Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
18 Waler Crescent
Smeaton Grange NSW 2567
Phone (02) 4647 0075

Greenfields Development Company Pty Ltd
5 Peter Brock Drive
ORAN PARK NSW 2570

Project 92287.60
29 January 2020
R.002.Rev0
CKM

Attention: Mr Steve Driscoll

Email: steve.driscoll@greenfields.net.au

Salinity Summary Letter
Proposed Rezoning
Tranche 41, Pondicherry, Oran Park

Douglas Partners Pty Ltd (DP) was commissioned by Greenfields Development Company Pty Ltd (GDC 2) to prepare a letter summarising the salinity status of Tranche 41, Pondicherry, Oran Park (the site, as shown on Drawing 1, Attachment 1). DP understands that the summary letter is required to support the proposed rezoning of the site for residential land use with associated open space and riparian corridors.

The site comprises an area of approximately 40 ha and is located within a land parcel known as Pondicherry. DP previously prepared *Report on Salinity Investigation and Management Plan, Pondicherry Residential Rezoning, Pondicherry, Oran Park, NSW,* Ref. 76778.29.R.001.Rev0 dated 31 August 2017 (the SMP) which incorporates the site. The SMP was undertaken to provide preliminary comments relating to design and construction practices for minimising the effects of salinity.

This letter summarises the findings of the previous SMP relevant to the site. No other additional field investigations were undertaken to support this summary letter.

The SMP included the completion of an electromagnetic survey, the excavation of test pits and collection, analysis and assessment of soil samples for salinity characterisation (ie: soil salinity, aggressivity to concrete and steel, sodicity and dispersibility). Three test pits (TP3, TP4 and TP5) were excavated within the site and TP6 was excavated immediately adjacent to the eastern site boundary. Works were undertaken in conjunction with geotechnical and contamination investigations for the site (Ref. 76778.28 and 76778.30 respectively) both reported separately.

The locations of the above referenced test pits are shown on Drawing 1.

A review of the SMP identified the following soil salinity conditions within the site:

- Mildly aggressive to concrete;
- Mildly aggressive to moderately aggressive to steel;
- Non-saline to highly saline;
- Non-sodic to highly sodic; and
- Dispersion potential of Class 1 - 5 (complete to no dispersion).

Management strategies to mitigate potential salinity impacts to the proposed development are outlined in Section 13 of the SMP.

The mildly aggressivity to concrete, the mildly to moderate aggressivity to steel, the presence of moderate to occasionally very saline materials and the highly sodic soils are naturally occurring features of the local landscape and are not considered significant impediments to the proposed development, provided appropriate remediation or management techniques are employed. It is considered that the management strategies outlined in Section 13 of the SMP, when incorporated into the design and construction works are appropriate to mitigate the levels of salinity, aggressivity and sodicity identified at the site.

The SMP was prepared for the purpose of providing preliminary advice. A detailed salinity investigation will be required prior to construction in order to provide more detailed recommendations for individual lots. Additional investigation should be undertaken in development areas which are to be excavated deeper than 3 m, where direct sampling and testing of salinity has not been carried out. Salinity management strategies may need to be modified or extended following additional investigations by deep test pitting and/or drilling, sampling and testing for soil and water pH, electrical conductivity, TDS, sodicity, sulphates and chlorides. Such works, if required, could be conducted when final cut and fill requirements have been determined.

We trust that the above is suitable for your present requirements. Please do not hesitate to contact the undersigned with any further queries.

Yours faithfully
Douglas Partners Pty Ltd

Cindy Murphy
Environmental Scientist

Reviewed by

Rod Gray
Senior Associate

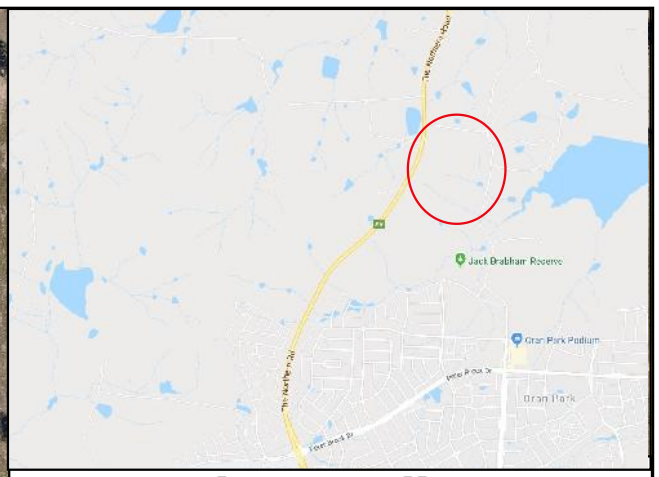
Attachment 1: Drawing 1
Attachment 2: The SMP

Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Tranche 41, Oran Park, NSW in accordance with DP's proposal MAC190377 dated 19 December 2019 and acceptance received from Greenfields Development Company No. 2 Pty Ltd dated 9 January 2020. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Greenfields Development Company No. 2 Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents. This letter should be read in conjunction with the Limitations provided in the SMP.

Attachment 1

Drawing 1



Site Locality

TP3

TP5

TP4

TP6

0 75 150 m

Site Boundary

Pondicherry Lands SMP Boundary

PSI Test Pit Locations

Nearmap aerial Photograph dated 7 November 2019

Douglas Partners
Geotechnics / Environment / Groundwater

TITLE: **Site Boundaries**
Salinity Summary Letter
Tranch 41, Pondicherry, Oran Park

N
MGA

OFFICE: Macarthur
DRAWN BY: CKM
DATE: 20.01.2020

CLIENT: Greenfields Development Company Pty Ltd
PROJ. #: 92287.60.R.002
DRAWING No: 1
REVISION: 0
SCALE: As Shown

Attachment 2

The SMP

Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Salinity Investigation and Salinity Management Plan

Pondicherry Residential Rezoning
Pondicherry, Oran Park, NSW

Prepared for
Department of Planning and Environment
And Camden Council

Project 76778.29
August 2017

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	76778.29	Document No.	R.001.Rev0
Document title	Report on Salinity Investigation and Salinity Management Plan Pondicherry Residential Rezoning		
Site address	Pondicherry, Oran Park, NSW		
Report prepared for	Department of Planning and Environment and Camden Council		
File name	76778.29.R.001.Rev0		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Emily McGinty	Christopher C. Kline	31 August 2017

Distribution of copies

Status	Electronic	Paper	Issued to
Revision 0	1	0	Greenfields Development Company 2 Pty Ltd – Mr Paul Hume

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		31 August 2017
Reviewer	pp for CCK	31 August 2017

bsi. ISO 9001 Quality Management

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
18 Waler Crescent
Smeaton Grange NSW 2567
Phone (02) 4647 0075
Fax (02) 4646 1886

Table of Contents

Page

Report on Salinity Investigation and Salinity Management Plan
Pondicherry Residential Rezoning
Pondicherry, Oran Park, NSW

1. Introduction

Douglas Partners Pty Ltd (DP) was commissioned by Greenfields Development Company No. 2 Pty Ltd (GDC2) on behalf of NSW Department of Planning and Environment (DPE) and Camden Council to undertake a Salinity Investigation and Salinity Management Plan (SMP) for a land parcel referred to as Pondicherry Lands, located within Oran Park, NSW (the site, as shown on Drawing B1). The works was carried out in accordance with DP's proposal MAC170014 dated 6 February 2017.

Saline soils affect much of the Western Sydney region. Buildings and infrastructure located on shales of the Wianamatta Group are particularly at risk. Salinity can affect urban structures in a number of ways, including corrosion of concrete, break down of bricks and mortar, corrosion of steel (including reinforcement), break up of roads, attack on buried infrastructure, reduced ability to grow vegetation and increased erosion potential.

It is understood that a residential subdivision is proposed and that an assessment of soil salinity is required to support a rezoning application.

The investigation comprised the completion of an electromagnetic survey (EM survey) of the site, followed by excavation of test pits, laboratory testing of selected samples, engineering analysis and reporting. Details of the work undertaken and the results obtained are given within this report, together with preliminary comments relating to design and construction practice for minimising the effects of salinity.

The field work was undertaken concurrently with a geotechnical investigation (Project 76778.28) and a contamination assessment (Preliminary Site Investigation - PSI) (Project 76778.30), which have been reported separately. A Land Capability Study Report (Project 76778.27) provides an overview of all investigations and results for this investigation, the geotechnical and contamination investigations.

2. Scope of Works

The scope of works for the current investigation comprised two parts as detailed below:

1. Salinity assessment of the site:

- Inspection of the site for signs of salinity;
- Excavation of 11[1] test pits across the site to a minimum depth of 3 m below ground level (bgl) or prior refusal ;

[1] DP were engaged by GDC to carry out 10 test pits, however in assessing the site conditions DP considered there was significant benefit in conducting an additional test pit.

- Collection of soil samples at regular 0.5 m depth intervals (i.e. 0.5 m to 3 m);
- Laboratory analysis of selected soil and rock samples (60 samples) for electrical conductivity (EC1:5), pH and texture by a NATA accredited laboratory for classification of salinity and aggressivity;
- Laboratory analysis of selected soil and rock samples for chloride and sulphate concentrations (15 samples) for further assessment of aggressivity; and analysis for sodicity (7 samples) and dispersibilty (3 samples) as an indicator of erodibility; and
- Assessment of the results with respect to potential for salinity impacts on the development.

2. Preparation of a Salinity Management Plan (SMP):

- Review of the salinity investigation results;
- Review of the following documents detailing Council requirements:
  - 'Map of Salinity Potential in Western Sydney', DNR (2002);
  - 'Guidelines to Accompany Map of Salinity Potential in Western Sydney', DNR (2002);
  - 'Western Sydney Salinity Code of Practice' (amended January 2004), Rebecca Nicholson for WSROC, DNR and Natural Heritage Trust;
  - 'Guide to Residential Slabs and Footings in a Saline Environment', Cement, Concrete and Aggregates, Australia (2005);
  - 'Introduction to Urban Salinity', DNR (2003);
  - 'Building in a Saline Environment' DNR (2003);
  - 'Roads and Salinity', DNR (2003);
  - 'Indicators of Urban Salinity', DNR (2002);
  - 'Site Investigations for Urban Salinity', DNR (2002);
  - 'Urban Salinity Processes', DNR (2004);
  - 'Waterwise Parks and Gardens', DNR (2004); and
  - 'Broad Scale Resources for Urban Salinity Assessment' DNR (2002).
- Providing management strategies to reduce the impact of saline material on the proposed development.

3. Site Description

3.1 Site Identification

The site is located within the local government area of Camden Council and comprises an irregular shaped area of approximately 238 ha. The site is currently registered as nine separate lots as listed below and shown on Drawing B1, Appendix A.

- Part Lot E, Deposited Plan (D.P) 438723;
- Part Lot A, D.P. 420694;
- Lot F, D.P. 420694;
- Lot B, D.P. 420694;
- Part Lot 1, D.P. 623190;
- Part Lot 2, D.P. 1066809;
- Lot 71, D.P. 752024;
- Part Lot C, D.P. 391340; and
- Part Lot 9070, D.P. 11225752.

The site location and boundaries are shown on Drawing B1, Appendix A.

3.2 Site Description

The site is bound by rural land to the north, South Creek and rural land to the east, Oran Park Precinct to the south and The Northern Road to the west and beyond by further rural residential and agricultural land (Bringelly). The site currently forms part of an active farming property which includes two large farm dams in the eastern/south eastern portion of the site and several smaller dams throughout the site. The southernmost large dam provides a storm water detention function for part of the existing Oran Park Precinct located to the south of the site. A major transmission line and associated easement runs east-west through the southern portion of the land. While most of the site has been cleared for use as grazing land, there are discontinuous zones of open to densely wooded areas along the creek lines and gullies in the south-western corner of the site.

A rail corridor is currently proposed through the site and may require associated cut/fill.

The site can be divided into the following topographic features:

1. Two separate surface drainage systems comprising creeks, gullies and dams are located at the site separated by a gently undulating ridgeline running approximately north east to south west through the site. The eastern/south eastern part of the site drains toward South Creek, while the northern/north western part of the site drains towards the north, into Howes Creek.
2. Gullies located at the site have entrenched the bedrock forming side slopes mostly to approximately 3 - 5°, but locally steeper towards the crests of ridgelines to approximately 5 - 10°. The gullies have been dammed in most locations for watering of stock. The highest elevation at the site is 116 m AHD (Australian Height Datum) and is located in the south-west corner of the site.

3. The low lying portions of the site comprise alluvium infilled valley floors associated with South Creek and gentler sloping hillsides feeding the creek. Surface levels range from approximately 86 m AHD to the north-west to 76 m AHD toward the central eastern edge of the site.

4. Regional Geology and Soil Landscapes

4.1 Geology

The site can be broadly divided into two broad geological units comprising sedimentary rocks and alluvial deposits (refer Figure B1 below, for additional detail).

The rolling hills, ridgelines and lower slopes in the northern, western and central portions of the site are underlain by Bringelly Shale (mapping unit Rwb) of the Triassic age Wianamatta Group (Penrith 1:100 000 Geological Series Sheet 9030). The Bringelly Shale in the vicinity of the site includes an unnamed, fine to medium grained quartz-lithic sandstone member, typically comprises shale, carbonaceous claystone, laminite and some minor coaly bands which weather to form clays of high plasticity.

The lower lying eastern portion of the site is generally underlain by Quaternary alluvial deposits (mapping unit Qal) of the Nepean River which are mainly derived from weathering of Permian and Triassic bedrock and typically comprise grey-brown, medium grained quartz sand with layers of silt and humic clay.

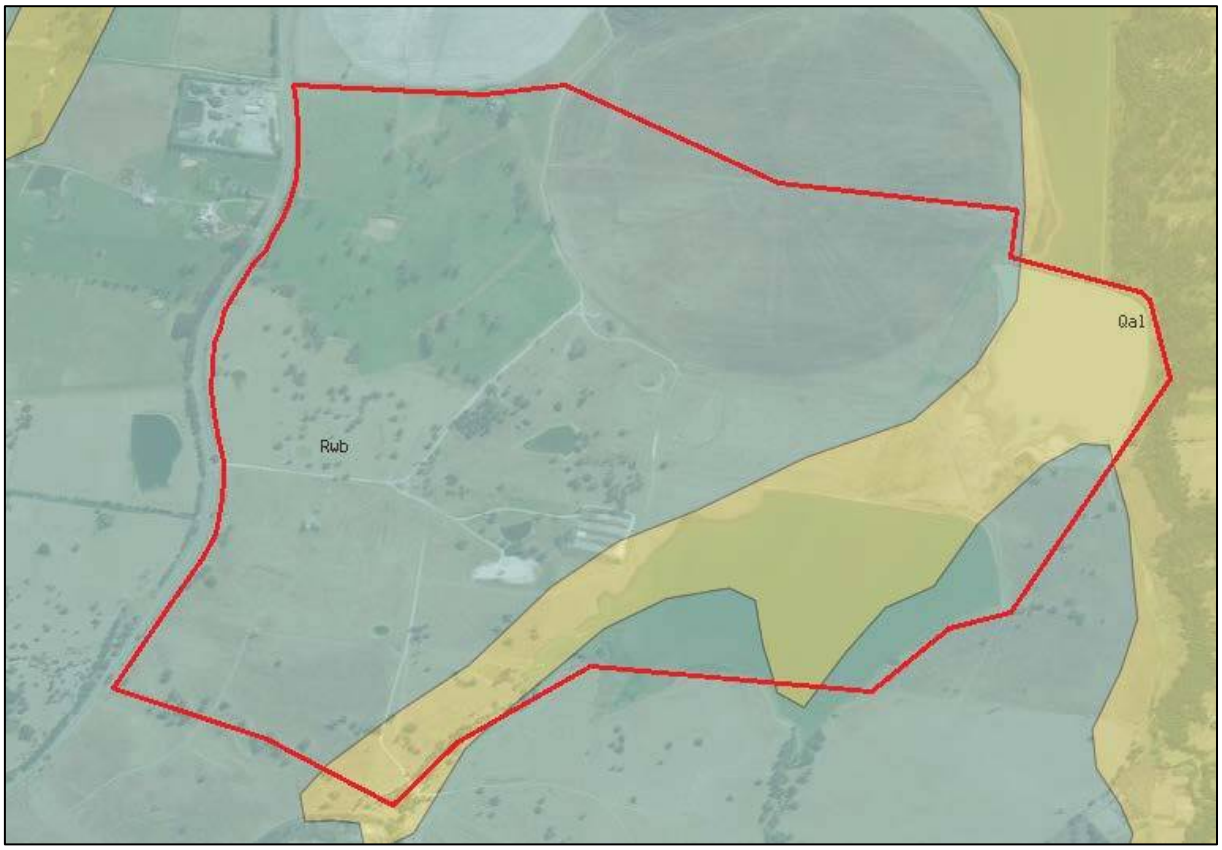


Figure B1: Geological Landscapes (Yellow – Quaternary Alluvium and Blue – Bringelly Shale)

4.2 Soil Landscapes

Soil landscapes over the site broadly reflect the underlying geology and topography. With reference to the Soil Landscapes of the Penrith 1:100 000 Sheet (Ref 2), the site is broadly divided into two distinct soil landscapes, the Blacktown residual soils present over most of the central and western part of the site and the South Creek alluvial soils present in the western portion of the site. The two soil landscapes are further described below (refer Figure B2 below for additional detail):

Soil landscapes over the site broadly reflect the underlying geology and topography. With reference to the Soil Landscapes of the Penrith 1:100 000 Sheet, the site is broadly divided into two distinct soil landscapes, the Blacktown residual soils present over most of the central and western part of the site and the South Creek alluvial soils present in the western portion of the site. The two soil landscapes are further described below (refer Figure B2 below for additional detail):

- **The Blacktown Soil Landscape** (mapping unit bt) is a residual soil group associated with the gently undulating slopes and broad rounded crests and ridges on the Wianamatta Group in the eastern part of the site. The unit comprises up to four soil horizons that range from shallow red-brown hard-setting sandy clay soils on crests and upper slopes to deep brown to yellow sand and clay soils overlying grey plastic mottled clay on mid to lower slopes. These soils are typically of low fertility, are moderately reactive and have a generally low wet bearing strength.
- **South Creek Soil Landscape** (mapping unit sc) is an alluvial soil group associated with floodplains, valley flats and drainage depressions of the channels on the Cumberland Plain. Usually flat with incised channels, mainly cleared, and is mapped along South Creek and associated minor creek extending south and south-west through southernmost dam. Mapping indicates soils associated with this landscape comprise very deep layered sediments over bedrock or relict soils. Red and yellow podsolic soils occur.

Figure B2: Soil Landscapes (Dark Green – Blacktown Soils and Light Green – South Creek Soils)

4.3 Groundwater

A detailed groundwater study was not undertaken in the site area as part of this study. However, there are two distinct groundwater settings in the area:

1) Groundwater within Wianamatta Group shale; and

2) Groundwater within unconsolidated Quaternary deposits of the Nepean River flood plain.

Groundwater flow in unconsolidated Quaternary deposits is likely to be by porous flow in sandy horizons, however, groundwater was only noted in one test pit carried out as part of the geotechnical and salinity investigations (refer to Section 1). Shales of the Wianamatta Group on the other hand have a very low intrinsic permeability, and groundwater flow is likely to be dominated by fracture flow.

4.4 Salinity Potential

Additional reference to the Map of Salinity Potential in Western Sydney (Ref 3) indicates that the site is predominantly located in an area of *"Moderate salinity potential"* where *"saline areas may occur ....which have not yet been identified or may occur if risk factors change adversely"*. South Creek and associated minor creeks and dam areas in the east / south east and northern portion of the site is located in an area of *"high salinity potential"* where *"conditions are similar to areas of known salinity"* and some portions of South Creek to the east of the site are mapped as areas of *"Known salinity potential"*. These classifications are based on the landform and geology and it is noted that due to the resolution at the scale of the mapping, it is not possible to delineate the zone boundaries with precision.

5. Investigation Methods

5.1 Horizontal and Vertical Control

All field measurements and mapping for this project have been carried out using the Geodetic Datum of Australia 1994 (GDA94) and the Map Grid of Australia 1994 (MGA94), Zone 56. Digital mapping has been carried out in a Geographic Information System (GIS) environment using MapInfo and AutoCAD software.

All reduced levels are given in relation to Australian Height Datum (AHD). All reduced levels have been interpolated from state survey data (with 2 m contour intervals), as such, the reduced levels should be considered approximate only.

5.2 Electromagnetic (EM) Profiling

EM profiling was undertaken as part of the examination of the soil salinity potential, allowing rapid continuous measurement of electrical conductivity of the upper soil profile. This enabled the targeting of areas for soil sampling, thereby reducing the sample density for laboratory testing of soils for salinity assessment purposes.

Electrical conductivity is variously referred to as ground conductivity, terrain conductivity, bulk conductivity or bulk electrical conductivity and is generally designated as σa or ECa (apparent). Although measurement of electrical conductivity can include contributions from a variety of sources including groundwater, conductive soil and rock minerals and metals, it has been estimated (Ref 4) that in 75% - 90% of cases in Australia, electrical conductivity anomalies in the upper soil profile can be explained by the presence of soluble salts. The apparent conductivity can therefore be considered, in the majority of cases, a good indicator of soil salinity. The ECa dataset for the site was correlated with the ECe laboratory-analysed data for the site, refer Drawing B5.

Most portable instruments measure apparent conductivity in milliSiemens per metre (mS/m) and typical measurement ranges (Table B1) have been suggested as indicative of salinity classes (after Ref 5).

Table B1: Salinity Classes in Relation to Apparent Conductivity (Ref 5)

Class	ECa (mS/m)
Non-Saline	<50
Slightly Saline	50 – 100
Moderately Saline	100 – 150
Very Saline	150 – 200
Extremely Saline	>200

The survey instrument employed was the DUALEM-42S Profiler, mounted on a quad motorcycle type vehicle. The Profiler (pictured on the following page) incorporates an electromagnetic (EM) transmitter that operates at a fixed frequency (9 KHz) and paired EM receivers. The theoretical depth of investigation (response to ground conductors) typically reaches up to approximately 4 m below the coils, however this is dependent on actual soil conductivities and most of the conductivity response was expected to be in the depth range of 2 m below the coils. Some depth discrimination (within the above range) is provided by concurrent measurements at two coil spacings and two coil orientations.

A Hemisphere R130 Differential Global Positioning System was used to continuously record position and to navigate and both positional data and ECa data were acquired at 1 Hz (1 second intervals) to the Profiler's data logger.

Data were obtained along approximately 107 line kilometres of traverse (38,500 data points) on a grid of primary survey lines approximately 18 m apart, with an average data point spacing of approximately 2.8 m.

Figure B3: DUALEM Profiler extended across quad bike, with DGPS system visible at rear

5.3 Test Pit Excavation

The test locations were nominated and located on site by DP during the investigation using a handheld GPS for which an accuracy of ±4 m is typical. The locations of the test locations are shown on Drawing B1 (Appendix A) and are coordinates are given on the logs (Appendix B).

The excavation of 11 test pits (Pits 1 - 11) was undertaken to depths of 2.3 m - 3.0 m using a backhoe fitted with a 450 mm wide bucket. The field work was undertaken by a geotechnical engineer who collected disturbed samples, 'undisturbed' samples (in 50 mm diameter thin-walled tubes) and bulk samples to assist in strata identification and for laboratory testing. As discussed in Section 2, an additional test pit (Pit 11) was completed to inform the SMP; ten of the eleven test pits were subject to sampling and analysis as per our proposal. After backfilling each test pit, the surface was reinstated to its previous level.

6. Field Work Results

6.1 EM Profiling Data Processing and Presentation

Data processing included a layback correction to align positional data with EM data, due to Profiler to GPS antenna separation. The apparent conductivity, quadrature and phase data were despiked, interpolated or truncated and filtered to remove responses from electric fences and known large metallic objects. The line data were subsequently processed in MapInfo to generate gridded data for map making.

Drawing B2 presents the location of the electromagnetic survey lines, survey points and apparent conductivities as colour images with continuous colour spectral scales in m AHD and mS/m, respectively. Areas of most interest are those at the red end of the spectrum representing the highest apparent conductivities and potentially the highest salinities. Apparent conductivities ranged from approximately 10 - 250 mS/m, potentially indicating soils covering the non-saline to extremely saline range based on Chhabra's typical measurement ranges (refer Table B1). The value of EM profiling, with high along-line sampling density and appropriate line spacings is the ability to identify local variations in the salinity distribution which are not visible in the broader-scale salinity potential map.

Based on the mapped distribution of apparent conductivities, test pit locations were selected to enable soil sampling, to provide real data for the range of apparent conductivities that were observed in the survey findings across the site.

The in-phase measurements are generally insensitive to soil conductivity but respond to subsurface metallic conductors and were mapped to assess the degree of interference with the apparent conductivity data.

6.2 Test Pit Excavation

Soil test pit logs are provided in Appendix B. The logs should be read in conjunction with the accompanying notes defining classification methods and descriptive terms.

As identified in Section 4.2, the site comprises two distinct soil landscapes with the test pits encountering variable subsurface conditions that were generally consistent with the soil mapping. The general succession of strata is broadly summarised as follows:

- TOPSOIL – silty clay and/or clayey silt encountered in all pits to depths in the range 0.2 m - 0.3 m;
- RESIDUAL – firm to hard silty clay and/or sandy silty clay encountered in Pits 1 - 5, 7, 8 and 11 to depths in the range 0.9 m - 2.3 m;
- ALLUVIAL – firm to hard silty clay and/or sandy silty clay encountered in Pits 6, 9 and 10 to depths in the range 2.3 m - 3.0 m, and to termination depth of 3.0 m in Pit 9; and
- BEDROCK – variably extremely low up to low to medium strength shale first encountered in most pits, except Pit 9, at depths in the range 0.9 m - 2.3 m. Pits 1 - 7 and 11 were terminated upon refusal of the excavator bucket at depths in the range 2.3 m - 2.9 m.

No free groundwater was observed in the pits during excavation for the short time that they were left open with exception of Pit 9. Pit 9 encountered groundwater at a depth 2.9 m. It must be noted, however, that the pits were immediately backfilled following excavation which precluded longer term monitoring of any groundwater levels that might be present. It must also be noted, groundwater levels are affected by factors such as soil permeability and weather conditions (which will vary with time).

Evidence of efflorescence was noted on the site surface in the eastern portion of the site, between the two large dams here. Efflorescence was also visible on part of the paddock with the pivot irrigator in the northern part of the site, however this is likely as a result of fertilizers added to the site here.

7. Laboratory Test Results

Soil samples from the test pits were tested in a NATA-accredited laboratory for parameters related to salinity:

- Electrical Conductivity (EC1:5) of a 1:5 soil:water extract (all samples);
- pH (all samples);
- chloride and sulphate concentrations (selected samples);
- exchangeable sodium content, cation exchange capacity (CEC) and exchangeable sodium potential (ESP or sodicity) (selected samples); and
- Dispersion (Emerson Crumb test) (selected samples).

Laboratory analytical results are included in Appendix C and a Summary Table showing all analytical results and their corresponding calculated aggressivity, sodicity and salinity class values are presented in Appendix D.

A textural classification, using the method of the former Department of Land and Water Conservation (DLWC - Ref 6), was undertaken on each sample tested for EC1:5, to allow determination of the appropriate Textural Factor (M) for conversion of EC1:5 to soil salinity ECe (electrical conductivity of a saturated extract). These factors are included in the Summary Table, along with the soil texture groups indicated by the factors, ranging from heavy clays (M=6) to loams (M=10) and rock at depth (assumed textural class=7, i.e. medium clay).

The total test sample numbers and the range of test results obtained are summarised in Table B2, below.

Table B2: Summary of Test Results

Parameter		Units	Samples	Minimum	Maximum
pH		pH units	61	4.5	7.8
Chlorides		(mg/kg)	15	<10	2700
Sulphates		(mg/kg)	15	<10	220
Aggressivity	to Concrete	[AS2159]	63	Non-Aggressive	Moderate
	to Steel	[AS2159]	63	Non-Aggressive	Moderate
Exchangeable Sodium (Na)		(meq/100g)	7	0.12	3.9
CEC (cation exchange capacity)		(meq/100g)	7	5.9	15
Sodicity [Na/CEC]		(ESP%)	7	1	32
Sodicity Class		[after DLWC – Ref 6]	7	Non-Sodic	Highly Sodic
EC1:5 [Lab.]		(uS/cm)	61	13	2,700
Resistivity		Ω.cm	61	370	76,923
ECe [M x EC1:5] [1]		(dS/m)	61	0.104	16.2
Salinity Class		[after Richards 1954 – Ref 7]	61	Non-Saline	Highly Saline

1 M is soil textural factor

8. Assessment of Soil Aggressivity to Concrete and Steel

Figure B4 presents variations of aggressivity with depth, based on pH profiles at all test pit locations, together with the aggressivity class ranges as indicated in Australian Standard AS 2159 - 2009 (Ref 8). The absence of free groundwater from all test pits and the impermeability of the sampled clay-rich soils indicate that soils at all test pits are in Condition “B”.

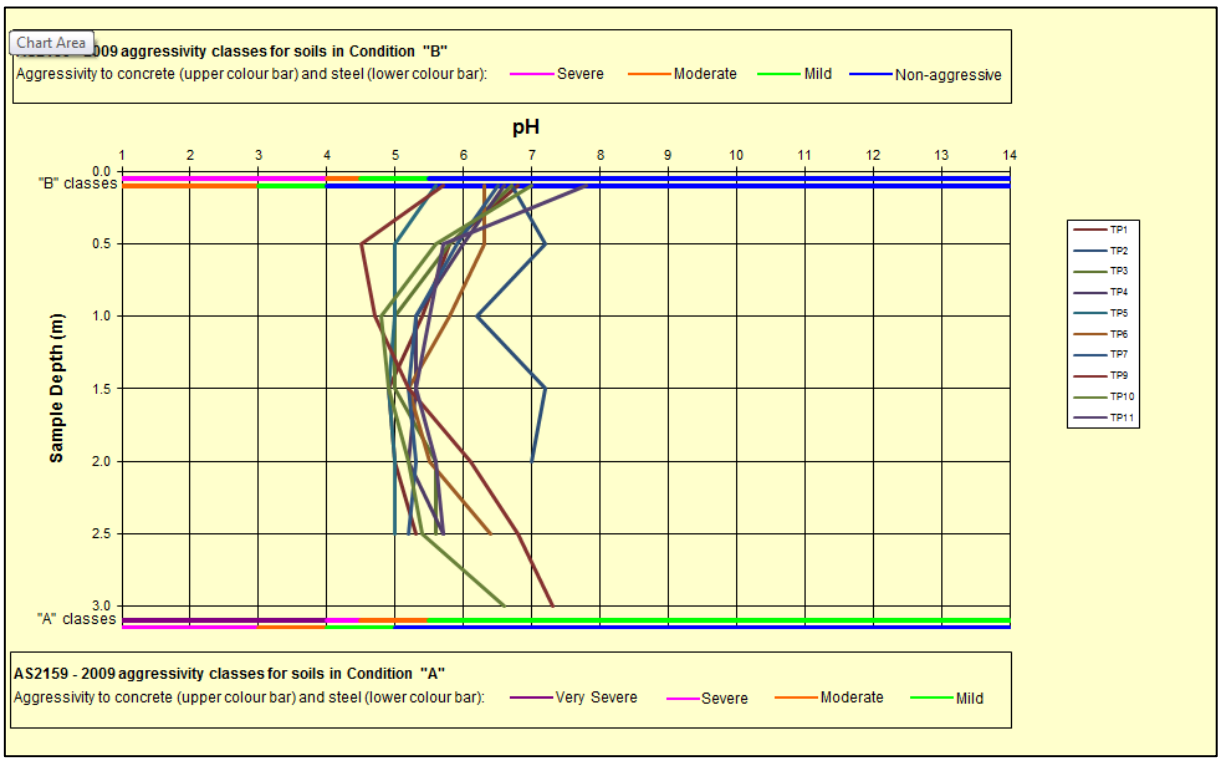


Figure B4: Vertical Soil pH Profiles and Aggressivity

The pH profiles (Figure B4) indicate that the materials throughout the site, at all investigation depths are generally non to mildly aggressive to concrete (with the exception of TP9 - moderately aggressive) and non to moderately aggressive to steel. Where measured, the sulphate and chloride concentration indicates that the soil is non-aggressive to concrete and steel respectively. However, based on sample resistivity data, samples were classified as non-aggressive, mildly aggressive to moderately aggressive to steel. Calculated worst-case soil resistivities for concrete and steel were interpolated to define areas of non-aggressive, mildly aggressive and moderately aggressive soil, as presented in Drawings B3 and B4, respectively (Appendix A).

The Summary Table (refer Appendix D) indicates that 52% of all samples were non-aggressive to concrete, 46% were mildly aggressive to concrete and 2% were moderately aggressive to concrete. Approximately 59% of all samples were non-aggressive to steel, 28% were mildly aggressive and 13% were moderately aggressive to steel.

9. Salinity Assessment from Laboratory Results

The DLWC guideline for salinity investigations (Ref 6) applies the method of Richards (Ref 7) and Hazelton and Murphy (Ref 9) in the classification of soil salinity on the basis of ECe. The implications of the resulting salinity classes on agriculture are described in Table B3.

Table B3: Soil Salinity Classification

Class	ECe (dS/m)	Implication
Non-Saline	<2	Salinity effects mostly negligible
Slightly Saline	2 – 4	Yields of sensitive crops affected
Moderately Saline	4 – 8	Yields of many crops affected
Very Saline	8 – 16	Only tolerant crops yield satisfactorily
Highly Saline	>16	Only a few very tolerant crops yield satisfactorily

Salinity measurements on 61 samples from 11 test pits (Pit 8 was not subject to salinity testing - refer to Section 2), including areas of elevated apparent conductivity determined by EM profiling, are distributed throughout the salinity classes as shown in detail in the Summary Table (Appendix D) and graphically in Figure B5.

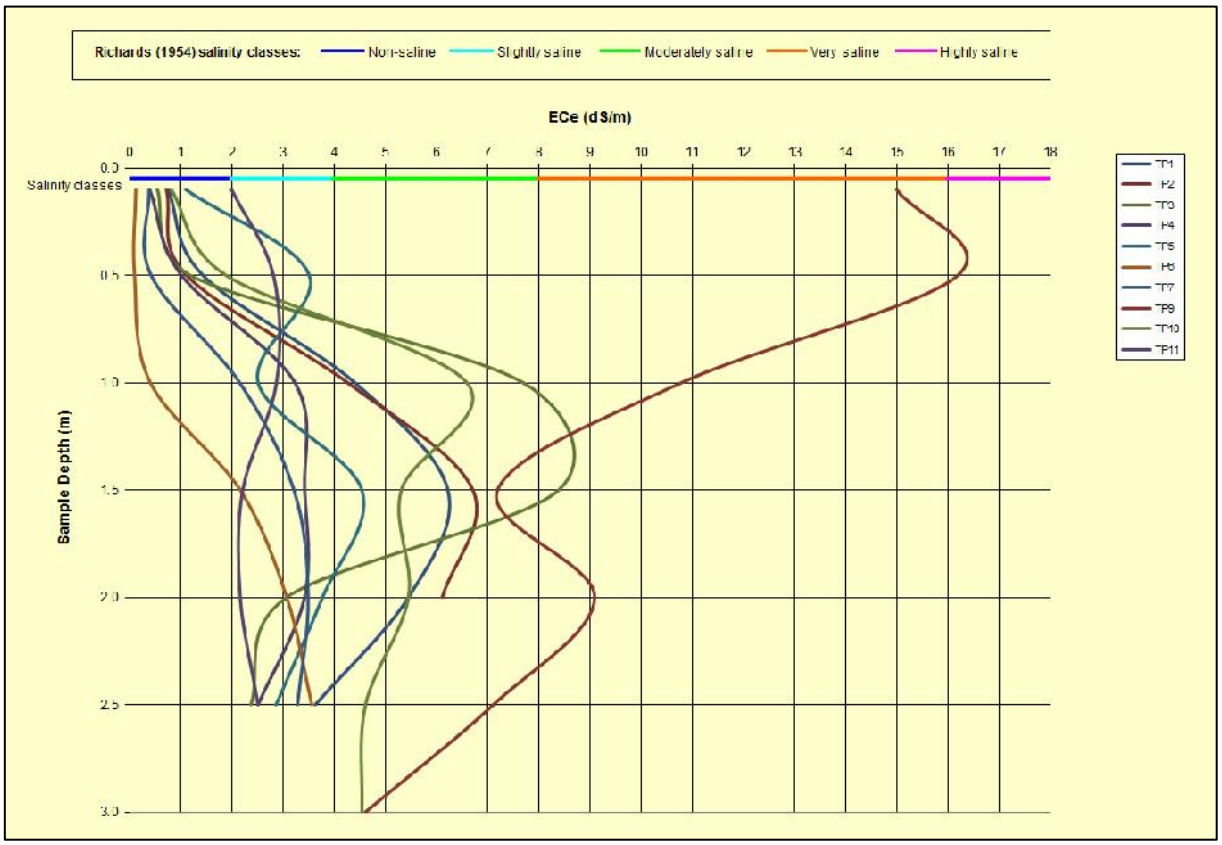


Figure B5: Vertical Soil Salinity Profiles

The Summary Table (Appendix D) indicates that 31% of all soil samples were non saline, 34% were slightly saline, 26% were moderately saline, 7% were very saline and 2% were highly saline.

10. Salinity Assessment Incorporating EM Results

The DLWC salinity investigation guideline allows for a reduction in the density of test locations and the number of laboratory tests, when an EM investigation is carried out and the ECa results are correlated with the laboratory ECe results, enabling interpolation of data throughout the EM survey area at the high spatial density of that data.

To carry out the required correlations, the ECa gridded line data was evaluated at the nearest test pit locations and the ECa values were plotted in a scattergram (Figure B6, below) against bulk ECe values. A reasonably strong positive linear trend between these parameters (correlation coefficient of 0.93) indicates that the EM system is responding to soil salinity and that the EM data obtained provides a good relative measure of the site salinity.

The line of best fit defines the ECe / ECa trend and provides an equation by which to convert apparent conductivities (ECa in mS/m), to estimate apparent salinities (ECe in dS/m) throughout the data set.

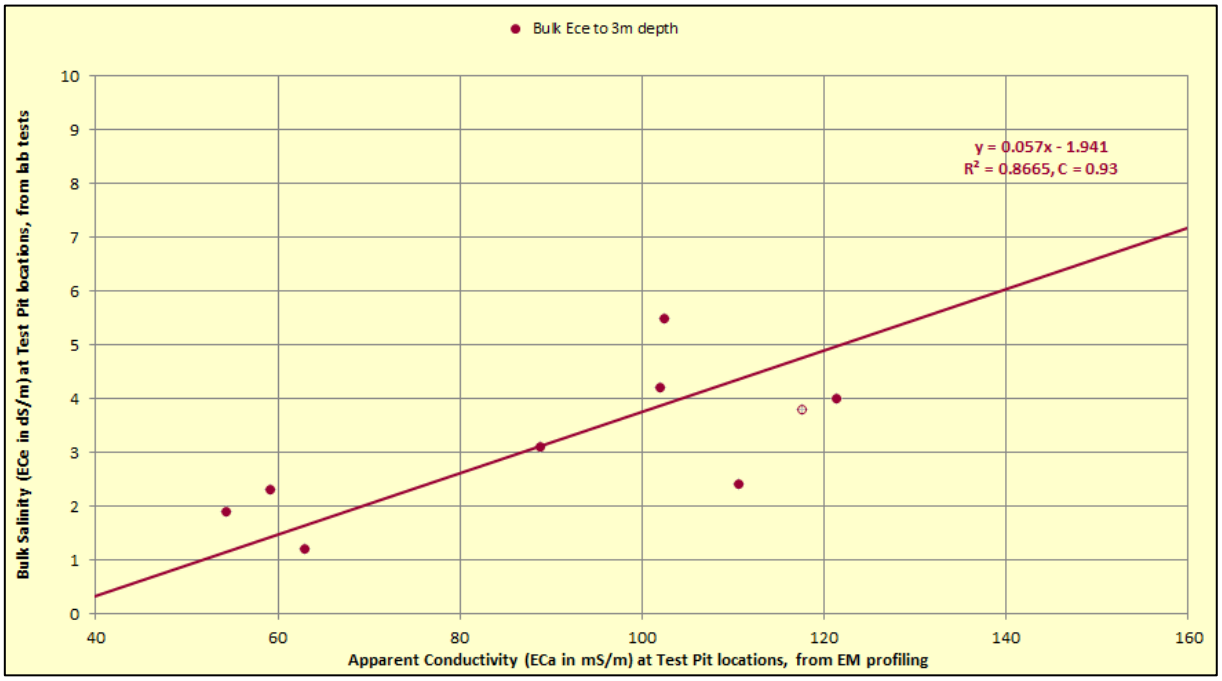


Figure B6 - Correlation of Bulk ECe and ECa data

The correlation equation (ECe = 0.057 x ECa - 1.941) has been applied to all apparent conductivity gridded data for presentation as a correlated salinity image with continuous colour spectral scales in dS/m (refer to Drawing B5).

Give a description of what these means, ie highly saline in the east around the dams non to slightly in the south west etc.

11. Assessment of Soil Sodicity and Dispersibilty

The sodicity test reported in the Summary Table (Appendix D) shows non-sodic to highly sodic soils, indicating some potential for erodibility of soils left exposed.

Dispersion potential, tested on twelve samples at depths of 0.5 and 1 m by the Emerson Crumb Test (Appendix D) shows much of the silty clay/sandy silty clay observed at the site exhibit dispersibilty between no dispersion to complete dispersion. Therefore soils at the site have the potential to exhibit poor drainage and the tendency for water logging to occur.

12. Impacts of the Site Materials on the Proposed Development

The non-aggressive to moderate aggressivity to concrete, the non-aggressive to moderate aggressivity to steel, the presence of moderate to occasionally very to highly saline materials and the highly sodic soils are naturally occurring features of the local landscape and are not considered significant impediments to the proposed development, provided appropriate remediation or management techniques are employed.

Salinity and aggressivity affects the durability of concrete and steel by causing premature breakdown of concrete and corrosion of steel. This has impacts on the longevity of structures in contact with these materials. As a result management will be required (refer to Section 13).

Sodic soils have low permeability due to infilling of interstices with fine clay particles during the weathering process, restricting infiltration of surface water and potentially creating perched water tables, seepage in cut faces or ponding of water in flat open areas. In addition, sodic soils tend to erode when exposed. Management of sodic soils is therefore required to prevent these adverse effects.

13. Preliminary Salinity Management Plan

The current salinity investigation indicates that materials within the site range from non-saline to highly saline. Testing of other parameters associated with salinity indicates that the materials are non-aggressive to moderately aggressive to steel and non-aggressive to moderately aggressive to concrete. In addition, shallow soils were in places highly sodic.

The following preliminary management strategies are confined to the management of those factors with a potential to impact on the development, this SMP will need to be updated based on the results of more detailed testing on each stage of the development:

A. Management should focus on capping of the upper surface of the sodic soils, both exposed by excavation and placed as filling, with a more permeable material to prevent ponding, to reduce capillary rise, to act as a drainage layer and to reduce the potential for erosion.

B. When possible, the placement of excavated soils in fill areas with similar salinity characteristics (i.e. to place material on to in-situ soils with a similar or higher aggressivity or salinity classification) should be carried out. With respect to imported fill material, testing should be undertaken prior to importation, to determine the salinity characteristics of the material. Drawing B5 shows the salinity classifications across the site.

C. Sodic soils can also be managed by maintaining vegetation where possible and planting new salt tolerant species. Topsoil added at the completion of bulk earthworks is, in effect, also adding organic matter which may help infiltration and leaching of sodium.

D. Avoiding water collecting in low lying areas, in depressions, or behind fill. This can lead to water logging of the soils, evaporative concentration of salts, and eventual breakdown in soil structure resulting in accelerated erosion.

E. Any pavements should be designed to be well drained of surface water. There should not be excessive concentrations of runoff or ponding that would lead to waterlogging of the pavement or additional recharge to the groundwater through any more permeable zones in the underlying filling material.

F. Surface drains should generally be provided along the top of batter slopes to reduce the potential for concentrated flows of water down slopes possibly causing scour.

G. Salt tolerant grasses and trees should be considered for landscaping, to reduce soil erosion as in Strategy A above and to maintain the existing evapotranspiration and groundwater levels. Reference should be made to an experienced landscape planner or agronomist.

The following additional strategies are recommended for completion of service installation and for building construction. These strategies should be complementary to standard good building practices recommended within the Building Code of Australia, including cover to reinforcement within concrete and correct installation of a brick damp course, so that it cannot be bridged to allow moisture to move into brick work and up the wall.

H. Where soils are classified as non-aggressive to concrete, piles should nevertheless have a minimum strength of 32 MPa and a minimum cover to reinforcement of 45 mm (as per AS 2159).

I. Where soils are classified as mildly aggressive to concrete, piles should have a minimum strength of 32 MPa and a minimum cover to reinforcement of 60 mm (as per AS 2159) to limit the corrosive effects of the surrounding soils (in accordance with AS 2159).

J. Where soils are classified as moderately aggressive to concrete, piles should have a minimum strength of 40 MPa and a minimum cover to reinforcement of 65 mm (as per AS 2159) to limit the corrosive effects of the surrounding soils (in accordance with AS 2159).

K. With regard to concrete structures, for non-saline and slightly saline soils (soils with salinities less than 4 dS/m):

- Where soils are classified as non-aggressive to concrete (AS 3600 - 2009 [Ref 10] - exposure classification A1), slabs and foundations should have a minimum strength of 20 MPa, and should be allowed to cure for a minimum of three days (as per AS 3600) to limit the corrosive effects of the surrounding soils; and
- Where soils are classified as mildly aggressive to concrete (AS 3600 – exposure classification A2), slabs and foundations should have a minimum strength of 25 MPa, and should be allowed to cure for a minimum of three days (as per AS 3600) to limit the corrosive effects of the surrounding soils.

L. With regard to concrete structures, for moderately saline soils (soils with salinities of 4 dS / m to 8 Ds / m) that are classified as non-aggressive to mildly aggressive to concrete, slabs and foundations should have a minimum strength of 25 MPa, a minimum cover to reinforcement of 45 mm from unprotected ground and should be allowed to cure for a minimum of three days (as per AS 3600) to limit the corrosive effects of the surrounding soils.

M. With regard to concrete structures, for very saline soils (soils with salinities of 8 dS / m - 16 dS / m) slabs and foundations should have a minimum strength of 32 MPa, a minimum cover to reinforcement of 50 mm from unprotected ground and should be allowed to cure for a minimum of three days (as per AS 3600) to limit the corrosive effects of the surrounding soils.

N. With regards to concrete structures, for highly saline materials with salinities of >16 dS/m:

- Where materials are classified as non-aggressive to concrete (refer AS3600 - A1 and Drawing B2), slabs and foundations should have a minimum strength of 40 MPa, a minimum cover to reinforcement of 55 mm from unprotected ground and should be allowed to cure for a minimum of seven days (as per AS3600) to limit the corrosive effects of the surrounding materials; and
- Where materials are classified as mildly aggressive to concrete (refer AS3600 - A2 and Drawing B2), slabs and foundations should have a minimum strength of 40 MPa, a minimum cover to reinforcement of 55 mm from unprotected ground and should be allowed to cure for a minimum of seven days (as per AS3600) to limit the corrosive effects of the surrounding materials.

O. Wet cast concrete pipes and currently manufactured spun concrete pipes are understood to have estimated compressive strengths of 50 MPa and 60 - 70 MPa, respectively, in excess of the requirements for mass concrete in K, L, M and N above. Reference to the maximum and minimum test results of Table B1 (Section 6 of this report) and to Tables E1 and 3.1 of AS 4058 - 2007 (Ref 11) indicates that the site falls within the AS 4058 Clay/Stagnant (low sulphate) soil type (chlorides ≤20 000 ppm, pH≥4.5 and sulphates ≤1000 ppm) and (in the absence of tidal water flow) falls within the AS 4058 Normal durability environment. Under these conditions, AS 4058 - compliant reinforced concrete pipes of general purpose Portland cement, with a minimum cover to reinforcement of 10 mm, are expected to have a design life in excess of 100 years. Any concrete pipes installed within the site should employ AS 4058-compliant steel reinforced pipes of general purpose Portland cement, with minimum cover to reinforcement of 10 mm, or should be fibre reinforced.

P. Resistivity results indicate soils that are moderately aggressive to steel. For these areas of soil identified as mildly and moderately aggressive to steel, the following corrosion allowances (as per AS 2159 - 2009) should be taken into account by the designer:

- Mild: uniform corrosion allowance 0.01 - 0.02 mm / year; and
- Moderate: uniform corrosion allowance 0.02 - 0.04 mm / year.

Q. In instances where a coating is applied to the pile, if the design life of the pile is greater than the design life for the coating, consideration must be given to corrosion of the pile in accordance with the above list.

14. Additional Recommendations and Conclusions

Additional investigation should be undertaken in development areas which are to be excavated deeper than 3 m, where direct sampling and testing of salinity has not been carried out. Salinity management strategies may need to be modified or extended following additional investigations by deep test pitting and/or drilling, sampling and testing for soil and water pH, electrical conductivity, TDS, sodicity, sulphates and chlorides. Such works, if required, could be conducted when final cut and fill requirements have been determined.

It is considered that the management strategies described herein when incorporated into the design and construction works are appropriate to mitigate the levels of salinity, aggressivity and sodicity identified at the site.

This salinity investigation has been undertaken for the purpose of providing preliminary advice. A detailed salinity investigation will be required prior to construction in order to provide more detailed recommendations for individual lots.

15. References

1. Geological Survey of New South Wales, 1991. *Geology of 1:100 000 Penrith Geological Series Sheet 9030* (Edition 1).
2. Bannerman, S. M and Hazelton, P A. *Soil Landscapes of the Penrith 1:100 000 Sheet*. Soil Conservation Service of NSW, Sydney.
3. DIPNR, 2002 Department of Infrastructure, Planning and Natural Resources, New South Wales (DIPNR) 2002, *Salinity Potential in Western Sydney*.
4. Spies, B. and Woodgate, P. 2004, *Technical Report Salinity Mapping Methods in the Australian Context*, Natural Resource Management Ministerial Council.
5. Chhabra, R. 1966, *Soil Salinity and Water Quality*, A. Bakema/Rotterdam/Brookfield, New York, 284 pp.
6. DNR, 2002, *Site Investigations for Urban Salinity* (now managed by DPI).
7. Richards, L. A. (ed.) 1954, *Diagnosis and Improvement of Saline and Alkaline Soils* USDA Handbook No 60, Washington D.C.
8. Standards Australia 1995, AS2159 – 2009 *Piling Design and Installation.*
9. Hazelton, P. A. and Murphy B. W. 2007, *Interpreting Soil Test Results* Department of Natural Resources
10. Standards Australia 2009, AS3600 - 2009 *Concrete Structures*
11. Standards Australia 2007, AS 4058 - 2007 *Precast Concrete Pipes*

16. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Pondicherry Lands, Oran Park, NSW in accordance with DP's proposal MAC170014 dated 6 February 2017 and acceptance received from Greenfields Development Company No. 2 Pty Ltd dated 27 February 2017. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Greenfields Development Company No. 2 Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the (geotechnical / environmental / groundwater) components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report
Drawings B1 – B5

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

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

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

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

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole 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. They may not be the same at the time of construction as are indicated in the report; and
- 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 first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or 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 a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

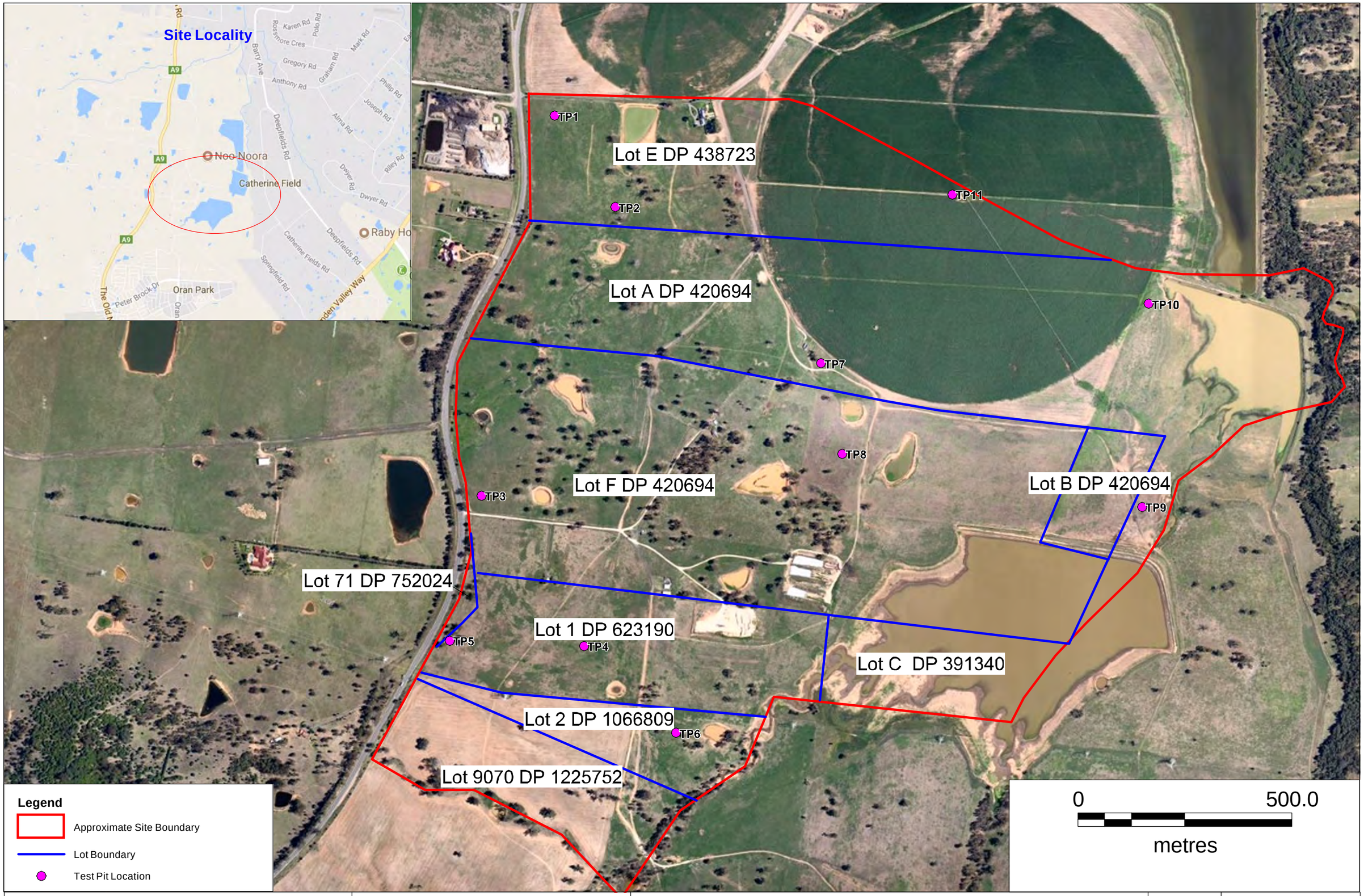
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

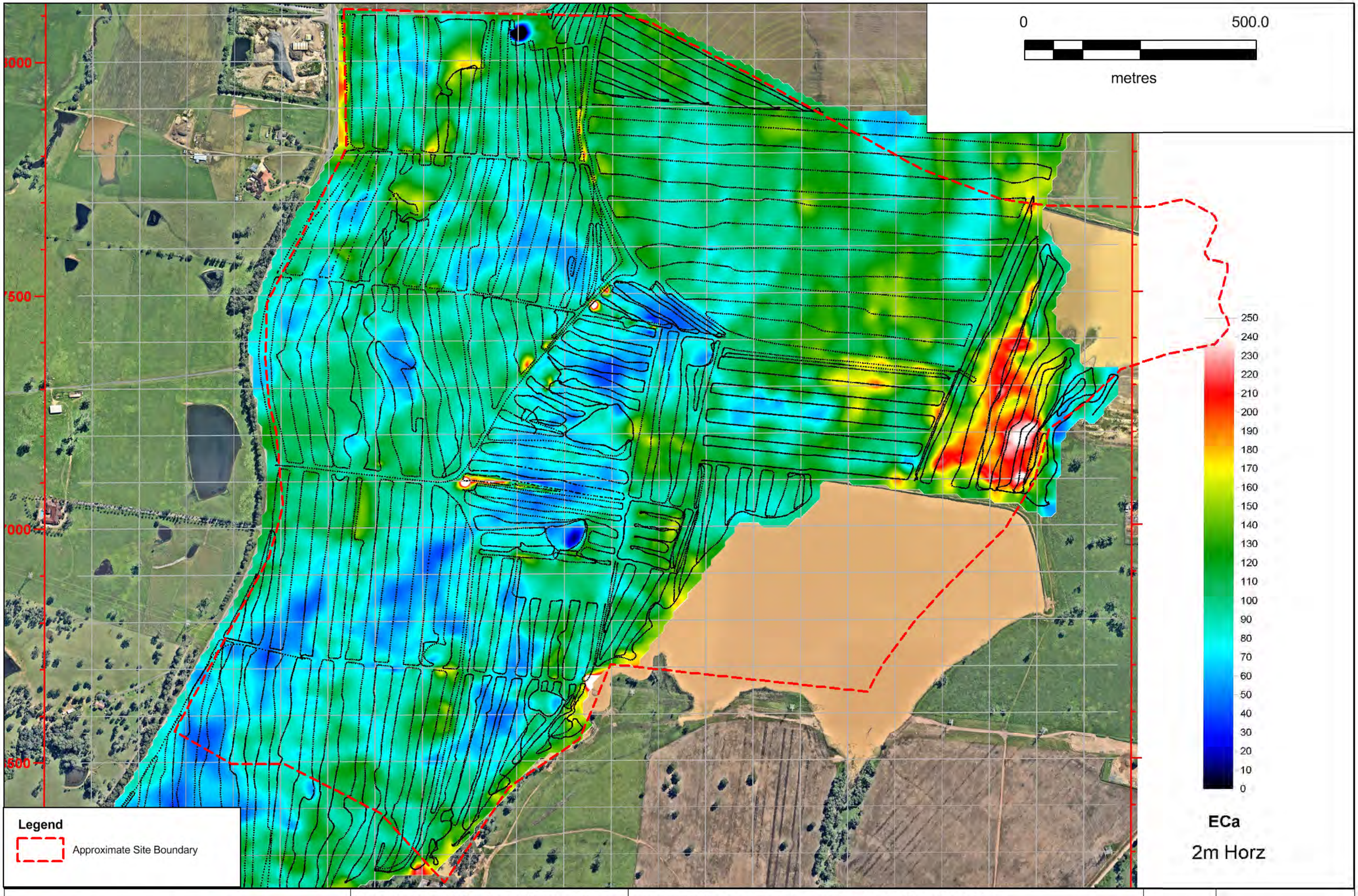
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.



CLIENT: Greenfields Development Company 2 Pty Ltd		TITLE: Site Layout and Test Pit Locations Proposed Residential Subdivision Pondicherry Lands, Oran Park, NSW	PROJECT No: 76778.29
OFFICE: Macarthur	DRAWN BY: CLN		DRAWING No: B1
SCALE: As shown	DATE: 11.08.2017		REVISION: A



Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Greenfields Development Company 2 Pty Ltd		
OFFICE: Macarthur	DRAWN BY: CLN	
SCALE: As shown	DATE: 11.08.2017	

TITLE: EM Survey Points and Apparent Conductivities
Proposed Residential Subdivision
Pondicherry Lands, Oran Park, NSW

N
MGA

PROJECT No:	76778.29
DRAWING No:	B2
REVISION:	A

TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP10
TP11

Legend

- Approximate Site Boundary
- Non-aggressive Test Pit Location
- Mildly Aggressive Test Pit Location
- Moderately Aggressive Test Pit Location

0 500.0
metres

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Greenfields Development Company 2 Pty Ltd		
OFFICE: Macarthur	DRAWN BY: CLN	
SCALE: As shown	DATE: 11.08.2017	

TITLE: Aggressivity to Concrete within 0 - 3 m Soil Surface
Proposed Residential Subdivision
Pondicherry Lands, Oran Park, NSW

N
MGA

PROJECT No:	76778.29
DRAWING No:	B3
REVISION:	A

TP1
TP2
TP11
TP10
TP7
TP8
TP3
TP9
TP5
TP4
TP6

Legend

- Approximate Site Boundary
- Non-Aggressive Test Pit Location
- Mildly Aggressive Test Pit Location
- Moderately Aggressive Test Pit Location

0 500.0
metres

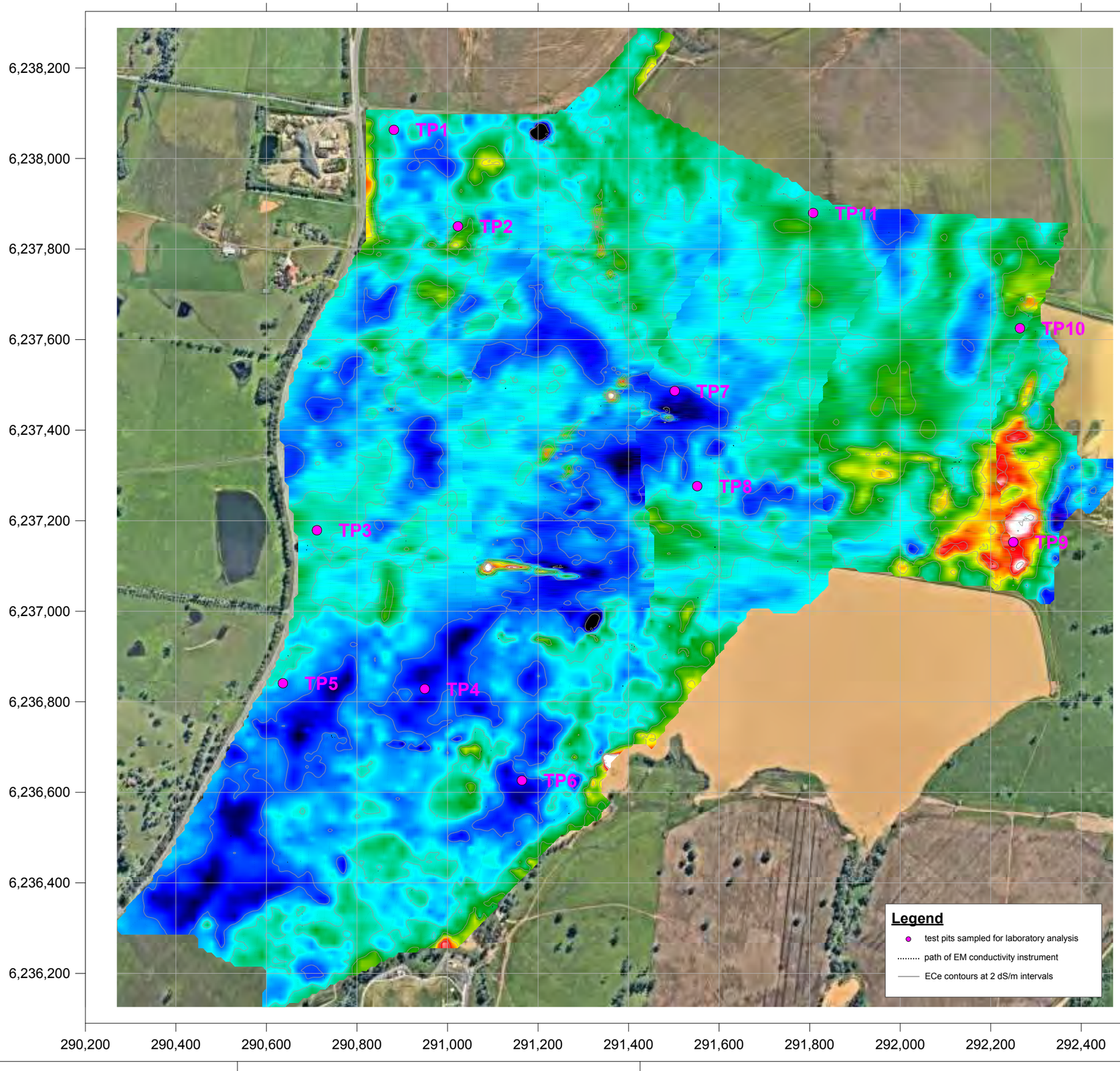
Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Greenfields Development Company 2 Pty Ltd		
OFFICE: Macarthur	DRAWN BY: CLN	
SCALE: As shown	DATE: 11.08.2017	

TITLE: Aggressivity to Steel within 0 - 3 m Soil Surface
Proposed Residential Subdivision
Pondicherry Lands, Oran Park, NSW

N
MGA

PROJECT No:	76778.29
DRAWING No:	B4
REVISION:	A



Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	Greenfield Development Company 2		
OFFICE:	Sydney	DRAWN BY:	AJK
SCALE:	as shown	DATE:	30 Aug 2017

TITLE: **Salinity ECe derived from ECa (EM conductivity) and Bulked ECe Data**

Proposed Residential Subdivision

Pondicherry, Oran Park, NSW

PROJECT No:	76778.29
DRAWING No:	B5
REVISION:	A

Appendix B

Test Pit Logs

TEST PIT LOG

CLIENT: Dept of Planning & Environment/Camden Council
PROJECT: Land Capability Study
LOCATION: Pondicherry, Oran Park, NSW

SURFACE LEVEL: 85.6 mAHD
EASTING: 290877
NORTHING: 6238063

PIT No: 1
PROJECT No: 76778.29
DATE: 10/7/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
85	0	TOPSOIL - brown silty clay with a trace of rootlets							
	0.3	SILTY CLAY - stiff, grey mottled red silty clay with a trace of ironstone gravel, MC~PL		D	0.5		pp = 300-400		
	1	- becoming MC>PL below 0.9m		D	1.0		pp = 200-300		
					1.4				
	1.5	SHALE - extremely low strength, extremely weathered, grey shale with iron induration		D	1.5				
84				U_{50}					
					1.8				
	2			D/B	2.0				
83		- becoming very low strength, highly weathered below 2.5m		D	2.5				
	2.8	Pit discontinued at 2.8m - refusal on low to medium strength shale							
82	3								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: LAH

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Dept of Planning & Environment/Camden Council
PROJECT: Land Capability Study
LOCATION: Pondicherry, Oran Park, NSW

SURFACE LEVEL: 85.4 mAHD
EASTING: 291021
NORTHING: 6237851

PIT No: 2
PROJECT No: 76778.29
DATE: 10/7/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL - brown clayey silt with a trace of rootlets		B	0.1				
	0.3	SILTY CLAY - stiff, light brown mottled grey and red silty clay, MC~PL		D	0.5		pp = 300-500		
85	0.9	SANDY SILTY CLAY - stiff, grey mottled light brown and red sandy silty clay, MC<PL		D	1.0		pp = 200-300		
	1			U_{50}					1
		- becoming light brown mottled grey and red with iron induration, MC>PL below 1.3m			1.4				
84				D	1.5		pp = 150-250		
	2	- with very low strength, highly weathered, sandy shale bands below 2.0m		D	2.0				2
	2.3	Pit discontinued at 2.3m - refusal on medium strength shale							
83									
	3								3
82									

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: LAH

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Dept of Planning & Environment/Camden Council
PROJECT: Land Capability Study
LOCATION: Pondicherry, Oran Park, NSW

SURFACE LEVEL: 100.4 mAHD
EASTING: 290712
NORTHING: 6237180

PIT No: 3
PROJECT No: 76778.29
DATE: 10/7/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
100	0.3	TOPSOIL - brown silty clay with a trace of rootlets							
		SILTY CLAY - stiff, red mottled grey silty clay with a trace of ironstone gravel, MC>PL		D	0.5		pp = 150-250		
		- with iron induration, MC~PL below 0.8m		D	1.0		pp = 200-300		
99		- with very low strength, highly weathered shale bands, MC<PL below 1.4m			1.3				
				U_{50} D	1.5				
					1.7				
98	2.0	SHALE - extremely low strength, extremely weathered, grey shale with iron induration and very low strength, highly weathered bands		D/B	2.0				
		- becoming very low strength, highly weathered below 2.4m		D	2.5				
97	2.7	Pit discontinued at 2.7m - refusal on low to medium strength shale							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: LAH

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Dept of Planning & Environment/Camden Council
PROJECT: Land Capability Study
LOCATION: Pondicherry, Oran Park, NSW

SURFACE LEVEL: 96.4 mAHD
EASTING: 290947
NORTHING: 6236825

PIT No: 4
PROJECT No: 76778.29
DATE: 11/7/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL - brown silty clay with a trace of rootlets							
	0.3	SILTY CLAY - stiff, red silty clay, MC>PL		D/B	0.5		pp = 150-250		
96		- becoming red mottled grey and light brown, MC~PL below 0.9m		D	1.0		pp = 150-300		
	1.4	SHALE - interbedded very low strength and extremely low strength, highly weathered and extremely weathered, grey sandy shale with iron induration		D	1.5				
95				U_{50}	1.9				
				D	2.0				
94	2.5	Pit discontinued at 2.5m - refusal on low to medium strength shale		D	2.5				
93									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: LAH

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Dept of Planning & Environment/Camden Council **SURFACE LEVEL:** 110.7 mAHD **PIT No:** 5
PROJECT: Land Capability Study **EASTING:** 290636 **PROJECT No:** 76778.29
LOCATION: Pondicherry, Oran Park, NSW **NORTHING:** 6236839 **DATE:** 11/7/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
110	0.2	TOPSOIL - red silty clay with a trace of rootlets							
		SILTY CLAY - stiff to very stiff, red mottled grey silty clay with iron induration, MC<PL		U_{50}	0.2				
				D/B	0.5				
	0.9				0.6				
	1	SHALE - very low strength, highly weathered, grey shale with iron induration and extremely low strength, extremely weathered bands from 0.9 - 2.2m		D	1.0				1
109				D	1.5				
	2			D	2.0				2
108				D	2.5				
	2.9	Pit discontinued at 2.9m							
	3	- refusal on low to medium strength shale							3
107									

RIG: John Deere 315SE backhoe - 450mm bucket **LOGGED:** LAH **SURVEY DATUM:** MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Dept of Planning & Environment/Camden Council
PROJECT: Land Capability Study
LOCATION: Pondicherry, Oran Park, NSW

SURFACE LEVEL: 87.8 mAHD
EASTING: 291162
NORTHING: 6236631

PIT No: 6
PROJECT No: 76778.29
DATE: 11/7/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
									5 10 15 20
		TOPSOIL - brown clayey silt with a trace of rootlets							
	0.3	SANDY SILTY CLAY - stiff, red mottled grey and light brown silty clay with iron induration, MC~PL		D	0.5		pp = 250-350		
87		- becoming grey mottled red and light brown below 0.8m							
	1			D	1.0		pp = 200-300		1
				U_{50}					
		- becoming hard, grey with iron induration, MC<PL below 1.4m			1.4				
				D	1.5		pp >600		
86		- with very low strength, highly weathered shale bands below 1.9m							
	2			D	2.0		pp >600		2
	2.3	SHALE - very low strength, highly weathered, grey sandy shale with iron induration and extremely low strength, extremely weathered bands							
				D/B	2.5				
85	2.8	Pit discontinued at 2.8m - refusal on low to medium strength shale							
	3								3
84									

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: LAH

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Dept of Planning & Environment/Camden Council
PROJECT: Land Capability Study
LOCATION: Pondicherry, Oran Park, NSW

SURFACE LEVEL: 95.7 mAHD
EASTING: 291505
NORTHING: 6237485

PIT No: 7
PROJECT No: 76778.29
DATE: 10/7/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL - brown silty clay with a trace of rootlets							
	0.3	SILTY CLAY - firm to stiff, red mottled grey and dark grey silty clay with some ironstone gravel and a trace of rootlets, MC~PL		D	0.5		pp = 380-500		
95		- becoming very stiff to hard, MC~PL below 0.7m		D	1.0		pp = 200-300		
	1.1	SHALE - interbedded very low strength and extremely low strength, highly weathered and extremely weathered, grey shale with iron induration		U_{50}					
					1.4				
				D	1.5				
94				D	2.0				
				D/B	2.5				
	2.6	Pit discontinued at 2.6m - refusal on low to medium strength shale							
93									
92									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20; 1, 2, 3

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: LAH

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Dept of Planning & Environment/Camden Council
PROJECT: Land Capability Study
LOCATION: Pondicherry, Oran Park, NSW

SURFACE LEVEL: 88.3 mAHD
EASTING: 291554
NORTHING: 6237275

PIT No: 8
PROJECT No: 76778.29
DATE: 10/7/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
88	0.3	TOPSOIL - brown silty clay with a trace of rootlets							
		SILTY CLAY - stiff, red mottled brown silty clay with a trace of ironstone gravel, MC>PL		D	0.5		pp = 300-400		
		- becoming red mottled grey below 0.7m							
	1			D	1.0		pp = 200-300		1
87				U_{50}					
		- becoming hard, grey mottled red and light brown with iron induration, MC<PL below 1.3m			1.4				
				D/B	1.5		pp >600		
	1.8	SHALE - extremely low strength, extremely weathered, grey shale with iron induration and very low strength, highly weathered bands							
	2			D	2.0				2
86									
				D	2.5				
	3	3.0 Pit discontinued at 3.0m - limit of investigation							3
85									

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: LAH

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Dept of Planning & Environment/Camden Council
PROJECT: Land Capability Study
LOCATION: Pondicherry, Oran Park, NSW

SURFACE LEVEL: 77.9 mAHD
EASTING: 292250
NORTHING: 6237153

PIT No: 9
PROJECT No: 76778.29
DATE: 10/7/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL - brown silty clay with some rootlets							
	0.3	SILTY CLAY - firm to stiff, light brown mottled grey and red silty clay, MC>PL		D/B	0.5		pp = 250-300		
77	1	- becoming grey mottled light brown below 1.0m		D	1.0		pp = 200-300		1
				U_{50}					
					1.4				
		- with iron induration below 1.5m		D	1.5		pp = 200-250		
76	2	- becoming MC~PL below 2.0m		D	2.0		pp = 200-300		2
	2.5	SANDY SILTY CLAY - stiff, grey mottled light brown with iron induration, MC~PL		D	2.5		pp = 200-300		
		- becoming MC>PL below 2.7m						▼ 10-07-17	
75	3	3.0 Pit discontinued at 3.0m - limit of investigation		D	3.0		pp = 150-200		3
74									

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: LAH

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: Free groundwater observed at 2.9m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Dept of Planning & Environment/Camden Council
PROJECT: Land Capability Study
LOCATION: Pondicherry, Oran Park, NSW

SURFACE LEVEL: 74.9 mAHD
EASTING: 292265
NORTHING: 6237625

PIT No: 10
PROJECT No: 76778.29
DATE: 10/7/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL - brown silty clay with some rootlets							
	0.3	SILTY CLAY - firm to stiff, light brown mottled grey and red silty clay with a trace of ironstone gravel, MC>PL		D	0.5		pp = 150-250		
74	1	- becoming grey mottled red, light brown and dark grey with some iron induration below 1.0m		D/B U_{50}	0.9 1.0		pp = 100-250		1
		- becoming stiff to very stiff, MC~PL below 1.3m			1.3				
				D	1.5		pp = 200-300		
73	2	2.0 SHALE - extremely low strength, extremely weathered, grey shale with iron induration and very low strength, highly weathered bands		D	2.0				2
				D	2.5				
72	3	3.0 Pit discontinued at 3.0m - limit of investigation		D	3.0				3
71									

Dynamic Penetrometer Test (blows per 150mm): 5 10 15 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: LAH

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Dept of Planning & Environment/Camden Council
PROJECT: Land Capability Study
LOCATION: Pondicherry, Oran Park, NSW

SURFACE LEVEL: 85.6 mAHD
EASTING: 291806
NORTHING: 6237875

PIT No: 11
PROJECT No: 76778.29
DATE: 10/7/2017
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
85	0.3	TOPSOIL - brown silty clay with a trace of rootlets							
		SILTY CLAY - stiff, red mottled grey silty clay with a trace of ironstone gravel, MC>PL		D	0.5		pp = 150-250		
		- with iron induration below 0.7m		D/B	1.0		pp = 100-200		
	1				1.2				
84				U_{50}					
				D	1.5		pp = 200-300		
					1.6				
	1.9	SHALE - extremely low strength, extremely weathered, grey shale with iron induration		D	2.0				
	2	- becoming very low strength, highly weathered with extremely low strength, extremely weathered bands below 2.3m		D	2.5				
83	2.7	Pit discontinued at 2.7m - refusal on low to medium strength shale							
	3								
82									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: John Deere 315SE backhoe - 450mm bucket

LOGGED: LAH

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

Appendix C

Laboratory Reports

12 Ashley Street, Chatswood, NSW 2067
tel: +61 2 9910 6200

email: sydney@envirolab.com.au
envirolab.com.au

Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS 171224

Client:

Douglas Partners Pty Ltd Smeaton Grange
18 Waler Crescent
Smeaton Grange
NSW 2567

Attention: Tom Mrdjen

Sample log in details:

Your Reference:	**76778.29, Proposed Residential Development**		
No. of samples:	68 soils		
Date samples received / completed instructions received	12/07/17	/	12/07/17

Analysis Details:

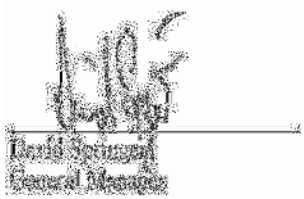
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	19/07/17	/	19/07/17
Date of Preliminary Report:	Not Issued		

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:



Misc Inorg - Soil						
Our Reference:	UNITS	171224-1	171224-2	171224-3	171224-4	171224-5
Your Reference	----------	TP1	TP1	TP1	TP1	TP1
	-					
Depth	----------	0.1	0.5	1.0	1.5	2.0
Date Sampled		10/07/2017	10/07/2017	10/07/2017	10/07/2017	10/07/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
Date analysed	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
pH 1:5 soil:water	pH Units	6.8	5.8	5.4	4.9	5.0
Electrical Conductivity 1:5 soil:water	µS/cm	76	240	630	890	780
Chloride, Cl 1:5 soil:water	mg/kg	<10	[NA]	[NA]	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	20	[NA]	[NA]	[NA]	[NA]

Misc Inorg - Soil						
Our Reference:	UNITS	171224-6	171224-7	171224-8	171224-9	171224-10
Your Reference	----------	TP1	TP2	TP2	TP2	TP2
	-					
Depth	----------	2.5	0.1	0.5	1.0	1.5
Date Sampled		10/07/2017	10/07/2017	10/07/2017	10/07/2017	10/07/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
Date analysed	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
pH 1:5 soil:water	pH Units	5.3	6.7	7.2	6.2	7.2
Electrical Conductivity 1:5 soil:water	µS/cm	520	52	160	610	960

Misc Inorg - Soil						
Our Reference:	UNITS	171224-11	171224-12	171224-13	171224-14	171224-15
Your Reference	----------	TP2	TP3	TP3	TP3	TP3
	-					
Depth	----------	2.0	0.1	0.5	1.0	1.5
Date Sampled		10/07/2017	10/07/2017	10/07/2017	10/07/2017	10/07/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
Date analysed	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
pH 1:5 soil:water	pH Units	7.0	6.7	5.8	5.0	5.0
Electrical Conductivity 1:5 soil:water	µS/cm	720	55	170	1,100	1,200
Chloride, Cl 1:5 soil:water	mg/kg	960	[NA]	71	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	65	[NA]	160	[NA]	[NA]

Misc Inorg - Soil						
Our Reference:	UNITS	171224-16	171224-17	171224-18	171224-19	171224-20
Your Reference	---------- -	TP3	TP3	TP4	TP4	TP4
Depth	----------	2.0	2.5	0.1	0.5	1.0
Date Sampled		10/07/2017	10/07/2017	11/07/2017	11/07/2017	11/07/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
Date analysed	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
pH 1:5 soil:water	pH Units	5.6	5.6	6.6	6.0	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	440	340	40	170	540
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	380	[NA]	[NA]	680
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	170	[NA]	[NA]	210

Misc Inorg - Soil						
Our Reference:	UNITS	171224-21	171224-22	171224-23	171224-24	171224-25
Your Reference	---------- -	TP4	TP4	TP4	TP5	TP5
Depth	----------	1.5	2.0	2.5	0.1	0.5
Date Sampled		11/07/2017	11/07/2017	11/07/2017	11/07/2017	11/07/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
Date analysed	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
pH 1:5 soil:water	pH Units	5.3	5.2	5.7	5.6	5.0
Electrical Conductivity 1:5 soil:water	µS/cm	490	490	360	110	440
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	24	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	39	[NA]

Misc Inorg - Soil						
Our Reference:	UNITS	171224-26	171224-27	171224-28	171224-29	171224-30
Your Reference	---------- -	TP5	TP5	TP5	TP5	TP6
Depth	----------	1.0	1.5	2.0	2.5	0.1
Date Sampled		11/07/2017	11/07/2017	11/07/2017	11/07/2017	11/07/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
Date analysed	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
pH 1:5 soil:water	pH Units	5.0	4.9	5.0	5.0	6.3
Electrical Conductivity 1:5 soil:water	µS/cm	360	650	540	410	13
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	680	[NA]	[NA]	<10
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	220	[NA]	[NA]	<10

Misc Inorg - Soil						
Our Reference:	UNITS	171224-31	171224-32	171224-33	171224-34	171224-35
Your Reference	---------- -	TP6	TP6	TP6	TP6	TP6
Depth	----------	0.5	1.0	1.5	2.0	2.5
Date Sampled		11/07/2017	11/07/2017	11/07/2017	11/07/2017	11/07/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
Date analysed	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
pH 1:5 soil:water	pH Units	6.3	5.8	5.2	5.5	6.4
Electrical Conductivity 1:5 soil:water	µS/cm	13	59	310	440	510
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	300	[NA]	540
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	30	[NA]	72

Misc Inorg - Soil						
Our Reference:	UNITS	171224-36	171224-37	171224-38	171224-39	171224-40
Your Reference	---------- -	TP7	TP7	TP7	TP7	TP7
Depth	----------	0.1	0.5	1.0	1.5	2.0
Date Sampled		10/07/2017	10/07/2017	10/07/2017	10/07/2017	10/07/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
Date analysed	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
pH 1:5 soil:water	pH Units	6.5	5.9	5.3	5.3	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	39	61	360	440	500
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	370	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	[NA]	130	[NA]

Misc Inorg - Soil						
Our Reference:	UNITS	171224-41	171224-46	171224-49	171224-50	171224-51
Your Reference	---------- -	TP7	TP8	TP9	TP9	TP9
Depth	----------	2.5	2.0	0.1	0.5	1.0
Date Sampled		10/07/2017	10/07/2017	10/07/2017	10/07/2017	10/07/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
Date analysed	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
pH 1:5 soil:water	pH Units	5.2	[NA]	5.7	4.5	4.7
Electrical Conductivity 1:5 soil:water	µS/cm	470	[NA]	1,500	2,700	1,700
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	370	[NA]	[NA]	2,600
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	100	[NA]	[NA]	200

Misc Inorg - Soil						
Our Reference:	UNITS	171224-52	171224-53	171224-54	171224-55	171224-56
Your Reference	---------- -	TP9	TP9	TP9	TP9	TP10
Depth	----------	1.5	2.0	2.5	3.0	0.1
Date Sampled		10/07/2017	10/07/2017	10/07/2017	10/07/2017	10/07/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
Date analysed	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
pH 1:5 soil:water	pH Units	5.2	6.1	6.8	7.3	7.0
Electrical Conductivity 1:5 soil:water	µS/cm	1,200	1,300	890	770	82

Misc Inorg - Soil						
Our Reference:	UNITS	171224-57	171224-58	171224-59	171224-60	171224-61
Your Reference	---------- -	TP10	TP10	TP10	TP10	TP10
Depth	----------	0.5	1.0	1.5	2.0	2.5
Date Sampled		10/07/2017	10/07/2017	10/07/2017	10/07/2017	10/07/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
Date analysed	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
pH 1:5 soil:water	pH Units	5.6	4.8	4.9	5.2	5.4
Electrical Conductivity 1:5 soil:water	µS/cm	270	1,100	760	780	660
Chloride, Cl 1:5 soil:water	mg/kg	[NA]	[NA]	1,100	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	[NA]	[NA]	150	[NA]	[NA]

Misc Inorg - Soil						
Our Reference:	UNITS	171224-62	171224-63	171224-64	171224-65	171224-66
Your Reference	---------- -	TP10	TP11	TP11	TP11	TP11
Depth	----------	3.0	0.1	0.5	1.0	1.5
Date Sampled		10/07/2017	10/07/2017	10/07/2017	10/07/2017	10/07/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
Date analysed	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
pH 1:5 soil:water	pH Units	6.6	7.8	5.7	5.5	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	650	200	470	360	370

Misc Inorg - Soil			
Our Reference:	UNITS	171224-67	171224-68
Your Reference	---------- -	TP11	TP11
Depth	----------	2.0	2.5
Date Sampled		10/07/2017	10/07/2017
Type of sample		Soil	Soil
Date prepared	-	14/07/2017	14/07/2017
Date analysed	-	14/07/2017	14/07/2017
pH 1:5 soil:water	pH Units	5.6	5.7
Electrical Conductivity 1:5 soil:water	µS/cm	310	360

Misc Inorg - Soil			
Our Reference:	UNITS	171224-67	171224-68
Your Reference	----------	TP11	TP11
	-		
Depth	----------	2.0	2.5
Date Sampled		10/07/2017	10/07/2017
Type of sample		Soil	Soil
Chloride, Cl 1:5 soil:water	mg/kg	280	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	110	[NA]

ESP/CEC Our Reference: Your Reference	UNITS ----------	171224-9 TP2	171224-17 TP3	171224-18 TP4	171224-31 TP6	171224-34 TP6
	-					
Depth	----------	1.0	2.5	0.1	0.5	2.0
Date Sampled		10/07/2017	10/07/2017	11/07/2017	11/07/2017	11/07/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	14/07/2017	14/07/2017	14/07/2017	14/07/2017	14/07/2017
Date analysed	-	17/07/2017	17/07/2017	17/07/2017	17/07/2017	17/07/2017
Exchangeable Ca	meq/100g	0.5	<0.1	7.2	1.4	<0.1
Exchangeable K	meq/100g	<0.1	0.2	0.9	0.1	<0.1
Exchangeable Mg	meq/100g	4.0	11	4.0	5.9	6.8
Exchangeable Na	meq/100g	1.3	3.9	0.12	0.84	3.2
Cation Exchange Capacity	meq/100g	5.9	15	12	8.3	10
ESP	%	23	27	<1	10	31

ESP/CEC Our Reference: Your Reference	UNITS ----------	171224-44 TP8	171224-61 TP10
	-		
Depth	----------	1.0	2.5
Date Sampled		10/07/2017	10/07/2017
Type of sample		Soil	Soil
Date prepared	-	14/07/2017	14/07/2017
Date analysed	-	17/07/2017	17/07/2017
Exchangeable Ca	meq/100g	0.2	<0.1
Exchangeable K	meq/100g	0.1	0.1
Exchangeable Mg	meq/100g	9.2	9.0
Exchangeable Na	meq/100g	3.1	3.5
Cation Exchange Capacity	meq/100g	13	13
ESP	%	25	27

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. 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 at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Alternatively determined by colourimetry/turbidity using Discrete Analyer.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.

QUALITY CONTROL Misc Inorg - Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			14/07/2017	171224-1	14/07/2017 || 14/07/2017	LCS-1	14/07/2017
Date analysed	-			14/07/2017	171224-1	14/07/2017 || 14/07/2017	LCS-1	14/07/2017
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	171224-1	6.8 || 6.8 || RPD: 0	LCS-1	103%
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	171224-1	76 || 82 || RPD: 8	LCS-1	98%
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	171224-1	<10 || <10	LCS-1	93%
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	171224-1	20 || 20 || RPD: 0	LCS-1	111%

QUALITY CONTROL ESP/CEC	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			14/07/2017	[NT]	[NT]	LCS-1	14/07/2017
Date analysed	-			17/07/2017	[NT]	[NT]	LCS-1	17/07/2017
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	102%
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	102%
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	98%
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	LCS-1	100%
ESP	%	1	Metals-009	[NT]	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	171224-11	14/07/2017 || 14/07/2017	LCS-2	14/07/2017
Date analysed	-	171224-11	14/07/2017 || 14/07/2017	LCS-2	14/07/2017
pH 1:5 soil:water	pH Units	171224-11	7.0 || 7.1 || RPD: 1	LCS-2	102%
Electrical Conductivity 1:5 soil:water	µS/cm	171224-11	720 || 960 || RPD: 29	LCS-2	100%
Chloride, Cl 1:5 soil:water	mg/kg	171224-11	960 || 1300 || RPD: 30	LCS-2	90%
Sulphate, SO4 1:5 soil:water	mg/kg	171224-11	65 || 84 || RPD: 26	LCS-2	100%

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	171224-20	14/07/2017 || 14/07/2017	LCS-3	14/07/2017
Date analysed	-	171224-20	14/07/2017 || 14/07/2017	LCS-3	14/07/2017
pH 1:5 soil:water	pH Units	171224-20	5.3 || 5.4 || RPD: 2	LCS-3	101%
Electrical Conductivity 1:5 soil:water	µS/cm	171224-20	540 || 580 || RPD: 7	LCS-3	96%
Chloride, Cl 1:5 soil:water	mg/kg	171224-20	680 || 600 || RPD: 12	LCS-3	94%
Sulphate, SO4 1:5 soil:water	mg/kg	171224-20	210 || 190 || RPD: 10	LCS-3	102%

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	171224-30	14/07/2017 || 14/07/2017	LCS-4	14/07/2017
Date analysed	-	171224-30	14/07/2017 || 14/07/2017	LCS-4	14/07/2017
pH 1:5 soil:water	pH Units	171224-30	6.3 || 6.3 || RPD: 0	LCS-4	103%
Electrical Conductivity 1:5 soil:water	µS/cm	171224-30	13 || 13 || RPD: 0	LCS-4	102%
Chloride, Cl 1:5 soil:water	mg/kg	171224-30	<10 || <10	LCS-4	97%
Sulphate, SO4 1:5 soil:water	mg/kg	171224-30	<10 || <10	LCS-4	104%
QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	171224-39	14/07/2017 || 14/07/2017	171224-13	14/07/2017
Date analysed	-	171224-39	14/07/2017 || 14/07/2017	171224-13	14/07/2017
pH 1:5 soil:water	pH Units	171224-39	5.3 || 5.2 || RPD: 2	[NR]	[NR]
Electrical Conductivity 1:5 soil:water	µS/cm	171224-39	440 || 460 || RPD: 4	[NR]	[NR]
Chloride, Cl 1:5 soil:water	mg/kg	171224-39	370 || 400 || RPD: 8	171224-13	76%
Sulphate, SO4 1:5 soil:water	mg/kg	171224-39	130 || 150 || RPD: 14	171224-13	127%
QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	171224-51	14/07/2017 || 14/07/2017	171224-33	14/07/2017
Date analysed	-	171224-51	14/07/2017 || 14/07/2017	171224-33	14/07/2017
pH 1:5 soil:water	pH Units	171224-51	4.7 || 4.7 || RPD: 0	[NR]	[NR]
Electrical Conductivity 1:5 soil:water	µS/cm	171224-51	1700 || 1800 || RPD: 6	[NR]	[NR]
Chloride, Cl 1:5 soil:water	mg/kg	171224-51	2600 || 2700 || RPD: 4	171224-33	105%
Sulphate, SO4 1:5 soil:water	mg/kg	171224-51	200 || 200 || RPD: 0	171224-33	100%
QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	171224-59	14/07/2017 || 14/07/2017	171224-46	14/07/2017
Date analysed	-	171224-59	14/07/2017 || 14/07/2017	171224-46	14/07/2017
pH 1:5 soil:water	pH Units	171224-59	4.9 || 4.8 || RPD: 2	[NR]	[NR]
Electrical Conductivity 1:5 soil:water	µS/cm	171224-59	760 || 780 || RPD: 3	[NR]	[NR]
Chloride, Cl 1:5 soil:water	mg/kg	171224-59	1100 || 1100 || RPD: 0	171224-46	#
Sulphate, SO4 1:5 soil:water	mg/kg	171224-59	150 || 140 || RPD: 7	171224-46	#

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	171224-67	14/07/2017
Date analysed	-	[NT]	[NT]	171224-67	14/07/2017
pH 1:5 soil:water	pH Units	[NT]	[NT]	[NR]	[NR]
Electrical Conductivity 1:5 soil:water	µS/cm	[NT]	[NT]	[NR]	[NR]
Chloride, Cl 1:5 soil:water	mg/kg	[NT]	[NT]	171224-67	#
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]	171224-67	97%

QUALITY CONTROL ESP/CEC	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	171224-9	14/07/2017 || 14/07/2017
Date analysed	-	171224-9	17/07/2017 || 17/07/2017
Exchangeable Ca	meq/100 g	171224-9	0.5 || 0.3 || RPD: 50
Exchangeable K	meq/100 g	171224-9	<0.1 || <0.1
Exchangeable Mg	meq/100 g	171224-9	4.0 || 3.8 || RPD: 5
Exchangeable Na	meq/100 g	171224-9	1.3 || 1.3 || RPD: 0
ESP	%	171224-9	23 || 24 || RPD: 4

Report Comments:

Chloride/Sulphate:

Percent recovery is not possible to report due to the high concentration of the analyte/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NR: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

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: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-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.

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

Project Name:	Proposed residential development			**To:**	Envirolab Services
Project No:	76778.29	**Sampler:**	Ludvig Arentz-Hansen		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	Tom Mrdjen	**Mob. Phone:**	0447 447 404	**Attn:**	Tania Notaras
Email:	tom.mrdjen@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil W - water)	Container Type (G - glass P - plastic)	Analytes: pH	EC	Chloride	Sulphate	Sodicity	Hold				Notes/preservation
TP1/0.1	1	10/07/17	S	P	X	X	X	X						
TP1/0.5	2	10/07/17	S	P	X	X								
TP1/1.0	3	10/07/17	S	P	X	X								
TP1/1.5	4	10/07/17	S	P	X	X								
TP1/2.0	5	10/07/17	S	P	X	X								
TP1/2.5	6	10/07/17	S	P	X	X								
TP2/0.1	7	10/07/17	S	P	X	X								
TP2/0.5	8	10/07/17	S	P	X	X								
TP2/1.0	9	10/07/17	S	P	X	X			X					
TP2/1.5	10	10/07/17	S	P	X	X								
TP2/2.0	11	10/07/17	S	P	X	X	X	X						
TP3/0.1	12	10/07/17	S	P	X	X								
TP3/0.5	13	10/07/17	S	P	X	X	X	X						

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 172
Date Received: 17/7/17
Time Received: 17 45
Received by: PR
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None
11.0

Lab Report No:			
Send Results to:	Douglas Partners Pty Ltd	**Address** 18 Waler Crescent, Smeaton Grange 2567	**Phone:** (02) 4647 0075 **Fax:** (02) 4646 1886
Relinquished by:	Ludvig Arentz-Hansen	**Transported to laboratory by:**	
Signed: Ludvig Arentz-Hansen	**Date & Time:** 12/07/2017	**Received by:** PRay	12/7/2017

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY

Project Name:	Proposed residential development			**To:**	Envirolab Services
Project No:	76778.29	**Sampler:**	Ludvig Arentz-Hansen		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	Tom Mrdjen	**Mob. Phone:**	0447 447 404	**Attn:**	Tania Notaras
Email:	tom.mrdjen@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					pH	EC	Chloride	Sulphate	Sodicity	Hold				
TP3/1.0	14	10/07/17	S	P	X	X								
TP3/1.5	15	10/07/17	S	P	X	X								
TP3/2.0	16	10/07/17	S	P	X	X								
TP3/2.5	17	10/07/17	S	P	X	X	X	X	X					
TP4/0.1	18	11/07/17	S	P	X	X			X					
TP4/0.5	19	11/07/17	S	P	X	X								
TP4/1.0	20	11/07/17	S	P	X	X	X	X						
TP4/1.5	21	11/07/17	S	P	X	X								
TP4/2.0	22	11/07/17	S	P	X	X								
TP4/2.5	23	11/07/17	S	P	X	X								
TP5/0.1	24	11/07/17	S	P	X	X	X	X						
TP5/0.5	25	11/07/17	S	P	X	X								

Lab Report No:					
Send Results to:	Douglas Partners Pty Ltd	**Address** 18 Waler Crescent, Smeaton Grange 2567		**Phone:** (02) 4647 0075	**Fax:** (02) 4646 1886
Relinquished by:	Ludvig Arentz-Hansen		**Transported to laboratory by:**		
Signed:		**Date & Time:** 12/07/2017	**Received by:** PRag 12/7/2017		

171224

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

Project Name:	Proposed residential development			**To:**	Envirolab Services
Project No:	76778.29	**Sampler:**	Ludvig Arentz-Hansen		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	Tom Mrdjen	**Mob. Phone:**	0447 447 404	**Attn:**	Tania Notaras
Email:	tom.mrdjen@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					pH	EC	Chloride	Sulphate	Sodicity	Hold				
TP5/1.0	26	11/07/17	S	P	X	X								
TP5/1.5	27	11/07/17	S	P	X	X	X	X						
TP5/2.0	28	11/07/17	S	P	X	X								
TP5/2.5	29	11/07/17	S	P	X	X								
TP6/0.1	30	11/07/17	S	P	X	X	X	X						
TP6/0.5	31	11/07/17	S	P	X	X			X					
TP6/1.0	32	11/07/17	S	P	X	X								
TP6/1.5	33	11/07/17	S	P	X	X	X	X						
TP6/2.0	34	11/07/17	S	P	X	X			X					
TP6/2.5	35	11/07/17	S	P	X	X	X	X						
TP7/0.1	36	10/07/17	S	P	X	X								
TP7/0.5	37	10/07/17	S	P	X	X								
TP7/1.0	38	10/07/17	S	P	X	X								

Lab Report No:					
Send Results to:	Douglas Partners Pty Ltd	**Address** 18 Waler Crescent, Smeaton Grange 2567		**Phone:** (02) 4647 0075	**Fax:** (02) 4646 1886
Relinquished by:	Ludvig Arentz-Hansen		**Transported to laboratory by:**		
Signed:		**Date & Time:** 12/07/2017	**Received by:**	PRay 12/7/2017	

171224

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

Project Name:	Proposed residential development			**To:**	Envirolab Services
Project No:	76778.29	**Sampler:**	Ludvig Arentz-Hansen		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	Tom Mrdjen	**Mob. Phone:**	0447 447 404	**Attn:**	Tania Notaras
Email:	tom.mrdjen@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					pH	EC	Chloride	Sulphate	Sodicity	Hold				
TP7/1.5	39	10/07/17	S	P	X	X	X	X						
TP7/2.0	40	10/07/17	S	P	X	X								
TP7/2.5	41	10/07/17	S	P	X	X								
TP8/0.1	42	10/07/17	S	P						X				
TP8/0.5	43	10/07/17	S	P						X				
TP8/1.0	44	10/07/17	S	P					X	X				
TP8/1.5	45	10/07/17	S	P						X				
TP8/2.0	46	10/07/17	S	P			X	X		X				
TP8/2.5	47	10/07/17	S	P						X				
TP8/3.0	48	10/07/17	S	P						X				
TP9/0.1	49	10/07/17	S	P	X	X								
TP9/0.5	50	10/07/17	S	P	X	X								
TP9/1.0	51	10/07/17	S	P	X	X	X	X						

Lab Report No:			
Send Results to:	Douglas Partners Pty Ltd	**Address** 18 Waler Crescent, Smeaton Grange 2567	**Phone:** (02) 4647 0075 **Fax:** (02) 4646 1886
Relinquished by:	Ludvig Arentz-Hansen	**Transported to laboratory by:**	
Signed:	**Date & Time:** 12/07/2017	**Received by:**	Ray 12/7/2017

171224

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY

Project Name:	Proposed residential development			**To:**	Envirolab Services
Project No:	76778.29	**Sampler:**	Ludvig Arentz-Hansen		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	Tom Mrdjen	**Mob. Phone:**	0447 447 404	**Attn:**	Tania Notaras
Email:	tom.mrdjen@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					pH	EC	Chloride	Sulphate	Sodicity	Hold				
TP9/1.5	52	10/07/17	S	P	X	X								
TP9/2.0	53	10/07/17	S	P	X	X								
TP9/2.5	54	10/07/17	S	P	X	X								
TP9/3.0	55	10/07/17	S	P	X	X								
TP10/0.1	56	10/07/17	S	P	X	X								
TP10/0.5	57	10/07/17	S	P	X	X								
TP10/1.0	58	10/07/17	S	P	X	X								
TP10/1.5	59	10/07/17	S	P	X	X	X	X						
TP10/2.0	60	10/07/17	S	P	X	X								
TP10/2.5	61	10/07/17	S	P	X	X			X					
TP10/3.0	62	10/07/17	S	P	X	X								
TP11/0.1	63	10/07/17	S	P	X	X								
TP11/0.5	64	10/07/17	S	P	X	X								

Lab Report No:					
Send Results to:	Douglas Partners Pty Ltd	**Address** 18 Waler Crescent, Smeaton Grange 2567		**Phone:** (02) 4647 0075	**Fax:** (02) 4646 1886
Relinquished by:	Ludvig Arentz-Hansen		**Transported to laboratory by:**		
Signed:		**Date & Time:** 12/07/2017	**Received by:**	Ray 12/7/2017	

171224

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY

Project Name:	Proposed residential development			**To:**	Envirolab Services
Project No:	76778.29	**Sampler:**	Ludvig Arentz-Hansen		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	Tom Mrdjen	**Mob. Phone:**	0447 447 404	**Attn:**	Tania Notaras
Email:	tom.mrdjen@douglaspartners.com.au			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes									Notes/preservation
					pH	EC	Chloride	Sulphate	Sodicity	Hold				
TP11/1.0	65	10/07/17	S	P	X	X								
TP11/1.5	66	10/07/17	S	P	X	X								
TP11/2.0	67	10/07/17	S	P	X	X	X	X						
TP11/2.5	68	10/07/17	S	P	X	X								

Lab Report No:					
Send Results to:	Douglas Partners Pty Ltd	**Address** 18 Waler Crescent, Smeaton Grange 2567		**Phone:** (02) 4647 0075	**Fax:** (02) 4646 1886
Relinquished by:	Ludvig Arentz-Hansen		**Transported to laboratory by:**		
Signed:		**Date & Time:** 12/07/2017	**Received by:**	Ray 12/7/2017	

171224

Ellen Wandala Gamage

From: Tom Mrdjen <Tom.Mrdjen@douglaspartners.com.au>
Sent: Thursday, 13 July 2017 12:44 PM
To: Ellen Wandala Gamage
Subject: RE: 76778.29, Proposed Residential Development

Ellen,

Undertake the sodicity.

Regards,

Tom Mrdjen | Associate / Geotechnical Engineer
Douglas Partners Pty Ltd | ABN 75 053 980 117 | www.douglaspartners.com.au
18 Waler Crescent Smeaton Grange NSW 2567
P: 02 4647 0075 | F: 02 4646 1886 | M: 0447 447 404 | E: Tom.Mrdjen@douglaspartners.com.au

From: Ellen Wandala Gamage [mailto:EWandalaGamage@envirolab.com.au]
Sent: Wednesday, 12 July 2017 8:03 PM
To: Tom Mrdjen
Subject: 76778.29, Proposed Residential Development

Hi Tom,
Hope you have been well, sample TP8/1.0 has been indicated for both hold & sodicity can you let me know which is required?
Thanks
Ellen

Regards,

Ellen Wandala Gamage | Customer Service (12pm - 8pm) | Envirolab Services Pty Ltd

Great Science, Great Service.

Chatswood NSW 2067

E EWandalaGamage@envirolab.com.au | W

#171224

Appendix D

Summary Table

Table C1: Summary Table - Laboratory Tests and Assessments

Test Pit	Sample Depth	pH	Chloride Concentration	Sulphate Concentration	Resistivity	Soil Condition	Sample Aggressivity Class					Exchangeable Sodium (Na) Concentration	Cation Exchange Capacity	Sodicity	Sodicity Class	Emerson Crumb Class Number	Dispersion?	Soil Texture Group	Textural Factor (M)	$EC_{1:5}$	EC_e	Sample Salinity Class
					By inversion of EC1:5		Aggr. to Concrete - from sample pH	Aggr. to Concrete - from Sulphate conc.	Aggr. to Steel - from sample pH	Aggr. to Steel - from Chloride conc.	Aggr. to Steel - from sample Resistivity			[Na/CEC]			(from Emerson Class)	(for detailed soil logs see Report Appendix)		[Lab.]	[M x $EC_{1:5}$]	(Based on sample ECe)
	(m bgl)	(pH units)	(mg/kg)	(mg/kg)	Ω.cm	[AS2159-2009]	[AS2159-2009]					(meq/100g)	(meq/100g)	(%)	[after DLWC]		[AS1289.3.8.1]	[after DLWC]	[after DLWC]	(microS/cm)	(deciS/m)	[Richards 1954]
TP1	0.1	6.8	10	20	13158	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Loam	10	76	0.8	Non-Saline
TP1	0.5	5.8			4167	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Heavy clay	6	240	1.4	Non-Saline
TP1	1	5.4			1587	B	Mild		Non-Aggressive		Mild							Medium clay	7	630	4.4	Moderately Saline
TP1	1.5	4.9			1124	B	Mild		Non-Aggressive		Mild							Medium clay	7	890	6.2	Moderately Saline
TP1	2	5			1282	B	Mild		Non-Aggressive		Mild							Medium clay	7	780	5.5	Moderately Saline
TP1	2.5	5.3			1923	B	Mild		Non-Aggressive		Mild							Medium clay	7	520	3.6	Slightly Saline
TP2	0.1	6.7			19231	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Sandy loam	14	52	0.7	Non-Saline
TP2	0.5	7.2			6250	B	Non-Aggressive		Non-Aggressive		Non-Aggressive					2	Some	Medium clay	7	160	1.1	Non-Saline
TP2	1	6.2			1639	B	Non-Aggressive		Non-Aggressive		Mild	1.3	5.9	22	Highly Sodic	1	Complete	Medium clay	7	610	4.3	Moderately Saline
TP2	1.5	7.2			1042	B	Non-Aggressive		Non-Aggressive		Mild							Medium clay	7	960	6.7	Moderately Saline
TP2	2	7	960	65	1389	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild							Light clay	8.5	720	6.1	Moderately Saline
TP3	0.1	6.7			18182	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Loam	10	55	0.6	Non-Saline
TP3	0.5	5.8	71	160	5882	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive					1	Complete	Medium clay	7	170	1.2	Non-Saline
TP3	1	5			909	B	Mild		Non-Aggressive		Moderate							Medium clay	7	1100	7.7	Moderately Saline
TP3	1.5	5			833	B	Mild		Non-Aggressive		Moderate							Medium clay	7	1200	8.4	Very Saline
TP3	2	5.6			2273	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	440	3.1	Slightly Saline
TP3	2.5	5.6	380	170	2941	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	3.9	15	26	Highly Sodic			Medium clay	7	340	2.4	Slightly Saline
TP4	0.1	6.6			25000	B	Non-Aggressive		Non-Aggressive		Non-Aggressive	0.12	12	1	Non-Sodic			Loam	10	40	0.4	Non-Saline
TP4	0.5	6			5882	B	Non-Aggressive		Non-Aggressive		Non-Aggressive					8	No	Heavy clay	6	170	1.0	Non-Saline
TP4	1	5.3	680	210	1852	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild							Heavy clay	6	540	3.2	Slightly Saline
TP4	1.5	5.3			2041	B	Mild		Non-Aggressive		Non-Aggressive							Medium clay	7	490	3.4	Slightly Saline
TP4	2	5.2			2041	B	Mild		Non-Aggressive		Non-Aggressive							Medium clay	7	490	3.4	Slightly Saline
TP4	2.5	5.7			2778	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	360	2.5	Slightly Saline
TP5	0.1	5.6	24	39	9091	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Loam	10	110	1.1	Non-Saline
TP5	0.5	5			2273	B	Mild		Non-Aggressive		Non-Aggressive					1	Complete	Light medium clay	8	440	3.5	Slightly Saline
TP5	1	5			2778	B	Mild		Non-Aggressive		Non-Aggressive							Medium clay	7	360	2.5	Slightly Saline
TP5	1.5	4.9	680	220	1538	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild							Medium clay	7	650	4.6	Moderately Saline
TP5	2	5			1852	B	Mild		Non-Aggressive		Mild							Medium clay	7	540	3.8	Slightly Saline
TP5	2.5	5			2439	B	Mild		Non-Aggressive		Non-Aggressive							Medium clay	7	410	2.9	Slightly Saline
TP6	0.1	6.3	10	10	76923	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Loam	10	13	0.1	Non-Saline
TP6	0.5	6.3			76923	B	Non-Aggressive		Non-Aggressive		Non-Aggressive	0.84	8.3	10	Sodic	4	No	Light medium clay	8	13	0.1	Non-Saline
TP6	1	5.8			16949	B	Non-Aggressive		Non-Aggressive		Non-Aggressive					3	Dispersive	Medium clay	7	59	0.4	Non-Saline
TP6	1.5	5.2	300	30	3226	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive					1	Complete	Medium clay	7	310	2.2	Slightly Saline
TP6	2	5.5			2273	B	Mild		Non-Aggressive		Non-Aggressive	3.2	10	32	Highly Sodic			Medium clay	7	440	3.1	Slightly Saline
TP6	2.5	6.4	540	72	1961	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild							Medium clay	7	510	3.6	Slightly Saline
TP7	0.1	6.5			25641	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Loam	10	39	0.4	Non-Saline
TP7	0.5	5.9			16393	B	Non-Aggressive		Non-Aggressive		Non-Aggressive					3	Dispersive	Medium clay	7	61	0.4	Non-Saline
TP7	1	5.3			2778	B	Mild		Non-Aggressive		Non-Aggressive					1	Complete	Heavy clay	6	360	2.2	Slightly Saline
TP7	1.5	5.2	400	150	2174	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Medium clay	7	460	3.2	Slightly Saline
TP7	2	5.3			2000	B	Mild		Non-Aggressive		Non-Aggressive							Medium clay	7	500	3.5	Slightly Saline
TP7	2.5	5.2			2128	B	Mild		Non-Aggressive		Non-Aggressive							Medium clay	7	470	3.3	Slightly Saline
TP8	1					B						3.1	13	24	Highly Sodic			Heavy clay	6			
TP8	2		370	100		B		Non-Aggressive		Non-Aggressive								Medium clay	7			
TP9	0.1	5.7			667	B	Non-Aggressive		Non-Aggressive		Moderate							Loam	10	1500	15.0	Very Saline
TP9	0.5	4.5			370	B	Moderate		Non-Aggressive		Moderate					4	No	Heavy clay	6	2700	16.2	Highly Saline
TP9	1	4.7	2700	200	556	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Moderate							Heavy clay	6	1800	10.8	Very Saline
TP9	1.5	5.2			833	B	Mild		Non-Aggressive		Moderate							Heavy clay	6	1200	7.2	Moderately Saline
TP9	2	6.1			769	B	Non-Aggressive		Non-Aggressive		Moderate					4	No	Medium clay	7	1300	9.1	Very Saline
TP9	2.5	6.8			1124	B	Non-Aggressive		Non-Aggressive		Mild							Light medium clay	8	890	7.1	Moderately Saline
TP9	3	7.3			1299	B	Non-Aggressive		Non-Aggressive		Mild							Heavy clay	6	770	4.6	Moderately Saline
TP10	0.1	7			12195	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Loam	10	82	0.8	Non-Saline
TP10	0.5	5.6			3704	B	Non-Aggressive		Non-Aggressive		Non-Aggressive					2	Some	Medium clay	7	270	1.9	Non-Saline
TP10	1	4.8			909	B	Mild		Non-Aggressive		Moderate							Heavy clay	6	1100	6.6	Moderately Saline
TP10	1.5	4.9	1100	150	1316	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild							Medium clay	7	760	5.3	Moderately Saline
TP10	2	5.2			1282	B	Mild		Non-Aggressive		Mild							Medium clay	7	780	5.5	Moderately Saline
TP10	2.5	5.4			1515	B	Mild		Non-Aggressive		Mild	3.5	13	27	Highly Sodic			Medium clay	7	660	4.6	Moderately Saline
TP10	3	6.6			1538	B	Non-Aggressive		Non-Aggressive		Mild							Medium clay	7	650	4.6	Moderately Saline
TP11	0.1	7.8			5000	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Loam	10	200	2.0	Slightly Saline
TP11	0.5	5.7			2128	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Heavy clay	6	470	2.8	Slightly Saline
TP11	1	5.5			2778	B	Mild		Non-Aggressive		Non-Aggressive							Light medium clay	8	360	2.9	Slightly Saline
TP11	1.5	5.3			2703	B	Mild		Non-Aggressive		Non-Aggressive							Heavy clay	6	370	2.2	Slightly Saline
TP11	2	5.6	280	110	3226	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Medium clay	7	310	2.2	Slightly Saline
TP11	2.5	5.7			2778	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	360	2.5	Slightly Saline