005	0.29
Nitrate as N in water	mg/L	0.41	2.1	<0.005	1.8	0.065
Nitrite as N in water	mg/L	<0.005	0.058	<0.005	0.01	0.02
NOx as N in water	mg/L	0.41	2.1	<0.005	1.8	0.087
Total Nitrogen in water	mg/L	0.4	2.6	0.4	3.8	1.7
TKN in water	mg/L	<0.1	0.5	0.4	2.0	1.6
Phosphate as P in water	mg/L	0.064	0.41	0.01	0.057	0.067
Organic Nitrogen as N	mg/L	<0.2	0.5	0.4	2.0	1.3

Ion Balance						
Our Reference	UNITS	382346-1	382346-2	382346-3	382346-4	382346-5
Your Reference		MW62	MW206	MW212	MW214	Creek1
Date Sampled		30/05/2025	30/05/2025	30/05/2025	31/05/2025	29/05/2025
Type of sample		Water	Water	Water	Water	Water
Date prepared	-	03/06/2025	03/06/2025	03/06/2025	03/06/2025	03/06/2025
Date analysed	-	03/06/2025	03/06/2025	03/06/2025	03/06/2025	03/06/2025
Calcium - Dissolved	mg/L	68	15	44	180	9.5
Potassium - Dissolved	mg/L	0.9	2	2	2	5.1
Sodium - Dissolved	mg/L	160	50	170	390	23
Magnesium - Dissolved	mg/L	57	7.0	22	140	6.8
Hardness (calc) equivalent $CaCO_3$	mg/L	410	65	200	1,000	52
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	<5	<5	<5	<5	<5
Bicarbonate Alkalinity as $CaCO_3$	mg/L	460	160	250	780	87
Carbonate Alkalinity as $CaCO_3$	mg/L	<5	<5	<5	<5	<5
Total Alkalinity as $CaCO_3$	mg/L	460	160	250	780	87
Sulphate, SO4	mg/L	31	8	84	130	1
Chloride, Cl	mg/L	150	17	140	710	18
Ionic Balance	%	3.0	-3.0	3.0	-1.0	-2.0

Microbiologocal Testing					
Our Reference		382346-1	382346-2	382346-4	382346-5
Your Reference	UNITS	MW62	MW206	MW214	Creek1
Date Sampled		30/05/2025	30/05/2025	31/05/2025	29/05/2025
Type of sample		Water	Water	Water	Water
Date of testing	-	04/06/2025	04/06/2025	04/06/2025	04/06/2025
E. coli	cfu/100mL	<1000	20 MPN/100mL	<18 MPN/100mL	16000 MPN/100mL
Thermotolerant Coliforms	cfu/100mL	<1000	790 MPN/100mL	<18 MPN/100mL	16000 MPN/100mL

Method ID	Methodology Summary
Ext-008	Subcontracted to Sonic Food & Water Testing. NATA Accreditation No. 4034.
Inorg-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell.
Inorg-006	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C. NOTE: Where the EC of the sample is <100µS/cm, the TDS will typically be below 70mg/L (as the sample is very likely to be at least drinking water quality). Therefore to ensure data quality for TDS, the TDS is typically calculated as per the equation below:- TDS = EC * 0.6
Inorg-019	Suspended Solids - determined gravimetricially by filtration of the sample. The samples are dried at 104+/-5°C.
Inorg-022	Turbidity - measured nephelometrically using a turbidimeter, in accordance with APHA latest edition, 2130-B.
Inorg-035	Analysed using an electrode. Please note that the results for water analyses are indicative only, samples are ideally analysed on collection.
Inorg-040	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% ie total anions = total cations +/-15%.
Inorg-055	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055	Nitrite - determined colourimetrically based on APHA latest edition NO2- B. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-055/062/127	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
Inorg-057	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
Inorg-060	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
Inorg-062	TKN - determined colourimetrically based on APHA latest edition 4500 Norg. Alternatively, TKN can be derived from calculation (Total N - NOx).
Inorg-079	TOC determined using a TOC analyser using the combustion method. Dissolved requires filtering prior to determination. Analysis using APHA latest edition 5310B.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Inorg-112	Dissolved Oxygen using membrane electrode. Note this analysis should ideally be carried out immediately after sampling.
INORG-120	Reactive Silica (SiO2) determined colorimetrically. Waters samples are filtered on receipt prior to analysis.

Method ID	Methodology Summary
Metals-020	Determination of various metals by ICP-AES. Total Phosphate determined stochiometrically from Phosphorus (assumed to be present as Phosphate). Where salts (oxides, chlorides etc.) are calculated from the element concentration stoichiometrically there is no guarantee that the salt form is completely soluble in the acids used in the preparation.
Metals-020	Calcium and Magnesium analysed by ICP-AES and SAR calculated.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS. Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements. Where salts (oxides, chlorides etc.) are calculated from the element concentration stoichiometrically there is no guarantee that the salt form is completely soluble in the acids used in the preparation.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			05/06/2025	4	05/06/2025	06/06/2025		05/06/2025	[NT]
Date analysed	-			06/06/2025	4	06/06/2025	10/06/2025		06/06/2025	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	4	12	<10	18	80	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	4	46	40	14	80	[NT]
Benzene	µg/L	1	Org-023	<1	4	<1	<1	0	83	[NT]
Toluene	µg/L	1	Org-023	<1	4	<1	<1	0	81	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	4	<1	<1	0	79	[NT]
m+p-xylene	µg/L	2	Org-023	<2	4	3	2	40	79	[NT]
o-xylene	µg/L	1	Org-023	<1	4	3	3	0	79	[NT]
Naphthalene	µg/L	1	Org-023	<1	4	2	2	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	101	4	103	103	0	100	[NT]
Surrogate Toluene-d8	%		Org-023	99	4	100	100	0	101	[NT]
Surrogate 4-Bromofluorobenzene	%		Org-023	96	4	100	98	2	102	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	382346-3
Date extracted	-			04/06/2025	1	04/06/2025	04/06/2025		04/06/2025	04/06/2025
Date analysed	-			05/06/2025	1	05/06/2025	05/06/2025		05/06/2025	05/06/2025
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	1	<50	<50	0	117	121
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	1	<100	<100	0	111	124
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	1	<100	<100	0	100	103
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	1	<50	<50	0	117	121
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	1	<100	<100	0	111	124
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	1	<100	<100	0	100	103
Surrogate o-Terphenyl	%		Org-020	109	1	134	108	21	101	130

Client Reference: E36314PT Lismore

QUALITY CONTROL: PAHs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	382346-3
Date extracted	-			04/06/2025	1	04/06/2025	04/06/2025		04/06/2025	04/06/2025
Date analysed	-			05/06/2025	1	05/06/2025	05/06/2025		05/06/2025	05/06/2025
Naphthalene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	89	87
Acenaphthylene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	73	68
Fluorene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	77	74
Phenanthrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	92	85
Anthracene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	86	78
Pyrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	88	82
Benzo(a)anthracene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	74	73
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	75	73
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	103	1	104	98	6	104	94

QUALITY CONTROL: Organochlorine Pesticides in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	
Date extracted	-			04/06/2025	1	04/06/2025	04/06/2025		04/06/2025	[NT]
Date analysed	-			05/06/2025	1	05/06/2025	05/06/2025		05/06/2025	[NT]
alpha-BHC	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	74	[NT]
HCB	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
beta-BHC	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	70	[NT]
gamma-BHC	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Heptachlor	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	78	[NT]
delta-BHC	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Aldrin	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	93	[NT]
Heptachlor Epoxide	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	95	[NT]
gamma-Chlordane	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
alpha-Chlordane	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Endosulfan I	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
pp-DDE	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	81	[NT]
Dieldrin	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	94	[NT]
Endrin	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	84	[NT]
Endosulfan II	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
pp-DDD	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	86	[NT]
Endrin Aldehyde	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
pp-DDT	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Endosulfan Sulphate	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	90	[NT]
Methoxychlor	µg/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Mirex	ug/L	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	68	1	67	65	3	73	[NT]

QUALITY CONTROL: Organochlorine Pesticides in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	382346-3
Date extracted	-			[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	04/06/2025
Date analysed	-			[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	05/06/2025
alpha-BHC	µg/L	0.2	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	68
beta-BHC	µg/L	0.2	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	66
Heptachlor	µg/L	0.2	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	73
Aldrin	µg/L	0.2	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	87
Heptachlor Epoxide	µg/L	0.2	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	87
pp-DDE	µg/L	0.2	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	77
Dieldrin	µg/L	0.2	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	88
Endrin	µg/L	0.2	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	82
pp-DDD	µg/L	0.2	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	81
Endosulfan Sulphate	µg/L	0.2	Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	83
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]	71

QUALITY CONTROL: All metals in water-dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W8	382346-2
Date prepared	-			04/06/2025	1	04/06/2025	04/06/2025		04/06/2025	04/06/2025
Date analysed	-			04/06/2025	1	04/06/2025	04/06/2025		04/06/2025	04/06/2025
Aluminium-Dissolved	µg/L	10	Metals-022	<10	1	<10	<10	0	103	100
Silver-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	103	116
Antimony-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	84	73
Barium-Dissolved	µg/L	1	Metals-022	<1	1	10	11	10	116	114
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	1	<0.5	<0.5	0	98	99
Boron-Dissolved	µg/L	20	Metals-022	<20	1	<20	<20	0	86	88
Cobalt-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	117	118
Iron-Dissolved	µg/L	10	Metals-022	<10	1	<10	<10	0	118	115
Lithium-Dissolved	µg/L	1	Metals-022	<1	1	5	6	18	99	105
Manganese-Dissolved	µg/L	5	Metals-022	<5	1	<5	<5	0	106	104
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	107	89
Selenium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	93	94
Strontium-Dissolved	µg/L	1	Metals-022	<1	1	650	650	0	115	103
Uranium-Dissolved	µg/L	0.5	Metals-022	<0.5	1	<0.5	<0.5	0	101	79
Vanadium-Dissolved	µg/L	1	Metals-022	<1	1	2	2	0	107	105
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	104	104
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	<0.1	0	105	105
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	106	103
Copper-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	115	115
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	[NT]		94	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	116	117
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	103	94
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	103	104

QUALITY CONTROL: All metals in water-dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	382346-3
Date prepared	-			[NT]	2	04/06/2025	04/06/2025		[NT]	04/06/2025
Date analysed	-			[NT]	2	04/06/2025	04/06/2025		[NT]	04/06/2025
Aluminium-Dissolved	µg/L	10	Metals-022	[NT]	2	20	[NT]		[NT]	[NT]
Silver-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	[NT]		[NT]	[NT]
Antimony-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	[NT]		[NT]	[NT]
Barium-Dissolved	µg/L	1	Metals-022	[NT]	2	19	[NT]		[NT]	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	[NT]	2	<0.5	[NT]		[NT]	[NT]
Boron-Dissolved	µg/L	20	Metals-022	[NT]	2	20	[NT]		[NT]	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	[NT]		[NT]	[NT]
Iron-Dissolved	µg/L	10	Metals-022	[NT]	2	60	[NT]		[NT]	[NT]
Lithium-Dissolved	µg/L	1	Metals-022	[NT]	2	4	[NT]		[NT]	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	[NT]	2	47	[NT]		[NT]	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	[NT]	2	6	[NT]		[NT]	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	[NT]		[NT]	[NT]
Strontium-Dissolved	µg/L	1	Metals-022	[NT]	2	130	[NT]		[NT]	[NT]
Uranium-Dissolved	µg/L	0.5	Metals-022	[NT]	2	<0.5	[NT]		[NT]	[NT]
Vanadium-Dissolved	µg/L	1	Metals-022	[NT]	2	1	[NT]		[NT]	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	[NT]		[NT]	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	[NT]	2	<0.1	[NT]		[NT]	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	[NT]		[NT]	[NT]
Copper-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	[NT]		[NT]	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	[NT]	2	<0.05	<0.05	0	[NT]	91
Nickel-Dissolved	µg/L	1	Metals-022	[NT]	2	2	[NT]		[NT]	[NT]
Lead-Dissolved	µg/L	1	Metals-022	[NT]	2	<1	[NT]		[NT]	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	[NT]	2	1	[NT]		[NT]	[NT]

QUALITY CONTROL: Metals in Waters - Acid extractable					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			05/06/2025	1	05/06/2025	05/06/2025		05/06/2025	[NT]
Date analysed	-			05/06/2025	1	05/06/2025	05/06/2025		05/06/2025	[NT]
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	1	0.05	<0.05	0	86	[NT]

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			03/06/2025	1	03/06/2025	03/06/2025		03/06/2025	[NT]
Date analysed	-			03/06/2025	1	03/06/2025	03/06/2025		03/06/2025	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	1	1400	[NT]		96	[NT]
pH	pH Units		Inorg-001	[NT]	1	7.1	[NT]		98	[NT]
Redox Potential*	mV		Inorg-035	[NT]	1	198	197	1	109	[NT]
Dissolved Oxygen*	mg/L	0.1	Inorg-112	<0.1	1	8.6	[NT]		[NT]	[NT]
Turbidity	NTU	0.1	Inorg-022	<0.1	1	<0.1	[NT]		99	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	1	770	760	1	97	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	<5	1	<5	[NT]		100	[NT]
Total Organic Carbon	mg/L	1	Inorg-079	<1	1	1	1	0	102	[NT]
Sodium Adsorption Ratio	-	0.01	Metals-020	[NT]	1	3.4	[NT]		96	[NT]
Silica (Reactive - SiO_2)	mg/L	0.1	INORG-120	<0.1	1	52	51	2	100	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	<0.005	[NT]		90	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.41	[NT]		96	[NT]
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	1	<0.005	[NT]		104	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.41	[NT]		97	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	1	0.4	[NT]		93	[NT]
TKN in water	mg/L	0.1	Inorg-062	<0.1	1	<0.1	[NT]		[NT]	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	0.064	[NT]		109	[NT]
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	<0.2	1	<0.2	[NT]		[NT]	[NT]

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	3	03/06/2025	03/06/2025		[NT]	[NT]
Date analysed	-			[NT]	3	03/06/2025	03/06/2025		[NT]	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	[NT]	3	1200	[NT]		[NT]	[NT]
pH	pH Units		Inorg-001	[NT]	3	7.4	[NT]		[NT]	[NT]
Redox Potential*	mV		Inorg-035	[NT]	3	184	[NT]		[NT]	[NT]
Dissolved Oxygen*	mg/L	0.1	Inorg-112	[NT]	3	8.5	[NT]		[NT]	[NT]
Turbidity	NTU	0.1	Inorg-022	[NT]	3	540	[NT]		[NT]	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	[NT]	3	1300	[NT]		[NT]	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	[NT]	3	2700	2700	0	[NT]	[NT]
Total Organic Carbon	mg/L	1	Inorg-079	[NT]	3	18	[NT]		[NT]	[NT]
Sodium Adsorption Ratio	-	0.01	Metals-020	[NT]	3	5.2	[NT]		[NT]	[NT]
Silica (Reactive - SiO_2)	mg/L	0.1	INORG-120	[NT]	3	20	[NT]		[NT]	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	[NT]	3	<0.005	[NT]		[NT]	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	[NT]	3	<0.005	[NT]		[NT]	[NT]
Nitrite as N in water	mg/L	0.005	Inorg-055	[NT]	3	<0.005	[NT]		[NT]	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	[NT]	3	<0.005	[NT]		[NT]	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	[NT]	3	0.4	[NT]		[NT]	[NT]
TKN in water	mg/L	0.1	Inorg-062	[NT]	3	0.4	[NT]		[NT]	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	[NT]	3	0.01	[NT]		[NT]	[NT]
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	[NT]	3	0.4	[NT]		[NT]	[NT]

QUALITY CONTROL: Ion Balance						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			03/06/2025	3	03/06/2025	03/06/2025		03/06/2025	[NT]
Date analysed	-			03/06/2025	3	03/06/2025	03/06/2025		03/06/2025	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	3	44	[NT]		100	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	3	2	[NT]		103	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	3	170	[NT]		96	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	3	22	[NT]		99	[NT]
Hardness (calc) equivalent $CaCO_3$	mg/L	3	Metals-020	[NT]	3	200	[NT]		[NT]	[NT]
Hydroxide Alkalinity (OH^-) as $CaCO_3$	mg/L	5	Inorg-006	<5	3	<5	[NT]		[NT]	[NT]
Bicarbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	3	250	[NT]		[NT]	[NT]
Carbonate Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	3	<5	[NT]		[NT]	[NT]
Total Alkalinity as $CaCO_3$	mg/L	5	Inorg-006	<5	3	250	[NT]		114	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	3	84	84	0	92	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	3	140	150	7	94	[NT]
Ionic Balance	%		Inorg-040	[NT]	3	3.0	[NT]		[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Air volumes are typically provided by customers (often as flow rate(s) and sampling time(s) and/or simply volumes) sampled or exposure times (determines 'volume' passive badges are exposed to)). Hence in such circumstances the volume measurement is inevitably not covered by Envirolab's NATA accreditation. An exception may occur where Envirolab Newcastle does the sampling where accreditation exists for certain types of sampling and hence volume determination(s). Note air volumes are often used to determine concentrations for dust and/or analyses on filters, sorbents and in impingers. For canister sampling, the air volume is covered by Envirolab's NATA accreditation.

Urine Analysis - The BEI values listed are taken from the 2022 edition of "TLVs and BEIs Threshold Limits" by ACGIH.

Report Comments

Holding time exceedance for PH/EC and nutrients.

vTRH & BTEXN in Water NEPM - TRH C6-C9/C6-C10 Results are positive (or in part positive) due to the presence of THMs within the sample.

Microbiology analysed by Sonic Food & Water Testing. Report no. W2512539, W2512509.

The time between collection and the commencement of testing should not exceed 24 hours. Samples tested outside this time may have their results compromised.

Escherichia Coli, Faecal coliforms not detected by the method.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200   fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details	
Client	JK Environments
Attention	Oisin Butler

Sample Login Details	
Your reference	E36314PT Lismore
Envirolab Reference	382346
Date Sample Received	03/06/2025
Date Instructions Received	03/06/2025
Date Results Expected to be Reported	11/06/2025

Sample Condition	
Samples received in appropriate condition for analysis	Holding time exceedance
No. of Samples Provided	10 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	10
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Please contact the laboratory within 24 hours if you wish to cancel the aforementioned testing. Otherwise testing will proceed as per the COC and hence invoiced accordingly.

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Sample ID	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	PAHs in Water	All metals in water-dissolved	Metals in Waters -Acid extractable	Electrical Conductivity	pH	Redox Potential*	Dissolved Oxygen*	Turbidity	Total Dissolved Solids(grav)	Total Suspended Solids	Total Organic Carbon	Sodium Adsorption Ratio	Silica (Reactive - SiO2)	Ammonia as N in water	Nitrate as N in water	Nitrite as N in water	NOx as N in water	Total Nitrogen in water	TKN in water	Phosphate as P in water	Organic Nitrogen as N	Calcium - Dissolved	Potassium - Dissolved	Sodium - Dissolved	Magnesium - Dissolved	Hardness (calc) equivalent CaCO3	Hydroxide Alkalinity (OH-) as CaCO3	Bicarbonate Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulphate, SO4	Chloride, Cl	Ionic Balance	Microbiological Testing
MW62	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MW206	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MW212	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MW214	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Creek1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GWDUP301	✓	✓	✓	✓																																
GWDUP302	✓	✓	✓																																	
FR302-IP	✓	✓	✓	✓																																
TB301	✓	✓	✓	✓																																
TS301	✓																																			

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

SAMPLE AND CHAIN OF CUSTODY FORM

TO:
ENVIROLAB SERVICES PTY LTD
12 ASHLEY STREET
CHATSWOOD NSW 2067
P: (02) 99106200
F: (02) 99106201

Attention: Aileen

JKE Job Number: E36314PT
Date Results Required: STANDARD
Page: 1 OF 1

FROM:
JKEnvironments
REAR OF 115 WICKS ROAD
MACQUARIE PARK, NSW 2113
P: 02-9888 5000 F: 02-9888 5001
Attention:

Location: Lismore
Sampler: OB

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Sample Containers	PID	Sample Description	Alkalinity suite	EC, pH, reddox, DO	Turbidity	TDS, TSS, TOC, SAR	Ionic balance, including hardness	#3	Additional metals: Al, Ag, Sb, Ba, Be, B, Co, Fe, Li, Mn, Mo, Se, Sr, U, V	Silica (reactive) - dissolved silica	Nutrient suite	Faecal coliforms + Escherichia (E) coli	BTEX	TRH/BTEXN/PAH
30/05/2025	1	MW62	##	0.1	Water	X	X	X	X	X	X	X	X	X	X		
30/05/2025	2	MW206	##	10.7	Water	X	X	X	X	X	X	X	X	X	X		
30/05/2025	3	MW212	##	24.8	Water	X	X	X	X	X	X	X	X	X	X		
31/05/2025	4	MW214	##	44.4	Water	X	X	X	X	X	X	X	X	X	X		
29/05/2025	5	Creek1	##	-	Water	X	X	X	X	X	X	X	X	X	X		
30/05/2025	6	GWDUP301		-	Water						X	X					
30/05/2025	7	GWDUP302		-	Water		X					X					X
30/05/2025	8	FR302-IP		-	Field Rinsate						X	X					
27/05/2025	9	TB301		-	Trip Blank					X	X						
27/05/2025	10	TS301		-	Trip Spike											X	
				-								X			X		
				-								X					
				-								X					
				-			X										

Remarks (comments/detection limits required):

Sample Containers:
Each sample includes: x2 amber bottles, x2 HCl preserved glass vials, x2 unpreserved plastic bottles, x2 nitric acid preserved bottles (1 is field filtered), x1 sulphuric acid preserved bottle and x1 sterile container

Relinquished By:	Date:	Time:	Received By:	Date:
			O-Wilczak	3/6/25

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 382346
Date Received: 3/6/25
Time Received: 1500
Received By: OW
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Appendix G: Report Explanatory Notes

Standard Sampling Procedure (SSP)

These protocols specify the basic procedures to be used when sampling soils or groundwater for environmental site assessments undertaken by JKE. The purpose of these protocols is to provide standard methods for: sampling, decontamination procedures for sampling equipment, sample preservation, sample storage and sample handling. Deviations from these procedures must be recorded.

A. Soil Sampling:

- Prepare a borehole/test pit log or made a note of the sample description for stockpiles.
- Layout sampling equipment on clean plastic sheeting to prevent direct contact with ground surface. The work area should be at a distance from the drill rig/excavator such that the machine can operate in a safe manner.
- Ensure all sampling equipment has been decontaminated prior to use.
- Remove any surface debris from the immediate area of the sampling location.
- Collect samples and place in appropriate sampling containers provided by the lab.
- Label the sampling containers with the JKE job number, sample location (eg. BH1), sampling depth interval and date. If more than one sample container is used, this should also be indicated (eg. 2 = Sample jar 1 of 2 jars).
- Record the lithology of the sample and sample depth on the borehole/test pit log generally in accordance with AS1726-1993[15].
- Store the sample in a sample container cooled with ice or chill packs. On completion of the sampling the sample container should be delivered to the lab immediately or stored in the refrigerator prior to delivery to the lab. All samples are preserved in accordance with the standards outlined in the report.
- Check for the presence of groundwater after completion of each borehole using an electronic dip metre or water whistle. Boreholes should be left open until the end of fieldwork. All groundwater levels in the boreholes should be rechecked on the completion of the fieldwork.
- Backfill the boreholes/test pits with the excavation cuttings or clean sand prior to leaving the site.

B. Groundwater Sampling

Groundwater samples are more sensitive than soil samples and therefore adhesion to this protocol is particularly important to obtain reliable, reproducible results. The recommendations detailed in AS/NZS 5667.1:1998 are considered to form a minimum standard. The basis of this protocol is to maintain the security of the borehole and obtain accurate and representative groundwater samples. The following procedure should be used for collection of groundwater samples from previously installed groundwater monitoring wells.

- After monitoring well installation, at least three bore volumes should be pumped from the monitoring wells (well development) to remove any water introduced during the drilling process and/or the water that is disturbed during installation of the monitoring well. This should be completed prior to purging and sampling.
- Groundwater monitoring wells should then be left to recharge for at least three days before purging and sampling. Prior to purging or sampling, the condition of each well should observed and any anomalies recorded on the field data sheets. The following information should be noted: the condition of the well, noting any signs of damage, tampering or complete destruction; the condition and operation of the well lock; the condition of the protective casing and the cement footing (raised or cracked); and, the presence of water between protective casing and well.
- Take the groundwater level from the collar of the piezometer/monitoring well using an electronic dip meter. The collar level should be taken (if required) during the site visit using a dumpy level and staff.
- Purging and sampling of piezometers/monitoring wells is done on the same site visit when using micro-purge (or other low flow) techniques.

---

[15] Standards Australia, (1993), *Geotechnical Site Investigations.* (AS1726-1993)

- Layout and organize all equipment associated with groundwater sampling in a location where they will not interfere with the sampling procedure and will not pose a risk of contaminating samples. Equipment generally required includes:
    - Micropore filtration system or Stericup single-use filters (for heavy metals samples);
    - Filter paper for Micropore filtration system; Bucket with volume increments;
    - Sample containers: teflon bottles with 1 ml nitric acid, 75mL glass vials with 1 mL hydrochloric acid, 1 L amber glass bottles;
    - Bucket with volume increments;
    - Flow cell;
    - pH/EC/Eh/T meters;
    - Plastic drums used for transportation of purged water;
    - Esky and ice;
    - Nitrile gloves;
    - Distilled water (for cleaning);
    - Electronic dip meter;
    - Low flow pump pack and associated tubing; and
    - Groundwater sampling forms.
- If single-use stericup filtration is not used, clean the Micropore filtration system thoroughly with distilled water prior to use and between each sample. Filter paper should be changed between samples. 0.45um filter paper should be placed below the glass fibre filter paper in the filtration system.
- Ensure all non-disposable sampling equipment is decontaminated or that new disposable equipment is available prior to any work commencing at a new location. The procedure for decontamination of groundwater equipment is outlined at the end of this section.
- Disposable gloves should be used whenever samples are taken to protect the sampler and to assist in avoidance of contamination.
- Groundwater samples are obtained from the monitoring wells using low flow/micro-purge sampling equipment to reduce the disturbance of the water column and loss of volatiles.
- During pumping to purge the well, the pH, temperature, conductivity, dissolved oxygen, redox potential and groundwater levels are monitored (where possible) using calibrated field instruments to assess the development of steady state conditions. Steady state conditions are generally considered to have been achieved when the difference in the pH measurements was less than 0.2 units and the difference in conductivity was less than 10%.
- All measurements are recorded on specific data sheets.
- Once steady state conditions are considered to have been achieved, groundwater samples are obtained directly from the pump tubing and placed in appropriate glass bottles or plastic bottles.
- All samples are preserved in accordance with water sampling requirements detailed in the NEPM 2013 and placed in an insulated container with ice. Groundwater samples are preserved by immediate storage in an insulated sample container with ice as outlined in the report text.
- Record the sample on the appropriate log in accordance with AS1726:1993. At the end of each water sampling complete a chain of custody form.

Appendix H: Groundwater Field Records

JKEnvironments

Client:	School Infrastructure NSW	**Job No.:**	E36314PT
Project:	Proposed Richland River High Campus Rebuild	**Well No.:**	mw62
Location:	163 – 170 Alexandra Parade, North Lismore, NSW	**Depth (m):**	11.29

WELL FINISH DETAILS

	Gatic Cover ☐	**Standpipe** ☐	**Other (describe)** ☒ monument compromised

WELL DEVELOPMENT DETAILS

Method:	Peristaltic Pump	**SWL – Before (m):**	6.65
Date:	28/5/25	**Time – Before:**	12:31
Undertaken By:	OB	**SWL – After (m):**	8.00
Total Vol. Removed:	30 L	**Time – After:**	14:00
PID Reading (ppm):	6.0		

Comments:

DEVELOPMENT MEASUREMENTS

Volume Removed (L)	SWL	Temp (°C)	DO (mg/L)	EC (µS/cm)	pH	Eh (mV)
1	6.65	22.0	3.25	1477	7.24	36.3
5		21.8	2.09	1446	7.12	18.6
10		21.7	2.11	1424	7.06	2.6
15		21.8	3.54	1456	7.04	-3.6
20		21.8	1.03	1443	7.03	-1.8
25		21.8	1.05	1442	7.03	7.9
30	7.86	21.7	1.08	1440	7.03	15.3

Comments: **Odours** (YES / [✓ NO]), **NAPL/PSH** (YES / [✓ NO]), **Sheen** (YES / [✓ NO]), **Steady State Achieved** (YES / [✓ NO])

YSI Used: 1

low silt load

Tested By:	OB	**Remarks:** - Steady state conditions - Difference in the pH less than 0.2 units, difference in the conductiveity less than 10% and SWL stable/not in drawdown - Minimum 3 monitoring well volumes purged, unless well purged until it is effectively dry
Date Tested:	28/5/25	
Checked By:	KT	
Date:	12.06.2025	

JKEnvironments

Client:	School Infrastructure NSW	**Job No.:**	E36314PT
Project:	Proposed Richland River High Campus Rebuild	**Well No.:**	MW206
Location:	163 – 170 Alexandra Parade, North Lismore, NSW	**Depth (m):**	5.70

WELL FINISH DETAILS

Gatic Cover ☐ **Standpipe** ☒ **Other (describe)** ☐

SPIPE
1.05m

WELL DEVELOPMENT DETAILS

Method:	Dow Pump	**SWL – Before (m):**	0.4
Date:	29/5/25	**Time – Before:**	15:04
Undertaken By:	OB	**SWL – After (m):**	5.53
Total Vol. Removed:	30 L	**Time – After:**	15:58
PID Reading (ppm):	1.1		

Comments:

DEVELOPMENT MEASUREMENTS

Volume Removed (L)	SWL	Temp (°C)	DO (mg/L)	EC (µS/cm)	pH	Eh (mV)
5		23.3	6.22	290.8	7.13	175.1
10		23.4	6.35	310.5	7.20	171.6
15		23.5	6.48	287.5	7.33	164.0
20		23.6	~~7~~.59	293.3	7.44	150.6
25		23.4	7.54	302.3	7.54	133.7
30		22.6	7.38	317.8	7.66	112.4
		well purged	effectively	dry		

Comments:Odours (YES / [✓ NO]), NAPL/PSH (YES / [✓ NO]), Sheen (YES / [✓ NO]), Steady State Achieved (YES / [✓ NO])
YSI Used: 1

no silt load. no recharge

Tested By:	OG
Date Tested:	29/5/25
Checked By:	KT
Date:	12.06.2025

Remarks:
- Steady state conditions
- Difference in the pH less than 0.2 units, difference in the conductiveity less than 10% and SWL stable/not in drawdown
- Minimum 3 monitoring well volumes purged, unless well purged until it is effectively dry

JKEnvironments

Client:	School Infrastructure NSW	**Job No.:**	E36314PT
Project:	Proposed Richland River High Campus Rebuild	**Well No.:**	212
Location:	163 – 170 Alexandra Parade, North Lismore, NSW	**Depth (m):**	6.0

WELL FINISH DETAILS

Gatic Cover ☒ **Standpipe** ☐ **Other (describe)** ☐

WELL DEVELOPMENT DETAILS

Method:	Dev Pump	**SWL – Before (m):**	2.80
Date:	28/5/25	**Time – Before:**	11:30
Undertaken By:	OB	**SWL – After (m):**	5.95 (dry)
Total Vol. Removed:	20 L	**Time – After:**	11 51 /
PID Reading (ppm):	4.6		

Comments:

DEVELOPMENT MEASUREMENTS

Volume Removed (L)	SWL	Temp (°C)	DO (mg/L)	EC (µS/cm)	pH	Eh (mV)
1		24.6	11.50	1334	7.20	107.7
5		24.4	1.52	1264	7.75	17.3
10		24.6	1.42	1254	7.75	-43.8
15		24.5	1.01	1180	7.72	-53.9
20		24.9	1.00	1080	7.80	-63.1

well purged effectively dry

Comments:Odours (YES / [✓ NO]) **NAPL/PSH** (YES / [✓ NO]), **Sheen** (YES / [✓ NO]), **Steady State Achieved** (YES / [✓ NO])

YSI Used: 1

High silt load, low recharge, brown - core water

Tested By:	Ok	**Remarks:** - Steady state conditions - Difference in the pH less than 0.2 units, difference in the conductiveity less than 10% and SWL stable/not in drawdown - Minimum 3 monitoring well volumes purged, unless well purged until it is effectively dry
Date Tested:	28/5/25	
Checked By:	KT	
Date:	12.06.2025	

JKEnvironments

Client:	School Infrastructure NSW	**Job No.:**	E36314PT
Project:	Proposed Richland River High Campus Rebuild	**Well No.:**	mw214
Location:	163 – 170 Alexandra Parade, North Lismore, NSW	**Depth (m):**	6.3

WELL FINISH DETAILS

Gatic Cover ☐ Standpipe ☒ 1.0m Other (describe) ☐

WELL DEVELOPMENT DETAILS

Method:	Dip Pump	**SWL – Before (m):**	3.00
Date:	30/5/25	**Time – Before:**	08.38
Undertaken By:	OR	**SWL – After (m):**	6.25 (dry)
Total Vol. Removed:	30L	**Time – After:**	09.21
PID Reading (ppm):	3.2		

Comments:

DEVELOPMENT MEASUREMENTS

water introduced

Volume Removed (L)	SWL	Temp (°C)	DO (mg/L)	EC (µS/cm)	pH	Eh (mV)
1		19.5	5.78	3184	7.14	275.9
5		23.2	4.61	3277	7.05	235.1
10		21.4	4.20	3314	7.08	224.6
15	5.70	21.5	2.30	3269	7.09	283.1
20		19.9	7.50	1130	8.21	377.0
25		19.9	8.30	1325	7.76	357.6
30	6.25	19.9	8.87	1527	7.70	154.6
		well pumped	effectively	dry		

Comments: Odours ([✓ YES] / NO), NAPL/PSH (YES / [✓ NO]), Sheen (YES / [✓ NO]), Steady State Achieved (YES / [✓ NO])

YSI Used: 1

H silt load. low recharge / brown

Hydrocarbon odours

Tested By:	OR	**Remarks:** - Steady state conditions - Difference in the pH less than 0.2 units, difference i[illegible]ity less than 10% and SWL stable/not in drawdown - Minimum 3 monitoring well volumes purged, unless [illegible] until it is effectively dry
Date Tested:	30/5/25	
Checked By:	KT	
Date:	12.06.2025	

JKEnvironments

Client:	School Infrastructure NSW	**Job No.:**	E36314PT
Project:	Proposed Richland River High Campus Rebuild	**Well No.:**	MW62
Location:	163 – 170 Alexandra Parade, North Lismore, NSW	**Depth (m):**	11.29

monument compromised

WELL FINISH

Gatic Cover		Standpipe	X	Other (describe)	

WELL PURGE DETAILS:

Method:	Peri Pump	**SWL – Before:**	6.78
Date:	30/5/25	**Time – Before:**	11:50
Undertaken By:	OB	**Total Vol Removed:**	~6.0 L
Pump Program No:	Low	**PID (ppm):**	0.1

PURGING / SAMPLING MEASUREMENTS

Time (min)	SWL (m)	Vol (L)	Notes	Temp (°C)	DO (mg/L)	EC (µS/cm)	pH	Eh (mV)
12:00 (0)	6.78	0.6		19.5	10.96	1223.2	8.14	81.7
12:03 (3)	6.90	1.3		21.1	3.87	1439.0	7.08	136.9
12:06 (6)	7.00	2.0		21.2	2.51	1441	7.03	138.9
12:09 (9)	7.10	2.7		21.2	2.12	1440	7.01	129.4
12:12 (12)	7.17	3.4		21.2	1.90	1439	7.00	120.1
12:15 (15)	7.23	4.0		21.1	1.78	1437	7.00	113.2
12:18 (18)	7.23	4.5		21.0	1.69	1432	7.00	107.1

Steady state achieved – start sampling

Comments: Odours (YES / [✓ NO]), NAPL/PSH (YES / [✓ NO]), Sheen (YES / [✓ NO]), Steady State Achieved ([✓ YES] / NO)
Sampling Containers Used: 4 x glass amber, 8 x BTEX vials, 4 x HNO3 plastic, 1 x H2SO4 plastic, 1 x unpreserved plastic x1 microbial x2 PFAS
YSI used: 1

m recharge, low silt load GWDUP301

Tested By:	OB
Date Tested:	30/5/25
Checked By:	KT
Date:	12.06.2025

Remarks:
- Steady state conditions
- difference in the pH less than 0.2 units, difference in conductivity less than 10% 10% and SWL stable/not in drawdown

JKEnvironments

Client:	School Infrastructure NSW	**Job No.:**	E36314PT
Project:	Proposed Richland River High Campus Rebuild	**Well No.:**	MW206
Location:	163 – 170 Alexandra Parade, North Lismore, NSW	**Depth (m):**	5.70

SPIPE 1.05m

WELL FINISH

Gatic Cover		**Standpipe**	1.05 m	**Other (describe)**

WELL PURGE DETAILS:

Method:	Peri Pump	**SWL – Before:**	2.37
Date:	30/5/25	**Time – Before:**	13:04
Undertaken By:	OB	**Total Vol Removed:**	~15L
Pump Program No:	low	**PID (ppm):**	10.7

PURGING / SAMPLING MEASUREMENTS

Time (min)	SWL (m)	Vol (L)	Notes	Temp (°C)	DO (mg/L)	EC (µS/cm)	pH	Eh (mV)
13:13 (3)	2.50	0.6		21.3	6.41	410.8	7.38	71.0
13:16 (6)	2.59	1.2		21.1	6.72	352.1	7.42	68.3
13:19 (9)	2.69	1.8		21.3	6.36	354.1	7.38	70.3
13:22 (12)	2.79	2.4		21.4	6.06	382.8	7.36	71.6
13:25 (15)	3.04	3.0		21.5	5.65	404.6	7.34	72.7
13:28 (18)	3.25	3.6		21.4	5.84	404.5	7.34	71.9
13:31 (21)	3.27	4.4	(pump slowed)	20.9	4.96	396.0	7.37	69.5
13:34 (24)	3.42	5.0		20.4	5.00	391.5	7.38	68.8
~~13~~								
13:47 (34)	3.52	6.0		19.0	6.90	370.7	7.38	51.2
13:50 (37)	3.58	6.3		18.9	5.47	367.5	7.38	53.6
13:53 (40)	3.58	6.6		18.8	5.45	364.8	7.39	53.9
13:56 (43)	3.61	6.9		18.7	5.45	361.0	7.40	54.4
13:59 (46)	3.63	7.2		18.6	5.44	357.5	7.41	55.0
14:02 (49)	3.67	7.5	pump overheated	18.7	5.46	356.5	7.41	56.0
14:04 (52)								
14:12 (62)	3.79	8.5		19.6	6.36	328.8	7.46	52.9
14:15 (65)	3.92	9.0		19.6	5.72	319.7	7.52	25.9
14:18 (68)	4.03	9.5		20.1	6.00	316.0	7.54	15.1
14:21 (71)	4.17	10.0		20.3	6.00	318.0	7.48	-3.1
14:24 (74)	4.30	10.5		20.3	6.16	307.7	7.43	8.4
14:27 (77)	4.43	11.0		20.4	6.28	311.6	7.41	16.9
14:30 (80)	4.59	11.5	pump lower setting	20.5	6.07	325.5	7.41	23.3
14:33 (83)	4.66	11.75		19.7	5.12	329.5	7.45	27.1
14:36 (86)	4.71	12.0		18.6	5.57	322.0	7.44	30.5
14:39 (89)	4.75	12.25	start sampling	19.0	5.78	321.7	7.40	34.4

Comments: Odours (YES / [✓ NO]), NAPL/PSH (YES / [✓ NO]), Sheen (YES / [✓ NO]), Steady State Achieved (YES / [✓ NO])

Sampling Containers Used: 1 x glass amber, 6 x BTEX vials, 2 x HNO3 plastic, 1 x H2SO4 plastic, - x unpreserved plastic x1 Microbial losing water x2 PFAS

YSI used: 1 start sampling - threat or

GWDUP302

low recharge, moderate silt load, yellow brown

Tested By:	OB
Date Tested:	30/5/25
Checked By:	KT
Date:	12.06.2025

Remarks:

- Steady state conditions
- difference in the pH less than 0.2 units, difference in conductivity less than 10% 10% and SWL stable/not in drawdown

JKEnvironments

Client:	School Infrastructure NSW	**Job No.:**	E36314PT
Project:	Proposed Richland River High Campus Rebuild	**Well No.:**	Mw212
Location:	163 – 170 Alexandra Parade, North Lismore, NSW	**Depth (m):**	6.0

WELL FINISH

X	**Gatic Cover**		**Standpipe**		**Other (describe)**

WELL PURGE DETAILS:

Method:	PO1 Pump	**SWL – Before:**	4.93
Date:	30/5/25	**Time – Before:**	09:57
Undertaken By:	OB	**Total Vol Removed:**	~3 L
Pump Program No:	low	**PID (ppm):**	24.8

PURGING / SAMPLING MEASUREMENTS

Time (min)	SWL (m)	Vol (L)	Notes	Temp (°C)	DO (mg/L)	EC (µS/cm)	pH	Eh (mV)
10:10 (0)	5.24	0.5		21.7	3.02	1142	7.74	41.1
10:13 (3)	5.37	1.0	pump slowed	21.7	2.41	1190	7.71	-5.8
10:16 (6)	5.46	1.25	pump slowed	21.7	1.57	1195	7.68	-91.8
10:19 (9)	5.50	1.50	pump on lowest setting	21.4	1.23	1188	7.67	-98.9
10:22 (12)	5.55							
10:25 (15)	5.60		↓					
10:28 (18)	5.65							
	start sampling - threat of losing water							

Comments: Odours (YES / [✓ NO]), NAPL/PSH (YES / [✓ NO]), Sheen (YES / [✓ NO]), Steady State Achieved (YES / [✓ NO])
Sampling Containers Used: 2 x glass amber, 4 x BTEX vials, 2 x HNO3 plastic, 1 x H2SO4 plastic, 1 x unpreserved plastic x2 PFAS
YSI used: 1

no microbial taken

Tested By:	OB
Date Tested:	30/5/25
Checked By:	KT
Date:	12.06.2025

Remarks:
- Steady state conditions
- difference in the pH less than 0.2 units, difference in conductivity less than 10% 10% and SWL stable/not in drawdown

JKEnvironments

Client:	School Infrastructure NSW	**Job No.:**	E36314PT
Project:	Proposed Richland River High Campus Rebuild	**Well No.:**	214
Location:	163 – 170 Alexandra Parade, North Lismore, NSW	**Depth (m):**	6.3

WELL FINISH

Gatic Cover	X	**Standpipe**	1.05m		**Other (describe)**

WELL PURGE DETAILS:

Method:	Peri Pump	**SWL – Before:**	3 29
Date:	31/5/25	**Time – Before:**	07:22
Undertaken By:	OB	**Total Vol Removed:**	~11L
Pump Program No:	Low	**PID (ppm):**	44.4

PURGING / SAMPLING MEASUREMENTS

Time (min)	SWL (m)	Vol (L)	Notes	Temp (°C)	DO (mg/L)	EC (µS/cm)	pH	Eh (mV)
07.29 (0)	3 39	0 5		20 6	6.58	3601	7.19	103-7
07.32 (3)	3.43	1.5		20.2	6.70	3696	7.12	111.0
07 35 (6)	3.53	2 5		20.8	4.95	3786	7.09	98.3
07.38 (9)	3 83	3 5		21.1	4.19	3806	7 06	77.5
07.41 (12)	4 14	4.5		21.2	4.05	3780	7.06	64 6
07:44 (15)	4.54	5.5		21 2	4.08	3766	7 05	52.4
07.47 (18)	4.83	6 5	pump slowed	21.3	4.08	3784	7 04	46.5
07.50 (21)	4 86	7 2		20 6	3.61	3694	7.05	42 7
07:53 (24)	4 92	7 9		20 2	3.88	3674	7.05	41.0
07:56 (27)	4.78	8-6		20 3	3.87	3661	7.05	40.8
	steady	stable	achieved - start	sampling				

Comments: Odours ([✓ YES] / NO), NAPL/PSH (YES / [✓ NO]), Sheen (YES / [✓ NO]), Steady State Achieved ([✓ YES] / NO)
Sampling Containers Used: 2 x glass amber, 4 x BTEX vials, 2 x HNO3 plastic, 1 x H2SO4 plastic, 1 x unpreserved plastic x2 PFAS
YSI used: 1
faint hydrocarbon odour. mild silt load. High recharge. brown x1 microbial

Tested By:	OB
Date Tested:	31/5/25
Checked By:	KT
Date:	12.06.2025

Remarks:
- Steady state conditions
- difference in the pH less than 0.2 units, difference in conductivity less than 10% 10% and SWL stable/not in drawdown

JKEnvironments

WATER QUALITY METER CALIBRATION FORM

Client: School Infrastructure NSW			
Project: Proposed Richland River High Campus Rebuild			
Location: 163 – 170 Alexandra Parade, North Lismore, NSW			
Job Number: E36314PT			
DISSOLVED OXYGEN			
Make: YSI		Model: 1	
Date of calibration: 29/5/25		Name of Calibrator: JT, OR	
Span value: 70% to 130%			
Measured value: 80.7			
Measured reading Acceptable (Yes/No): Yes.			
pH			
Make: YSI		Model: 1	
Date of calibration: 28/5/25		Name of Calibrator: JT, OR	
Buffer 1: Theoretical pH = 7.01± 0.01		Expiry date: 29/10/25	Lot No: CC291024
Buffer 2: Theoretical pH = 4.01± 0.01		Expiry date: 12/11/25	Lot No: CA121124
Measured reading of Buffer 1: 7.07			
Measured reading of Buffer 2: 4,07			
Slope: –		Measured reading Acceptable (Yes/No): Yes.	
EC			
Make: YSI		Model: 1	
Date:	29/5/25	Name of Calibrator: JT, OR	Temperature: 18 °C
Calibration solution: ROWE Scientific		Expiry date: 13/08/25	Lot No: CR130824
Theoretical conductivity at temperature (see solution container): 1224 µS/cm			
Measured conductivity: 1557 µS/cm		Measured reading Acceptable (Yes/No): Yes	
REDOX			
Make: YSI		Model: 1	
Date of calibration: 29/5/25		Name of Calibrator: JT, OR	
Calibration solution: Hanna instruments.		Expiry date: 09/29	Lot No: 0567
Theoretical redox value: 240mV			
Measured redox reading: 236.1mV		Measured reading Acceptable (Yes/No): Yes.	

JKEnvironments

WATER QUALITY METER CALIBRATION FORM

Client: School Infrastructure NSW
Project: Proposed Richland River High Campus Rebuild
Location: 163 – 170 Alexandra Parade, North Lismore, NSW
Job Number: E36314PT

DISSOLVED OXYGEN

Make: YSI	Model: 1
Date of calibration: 29/5/25	Name of Calibrator: OB

Span value: 70% to 130%
Measured value: 101 %
Measured reading Acceptable (Yes/No): yes

pH

Make: YSI	Model: 1	
Date of calibration: 29/5/25	Name of Calibrator: OB	
Buffer 1: Theoretical pH = 7.01± 0.01	Expiry date: 29/10/25	Lot No: CC291024
Buffer 2: Theoretical pH = 4.01± 0.01	Expiry date: 12/11/25	Lot No: CA121124

Measured reading of Buffer 1: 7.01
Measured reading of Buffer 2: 4.01

Slope:	Measured reading Acceptable (Yes/No): yes

EC

Make: YSI	Model: 1	
Date: 29/5/25	Name of Calibrator: OB	Temperature: 21 °C
Calibration solution: Rowe Scientific	Expiry date: 13/8/25	Lot No: CB130824

Theoretical conductivity at temperature (see solution container): 1305 µS/cm

Measured conductivity: 1296 µS/cm	Measured reading Acceptable (Yes/No): yes

REDOX

Make: YSI	Model: 1	
Date of calibration: 29/5/25	Name of Calibrator: OB	
Calibration solution: HANNA	Expiry date: 09/29	Lot No: 0567

Theoretical redox value: 240mV

Measured redox reading: 228.4 mV	Measured reading Acceptable (Yes/No): yes

JKEnvironments

WATER QUALITY METER CALIBRATION FORM

Client: School Infrastructure NSW

Project: Proposed Richland River High Campus Rebuild

Location: 163 – 170 Alexandra Parade, North Lismore, NSW

Job Number: E36314PT

DISSOLVED OXYGEN

Make: YSI	Model: /
Date of calibration: 30/5/25	Name of Calibrator: OB

Span value: 70% to 130%

Measured value: 98%

Measured reading Acceptable (Yes/No): Yes

pH

Make: YSI	Model: /	
Date of calibration: 30/5/25	Name of Calibrator: OB	
Buffer 1: Theoretical pH = 7.01± 0.01	Expiry date: 10/25	Lot No: CC291024
Buffer 2: Theoretical pH = 4.01± 0.01	Expiry date: 11/25	Lot No: CA121124

Measured reading of Buffer 1: 7.01

Measured reading of Buffer 2: 4.01

Slope:	Measured reading Acceptable (Yes/No): Yes

EC

Make: YSI		Model: /	
Date:	30/5/25	Name of Calibrator: OB	Temperature: 21 °C
Calibration solution: Rowe Scientific		Expiry date: 8/25	Lot No: CB130824

Theoretical conductivity at temperature (see solution container): 1305 µS/cm

Measured conductivity: 1480 µS/cm	Measured reading Acceptable (Yes/No): Yes

REDOX

Make: YSI	Model: /	
Date of calibration: 30/5/25	Name of Calibrator: OB	
Calibration solution: HANNA	Expiry date: 09/29	Lot No: 0567

Theoretical redox value: 240mV

Measured redox reading: 230.0 mV	Measured reading Acceptable (Yes/No): Yes

JKEnvironments

WATER QUALITY METER CALIBRATION FORM

Client:	School Infrastructure NSW		
Project:	Proposed Richland River High Campus Rebuild		
Location:	163 – 170 Alexandra Parade, North Lismore, NSW		
Job Number:	E36314PT		
DISSOLVED OXYGEN			
Make: YSI		Model: /	
Date of calibration: 31/5/25		Name of Calibrator: OB	
Span value: 70% to 130%			
Measured value:			
Measured reading Acceptable (Yes/No): yes			
pH			
Make: YSI		Model: /	
Date of calibration: 31/5/25		Name of Calibrator: OB	
Buffer 1: Theoretical pH = 7.01± 0.01		Expiry date: 10/25	Lot No: CC291024
Buffer 2: Theoretical pH = 4.01± 0.01		Expiry date: 11/25	Lot No: CA121124
Measured reading of Buffer 1: 7.01			
Measured reading of Buffer 2: 4.01			
Slope:		Measured reading Acceptable (Yes/No): yes	
EC			
Make: YSI		Model: /	
Date:	31/5/25	Name of Calibrator: OB	Temperature: 18 °C
Calibration solution: Rowe Scientific		Expiry date: 8/25	Lot No: CB130824
Theoretical conductivity at temperature (see solution container): 1224 µS/cm			
Measured conductivity: 1400 µS/cm		Measured reading Acceptable (Yes/No): yes	
REDOX			
Make: YSI		Model: /	
Date of calibration: 31/5/25		Name of Calibrator: OB	
Calibration solution: HANNA		Expiry date: 09/29	Lot No: 0567
Theoretical redox value:	240mV		
Measured redox reading: 232.8 mV		Measured reading Acceptable (Yes/No): yes	

JKEnvironments

PID FIELD CALIBRATION FORM

Client: School Infrastructure NSW
Project: Proposed Richland River High Campus Rebuild
Location: 163 – 170 Alexandra Parade, North Lismore, NSW

Job Number: E36314PT

PID

Make: Honeywell
Model: MINIRAELITE+
Unit: 4
Date of last factory calibration: 28/1/25
Date of calibration: 3/6/25
Name of Calibrator: OB
Calibration gas: Iso-butylene
Calibration Gas Concentration: 100.0 ppm
Measured reading: 97.3 ppm
Error in measured reading: ± 2.7 ppm
Measured reading Acceptable (Yes/No): Yes

PID

Make:
Model:
Unit:
Date of last factory calibration:
Date of calibration:
Name of Calibrator:
Calibration gas: Iso-butylene
Calibration Gas Concentration: 100.0 ppm
Measured reading: ppm
Error in measured reading: ± ppm
Measured reading Acceptable (Yes/No):

PID

Make:
Model:
Unit:
Date of last factory calibration:
Date of calibration:
Name of Calibrator:
Calibration gas: Iso-butylene
Calibration Gas Concentration: 100.0 ppm
Measured reading: ppm
Error in measured reading: ± ppm
Measured reading Acceptable (Yes/No):

PID

Make:
Model:
Unit:
Date of last factory calibration:
Date of calibration:
Name of Calibrator:
Calibration gas: Iso-butylene
Calibration Gas Concentration: 100.0 ppm
Measured reading: ppm
Error in measured reading: ± ppm
Measured reading Acceptable (Yes/No):

PID

Make:
Model:
Unit:
Date of last factory calibration:
Date of calibration:
Name of Calibrator:
Calibration gas: Iso-butylene
Calibration Gas Concentration: 100.0 ppm
Measured reading: ppm
Error in measured reading: ± ppm
Measured reading Acceptable (Yes/No):