Attachment 3 – Geotechnical Report

Douglas Partners
Geotechnics • Environment • Groundwater

REPORT
on
EFFLUENT DISPOSAL, EROSION AND SALINITY ASSESSMENT

PROPOSED REZONING
STANDEN DRIVE, LOWER BELFORD, NSW

Prepared for
BELFORD LAND CORPORATION

Project 49385
JULY 2009

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31 July 2009

REPORT ON
EFFLUENT DISPOSAL, EROSION AND SALINITY ASSESSMENT
LOWER BELFORD PROPOSED REZONING
STANDEN DRIVE, LOWER BELFORD, NSW

1. INTRODUCTION

This revised report presents the findings of a preliminary effluent disposal, erosion and salinity assessment for the proposed rezoning of several lots off Standen Drive, Lower Belford. The investigation was undertaken for Belford Land Corporation.

The purpose of the preliminary effluent disposal assessment was to provide the following:

- Subsurface conditions;
- On site effluent disposal assessment in accordance with AS 1547-2000;
- Recommendations on disposal options;
- Comments on the suitability of the site for on-site effluent disposal;
- Estimates on minimum areas required for disposal.

The effluent disposal assessment was undertaken with reference to the current Environmental and Health Protection Guidelines: “On-site Sewage Management for Single Household”, (Ref 1) and AS 1547:2000 “On-site domestic-wastewater management” (Ref 2).

Based on discussions with the client, the following is understood:

- Residential development with reticulated water supply is proposed for the site;
- Singleton Council has requested information regarding the suitability of 8000 m^2 residential lots with regards to on-site effluent disposal;
- Council has also requested assessment of the land for salinity and erosion risk with regards to the proposed subdivision and on-site effluent disposal.

2. SITE INFORMATION

Site-specific information relevant to the assessment is outlined in Table 1 below:

Table 1 - Site Information

Address:	Standen Drive, Lower Belford
Lot/DP:	Lot 2, DP 739822; Part Lot 6, DP 237936; Part Lot 13, DP 1100005; Part Lot 12, DP 1100005; Lot 11, DP 844443
Client:	Belford Land Corporation
Site Area:	139 ha approx.
Intended water supply (i.e. reticulated or non-reticulated):	Reticulated

3. GEOLOGY / HYDROGEOLOGY

Reference to the 1:100,000 Newcastle Coalfield Regional Geology map indicates the site is underlain by the Muree Sandstone formation of the Maitland Group. The Maitland Group is of middle to late Permian age, and typically includes sandstone, conglomerate and minor clay.

The regional groundwater flow regime for the site is believed to be towards Black Creek, which is located approximately between 700 m and 2.1 km east of the site.

The nearest registered groundwater well (GW080958) is approximately 740 m to the north from the north western corner of the site. The groundwater well was registered as a fire fighting monitoring bore. The well information indicated a water bearing zone between 18 m and 27 m depth below the ground surface and subsurface conditions generally comprising clay to approximately 2 m, underlain by 'shale' to termination at 30 m.

Searches on the Department of Lands web site (www.nratlas.nsw.gov.au) indicate that the following areas may have dryland salinity characteristics (i.e. observations of saline indicator species and possible salt outbreaks):

- A drainage channel in the north east corner of the site where Black Creek's minor tributaries exit the site;
- A drainage channel in the eastern portion of the site.

The approximate mapped areas by the Department of Lands have been reproduced on Drawing 1, attached.

4. SITE FEATURES

A site walkover was undertaken on 15 May 2009 by an experienced environmental engineer from Douglas Partners to assess the site with regards to effluent disposal constraints and potential salinity and erosion issues.

Relevant site features observed include the following:

- Drainage gullies across the site (Photos 1 to 6) and associated steep slopes;
- Rock outcrops generally observed in the south western and western portion of the site (Photos 7 to 9);
- Dams at several locations across the site (Photos 10 to 12);
- Localised erosion scouring (Photos 13 and 14);
- Localised filling (generally in the north western portion of the site and in existing effluent disposal areas within the site).

Drainage gullies and associated site slopes generally fell to the east on the eastern side of the ridge line in the western portion of the site. Site slops on the western side of the ridge line fell to the west. Site slops were generally about 8%, however localised slops of 20% to 40% were observed in the vicinity of gullies. Gullies are shown in Photos 1 to 6 below.

Photo 1 – Drainage gully and vegetation in the north eastern portion of the site

Photo 2 – Drainage gully in the northern portion of the site

Photo 3 – Drainage gully and dam in the central eastern portion of the site

Photo 4 – Drainage gully in the central portion of the site

Photo 5 – Drainage gully in the central-southern portion of the site

Photo 6 – Drainage gullies in the southern portion of the site

Rock outcrops were observed along the ridge line in the western and south western portion of the site as shown in Photos 7 to 9 below.

Photo 7 – Rock outcrops in the south western portion of the site

Photo 8 – Rock outcrops in the south western portion of the site

Photo 9 – Rock outcrop in the western portion of the site

Dams were observed in the majority of gullies across the site, as shown in Photo 3 above, and Photos 10 to 12 below.

Photo 10 – Dam in the north western portion of the site

Photo 11 – Dams in the southern portion of the site

Photo 12 – Dam in the south – eastern portion of the site

Localised erosion scouring was observed in the north eastern portion of the site, in the vicinity of a dam overflow, as shown in Photo 13.

Photo 13 – Localised erosion scour in the north eastern portion of the site (note dam overflow culvert)

Photo 14 – Localised minor erosion in the central portion of the site

Localised minor filling was observed in the north–western portion of the site (i.e. in the vicinity of a small shed and dumped rubbish - Photo 15) and in possible existing effluent disposal areas adjacent to existing residences in the north-western, central, southern and south-eastern portions the site (Photo 16).

Photo 15 – Dumped rubbish and possible filling in the north-western portion of the site

Photo 16 – Possible effluent disposal area in the central portion of the site

Surface water monitoring for pH and Electrical Conductivity (EC) was undertaken during the site walkover. The results of surface water monitoring are presented in Table 2 below. Approximate locations are shown on Drawing 1, attached.

Table 2 - Surface Water Monitoring

Location	pH	EC (mS/cm)
A	8.1	0.18
B	7.6	0.24
C	7.2	0.3
D	7.9	0.1
E	7.3	0.09
F	7.4	0.093
G	7.5	0.09
H	8.2	0.07
I	8.0	0.07
J	8.5	0.06
K	8.2	0.07
L	9.2	0.08
M	9.0	0.07
N	8.7	0.09

Various relevant site features are listed in Table 3 below and have been compared to the requirements of Reference 1 in terms of possible limitations to effluent disposal.

Table 3 - Site Features

Site Feature	Rating	Limitation
Flood potential	To be confirmed by Surveyor	
Exposure	Well exposed to sun and wind	Minor
Slope	Generally 5 % to 8% Near gullies 10% to 40%	Minor Moderate/Major
Land form	Convex side slopes across majority of site, some areas of gullies	Minor to Major
Run-on and upslope seepage	Some potential for run-on	Minor/moderate
Erosion Potential	Generally localised erosion only, gullies are generally well vegetated	Minor
Site Drainage	No obvious signs of surface dampness	Minor
Fill	Fill present in north western corner of the site	Minor/Moderate
Depth to Bedrock	Generally >0.5 m	Minor/moderate
Rock outcrops	Some rock outcrops observed in western portion (ridge)	Minor/Moderate
Buffer distances	See Table 9 for further information.	Minor/moderate
Land availability	Land generally available	Minor
Geology/Regolith	Muree sandstone formation – sandstone, conglomerate, minor clay	Minor

Notes to Table 3:

Limitation as defined by the NSW Government Environmental and Health Protection Guidelines (Ref 1).

5. SUBSURFACE CONDITIONS

Fieldwork and subsequent laboratory testing has been undertaken to assess the site's suitability for effluent disposal. A summary of the fieldwork test methods and results is shown below in Table 4.

Table 4 - Field Work

Date Sampled	18/05/09 – 20/05/09
Test Method	Test Pits undertaken by an environmental engineer from DP
Number of Pits [2]	30
Depth of Investigation	0.7 m to 2.0 m
Summary of Subsurface Conditions [1]	Generally topsoil over clay/sandy clay, underlain by clayey sand and gravel, and sandstone
Groundwater Observations	No free groundwater was observed during fieldwork

Notes to Table 4:

1 - Detailed test pit report sheets are attached and should be read in conjunction with the general notes preceding them.

2 - Refer to Drawing 1 attached for approximate test pit locations.

Laboratory testing for the effluent disposal assessment was performed by SESL and comprised measurement of various soil parameters, as suggested for subdivision developments by the NSW Government Guidelines (Ref 1) on the predominant/controlling soil types within the site.

The results are shown in Table 5 below and have been marked where the results indicate possible limitations to suitability for effluent application (Ref 1).

Table 5 - Laboratory Test Results

Test Location	1/0.1	5/0.2	9/0.1	12/0.4	14/0.1	18/0.2	20/0.5	23/0.3	26/0.5	30/0.5
Description	Clayey sand topsoil	Clay	Clayey sand topsoil	Clay	Clayey sand topsoil	Sandy clay & gravel	Clay	Clayey sand & gravel	Sandy Clay	Clay
Bulk Density (t/m^3)	1.46	1.84	1.61	1.93	1.42	1.59	1.81	1.77	1.75	1.85
pH in water	5.8	5.9	5.8	4.9	5.8	5.6	5.8	6.1	5.8	5.6
pH in CaCl	**4.7**	**4.7**	**4.8**	4.3	**4.9**	**4.5**	4.4	**4.5**	4.3	4.4
ESP (%)	**7.1**	**5.9**	1.5	19	2.7	4.3	3.2	**8**	14.5	**7.9**
CEC (Cmol/kg)	3.4	16.3	2.7	23	4.4	3	**13.5**	**8.1**	**12.1**	**13.6**
ECe (dS/m)	0.45	0.56	0.18	**5**	0.27	0.17	0.21	0.27	0.63	0.63
Phosphorus Sorption [1] (kg/ha)	**5220**	13950	1560	17850	**5700**	**2460**	17700	**5490**	18220	16620
Modified Emerson Class [2]	5	5	3	6	5	5	6	6	6	6

Notes to Table 5:
ECe – Electrical Conductivity (Laboratory results EC (1soil:5 water) converted to ECe using soil correction factor (Ref 3))
CEC – Cation Exchange Capacity
ESP - Exchangeable Sodium Percentage
1 - Based on 1 m soil profile or observed depth to bedrock
2 - Modified Emerson Class carried out using SAR 5 solution, which replicates domestic effluent
Bold results indicate a moderate limitation as defined by Reference 1
Shaded results indicate a major limitation as defined by Reference 1

Additional laboratory testing was undertaken by SGS Australia and comprised analysis of soil samples for pH and Electrical Conductivity (EC). The results of this analysis are presented in Table 6 below.

Table 6 - Laboratory Test Results

Test Location	Description	pH	EC_e (dS/m)	Salinity Class
2/0.1	Clayey sand topsoil	6.3	0.09	Non-saline
2/0.5	Clay	6.3	0.26	Non-saline
3/0.1	Gravelly sand clay topsoil	5.6	0.28	Non-saline
4/0.25	Clay	5.8	0.27	Non-saline
6/0.05	Sand topsoil	6.3	0.23	Non-saline
7/0.15	Sandy clay topsoil	5.4	0.07	Non-saline
13/0.5	Clay	5.1	2.29	Slightly saline
14/0.5	Clay	5.9	7.47	Moderately Saline
15/0.05	Clayey sand topsoil	5.9	1.17	Non-saline
16/0.25	Clayey sand	6.0	0.10	Non-saline
17/0.2	Silty clay topsoil	5.9	0.24	Non-saline
18/0.5	Clay	5.8	1.44	Non-saline
19/0.15	Silty clay topsoil	6.3	0.35	Non-saline
21/0.2	Silty clay topsoil	6.0	1.54	Non-saline
22/0.1	Clayey sand topsoil	6.5	0.25	Non-saline
22/0.5	Clay	5.9	0.38	Non-saline
24/0.2	Gravelly sand	6.3	0.17	Non-saline
25/0.2	Sandy gravelly clay	6.4	0.06	Non-saline
28/0.15	Clayey sand topsoil	5.9	0.43	Non-saline
29/0.25	Clay	5.9	0.16	Non-saline

6. EFFLUENT DISPOSAL AREA REQUIREMENTS

Estimated land areas required for both irrigation (spray, trickle or subsurface) and evapotranspiration absorption (ETA) systems are provided based on typical effluent quality as published in Reference 1 for the following effluent treatment systems:

- Standard Septic Treatment System;
- Standard Aerated Wastewater Treatment System (AWTS);
- Enhanced Aerated Wastewater Treatment System (i.e. Treatment system such as an 'Envirocycle', which reduced the nitrogen output to 10 mg/L).

Minimum disposal areas have been calculated by taking account of both the hydraulic capability of the land to accept effluent as well as the ability of the land to accept nutrients. The main parameters used in these calculations are outlined in Table 7 below:

Table 7 - Model Parameters

Effluent Treatment System	Standard AWTS	Enhanced AWTS	Septic System
Nitrogen loading (mg/L) [2]	37	10	55
Phosphorus loading (mg/L) [2]	10		
Rainfall data [1]	Singleton[4]		
Evaporation data	Cessnock[4]		
DIR (mm/week)	15		
DLR (mm/day)	5		
Design Period (yrs) [3]	50		

Notes to Table 7:
DIR – Design Irrigation Rate in accordance with AS 1547-2000 (Ref 2)
DLR – Design Loading Rate (ETA systems) in accordance with AS 1547-2000 (Ref 2)
1 – Median (50th percentile or 5 Decile) monthly rainfall supplied by the Bureau of Meteorology
2 – Typical nutrient loading rates as published in Reference 1
3 – In accordance with Reference 1
4 – Nearest available weather station with appropriate data

At present, there is no town water supply to the site, however, it is understood that town water supply is required for the proposed development. Minimum disposal areas have therefore been calculated based on reticulated water supply.

The minimum plan areas noted in Table 8 below are the limiting areas based on consideration of the hydraulic and nutrient (nitrogen and phosphorus) balance estimates.

Table 8 - Minimum Plan Area (m^2) Required for Both ETA and Irrigation Disposal Systems

No of Bedrooms	Evapotranspiration/Absorption				Irrigation		
	Daily Effluent Load (L/day)	Effluent Treatment System			Effluent Treatment System		
		Septic [1, 2]	Standard AWTS [1]	Enhanced AWTS [3]	Septic [1, 2]	Standard AWTS [1]	Enhanced AWTS [3]
2	600	1220	820	270	NA	820	330
3	900	1830	1230	410	NA	1230	490
4	1200	2440	1640	550	NA	1640	660
5	1500	3060	2060	680	NA	2060	820

Notes to Table 8:

1 - Minimum plan areas for both septic and standard AWTS treatment system were found to be governed by the nitrogen balance.

2 - It should be noted that septic treatment systems should only be used in conjunction with ETA disposal systems and not used in conjunction with irrigation disposal systems. Subsoil application is required for septic systems due to the highly infectious nature of the effluent (Ref 1).

3 - The minimum plan area for an enhanced AWTS system, however, was found to be governed by a combination of the phosphorus balance and the hydraulic balance. The calculation for the phosphorus balance has assumed that the underlying clay soils are the predominant soil type.

During periods of rainfall, the nutrient levels in the effluent would be diluted, increasing the importance of the hydraulic capability of the soil. Wet weather storage should be provided for prolonged heavy rainfall events. A minimum storage capacity of three days is recommended based on NSW EPA guidelines (Ref 1), subject to council requirements.

7. RECOMMENDATIONS

7.1 Salinity

No obvious signs of soil salinity were observed during the current investigation. The results of surface water monitoring across the site generally indicated minimal salinity potential in runoff from gullies/drainage channels (i.e. fresh waters).

The results of laboratory testing undertaken on topsoil and underlying clays generally indicate minimal salinity potential. The measured electrical conductivity of the soils is unlikely to have a measurable impact on vegetation growth, and is unlikely to be a limiting factor in residential development and on-site effluent disposal at the site.

Regardless of the absence of saline indicators, it is recommended that future design and construction should be undertaken with respect to good practices as detailed in Reference 3 to minimise the potential for saline impact to occur. Typical construction practices include:

- Correctly installing a damp-proof course within each building;
- Providing adequate floor ventilation beneath buildings constructed on bearers and joists;
- Minimise the disruption to natural water courses (surface and subsurface) to reduce the potential for waters to come in contact with structures, i.e. minimising cut and fill;
- Maintaining good drainage and minimising excessive infiltration;
- Ensuring that paths which are provided around buildings slope away from the building;
- Careful design of landscaping and landscape watering methods;
- Adequate drainage provided behind retaining walls;
- Regular monitoring of pipes, etc for leaks.

Most of the above features are consistent with the guidelines AS 2870 (Ref 4) for standard non-saline sites.

For the construction of roads the following is recommended:

- Minimise ponding of water and the concentration of surface run-off on shoulders and adjacent drains;
- Increasing the seal width to minimise water infiltrating beneath the pavement. This could be achieved by bitumen sealing of the road shoulders and ensuring adequate cross fall to drains;
- Careful selection of construction materials to minimise salt content and to maximise compaction.

7.2 Soil Erosion

Observations made during the site walkover generally indicated the absence of gross erosion within gullies and slopes at the site. With the exception of eroded soils in the north-eastern portion of the site (i.e. in the vicinity of potentially high velocity dam overflows), drainage gullies were generally vegetated, with only minor exposed soils observed across the site.

The results of modified Emerson dispersion testing at the site generally indicate non-dispersive soils, particularly when testing is undertaken using a high salt solution (i.e. used to model the effect of treated effluent on soil dispersion), with the exception of clayey sand topsoils in the sample from Pit 9.

Provided adequate vegetation cover is maintained within the effluent disposal area and disposal area slopes are minimised, the site soils are considered generally suitable for residential development and to accept treated effluent with respect to potential soil erosion.

7.3 Lot Sizing

When calculating minimum lot sizes, the following should be considered:

- Maintaining the minimum effluent disposal area (as presented in Table 8 above), including reserve disposal area, soil bunds etc;
- Maintaining buffer distances to water bodies, drainage channels, residences etc (as discussed in Section 7.5 below);
- The location of flood contours (1 in 20 year contour for land application systems, 1 in 100 year contour for treatment systems).

The overall site has been assessed with reference to NSW guidelines (Ref 1). The results of the assessment indicate that the site is suitable for residential subdivision with on-site effluent disposal, and that limitations to effluent disposal assessment are minimal. Based on the calculation of minimum disposal areas as presented in Table 8 above and the assessment of the site with reference to the NSW guidelines (Ref 1), lot sizes of 8000 m^2 will allow adequate area for the proposed effluent disposal system.

Provided that the above points and the recommended site improvements (as presented in Section 7.4 below) and recommended buffer distances are adhered to in the design of lot sizes (as shown in Table 9 below), a lot size of 8000 m^2 would be unlikely to generate gross adverse cumulative impact on the site and surrounding sites.

7.4 Site Improvements

The site is considered to be generally suitable for on-site disposal of domestic effluent provided that the limitations previously mentioned are addressed, as discussed below:

Soil pH

Laboratory testing has indicated some acid soil conditions within the site. While the current site vegetation appears to have relatively good growth, agricultural lime could be added to the disposal area to maintain plant growth. Recommended lime application rates are presented in the attached SESL laboratory report sheets.

Sodic Soils/Erosivity

The soil within each disposal area could be treated with an appropriate application of gypsum. Adding gypsum to the soil increases the salinity of the soil moisture without increasing the sodium level, thereby reducing the Sodium Adsorption Ratio (SAR). This will improve the soil structure and reduce the potential for dispersion and erosion. Recommended gypsum application rates are presented in the attached SESL laboratory sheets.

Shallow Bedrock

The minor to moderate limitation caused by the presence of shallow rock within some areas of the site could be improved by mounding suitable clay loam filling within the disposal area to achieve a minimum depth of 1 m to bedrock. The material should be moderately permeable and have a high nutrient uptake. This would reduce the potential for effluent resurfacing and increase the soil's ability to uptake phosphorus.

The requirements for this would be subject to the treatment and disposal system proposed, and the depth to rock within the lot-specific disposal area.

If imported clays are to be used for additional filling, it is recommended that further laboratory testing be undertaken to assess the phosphorus absorption capacity and general suitability.

Run-on/Run-off

Catch drains / bunds upslope and downslope of the disposal areas are recommended to prevent rainfall run-on and run-off of the effluent respectively. This is particularly important on steeper areas of the site where irrigation disposal systems are proposed.

Flood Potential

In accordance with Reference 1, all components of the effluent disposal system including electrical components, vents and inspection openings of wastewater treatment devices should be located above the 1 in 100 year probability flood contour. However the 1 in 20 year probability flood contour may be used as a limit for land application areas.

General

Disposal areas should be planted with high nutrient uptake vegetation, and lawn clippings should be removed.

Maintenance of the effluent disposal area is important and should be conducted regularly. The attached pamphlet titled “Your Land Application Area” produced by the Department of Local Government provides recommendations on maintenance procedures. Additionally, all disposal areas should be constructed in accordance with AS 1547-2000 (Ref 2).

7.5 Location of Disposal Systems

Buffer zones should be kept between on-site systems and sensitive environments on and off-site. It is suggested that the buffer distances given in Reference 1 for land application systems be adopted for locating disposal areas on this site. The buffer distances from Reference 1 are reproduced below.

Table 9 – Recommended Buffer Distances for On-site Systems

System	Recommended Buffer Distances
All land application systems	• 100 m to permanent surface waters (e.g. river, streams, lakes, etc) • 250 m to domestic groundwater well • 40 m to other waters (e.g. farm dams, intermittent waterways and drainage channels, etc)
Surface spray irrigation	• 6 m if area up-gradient and 3 m if area down-gradient of driveways and property boundaries • 15 m to dwellings • 3 m to paths and walkways • 6 m to swimming pools
Surface drip and trickle irrigation and subsurface irrigation	• 6 m if area up-gradient and 3 m if area down-gradient of swimming pools, property boundaries, driveways and buildings

7.6 General

It is noted that the above assessment is preliminary only, and has been undertaken to assess general site conditions. Additional lot specific investigation may therefore be required once the proposed lot layout has been finalised to confirm the depth to rock and disposal area requirements.

8. LIMITATIONS OF THIS REPORT

DP has performed investigation and consulting services for this project in general accordance with current professional and industry standards for land contamination investigation.

Whilst every effort has been made to ensure a representative programme of field and laboratory sampling and testing, conditions different to those identified during these tasks may exist. Therefore DP cannot provide unqualified warranties nor does DP assume any liability for site conditions not observed, or accessible during the time of the investigations.

Despite all reasonable care and diligence, the ground conditions encountered and concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. In addition, site characteristics may change over time in response to variations in natural conditions, chemical reactions and other events, eg. groundwater movement and/or spillages of contaminating substances. These changes may occur subsequent to DP's investigations and assessment.

This report and associated documentation and the information herein have been prepared solely for the use of Belford Land Corporation Pty Ltd. Any reliance assumed by other parties on this report shall be at such party's own risk. Any ensuing liability resulting from use of the report by other parties cannot be transferred to DP.

DOUGLAS PARTNERS PTY LTD

Reviewed by:

Bahareh Mansouri
Environmental Engineer

John Harvey
Principal

Patrick Heads
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REFERENCES

1. Environment & Health Protection Guidelines On-Site Wastewater Management Systems for Single Households, NSW EPA, NSW Department of Health", NSW Department Land & Water Conservation, NSW Department of Local Government, January 1998.

2. Australian Standard AS 1547-2000, "On-site domestic - wastewater management", Standards Australia.

3. Department of Infrastructure Planning and Natural Resources, "Site Investigations for Urban Salinity", 2002.

4. Australian Standard AS 2870-1996 ''Residential Slabs and Footings - Construction'', June 1996, Standards Australia

- Overloading the treatment system with wastewater.
- The clogging of the trench with solids not trapped by the septic tank. The tank may require desludging.
- The application area has been poorly designed.
- Stormwater is running onto the area.

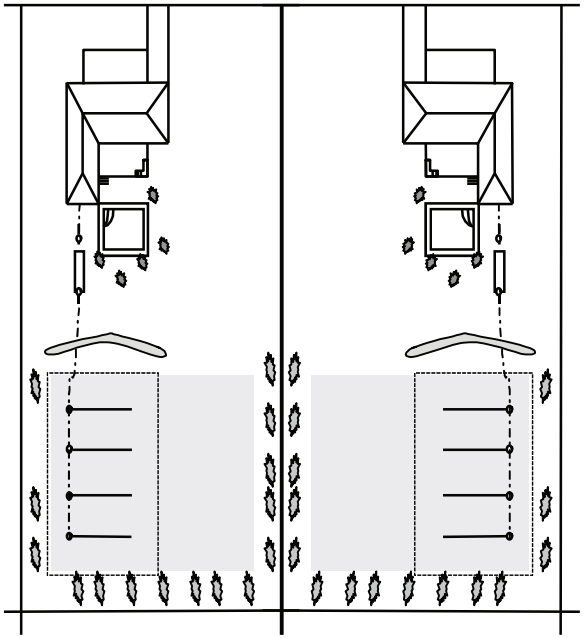
HELP PROTECT YOUR HEALTH AND THE ENVIRONMENT

Poorly maintained land application areas are a serious source of water pollution and may present health risks, cause odours and attract vermin and insects.

By looking after your sewage management system you can do your part in helping to protect the environment and the health of you and your family.

For more information please contact:

Your Land Application Area



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NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring 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.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigations Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Silt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00 mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Undrained Shear Strength kPa
Very soft	less than 12
Soft	12—25
Firm	25—50
Stiff	50—100
Very stiff	100—200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer tests (CPT) as below:

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q_c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2—5
Medium dense	10—30	5—15
Dense	30—50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing with a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

Drilling Methods.

The following is a brief summary of drilling methods currently adopted by the Company and some comments on their use and application.

Test Pits — these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descent into the pit. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (eg. Pengo) — the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling — the hole is advanced by pushing a 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength, etc. is only marginally affected.

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water

table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling — the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling — similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling — a continuous core sample is obtained using a diamond-tipped core barrel, usually 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" — Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

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

  as 4, 6, 7
  N = 13

- In the case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm

  as 15, 30/40 mm.

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

Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test 6.4.1.

In the tests, a 35 mm diameter rod with a cone-tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20 mm per second) the information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: —

- Cone resistance — the actual end bearing force divided by the cross sectional area of the cone — expressed in MPa.
- Sleeve friction — the frictional force on the sleeve divided by the surface area — expressed in kPa.
- Friction ratio — the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower scale (0—5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main scale (0—50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve friction to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1%—2% are commonly encountered in sands and very soft clays rising to 4%—10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:—

q_c (MPa) = (0.4 to 0.6) N (blows per 300 mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:—

q_c = (12 to 18) c_u

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes, etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Hand Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150 mm increments of penetration. Normally, there is a depth limitation of 1.2 m but this may be extended in certain conditions by the use of extension rods.

Two relatively similar tests are used.

- Perth sand penetrometer — a 16 mm diameter flat-ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms.

Bore Logs

The bore logs presented herein 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. 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 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, the frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems;

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

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company 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 condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions — the potential for this will depend partly on bore spacing and sampling frequency
- changes in policy or interpretation of policy by statutory authorities
- the actions of contractors responding to commercial pressures.

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

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, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation 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. The Company 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 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.

AN ENGINEERING CLASSIFICATION OF SEDIMENTARY ROCKS IN THE SYDNEY AREA

This classification system provides a standardized terminology for the engineering description of the sandstone and shales in the Sydney area, but the terms and definitions may be used elsewhere when applicable.

Under this system rocks are classified by Rock Type, Degree of Weathering, Strength, Stratification Spacing, and Degree of Fracturing. These terms do not cover the full range of engineering properties. Descriptions of rock may also need to refer to other properties (e.g. durability, abrasiveness, etc.) where these are relevant.

ROCK TYPE DEFINITIONS

Rock Type	Definition
Conglomerate:	More than 50% of the rock consists of gravel sized (greater than 2mm) fragments
Sandstone:	More than 50% of the rock consists of sand sized (.06 to 2mm) fragments
Siltstone:	More than 50% of the rock consists of silt-sized (less than 0.06mm) granular particles and the rock is not laminated
Claystone:	More than 50% of the rock consists of clay or sericitic material and the rock is not laminated
Shale:	More than 50% of the rock consists of silt or clay sized particles and the rock is laminated

Rocks possessing characteristics of two groups are described by their predominant particle size with reference also to the minor constituents, e.g. clayey sandstone, sandy shale.

DEGREE OF WEATHERING

Term	Symbol	Definition
Extremely Weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.
Highly Weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original fresh rock substance is no longer recognisable.
Moderately Weathered	MW	Rock substance affected by weathering to the extent that staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is no longer recognisable.
Slightly Weathered	SW	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable.
Fresh	Fs	Rock substance unaffected by weathering, limonite staining along joints.
Fresh	Fr	Rock substance unaffected by weathering.

STRATIFICATION SPACING

Term	Separation of Stratification Planes
Thinly laminated	<6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	>2 m

ROCK STRENGTH

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the direction normal to the bedding. The test procedure is described by the International Society of Rock Mechanics (Reference).

Strength Term	Is(50) MPa	Field Guide	Approx. qu MPa*
Extremely Low:	0.03	Easily remoulded by hand to a material with soil properties	0.7
Very Low:	0.1	May be crumbled in the hand. Sandstone is "sugary" and friable.	2.4
Low:	0.3	A piece of core 150 mm long x 50 mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.	7
Medium:	1	A piece of core 150 mm long x 50 mm dia. can be broken by hand with considerable difficulty. Readily scored with knife.	24
High:	3	A piece of core 150 mm long x 50 mm dia. cannot be broken by unaided hands, can be slightly scratched or scored with knife.	70
Very High:	10	A piece of core 150 mm long x 50 mm dia. may be broken readily with hand held hammer. Cannot be scratched with pen knife.	240
Extremely High:		A piece of core 150 mm long x 50 mm dia. is difficult to break with hand held hammer. Rings when struck with a hammer.	

* The approximate unconfined compressive strength (qu) shownin the table is based on an assumed ratio to the point load index of 24:1. This ratio may vary widely.

DEGREE OF FRACTURING

This classification applies to diamond drill cores and refers to the spacing of all types of natural fractures along which the core is discontinuous. These include bedding plane partings, joints and other rock defects, but exclude known artificial fractures such as drilling breaks

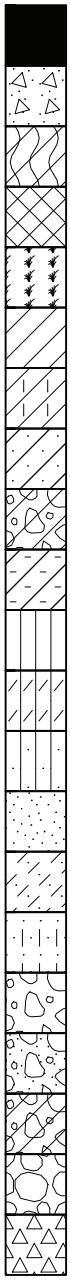
Term	Description
Fragmented:	The core is comprised primarily of fragments of length less than 20 mm, and mostly of width less than the core diameter.
Highly Fractured:	Core lengths are generally less than 20 mm - 40 mm with occasional fragments.
Fractured:	Core lengths are mainly 30 mm - 100 mm with occasional shorter and longer sections.
Slightly Fractured:	Core lengths are generally 300 mm - 1000 mm with occasional longer sections and occasional sections of 100 mm - 300 mm.
Unbroken:	The core does not contain any fracture.

REFERENCE

International Society of Rock Mechanics, Commission on Standardisation of Laboratory and Field Tests, Suggested Methods for Determining the Uniaxial Compressive Strength of Rock Materials and the Point Load Strength Index, Committee on Laboratory Tests Document No. 1 Final Draft October 1972

GRAPHIC SYMBOLS FOR SOIL & ROCK

SOIL



BITUMINOUS CONCRETE

CONCRETE

TOPSOIL

FILLING

PEAT

CLAY

SILTY CLAY

SANDY CLAY

GRAVELLY CLAY

SHALY CLAY

SILT

CLAYEY SILT

SANDY SILT

SAND

CLAYEY SAND

SILTY SAND

GRAVEL

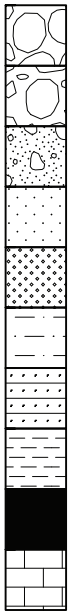
SANDY GRAVEL

CLAYEY GRAVEL

COBBLES/BOULDERS

TALUS

SEDIMENTARY ROCK



BOULDER CONGLOMERATE

CONGLOMERATE

CONGLOMERATIC SANDSTONE

SANDSTONE FINE GRAINED

SANDSTONE COARSE GRAINED

SILTSTONE

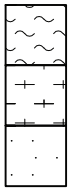
LAMINITE

MUDSTONE, CLAYSTONE, SHALE

COAL

LIMESTONE

METAMORPHIC ROCK

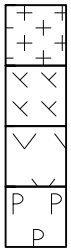


SLATE, PHYLITTE, SCHIST

GNEISS

QUARTZITE

IGNEOUS ROCK



GRANITE

DOLERITE, BASALT

TUFF

PORPHYRY

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342668
NORTHING: 6387205
DIP/AZIMUTH: 90°/--

PIT No: 1
PROJECT No: 49385
DATE: 19 May 09
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 mm) 5 10 15 20
		TOPSOIL - Dark grey/brown clayey sand, some gravel, humid		D	0.1				
	0.26	CLAY - Very stiff/hard, red/brown clay, M>Wp		D, pp	0.8		190 - 240 kPa		
1	1.03	SANDSTONE - Very low strength, extremely weathered dark grey/brown sandstone		D	1.1				1
	1.15	At 1.11m, strength increasing with depth							
		Pit discontinued at 1.15m, slow progress on sandstone							
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342574
NORTHING: 6387143
DIP/AZIMUTH: 90°/--

PIT No: 2
PROJECT No: 49385
DATE: 19 May 09
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 mm) 5 10 15 20
		TOPSOIL - Dark grey/brown clayey sand, with some fine to coarse grained gravel, damp		D	0.1				
	0.28	CLAY - Very stiff, red/brown clay, M<Wp		D, pp	0.5		220 - 340 kPa		
	0.89	CLAYEY SAND - Grey/orange/brown clayey sand, damp		D	0.9				
1	1.03	SANDSTONE - Extremely low strength, extremely weathered, grey/orange sandstone		D	1.05				1
	1.13	At 1.08m, strength increases with depth Pit discontinued at 1.13m, slow progress on sandstone							
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342529
NORTHING: 6386993
DIP/AZIMUTH: 90°/--

PIT No: 3
PROJECT No: 49385
DATE: 19 May 09
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 mm) 5 10 15 20
		TOPSOIL - Grey/brown gravelly sandy clay/clayey sand, fine to coarse grained gravel, damp		D	0.1				
	0.18	CLAY - Very stiff, grey/brown/yellow clay, trace sand, M≥ Wp		D, pp	0.6		270 - 310 kPa		
	0.74	SANDSTONE - Extremely low strength, extremely weathered, grey mottled orange, sandstone		D	0.8				
	0.85	Pit discontinued at 0.85m, slow progress on sandstone							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341980
NORTHING: 6387312
DIP/AZIMUTH: 90°/--

PIT No: 4
PROJECT No: 49385
DATE: 18 May 09
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 mm) 5 10 15 20
		TOPSOIL - Grey/brown sand, trace rootlets, damp		D	0.05				
	0.2	CLAY - Very stiff, brown mottled orange clay, with trace sand and rootlets, M<Wp		D, pp	0.25		300 - 380 kPa		
	0.7	SANDY CLAY AND GRAVEL - Light brown sandy clay and fine to medium grained gravel, M<Wp		D	0.75				
	1								1
	1.15	At 1.10m, strength increasing with depth Pit discontinued at 1.15m, slow progress on gravel							
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341900
NORTHING: 6387196
DIP/AZIMUTH: 90°/--

PIT No: 5
PROJECT No: 49385
DATE: 18 May 09
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 mm) 5 10 15 20
		TOPSOIL - Grey/brown sand, trace rootlets, damp		D	0.05				
	0.15	CLAY - Hard, brown mottled orange clay, with some gravel, M<Wp		D, pp	0.2		>400 kPa		
	0.85	SANDY CLAY AND GRAVEL - Light brown sandy clay and fine to medium grained gravel, M<Wp							
	0.95	Pit discontinued at 0.95m, slow progress on gravel							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342021
NORTHING: 6387203
DIP/AZIMUTH: 90°/--

PIT No: 6
PROJECT No: 49385
DATE: 18 May 09
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 mm) 5 10 15 20
	0.07	TOPSOIL - Grey/brown sand, trace rootlets, damp		D	0.05				
		CLAY - Stiff, brown mottled orange clay, trace sand and rootlets, M>Wp		D, pp	0.1		100 - 200 kPa		
	0.7	SANDY CLAY AND GRAVEL - Light grey/brown mottled orange sandy clay and fine to medium grained gravel, M<Wp							
	1			D	1.0				1
	1.31	Pit discontinued at 1.31m, slow progress on gravel							
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342344
NORTHING: 6387167
DIP/AZIMUTH: 90°/--

PIT No: 7
PROJECT No: 49385
DATE: 19 May 09
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 mm) 5 10 15 20
		TOPSOIL - Grey/brown sandy clay, trace organics and rootlets, trace gravel		D	0.15				
	0.24	CLAY - Very stiff, red/brown clay, trace organics, M>Wp		D, pp	0.9		260 - 340 kPa		
	1.03	SANDSTONE - Extremely low strength, extremely weathered, grey mottled orange sandstone		D	1.1				
	1.15	Pit discontinued at 1.15m, slow progress							

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341863
NORTHING: 6386924
DIP/AZIMUTH: 90°/--

PIT No: 8
PROJECT No: 49385
DATE: 18 May 09
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 mm) 5 10 15 20
		TOPSOIL - Dark brown sand, trace organics, damp		D	0.05				
	0.25	SANDY CLAY - Stiff, light grey/brown mottled orange, trace organics, trace medium to coarse grained gravel, M<Wp		D, pp	0.3		150 - 200 kPa		
	0.5	SANDSTONE - Extremely low strength, extremely weathered, grey/brown sandstone		D	0.6				
	0.7	Pit discontinued at 0.7m, slow progress on sandstone							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341792
NORTHING: 6386519
DIP/AZIMUTH: 90°/--

PIT No: 9
PROJECT No: 49385
DATE: 19 May 09
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 mm) 5 10 15 20
		TOPSOIL - Dark grey/brown clayey sand, trace gravel, rootlets, damp		D	0.1				
	0.2	CLAYEY SAND AND GRAVEL - Light grey/brown clayey sand and fine to coarse grained gravel		D	0.3				
	0.43	SANDY CLAY - Stiff to very stiff, grey/brown mottled orange sandy clay, M<Wp		D, pp	0.6		140 - 220 kPa		
	0.88	SANDSTONE - Low strength, extremely weathered, light grey/brown sandstone		D	0.9				
1	1.0	Pit discontinued at 1.0m, slow progress on sandstone							1
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341863
NORTHING: 6386509
DIP/AZIMUTH: 90°/--

PIT No: 10
PROJECT No: 49385
DATE: 19 May 09
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 mm) 5 10 15 20
		TOPSOIL - Grey/brown clayey sand, trace gravel and rootlets, damp		D	0.1				
	0.15	CLAYEY SAND - Dark grey/brown clayey sand, with some fine to coarse grained gravel, damp		D	0.2				
	0.4	SANDY CLAY - Stiff to very stiff, grey/brown mottled orange sandy clay, M>Wp		D, pp	0.5		180 - 240 kPa		
	0.85	SANDSTONE - Extremely low strength, extremely weathered, grey mottled orange sandstone		D	0.95				
1	1.0	Pit discontinued at 1.0m, slow progress on sandstone							1
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341826
NORTHING: 6387101
DIP/AZIMUTH: 90°/--

PIT No: 11
PROJECT No: 49385
DATE: 18 May 09
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 mm) 5 10 15 20
	0.1	TOPSOIL - Light grey/brown sand, with gravel, trace rootlets, damp							
		SAND AND GRAVEL - Dark grey/brown fine to coarse grained sand, with fine to coarse grained gravel, damp		D	0.2				
	0.3	CLAY - Very stiff light orange/brown clay, trace sand, M>Wp		D, pp	0.5		200 -300 kPa		
1	1.0	SANDSTONE - Extremely low strength, highly weathered, light grey/brown sandstone							1
		At 1.5m, strength increasing with depth		D	1.4				
	1.6	Pit discontinued at 1.6m, slow progress on sandstone							
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342080
NORTHING: 6386975
DIP/AZIMUTH: 90°/--

PIT No: 12
PROJECT No: 49385
DATE: 18 May 09
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 mm) 5 10 15 20
		TOPSOIL - Dark grey/brown clayey sand, trace rootlets, damp		D	0.1				
	0.2	CLAY - Stiff, grey mottled brown clay, M>Wp		D, pp	0.4		120 - 150 kPa		
		From 0.8m, hard		D, pp	0.9		400 - 460 kPa		
	1	From 1.0m, some sand		D	1.3				1
		From 1.8m, grading to extremely low strength, extremely weathered, grey mottled red claystone		D	1.85				
	1.9	Pit discontinued at 1.9m, slow progress							
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342061
NORTHING: 6386784
DIP/AZIMUTH: 90°/--

PIT No: 13
PROJECT No: 49385
DATE: 18 May 09
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 mm) 5 10 15 20
		TOPSOIL - Grey/brown gravelly sand, some cobbles, trace rootlets, damp		D	0.05				
	0.1	CLAY - Very stiff/hard grey/brown clay, trace gravel, trace cobble, M>Wp		D, pp	0.5		150 - 220 kPa		
	0.77	SANDSTONE - Extremely low strength, extremely weathered, grey mottled orange sandstone		D	0.9				
	1								1
		At 1.9m, strength increasing with depth							
	2 2.0	Pit discontinued at 2.0m, limit of investigation							2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342072
NORTHING: 6386064
DIP/AZIMUTH: 90°/--

PIT No: 14
PROJECT No: 49385
DATE: 20 May 09
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 mm) 5 10 15 20
	0.15	TOPSOIL - Dark grey/brown clayey sand topsoil, trace gravel, damp		D	0.1				
		CLAY - Very stiff to hard, yellow/grey/brown clay, trace sand, trace cobbles, M>Wp		D, pp	0.5		310 - 410 kPa		
1	1.0	SILTSTONE - Extremely low strength, highly weathered grey/brown siltstone		D	1.05				1
	1.1	Pit discontinued at 1.1m, slow progress							
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341683
NORTHING: 6386204
DIP/AZIMUTH: 90°/--

PIT No: 15
PROJECT No: 49385
DATE: 20 May 09
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 mm)
	0.1	TOPSOIL - Dark grey/brown clayey sand topsoil, trace gravel, damp		D	0.05				
		SANDY GRAVELLY CLAY - Dark grey/brown sandy gravelly clay, fine to coarse grained gravel, some cobbles		D	0.25				
	0.3	SANDY CLAY - Very stiff, grey/brown/yellow, sandy clay, trace cobbles, M<Wp		D, pp	0.5		230 - 280 kPa		
	0.6	SILTSTONE - Extremely low strength, extremely weathered, siltstone							
		At 0.81m, strength increasing with depth		D	0.79				
	0.9	Pit discontinued at 0.9m, slow progress							
	1								1
	2								2

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

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341832
NORTHING: 6385842
DIP/AZIMUTH: 90°/--

PIT No: 16
PROJECT No: 49385
DATE: 20 May 09
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 mm) 5 10 15 20
		TOPSOIL - Dark grey/brown sandy clay, trace organics, rootlets, damp		D	0.1				
	0.15	CLAYEY SAND - Light grey/brown clayey sand, some fine to coarse grained gravel		D	0.25				
	0.42	CLAY - Stiff to very stiff, yellow/brown clay, trace sand and roots, M>Wp		D, pp	0.7		180 - 240 kPa		
	1			D, pp	1.1		160 - 200 kPa		1
	1.32	SILTSTONE - Very low strength, extremely weathered, grey mottled orange siltstone At 1.45m, strength increasing with depth		D	1.4				
	1.55	Pit discontinued at 1.55m, slow progress							
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 127797
NORTHING: 6385797
DIP/AZIMUTH: 90°/--

PIT No: 17
PROJECT No: 49385
DATE: 20 May 09
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 mm) 5 10 15 20
		TOPSOIL - Dark grey/brown silty clay, trace rootlets, damp		D	0.2				
	0.25	SILTY CLAY - Dark grey/brown silty clay, M<Wp							
	0.5	SANDY CLAY - Grey mottled orange sandy clay, M<Wp		D	0.7				
	0.9	SANDSTONE - Extremely low strength, extremely weathered, grey mottled orange sandstone		D	1.0				1
1	1.04	At 1.0m, strength increasing with depth							
		Pit discontinued at 1.04m, slow progress							
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342423
NORTHING: 6386620
DIP/AZIMUTH: 90°/--

PIT No: 18
PROJECT No: 49385
DATE: 19 May 09
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 mm) 5 10 15 20
		TOPSOIL - Grey/brown sandy clay, trace gravel, damp		D	0.1				
	0.15	SANDY CLAYEY AND GRAVEL - Light grey/brown sandy clay, fine to coarse grained gravel, trace cobble, M<Wp		D	0.2				
	0.3	CLAY - Very stiff, red/brown mottled grey clay, trace sand, M>Wp		D, pp	0.5		200 - 260 kPa		
	0.7	CLAYEY SAND - Light grey/orange fine to coarse grained clayey sand, damp		D	0.8				
	0.89	SANDSTONE - Extremely low strength, extremely weathered, grey mottled orange sandstone		D	0.92				
	0.96	Pit discontinued at 0.96m, slow progress							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342265
NORTHING: 6386110
DIP/AZIMUTH: 90°/--

PIT No: 19
PROJECT No: 49385
DATE: 20 May 09
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 mm) 5 10 15 20
		TOPSOIL - Dark grey/brown gravelly silty clay, fine to coarse grained gravel, some cobbles, damp		D	0.15				
	0.2	CLAY - Very stiff, red/grey/brown, trace rootlets, M>Wp		D, pp	0.5		210 - 310 kPa		
	1								1
				D	1.1				
	1.3	SILTSTONE - Extremely low strength, moderately weathered, grey/brown siltstone							
	1.4	Pit discontinued at 1.4m, slow progress							
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342511
NORTHING: 6386039
DIP/AZIMUTH: 90°/--

PIT No: 20
PROJECT No: 49385
DATE: 20 May 09
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 mm) 5 10 15 20
		TOPSOIL - Dark grey/brown gravelly silty clay, fine to coarse grained gravel, some cobbles, damp		D	0.15				
	0.3	CLAY - Very stiff, red/brown clay, trace coarse grained gravel, organics, M<Wp		D, pp	0.5		220 - 340 kPa		
	0.7	SANDSTONE - Extremely low strength, extremely weathered, grey mottled orange sandstone		D	0.8				
	0.93	Pit discontinued at 0.93m, slow progress							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342465
NORTHING: 6385418
DIP/AZIMUTH: 90°/--

PIT No: 21
PROJECT No: 49385
DATE: 20 May 09
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 mm) 5 10 15 20
		TOPSOIL - Dark grey/brown silty clay, trace organics, clay increases with depth		D	0.2				
	0.4	CLAY - Very stiff, dark grey/brown clay, some fine to coarse grained gravel, M>Wp		D, pp	0.6		200 - 260 kPa		
	0.8	SILTSTONE - Extremely low strength, highly weathered, grey/yellow siltstone		D	0.85				
	0.91	Pit discontinued at 0.91m, slow progress							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342310
NORTHING: 6386262
DIP/AZIMUTH: 90°/--

PIT No: 22
PROJECT No: 49385
DATE: 19 May 09
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 mm) 5 10 15 20
		TOPSOIL - Grey/brown clayey sand, trace gravel, rootlets, damp		D	0.1				
	0.14	CLAY - Very stiff, red/brown clay, trace sand, M>Wp		D, pp	0.5		280 - 300 kPa		
	0.75	SILTSTONE - Extremely low strength, extremely weathered, light grey/brown siltstone		D	0.8				
	0.9	Pit discontinued at 0.91m, slow progress							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342019
NORTHING: 6386307
DIP/AZIMUTH: 90°/--

PIT No: 23
PROJECT No: 49385
DATE: 19 May 09
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 mm) 5 10 15 20
	0.1	TOPSOIL - Dark grey/brown clayey sand, trace gravel and rootlets, damp		D	0.05				
		CLAYEY SAND WITH GRAVEL AND COBBLES - Dark grey/brown mottled orange clayey sand, with medium to coarse grained gravel and cobbles, damp		D	0.3				
	0.45	SILTSTONE - Extremely low strength, extremely weathered, light grey/brown siltstone		D	0.55				
		At 0.63m, strength increasing with depth							
	0.7	Pit discontinued at 0.7m, slow progress							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341881
NORTHING: 6386764
DIP/AZIMUTH: 90°/--

PIT No: 24
PROJECT No: 49385
DATE: 18 May 09
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 mm) 5 10 15 20
		TOPSOIL - Grey/brown sand, with some fine to coarse grained gravel, damp		D	0.1				
	0.16	GRAVELLY SAND - Grey/brown gravelly sand, fine to coarse grained gravel, some cobbles, damp		D	0.2				
	0.32	CLAY - Stiff, orange/brown clay, with some fine grained sand, trace gravel, M>Wp		D, pp	0.6		150 - 210 kPa		
	0.84	SANDSTONE - Very low strength, highly weathered, light grey/brown sandstone		D	1.2				
	1.25	Pit discontinued at 1.25m, slow progress							

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341826
NORTHING: 6386069
DIP/AZIMUTH: 90°/--

PIT No: 25
PROJECT No: 49385
DATE: 20 May 09
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 mm) 5 10 15 20
		TOPSOIL - Dark grey/brown clayey sand topsoil, trace gravel, damp		D	0.07				
	0.12	SANDY GRAVELLY CLAY - Dark grey/brown sandy gravelly clay, fine to coarse grained gravel, trace cobbles, M<Wp		D	0.2				
	0.27	CLAY - Very stiff, red brown clay, trace sand, M>Wp		D, pp	0.4		200 - 290 kPa		
	0.8	SILTY CLAY - Very stiff, yellow/brown clay, trace sand, M<Wp		D, pp	0.9		200 - 260 kPa		
1	1.04	SANDSTONE - Low strength, extremely weathered, grey/brown sandstone		D	1.1				1
	1.15	Pit discontinued at 1.15m, slow progress							
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341662
NORTHING: 6385817
DIP/AZIMUTH: 90°/--

PIT No: 26
PROJECT No: 49385
DATE: 20 May 09
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 mm) 5 10 15 20
		TOPSOIL - Dark grey/brown sandy clay, damp		D	0.1				
	0.3	SANDY CLAY - Very stiff, light grey/orange sandy clay, some medium to coarse grained gravel, trace rootlets, M<Wp		D, pp	0.5		280 - 340 kPa		
	0.9	SILTSTONE - Low strength, highly weathered, grey/brown siltstone		D	0.95				
1	1.0	Pit discontinued at 1.0m, slow progress							1
2									2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
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TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341856
NORTHING: 6387300
DIP/AZIMUTH: 90°/--

PIT No: 27
PROJECT No: 49385
DATE: 18 May 09
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 mm) 5 10 15 20
		TOPSOIL - Light grey/brown sand, with gravel, trace rootlets, damp		D	0.05				
	0.15	CLAY - Very stiff, light orange/brown clay, some sand, trace organics, M≤Wp		D, pp	0.2		280 - 360 kPa		
	0.62	SANDY CLAY AND GRAVEL - Light brown mottled yellow sandy clay and medium to coarse grained gravel, M<Wp		D	0.8				
	0.9	CLAYSTONE/TUFF - Medium to high strength, moderately weathered, white claystone/tuff		D	1.0				
	1.1	Pit discontinued at 1.1m, slow progress							

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342441
NORTHING: 6387266
DIP/AZIMUTH: 90°/--

PIT No: 28
PROJECT No: 49385
DATE: 19 May 09
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 mm) 5 10 15 20
		TOPSOIL - Dark grey/brown, clayey sand, damp		D	0.15				
	0.2	CLAYEY SAND - Grey/brown clayey sand, trace rootlets, damp		D	0.5				
	1								1
	1.7	SANDSTONE - Low to medium strength, moderately weathered, grey sandstone		D	1.75				
	1.85	Pit discontinued at 1.85m, slow progress							
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 342210
NORTHING: 6386884
DIP/AZIMUTH: 90°/--

PIT No: 29
PROJECT No: 49385
DATE: 18 May 09
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 mm) 5 10 15 20
	0.12	TOPSOIL - Grey/brown gravelly sand, fine to coarse grained gravel, trace rootlets, damp		D	0.08				
		CLAY - Brown/red clay, some fine to coarse grained gravel, trace cobbles and rootlets, M<Wp		D	0.25				
	0.65	SANDY CLAY/CLAYEY SAND - Light grey/brown mottled red sandy clay/clayey sand, trace gravel, M<Wp							1
	1			D	1.3				
	1.45	SILTSTONE - Extremely low strength, extremely weathered, light grey siltstone							
	2			D	1.8				2
	2.0	Pit discontinued at 2.0m, limit of investigation							

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED	
Initials:	
Date:	

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Belford Land Corporation
PROJECT: Proposed Rezoning
LOCATION: Standen Drive, Lower Belford

SURFACE LEVEL: --
EASTING: 341761
NORTHING: 6386844
DIP/AZIMUTH: 90°/--

PIT No: 30
PROJECT No: 49385
DATE: 18 May 09
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 mm) 5 10 15 20
		TOPSOIL - Grey/brown sand, with fine to coarse grained gravel, trace organics and rootlets, trace coal, damp		D	0.05				
	0.2	GRAVELLY SAND - Light brown fine to coarse grained gravelly sand, damp		D	0.25				
	0.4	CLAY - Firm to stiff light grey/brown mottled red/orange clay, trace sand, fine to medium grained gravel rootlets, coal, M<Wp		D, pp	0.5		70 - 140 kPa		
	0.75	SANDSTONE - Extremely low strength, extremely weathered, grey/brown sandstone		D	0.8				
	0.9	Pit discontinued at 0.9m, slow progress							
	1								1
	2								2

RIG: 3.5 tonne excavator, 450mm bucket with teeth

LOGGED: Mansouri

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	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **1**
Name: **1/0.1 - 19/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

Certified System Quality ISO 9001

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Sydney Environmental & Soil Laboratory Pty Ltd
ABN 70 106 810 708
16 Chilvers Road
Thornleigh NSW 2120
Australia
Address mail to:
PO Box 357
Pennant Hills NSW 1715
Tel: 02 9980 6554
Fax: 02 9484 2427
Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	5.8	Medium Acidity
pH in $CaCl_2$ 1:5	4.7	Very Strong Acidity
EC mS/cm 1:5	.05	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.24	7.10	Elevated
Potassium			.32	9.40	Acceptable
Calcium			.78	22.90	Very Low
Magnesium			1.65	48.50	Extreme
Aluminium			.36	10.6	Extreme
		ECEC	3.40		Very Low
		Ca/Mg	0.80		Low

Phosphate Retention Index % 7.70 Very Low PRI mgP/kg 355.1 PRI kg/ha 777.7 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.46

Structure:

Emerson Stability Class : H20 2.3 Low SAR 3.1 High SAR 5.2

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

For the purpose of onsite effluent disposal report, this soil shows very strong acidity and very low salt content. The soils ability to absorb phosphorus is very low, but to a depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates show only partial dispersion with obvious milkiness and more than 50% of the aggregate affected. This is a less severe form of Class 1 dispersion but nonetheless some susceptibility to erosion and tunnelling. The stability of aggregates is expected to increase with the application of high ionic strength water (i.e. effluent). The Emerson Stability Class indicates soil aggregates disperse with obvious milkiness and less than 50% of the aggregate affected when the water content intermediates between field capacity and that of suspension. Materials disperse when severely provoked by dilution into slurry form combined with significant mechanical action. They represent a much lower erosion risk on exposed soil but will erode if raindrop impact and running water are combined. Precautions to reduce the velocity on running water (i.e. soil conservation structures, roughened surface etc) should be employed where there is a risk (i.e. long slopes). This soil poses slight to nil limitations to effluent disposal depending of topography.

The very strong acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 80g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 200g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson’s Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **2**
Name: **5/0.2 - 18/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

Sydney Environmental & Soil Laboratory Pty Ltd
ABN 70 106 810 708
16 Chilvers Road
Thornleigh NSW 2120
Australia
Address mail to:
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Web: www.sesl.com.au

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

TEST	RESULT	COMMENTS
pH in water 1:5	5.9	Medium Acidity
pH in $CaCl_2$ 1:5	4.7	Very Strong Acidity
EC mS/cm 1:5	.08	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.96	5.90	Elevated
Potassium			.35	2.10	Very Low
Calcium			9.67	59.30	Low
Magnesium			4.24	26.00	Elevated
Aluminium			1.06	6.5	High
		ECEC	16.30		Moderate
		Ca/Mg	3.80		Normal

Phosphate Retention Index % 19.40 Low PRI mgP/kg 892.0 PRI kg/ha 2461.9 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.84

Structure:

Emerson Stability Class : H20 5.3 Low SAR 5.1 High SAR 5.1

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

For the purpose of onsite effluent disposal report, this soil shows very strong acidity and low salt content. The soils ability to absorb phosphorus is low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates disperse with obvious milkiness and less than 50% of the aggregate affected when the water content intermediates between field capacity and that of suspension. Materials disperse when severely provoked by dilution into slurry form combined with significant mechanical action. They represent a much lower erosion risk on exposed soil but will erode if raindrop impact and running water are combined. Precautions to reduce the velocity on running water (i.e. soil conservation structures, roughened surface etc) should be employed where there is a risk (i.e. long slopes). This soil poses slight to nil limitations to effluent disposal depending of topography. The stability of aggregates is expected to only slightly increase with the application of high ionic strength water (i.e. effluent) as seen in the reduction of the subclass.

The very strong acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as "kikuyu" or "paspalum", which are very hardy;
- apply 180g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 50g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **3**
Name: **12/0.4 - 18/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

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Sydney Environmental and Soil Laboratory
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TEST	RESULT	COMMENTS
pH in water 1:5	4.9	Very Strong Acidity
pH in $CaCl_2$ 1:5	4.3	Extreme Acidity
EC mS/cm 1:5	.71	High Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			4.37	19.00	Extreme
Potassium			.5	2.20	Very Low
Calcium			3.88	16.90	Very Low
Magnesium			12.43	54.00	Extreme
Aluminium			1.85	8	High
		ECEC	23.00		Moderate
		Ca/Mg	0.50		Low

Phosphate Retention Index % 20.10 Low PRI mgP/kg 925.2 PRI kg/ha 2678.5 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.93

Structure:

Emerson Stability Class : H20 6 Low SAR 6 High SAR 6

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

For the purpose of onsite effluent disposal report, this soil shows extreme acidity and high salt content. The soils ability to absorb phosphorus is low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates, in suspension, flocculate completely after standing for five minutes. Aggregates in this class are mechanically weak (slaking) but chemical conditions are such that colloids will not disperse even if severely provoked. A minimum of precaution in ploughed fields to prevent long runoff slopes is required. This soil poses slight to nil limitations to effluent disposal depending of topography. The stability of aggregates is not expected to increase with the application of high ionic strength water (i.e. effluent).

The extreme acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 300g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 1800g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **4**
Name: **18/0.2 - 19/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

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TEST	RESULT	COMMENTS
pH in water 1:5	5.6	Medium Acidity
pH in $CaCl_2$ 1:5	4.5	Extreme Acidity
EC mS/cm 1:5	.02	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.13	4.30	Acceptable
Potassium			.13	4.30	Low
Calcium			1.25	41.70	Very Low
Magnesium			.89	29.70	Elevated
Aluminium			.55	18.3	Extreme
		ECEC	3.00		Very Low
		Ca/Mg	2.30		Low

Phosphate Retention Index % 3.70 Very Low PRI mgP/kg 171.9 PRI kg/ha 410.0 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.59

Structure:

Emerson Stability Class : H20 2.1 Low SAR 5.3 High SAR 5.2

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

For the purpose of onsite effluent disposal report, this soil shows extreme acidity and very low salt content. The soils ability to absorb phosphorus is very low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates show only partial dispersion with slight milkiness immediately adjacent to the aggregate. This is a less severe form of Class 1 dispersion but nonetheless some susceptibility to erosion and tunnelling. The stability of aggregates is expected to increase with the application of high ionic strength water (i.e. effluent). The Emerson Stability Class indicates soil aggregates disperse with obvious milkiness and less than 50% of the aggregate affected when the water content intermediates between field capacity and that of suspension. Materials disperse when severely provoked by dilution into slurry form combined with significant mechanical action. They represent a much lower erosion risk on exposed soil but will erode if raindrop impact and running water are combined. Precautions to reduce the velocity on running water (i.e. soil conservation structures, roughened surface etc) should be employed where there is a risk (i.e. long slopes). This soil poses slight to nil limitations to effluent disposal depending of topography.

The extreme acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 100g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 20g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson’s Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **5**
Name: **30/0.5 - 18/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

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Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	5.6	Medium Acidity
pH in $CaCl_2$ 1:5	4.4	Extreme Acidity
EC mS/cm 1:5	.09	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			1.08	7.90	Elevated
Potassium			.21	1.50	Very Low
Calcium			4.85	35.70	Very Low
Magnesium			5.09	37.40	High
Aluminium			2.34	17.2	Extreme
		ECEC	13.60		Moderate
		Ca/Mg	1.60		Low

Phosphate Retention Index % 26.00 Low PRI mgP/kg 1197.6 PRI kg/ha 3323.3 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.85

Structure:

Emerson Stability Class : H20 2.2 Low SAR 5.1 High SAR 6

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

For the purpose of onsite effluent disposal report, this soil shows extreme acidity and low salt content. The soils ability to absorb phosphorus is low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates show only partial dispersion with obvious milkiness and less than 50% of the aggregate affected. This is a less severe form of Class 1 dispersion but nonetheless some susceptibility to erosion and tunnelling. The stability of aggregates is expected to increase with the application of high ionic strength water (i.e. effluent). The Emerson Stability Class indicates soil aggregates, in suspension, flocculate completely after standing for five minutes. Aggregates in this class are mechanically weak (slaking) but chemical conditions are such that colloids will not disperse even if severely provoked. A minimum of precaution in ploughed fields to prevent long runoff slopes is required. This soil poses slight to nil limitations to effluent disposal depending of topography.

The extreme acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 360g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 340g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson’s Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **6**
Name: **9/0.1 - 19/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

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Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	5.8	Medium Acidity
pH in $CaCl_2$ 1:5	4.8	Very Strong Acidity
EC mS/cm 1:5	.02	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.04	1.50	Acceptable
Potassium			.32	11.90	Acceptable
Calcium			1.77	65.60	Acceptable
Magnesium			.53	19.60	Acceptable
Aluminium			.05	1.9	Acceptable
		ECEC	2.70		Very Low
		Ca/Mg	5.50		Normal

Phosphate Retention Index % 2.40 Very Low PRI mgP/kg 110.1 PRI kg/ha 265.9 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.61

Structure:

Emerson Stability Class : H20 3.1 Low SAR 3.1 High SAR 3.1

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

For the purpose of onsite effluent disposal report, this soil shows very strong acidity and very low salt content. The soils ability to absorb phosphorus is very low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates, after remoulding at a water content equivalent to field capacity, show dispersion with slight milkiness immediately adjacent to the aggregate when immersed in water. These aggregates can be provoked into dispersion if water is combined with mechanical stress. When the impact energy of rainfall is combined with the aggregates, water erosion may be predicted. It may also show crusting and emergence problems. This soil poses a moderate limitation to effluent disposal. The stability of aggregates is not expected to increase with the application of high ionic strength water (i.e. effluent).

The very strong acidity, slightly unbalanced cations and slight potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 20g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 20g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson’s Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **7**
Name: **23/0.3 - 19/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

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TEST	RESULT	COMMENTS
pH in water 1:5	6.1	Slight Acidity
pH in $CaCl_2$ 1:5	4.5	Extreme Acidity
EC mS/cm 1:5	.03	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.65	8.00	Elevated
Potassium			.23	2.80	Very Low
Calcium			2.28	28.10	Very Low
Magnesium			3.72	45.90	Extreme
Aluminium			1.2	14.8	Extreme
		ECEC	8.10		Low
		Ca/Mg	1.00		Low

Phosphate Retention Index % 15.00 Low PRI mgP/kg 688.8 PRI kg/ha 1828.8 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.77

Structure:

Emerson Stability Class : H20 2.1 Low SAR 5.3 High SAR 6

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

For the purpose of onsite effluent disposal report, this soil shows extreme acidity and very low salt content. The soils ability to absorb phosphorus is low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates show only partial dispersion with slight milkiness immediately adjacent to the aggregate. This is a less severe form of Class 1 dispersion but nonetheless some susceptibility to erosion and tunnelling. The stability of aggregates is expected to increase with the application of high ionic strength water (i.e. effluent). The Emerson Stability Class indicates soil aggregates, in suspension, flocculate completely after standing for five minutes. Aggregates in this class are mechanically weak (slaking) but chemical conditions are such that colloids will not disperse even if severely provoked. A minimum of precaution in ploughed fields to prevent long runoff slopes is required. This soil poses slight to nil limitations to effluent disposal depending of topography.

The extreme acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 200g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 300g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992) **Chloride:** Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson’s Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **8**
Name: **26/0.5 - 20/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

Certified System Quality ISO 9001

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Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	5.8	Medium Acidity
pH in $CaCl_2$ 1:5	4.3	Extreme Acidity
EC mS/cm 1:5	.09	Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			1.75	14.50	High
Potassium			.29	2.40	Very Low
Calcium			.42	3.50	Very Low
Magnesium			6.76	55.90	Extreme
Aluminium			2.9	24	Extreme
		ECEC	12.10		Moderate
		Ca/Mg	0.10		Low

Phosphate Retention Index % 25.10 Low PRI mgP/kg 1156.7 PRI kg/ha 3036.3 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.75

Structure:

Emerson Stability Class : H20 2.1 Low SAR 5.1 High SAR 6

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

For the purpose of onsite effluent disposal report, this soil shows extreme acidity and very low salt content. The soils ability to absorb phosphorus is low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates show only partial dispersion with slight milkiness immediately adjacent to the aggregate. This is a less severe form of Class 1 dispersion but nonetheless some susceptibility to erosion and tunnelling. The stability of aggregates is expected to increase with the application of high ionic strength water (i.e. effluent). The Emerson Stability Class indicates soil aggregates, in suspension, flocculate completely after standing for five minutes. Aggregates in this class are mechanically weak (slaking) but chemical conditions are such that colloids will not disperse even if severely provoked. A minimum of precaution in ploughed fields to prevent long runoff slopes is required. This soil poses slight to nil limitations to effluent disposal depending of topography.

The extreme acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as "kikuyu" or "paspalum", which are very hardy;
- apply 450g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 680g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant	Authorised Signatory	Date of Report
Ryan Jacka	Simon Leake	04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **9**
Name: **14/0.1 - 20/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

Certified System Quality ISO 9001

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Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	5.8	Medium Acidity
pH in $CaCl_2$ 1:5	4.9	Very Strong Acidity
EC mS/cm 1:5	.03	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.12	2.70	Acceptable
Potassium			.22	5.00	Low
Calcium			2.68	60.90	Low
Magnesium			1.38	31.40	High
Aluminium			.02	.5	Acceptable
		ECEC	4.40		Very Low
		Ca/Mg	3.20		Normal

Phosphate Retention Index % 8.70 Very Low PRI mgP/kg 401.3 PRI kg/ha 854.8 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.42

Structure:

Emerson Stability Class : H20 3.1 Low SAR 3.1 High SAR 5.1

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

For the purpose of onsite effluent disposal report, this soil shows very strong acidity and very low salt content. The soils ability to absorb phosphorus is very low, but to depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates, after remoulding at a water content equivalent to field capacity, show dispersion with slight milkiness immediately adjacent to the aggregate when immersed in water. These aggregates can be provoked into dispersion if water is combined with mechanical stress. When the impact energy of rainfall is combined with the aggregates, water erosion may be predicted. It may also show crusting and emergence problems. The stability of aggregates is expected to increase with the application of high ionic strength water (i.e. effluent). The Emerson Stability Class indicates soil aggregates disperse with slight milkiness immediately adjacent to the aggregate when the water content intermediates between field capacity and that of suspension. Materials disperse when severely provoked by dilution into slurry form combined with significant mechanical action. They represent a much lower erosion risk on exposed soil but will erode if raindrop impact and running water are combined. Precautions to reduce the velocity of running water (i.e. soil conservation structures, roughened surface etc) should be employed where there is a risk (i.e. long slopes). This soil poses slight to nil limitations to effluent disposal depending on topography.

The very strong acidity, unbalanced cations and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations: - use acid tolerant plants, such as "kikuyu" or "paspalum", which are very hardy;
- apply 20g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable;
- apply 80g/sqm of gypsum incorporated into 150mm of this material which will reduce the sodicity and improve the cation balance.

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson's Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

Effluent Subdivison Profile

CLIENT: **Douglas Partners (Newcastle)**
PO Box 324
Hunter Region Mail Centre NSW 2310
Attn: Patrick Heads

PROJECT: Name: **Lower Belford**
Location: **# 49385**
SESL Quote N°: Client Job N°: Order N°: **80198**
Date Received: **26/05/2009**

SAMPLE: Batch N°: **10283** Sample N°: **10**
Name: **20/0.5 - 20/5/09**
Test Type: **Bulk Density, pHEC, CEC, ESP, PRI, mEAT**

Certified System Quality ISO 9001

Sydney Environmental and Soil Laboratory
Specialists in Soil Chemistry, Agronomy and Contamination Assessments

Tests are performed under a quality system certified as complying with ISO 9001: 2000. Results and conclusions assume that sampling is representative. This document shall not be reproduced except in full.

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Em: info@sesl.com.au
Web: www.sesl.com.au

TEST	RESULT	COMMENTS
pH in water 1:5	5.8	Medium Acidity
pH in $CaCl_2$ 1:5	4.4	Extreme Acidity
EC mS/cm 1:5	.03	Very Low Salinity

CATION ANALYSIS

TEST	SOLUBLE		EXCHANGEABLE		
Unit	meq%	Comment	meq%	% of ECEC	Comment
Sodium			.43	3.20	Acceptable
Potassium			.33	2.40	Very Low
Calcium			5.19	38.40	Very Low
Magnesium			4.04	29.90	Elevated
Aluminium			3.49	25.9	Extreme
		ECEC	13.50		Moderate
		Ca/Mg	2.10		Low

Phosphate Retention Index % 30.40 Low PRI mgP/kg 1396.7 PRI kg/ha 3792.0 to 150mm

PHYSICAL CHARACTERISTICS

Texture: Field Density g/mL: 1.81

Structure:

Emerson Stability Class : H20 2.1 Low SAR 5.1 High SAR 6

Particle Size Analysis (PSA)

> 2mm	Gravel
2 - 0.2 mm	Coarse Sand
0.2 - 0.02 mm	Fine Sand
0.02 - 0.002 mm	Silt
< 0.002 mm	Clay

Recommendations

For the purpose of onsite effluent disposal report, this soil shows extreme acidity and very low salt content. The soils ability to absorb phosphorus is low, but to a depth of 150mm can absorb a considerable amount, increasing the longevity of the effluent disposal system.

The Emerson Stability Class indicates soil aggregates show only partial dispersion with slight milkiness immediately adjacent to the aggregate. This is a less severe form of Class 1 dispersion but nonetheless some susceptibility to erosion and tunnelling. The stability of aggregates is expected to increase with the application of high ionic strength water (i.e. effluent). The Emerson Stability Class indicates soil aggregates, in suspension, flocculate completely after standing for five minutes. Aggregates in this class are mechanically weak (slaking) but chemical conditions are such that colloids will not disperse even if severely provoked. A minimum of precaution in ploughed fields to prevent long runoff slopes is required. This soil poses slight to nil limitations to effluent disposal depending of topography.

This soil poses slight to nil limitations to effluent disposal depending of topography. Stability of aggregates is not expected to increase with the application of high ionic strength water (i.e. effluent).

The extreme acidity and potential aluminium toxicity are the main limitation to effluent disposal, and if initial plant growth is struggling, this soil can be ameliorated by the following recommendations:

- use acid tolerant plants, such as “kikuyu” or “paspalum”, which are very hardy;
- apply 540g/sqm of lime incorporated into 150mm of this material which will raise the pH, rendering the aluminium unavailable, and improve the calcium levels.

Explanation of the Methods:
pH, EC, Soluble Cations, Nitrate: Bradley et al (1983). **Exchangeable Cations, ECEC:** Method 15A1 Rayment & Higginson (1992)
Chloride: Vogel (1961). **Aluminium:** Method 3500 APHA (1992). **Phosphate:** Method 9E1 Rayment & Higginson (1992). **Wax Block Density:** Method 30-4 Black (1983), **Texture:** Charman & Murphy (1991), **Emerson’s Aggregate Test:** Charman & Murphy (1991), **Particle Size Analysis:** Modified Black (1983) Method 43-1 to 43-6.

Consultant Ryan Jacka

Authorised Signatory Simon Leake

Date of Report 04/06/2009

ANALYTICAL REPORT

29 May 2009

Douglas Partners Pty Ltd
Box 324
Hunter Region Mail Centre
NSW 2310

Attention: **Bahareh Mansouri**

Your Reference: 49385 - Lower Belford

Our Reference: SE69463 Samples: 20 Soils
Received: 26/05/09

Preliminary Report Sent: Not Issued

These samples were analysed in accordance with your written instructions.

For and on Behalf of:
SGS ENVIRONMENTAL SERVICES

Client Services:	Simon Matthews	Simon.Matthews@sgs.com
Sample Receipt:	Angela Mamalicos	AU.SampleReceipt.Sydney@sgs.com
Laboratory Manager:	Edward Ibrahim	Edward.Ibrahim@sgs.com

Results Approved and/or Authorised by:

Nick Solarmis
Inorganics Signatory

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Inorganics Our Reference: Your Reference Sample Matrix Date Sampled	UNITS ---------- ----------	SE69463-1 2/0.1 Soil 19/05/2009	SE69463-2 2/0.5 Soil 19/05/2009	SE69463-3 3/0.1 Soil 19/05/2009	SE69463-4 4/0.25 Soil 18/05/2009	SE69463-5 6/0.05 Soil 18/05/2009
Date Extracted (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Electrical Conductivity 1:5 soil:water	µS/cm	12	29	20	35	17
Date Extracted- (pH 1:5 soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (pH 1:5 Soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
pH 1:5 soil:water 1:5 soil:water	pH Units	6.3	6.3	5.6	5.8	6.3

Inorganics Our Reference: Your Reference Sample Matrix Date Sampled	UNITS ---------- ----------	SE69463-6 7/0.15 Soil 19/05/2009	SE69463-7 13/0.5 Soil 18/05/2009	SE69463-8 14/0.5 Soil 20/05/2009	SE69463-9 15/0.05 Soil 20/05/2009	SE69463-10 16/0.25 Soil 20/05/2009
Date Extracted (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Electrical Conductivity 1:5 soil:water	µS/cm	72	270	830	13	7.2
Date Extracted- (pH 1:5 soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (pH 1:5 Soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
pH 1:5 soil:water 1:5 soil:water	pH Units	5.4	5.1	5.9	5.9	6.0

Inorganics Our Reference: Your Reference Sample Matrix Date Sampled	UNITS ---------- ----------	SE69463-11 17/0.2 Soil 20/05/2009	SE69463-12 18/0.5 Soil 19/05/2009	SE69463-13 19/0.15 Soil 20/05/2009	SE69463-14 21/0.2 Soil 20/05/2009	SE69463-15 22/0.1 Soil 19/05/2009
Date Extracted (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Electrical Conductivity 1:5 soil:water	µS/cm	27	170	25	11	18
Date Extracted- (pH 1:5 soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (pH 1:5 Soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
pH 1:5 soil:water 1:5 soil:water	pH Units	5.9	5.8	6.3	6.0	6.5

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Inorganics Our Reference:	UNITS	SE69463-16	SE69463-17	SE69463-18	SE69463-19	SE69463-20
Your Reference	----------	22/0.5	24/0.2	25/0.2	28/0.15	29/0.25
Sample Matrix	----------	Soil	Soil	Soil	Soil	Soil
Date Sampled		19/05/2009	18/05/2009	20/05/2009	19/05/2009	18/05/2009
Date Extracted (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (Conductivity)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Electrical Conductivity 1:5 soil:water	µS/cm	45	10	6.3	31	20
Date Extracted- (pH 1:5 soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Date Analysed (pH 1:5 Soil: Water)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
pH 1:5 soil:water 1:5 soil:water	pH Units	5.9	6.3	6.4	5.9	5.9

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Moisture Our Reference: Your Reference Sample Matrix Date Sampled	UNITS ---------- ----------	SE69463-1 2/0.1 Soil 19/05/2009	SE69463-2 2/0.5 Soil 19/05/2009	SE69463-3 3/0.1 Soil 19/05/2009	SE69463-4 4/0.25 Soil 18/05/2009	SE69463-5 6/0.05 Soil 18/05/2009
Date Analysed (moisture)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Moisture	%	9	14	3	17	12

Moisture Our Reference: Your Reference Sample Matrix Date Sampled	UNITS ---------- ----------	SE69463-6 7/0.15 Soil 19/05/2009	SE69463-7 13/0.5 Soil 18/05/2009	SE69463-8 14/0.5 Soil 20/05/2009	SE69463-9 15/0.05 Soil 20/05/2009	SE69463-10 16/0.25 Soil 20/05/2009
Date Analysed (moisture)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Moisture	%	7	20	14	10	9

Moisture Our Reference: Your Reference Sample Matrix Date Sampled	UNITS ---------- ----------	SE69463-11 17/0.2 Soil 20/05/2009	SE69463-12 18/0.5 Soil 19/05/2009	SE69463-13 19/0.15 Soil 20/05/2009	SE69463-14 21/0.2 Soil 20/05/2009	SE69463-15 22/0.1 Soil 19/05/2009
Date Analysed (moisture)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Moisture	%	17	15	9	8	11

Moisture Our Reference: Your Reference Sample Matrix Date Sampled	UNITS ---------- ----------	SE69463-16 22/0.5 Soil 19/05/2009	SE69463-17 24/0.2 Soil 18/05/2009	SE69463-18 25/0.2 Soil 20/05/2009	SE69463-19 28/0.15 Soil 19/05/2009	SE69463-20 29/0.25 Soil 18/05/2009
Date Analysed (moisture)		27/05/2009	27/05/2009	27/05/2009	27/05/2009	27/05/2009
Moisture	%	15	6	9	9	14

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Method ID	Methodology Summary
SEI-037	Ammonia - Determined by salicylate colourimetric method using Discrete Analyser.
AN106	Conductivity and TDS by Calculation (cTDS) - Conductivity is measured using a conductivity cell and dedicated meter, in accordance with APHA 21st Edition, 2510. TDS is calculated by TDS(mg/L)=0.6 x Conductivity(µS/cm).
AN101	pH - Measured using pH meter and electrode based on APHA 21st Edition, 4500-H+. For water analyses the results reported are indicative only as the sample holding time requirement specified in APHA was not met (APHA requires that the pH of the samples are to be measured within 15 minutes after sampling).
AN002	Preparation of soils, sediments and sludges undergo analysis by either air drying, compositing, subsampling and 1:5 soil water extraction where required. Moisture content is determined by drying the sample at 105 ± 5°C.

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QUALITY CONTROL Inorganics	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD
Electrical Conductivity 1:5 soil:water	µS/cm	1	AN106	<1.0	SE69463-1	12 || 8.9 || RPD: 30
Date Extracted- (pH 1:5 soil: Water)				[NT]	SE69463-1	27/05/2009 || 27/05/2009
Date Analysed (pH 1:5 Soil: Water)				[NT]	SE69463-1	27/05/2009 || 27/05/2009
pH 1:5 soil:water 1:5 soil:water	pH Units	0	AN101	[NT]	SE69463-1	6.3 || 6.3 || RPD: 0

QUALITY CONTROL Moisture	UNITS	LOR	METHOD	Blank
Date Analysed (moisture)				[NT]
Moisture	%	1	AN002	<1

QUALITY CONTROL Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Electrical Conductivity 1:5 soil:water	µS/cm	SE69463-10	7.2 || 7.7 || RPD: 7
Date Extracted- (pH 1:5 soil: Water)		SE69463-10	27/05/2009 || 27/05/2009
Date Analysed (pH 1:5 Soil: Water)		SE69463-10	27/05/2009 || 27/05/2009
pH 1:5 soil:water 1:5 soil:water	pH Units	SE69463-10	6.0 || 6.0 || RPD: 0

QUALITY CONTROL Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Electrical Conductivity 1:5 soil:water	µS/cm	SE69463-20	20 || 21 || RPD: 5
Date Extracted- (pH 1:5 soil: Water)		SE69463-20	27/05/2009 || 27/05/2009
Date Analysed (pH 1:5 Soil: Water)		SE69463-20	27/05/2009 || 27/05/2009
pH 1:5 soil:water 1:5 soil:water	pH Units	SE69463-20	5.9 || 5.9 || RPD: 0

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Result Codes

[INS]	:	Insufficient Sample for this test	[RPD]	:	Relative Percentage Difference
[NR]	:	Not Requested	*	:	Not part of NATA Accreditation
[NT]	:	Not tested	[N/A]	:	Not Applicable

Report Comments

Samples analysed as received. Solid samples expressed on a dry weight basis.
Date Organics extraction commenced:
NATA Corporate Accreditation No. 2562, Site No 4354
Note: Test results are not corrected for recovery (excluding Dioxins/Furans*)
This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

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Quality Control Protocol

Method Blank: An analyte free matrix to which all reagents are added in the same volume or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. A method blank is prepared every 20 samples.
Duplicate: A separate portion of a sample being analysed that is treated the same as the other samples in the batch. One duplicate is processed at least every 10 samples.
Surrogate Spike: An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are added to samples before extraction to monitor extraction efficiency and percent recovery in each sample.
Internal Standard: Added to all samples requiring analysis for organics (where relevant) or metals by ICP after the extraction/digestion process; the compounds/elements serve to give a standard of retention time and/or response, which is invariant from run-to-run with the instruments.
Laboratory Control Sample: A known matrix spiked with compound(s) representative of the target analytes. It is used to document laboratory performance. When the results of the matrix spike analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the laboratory can perform the analysis in a clean matrix.
Matrix Spike: An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

Quality Acceptance Criteria

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: http://www.au.sgs.com/sgs-mp-au-env-qu-022-qa-qc-plan-en-09.pdf

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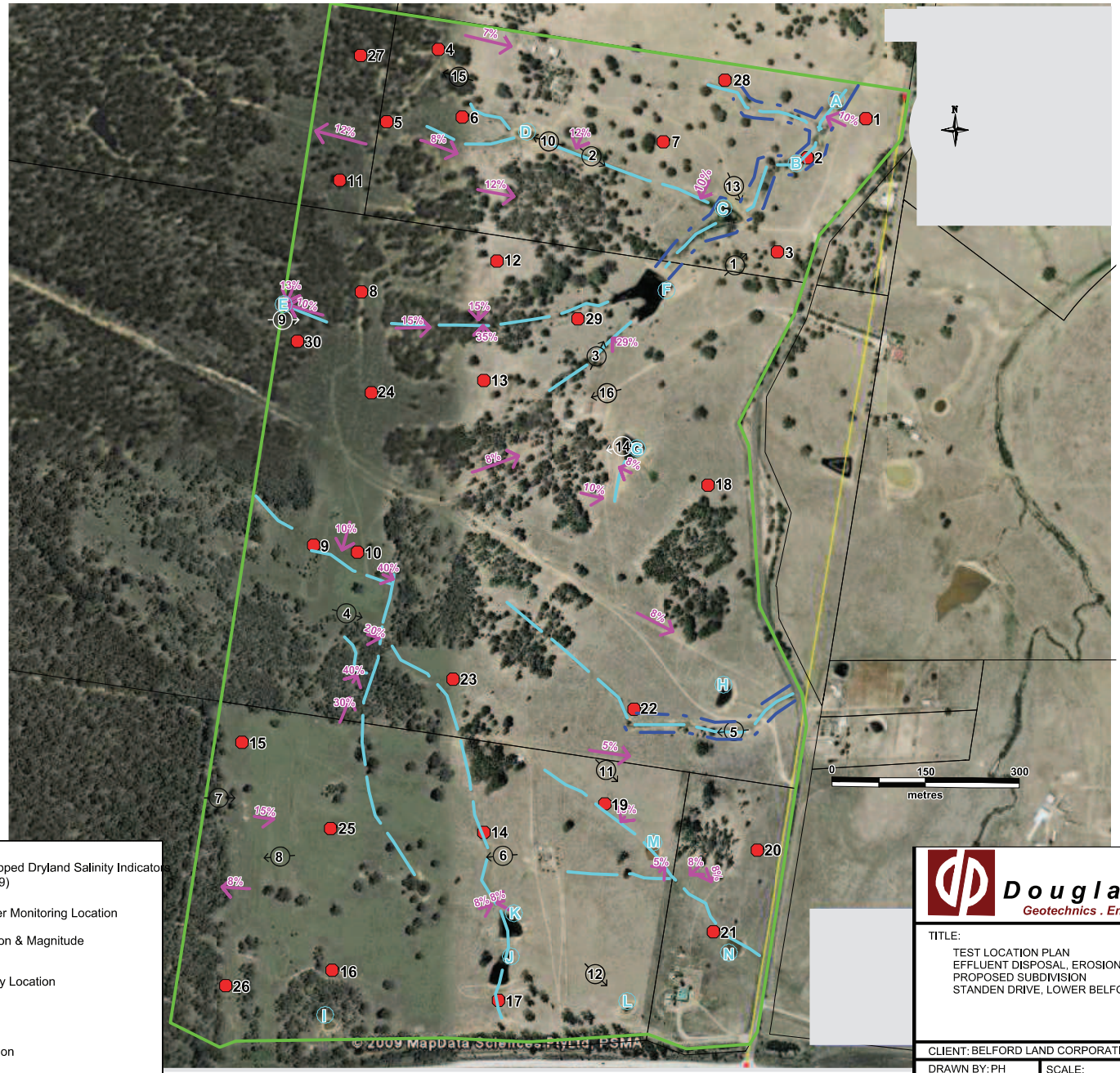

Approximate Extent of Mapped Dryland Salinity Indicators (Department of Lands 1999)

Approximate Surface Water Monitoring Location

Approximate Slope Direction & Magnitude

Approximate Drainage Gully Location

Approximate Site Extent

Approximate Test Pit Location

Approxiamte Photo Location and Direction

Douglas Partners
Geotechnics . Environment . Groundwater

TITLE:
TEST LOCATION PLAN
EFFLUENT DISPOSAL, EROSION & SALINITY ASSESSMENT
PROPOSED SUBDIVISION
STANDEN DRIVE, LOWER BELFORD

CLIENT: BELFORD LAND CORPORATION

DRAWN BY: PH	SCALE:	PROJECT №9385	OFFICE: NEWCASTLE
APPROVED BY:		DATE:	DRAWING No: 1