



Douglas Partners

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Report on
Geotechnical Assessment

Gilead Rezoning
Gilead, NSW

Prepared for
Lendlease Communities (Figtree Hill) Pty Limited

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Integrated Practical Solutions



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

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Table of Contents

	Page
1. Introduction.....	1
2. Proposed Development.....	2
2.1 Background	2
2.2 Rezoning Process.....	2
3. Site Description	3
4. Regional Geology and Soil Landscapes	3
4.1 Hydrogeology.....	6
4.2 Soil Salinity	7
4.3 Acid Sulfate Soils	7
5. Field Work Results from Previous Investigation	8
5.1 Site Observations.....	8
5.2 Subsurface Conditions.....	10
5.3 Surface Water and Groundwater	10
6. Laboratory Testing	11
7. Proposed Development.....	12
8. Comments	12
8.1 Slope Instability.....	12
8.2 Erosion Potential.....	12
8.3 Site Preparation and Earthworks	12
8.3.1 Topsoil.....	12
8.3.2 Rock	13
8.3.3 Site Preparation	14
8.4 Pavements	15
8.5 Site Classification.....	16
9. Further Investigations.....	17
10. Summary of Constraints for Site Development.....	18
11. References	18
12. Limitations	19

Appendices:

- A: About this Report
- B: Drawing 1 – Site locality and Test Pit Locations
- C: Field Work Results – TP8 to TP25, TP101 – 111 and BH201 – 215
- D: Laboratory Test Results – Geotechnical
- E: Laboratory Test Results – Salinity

Report on Geotechnical Assessment

Gilead Rezoning

Gilead, NSW

1. Introduction

This report presents a geotechnical assessment undertaken for the Gilead Rezoning. The report was commissioned in an email dated 29 May 2022 by Will Laurantus of Lendlease Communities (Figtree Hill) Pty Limited and was undertaken in accordance with Douglas Partners Pty Ltd (DP) proposal 76649.31 dated 27 May 2022.

The site comprises the following five properties that have a combined area of 495ha:

- Lot 2 in Deposited Plan (D.P.) 1218887;
- Lot 2 in D.P. 249393;
- Lot 1 D.P. 603675;
- Lot 2 D.P. 603674; and
- Part Lot 5 in D.P. 1240836.

The assessment is based on a review of DP *Report on Preliminary Geotechnical Assessment Proposed Mount Gilead Estate* (Project 76649.00 date March 2015 which incorporates the Lot 2 in DP 1218887 and Part Lot 5 in D.P. 1240836 part of the site. The balance of the site was assessed through review of published mapping and site walkover inspections.

Current site use includes agricultural and vacant bushland. Through the rezoning, Lot 2 in D.P. 1218887 and Lot 2 in D.P. 249393 will be subject to a combination of conservation and urban development zones, and Lot 1 D.P. 603675, Lot 2 D.P. 603674 and part Lot 5 in D.P. 1240836 will be subject to a conservation zone.

The site lies within the Local Government Area of Campbelltown City Council and the objective of the geotechnical assessment is to comment on the suitability of the site, from a geotechnical perspective, for the proposed rezoning. This report must be read in conjunction with all appendices including the notes provided in Appendix B.

2. Proposed Development¹

2.1 Background

Greater Macarthur has been identified as Growth Area by the NSW Government and will provide for 15 000 new homes to the broader south Campbelltown region. Lendlease's landholding at Gilead has been identified as a Priority Precinct and will make the first contribution to housing supply in the region of approximately 3 300 new homes, retail centre and education facilities.

Importantly, it will secure key conservation outcomes including the establishment of linked koala and fauna corridors between the Georges River and Nepean River.

Once Gilead is rezoned, as necessary, technical studies will be further refined to lock in specific place-based outcomes that will be engrained within the Development Control Plan and infrastructure within Planning Agreements with Campbelltown City Council and the Minister for Planning.

2.2 Rezoning Process

The State Government commenced investigations into the development capability of Greater Macarthur in 2014 with the Greater Macarthur Land Release Investigation Preliminary Strategy and Action Plan. Since its release, strategic planning for Greater Macarthur has continued to be refined for the region with a high-level structure plan and key planning principles adopted as part of *Greater Macarthur 2040 An Interim Plan* (Greater Macarthur 2040). Greater Macarthur 2040 identified precincts that resulted in an amendment to *State Environmental Planning Policy (Sydney Region Growth Centres) 2006*. As part of the declaration of precincts, the Gilead North Precinct was identified as a priority for Government to progress detailed planning for in response to the key planning principles.

Lendlease has worked with the NSW Government through the Technical Assurance Panel Process between 2021 to 2022 to resolve positions on key matters that will shape the development and conservation outcomes for the Gilead Precinct. On this basis, Lendlease has prepared a structure plan to define appropriate development and conservation outcomes for the Gilead Precinct.

The structure plan has been informed by a suite of technical studies that have been used to prepare a Planning Proposal that will put in place an Urban Development zone and Conservation Zone and development controls by an amendment to *State Environmental Planning Policy (Precincts – Western Parkland City) 2021*. As part of the Planning Proposal, the technical studies have been used to identify design principles to be used to inform the next stages of detailed planning and development delivery.

Once Gilead is rezoned, as necessary, technical studies will be further refined to lock in specific place-based outcomes that will be ingrained within the Development Control Plan and infrastructure within Planning Agreements with Campbelltown City Council and the Minister for Planning.

¹ Information provided by Lendlease

3. Site Description

The site comprises the following five properties that have a combined area of 495 ha:

- Lot 2 in Deposited Plan (D.P.) 1218887;
- Lot 2 in D.P. 249393;
- Lot 1 D.P. 603675;
- Lot 2 D.P. 603674; and
- Part Lot 5 in D.P. 1240836.

It is bounded to the north and south by rural properties and vacant land, to the east Appin Road and to the west by Nepean River.

The site traverses undulating terrain with overall relief of approximately 130 m from the highest part of the site (approximately RL 200, relative to Australian height datum – AHD) to the lowest part (approximately RL 70) at the Nepean River. Ground surface slopes within the site are typically less than 10 degrees and often less than 5 degrees. Ground surface slopes steepen considerably within the gullies, often approaching near-vertical conditions along existing sandstone cliff faces, although all steep gullies lie outside the proposed development area.

4. Regional Geology and Soil Landscapes

Reference to the NSW Seamless Geological Series (GSNSW, 2019) indicates that most of the site including the lower elevations and riparian zones are underlain by Hawkesbury Sandstone (mapping unit Tuth) of Triassic age. This formation typically comprises medium to coarse-grained quartz sandstone, very minor shale and laminite lenses. is underlain by Ashfield Shale (mapping unit Twia) of the Wianamatta Group of Triassic age. This formation typically comprises laminite and dark grey siltstone.

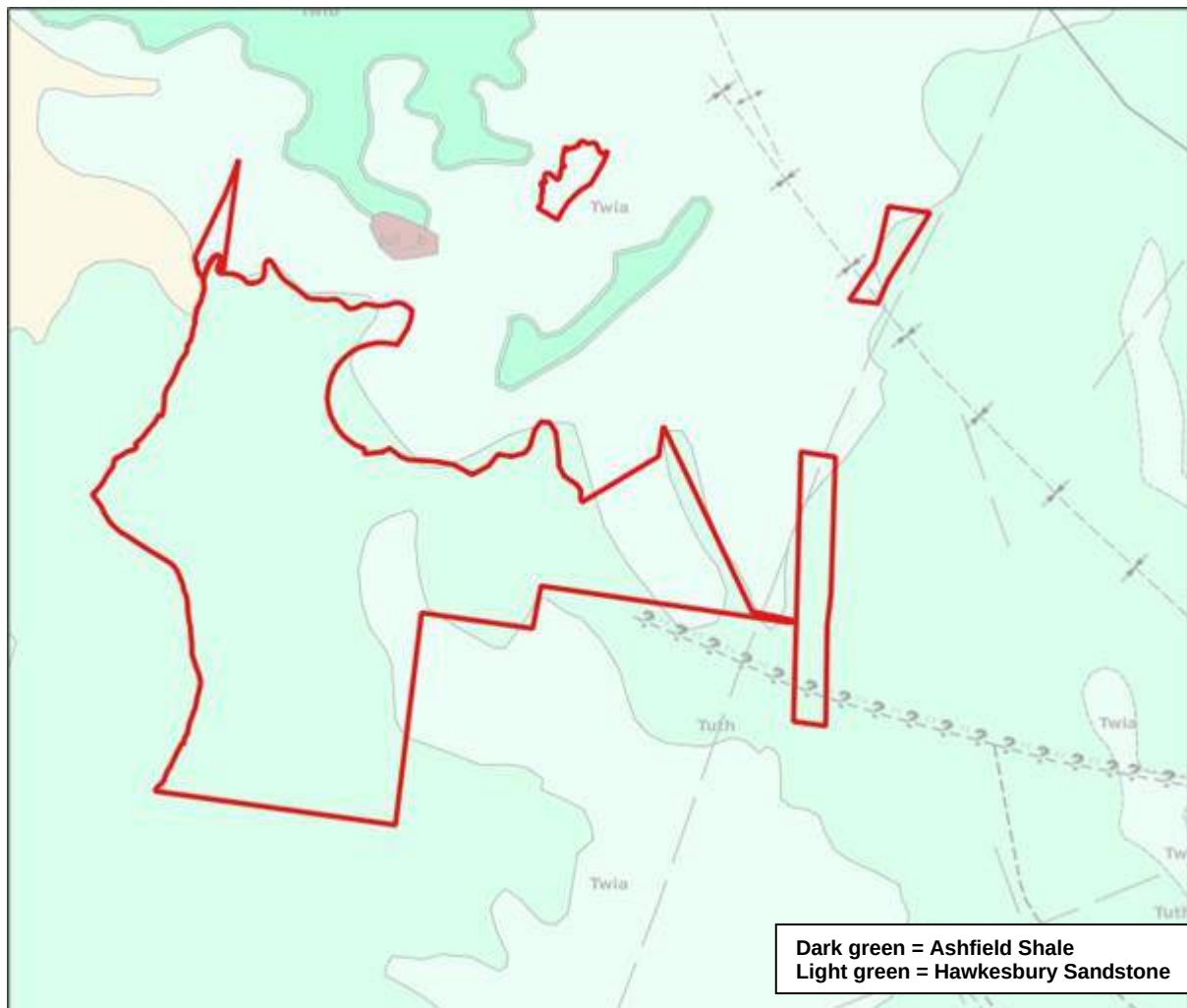


Figure 1: Site Geology

In addition, it is known from geotechnical investigations undertaken of surrounding sites that the Mittagong Formation forms a transitional geological sequence between the Ashfield Shale and Hawkesbury Sandstone. The Mittagong Formation is typically up to 6 m thick and comprises interbedded shale, laminite and fine-grained quartz sandstone.

A number of major faults are known to cross the site with vertical displacements ranging between 20 m and 80 m. These are not considered to have a significant impact on the proposed subdivision and will be more relevant to the development of coal mining beneath the site.

Reference to the 1:100 000 Soil Landscapes of Wollongong-Port Hacking Sheet indicates that the site includes three soil landscape groups, namely the Blacktown and Hawkesbury soil landscapes. The approximate soil landscape boundaries, as shown on the soil landscape maps, are shown on Figure 2.

Mapping indicates that most of the site comprises soils of the Blacktown soil landscape (mapping unit bt), which is characterised by topography of gently undulating rises on Wianamatta Group Shale, with local relief to 30 m and slopes usually less than 5%, typically represented by broad rounded crests and ridges with gently inclined slopes. This is a residual soil landscape, which the mapping indicates comprises multiple soil horizons that range from shallow red-brown podzolic soils comprising mostly

clayey soils on crests and upper slopes, to deep brown to yellow clay soils on mid to lower slopes and in areas of poor drainage. These soils are typically of low fertility, are moderately reactive, highly plastic and generally have a low wet strength.



Figure 2: Soil Landscapes

Whilst the Blacktown soil group is typically associated with Wianamatta shales on this site, it is mapped as overlying the Hawkesbury Sandstone. This is common at the interface zones between the shale and the sandstone.

Areas surrounding the Nepean River and Woodhouse Creek are within the Hawkesbury soil landscape (mapping unit ha), which is characterised by rugged, rolling to very steep hills on Hawkesbury Sandstone, with local relief of 40 m to 200 m and slopes usually greater than 25% and rock outcrops of more than 50%. This is a colluvial soil landscape, which mapping indicates comprises multiple soil horizons, including localised yellow and red podzolic soils associated with shale lenses, siliceous sands and yellow earth along drainage lines, shallow and discontinuous sands associated with rock outcrops and some yellow podzolic soils on the insides of benches and along rock joints and fractures. These soils are typically associated with an extreme soil erosion hazard, mass movement (rock fall) hazard, steep slopes, rock outcrop or shallow, stony, highly permeable soil of low soil fertility.

4.1 Hydrogeology

McNally (2005, Ref 3) describes general features of the hydrogeology of Western Sydney which are relevant to this site. The shale terrain of much of Western Sydney is known for saline groundwater, resulting either from the release of connate salt in shales of marine origin or from the accumulation of windblown sea salt. This salt is concentrated by evapo-transpiration and often reaches highest concentrations in the B-horizon of residual soils. The B-horizon at the site is between 0.8 m and 2 m below ground level and typically underlies the topsoil unit. In areas of urban development, this can lead to damage to building foundations, lower course brickwork, road surfaces and underground services, where these affect the saline zone or where the salts are mobilised by changing groundwater levels.

Groundwater associated with aquifers located within the Hawkesbury Sandstone are generally of good quality, suitable for stock and domestic purposes. Groundwater yield is dependent on defect type and spacing. Typical groundwater bores installed in Hawkesbury Sandstone are in excess of 30 m depth. The approximate water boundaries, as shown on the NSW Sydney Water sources, are shown on Figure 3, following page.

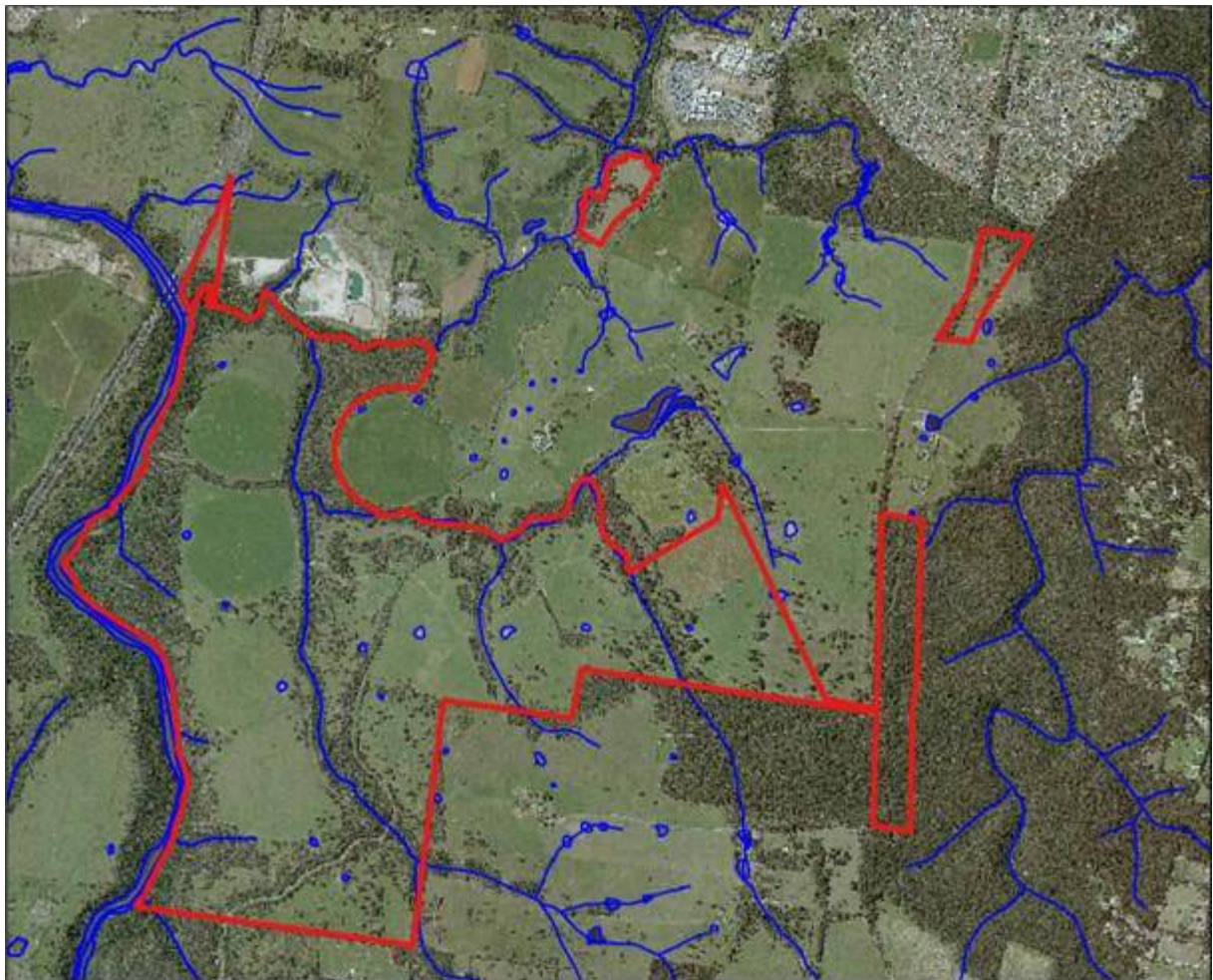


Figure 3: NSW Sydney Water sources

4.2 Soil Salinity

The former Department of Environment Climate Change (DECC), now the NSW Environment Protection Authority (EPA), infers a low salinity potential for the site on their salinity hazard map extracted from the Soil and Land Resources of the Hawkesbury Nepean Catchment (DECC 2008) (Ref 4). The mapping is based on soil type, surface level and general groundwater considerations but is not generally ground-truthed, hence actual soil salinity needs to be assessed to confirm the DECC potential salinity mapping indication.

Approximate salinity potential boundaries, as shown on the salinity potential map, are shown on Figure 4.



Figure 4: Western Sydney Salinity Potential

4.3 Acid Sulfate Soils

The lowest elevation on site is 60 m AHD, this is well above the level at which Acid Sulphate soils are known to occur. For this reason there is no government-produced mapping in this region. ASS is not considered to be a constraint to development.

5. Field Work Results from Previous Investigation

The relevant field work results from previous DP investigations (Project 76649.00, dated March 2015) include:

5.1 Site Observations

The observations made during the various inspections of the site undertaken during and following the field investigation (February 2015) are summarised below:

Stability

- The landform is predominantly gently sloping undulating terrain of gradual relief, although relief is significant if considering the whole of site extremes. Crests and gullies are mostly broad, although deep and steeply incised gullies are present along the major creek lines.
- In general the site is considered to be stable with slopes typically less than 5 degrees, occasionally increasing to 10 degrees in paddocks adjacent to creek lines.
- Creek lines are typically steep (up to 35 degrees) especially in the areas of the site underlain by Hawkesbury Sandstone. Creeks are deeply incised, especially as they approach the Nepean River, with depths of up to 15 m noted on site.
- Steepened creek banks are predominantly colluvial with large (>3 m) boulders and cobbles overlying exposed sandstone. Some areas of the creek lines have formed cliffs. Evidence of rock fall is apparent, with fresh rock (from rock strikes), rock piles in the base of creeks and behind trees noted
- The banks of the Nepean River have formed cliffs in Hawkesbury sandstone from the southern third of the site. The cliff is approximately 15 m high. The northern two thirds of the bank adjacent to the site grade steeply to the water's edge with slopes of between 15 and 35 degrees

Erosion

- Widespread erosion was limited to the northern portion of the MDP land, where it was noted about some of the creek lines draining the shale landscape.

Soil and Rock Profiles

- Soil exposures in existing farm dams across the site and at a shale pit in the MDP land, revealed a relatively thin topsoil profile of between 0.1 and 0.2 m;
- The most consistent feature of the site, especially those parts underlain by Hawkesbury Sandstone, was the presence of outcropping rock. Outcropping rock was noted at the top of all creek banks, at the base of all dams and in numerous other locations within the paddocks. Exposed rock was typically high strength medium grained sandstone.
- An alluvial deposit not shown on the published mapping was encountered adjacent to the Nepean River in the northern parts of the Balance Land. It is understood that approximately 1 million cubic metres has been mined from this area. It is unknown whether a mine closure plan has been enacted or is necessary for this site.

Stockpiles and Uncontrolled Fill

- The edges of paddocks, especially where they bordered the incised creeks, had been “pushed up” by bulldozer. This has resulted in uncontrolled fill platforms being created. Based on site observations, these appear to be relatively shallow and in most cases no more than 0.8 m in depth.
- In a similar manner a number of soil stockpiles were evident on site. In most cases, no refuse or anthropogenic inclusions were noted within these, leading to the conclusion that they were likely the result of bulldozer work during land clearing.
- Soil and rock stockpiles were also noted within the Sydney Water Supply Canal easement. It is understood that these stockpiles are within Sydney Water’s land and may be heritage items. Whilst not a geotechnical matter it is noted that the stockpiles may be an aesthetic constraint (ie: unsightly).
- In the southern portion of the Balance Land are the remnants of sandstone quarries, with numerous sandstone blocks scattered on the surface.
- In the central portion of the balance land a number of food waste stockpiles have been left on the site. It is understood that this material was typically used as pasture improvement, however in this case the material has not been spread
- Adjacent to the food waste stockpiles are a number of soil stockpiles that appear to contain building demolition rubble).
- There are a number of fertiliser stockpiles and superphosphate dumps noted across the site.

Buried Services

- Two asbestos cement pipe networks traverse the site, which are further discussed in the preliminary contamination assessment. The pipes are connected to a series of hydrants on the MDP land and to the pivot irrigators on the Balance Land, where they are fed from a pump on the Nepean River and a pump on the “Heritage Dam” respectively.
- Buried electrical services run to the pivot irrigators and pump houses.
- Three high pressure gas mains and a water main traverse the central portion of the site from north to south. A sewer carrier is buried on the eastern boundary of the site adjacent to Appin Road.
- Telstra cables traverse the eastern boundary of the site approximately 150 m west of Appin Road.
- An exploration borehole is located on the property. Anecdotally it is thought that they may be related to groundwater monitoring in the southern coalfields.

Water logging and Salinity

- Numerous farm dams were located across the MDP and Balance land. Dam walls consisted of uncontrolled fill, pushed up by bulldozer from the reservoir base. DP understand from discussions with the site owner that no fill was imported to construct the farm dam walls.
- In dams and drainages overlying the shales (ie: northern end of the MDP land) some water logging was noted, as is typical on soils overlying the Wianamatta group
- Salt tolerant vegetation was noted in these water logged areas (*Juncus acutus*). It is noted that whilst salinity tolerant *Juncus* is also tolerant of water logged soil .
- No other signs of dryland salinity were noted during the site walkover.

Recent Inspection

DP completed an inspection of the following three Lots (on 17 June 2022), given they were not inspected during previous investigations:

- Lot 2 in D.P. 249393;
- Lot 1 D.P. 603675; and
- Lot 2 D.P. 603674.

All three lots were vacant with dense vegetation present. No specific geotechnical constraints were observed on Lot 1 D.P. 603675 and Lot 2 D.P. 603674 (noting that structural development is not proposed in these parts of the site). With respect to Lot 2 in D.P. 249393, batter slopes adjacent to the Hume Highways and slopes grading down to the Nepean River were observed. These features will require consideration during the design and planning stages of the development.

5.2 Subsurface Conditions

The test pits encountered relatively uniform conditions underlying the site, with the succession of strata broadly summarised as follows:

- TOPSOIL – silty clay topsoil, sandy clay topsoil, clayey silt topsoil, and silty topsoil encountered to depths of 0.05 m to 0.3 m in all TPs, with the exception of, TP12, TP17, TP18 and TP25 where no topsoil was observed;
- CLAY/SILT – silty clays, sandy clays, shaly clays, sandy silty clays, and clayey silts were encountered to depths of up to 1.8 m in all pits with the exception of TP15, TP17, TP23 and TP24 where topsoil directly overlay rock;
- BEDROCK – weathered sandstone or shale was encountered in all pits to the depth of termination with the exception of TP108 where rock was not encountered.

Filling was encountered in TP23 to depth 0.2 m.

No free groundwater was observed in the test pits excavated during the field work programme. It is noted that the test pits were immediately backfilled on completion, which precluded long term monitoring of groundwater levels.

Soil conditions were relatively uniform across the site and were generally as indicated by the soil landscape map (refer Figure 2). Sandstone was present at lower elevations about the site perimeter, whereas shales were present in the central, elevated areas of the site. This is consistent with the geology map for the site (refer Figure 1).

In addition to the above soil profiles, filling should be expected within the existing dam walls and is likely to comprise a blend of the residual soils and upper weathered rock profiles.

5.3 Surface Water and Groundwater

Groundwater was not observed in any of the test pits excavated at site. Although test pits were immediately backfilled, preventing long term monitoring of groundwater levels, the moisture contents of

the subsurface soils did not indicate free groundwater to be likely within the depth of the investigation. Given the elevation of the site above the adjoining creek lines, groundwater levels are expected to lie well below the ground surface.

6. Laboratory Testing

Soil and weathered rock samples were collected from the test pits during the field investigation. Samples were selected to undergo the following suite of geotechnical tests:

- Field moisture content tests;
- Atterberg limits tests; and
- Shrink-swell index tests.

The results of these tests are presented in Appendix E and are summarised in Table 1.

Table 1: Laboratory Test Results (Geotechnical)

Pit	Depth (m)	W _F (%)	W _P (%)	W _L (%)	PI (%)	I _{ss} (%/ΔpF)	Material
12	0.3 – 0.7	28.4	-	-	-	3.5	Silty/Sandy Clay
21	0.3 – 0.7	26.4	-	-	-	1.9	Sandy Clay
14	1.0	14.6	23	51	28	-	Silty Clay
20	1.0	13.3	-	-	-	-	Silty/Sandy Clay
21	1.0	17.7	23	47	24	-	Sandy Clay

Where:

FMC	=	Field Moisture Content	SSI	=	Shrink-swell Index
LL	=	Liquid Limit	PL	=	Plastic Limit
PI	=	Plasticity Index	ECN	=	Emerson Class Number

The laboratory test results indicate medium to high plasticity, slight to moderate reactivity and some predisposition to dispersion and slaking.

The laboratory test results confirm the consistent clayey nature of the soils at the site and indicate soil classifications, in accordance with the unified soil classification system, corresponding to inorganic clays of medium to high plasticity (CH) and inorganic silts or fine sandy or silty soils (MH).

California bearing ratio testing was also undertaken on four samples for the purposes of determining likely pavement thicknesses and the results are presented in Table 2.

Table 2: Results of California Bearing Ratio Testing

Pit No	Depth (m)	FMC (%)	OMC (%)	MDD (t/m ³)	Swell (%)	CBR (%)	Material
12	0.5 – 0.6	21.5	21.5	1.66	1.4	3.0	Silty/Sandy Clay
21	0.5 – 0.6	19.0	19.0	1.68	1.2	4.0	Sandy Clay

7. Proposed Development

It is understood that the site is being considered for the staged urban development. The development will include approximately 3,300 new homes, retail centre and education facilities.

The following sections provide general comments on development constraints relevant to geotechnical factors and soil chemistry to assist in the conceptual planning of the site. Further investigations will need to be undertaken as the conceptual planning and design process progresses.

8. Comments

8.1 Slope Instability

No evidence of slope instability (i.e. landslip) was observed within the areas of the site proposed for urban development, which is consistent with the gently sloping landforms that typically provide hillside slopes with falls of 5 – 10 degrees or less across most of the site.

Although a high risk of slope instability was identified in the form of rock fall along the crest of the steeply incised gullies it is understood that these areas will not form part of the development area. Therefore, it is considered that hillside instability does not impose significant constraints on the proposed site development. A stability hazard map has not been prepared, as no significant stability hazards were identified within the site.

8.2 Erosion Potential

Soils of the Blacktown soil landscape are typically of moderate erodibility. The more sodic or saline soils of the Blacktown soil landscape can have a high to very high erodibility and the erosion hazard for this landscape is estimated as moderate to very high (Ref 2). The results of Emerson class number tests and salinity testing indicate a low to moderate risk of erosion.

In all instances, erosion scarring was less than 1 m deep (typically 0.5 m) and covered an area of less than 500 m².

It is considered that the erosion hazard within the areas proposed for urban development would be within usually accepted limits, and can be managed by good engineering and land management practices.

8.3 Site Preparation and Earthworks

8.3.1 Topsoil

Topsoil is relatively shallow across the site (0.05 – 0.3 m, typically 0.1 m). This depth should be relatively easily managed during bulk earthworks and is unlikely to result in generation of significant excess.

8.3.2 Rock

Rock depth is relatively shallow across the site (0.2 m – 1 m). The rock profile is dependent on the geology type (refer Figure 1, page 4). Northern portions of the MDP land which are underlain by Wianamatta shale typically have deeper soil profiles and significantly deeper weathering profiles. In these locations the backhoe was able to excavate to 3 m through the rock. Cut to fill earthworks in these areas would be expected to be relatively straight forward using tractor scrapers and, possibly, light ripping with small dozers (D6 or larger) in the deeper areas or in sandstone bands.

The southern portion of the MDP is also underlain by Wianamatta Shale, though approaching the boundary with the Hawkesbury Sandstone. Soil profiles are thinner and rock strengths are higher and often interbedded with sandstone (likely to be the Mittagong Formation, which is typically found at the base of the Wianamatta shale). In these areas the upper 1 – 2 m will be able to be removed using scrapers, however heavier ripping using larger dozers (D9, D9L or D10) may be required. Ripping may generate oversize rock which may need to be broken down using pneumatic hammers prior to reuse in the fill. Oversize rock generated from Wianamatta shale is not suitable to use in landscaping due to its propensity to degrade and weather over time.

The bulk of the Balance Land is located on Hawkesbury Sandstone. Hawkesbury Sandstone has significantly higher strength and lower defect spacing than the Wianamatta shale. Across these areas numerous sandstone rock outcrops were noted. Rock depths in the test pits typically varied between the surface and 1 m. Bulk removal in these areas will be difficult and low production rates must be anticipated. Where bulk removal can be undertaken using tractor scrapers it is anticipated that high strength boulder sized “floaters” will be generated. Deeper areas of cut (>2 m) will require heavy ripping using large bulldozers (ie: D11 or equivalent). An alternative to using a dozer in these areas may be the use of a large rock hammer (3 – 5 Tonne on a 30 - 45t excavator) or an 85 tonne excavator with a ripper. Ripping will generate significant quantities of oversize. This will require breaking down using pneumatic hammers prior to crushing before reuse in the fill or reuse in landscaping areas.

To assist the conceptual design, the bore logs include additional comment on the type of excavation that will likely be required to remove the relevant strata based on the following definitions:

- Scrapers – bulk removal by scraper with occasional light ripping by D6 or D9 dozer.
- Medium ripping – D9 or larger dozer, low production rate.
- Heavy ripping – D9L or D10 or larger, low production rate.
- Very Heavy ripping – D11 Dozer, very low production rates or a large rock hammer (3 – 5 t on a 30 – 45 tonne excavator) (low production rate) or an 85 tonne excavator with a ripper (higher production rate).

In locations where medium to heavy ripping is indicated on the logs detailed excavations (eg footings or service trenches) will need to be rock sawed (for shallow locations). Deeper trenches may require the use of a trencher such as a Vermeer 850. Boring of some deep service trenches in rock may also need to be considered as has been undertaken in nearby subdivisions in similar geology.

Reference should be made to the test pit logs and borehole logs in Appendix C for information on rock strength and soil profiles.

As discussed in this section, cut areas and trenching in sandstone will generate significant quantities of oversize rock. This rock will not be suitable for reuse directly in fill areas and will require processing

(breaking down and crushing) before being suitable for reuse as structural fill. Consideration could also be given to the reuse of some of the sandstone in landscaping areas, though further durability testing would be required to assess the suitability of the rock to withstand weathering. There is also the possibility that the rock could be reused as a select subgrade or possibly as subbase material. If this option was considered, further testing would be required to assess the quality of the rock and the cost associated with producing a product with appropriate grading (particle size). The quality of such a product would be unlikely to meet RTA standard 3051 for subbase and as such would require a structural (project-specific) design of the pavements.

8.3.3 Site Preparation

Site preparation for the construction of structures and pavements should include the removal of topsoils and other deleterious materials from the proposed building areas.

In areas that require filling, the stripped surfaces should be test rolled in the presence of a geotechnical engineer. Any areas exhibiting significant deflections during test rolling should be rectified by excavation of the weak material and replacement with low plasticity filling, placed in near horizontal layers no thicker than 250 mm compacted thickness. Each layer should be compacted to a minimum dry density ratio of 98%, relative to Standard compaction with placement moisture contents maintained within 2% of Standard optimum. In areas of pavement construction, the upper 0.5 m should be compacted to achieve a minimum dry density ratio of 100% relative to Standard compaction with placement moisture contents similarly maintained.

All batters should be constructed no steeper than 3H:1V and appropriately vegetated to reduce the effects of erosion.

To validate site classifications, sufficient field inspections and in situ testing of future earthworks should be undertaken in order to satisfy the requirements of Level 1 geotechnical inspection and testing as defined in AS3798-2007 *“Guidelines on Earthworks for Commercial and Residential Developments”* (Ref 10). This is a standard requirement of Campbelltown City Council.

Batters required for pavement construction should be formed no steeper than 3H:1V in the residual clays and any engineered filling. All batters should be suitably protected against erosion with toe and spoon drains constructed to control surface flows on the slopes.

If embankments are proposed for use as water quality control ponds, then the results of testing completed to date indicates that the site soils may be suitable for re-use as embankment materials, subject to further testing of sodicity and erosion potential. Preliminary design of detention basins (i.e.: short term storage only) could be dimensioned with maximum batter slopes of 4H:1V, with allowance made for the results of erosion control (such as topsoiling and turfing) if soils with an ECN of less than 4 are used. Subject to design permeability requirements, the use of liners on both the embankments and within parts of the reservoir area may also be necessary.

Site observations have indicated the presence of silty topsoils and silty clays which could be adversely affected by inclement weather. Whilst these soils are typically of a stiff to very stiff consistency when dry, they can rapidly lose strength during rainfall and subsequent partial saturation, and result in difficult trafficability conditions. As a result, surface drainage that directs runoff away from work areas should be installed prior to construction, possibly in conjunction with the designation of construction equipment haul routes to minimise trafficking of stripped areas.

Conventional sediment and erosion control measures should be implemented during the construction phase, with exposed surfaces to be topsoiled and vegetated as soon as practicable following the completion of earthworks.

8.4 Pavements

Whilst detailed design of pavements will be undertaken at the development application stage, a range of pavement thickness designs (excluding asphalt thicknesses) is shown in Table 6 based on the results from the assessment (refer Table 2). These designs are based on the procedures given in AUSTROADS Guide to Pavement Technology Part 2: Pavement Structural Design, Figure 8.4 (Ref 11) for a range of traffic loadings and subgrade CBR values and are provided to give an indication of the range of pavement thickness that can be expected. Campbelltown City Council may require slightly thicker pavements, where the following thicknesses are less than Council's minimum pavement construction thickness. Where weak, water-logged soils are encountered (for example, in the vicinity of gullies or downstream of existing dams), the inclusion of a 500 mm thick granular bridging layer (possibly in conjunction with geotextiles) may be required.

Based on the range of result determined during the investigation, a design CBR of 3% could be used for pavements on clay or clay fill. Where the pavements will be constructed on rock (ie in some cut areas) a design CBR of 7% could be adopted. These preliminary estimates will need to be reviewed during detailed design.

Table 6: Preliminary Pavement Thickness Designs

Traffic Loading (ESA)	Total Pavement Thickness Excluding Asphalt (mm)			
	CBR 3%	CBR 4%	CBR 5%	CBR 7% (rock)
1 x 10 ⁵	385	330	290	240
3 x 10 ⁵	445	385	340	280
1 x 10 ⁶	515	445	390	320

The pavements should be placed and compacted in layers no thicker than 200 mm with control exercised over placement moisture contents. If layer thicknesses greater than 200 mm are proposed, then it may be necessary to test the top and bottom of the layer to ensure that the minimum level of compaction has been achieved through the layer. Suggested material quality and compaction requirements are given in Table 7.

Table 7: Suggested Materials and Compaction Requirements

Layer	Material Quality	Minimum Compaction
Wearing Course	To conform to Council requirements Generally AC10/AC14 asphalt	To conform to Council requirements
Base Course	To conform to RTA3051 for DGB20 Soaked CBR $\geq 80\%$, PI $\leq 6\%$ or Council requirements	Minimum dry density ratio of 98% Modified (AS1289.5.2.1)
Sub-base Course	To conform to RTA3051 for DGS20 Soaked CBR $\geq 30\%$, PI $\leq 12\%$ or Council requirements	Minimum dry density ratio of 98% Modified (AS1289.5.2.1)
Subgrade		Minimum dry density ratio of 100% Standard (AS1289.5.1.1)

Note: PI = Plasticity Index

It is suggested that advice be sought from Council if lesser quality pavement materials are proposed. If crushed sandstone is utilised as sub base material it must be tested to comply with RTA3051 for DGS20, alternatively a structural analysis of the pavement must be undertaken by the geotechnical engineer to take in to account the lower quality subbase.

Surface and subsoil drainage should be installed and maintained to protect the pavement and subgrade. The subsoil drains should be located at a minimum of 0.6 m depth below the pavement subgrade with drains placed on the high sides of all pavements, as a minimum. Guidelines on the arrangement of subsoil drains are given on Page 20 of ARRB-SR41 (Ref 12).

8.5 Site Classification

Classification of individual lots or residential building areas within the site should comply with the requirements of AS 2870 – 2011 *"Residential Slabs and Footings"* (Ref 5). Based on the limited work for the current investigation, the undisturbed subsurface profiles at most locations are typical of Class M (moderately reactive) and Class H (highly reactive) sites. Further delineation between Class H1 and Class H2 sites would need to be made for any subsequent construction certificate issue or prior to linen release. Where there is shallow rock classifications of A or S may be appropriate.

Laboratory Shrink-swell Index tests have low to moderately high results, indicating variable shrink swell potential across the site. The current results of Atterberg limits testing are considered more representative of the soils observed in the test pits. Prior to development construction, lot classification should be clarified and specific assessments should be made for each new residential site.

Areas with filling, such as that within the existing dam walls, will be classified as Class P. However, the construction of residences is unlikely to occur on these dams, as they will be removed during subdivision construction. Similarly, placement of filling during subdivisional earthworks may alter the classification of site areas, although with appropriate consideration during design, filled lots could be maintained as Class M or Class H (1 or 2) sites (provided all earthworks are undertaken under Level 1 inspection and testing as defined in AS3798).

In addition, future coal or other mining leases that affect the site will result in the forced issuing of Class P classifications for all new lots due to the probable future effects of mine subsidence. This potentially

affects all new lots within the study area. The design of new structures on sites affected by mine subsidence will require particular structural design consideration and the assistance of the mine subsidence board to provide recommendations to designers on appropriate design parameters, such as settlement, curvature, tilt and horizontal strain. In other development areas with similar geology in terms of depths of cover to coal and seam thickness, this has required undertaking residential footing design in accordance with AS2870 and the inclusion of additional control joints. For costing comparison purposes, a structural engineer could prepare a typical design for the mine subsidence parameters specified as well as a standard H1 design for the same typical design.

Construction of larger buildings (eg schools, shopping centres) will require specific recommendations from the Mine Subsidence Board (MSB). Articulation is likely to be required, with large structures broken down into smaller elements.

Due to confidentiality requirements, DP has made these recommendations without reference to the MSB. DP understands that the effects of mine subsidence will be further considered by mine subsidence engineering consultants.

9. Further Investigations

The results of the preliminary geotechnical assessment have not identified any issue that would preclude urban development at the site. Further investigation will be required as the project progresses to rezoning. Additional work will also be required during the project's construction phase. Specific investigation would include (but not necessarily be limited to):

- Further rock depth and rippability assessment (including an earthworks methodology trial to assess plant requirements and oversize partial generation).
- Additional salinity investigations for site soils and surface waters (i.e. dams) to increase the density of the data obtained to date. The investigation programme should be increased to compliment the current study and augment the findings to a frequency of testing satisfying one test location per one to two hectares, including additional full depth profile sampling and laboratory analysis. A cost effective way of conducting the salinity assessment would be to measure site conductivity using an electro-magnetic (EM) transceiver mounted to an all-terrain vehicle (ATV or quad-bike), thus reducing the number of test pits required for the assessment. This method would also significantly increase the number of conductivity readings measured and thus provide greater coverage of the site.
- Additional testing of the site soils and surface water (and groundwater, if encountered) for aggressivity testing and to determine the effects on buried concrete and steel structures.
- Additional testing of site soils for erosion and dispersion for the detailed design and construction of future water bodies and the ability of the soils to be used as clay liners, or similar.
- Stability analysis of the banks of creek lines if development is proposed within these areas.
- Detailed geotechnical investigations on a stage-by-stage basis to determine pavement thickness designs and lot classifications, as well as stage specific issues, such as deep excavations and construction of roads, dwellings/structures on steeper landforms and crests.
- Routine inspections and earthworks monitoring during construction.
- Consultation with the Mine Subsidence Board.

10. Summary of Constraints for Site Development

Based on the results of the assessment thus far, the following summary points are noted:

- No significant evidence of hillside/slope instability was observed within the proposed development area. It is therefore considered that the potential for instability does not impose significant constraints on the proposed site development under the current masterplan. Further assessment of creek lines where rockfall is a hazard will be required if development (including foot paths) is proposed in these areas.
- Shallow rock depth is likely to be a constraint to the economic and efficient development of the site, based on reduced production rates during earthworks and the requirement for additional plant (eg large dozers, crushers etc).
- The presence of erodible soils on the site should not present significant constraints to development provided they are well managed during site preparation and earthworks.
- No significant evidence of saline soil was identified within the site. Although further salinity testing will be required, the results of the testing indicate that salinity levels are sufficiently low for this site to be considered free of significant salinity constraints.
- Although mildly aggressive soil conditions were encountered across the site, aggressivity levels are considered to be manageable, subject to appropriate design and construction considerations.
- Highly sodic and sodic soils appear widespread and will require management to reduce dispersion, erosion and to improve drainage.

The results of the land capability assessment have not identified any geotechnical issues that would preclude the urban development or rezoning of the Gilead site.

11. References

1. Geology of Wollongong-Port Hacking 1:100 000 Sheet, New South Wales Geological Survey, Sydney.
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3. McNally, G. 2005. Investigation of urban salinity – case studies from western Sydney. UrbanSalt 2005 Conference Paper, Parramatta.
4. DECC, 2008. Salinity Potential of the Hawkesbury Nepean Catchment 1:100 000 Sheet. Department of Environment and Climate Change, New South Wales.
5. Standards Australia. 2011. AS2870-2011 Residential Slabs and Footings.
6. Richards, L. A. (ed.) 1954. Diagnosis and Improvement of Saline and Alkaline Soils. USDA Handbook No. 60, Washington D.C.
7. Hazelton, P. A. and Murphy B. W. 1992. A Guide to the Interpretation of Soil Test Results. Department of Conservation and Land Management.
8. Standards Australia. 2009. AS2159-2009 Piling – Design and Installation.
9. Australian Geomechanics Society (AGS). Practice Note on Landslide Risk Management, 2007.
10. Standards Australia. 2007. AS3798-2007 Guidelines on Earthworks for Commercial and Residential Developments.

11. AUSTROADS Guide to Pavement Technology Part 2: Pavement Structural Design.
12. Australian Roads Research Board – Special Report 41, 1989. A Structural Design Guide for Residential Street Pavements.
13. Report on Preliminary Geotechnical Assessment – DP Project 76649.00, March 2015. Proposed Mount Gilead Estate Appin Road, Gilead.

12. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Mount Gilead, Appin Road, Gilead, NSW, in accordance with DP's proposal and acceptance received from Mr Will Laurantus of Lend Lease Communities Pty Ltd. The work was carried out under the terms of the contract agreement between DP and Lend Lease Communities Pty Ltd. The report is provided for the exclusive use of Lend Lease Communities Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations.

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

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

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction. The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the

knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the geotechnical components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners



Introduction

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

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

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

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

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

Groundwater

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

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;

- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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



Sampling

Sampling is carried out during drilling or test pitting 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 it to obtain 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.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally 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 samples.

Continuous Spiral Flight Augers

The borehole 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 sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low

reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud 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 the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils 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 before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:
15, 30/40 mm

Sampling Methods

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. 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 types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Symbols & Abbreviations

Douglas Partners



Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core Drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U ₅₀	Undisturbed tube sample (50mm)
W	Water sample
pp	pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General



Asphalt



Road base



Concrete



Filling

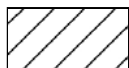
Soils



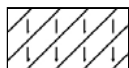
Topsoil



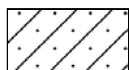
Peat



Clay



Silty clay



Sandy clay



Gravelly clay



Shaly clay



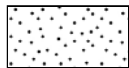
Silt



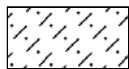
Clayey silt



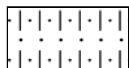
Sandy silt



Sand



Clayey sand



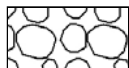
Silty sand



Gravel



Sandy gravel

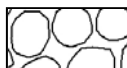


Cobbles, boulders



Talus

Sedimentary Rocks



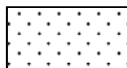
Boulder conglomerate



Conglomerate



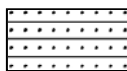
Conglomeratic sandstone



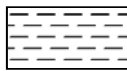
Sandstone



Siltstone



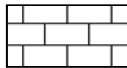
Laminite



Mudstone, claystone, shale

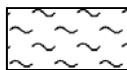


Coal

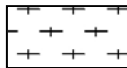


Limestone

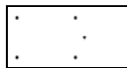
Metamorphic Rocks



Slate, phyllite, schist

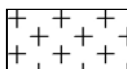


Gneiss

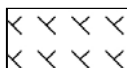


Quartzite

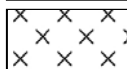
Igneous Rocks



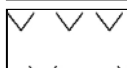
Granite



Dolerite, basalt, andesite



Dacite, epidote



Tuff, breccia



Porphyry



Description and Classification Methods

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

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 - 5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.



Rock Strength

Rock strength is defined by the Point Load Strength Index ($IS_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $IS_{(50)}$ MPa	Approx Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

* Assumes a ratio of 20:1 for UCS to $IS_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and longer sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq 100 \text{ mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

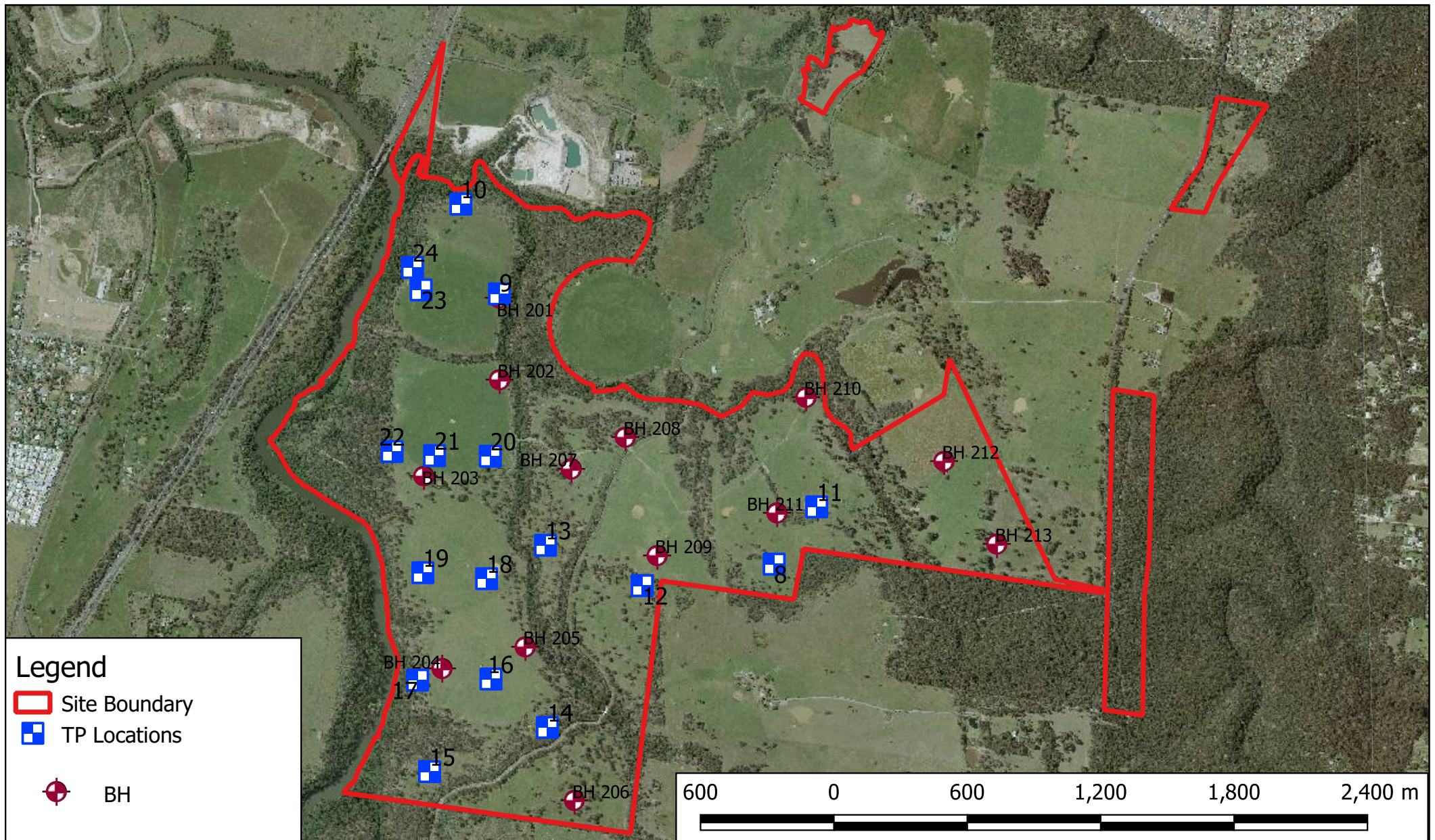
Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

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

Appendix B

Drawings 1



Douglas Partners
Geotechnics | Environment | Groundwater

TITLE: Geotechnical Investigation
Gilead Rezoning
Gilead, NSW



MGA

CLIENT: Lend Lease Communities

PROJECT No.: 76649.31

SCALE: As shown

DRAWING No: 1

OFFICE: Macarthur

DRAWN BY: B.B

DATE: 20.06.2022

REVISION: 0

Appendix C

Field Work Results – TP8 to TP25, TP101 to TP111, and BH201 to
BH215

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 163.5 mAHD **PIT No:** 8
EASTING: 294824 **PROJECT No:** 76649.00
NORTHING: 6220404 **DATE:** 10/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
	0.05	TOPSOIL - brown silty clay										
		SILTY CLAY - very stiff to hard, brown silty clay, mc<pl										
		- becoming red brown mottled grey below 0.3m										
163	0.5	SHALE - low strength, highly weathered, grey shale with trace clay bands		D	0.5							
	0.9	SANDSTONE - medium strength, moderately weathered, brown medium grained sandstone		D	1.0			1				
1	1.3	Pit discontinued at 1.3m - refusal in medium strength sandstone		D	1.3							
162												
	2							2				
161												
	3							3				
160												
	4							4				
159												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 95.3 mAHd
EASTING: 293588
NORTHING: 6221620

PIT No: 9
PROJECT No: 76649.00
DATE: 11/2/2015
SHEET 1 OF 1

[illegible]

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

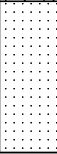


TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 86.1 mAHD
EASTING: 293415
NORTHING: 6222023

PIT No: 10
PROJECT No: 76649.00
DATE: 11/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
86.1	0.0	TOPSOIL - brown sandy clay										
	0.3	SANDSTONE - medium strength, moderately weathered, brown coarse grained sandstone		D	0.6							
	0.8	Pit discontinued at 0.8m - refusal in medium strength sandstone										
85.1	1.0											
84.1	2.0											
83.1	3.0											
82.1	4.0											

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

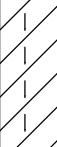
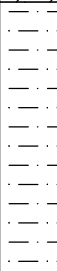
☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 163.1 mAHD **PIT No:** 11
EASTING: 295015 **PROJECT No:** 76649.00
NORTHING: 6220661 **DATE:** 10/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
163	0.1	TOPSOIL - brown silty clay							
		SILTY CLAY - very stiff, brown silty clay, mc<pl - becoming red brown below 0.2m		D,E	0.3				
				D	0.5				
0.6		SILTSTONE - high strength, slightly weathered, fragmented, grey siltstone							
				D	1.0				
1									
162									
	1.5	Pit discontinued at 1.5m - refusal in high strength siltstone		D	1.5				
2									
161									
3									
160									
4									
159									

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 143.5 mAHD **PIT No:** 12
EASTING: 294230 **PROJECT No:** 76649.00
NORTHING: 6220307 **DATE:** 10/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
143		SANDY CLAY - hard, light brown sandy clay, mc<pl										
	0.35	SANDY SILTY CLAY - hard, red brown mottled grey sandy silty clay, mc<pl		D,E	0.3							
	0.65			U _{R0}	0.5							
	0.8	SANDSTONE - high strength, moderately weathered, red brown and brown coarse grained sandstone		D	0.8							
1		Pit discontinued at 0.8m - refusal in high strength sandstone										
142												
2												
141												
3												
140												
4												
139												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 116.7 mAHD **PIT No:** 13
EASTING: 293795 **PROJECT No:** 76649.00
NORTHING: 6220489 **DATE:** 10/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
116	0.05	TOPSOIL - brown silty clay		D	0.5							
		CLAYEY SILT - dark brown clayey silt										
	0.3	SANDSTONE - extremely low strength, extremely weathered, brown coarse grained sandstone										
	0.6	SANDSTONE - high strength, moderately weathered, brown coarse grained sandstone										
115	0.7	Pit discontinued at 0.7m - refusal in high strength sandstone		D	0.7							
	1											
114	2											
113	3											
112	4											

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

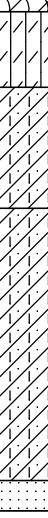
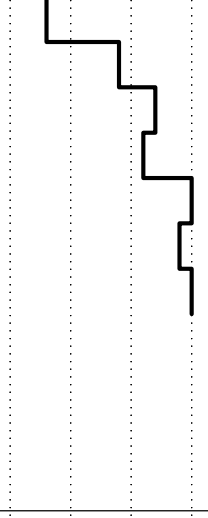
☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 123.8 mAHD **PIT No:** 14
EASTING: 293804 **PROJECT No:** 76649.00
NORTHING: 6219669 **DATE:** 11/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
123	0.05	TOPSOIL - brown silty clay with some roots							
		CLAYEY SILT - light brown clayey silt							
	0.3	SANDY SILTY CLAY - hard, red brown sandy silty clay, mc<pl		D	0.5				
	0.7	SANDY SILTY CLAY - hard, light grey mottled orange brown sandy silty clay with some ironstone bands, mc<pl		D	1.0				
122	1.6	SANDSTONE - medium strength, moderately weathered, light brown medium grained sandstone		D	1.5				
	1.7	Pit discontinued at 1.7m - refusal in medium strength sandstone		D	1.7				
121	2								
	3								
120	4								
119									

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 120.0 mAHD **PIT No:** 15
EASTING: 293274 **PROJECT No:** 76649.00
NORTHING: 6219470 **DATE:** 11/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 10mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
120	0.05	TOPSOIL - brown sandy clay										
		SANDSTONE - high strength, slightly weathered, light brown coarse grained sandstone										
	0.3	SANDSTONE - very low strength, highly weathered, red brown and brown coarse grained sandstone		D,E	0.3							
				D	0.5							
119	1			D	1.0							
	1.1	- becoming medium strength, moderately weathered below 1.0m Pit discontinued at 1.1m - refusal in medium strength sandstone										
118	2											
117	3											
116	4											

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

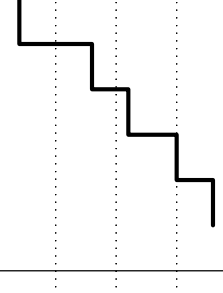
☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 117.9 mAHD **PIT No:** 16
EASTING: 293550 **PROJECT No:** 76649.00
NORTHING: 6219887 **DATE:** 10/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
				Type	Depth	Sample	Results & Comments		5	10	15	20																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
117	0.15	TOPSOIL - brown clayey silt		D,E	0.3																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	0.3	SANDY CLAY - hard, brown sandy clay with fine to coarse grained (ironstone) gravel, mc<pl																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	0.6	SILTSTONE - extremely low strength, extremely weathered, red brown and grey siltstone		D	0.5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	0.8	SHALE - low to medium strength, highly weathered, grey shale																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	0.9	SANDSTONE - high strength, moderately weathered, grey medium grained sandstone		D	0.9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
1		Pit discontinued at 0.9m - refusal in high strength sandstone																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 106.4 mAH
PIT No: 17
EASTING: 293220
PROJECT No: 76649.00
NORTHING: 6219882
DATE: 10/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
	0.2	SANDSTONE - high strength, slightly weathered, brown coarse grained sandstone		D.E	0.2							
		Pit discontinued at 0.2m - refusal in high strength sandstone										
106												
1												
105												
2												
104												
3												
103												
4												
102												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 118.4 mAHD **PIT No:** 18
EASTING: 293530 **PROJECT No:** 76649.00
NORTHING: 6220338 **DATE:** 10/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
118		SANDY CLAY - hard, light brown sandy clay, mc<pl			0.2				
				D,E	0.3				
	0.5	SILTSTONE - extremely low strength, extremely weathered, dark red brown siltstone		U ₅₀	0.5				
				D	0.6				
	0.9	SILTY CLAY - hard, red brown mottled grey silty clay, mc<pl		B					
1				D	1.0			1	
117	1.4	SANDY SILTY CLAY - hard, light grey mottled brown sandy silty clay		D	1.5				
	1.6	SHALE - low strength, moderately weathered, grey shale with some clay bands							
	1.9	SILTSTONE - low to medium strength, slightly weathered, grey siltstone with clay bands		D	2.0			2	
116	2.5	SHALE - medium strength, moderately weathered, grey shale with trace clay bands		D	2.5				
2	3.0	Pit discontinued at 3.0m - limit of investigation		D	3.0			3	
115									
4									
114									

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 113.3 mAHD **PIT No:** 19
EASTING: 293244 **PROJECT No:** 76649.00
NORTHING: 6220365 **DATE:** 10/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
113	0.1	TOPSOIL - brown clayey silt										
		SILTY CLAY - hard, red brown silty clay, mc<pl										
1		- becoming mottled grey below 0.6m		D,E	0.3							
				D	0.5							
1.2												
1.2		SANDY CLAY - very stiff, light grey mottled red brown sandy clay with iron indurated bands, mc-pl										
				D	1.5							
1.8												
2		SHALE - medium strength, highly weathered, brown shale with grey sandy clay bands										
				D	2.0							
2.5												
2.5		Pit discontinued at 2.5m - limit of investigation		D	2.5							
3												
3												
4												
4												
109												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 107.3 mAHD **PIT No:** 20
EASTING: 293547 **PROJECT No:** 76649.00
NORTHING: 6220889 **DATE:** 11/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
107	0.2	TOPSOIL - brown silty clay		D	0.5				
		SILTY CLAY - very stiff to hard, red brown silty clay, mc<pl							
	0.6	SANDY SILTY CLAY - hard, light grey mottled red brown sandy silty clay with ironstone and shale bands							
	1.2	SHALE - low to medium strength, slightly weathered, dark brown shale		D	1.0				
	1.4	Pit discontinued at 1.4m - refusal in low strength shale		D	1.4				
106									
105									
104									
103									

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 102.1 mAHD **PIT No:** 21
EASTING: 293296 **PROJECT No:** 76649.00
NORTHING: 6220892 **DATE:** 11/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
102	0.1	TOPSOIL - brown silty clay							
		SILTY CLAY - hard, red brown silty clay, mc<pl		D,E	0.3				
	0.4	SANDY CLAY - hard, light brown mottled grey silty clay, mc<pl		U _{R0}	0.5				
				D	0.6				
				B	0.7				
1				D	1.0				
		- with some sandstone bands below 1.3m		D	1.5				
2				D	2.0				
2.1		SANDSTONE - low to medium strength, moderately weathered, brown fine grained sandstone with some grey sandy clay bands							
2.5		Pit discontinued at 2.5m - refusal in low to medium strength sandstone		D	2.5				
3									
4									

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U ₁	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	≡	Water level	V	Shear vane (kPa)

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 96.4 mAHD
EASTING: 293105
NORTHING: 6220910

PIT No: 22
PROJECT No: 76649.00
DATE: 11/2/2015
SHEET 1 OF 1

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RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W _{seep}	Water seep
E	Environmental sample	W _{level}	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test (s(50) (MPa)
		PL(D)	Point load diametral test (s(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

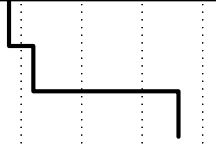
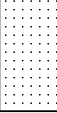


TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 87.5 mAHD
EASTING: 293236
NORTHING: 6221638

PIT No: 23
PROJECT No: 76649.00
DATE: 11/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
	0.2	FILLING - brown silty clay with trace of plastic fragments		D,E	0.2				
	0.3	TOPSOIL - brown sandy silty clay							
	0.7	SANDSTONE - medium strength, moderately weathered, light brown and red brown coarse grained sandstone		D,E	0.5				
	0.7	Pit discontinued at 0.7m - refusal in medium strength sandstone							

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 81.3 mAHD
EASTING: 293197
NORTHING: 6221738

PIT No: 24
PROJECT No: 76649.00
DATE: 11/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
81	0.3	TOPSOIL - dark brown sandy silty clay		D	0.5							
		SANDSTONE - medium strength, moderately weathered, light brown coarse grained sandstone - becoming red brown below 0.6m										
	1.0	Pit discontinued at 1.0m - refusal in medium strength sandstone		D	1.0							
80												
79												
78												
77												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 160.2 mAHD **PIT No:** 25
EASTING: 295786 **PROJECT No:** 76649.00
NORTHING: 6221132 **DATE:** 10/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
160		SILTY CLAY - brown silty clay with some roots and (sandstone) cobbles, mc<pl (topsoil)		D,E	0.5							
0.7		SILTY CLAY - brown silty clay, mc<pl										
0.8		Pit discontinued at 0.8m - limit of investigation										
1												
159												
2												
158												
3												
157												
4												
156												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

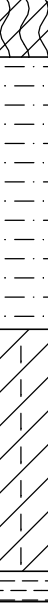
☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 119.5 mAHD **PIT No:** 101
EASTING: 294212 **PROJECT No:** 76649.00
NORTHING: 6221357 **DATE:** 9/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
119	0.2	TOPSOIL - dark brown silty clay with rootlets, mc<pl		D,E	0.1							
		SILTSTONE - extremely low strength, extremely weathered, grey and brown siltstone with some clay bands		D	0.5							
				D,E	0.6							
		- becoming low strength below 0.9m		D	1.0							
	1.1	SILTY CLAY - stiff (tactile assessment), light grey mottled light brown sandy silty clay with some ironstone and sandstone bands, mc>pl		D	1.5							
118	1.9	SHALE - medium strength, moderately weathered, grey sandy shale with iron indurations		D	2.0							
2	2.0	Pit discontinued at 2.0m - limit of investigation										
117												
3												
116												
4												
115												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 110.0 mAHD **PIT No:** 102
EASTING: 293961 **PROJECT No:** 76649.00
NORTHING: 6221382 **DATE:** 9/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
10		TOPSOIL - dark brown silty clay with some rootlets		D,E	0.1							
	0.2	SILTY CLAY - stiff to very stiff (tactile assessment), light brown mottled red brown silty clay, mc~pl		D	0.5							
				D,E	0.6							
	0.75	SANDSTONE - extremely low strength, extremely weathered, light grey and red brown medium grained sandstone with some very low strength and clay bands		D	1.0							
109	1											
	1.4	SANDSTONE - low to medium strength, moderately weathered, brown medium grained sandstone		D	1.5							
	1.5	Pit discontinued at 1.5m - refusal in low strength sandstone										
108	2											
107	3											
106	4											

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 107.5 mAHD **PIT No:** 103
EASTING: 294109 **PROJECT No:** 76649.00
NORTHING: 6221626 **DATE:** 9/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
107	0.2	TOPSOIL - brown silty clay		D,E	0.1							
		SILTY CLAY - red brown mottled grey silty clay, mc<pl										
				D	0.5							
				D,E	0.6							
	0.7	SILTY CLAY - light grey mottled red brown silty clay with trace ironstone bands, mc<pl										
1				D	1.0			1				
106	1.5	SHALE - low strength, moderately weathered, brown and grey shale with ironstone bands		D	1.5							
	1.7	Pit discontinued at 1.7m - refusal in low strength shale										
2								2				
105												
3								3				
104												
4								4				
103												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 110.3 mAH **PIT No:** 104
EASTING: 294369 **PROJECT No:** 76649.00
NORTHING: 6221815 **DATE:** 9/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
110	0.1	TOPSOIL - brown silty clay		D,E	0.1							
		SILTY CLAY - dark brown silty clay, mc~pl										
	0.3	SILTY CLAY - red brown mottled grey silty clay, mc<pl										
				D	0.5							
				D,E	0.6							
1	0.9	SHALE - low strength, highly weathered, brown and grey shale										
	1.0	Pit discontinued at 1.0m - limit of investigation		D	1.0				1			
109												
2									2			
108												
3												
107									3			
4												
106									4			

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W _{seep}	Water seep
E	Environmental sample	W _{level}	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test (s(50) (MPa)
		PL(D)	Point load diametral test (s(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

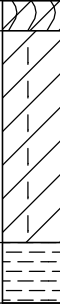


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TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 116.8 mAHD **PIT No:** 105
EASTING: 294594 **PROJECT No:** 76649.00
NORTHING: 6221844 **DATE:** 9/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
116	0.1	TOPSOIL - brown silty clay		D,E	0.1							
		SILTY CLAY - red brown silty clay, mc<pl										
				D	0.5							
				D,E	0.6							
116	0.8	SHALE - very low strength, moderately weathered, grey shale										
1	1.0	Pit discontinued at 1.0m - limit of investigation		D	1.0				1			
115	2								2			
114	3								3			
113	4								4			
112												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 116.8 mAHD **PIT No:** 106
EASTING: 294683 **PROJECT No:** 76649.00
NORTHING: 6222112 **DATE:** 9/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
116	0.1	TOPSOIL - brown silty clay		D,E	0.1							
		SILTY CLAY - dark brown silty clay, mc<pl - becoming red brown below 0.3m										
	0.6			D	0.5							
		SHALE - very low strength, moderately weathered, grey shale		D,E	0.6							
1	1.0	Pit discontinued at 1.0m - limit of investigation		D	1.0				1			
115	2								2			
114	3								3			
113	4								4			
112												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	Δ	Water seep	S	Standard penetration test
IE	Environmental sample	≡	Water level	V	Shear vane (kPa)

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 115.3 mAHD **PIT No:** 107
EASTING: 294797 **PROJECT No:** 76649.00
NORTHING: 6222301 **DATE:** 9/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
115	0.1	TOPSOIL - brown silty clay		D,E	0.1							
		SILTY CLAY - red brown mottled grey silty clay										
				D	0.5							
				D,E	0.6							
	0.8	SILTSTONE - extremely low strength, extremely weathered siltstone with some clay bands										
1				D	1.0							
1.1		SHALE - low strength, slightly weathered, grey shale										
1.3		Pit discontinued at 1.3m - limit of investigation										
2												
3												
4												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 116.5 mAHD **PIT No:** 108
EASTING: 295140 **PROJECT No:** 76649.00
NORTHING: 6222667 **DATE:** 9/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
116	0.15	TOPSOIL - light brown clayey silt		D,E	0.1							
		SILTY CLAY - hard (tactile assessment), red brown silty clay, mc<pl		D	0.5							
				D,E	0.6							
	1			D	1.0			1				
	1.5			D	1.5							
	2	- becoming brown below 1.9m		D	2.0			2				
114				D	2.5							
	3	Pit discontinued at 3.0m - limit of investigation		D	3.0			3				
113												
	4							4				
112												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 159.9 mAHD **PIT No:** 109
EASTING: 295581 **PROJECT No:** 76649.00
NORTHING: 6221284 **DATE:** 10/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
	0.02	TOPSOIL - brown silty clay										
		SANDY CLAY - very stiff to hard, brown silty clay, mc<pl										
		- becoming red brown below 0.3m										
	0.4			D	0.4							
	0.5	SANDSTONE - high strength, moderately weathered, red brown medium grained sandstone		D,E	0.5							
		Pit discontinued at 0.5m										
		- refusal in high strength sandstone										
159	1											
158	2											
157	3											
156	4											
155												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 152.1 mAHD **PIT No:** 110
EASTING: 295437 **PROJECT No:** 76649.00
NORTHING: 6221487 **DATE:** 10/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
152	0.1	TOPSOIL - brown sandy clay										
	0.3	SANDY CLAY - hard (tactile assessment), light brown sandy clay with some fine to coarse grained (ironstone) gravel										
		SANDY CLAY - very stiff to hard (tactile assessment), red brown mottled grey sandy clay with ironstone bands, mc<pl		D	0.5							
				D,E	0.6							
1	0.9											
151	1.0	SANDSTONE - high strength, moderately weathered, red brown fine grained sandstone		D	1.0							
		Pit discontinued at 1.0m - refusal in high strength sandstone										
2												
150												
3												
149												
4												
148												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

TEST PIT LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 147.8 mAHD **PIT No:** 111
EASTING: 295213 **PROJECT No:** 76649.00
NORTHING: 6221145 **DATE:** 10/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
	0.05	TOPSOIL - brown silty clay										
	0.1	SANDY CLAY - hard, light brown sandy clay, mc<pl										
	0.2	SANDSTONE - high strength, slightly weathered, red brown and light brown coarse grained sandstone Pit discontinued at 0.2m - refusal in high strength sandstone		D,E	0.2							
147	1											
146	2											
145	3											
144	4											
143												

RIG: JCB 3XC backhoe - 450mm bucket

LOGGED: MV

SURVEY DATUM: MGA94 Zone 56

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

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

BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 96.5 mAHD
EASTING: 293576
NORTHING: 6221594
DIP/AZIMUTH: 90°/--

BORE No: 201
PROJECT No: 76649.00
DATE: 20/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering						Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
			EW	HW	MW	SW	FS	FR		Ex Low	Very Low	Low	Medium	High			Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		SILTY CLAY - light brown to red brown silty clay, moist																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										

RIG: DT 100

DRILLER: LC

LOGGED: SI

CASING: HW to 0.5m

TYPE OF BORING: SFA to 0.5m, NMLC coring to 4.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

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



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BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 102.4 mAHD **BORE No:** 202
EASTING: 293580 **PROJECT No:** 76649.00
NORTHING: 6221223 **DATE:** 20/2/2015
DIP/AZIMUTH: 90°/- **SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low Very Low Low Medium High Very High Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing			
									Type	Core Rec. %	RQD %	Test Results & Comments
102 101 100 99 98	0.4	CLAY - light grey brown clay, moist						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping at 0 - 10°				
	0.9	CLAY - very stiff, red brown clay, slightly silty, moist						0.4-0.9m: clay				Scrapers pp = 450 with occasional Light Ripping
	1.4	SANDSTONE - extremely low strength, extremely weathered, light grey and red brown fine grained sandstone						1.15m: B, 0°, fe, clay	C	100	30	PL(D) = 0.5 Medium Ripping
	1.85	SANDSTONE - medium strength, highly to moderately weathered, fractured, light grey and brown medium grained sandstone						1.4m: J, 30°, pl ro, clay 1.46m: J, 30-45°, cu, ro, clay 1.52m: J, 50°, pl, ro, clay 1.65-1.85m: B(x4), 10-15°, clay co 2-5mm				PL(D) = 0.9
	2	SANDSTONE - medium strength, moderately weathered, slightly fractured and unbroken, brown medium grained sandstone						2.85m: B, 0°, clay 5mm 2.90-2.93m: clay				Heavy Ripping
99 98	3							3.07m: B, 5°, fe, clay 10mm 3.40-3.78m: Bs, 5°, fe	C	100	92	PL(D) = 0.8
	4.0	Bore discontinued at 4.0m - limit of investigation										

RIG: DT 100

DRILLER: LC

LOGGED: SI

CASING: HW to 0.4m

TYPE OF BORING: SFA to 0.4m, NMLC coring to 4.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 104.5 mAHD **BORE No:** 203
EASTING: 293240 **PROJECT No:** 76649.00
NORTHING: 6220790 **DATE:** 20/2/2015
DIP/AZIMUTH: 90°/-- **SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
	0.35	SILTY CLAY - light grey and red brown silty clay, moist																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															

RIG: Explorer **DRILLER:** JS **LOGGED:** SI **CASING:** HW to 0.35m
TYPE OF BORING: SFA to 0.35m, NMLC coring to 4.0m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

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

BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 113.7 mAHD **BORE No:** 204
EASTING: 293321 **PROJECT No:** 76649.00
NORTHING: 6219926 **DATE:** 20/2/2015
DIP/AZIMUTH: 90°/- **SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
113		SILTY CLAY - brown silty clay, moist																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						</

RIG: Scout 4 **DRILLER:** RKE **LOGGED:** SI **CASING:** HW to 1.0m
TYPE OF BORING: SFA to 1.0m, NMLC coring to 4.0m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

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

BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 122.0 mAHD **BORE No:** 205
EASTING: 293696 **PROJECT No:** 76649.00
NORTHING: 6220023 **DATE:** 20/2/2015
DIP/AZIMUTH: 90°/- **SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low Very Low Low Medium High Very High Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing			
									Type	Core Rec. %	RQD %	Test Results & Comments
122		SILTY CLAY - light grey brown to red brown silty clay, damp										
								Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping at 0 - 10°	A			Scrapper
121	1.0 1.08	CLAY - hard, light grey and red brown clay, slightly silty, moist						1m: CORE LOSS: 80mm 1.05-2.08m: clay				pp >600
120	2.08	SANDSTONE - very low strength, highly weathered, light grey brown fine grained sandstone										with Light Ripping
	2.3	SANDSTONE - high then medium strength, slightly weathered then fresh, slightly fractured, light grey and brown medium grained sandstone						2.3m: B, 5°, fe, clay 2.37m: B, 15°, pl, ro, clay vn 2.54m: B, 0°, fe, clay 10mm	C	97	55	PL(D) = 1.3 Medium Ripping
119	3							2.9&3.08m: Bx, 10-15°, clay vn, ti				Heavy PL(D) = 0.7 Ripping
118	4.0	Bore discontinued at 4.0m - limit of investigation										

RIG: Scout 4 **DRILLER:** RKE **LOGGED:** SI **CASING:** HW to 1.0m
TYPE OF BORING: SFA to 1.0m, NMLC coring to 4.0m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

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

BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 140.9 mAHD **BORE No:** 206
EASTING: 293917 **PROJECT No:** 76649.00
NORTHING: 6219330 **DATE:** 20/2/2015
DIP/AZIMUTH: 90°/- **SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing			
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
140 <																					

RIG: DT 100 **DRILLER:** LC **LOGGED:** SI **CASING:** HW to 1.0m
TYPE OF BORING: SFA to 1.0m, NMLC coring to 4.0m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

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

BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 113.0 mAHD **BORE No:** 207
EASTING: 293903 **PROJECT No:** 76649.00
NORTHING: 6220824 **DATE:** 19/2/2015
DIP/AZIMUTH: 90°/- **SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low Very Low Low Medium High Very High Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing			
									Type	Core Rec. %	RQD %	Test Results & Comments
113		SILTY CLAY - brown silty clay, moist										<i>Scraper</i>
112	1.0	SHALE - extremely low strength, extremely weathered, light grey brown shale						1.0-1.35m: clay				pp = 600
	1.45	LAMINITE - high and medium strength, moderately weathered, fractured and slightly fractured, grey brown laminite with approximately 40% siltstone and 60% fine grained sandstone						1.55&1.75m: B, 5°, clay 30mm 1.83m: J, 30° & 70°, st-ro, clay 1.96-2.25m: B(x4), 5°, clay 5-10mm				PL(D) = 2.2 <i>Medium Ripping</i>
111	2							2.35&2.45m: Bs, 5°, fe, clay 20mm 2.67m: J, 70°, pl, ro, cln 2.72m: B, 0°, fe, clay 10mm	C	100	60	PL(D) = 0.4
110	3.0	SANDSTONE - high strength, slightly weathered, slightly fractured, light grey brown medium to coarse grained sandstone						3m: B, 60°, clay 10mm 3.17m: J, 30°, pl, ro, clay 25mm 3.55m: B, 0°, cbs co				<i>Heavy Ripping</i>
109	4.0	Bore discontinued at 4.0m - limit of investigation										

RIG: Scout 4

DRILLER: RKE

LOGGED: SI

CASING: HW to 1.0m

TYPE OF BORING: SFA to 1.0m, NMLC coring to 4.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 121.6 mAHD **BORE No:** 208
EASTING: 294147 **PROJECT No:** 76649.00
NORTHING: 6220966 **DATE:** 20/2/2015
DIP/AZIMUTH: 90°/- **SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low			Medium	High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type
121 1 120 2 2.4 119 3 118 4 117		CLAY - very stiff, red brown clay, damp																			
	0.45	CLAY - hard, red brown clay with trace (ironstone) gravel, moist																			Scraper pp >600
	1.0	SHALE - extremely then very low strength, light grey and brown shale															C	100	10		with Light Ripping
		- with some low strength bands from 1.9m																			PL(D) = 0.5
	2.4	SANDSTONE - high strength, moderately then slightly weathered, slightly fractured, light grey to grey and brown fine grained sandstone with some carbonaceous laminations																			Medium Ripping pp >600 PL(D) = 1.8
		- with medium strength laminations from 3.15 - 3.35m																			Medium to Heavy Ripping
															</						

RIG: DT 100 **DRILLER:** LC **LOGGED:** SI **CASING:** HW to 0.45m
TYPE OF BORING: SFA to 0.45m, NMLC coring to 4.0m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

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

BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 153.2 mAHD **BORE No:** 209
EASTING: 294289 **PROJECT No:** 76649.00
NORTHING: 6220433 **DATE:** 19/2/2015
DIP/AZIMUTH: 90°/- **SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing			
									Type	Core Rec. %	RQD %	Test Results & Comments
153	0.4	SILTY CLAY - red brown silty clay, moist										
		SHALY CLAY - hard, light brown to red brown shaly clay, moist						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping at 0 - 10°				
1	1.0	SHAPE - very low strength, highly weathered, fragmented, grey brown shale						1m: CORE LOSS: 200mm	C	94	35	Scrapper
	1.2							1.2-1.42m: fg				
	1.4	SHAPE - low to medium and medium strength, slightly weathered, fractured to slightly fractured, grey brown shale						1.52m: J, 30°, pl, ro, cln				PL(D) = 0.3
								1.66m: J, 40°, pl, ro, clay				
								1.8m: J, 45°, pl, ro, cln				
								1.88m: J, 50°, pl, ro, cln				
2								2.12m: B, 0°, clay				Medium
								2.25&2.32m: Js, 35-60°, pl, ro, cln				
								2.62m: B, 0°, clay 10mm				PL(D) = 0.5
3								3.05&3.1m: J, 35° & 50°, pl, ro, cln				Ripping
								3.20&3.25m: B, 0°, clay 5-10mm				
								3.42m: J, 40°, pl, sm, cln				
								3.75-3.95m: fg				PL(D) = 0.3
4	4.0	Bore discontinued at 4.0m - limit of investigation										

RIG: Scout 4

DRILLER: RKE

LOGGED: SI

CASING: HW to 1.0m

TYPE OF BORING: SFA to 1.0m, NMLC coring to 4.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 137.5 mAHD **BORE No:** 210
EASTING: 294959 **PROJECT No:** 76649.00
NORTHING: 6221145 **DATE:** 20/2/2015
DIP/AZIMUTH: 90°/- **SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing						
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
137	0.6	SILTY CLAY - light grey brown silty clay, moist							—	—	—	—	—	—								Scrapper		
		SANDSTONE - high strength, moderately then slightly weathered, slightly fractured and unbroken, light grey brown medium to coarse grained sandstone																			PL(D) = 1.3			
1																							Heavy Ripping	
136																								PL(D) = 1.2
2																								
135																					PL(D) = 1.3			
3																						PL(D) = 1.5		
134																								
4	4.0	Bore discontinued at 4.0m - limit of investigation																						
133																								

RIG: DT 100

DRILLER: LC

LOGGED: SI

CASING: HW to 0.6m

TYPE OF BORING: SFA to 0.6m, NMLC coring to 4.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 157.5 mAHD **BORE No:** 211
EASTING: 294829 **PROJECT No:** 76649.00
NORTHING: 6220625 **DATE:** 20/2/2015
DIP/AZIMUTH: 90°/- **SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low Very Low Low Medium High Very High Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing			
									Type	Core Rec. %	RQD %	Test Results & Comments
		CLAY - red brown clay, moist										
157	0.4	CLAY - hard, red brown clay with some (ironstone) gravel, moist						0.4-1.0m: clay				Scrapers pp = 500
1	1.0	SANDSTONE - extremely low strength, extremely weathered, light grey fine grained sandstone (possibly very stiff sandy clay)						1.1m: CORE LOSS: 50mm	C	97	0	pp = 350
156	1.15											
	1.5	SANDSTONE - alternate bands of extremely low and medium strength, slightly and highly weathered, fractured, light grey brown fine grained sandstone						1.5-2.2m: Bs, 0-5°, fe, clay 10-40mm				Light to Medium Ripping PL(D) = 0.9
2												
	2.5	SANDSTONE - high strength, moderately weathered, slightly fractured, brown medium to coarse grained sandstone						2.28m: J, 70° & 60°, st, ro, cln 2.47-2.5m: clay				PL(D) = 1.4
3												
154								3.15m: B, 5°, fe	C	100	97	Heavy Ripping
								3.6m: B, 10°, fe, clay 10mm				PL(D) = 1.9
4	4.0	Bore discontinued at 4.0m - limit of investigation										
153												

RIG: DT 100

DRILLER: LC

LOGGED: SI

CASING: HW to 0.6m

TYPE OF BORING: SFA to 0.6m, NMLC coring to 4.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 173.8 mAHD **BORE No:** 212
EASTING: 295580 **PROJECT No:** 76649.00
NORTHING: 6220857 **DATE:** 19/2/2015
DIP/AZIMUTH: 90°/- **SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering						Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
			EW	HW	MW	SW	FS	FR		Ex Low	Very Low	Low	Medium	High		Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
173		SILTY CLAY - brown to red brown silty clay, moist																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	

RIG: Scout 4 **DRILLER:** RKE **LOGGED:** SI **CASING:** HW to 1.0m
TYPE OF BORING: SFA to 1.0m, NMLC coring to 4.05m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

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

BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 183.9 mAHD **BORE No:** 213
EASTING: 295818 **PROJECT No:** 76649.00
NORTHING: 6220485 **DATE:** 19/2/2015
DIP/AZIMUTH: 90°/- **SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low Very Low Low Medium High Very High Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing			
									Type	Core Rec. %	RQD %	Test Results & Comments
183	1.0	SILTY CLAY - brown silty clay with trace (ironstone) gravel, damp										
182	1.1	CLAY - very stiff, light grey and red brown clay, moist										
181	1.6	LAMINITE - medium and medium to high strength, highly to moderately then moderately weathered, fragmented to fractured then slightly fractured, grey brown laminite with approximately 60% sandstone and 40% siltstone										
180	3.45	SHALE - medium strength, moderately weathered, slightly fractured, grey brown shale										
179	4.0	Bore discontinued at 4.0m - limit of investigation										

RIG: Scout 4 **DRILLER:** RKE **LOGGED:** SI **CASING:** HW to 1.0m
TYPE OF BORING: SFA to 1.0m, NMLC coring to 4.0m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

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

BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

SURFACE LEVEL: 117.7 mAHD **BORE No:** 214
EASTING: 295011 **PROJECT No:** 76649.00
NORTHING: 6222395 **DATE:** 19/2/2015
DIP/AZIMUTH: 90°/-- **SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering					Graphic Log	Rock Strength					Water	Fracture Spacing (m)	Discontinuities		Sampling & In Situ Testing				
			EW	HW	MW	SW	FS		FR	Ex Low	Very Low	Low	Medium			High	Very High	Ex High	B - Bedding S - Shear	J - Joint F - Fault	Type	Core Rec. %
117	0.8	SILTY CLAY - light brown to red brown silty clay, moist															Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping at 0 - 10°	A				
1		SILTY CLAY - very stiff to hard, red brown silty clay, moist																				
116	2																1.0-1.73m: clay	C	96	0	Scrapers pp >600 pp = 250 pp = 260	
2																						
115																						
2.73																						
2.82	3	SHALE - extremely low strength, extremely weathered, light grey shale															2.73m: CORE LOSS: 90mm					
3.18		SHALE - medium strength, slightly weathered, fragmented to fractured, grey brown shale with some clay bands															3.1m: CORE LOSS: 80mm 3.18-3.45m: fg					
114	4																3.6-3.65m: clay	C	95	0	PL(D) = 0.8	
4																	3.82-3.90m: clay					
																	4.13m: J, 30°, pl, sm, cln				Medium Ripping	
																	4.3-4.32m: clay					PL(D) = 0.4
113	4.5	Bore discontinued at 4.5m - limit of investigation																				

RIG: Scout 4 **DRILLER:** RKE **LOGGED:** SI **CASING:** HW to 1.0m
TYPE OF BORING: SFA to 1.0m, NMLC coring to 4.5m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

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

BOREHOLE LOG

CLIENT: Lend Lease Communities Pty Ltd
PROJECT: Prelim Geotech & Contamination Assessments
LOCATION: Appin Road, Gilead

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

BORE No: 215
PROJECT No: 76649.00
DATE: 20/2/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering				Graphic Log	Rock Strength					Water	Fracture Spacing (m)				Discontinuities		Sampling & In Situ Testing											
			EW	HW	MW	SW		FS	FR	Ex Low	Very Low	Low		Medium	High	Very High	Ex High	0.01	0.05	0.10	0.50	1.00	B - Bedding S - Shear		J - Joint F - Fault		Type	Core Rec. %	RQD %	Test Results & Comments	
		SILTY CLAY - light brown to red brown silty clay, moist																													
	0.4	SILTY CLAY - hard, light brown to red brown silty clay with (ironstone) gravel, damp																													
	1																														pp >600
	1.1	SANDSTONE - extremely low strength, extremely weathered, light grey brown fine grained sandstone (hard clay)																													Scrapers
	1.7	SANDSTONE - high strength, moderately weathered, slightly fractured and unbroken, brown medium to coarse grained sandstone																													PL(D) = 2.3
	2																														Very
	3																														PL(D) = 1.8
																															Heavy
	4																														
	4.0	Bore discontinued at 4.0m - limit of investigation																													

RIG: DT 100

DRILLER: LC

LOGGED: SI

CASING: HW to 0.4m

TYPE OF BORING: SFA to 0.4m, NMLC coring to 4.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

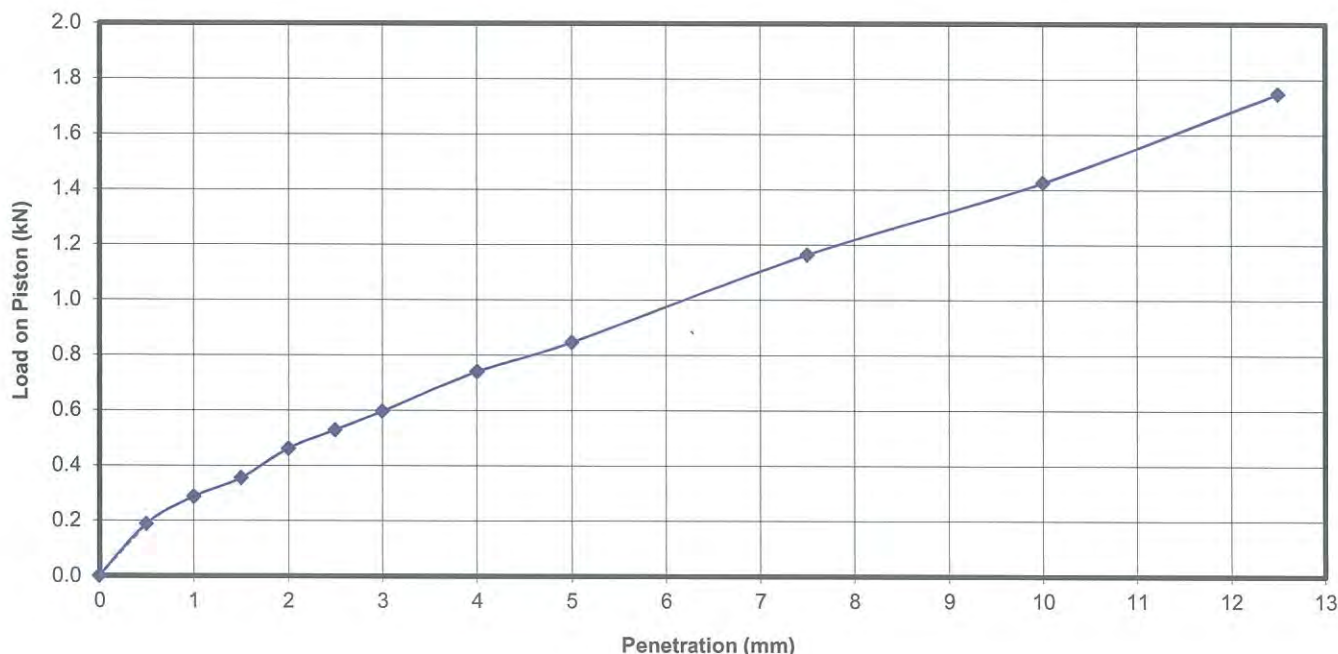
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample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

Appendix D

Laboratory Test Results - Geotechnical

Results of California Bearing Ratio Test

Client :	Lend Lease Communities Pty Ltd	Project No. :	76649.00
Project :	Prelim Geotech and Contamination Assessments	Report No. :	MA15-080
Location :	Mount Gilead Estate, Appin Road, GILEAD	Report Date :	24/02/2015
Test Location :	TP1	Date Sampled :	11/02/2015
Depth / Layer :	0.5 - 0.6m	Date of Test:	13/02/2015
		Page:	1 of 1



Description: SILTY CLAY - Red brown silty clay

Sampling Method(s): Sampled By DP Engineering

Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Remarks:

LEVEL OF COMPACTION: 100% of STD MDD
MOISTURE RATIO: 98% of STD OMC

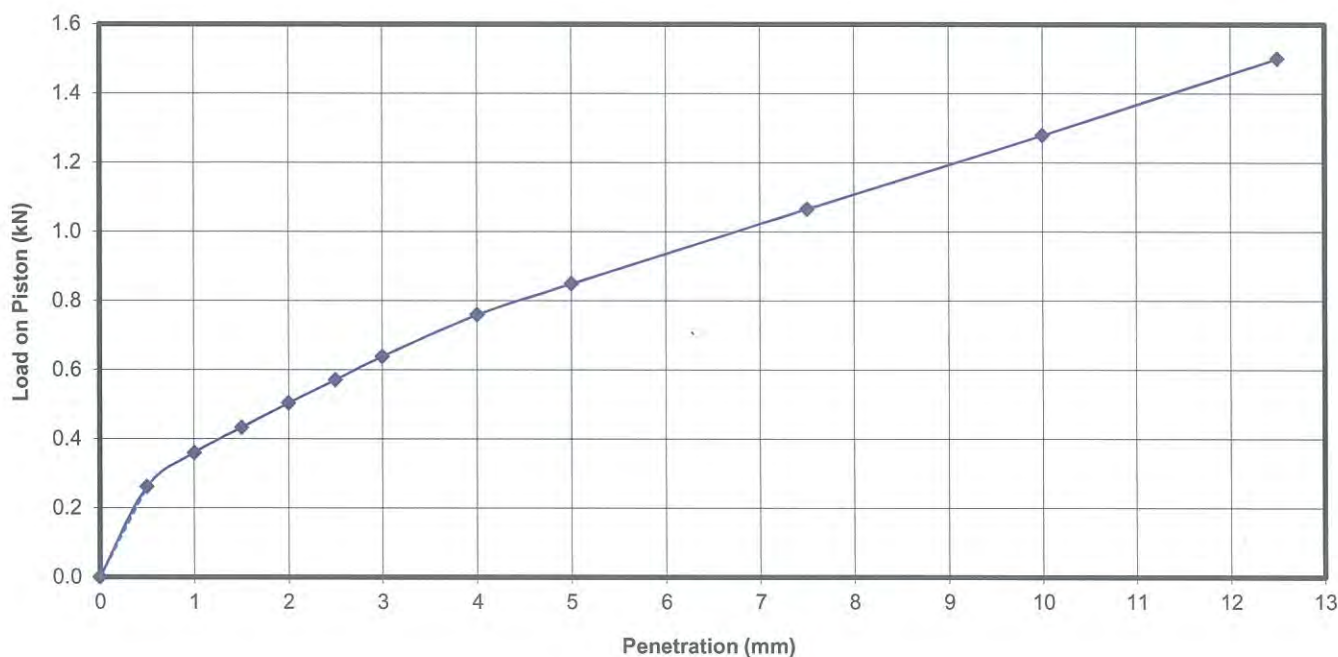
Percentage > 19mm: 0.0%
SURCHARGE: 4.5 kg
SWELL: 0.9%
SOAKING PERIOD: 4 days

CONDITION	MOISTURE CONTENT %	DRY DENSITY t/m ³
At compaction	20.4	1.65
After soaking	23.9	1.64
After test	Top 30mm of sample	25.4
	Remainder of sample	23.0
Field values	14.6	-
Standard Compaction (OMC/MDD)	20.7	1.66

RESULTS		
TYPE	PENETRATION	CBR (%)
TOP	5.0mm	4.5

Results of California Bearing Ratio Test

Client :	Lend Lease Communities Pty Ltd	Project No. :	76649.00
Project :	Prelim Geotech and Contamination Assessments	Report No. :	MA15-081
Location :	Mount Gilead Estate, Appin Road, GILEAD	Report Date :	24/02/2015
Test Location :	TP4	Date Sampled :	11/02/2015
Depth / Layer :	0.5 - 0.6m	Date of Test:	13/02/2015
		Page:	1 of 1



Description: SILTY CLAY - Red brown mottled grey silty clay

Sampling Method(s): Sampled By DP Engineering

Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Remarks:

LEVEL OF COMPACTION: 101% of STD MDD
MOISTURE RATIO: 100% of STD OMC

SURCHARGE: 4.5 kg
SOAKING PERIOD: 4 days

Percentage > 19mm: 0.0%

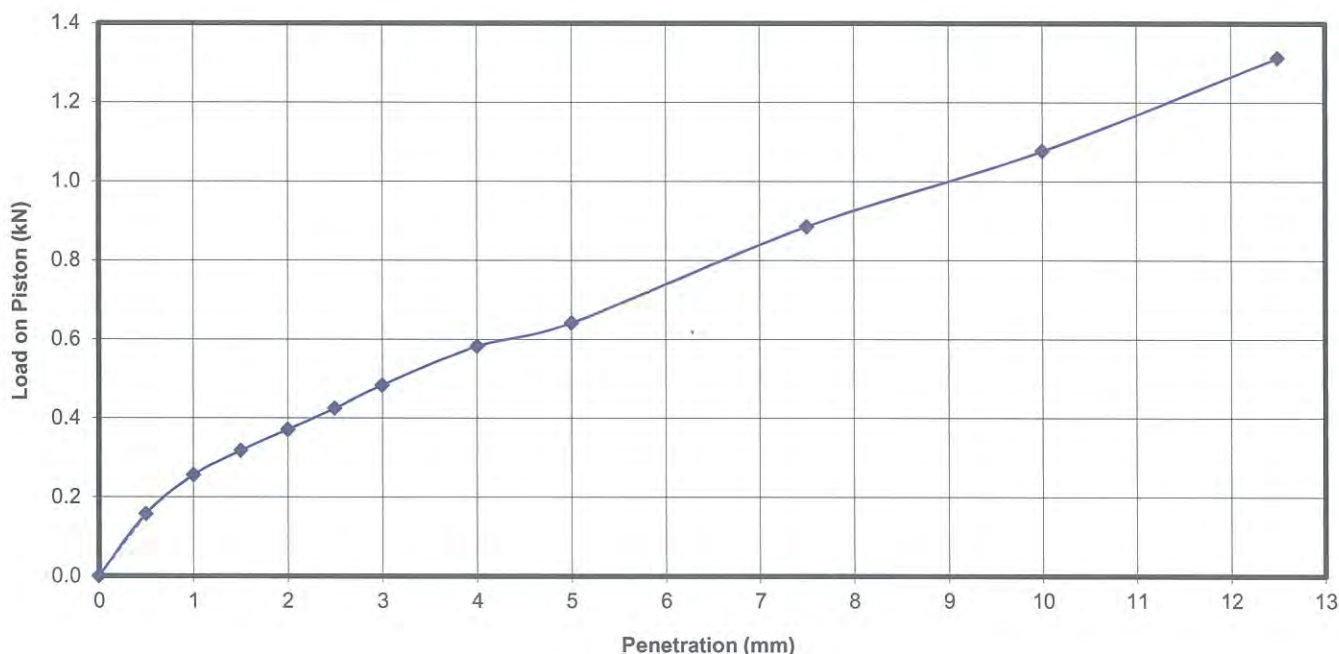
SWELL: 0.2%

CONDITION	MOISTURE CONTENT %	DRY DENSITY t/m ³
At compaction	23.5	1.59
After soaking	26.5	1.59
After test	28.2	-
Top 30mm of sample	26.2	-
Remainder of sample	20.8	-
Field values	23.5	1.58
Standard Compaction (OMC/MDD)		

RESULTS		
TYPE	PENETRATION	CBR (%)
TOP	5.0mm	4.5

Results of California Bearing Ratio Test

Client :	Lend Lease Communities Pty Ltd	Project No. :	76649.00
Project :	Prelim Geotech and Contamination Assessments	Report No. :	MA15-082
Location :	Mount Gilead Estate, Appin Road, GILEAD	Report Date :	24/02/2015
Test Location :	TP12	Date Sampled :	11/02/2015
Depth / Layer :	0.5 - 0.6m	Date of Test:	13/02/2015
		Page:	1 of 1



Description: SILTY SANDY CLAY - Red brown mottled grey silty sandy clay

Sampling Method(s): Sampled By DP Engineering

Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Remarks:

LEVEL OF COMPACTION: 100% of STD MDD
MOISTURE RATIO: 100% of STD OMC

SURCHARGE: 4.5 kg
SOAKING PERIOD: 4 days

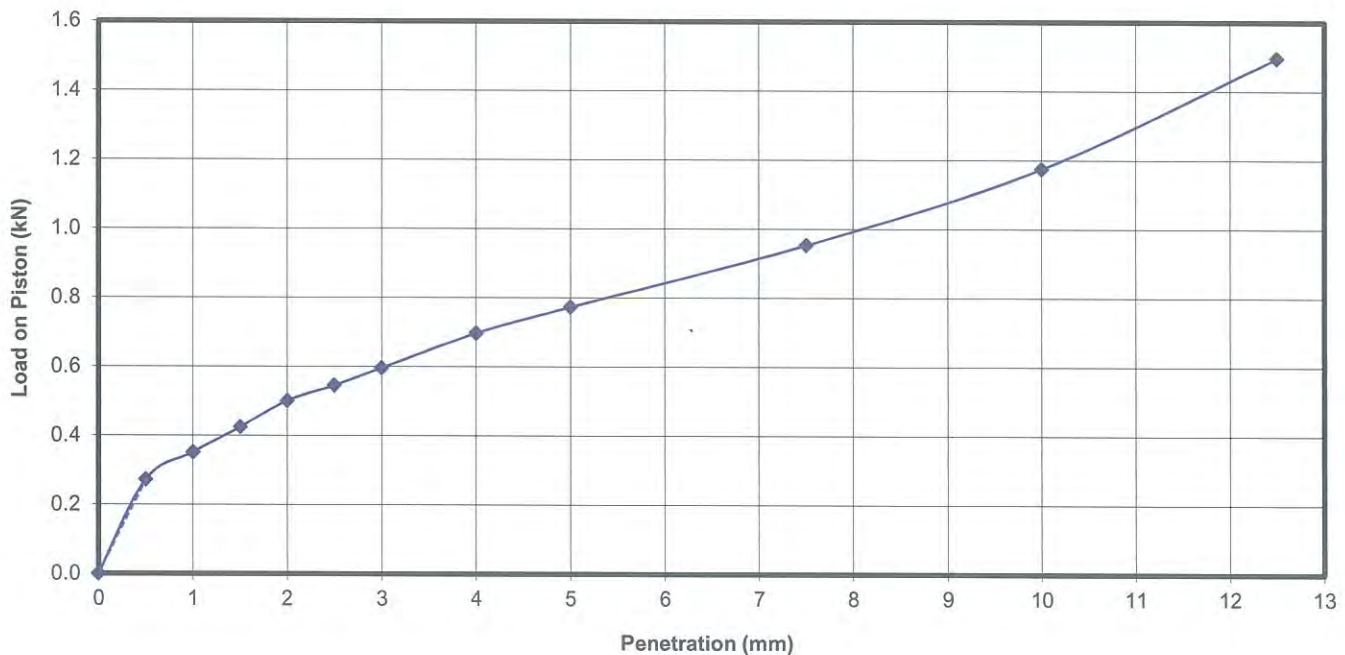
Percentage > 19mm: 0.0%
SWELL: 1.4%

CONDITION	MOISTURE CONTENT %	DRY DENSITY t/m ³
At compaction	21.5	1.66
After soaking	24.5	1.64
After test	23.5	-
Top 30mm of sample	22.4	-
Remainder of sample	18.5	-
Field values	21.5	1.66
Standard Compaction (OMC/MDD)		

RESULTS		
TYPE	PENETRATION	CBR (%)
TOP	5.0mm	3.0

Results of California Bearing Ratio Test

Client :	Lend Lease Communities Pty Ltd	Project No. :	76649.00
Project :	Prelim Geotech and Contamination Assessments	Report No. :	MA15-083
Location :	Mount Gilead Estate, Appin Road, GILEAD	Report Date :	24/02/2015
Test Location :	TP21	Date Sampled :	11/02/2015
Depth / Layer :	0.5 - 0.6m	Date of Test:	13/02/2015
		Page:	1 of 1



Description: SANDY CLAY - Light brown mottled grey sandy clay

Sampling Method(s): Sampled By DP Engineering

Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Remarks:

LEVEL OF COMPACTION: 100% of STD MDD
MOISTURE RATIO: 100% of STD OMC

SURCHARGE: 4.5 kg
SOAKING PERIOD: 4 days

Percentage > 19mm: 0.0%

SWELL: 1.2%

CONDITION	MOISTURE CONTENT %	DRY DENSITY t/m ³
At compaction	19.0	1.68
After soaking	20.8	1.66
After test	21.0	-
Top 30mm of sample	20.0	-
Remainder of sample	17.0	-
Field values	19.0	1.68
Standard Compaction (OMC/MDD)		

RESULTS		
TYPE	PENETRATION	CBR (%)
TOP	5.0mm	4.0

Result of Shrink-Swell Index Determination

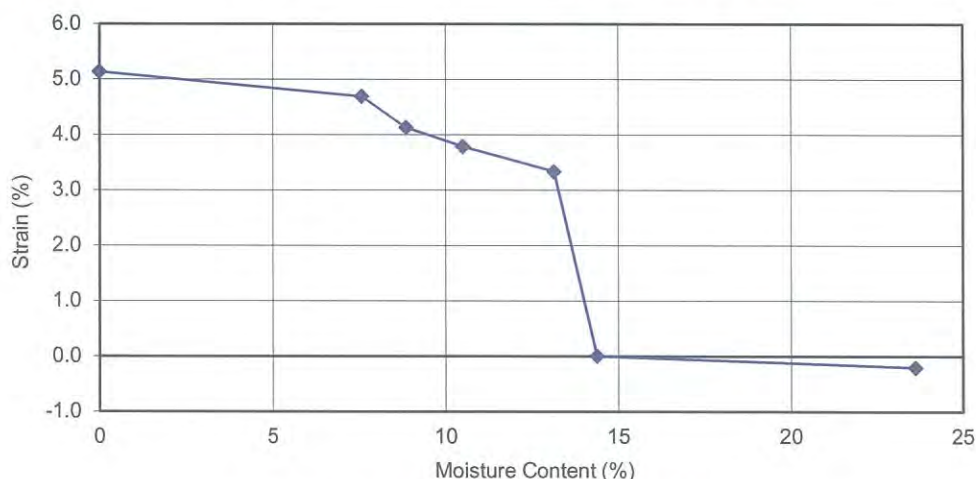
Client :	Lend Lease Communities Pty Ltd	Project No. :	76649.00
Project :	Prelim Geotech and Contamination Assessments	Report No. :	MA15-084
Location :	Mount Gilead Estate, Appin Road, GILEAD	Report Date :	19/02/2015
Test Location :	TP1	Date Sampled :	11/02/2015
Depth / Layer :	0.5 - 0.85m	Date of Test:	13/02/2015
		Page:	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	4.7 %
Shrinkage - oven dried	5.1 %
Significant inert inclusions	%
Extent of cracking	SC
Extent of soil crumbling	%
Moisture content of core	14.4 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	600 kPa
Pocket penetrometer reading at final moisture content	300 kPa
Initial Moisture Content	12.5 %
Final Moisture Content	23.6 %
Swell under 25kPa	0.2 %



SHRINK-SWELL INDEX I_{ss} 2.9% per ΔpF

Description:	SILTY CLAY - Red brown mottled light grey silty clay	
Test Method(s):	AS 1289.7.1.1, AS 1289.2.1.1	
Sampling Method(s):	Sampled by Macarthur Engineering Department	
Extent of Cracking:	UC - Uncracked SC - Slightly cracked MC - Moderately cracked	HC - Highly cracked FR - Fractured

Remarks:

Note that NATA accreditation does not cover the performance of pocket penetrometer readings



NATA Accredited Laboratory Number: 828

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025

Tested:	HD
Checked:	AJS


 A J Sweetland
 Laboratory Manager

Result of Shrink-Swell Index Determination

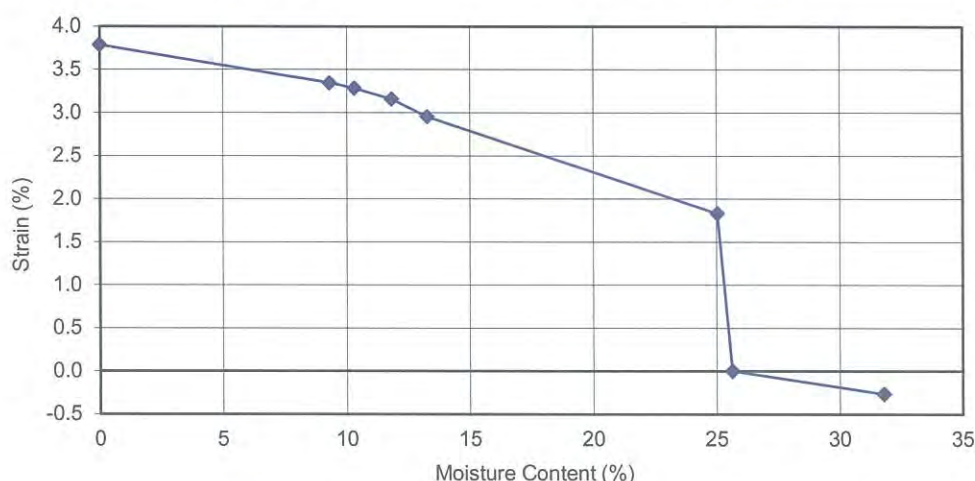
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Project :	Prelim Geotech and Contamination Assessments	Report No. :	MA15-085
Location :	Mount Gilead Estate, Appin Road, GILEAD	Report Date :	19/02/2015
Test Location :	TP4	Date Sampled :	11/02/2015
Depth / Layer :	0.3 - 0.65m	Date of Test:	13/02/2015
		Page:	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	3.3 %
Shrinkage - oven dried	3.8 %
Significant inert inclusions	%
Extent of cracking	SC
Extent of soil crumbling	%
Moisture content of core	25.6 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	550 kPa
Pocket penetrometer reading at final moisture content	250 kPa
Initial Moisture Content	27.4 %
Final Moisture Content	31.8 %
Swell under 25kPa	0.3 %



SHRINK-SWELL INDEX I_{ss} 2.2% per ΔpF

Description:	SILTY CLAY - Red brown mottled grey silty clay
Test Method(s):	AS 1289.7.1.1, AS 1289.2.1.1
Sampling Method(s):	Sampled by Macarthur Engineering Department
Extent of Cracking:	UC - Uncracked SC - Slightly cracked MC - Moderately cracked HC - Highly cracked FR - Fractured

Remarks:

Note that NATA accreditation does not cover the performance of pocket penetrometer readings



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Accredited for compliance with ISO/IEC 17025

Tested:	HD
Checked:	AJS

A J Sweetland
Laboratory Manager

Result of Shrink-Swell Index Determination

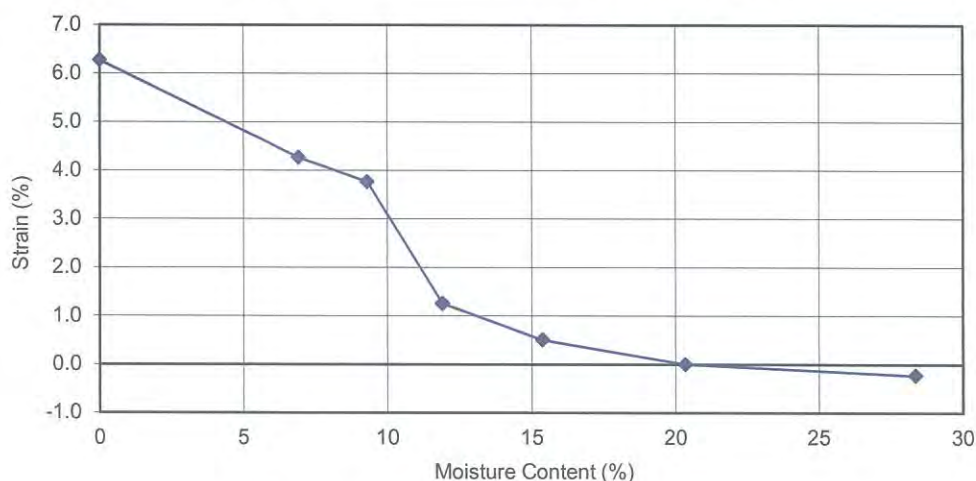
Client :	Lend Lease Communities Pty Ltd	Project No. :	76649.00
Project :	Prelim Geotech and Contamination Assessments	Report No. :	MA15-086
Location :	Mount Gilead Estate, Appin Road, GILEAD	Report Date :	19/02/2015
Test Location :	TP12	Date Sampled :	11/02/2015
Depth / Layer :	0.3 - 0.7m	Date of Test:	13/02/2015
		Page:	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	4.3 %
Shrinkage - oven dried	6.3 %
Significant inert inclusions	%
Extent of cracking	SC
Extent of soil crumbling	%
Moisture content of core	20.3 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	600 kPa
Pocket penetrometer reading at final moisture content	150 kPa
Initial Moisture Content	19.8 %
Final Moisture Content	28.4 %
Swell under 25kPa	0.2 %



SHRINK-SWELL INDEX I_{ss} 3.5% per ΔpF

Description:	SILTY SANDY CLAY - Red brown mottled grey silty sandy clay
Test Method(s):	AS 1289.7.1.1, AS 1289.2.1.1
Sampling Method(s):	Sampled by Macarthur Engineering Department
Extent of Cracking:	UC - Uncracked SC - Slightly cracked MC - Moderately cracked HC - Highly cracked FR - Fractured

Remarks:

Note that NATA accreditation does not cover the performance of pocket penetrometer readings



NATA Accredited Laboratory Number: 828

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 Accredited for compliance with ISO/IEC 17025

Tested:	HD
Checked:	AJS


 A J Sweetland
 Laboratory Manager

Result of Shrink-Swell Index Determination

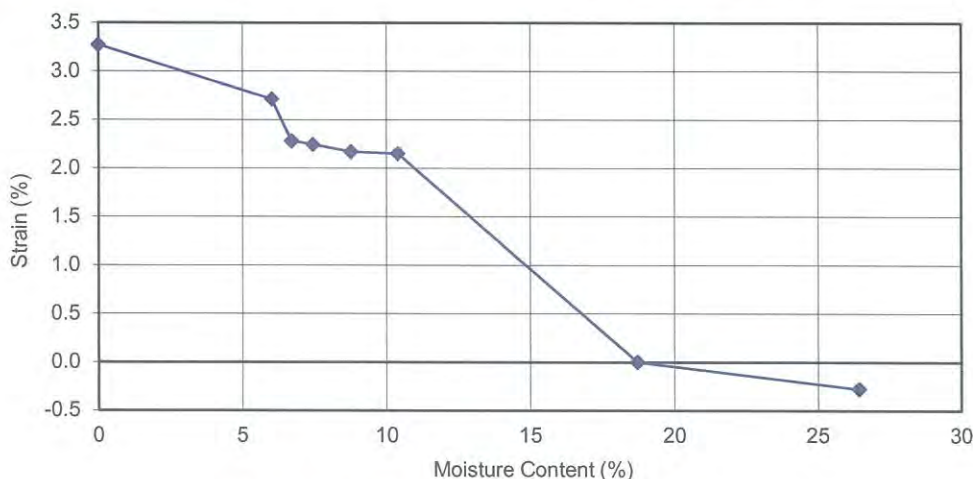
Client :	Lend Lease Communities Pty Ltd	Project No. :	76649.00
Project :	Prelim Geotech and Contamination Assessments	Report No. :	MA15-087
Location :	Mount Gilead Estate, Appin Road, GILEAD	Report Date :	24/02/2015
Test Location :	TP21	Date Sampled :	11/02/2015
Depth / Layer :	0.5 - 0.6m	Date of Test:	13/02/2015
		Page:	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	2.7 %
Shrinkage - oven dried	3.3 %
Significant inert inclusions	%
Extent of cracking	SC
Extent of soil crumbling	%
Moisture content of core	18.7 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	325 kPa
Pocket penetrometer reading at final moisture content	250 kPa
Initial Moisture Content	18.8 %
Final Moisture Content	26.4 %
Swell under 25kPa	0.3 %



SHRINK-SWELL INDEX I_{ss} 1.9% per ΔpF

Description:	SANDY CLAY - Light brown mottled grey sandy clay
Test Method(s):	AS 1289.7.1.1, AS 1289.2.1.1
Sampling Method(s):	Sampled by Macarthur Engineering Department
Extent of Cracking:	UC - Uncracked SC - Slightly cracked MC - Moderately cracked HC - Highly cracked FR - Fractured

Remarks:

Note that NATA accreditation does not cover the performance of pocket penetrometer readings



NATA Accredited Laboratory Number: 828

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 Accredited for compliance with ISO/IEC 17025

Tested:	HD
Checked:	AJS



A J Sweetland
 Laboratory Manager

Results of Moisture Content, Plasticity and Linear Shrinkage Tests

Client: Lend Lease Communities Pty Ltd		Project No: 76649.00	
Project: Prelim Geotech and Contamination Assessments		Report No: MA15-089	
Location: Mount Gilead Estate, Appin Road, GILEAD		Report Date: 17/02/2015	
		Date Sampled: 11/02/2015	
		Date of Test: 16/02/2015	
		Page: 1 of 1	

Test Location	Depth (m)	Description	Code	W _F %	W _L %	W _P %	PI %	*LS %
TP14	1.0	SILTY CLAY - Light grey mottled red brown silty clay with some ironstone bands	2,5	14.6	51	23	28	-
TP20	1.0	SILTY/SANDY CLAY - Light grey mottled red brown silty/sandy clay with ironstone and shale bands	3	13.3	-	-	-	-
TP21	1.0	SANDY CLAY - Light brown mottled grey sandy clay	2,5	17.7	47	23	24	-

Legend:

W_F Field Moisture Content
 W_L Liquid limit
 W_P Plastic limit
 PI Plasticity index
 LS Linear shrinkage from liquid limit condition

Test Methods:

Moisture Content: AS 1289 2.1.1
 Liquid Limit: AS 1289 3.1.2
 Plastic Limit: AS 1289 3.2.1
 Plasticity Index: AS 1289 3.3.1
 Linear Shrinkage: AS 1289 3.4.1

Code:

Sample history for plasticity tests

1. Air dried
2. Low temperature (<50°C) oven dried
3. Oven (105°C) dried
4. Unknown

Method of preparation for plasticity tests

5. Dry sieved
6. Wet sieved
7. Natural

*Specify if sample crumbled CR or curled CU

Sampling Methods: AS 1289.1.2.1, AS 1289.1.1

Remarks:



NATA Accredited Laboratory Number: 828

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025

Tested: AS
 Checked: AJJ


 A J Sweetland
 Laboratory Manager

Results of Moisture Content, Plasticity and Linear Shrinkage Tests

Client: Lend Lease Communities Pty Ltd		Project No: 76649.00	
Project: Prelim Geotech and Contamination Assessments		Report No: MA15-088	
Location: Mount Gilead Estate, Appin Road, GILEAD		Report Date: 17/02/2015	
		Date Sampled: 11/02/2015	
		Date of Test: 16/02/2015	
		Page: 1 of 1	

Test Location	Depth (m)	Description	Code	W _F %	W _L %	W _P %	PI %	*LS %
TP1	0.5	SILTY CLAY - Red silty clay	2,5	14.5	48	25	23	-
TP2	0.5	SILTY CLAY - Light grey silty clay with shale bands	3	16.8	-	-	-	-
TP3	0.5	SANDY CLAY - Light grey mottled red brown sandy clay with iron indurated bands	3	21.3	-	-	-	-
TP4	1.0	SILTY CLAY - Light grey mottled red brown silty clay with some ironstone bands	2,5	15.4	58	28	30	-
TP5	1.0	SILTY CLAY - red brown and grey silty clay with iron indurated bands	3	18.7	-	-	-	-
TP6	1.0	SILTY CLAY - Light grey mottled red brown silty clay	3	19.5	-	-	-	-
TP12	0.5	SILTY/SANDY CLAY - red brown mottled grey Silty/Sandy Clay	3	-	-	-	-	-

Legend:

W_F Field Moisture Content
 W_L Liquid limit
 W_P Plastic limit
 PI Plasticity index
 LS Linear shrinkage from liquid limit condition

Test Methods:

Moisture Content: AS 1289 2.1.1
 Liquid Limit: AS 1289 3.1.2
 Plastic Limit: AS 1289 3.2.1
 Plasticity Index: AS 1289 3.3.1
 Linear Shrinkage: AS 1289 3.4.1

Code:

Sample history for plasticity tests

1. Air dried
2. Low temperature (<50°C) oven dried
3. Oven (105°C) dried
4. Unknown

Method of preparation for plasticity tests

5. Dry sieved
6. Wet sieved
7. Natural

*Specify if sample crumbled CR or curled CU

Sampling Methods: AS 1289.1.2.1, AS 1289.1.1

Remarks:



NATA Accredited Laboratory Number: 828

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025

Tested: AS
 Checked: AJS


 A J Sweetland
 Laboratory Manager

Determination of Emerson Class Number of Soil

Client:	Lend Lease Communities Pty Ltd	Project No:	76649.00
Project:	Prelim Geotech and Contamination Assessments	Report No:	MA15-090
		Report Date:	17/02/2015
Location:	Mount Gilead Estate, Appin Road, GILEAD	Date of Test:	16/02/2015
		Page:	1 of 1

Sample No.	Depth (m)	Description	Water Type	Water Temp	Class No.
101	0.5	SILTSTONE - Grey and brown siltstone with some clay bands	Distilled	20°C	Rock
102	0.5	SILTY CLAY - Light brown mottled red brown silty clay	Distilled	20°C	6
103	0.5	SILTY CLAY - Red brown mottled grey silty clay	Distilled	20°C	6
104	0.5	SILTY CLAY - Red brown mottled grey silty clay	Distilled	20°C	6
105	0.5	SILTY CLAY - Red brown silty clay.	Distilled	20°C	5
106	0.5	SILTY CLAY - Red brown silty clay	Distilled	20°C	5

Test Methods: AS 1289 3.8.1

Sampling Methods: Sampled By DP Engineering

Remarks:



NATA Accredited Laboratory Number: 828

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025

Tested: JW
Checked: AJS


 A J Sweetland
 Laboratory Manager

Determination of Emerson Class Number of Soil

Client:	Lend Lease Communities Pty Ltd	Project No:	76649.00
Project:	Prelim Geotech and Contamination Assessments	Report No:	MA15-090A
		Report Date:	17/02/2015
Location:	Mount Gilead Estate, Appin Road, GILEAD	Date of Test:	16/02/2015
		Page:	1 of 1

Sample No.	Depth (m)	Description	Water Type	Water Temp	Class No.
107	0.5	SILTY CLAY - Red brown mottled grey silty clay	Distilled	20°C	6
108	0.5	SILTY CLAY - Red brown silty clay	Distilled	20°C	5
109	0.5	SANDSTONE - Red brown medium grained sandstone	Distilled	20°C	Rock
110	0.5	SANDY CLAY - Red brown mottled grey sandy clay and ironstone bands	Distilled	20°C	6
111	0.5	SANDSTONE - Red brown and light brown course grained sandstone	Distilled	20°C	Rock

Test Methods: AS 1289 3.8.1

Sampling Methods: Sampled By DP Engineering

Remarks:



NATA Accredited Laboratory Number: 828

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025

Tested: JS
Checked: AJS



A J Sweetland
Laboratory Manager

Sample Drop Off: 16 Chilvers Road
 Thornleigh NSW 2120
Mailing Address: PO Box 357
 Pennant Hills NSW 1715

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Batch N°: 33638	Sample N°: 1	Date Received: 18/2/15	Report Status: ☐ Draft ☒ Final
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Client Name: Douglas Partners PL - Smeaton Client Contact: Chris Kline Client Job N°: Client Order N°: Address: 5/50 Topham Rd Smeaton Grange NSW 2567	Project Name: REF: 76649.00 - Mt Gilead Estate SESL Quote N°: Sample Name: 101/0.6 Description: Soil Test Type: PSI, mEAT
--	--

TEST	RESULT	COMMENTS
pH in water 1:5		
pH in CaCl ₂ 1:5		
EC mS/cm 1:5	-	

CATION ANALYSIS					
TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			-	-	
Potassium			-	-	
Calcium			-	-	
Magnesium			-	-	
Aluminium			-	-	
ECEC Ca/Mg			-		

Phosphate Retention Index (%):	PRI (mgP/kg):	PRI (kg/ha): -
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PHYSICAL CHARACTERISTICS		Comment
Texture:	-	
Colour:	-	
Size:	-	
Aggregate strength:	-	
Structural unit:	Did not test	
Approx. Clay Content (%):	Did not test	
Potential infiltration rate:	Did Not Test	
Gravel Content:	Soil is	
Additional comments:		
Field Density (g/mL):		
Emerson Stability Class:		H20 Class 5
High SAR/Low Ionic Strength:		Class 6
Med SAR/High Ionic Strength:		Class 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

Phosphate Sorption Index: 276.2 mg/kg -1 / log 10 ug L-1 Phosphate Adsorb from Soil from 150mg P kg -1: 93.29% No commentary requested from SESL.

Method References:
 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: 9H1 of Rayment & Lyons. Wax Block Density: Method 30-4 Black (1983).
 Emerson's Aggregate Test: Charman & Murphy (1991). Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6. Texture/Structure/Colour -
 PM0003 (Texture- "Northcote" (1992), Structure- "Murphy" (1991), Colour- "Munsell" (2000))

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Consultant: Andrew Jacovides

Authorised Signatory: Ryan Jacka

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Batch N°: 33638	Sample N°: 2	Date Received: 18/2/15	Report Status: ☐ Draft ☒ Final
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Client Name: Douglas Partners PL - Smeaton	Project Name: REF: 76649.00 - Mt Gilead Estate
Client Contact: Chris Kline	SESL Quote N°:
Client Job N°:	Sample Name: 102/0.6
Client Order N°:	Description: Soil
Address: 5/50 Topham Rd Smeaton Grange NSW 2567	Test Type: PSI, mEAT

TEST	RESULT	COMMENTS
pH in water 1:5		
pH in CaCl ₂ 1:5		
EC mS/cm 1:5	-	

CATION ANALYSIS					
TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			-	-	
Potassium			-	-	
Calcium			-	-	
Magnesium			-	-	
Aluminium			-	-	
ECEC Ca/Mg			-		

Phosphate Retention Index (%):	PRI (mgP/kg):	PRI (kg/ha): -
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PHYSICAL CHARACTERISTICS		Comment
Texture:	-	
Colour:	-	
Size:	-	
Aggregate strength:	-	
Structural unit:	Did not test	
Approx. Clay Content (%):	Did not test	
Potential infiltration rate:	Did Not Test	
Gravel Content:	Soil is	
Additional comments:		
Field Density (g/mL):		
Emerson Stability Class:		H20 Class 6
High SAR/Low Ionic Strength:		Class 6
Med SAR/High Ionic Strength:		Class 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

Phosphate Sorption Index: 449.7 mg/kg -1 / log 10 ug L-1
Phosphate Adsorb from Soil from 150mg P kg -1: 97.97%
No commentary requested from SESL.

Method References:
 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: 9H1 of Rayment & Lyons. Wax Block Density: Method 30-4 Black (1983).
 Emerson's Aggregate Test: Charman & Murphy (1991). Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6. Texture/Structure/Colour -
 PM0003 (Texture- "Northcote" (1992), Structure- "Murphy" (1991), Colour- "Munsell" (2000))

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Batch N°: 33638	Sample N°: 3	Date Received: 18/2/15	Report Status: ☐ Draft ☒ Final
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Client Name: Douglas Partners PL - Smeaton	Project Name: REF: 76649.00 - Mt Gilead Estate
Client Contact: Chris Kline	SESL Quote N°:
Client Job N°:	Sample Name: 103/0.6
Client Order N°:	Description: Soil
Address: 5/50 Topham Rd Smeaton Grange NSW 2567	Test Type: PSI, mEAT

TEST	RESULT	COMMENTS
pH in water 1:5		
pH in CaCl ₂ 1:5		
EC mS/cm 1:5	-	

CATION ANALYSIS					
TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			-	-	
Potassium			-	-	
Calcium			-	-	
Magnesium			-	-	
Aluminium			-	-	
ECEC Ca/Mg			-		

Phosphate Retention Index (%):	PRI (mgP/kg):	PRI (kg/ha): -
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PHYSICAL CHARACTERISTICS		Comment
Texture:	-	
Colour:	-	
Size:	-	
Aggregate strength:	-	
Structural unit:	Did not test	
Approx. Clay Content (%):	Did not test	
Potential infiltration rate:	Did Not Test	
Gravel Content:	Soil is	
Additional comments:		
Field Density (g/mL):		
Emerson Stability Class:		H20 Class 6
High SAR/Low Ionic Strength:		Class 6
Med SAR/High Ionic Strength:		Class 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

Phosphate Sorption Index: 320.3 mg/kg -1 / log 10 ug L-1
Phosphate Adsorb from Soil from 150mg P kg -1: 95.48%
No commentary requested from SESL.

Method References:
 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: 9H1 of Rayment & Lyons. Wax Block Density: Method 30-4 Black (1983).
 Emerson's Aggregate Test: Charman & Murphy (1991). Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6. Texture/Structure/Colour -
 PM0003 (Texture- "Northcote" (1992), Structure- "Murphy" (1991), Colour- "Munsell" (2000))

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Authorised Signatory: Ryan Jacka

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Batch N°: 33638	Sample N°: 4	Date Received: 18/2/15	Report Status: ☐ Draft ☒ Final
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Client Name: Douglas Partners PL - Smeaton	Project Name: REF: 76649.00 - Mt Gilead Estate
Client Contact: Chris Kline	SESL Quote N°:
Client Job N°:	Sample Name: 104/0.6
Client Order N°:	Description: Soil
Address: 5/50 Topham Rd Smeaton Grange NSW 2567	Test Type: PSI, mEAT

TEST	RESULT	COMMENTS
pH in water 1:5		
pH in CaCl ₂ 1:5		
EC mS/cm 1:5	-	

CATION ANALYSIS					
TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			-	-	
Potassium			-	-	
Calcium			-	-	
Magnesium			-	-	
Aluminium			-	-	
ECEC Ca/Mg			-		

Phosphate Retention Index (%):	PRI (mgP/kg):	PRI (kg/ha): -
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PHYSICAL CHARACTERISTICS		Comment
Texture:	-	
Colour:	-	
Size:	-	
Aggregate strength:	-	
Structural unit:	Did not test	
Approx. Clay Content (%):	Did not test	
Potential infiltration rate:	Did Not Test	
Gravel Content:	Soil is	
Additional comments:		
Field Density (g/mL):		
Emerson Stability Class:		H20 Class 6
High SAR/Low Ionic Strength:		Class 6
Med SAR/High Ionic Strength:		Class 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

Phosphate Sorption Index: 414.2 mg/kg -1 / log 10 ug L-1
Phosphate Adsorb from Soil from 150mg P kg -1: 97.58%
No commentary requested from SESL.

Method References:
 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: 9H1 of Rayment & Lyons. Wax Block Density: Method 30-4 Black (1983).
 Emerson's Aggregate Test: Charman & Murphy (1991). Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6. Texture/Structure/Colour - PM0003 (Texture- "Northcote" (1992), Structure- "Murphy" (1991), Colour- "Munsell" (2000))

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Batch N°: 33638	Sample N°: 5	Date Received: 18/2/15	Report Status: ☐ Draft ☒ Final
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Client Name: Douglas Partners PL - Smeaton Client Contact: Chris Kline Client Job N°: Client Order N°: Address: 5/50 Topham Rd Smeaton Grange NSW 2567	Project Name: REF: 76649.00 - Mt Gilead Estate SESL Quote N°: Sample Name: 105/0.6 Description: Soil Test Type: PSI, mEAT
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TEST	RESULT	COMMENTS
pH in water 1:5		
pH in CaCl ₂ 1:5		
EC mS/cm 1:5	-	

CATION ANALYSIS					
TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			-	-	
Potassium			-	-	
Calcium			-	-	
Magnesium			-	-	
Aluminium			-	-	
ECEC Ca/Mg			-		

Phosphate Retention Index (%):	PRI (mgP/kg):	PRI (kg/ha): -
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PHYSICAL CHARACTERISTICS		Comment
Texture:	-	
Colour:	-	
Size:	-	
Aggregate strength:	-	
Structural unit:	Did not test	
Approx. Clay Content (%):	Did not test	
Potential infiltration rate:	Did Not Test	
Gravel Content:	Soil is	
Additional comments:		
Field Density (g/mL):		
Emerson Stability Class:		H20 Class 6
High SAR/Low Ionic Strength:		Class 6
Med SAR/High Ionic Strength:		Class 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

Phosphate Sorption Index: 422.5 mg/kg -1 / log 10 ug L-1 Phosphate Adsorb from Soil from 150mg P kg -1: 97.90 No commentary requested from SESL.
--

Method References:
 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: 9H1 of Rayment & Lyons. Wax Block Density: Method 30-4 Black (1983).
 Emerson's Aggregate Test: Charman & Murphy (1991). Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6. Texture/Structure/Colour -
 PM0003 (Texture- "Northcote" (1992), Structure- "Murphy" (1991), Colour- "Munsell" (2000))

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Batch N°: 33638	Sample N°: 6	Date Received: 18/2/15	Report Status: ☐ Draft ☒ Final
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Client Name: Douglas Partners PL - Smeaton	Project Name: REF: 76649.00 - Mt Gilead Estate
Client Contact: Chris Kline	SESL Quote N°:
Client Job N°:	Sample Name: 106/0.6
Client Order N°:	Description: Soil
Address: 5/50 Topham Rd Smeaton Grange NSW 2567	Test Type: PSI, mEAT

TEST	RESULT	COMMENTS
pH in water 1:5		
pH in CaCl ₂ 1:5		
EC mS/cm 1:5	-	

CATION ANALYSIS					
TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			-	-	
Potassium			-	-	
Calcium			-	-	
Magnesium			-	-	
Aluminium			-	-	
ECEC Ca/Mg			-		

Phosphate Retention Index (%):	PRI (mgP/kg):	PRI (kg/ha): -
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PHYSICAL CHARACTERISTICS		Comment
Texture:	-	
Colour:	-	
Size:	-	
Aggregate strength:	-	
Structural unit:	Did not test	
Approx. Clay Content (%):	Did not test	
Potential infiltration rate:	Did Not Test	
Gravel Content:	Soil is	
Additional comments:		
Field Density (g/mL):		
Emerson Stability Class:		H20 Class 5
High SAR/Low Ionic Strength:		Class 6
Med SAR/High Ionic Strength:		Class 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

Phosphate Sorption Index: 279.8 mg/kg -1 / log 10 ug L-1
Phosphate Adsorb from Soil from 150mg P kg -1: 993.52%
No commentary requested from SESL.

Method References:
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: 9H1 of Rayment & Lyons. Wax Block Density: Method 30-4 Black (1983).
Emerson's Aggregate Test: Charman & Murphy (1991). Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6. Texture/Structure/Colour - PM0003 (Texture- "Northcote" (1992), Structure- "Murphy" (1991), Colour- "Munsell" (2000))

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Authorised Signatory: Ryan Jacka

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Batch N°: 33638	Sample N°: 7	Date Received: 18/2/15	Report Status: ☐ Draft ☒ Final
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Client Name: Douglas Partners PL - Smeaton Client Contact: Chris Kline Client Job N°: Client Order N°: Address: 5/50 Topham Rd Smeaton Grange NSW 2567	Project Name: REF: 76649.00 - Mt Gilead Estate SESL Quote N°: Sample Name: 107/0.6 Description: Soil Test Type: PSI, mEAT
--	--

TEST	RESULT	COMMENTS
pH in water 1:5		
pH in CaCl ₂ 1:5		
EC mS/cm 1:5	-	

CATION ANALYSIS					
TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			-	-	
Potassium			-	-	
Calcium			-	-	
Magnesium			-	-	
Aluminium			-	-	
ECEC Ca/Mg			-		

Phosphate Retention Index (%):	PRI (mgP/kg):	PRI (kg/ha): -
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PHYSICAL CHARACTERISTICS		Comment
Texture:	-	
Colour:	-	
Size:	-	
Aggregate strength:	-	
Structural unit:	Did not test	
Approx. Clay Content (%):	Did not test	
Potential infiltration rate:	Did Not Test	
Gravel Content:	Soil is	
Additional comments:		
Field Density (g/mL):		
Emerson Stability Class:		H20 Class 6
High SAR/Low Ionic Strength:		Class 6
Med SAR/High Ionic Strength:		Class 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

Phosphate Sorption Index: 459.9 mg/kg -1 / log 10 ug L-1 Phosphate Adsorb from Soil from 150mg P kg -1: 98.06% No commentary requested from SESL.

Method References:
 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: 9H1 of Rayment & Lyons. Wax Block Density: Method 30-4 Black (1983).
 Emerson's Aggregate Test: Charman & Murphy (1991). Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6. Texture/Structure/Colour -
 PM0003 (Texture- "Northcote" (1992), Structure- "Murphy" (1991), Colour- "Munsell" (2000))

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Batch N°: 33638	Sample N°: 8	Date Received: 18/2/15	Report Status: ☐ Draft ☒ Final
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Client Name: Douglas Partners PL - Smeaton	Project Name: REF: 76649.00 - Mt Gilead Estate
Client Contact: Chris Kline	SESL Quote N°:
Client Job N°:	Sample Name: 108/0.6
Client Order N°:	Description: Soil
Address: 5/50 Topham Rd Smeaton Grange NSW 2567	Test Type: PSI, mEAT

TEST	RESULT	COMMENTS
pH in water 1:5		
pH in CaCl ₂ 1:5		
EC mS/cm 1:5	-	

CATION ANALYSIS					
TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			-	-	
Potassium			-	-	
Calcium			-	-	
Magnesium			-	-	
Aluminium			-	-	
ECEC Ca/Mg			-		

Phosphate Retention Index (%):	PRI (mgP/kg):	PRI (kg/ha): -
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PHYSICAL CHARACTERISTICS		Comment
Texture:	-	
Colour:	-	
Size:	-	
Aggregate strength:	-	
Structural unit:	Did not test	
Approx. Clay Content (%):	Did not test	
Potential infiltration rate:	Did Not Test	
Gravel Content:	Soil is	
Additional comments:		
Field Density (g/mL):		
Emerson Stability Class:		H20 Class 5
High SAR/Low Ionic Strength:		Class 6
Med SAR/High Ionic Strength:		Class 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

Phosphate Sorption Index: 516.7 mg/kg -1 / log 10 ug L-1
Phosphate Adsorb from Soil from 150mg P kg -1: 98.45%
No commentary requested from SESL.

Method References:
 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: 9H1 of Rayment & Lyons. Wax Block Density: Method 30-4 Black (1983).
 Emerson's Aggregate Test: Charman & Murphy (1991). Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6. Texture/Structure/Colour - PM0003 (Texture- "Northcote" (1992), Structure- "Murphy" (1991), Colour- "Munsell" (2000))

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Authorised Signatory: Ryan Jacka

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24/02/2015




Sample Drop Off: 16 Chilvers Road
 Thornleigh NSW 2120

Mailing Address: PO Box 357
 Pennant Hills NSW 1715

Tel: 1300 30 40 80
Fax: 1300 64 46 89
Em: info@sesl.com.au
Web: www.sesl.com.au

Batch N°: 33638	Sample N°: 10	Date Received: 18/2/15	Report Status: ☐ Draft ☒ Final
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Client Name: Douglas Partners PL - Smeaton	Project Name: REF: 76649.00 - Mt Gilead Estate
Client Contact: Chris Kline	SESL Quote N°:
Client Job N°:	Sample Name: 110/0.6
Client Order N°:	Description: Soil
Address: 5/50 Topham Rd Smeaton Grange NSW 2567	Test Type: PSI, mEAT

TEST	RESULT	COMMENTS
pH in water 1:5		
pH in CaCl ₂ 1:5		
EC mS/cm 1:5	-	

CATION ANALYSIS					
TEST	SOLUBLE		EXCHANGEABLE		
	meq%	Comment	meq%	% of ECEC	Comment
Sodium			-	-	
Potassium			-	-	
Calcium			-	-	
Magnesium			-	-	
Aluminium			-	-	
ECEC Ca/Mg			-		

Phosphate Retention Index (%):	PRI (mgP/kg):	PRI (kg/ha): -
---------------------------------------	----------------------	-----------------------

PHYSICAL CHARACTERISTICS		Comment
Texture:	-	
Colour:	-	
Size:	-	
Aggregate strength:	-	
Structural unit:	Did not test	
Approx. Clay Content (%):	Did not test	
Potential infiltration rate:	Did Not Test	
Gravel Content:	Soil is	
Additional comments:		
Field Density (g/mL):		
Emerson Stability Class:		H20 Class 5
High SAR/Low Ionic Strength:		Class 6
Med SAR/High Ionic Strength:		Class 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

Phosphate Sorption Index: 459.9 mg/kg -1 / log 10 ug L-1
Phosphate Adsorb from Soil from 150mg P kg -1: 98.06%
No commentary requested from SESL.

Method References:
 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: 9H1 of Rayment & Lyons. Wax Block Density: Method 30-4 Black (1983).
 Emerson's Aggregate Test: Charman & Murphy (1991). Particle Size Analysis: Modified Black (1983) Method 43-1 to 43-6. Texture/Structure/Colour -
 PM0003 (Texture- "Northcote" (1992), Structure- "Murphy" (1991), Colour- "Munsell" (2000))

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.

Consultant: Andrew Jacovides

Authorised Signatory: Ryan Jacka

Date Report Generated
24/02/2015




Appendix E

Laboratory Test Results - Salinity

CERTIFICATE OF ANALYSIS

123478

Client:

Douglas Partners Pty Ltd Smeaton Grange

Unit 5/50 Topham Rd

Smeaton Grange

NSW 2567

Attention: Chris Kline

Sample log in details:

Your Reference:	<u>76649.00,Mt Gilead Estate Gilead</u>
No. of samples:	40 soils
Date samples received / completed instructions received	12/02/15 / 12/02/15

Analysis Details:

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

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

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

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

Report Details:

Date results requested by: / Issue Date: 19/02/15 / 19/02/15

Date of Preliminary Report: Not Issued

NATA accreditation number 2901. This document shall not be reproduced except in full.

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

Results Approved By:



ESP/CEC						
Our Reference:	UNITS	123478-1	123478-2	123478-3	123478-4	123478-5
Your Reference	-----	101	102	103	104	105
Depth	-----	0.6	0.6	0.6	0.6	0.6
Date Sampled		09/02/2015	09/02/2015	09/02/2015	09/02/2015	09/02/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
Date analysed	-	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
Exchangeable Ca	meq/100g	1.9	2.2	0.2	1.6	1
Exchangeable K	meq/100g	0.2	0.1	0.1	0.1	0.2
Exchangeable Mg	meq/100g	4.5	9.4	5.8	5.6	4.2
Exchangeable Na	meq/100g	1.3	1.1	1.3	1.4	1.1
Cation Exchange Capacity	meq/100g	7.8	13	7.5	8.8	6.5
ESP	%	16	9	18	16	17

ESP/CEC						
Our Reference:	UNITS	123478-6	123478-7	123478-8	123478-9	123478-10
Your Reference	-----	106	107	108	109	110
Depth	-----	0.6	0.6	0.6	0.5	0.6
Date Sampled		09/02/2015	09/02/2015	09/02/2015	10/02/2015	10/02/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
Date analysed	-	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
Exchangeable Ca	meq/100g	3.2	2.4	0.3	<0.1	0.7
Exchangeable K	meq/100g	0.1	0.2	0.1	<0.1	<0.1
Exchangeable Mg	meq/100g	4.7	6.6	7.7	1.2	2.9
Exchangeable Na	meq/100g	0.55	0.74	1.2	0.17	0.30
Cation Exchange Capacity	meq/100g	8.6	9.9	9.3	1.4	3.9
ESP	%	6	8	13	12	8

ESP/CEC		
Our Reference:	UNITS	123478-11
Your Reference	-----	111
Depth	-----	0.2
Date Sampled		10/02/2015
Type of sample		Soil
Date extracted	-	17/02/2015
Date analysed	-	17/02/2015
Exchangeable Ca	meq/100g	0.2
Exchangeable K	meq/100g	<0.1
Exchangeable Mg	meq/100g	0.59
Exchangeable Na	meq/100g	<0.1
Cation Exchange Capacity	meq/100g	<1.0
ESP	%	5

Misc Inorg - Soil						
Our Reference:	UNITS	123478-1	123478-2	123478-3	123478-4	123478-5
Your Reference	-----	101	102	103	104	105
Depth	-----	0.6	0.6	0.6	0.6	0.6
Date Sampled		09/02/2015	09/02/2015	09/02/2015	09/02/2015	09/02/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
Date analysed	-	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
pH 1:5 soil:water	pH Units	5.1	6.0	4.8	5.3	5.3
Electrical Conductivity 1:5 soil:water	µS/cm	230	190	690	240	69
TKN in soil	mg/kg	720	320	320	360	430
Sodium Adsorption Ratio		2.3	1.5	2.4	2.3	2.1

Misc Inorg - Soil						
Our Reference:	UNITS	123478-6	123478-7	123478-8	123478-9	123478-10
Your Reference	-----	106	107	108	109	110
Depth	-----	0.6	0.6	0.6	0.5	0.6
Date Sampled		09/02/2015	09/02/2015	09/02/2015	10/02/2015	10/02/2015
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
Date analysed	-	17/02/2015	17/02/2015	17/02/2015	17/02/2015	17/02/2015
pH 1:5 soil:water	pH Units	6.4	5.6	6.2	5.4	5.5
Electrical Conductivity 1:5 soil:water	µS/cm	32	75	52	40	58
TKN in soil	mg/kg	500	840	400	130	250
Sodium Adsorption Ratio		0.87	1.1	1.8	0.67	0.70

Misc Inorg - Soil		
Our Reference:	UNITS	123478-11
Your Reference	-----	111
Depth	-----	0.2
Date Sampled		10/02/2015
Type of sample		Soil
Date prepared	-	17/02/2015
Date analysed	-	17/02/2015
pH 1:5 soil:water	pH Units	5.9
Electrical Conductivity 1:5 soil:water	µS/cm	20
TKN in soil	mg/kg	85
Sodium Adsorption Ratio		0.21

Method ID	Methodology Summary
Metals-009	Determination of exchangeable cations and cation exchange capacity in soil based on Rayment and Lyons 2011.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-062	TKN - determined colourimetrically based on APHA latest edition 4500 Norg.
Metals-007	Calcium and Magnesium analysed by ICP-AES and SAR calculated.

QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
ESP/CEC						Base Duplicate %RPD		
Date extracted	-			17/02/2015	123478-11	17/02/2015 17/02/2015	LCS-1	17/02/2015
Date analysed	-			17/02/2015	123478-11	17/02/2015 17/02/2015	LCS-1	17/02/2015
Exchangeable Ca	meq/100 g	0.1	Metals-009	<0.1	123478-11	0.2 0.2 RPD: 0	LCS-1	106%
Exchangeable K	meq/100 g	0.1	Metals-009	<0.1	123478-11	<0.1 <0.1	LCS-1	103%
Exchangeable Mg	meq/100 g	0.1	Metals-009	<0.1	123478-11	0.59 0.51 RPD: 15	LCS-1	106%
Exchangeable Na	meq/100 g	0.1	Metals-009	<0.1	123478-11	<0.1 <0.1	LCS-1	116%
Cation Exchange Capacity	meq/100 g	1	Metals-009	<1.0	123478-11	<1.0 <1.0	[NR]	[NR]
ESP	%	1	Metals-009	<1	123478-11	5 5 RPD: 0	[NR]	[NR]
QUALITY CONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Misc Inorg - Soil						Base Duplicate %RPD		
Date prepared	-			16/02/2015	123478-1	17/02/2015 17/02/2015	LCS-1	17/02/2015
Date analysed	-			17/02/2015	123478-1	17/02/2015 17/02/2015	LCS-1	17/02/2015
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	123478-1	5.1 5.1 RPD: 0	LCS-1	101%
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	123478-1	230 210 RPD: 9	LCS-1	103%
TKN in soil	mg/kg	10	Inorg-062	<10	123478-1	720 710 RPD: 1	LCS-1	97%
Sodium Adsorption Ratio		0.01	Metals-007	<0.01	123478-1	2.3 [N/T]	[NR]	[NR]
QUALITY CONTROL	UNITS	Dup. Sm#		Duplicate				
Misc Inorg - Soil				Base + Duplicate + %RPD				
Date prepared	-	123478-11		17/02/2015 17/02/2015				
Date analysed	-	123478-11		17/02/2015 17/02/2015				
pH 1:5 soil:water	pH Units	123478-11		5.9 5.9 RPD: 0				
Electrical Conductivity 1:5 soil:water	µS/cm	123478-11		20 19 RPD: 5				
TKN in soil	mg/kg	123478-11		85 91 RPD: 7				
Sodium Adsorption Ratio		123478-11		0.21 0.21 RPD: 0				

Report Comments:

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

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

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike: A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample): This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

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

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

Project Name: Mt Gilead Estate, Gilead		To: Envirolab Services	
Project No: 76649.00	Sampler: MV	12 Ashley Street, Chatswood NSW 2067	
Project Mgr: CCK	Mob. Phone:	Attn: Tania Notaras	
Email: chris.kline@douglaspartners.com.au		Phone: (02) 9910 6200	Fax: (02) 9910 6201
Date Required: Standard		Email: tnotaras@envirolabservices.com.au	

Sample ID	Lab ID	Sampling Date	Sample Type	Container Type	Analytes								Notes/preservation
			S - soil W - water	G - glass P - plastic	EC	pH	CEC	ESP	TKN	SAR			
101/0.6	1	09/02/15	S	G	x	x	x	x	x	x			
102/0.6	2	09/02/15	S	G	x	x	x	x	x	x			
103/0.6	3	09/02/15	S	G	x	x	x	x	x	x			
104/0.6	4	09/02/15	S	G	x	x	x	x	x	x			
105/0.6	5	09/02/15	S	G	x	x	x	x	x	x			
106/0.6	6	09/02/15	S	G	x	x	x	x	x	x			
107/0.6	7	09/02/15	S	G	x	x	x	x	x	x			
108/0.6	8	09/02/15	S	G	x	x	x	x	x	x			
109/0.5	9	10/02/15	S	G	x	x	x	x	x	x			
110/0.6	10	10/02/15	S	G	x	x	x	x	x	x			
111/0.2	11	10/02/15	S	G	x	x	x	x	x	x			


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

Job No: 123478
Date Received: 12/2/2015
Time Received: 1730
Received by: [Signature]
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Lab Report No:			
Send Results to: Douglas Partners Pty Ltd	Address: Unit 5, 50 Topham Road, Smeaton Grange 2567	Phone: (02) 4647 0075	Fax: (02) 4646 1886
Relinquished by: MV	Transported to laboratory by: [Signature]		
Signed:	Date & Time: 12/02/2015	Received by: [Signature] 12/2/15 1730	

Project Name: Mt Gilead Estate, Gilead		To: Envirolab Services	
Project No: 76649.00	Sampler: MV	12 Ashley Street, Chatswood NSW 2067	
Project Mgr: CCK	Mob. Phone:	Attn: Tania Notaras	
Email: chris.kline@douglaspartners.com.au		Phone: (02) 9910 6200	Fax: (02) 9910 6201
Date Required: Standard		Email: tnotaras@envirolabservices.com.au	

Sample ID	Lab ID	Sampling Date	Sample Type	Container Type	Analytes								Notes/preservation
			S - soil W - water	G - glass P - plastic									
6/0.5	12		S	G									ON HOLD
11/0.3	13		S	G									ON HOLD
12/0.3	14		S	G									ON HOLD
15/0.3	15		S	G									ON HOLD
16/0.3	16		S	G									ON HOLD
17/0.2	17		S	G									ON HOLD
18/0.3	18		S	G									ON HOLD
19/0.3	19		S	G									ON HOLD
21/0.3	20		S	G									ON HOLD
23/0.2	21		S	G									ON HOLD
23/0.5 22	22 23		S	G									ON HOLD
BD1 23	24 24		S	G									ON HOLD
BD2 24	25 25		S	G									ON HOLD

Lab Report No:			
Send Results to: Douglas Partners Pty Ltd	Address: Unit 5, 50 Topham Road, Smeaton Grange 2567	Phone: (02) 4647 0075	Fax: (02) 4646 1886
Relinquished by: MV	Transported to laboratory by: E.S.		
Signed:	Date & Time: 12/02/2015	Received by: P. Ray 12/2/2015 17.30	

Project Name: Mt Gilead Estate, Gilead		To: Envirolab Services	
Project No: 76649.00	Sampler: MV	12 Ashley Street, Chatswood NSW 2067	
Project Mgr: CCK	Mob. Phone:	Attn: Tania Notaras	
Email: chris.kline@douglaspartners.com.au		Phone: (02) 9910 6200	Fax: (02) 9910 6201
Date Required: Standard		Email: tnotaras@envirolabservices.com.au	

Sample ID	Lab ID	Sampling Date	Sample Type	Container Type	Analytes								Notes/preservation
			S - soil W - water	G - glass P - plastic									
A/0.5 25	26	26	S	G									ON HOLD
B/0.0 26	27	27	S	G									ON HOLD
C1/0.0 27	28	28	S	G									ON HOLD
C2/0.0 28	29	29	S	G									ON HOLD
C3/0.0 29	30	30	S	G									ON HOLD
C4/0.0 30	31	31	S	G									ON HOLD
D/0.0 31	32		S	G									ON HOLD
E/0.0 32	33		S	G									ON HOLD
F/0.0 33	34		S	G									ON HOLD
G/0.0 34	35		S	G									ON HOLD
H/0.0 35	36		S	G									ON HOLD

Lab Report No:			
Send Results to: Douglas Partners Pty Ltd	Address: Unit 5, 50 Topham Road, Smeaton Grange 2567	Phone: (02) 4647 0075	Fax: (02) 4646 1886
Relinquished by: MV	Transported to laboratory by: EU		
Signed:	Date & Time: 12/02/2015	Received by: P. Ray	12/2/15 17:30

Project Name: Mt Gilead Estate, Gilead	To: Envirolab Services
Project No: 76649.00	Sampler: MV
Project Mgr: CCK	Attn: Tania Notaras
Email: chris.kline@douglaspartners.com.au	Phone: (02) 9910 6200 Fax: (02) 9910 6201
Date Required: Standard	Email: tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Sampling Date	Sample Type	Container Type	Analytes								Notes/preservation
			S - soil W - water	G - glass P - plastic									
I/O.0 30	37		S	G									ON HOLD
J/O.0 37	38		S	G									ON HOLD
K/O.0 38	39		S	G									ON HOLD
L/O.0 39	40		S	G									ON HOLD
M/O.0 40	41		S	G									ON HOLD

Lab Report No:		Send Results to: Douglas Partners Pty Ltd		Address: Unit 5, 50 Topham Road, Smeaton Grange 2567		Phone: (02) 4647 0075		Fax: (02) 4646 1886	
Relinquished by: MV		Transported to laboratory by: E.S.							
Signed:		Date & Time: 12/02/2015		Received by: P. Ray 12/2/2015 17.30					