Douglas Partners
Geotechnics • Environment • Groundwater

Integrated Practical Solutions

REPORT
on
ADDITIONAL URBAN CAPABILITY ASSESSMENT

PROPOSED REZONING
"KINGSHILL"
PACIFIC HIGHWAY, NORTH RAYMOND TERRACE

Prepared for

JW PLANNING PTY LTD

Project 31638

JULY 2005

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Project 31638

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1 July 2005

REPORT ON
URBAN CAPABILITY ASSESSMENT – ADDITIONAL INVESTIGATION
"KINGSHILL", PACIFIC HIGHWAY, NORTH RAYMOND TERRACE
PROPOSED REZONING

1. INTRODUCTION

This report presents the results of an additional investigation, which was undertaken to further assess urban capability for the proposed rezoning of the 810 ha "Kingshill" site.

The investigation was undertaken to supplement the initial preliminary assessment conducted in September 2002 by PPK (Ref 1).

The purpose of the investigation was to provide additional site specific information to identify possible constraints and opportunities to development with respect to the following:

- slope stability;
- soil erosion/dispersion conditions;
- foundation conditions;
- acid sulphate soils;
- salinity;
- on-site effluent disposal;
- potential site contamination.

The investigation comprised the following:

- review of relevant information
  - preliminary assessment (September 2002 – Ref 1);
  - topographic, orthophoto, geological, soil landscape, acid sulphate soil maps;
  - aerial photograph;
  - DLWC Draft Hunter Catchment Blueprint – November 2001;
- site reconnaissance survey by an experienced engineering geologist within accessible areas of the site;
- excavation of 22 test pits across the site by backhoe;
- laboratory testing on ten selected soil samples for dispersion assessment;
- in-situ testing of selected surface waters for pH and electrical conductivity (EC);
- preliminary contamination assessment
  - discussions with NSW EPA, Port Stephens Council (PSC) and DLWC;
  - discussions with Myall Coast Archaeology Pty Ltd;
  - site inspection.

2. SITE DESCRIPTION

The "Kingshill" investigation area forms a parcel of land of about 810 ha, which includes 16 current allotments. It is bounded to the east by the Pacific Highway, to the north by Six Mile Road and an existing rural residential subdivision, to the west by Newline Road and the Williams River, and to the south by Hunter Water Corporation land (open paddocks forming part of the Grahamstown Dam spillway) and an abandoned quarry.

The allotments included in the current investigation are outlined in Table 1 below, and are shown in Drawing 1, Appendix A.

Table 1 – Allotments within the "Kingshill" Investigation Area

Lot Description	Owner	Area
Lot 41 DP 1037411	Mondell Properties	407.6ha
Lot 51 DP 839722	*Mondell Properties*	8.28ha
Lot 42 DP 1037411	*Riding for the Disabled*	2.1ha
Lot 4821 DP 852073	*Mr Ian Eagleton*	113.4ha
Lot 4822 DP 852073	*Mr Noel Langbein*	40.3ha
Lot 481 DP 804971	*Mr Alfred Howe*	28.39ha
Part of Lot 105 DP 1016640	*Newline Resources Pty Ltd*	12.4ha
Lot 31 DP 554875	*Messrs Warnes and Russell*	10.1ha
Lot 32 DP 554875	*Mr JK Windeyer*	119.5ha
Pt Lot 2 DP 37430	*Mr JK Windeyer*	18.4ha
Lot 42 DP 618892	*Mr RA and Mrs J Badior*	11.4ha
Lot 41 DP 618892	*Mr PW and Mrs H De Sylva*	1.6ha
Lot 5 DP 234521	*Hunter Water Corporation*	9.9ha
Lot 31 DP 255228	*Available on request*	10ha
Lot 32 DP 255228	*Available on request*	10ha
Lot 33 DP 255228	*Available on request*	10ha
TOTAL AREA UNDER INVESTIGATION		**Approx. 810ha**

Reference should be made to the September 2002 report by PPK (Ref 1) for details including site description, topography, drainage, vegetation, existing development, geology, soil landscape and acid sulphate soils..

Subsequent to the assessment of the above area, an additional parcel of land to be included in the rezoning submission (Part Lot 2, DP37430) was investigated in March 2004. The results of the additional investigation are included in Appendix D.

3. FIELD WORK

3.1 Methods

Field work was carried out in two stages, and comprised initially a walkover survey by an experienced engineering geologist to record observations of significant geological and geomorphic features, followed by limited subsurface investigation by backhoe.

The walkover survey was carried out on 20 to 23 January 2003. Slopes were measured using a clinometer and observations of rock outcrops and surface boulders/cobbles were recorded.

The preliminary road alignment (Figure 1) and concept structure plan (Figure 2) were considered, together with the results of field mapping and data review, to select suitable locations for subsurface investigation (i.e. test pits).

Test pit excavation was carried out at 22 locations on 23 and 24 January 2003. The pits were set out and logged by a geotechnical engineer.

In addition to the above work, the pH and electrical conductivity (EC) of surface water was measured in-situ using calibrated hand held equipment at selected locations across the site. The approximate locations of water samples are shown on Drawing 2, Appendix A.

The location of all test and observation points were recorded using handheld GPS as MGA coordinates and converted to the local grid. The approximate locations are shown in Drawing 2.

3.2 Results

3.2.1 Walkover

The results of the walkover survey include slope measurement and rock observations, and are presented in Drawing 2.

The site comprises a range of slopes, including gentle slopes (<10°) in the low lying parts of the sites generally steepening toward the northeast to southwest ridgeline which bisects the site. The lowest parts of the site, below RL 10, are prone to inundation. The flanks and head of gullies are typically steep, generally up to 15° with some steeper areas, particularly near the gully axes. The greatest proportion of steep topography is generally above RL 40. Numerous rock outcrops on the ridgeline produce locally steeper areas and development of cliff lines.

It is understood that development of land with slopes in excess of 4H:1V (14°) is not proposed. Areas with slopes in excess of 4H:1V have been estimated using the provided topographic map of the site, in conjunction with slope measurements taken in the field, and are therefore approximate only. Estimated areas with slopes in excess of 4H:1V are shown in Drawing 2, Appendix A. Isolated areas of similarly steep slopes may be present that are not shown on the drawing.

3.2.2 Test Pits

Detailed test pit report sheets are included in Appendix B, and should be read in conjunction with the general notes preceding them which explain descriptive terms and classification methods.

Subsurface conditions were highly variable between pits, however, generally comprised silty topsoils, overlying silty/sandy clays in the majority of pits, underlain by bedrock. Bedrock type and depth also varied considerably between pits, and ranged between sedimentary and volcanic strata from the surface to depths of >2 m. Refer to test pit report sheets for details.

The depth to bedrock within test pits is summarised in Table 2, below:

Table 2 – Depth to Bedrock/Backhoe Refusal within Test Pits

Test Pit	Depth To Rock/Backhoe Refusal Depth (m)
1	0.9/>2.1
2	>2.1
3	0.2/0.4
4	>2.1
5	0.8/1.2
6	1.7/1.9
7	0.2/0.2
8	0.2/0.6
9	0.4/1.0
10	0.6/1.7
11	0.4/0.5
12	2.3/>2.8
13	0.1/0.7
14	0.45/1.2
15	0.55/0.75
16	1.4/1.9
17	2.7/>3
18	0.95/1.6 (slow dig)
19	0.5/1.3 (slow dig)
20	0.1/2.0 (slow dig)
21	0.8/1.0 (slow dig)
22	0.8/1.4

Notes to Table 2:

1. Depth below existing ground level
2. Backhoe refusal depth using a JCB 3CX backhoe
3. Refer to Drawing 2, Appendix A for approximate test pit locations

3.2.3 Surface Waters

The results of in-situ pH and EC testing of surface waters at selected locations are summarised in Table 3 below.

Table 3 – Surface Water pH and EC Testing

Sample	Location (1)	PH	EC (µS/cm)
W1	Dam	6.5	400
W2	Dam	6.6	250
W3	Dam near Pit 15	6.2	310
W4	Dam	6.9	314
W5	Dam	6.7	156
W6	Dam	6.4	271
W7	Dam	7.1	300
W8	Dam	6.9	375
W9	Dam	7.5	490
W10	Dam downstream of landfill	6.4	395
W11	Swamp/Wetland	4.7	4090
W12	Swamp/Wetland	5.6	4200
W13	Leachate dam	9.3	1850
W14	Swamp/Wetland	7.1	4640
W15	Swamp/Wetland	6.6	4300
W16	Dam immediately upstream of swamp	8.6	390
W17	Swamp/Wetland	4.6	4450
W18	Dam	7.5	250
W19	Dam	7.2	275
W20	Williams River	7.4	5150

Notes to Table 3:

1. EC – Electrical Conductivity
2. Refer to Drawing 3, Appendix A for approximate sample locations

The results of subsurface water testing generally indicates the following:

- on-site dam water
  - pH 6.2 to 7.5 (generally neutral);
  - generally fresh;
- swamp/wetland
  - pH 4.6 to 7.1 (acidic to neutral);
  - brackish;
- leachate dam
  - pH 9.3 (alkaline);
  - brackish;
- Williams River
  - pH 7.4 (neutral);
  - brackish.

The above results represent preliminary screening tests.

3.3 Laboratory Testing

Ten selected soil samples from the subsurface investigation were submitted for laboratory testing (Emerson Class Number determination) to assess soil dispersion properties.

The laboratory test report sheet is included in Appendix B. The results are summarised in Table 4 below.

Table 4 – Laboratory Test Results – Emerson Class No.

Sample No	Depth (m)	Description	Emerson Class No.
TP 1	0.5	Yellow-brown silty sandy clay	5
TP 4	0.5	Grey-brown clay some sand	6
TP 5	0.4	Grey-brown clay some sand/gravel	5
TP 9	0.2	Light brown-grey sandy silty clay/clayey sandy silt	8
TP 12	0.7	Brown mottled orange sandy clay	3
TP 15	0.4	Grey-brown mottled orange clay with some silt/sand	5
TP 16	0.5	Red-brown clay trace iron-cemented gravel	6
TP 17	0.4	Brown-grey clay with some silt	5
TP 19	0.3	Light brown mottled orange silty clay some sand	5
TP 22	0.5	Light grey sandy silty clay/clayey silt with some siltstone gravel	5

Notes to Table 4:

Refer to Drawing 2, Appendix A for approximate test pit locations

The results of testing generally indicates that the soils tested are non-dispersive, with the exception of the sandy clay in Pit 12, which exhibited partial dispersion of remoulded crumbs.

4. URBAN CAPABILITY

4.1 Slope Stability

No overt signs of deep seated instability were observed during the field investigation.

Although development is not proposed within areas of the site containing slopes in excess of 4H:1V, on-going slope evolution processes may result in some natural instability in particularly steep areas. This would most likely be in the form of blocks of strata becoming detached from cliff lines and large outcrop bodies, or detachment of surface boulders.

Potential slope instability may also arise due to development where earthworks can cause displacement of surface boulders or excavation exposing joint bound blocks or buried boulders which could become detached.

In addition, there is a potential for instability of the rock faces associated with the quarry adjacent to Six Mile Road on Lot 4821 (northern site area).

A number of small dams within the site exhibited batter erosion, suggesting the potential for instability, which should also be considered in the development.

The above slope stability issues could, however, be readily mitigated during the staged development of the site as follows:

1. Restrict development in steep areas with slopes in excess of 4H:1V, without specific geotechnical investigation. Development in these areas could be considered, but will require site specific assessment.

2. Undertake investigation/inspection upslope of development areas to identify cobbles/boulder which could become detached, and undertake appropriate remedial action (i.e. remove/reshape boulders).

3. Undertake specific geotechnical investigation for development requiring cutting and/or filling in all areas, recommending appropriate restrictions and/or remedial measures.

4. Specific investigations should also be undertaken where dams are present to assess the integrity and long term stability, and recommend remedial works where dams are likely to be retained.

5. Undertake a detailed assessment of the quarry (Lot 4821) and recommend appropriate setbacks for development, or remedial works to allow development of the quarry area.

It is noted that the above slope stability issues would not preclude development. Detailed investigation and mitigation measures, however, will be required prior to development of each stage.

4.2 Erosion/Dispersion

The soil landscape map indicates that the site contains soils with a "high water erosion hazard". Near surface silts/sands were found within the test pits which confirmed the presence of erodable soils. Localised erosion of such soils is common where vegetation is sparse, as observed during the site inspection. These soils are readily amenable to standard mitigation measures, to address the potential for erosion during and following each stage of the development.

The results of Emerson Class testing of soils (Section 3.3) indicated that the site soils are generally non-dispersive, with the exception of one sandy clay sample in Pit 12 (refer to Drawing 2, Appendix A) which exhibited partial dispersion of remoulded crumbs. Detailed investigation would be recommended prior to the construction of each stage of the development to further assess the presence and extent of partially dispersive soils. Mitigation measures will be required during and following development to address soil dispersion if identified in specific areas.

4.3 Foundation Conditions and Depth to Rock

The subsurface conditions vary across the site in relation to both the underlying geology and the topography. Test pits were located on the lower slopes, spurs lines, hill crests and gullies, targeting various landscape types. The subsurface conditions encountered in the test pits in conjunction with field observations can be broadly divided into two categories:

1. Lower slopes with variable soil depth from 0 m to >2 m depth. Soil composition generally comprising near surface silt/sand overlying clays, overlying a variety of rock types.

2. Upper slopes, spur lines and hill crests with shallow (less than 1 m) to no soil cover. Soils generally sandy and silty overlying predominantly sandstone and conglomerate.

The depth to backhoe refusal on bedrock also varied across the site. The presence of rock would influence excavation conditions. Heavy ripping or blasting may be required for rock excavation below backhoe refusal depths, and would depend on jointing and fracturing. Excavation conditions for each stage of the development could be confirmed through detailed investigation prior to construction.

The clay soils across the site were generally observed to be reactive. Appropriate investigation and laboratory testing would be required to address clay reactivity and confirm foundation classification, prior to construction of each stage of residential development.

The localised low lying areas within the site (generally <RL 10), including the swamp over the south-west corner, are likely to contain low bearing capacity soils. Investigation and engineering design is recommended prior to construction, if development is proposed in the vicinity of these areas.

Development over the former putrescible landfill located at the south-west corner of the site is not recommended due to the presence of compressible waste materials and likely associated settlement. The landfill is discussed further in Section 5.

4.4 Acid Sulphate Soils

The Karuah and Maitland Acid Sulphate Soil Risk indicate that acid sulphate soils are likely to be present within the site as follows:

- high probability of acid sulphate soils within a depth of 1 m of the ground surface in the western part of Lot 41, DP1037411;
- high probability of acid sulphate soils between 1 m and 3 m depth in Lot 2 DP37430;
- low probability of acid sulphate soils below 3 m depth on Lot 42 DP618892.

The presence of acid sulphate soils (ASS) within the site does not necessarily preclude future development. Development within or in the vicinity of areas containing ASS will require further investigation prior to development, and appropriate soil management during construction of each stage of the development.

4.5 Salinity

Reference to the DLWC Draft Hunter Catchment Blueprint (November 2001) indicates that the site is not located within a priority saline catchment. Preliminary in-situ screening test of selected surface waters generally indicated that dams within the site contained neutral, fresh surface waters (refer to Section 3.2.3).

The swamp/wetland (south-west corner of the site) and the nearby Williams River, contained brackish waters which was generally expected.

It is therefore considered that site development is unlikely to result in increased salinity, subject to the appropriate management of erosion and runoff.

4.6 On-site Effluent Disposal

It is noted that limitations to on-site effluent disposal were observed within the site due to the following:

- steep slopes (>10%) associated with upper slopes;
- presence of rock outcrops and shallow rock (variable);
- flood potential (areas <5 AHD) south-west and west boundary of the site;
- proximity to permanent surface waters (south-west corner of site).

On-site disposal of domestic effluent could, however, be achieved in certain areas of the site, subject to investigation, and site improvements.

5. PRELIMINARY CONTAMINATION ASSESSMENT

5.1 Introduction

In conjunction with the preliminary geotechnical assessment of the site, a preliminary contamination assessment was conducted to assess possible constraints to development due to site contamination.

The assessment comprised the following:

- review of available historical information provided by Mr Len Roberts of Myall Coast Archaeology Pty Ltd;
- searches and discussions with Port Stephens Council (PSC);
- searches with the Environmental Protection Authority (EPA);
- searches with the Department of Land and Water Conservation (DLWC);
- brief site visit by an environmental engineer.

5.2 Discussions with Myall Coast Archaeology Pty Ltd

Mr Len Roberts of Myall Coast Archaeology indicated that past land use in the vicinity of the site was likely to include grazing, timber production, and small scale orchards, vineyards, quarrying and dairying for various lengths of time and success. The exact locations of the above land uses, however, are difficult to establish. Mr Roberts also indicated that the site was likely to be outside the early Raymond Terrace farming areas.

5.3 Discussion with PSC

A search of PSC historical and current records of Building Applications (BA)/Development Applications (DA) indicated the following DA/BAs have been lodged for the site, as shown in Appendix C:

Lot 4821, DP 852073

- septic tank, approved in 1997;
- creation of a two lot subdivision, withdrawn in 1999;
- dam, approved in 2000.

Lot 4822, DP 852073

- combined machinery shed and wastewater treatment plant, approved in 1995;
- relocation of dwelling, approved in 1996.

Lot 41, DP 618892

- conversion of existing dwelling to duplex dwelling, approved 1982 to 1983.

Lot 5, DP 234521

- riding club and dwelling, approved 1985;
- three Lot Subdivision, approved 6 December 1990;
- three Lot Subdivision, withdrawn 31 December 1990;
- riding arena, approved 1991;
- hay shed, approved 1992;
- shed (for covered riding), approved 1993;
- amenities block and viewing area, approved 1995;
- additions to premises, approved 2001.

Lot 31, DP 255228

- dwelling, approved 1981 to 1991;
- additions to dwelling and pergola, approved 1995;
- farm/machinery shed, approved 1997;
- farm shed, approved 1999.

Lot 32, DP 255228

- dwelling, approved 1980;
- garage, approved 1994;
- track and widen dam wall, withdrawn 1997;
- dwelling, approved 1997;
- septic tank, approved 1997;
- swimming pool, approved 1998;
- tourist facility, approved 1998;
- change tourist facility to dual occupancy and dwelling, approved 2001.

Lot 33, DP 255228

- dwelling, approved 1985.

Lot 51, DP 839722

Preliminary discussion with PSC personnel indicated the following information, with respect to the former landfill located over the south-west corner of the site:

- the landfill operated from approximately 1988 to 1998;

- putrescible waste was disposed at the landfill (i.e. solid waste);
- a waste thickness of up to 5 m is present;
- the landfill is no longer operational, however, it has not been appropriately decommissioned or capped;
- PSC intend to undertake remedial works in future to complete closure requirements;
- a monitoring program is in place for the landfill.

5.4 Discussion with NSW EPA

A property information inquiry with the NSW EPA indicated that there are no statutory notices issued under the provision of the Contaminated Land Management Act 1997 or the Unhealthy Building Land Act 1990 for the subject site.

Records provided to the EPA by the Department of health, however, indicated that PSC on the 23 March 1989 proposed to operate a landfill on Lot 51, DP 839722. The EPA was unaware of whether the land was actually used as a landfill (refer to EPA correspondence in Appendix C).

5.5 Discussion with DLWC

A groundwater bore search undertaken by the DLWC indicated that a registered groundwater well is located within Lot 32, DP 255228 (GW 066683), which is situated within the investigation site and is used for domestic and stock purposes. The nearest registered groundwater well outside the site is located approximately 3 km south of the site (GW 057239) and is used for domestic purposes.

A copy of the groundwater bore search data is included in Appendix C.

5.6 Site Observations

Observations relating to potential site contamination made during the brief site visit included the following:

- presence of former Council landfill immediately adjacent to the swamp/wetland over the south-west corner of the site;
- minor stockpiles containing building rubble, car parts, scrap metal, empty 44 gallon drums, vehicle wrecks etc;
- presence of localised fill which may include imported fill materials;
- presence of existing domestic effluent disposal systems;
- presence of former quarry within the northern portion of the site.

5.7 Potential Contamination

On the basis of the available site history and observations made during the site inspection, the principal sources of potential contamination within the site are considered to be:

- PSC landfill – possible migration implications due to the proximity to the wetland, and the fact that the landfill has not been appropriately decommissioned (it is understood that PSC intend to undertake appropriate remedial actions for site closure in future);
- localised dumping/stockpiles – may contain a range of potential contaminants, including metals, hydrocarbons etc;
- effluent disposal areas – may contain heavy metals, hydrocarbons and elevated nutrient and microbiological levels. Appropriate decommissioning should occur prior to re-development in those areas;
- former quarry (northern site area) – may contain localised heavy metal, hydrocarbon impact from former quarry equipment and machinery;
- former vineyard/orchard areas – may contain localised near surface soil impact from metals, pesticides/herbicides.

5.8 Comments

Our review of the sites history and the observations made during the site visit suggests that the site is generally unlikely to contain gross environmental impact associated with the current and former site activities, with the exception of the PSC landfill.

The presence of the landfill is considered to be the greatest risk of contamination within the site due to the fact that the landfill has not been appropriately capped; its proximity to the adjacent wetland; the potential for leachate migration to the wetland; and the possibility that the leachate ponds are located below the 100 year flood level.

Future development in the vicinity of the landfill should be located to protect human health and the amenity of the neighbourhood, in accordance with NSW EPA Environmental Guidelines for Solid Waste Landfills (January 1996).

The potential localised contamination sources described in Section 5.7 can be readily investigated, and where required remediated and validated, prior to construction or each stage of the development.

Reference should be made to the letter report in Appendix D in relation to the results of the additional investigation area (Part Lot 2, DP37430).

6. TERRAIN UNITS

The review of available information, field observations and subsurface investigation results have been used to develop “Terrain Units” which delineate areas of similar site conditions in the context of potential constraints to development, and include the following:

- steep slopes;
- depth to rock;
- low lying areas;
- landfill/quarry (disturbed areas).

The terrain units and their principle features and geotechnical constraints are described in Table 5 below, and are shown on Drawing 4, Appendix A.

Table 5 – Terrain Units and Geotechnical Constraints

Terrain Unit	Description	Features	Geotechnical Constraints
TU1	Upper hill slopes, gully flanks, hill crests and spur lines (see also 4H:1V slope drawing)	• including steep slopes in excess of 4H:1V • typically shallow rock, <1 m deep • common rock outcrop • includes cliff lines	• potential stability issues associated with loose boulders and cliff lines, impacting on downslope areas, specific stability assessment recommended where slope in excess of 4H:1V • difficult excavation, possible heavy ripping or drill and blast required in some areas • high potential for erosion caused by development • contains major limitations to on-site effluent disposal
TU2	Lower slopes, base of gullies	• slopes generally less than 4H:1V • variable depth to rock (0 m to >2 m) • variable soil types, predominantly high plasticity clays • gully erosion on some parts of site, where clearing has been undertaken • presence of earth dams in some gullies • variable vegetation cover	• potential stability issues associated where upslope boulders could impact on development • difficult excavation in some areas • high potential for erosion caused by development • waterlogging of soils in some areas, particularly gully bases and low elevation • potential reactive soils, site classification required • remediation or removal of dams required • on-site effluent subject to detailed investigation and design
TU3	Low lying areas	• low lying areas and wetlands below about RL 10	• existing wetlands • poorly drained • prone to inundation, 1 in 100 yr flood level at about RL 5 • potential acid sulphate soils below RL 5 • low wet strength, potentially compressible foundation soil conditions • sensitive to upstream development
TU4	Altered terrains	• disturbed soils • quarries • landfill	• stability issues in and around quarries, remediation of quarries may be required • uncontrolled filling • settlement of landfill

Notes to Table 5:

1. Refer to Drawing 4, Appendix A
2. The above geotechnical constraints should be considered, as discussed in Section 4, when assessing land use opportunities during the master planning process.

7. RECOMMENDATIONS

The site is considered to be suitable for the proposed urban development including the additional parcel discussed in Appendix D, subject to consideration of the constraints and recommendations discussed in this report. Reference should be made to the report in Appendix D for details regarding the additional site area.

It is noted that the foregoing assessment was based on a desk top review and a limited site inspection and subsurface investigation program, which is considered to be sufficient for the purposes of site planning.

Further site specific investigation will be required prior to construction of each stage of the development (i.e. for DA preparation), as recommended above, and will include the following:

- investigation of subgrade conditions for pavement construction and further erosion/dispersion investigation;
- site classification for residential foundations;
- slope stability assessment where development is likely to be impacted by stability issues;
- assessment of acid sulphate soil conditions (ASS) and preparation of management procedures if development is likely to be required within or in the immediate vicinity of ASS;
- assessment for on-site effluent disposal (if considered);
- investigation of localised potential contamination, remediation and validation where required;

In addition, further assessment is recommended to confirm an appropriate setback/buffer for development from the landfill over the south-west corner of the site.

DOUGLAS PARTNERS PTY LTD

Reviewed by:

Chris Bozinovski
Associate

Stephen Jones
Principal

REFERENCE

1. PPK (2002) "Geotechnical and Urban Capability Assessment, Proposed Rezoning, Pacific Highway, Raymond Terrace", September 2002.

APPENDIX A

Drawing 1 – Site Plan (Allotments)
Drawing 2 – Observations and Test Pit Location Plan
Drawing 3 – Test Location Plan – In situ pH and EC Testing of Surface Water
Drawing 4 – Terrain Units
Figure 1 – Preliminary Road Alignment
Figure 2 – Concept Structure Plan

N

CLARENCE TOWN

WILLIAMS RIVER

WINSTON ROAD

SIX MILE ROAD

KURUAH ROAD

PACIFIC HIGHWAY

NEWLINE ROAD

RAYMOND TERRACE

LOT 33

LOT 32

LOT 31 DP 255228

LOT 4822 DP852073

LOT 4821 DP852073

LOT 41 DP618892

LOT 42 DP618892

LOT 2 DP37430

LOT 481 DP804971

LOT 32 DP554875

LOT 31 DP554875

LOT 41 DP1037411

LOT 42 DP1037411

RIDING FOR THE DISABLED

LOT 51 DP839722

LOT 105

LOT 105

LOT 105 DP1016640

DP1016640

LOT 5 DP234521

PM 27956

HUNTER WATER CORPORATION LAND

RAYMOND TERRACE

LEGEND

DRAWING ADAPTED FROM PLAN SUPPLIED BY JW PLANNING, REF NO. NRTBASETOP001, DATED 12.1.02

0 250 500 750 m

SCALE 1:15000 (A2 SHEET)

Douglas Partners

Geotechnics Environment Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Campbelltown, Townsville, Cairns, Wollongong, Darwin

TITLE: SITE PLAN (ALLOTMENTS)
PRELIMINARY GEOTECHNICAL AND CONTAMINATION ASSESSMENT
NORTH RAYMOND TERRACE

CLIENT: MONDEL PROPERTIES/MORGAN AND BANKS INVESTMENT PARTNERSHIP

DRAWN BY: LD	SCALE: 1:15000 (A2)	PROJECT No: 31638	OFFICE: NEWCASTLE
APPROVED BY:		DATE:	DRAWING No: 1

N

CLARENCE TOWN

WILLIAMS RIVER

WINSTON ROAD

SIX MILE ROAD

KURUAH ROAD

PACIFIC HIGHWAY

NEWLINE ROAD

RAYMOND TERRACE

LOT 33

LOT 32 DP 255220

LOT 31

LOT 4822 DP852073

LOT 4821 DP852073

LOT 41 DP618892

LOT 42 DP618892

LOT 2 DP37430

LOT 32 DP554875

LOT 31 DP554875

LOT 41 DP1037411

LOT 42 DP1037411

LOT 481 DP804971

LOT 51 DP839722

LOT 105 DP1016640

LOT 5 DP234521

RIDING FOR THE DISABLED

PM 27956

HUNTER WATER CORPORATION LAND

LEGEND

- OBSERVATION POINT, WITH SLOPE WHERE
  - oc – OUTCROP IN AREA
  - b – BOULDERS AT SURFACE IN AREA
  - c – COBBLES AT SURFACE
  - (ss) – SANDSTONE
  - (cg) – CONGLOMERATE
  - (sh) – SHALE
  - (st) – SILTSTONE
  - (v) – VOLCANIC

TEST PIT LOCATION WITH DEPTH TO ROCK AND TERMINATION DEPTH

DRAWING ADAPTED FROM PLAN SUPPLIED BY JW PLANNING, REF NO. NRTBASETOP001, DATED 12.1.02

0 250 500 750 m

SCALE 1:15000 (A2 SHEET)

Douglas Partners
Geotechnics Environment Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Campbelltown, Townsville, Cairns, Wollongong, Darwin

TITLE: OBSERVATIONS AND TEST PIT LOCATION PLAN
PRELIMINARY GEOTECHNICAL AND CONTAMINATION ASSESSMENT
NORTH RAYMOND TERRACE

CLIENT: MONDEL PROPERTIES/MORGAN AND BANKS INVESTMENT PARTNERSHIP

DRAWN BY: LD	SCALE: 1:15000 (A2)	PROJECT No: 31638	OFFICE: NEWCASTLE
APPROVED BY:		DATE:	DRAWING No: 2

N

CLARENCE TOWN

WILLIAMS RIVER

WINSTON ROAD

SIX MILE ROAD

KURUAH ROAD

PACIFIC HIGHWAY

NEWLINE ROAD

RAYMOND TERRACE

LOT 33

LOT 32

DP 255221

LOT 31

W5 (6.7,155)

LOT 4822
DP852073

LOT 4821
DP852073

LOT 481
DP804971

W3 (6.2,310)

LOT 41
DP618892

LOT 42
DP618892

LOT 2
DP37430

W18 (7.5,250)

W19 (7.2,275)

LOT 32
DP554875

W1 (6.5,400)

LOT 31
DP554875

W17 (4.6,4450)

W16 (8.6,390)

W15 (6.6,4300)

W20 (7.4,5150)

W14 (7.1,4640)

W12 (5.6,4200)

W13 (9.3,1856)

LOT 51
DP839722

W11 (4.7,4090)

W10 (6.7,395)

LOT 41
DP1037411

W2 (6.6,250)

LOT 105

W6 (6.4,271)

W7 (7.7, 300)

DP1016640

W8 (6.9,375)

LOT 105

W9 (7.5,490)

DP1016640

W4 (6.9,314)

LOT 42
DP1037411

RIDING FOR THE DISABLED

LOT 5
DP234521

PM 27956

RAYMOND TERRACE

HUNTER WATER CORPORATION LAND

LEGEND

⊗ WATER TEST LOCATION (pH, EC (µS/cm))

DRAWING ADAPTED FROM PLAN SUPPLIED BY JW PLANNING, REF NO. NRTBASETOP001, DATED 12.1.02

0 250 500 750 m

SCALE 1:15000 (A2 SHEET)

Douglas Partners
Geotechnics Environment Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Campbelltown, Townsville, Cairns, Wollongong, Darwin

TITLE: TEST LOCATION PLAN
IN SITU pH AND EC TESTING OF SURFACE WATER
PRELIMINARY GEOTECHNICAL AND CONTAMINATION ASSESSMENT
NORTH RAYMOND TERRACE

CLIENT: MONDEL PROPERTIES/MORGAN AND BANKS INVESTMENT PARTNERSHIP			
DRAWN BY: LD	SCALE: 1:15000 (A2)	PROJECT No: 31638	OFFICE: NEWCASTLE
APPROVED BY:		DATE:	DRAWING No: 3

N

CLARENCE TOWN

RIVER

WILLIAMS

WINSTON ROAD

SIX MILE ROAD

KURUAH

LOT 33

LOT 32

LOT 31

DP 255228

LOT 4822
DP852073

LOT 4821
DP852073

LOT 481
DP804971

LOT 41
DP618892

LOT 42
DP618892

LOT 2
DP37430

LOT 32
DP554879

LOT 31
DP554879

LOT 41
DP1037411

LOT 42
DP1037411

LOT 51
DP839722

LOT 105

DP1016640

LOT 5
DP234521

PACIFIC HIGHWAY

NEWLINE ROAD

RAYMOND TERRACE

PM 27956

HUNTER WATER CORPORATION LAND

RIDING FOR THE DISABLED

TP1 (0.9/2.1)
TP2 (>2.1)
TP3 (0.2)
TP4 (>2.1)
TP5 (0.8/1.2)
TP6 (1.7/1.9)
TP7 (0.2/0.6)
TP8 (0.2/0.6)
TP9 (0.4/1.8)
TP10 (0.6/1.7)
TP11 (0.4/0.5)
TP12 (2.3/2.8)
TP13 (0.1/0.7)
TP14 (0.45/1.2)
TP15 (0.55/0.75)
TP16 (1.4/1.9)
TP17 (2.7/3.0)
TP18 (0.95/1.6)
TP19 (0.5/1.3)
TP20 (0.7/2.0)
TP21 (0.6/1.0)
TP22 (0.8/1.1)

LEGEND

GEOTECHNICAL TERRAIN UNITS (REFER TO TABLE 5 IN REPORT FOR DEFINITIONS)

TU1 – UPPER HILL SLOPES

TU2 – LOWER SLOPES

TU3 – LOW LYING

TU4 – ALTERED TERRAINS

APPROXIMATE AREA WHERE SLOPE EXCEEDS 4H:1V

TEST PIT LOCATION WITH DEPTH TO ROCK AND TERMINATION DEPTH

DRAWING ADAPTED FROM PLAN SUPPLIED BY JW PLANNING, REF NO. NRTBASETOPO01, DATED 12.1.02

0 250 500 750 m

SCALE 1:15000 (A2 SHEET)

Douglas Partners
Geotechnics Environment Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Campbelltown, Townsville, Cairns, Wollongong, Darwin

TITLE: GEOTECHNICAL TERRAIN UNITS
PRELIMINARY GEOTECHNICAL AND CONTAMINATION ASSESSMENT
NORTH RAYMOND TERRACE

CLIENT: MONDEL PROPERTIES/MORGAN AND BANKS INVESTMENT PARTNERSHIP			
DRAWN BY: LD	SCALE: 1:15000 (A2)	PROJECT No: 31638	OFFICE: NEWCASTLE
APPROVED BY:		DATE:	DRAWING No: 4

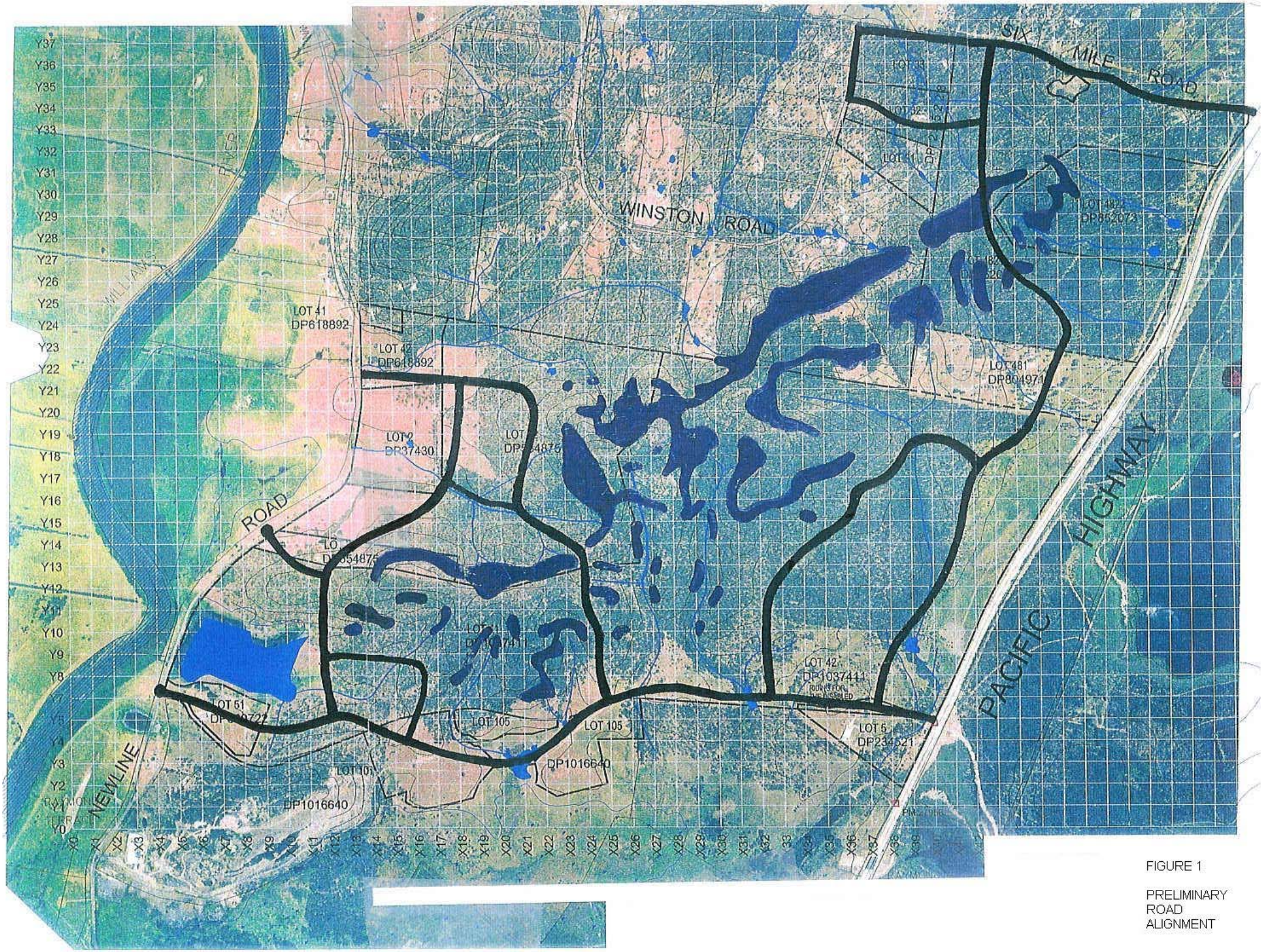
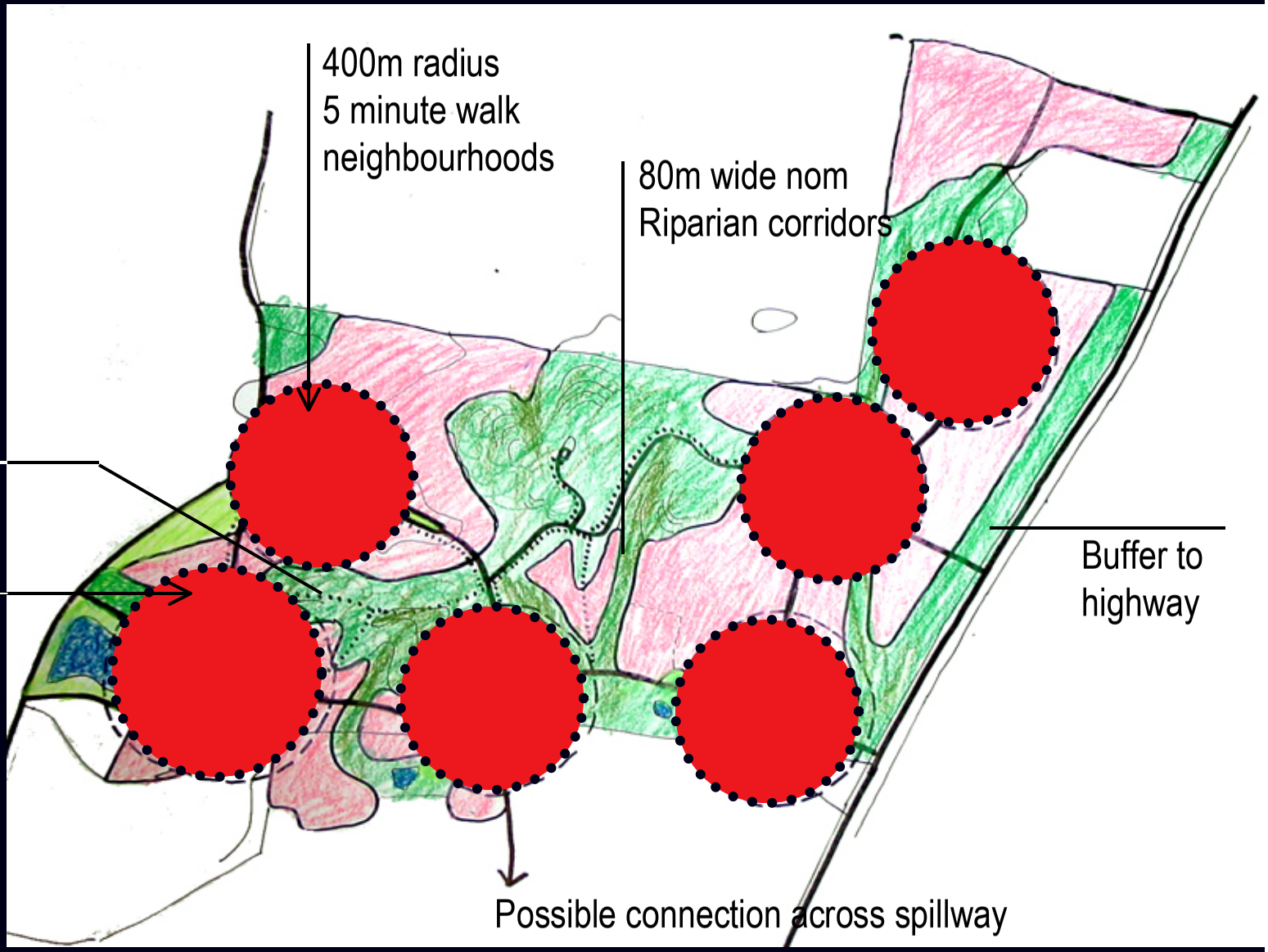


FIGURE 1

PRELIMINARY
ROAD
ALIGNMENT

FIGURE 2 – CONCEPT STRUCTURE PLAN



APPENDIX B

Notes Relating to this Report
Test Pit Report Sheets – Pits 1 to 22
Laboratory Report Sheet – Emerson Class Testing

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NOTES RELATING TO THIS REPORT

Introduction

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

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

Description and Classification Methods

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

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

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

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

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

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

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

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

Sampling

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

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

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

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

Drilling Methods.

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

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

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

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

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

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

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

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

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

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

  as 4, 6, 7
  N = 13

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

  as 15, 30/40 mm.

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

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

Cone Penetrometer Testing and Interpretation

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

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

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

The information provided on the plotted results comprises: —

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

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

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

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

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

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

q_c = (12 to 18) c_u

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

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

Hand Penetrometers

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

Two relatively similar tests are used.

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

Laboratory Testing

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

Bore Logs

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

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

Ground Water

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

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

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

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

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

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

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

Site Anomalies

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

Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section

is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

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

AN ENGINEERING CLASSIFICATION OF SEDIMENTARY ROCKS IN THE SYDNEY AREA

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

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

ROCK TYPE DEFINITIONS

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

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

DEGREE OF WEATHERING

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

STRATIFICATION SPACING

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

ROCK STRENGTH

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

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

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

DEGREE OF FRACTURING

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

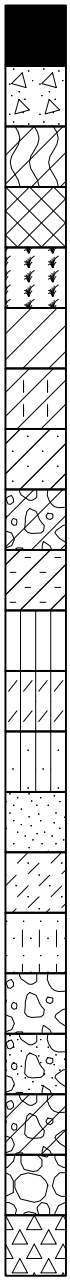
Term	Description
Fragmented:	The core is comprised primarily of fragments of length less than 20 mm, and mostly of width less than the core diameter.
Highly Fractured:	Core lengths are generally less than 20 mm - 40 mm with occasional fragments.
Fractured:	Core lengths are mainly 30 mm - 100 mm with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

REFERENCE

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

GRAPHIC SYMBOLS FOR SOIL & ROCK

SOIL



BITUMINOUS CONCRETE

CONCRETE

TOPSOIL

FILLING

PEAT

CLAY

SILTY CLAY

SANDY CLAY

GRAVELLY CLAY

SHALY CLAY

SILT

CLAYEY SILT

SANDY SILT

SAND

CLAYEY SAND

SILTY SAND

GRAVEL

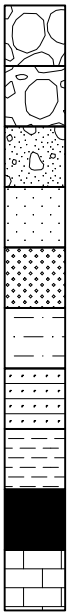
SANDY GRAVEL

CLAYEY GRAVEL

COBBLES/BOULDERS

TALUS

SEDIMENTARY ROCK



BOULDER CONGLOMERATE

CONGLOMERATE

CONGLOMERATIC SANDSTONE

SANDSTONE FINE GRAINED

SANDSTONE COARSE GRAINED

SILTSTONE

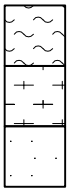
LAMINITE

MUDSTONE, CLAYSTONE, SHALE

COAL

LIMESTONE

METAMORPHIC ROCK

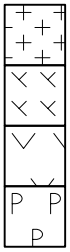


SLATE, PHYLITTE, SCHIST

GNEISS

QUARTZITE

IGNEOUS ROCK



GRANITE

DOLERITE, BASALT

TUFF

PORPHYRY

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Site Assessment
LOCATION: North Raymond Terrace

DATE: 23 January 2003
PROJECT No.: 31638
SURFACE LEVEL: -

PIT No: 1
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Depth (m)	Results	Water
	TOPSOIL: Hard, dark grey black clay topsoil, fissured, M<Wp		D,pp	0.1	>400kPa	
0.3	SILTY SANDY CLAY: Hard, yellow brown silty sandy clay, gradational base, M<Wp		D,pp	0.5	>400kPa	
0.9	SILTSTONE: Highly weathered, highly fractured, thinly bedded, easy digging		D	1.5		
2.1	Test Pit 1 terminated at 2.1m					

RIG: JCB 3CX
LOGGED: Ramage
GROUND WATER OBSERVATIONS: No free groundwater observed
REMARKS: N385481, E6378554

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)
D	Disturbed sample	Wp	Plastic limit (%)
M	Moisture content	HV	Hand Vane

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Site Assessment
LOCATION: North Raymond Terrace

DATE: 23 January 2003
PROJECT No.: 31638
SURFACE LEVEL: -

PIT No: 2
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Sampling & Testing: Depth (m)	Sampling & Testing: Results	Water
0.05	TOPSOIL: Grey sandy silt, dry					
	CLAY: Very stiff to hard, grey brown clay with some sand, M<Wp		D,pp	0.5	>400kPa	
0.8	SILTY CLAY: Hard, orange/grey brown silty clay with some sand/gravel, minor weak siltstone/sandstone seams, M<Wp		D,pp	1.5	>400kPa	
2.1	Test Pit 2 terminated at 2.1m					

RIG: JCB 3CX
LOGGED: Ramage

GROUND WATER OBSERVATIONS: No free groundwater observed

REMARKS: N385026, E6378573, Approx 15m from outcrop

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	pp Pocket penetrometer (kPa)
B Bulk sample	U_x Tube sample (x mm dia.)
D Disturbed sample	Wp Plastic limit (%)
M Moisture content	HV Hand Vane

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Site Assessment
LOCATION: North Raymond Terrace

DATE: 23 January 2003
PROJECT No.: 31638
SURFACE LEVEL: -

PIT No: 3
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing			Water
			Type	Depth (m)	Results	
0.2	TOPSOIL: Hard, grey clayey silt with some sand, dry		D	0.1		
0.4	DOLERITE/DACITE: Highly weathered, medium to coarse grained phenocrysts, fractured		D	0.3		
	Test Pit 3 terminated at 0.4m, refusal					

RIG: JCB 3CX
LOGGED: Ramage/Blackert
GROUND WATER OBSERVATIONS: No free groundwater observed
REMARKS: N384166, E6378255

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)
D	Disturbed sample	Wp	Plastic limit (%)
M	Moisture content	HV	Hand Vane

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Site Assessment
LOCATION: North Raymond Terrace

DATE: 23 January 2003
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SURFACE LEVEL: -

PIT No: 4
SHEET 1 **of** 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Sampling & Testing: Depth (m)	Sampling & Testing: Results	Water
	TOPSOIL: Hard, grey sandy silt, rootlets top 0.1m, dry		D	0.2		
0.3	CLAY: Very stiff to hard, grey brown clay with some sand, M<Wp		D,pp	0.5	>400kPa	
1.0	CLAYEY SAND: Hard, grey brown clayey sand with some gravel (possibly cemented colluvium), slow digging, dry		D,pp	1.5	>400kPa	
2.1	Test Pit 4 terminated at 2.1m					

RIG: JCB 3CX
LOGGED: Ramage

GROUND WATER OBSERVATIONS: No free groundwater observed

REMARKS: N384161, E6378314

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	pp Pocket penetrometer (kPa)
B Bulk sample	U_x Tube sample (x mm dia.)
D Disturbed sample	Wp Plastic limit (%)
M Moisture content	HV Hand Vane

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Site Assessment
LOCATION: North Raymond Terrace

DATE: 23 January 2003
PROJECT No.: 31638
SURFACE LEVEL: -

PIT No: 5
SHEET 1 **of** 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Depth (m)	Results	Water
0.1	TOPSOIL: Hard, grey sandy silt some rootlets, dry		D	0.05		
	CLAY: Hard, grey brown clay with some sand/gravel, M<Wp		D,pp	0.4	>400kPa	
0.6	SILTY SANDY CLAY: Hard, orange/yellow brown silty sandy clay, M<Wp		D,pp	0.7	>400kPa	
0.8	DOLERITE/DACITE: Extremely weathered, grey brown with white phenocrysts					
1.5	Test Pit 5 terminated at 1.5m, refusal					

RIG: JCB 3CX
LOGGED: Ramage

GROUND WATER OBSERVATIONS: No free groundwater observed

REMARKS: N383218, E6378354

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)
D	Disturbed sample	Wp	Plastic limit (%)
M	Moisture content	HV	Hand Vane

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
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LOCATION: North Raymond Terrace

DATE: 23 January 2003
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SURFACE LEVEL: -

PIT No: 6
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Sampling & Testing: Depth (m)	Sampling & Testing: Results	Water
0.3	TOPSOIL: Grey sandy silt, rootlets top 0.1m, dry		D	0.2		
	SANDY CLAY: Hard, orange brown sandy clay with some gravel, grading to extremely low strength siltstone, M<Wp		D,pp	1.0	>400kPa	
1.7	SILTSTONE: Highly weathered, light orange brown, fractured siltstone					
1.9	Test Pit 6 terminated at 1.9m, refusal					

RIG: JCB 3CX
LOGGED: Ramage
GROUND WATER OBSERVATIONS: No free groundwater observed
REMARKS: N383603, E6378630

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	pp Pocket penetrometer (kPa)
B Bulk sample	U_x Tube sample (x mm dia.)
D Disturbed sample	Wp Plastic limit (%)
M Moisture content	HV Hand Vane

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Site Assessment
LOCATION: North Raymond Terrace

DATE: 23 January 2003
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SURFACE LEVEL: -

PIT No: 7
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Sampling & Testing: Depth (m)	Sampling & Testing: Results	Water
	TOPSOIL: Grey silty sand and some rootlets		D	0.1		
0.2	Test Pit 7 terminated at 0.2m, refusal in sandstone					

RIG: JCB 3CX
LOGGED: Ramage

GROUND WATER OBSERVATIONS: No free groundwater observed

REMARKS: N383342, E6379056

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)
D	Disturbed sample	Wp	Plastic limit (%)
M	Moisture content	HV	Hand Vane

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Site Assessment
LOCATION: North Raymond Terrace

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SURFACE LEVEL: -

PIT No: 8
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Sampling & Testing: Depth (m)	Sampling & Testing: Results	Water
0.2	TOPSOIL; Grey sandy silt some rootlets, dry					
0.6	SANDSTONE: Highly weathered, yellow-brown highly fractured sandstone					
	Test Pit 8 terminated at 0.6m, refusal in fractured sandstone					

RIG: JCB 3CX
LOGGED: Ramage
GROUND WATER OBSERVATIONS: No free groundwater observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)
D	Disturbed sample	Wp	Plastic limit (%)
M	Moisture content	HV	Hand Vane

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SURFACE LEVEL: -

PIT No: 9
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Depth (m)	Results	Water
	SANDY SILTY CLAY/CLAYEY SILT: Hard, light brown/grey sandy silt clay/clayey silt with some fine to medium grained gravel and rootlets to 0.1m, M<<Wp		D,pp	0.2	>600kPa	
0.4	SANDSTONE: Extremely weathered, light grey/orange sandstone		D	0.45		
0.5	CONGLOMERATE: Extremely weathered, light grey mottled orange conglomerate, gravel up to 100mm, some rounded and other fractured sandstone cobbles		D	0.8		
1.0	Test Pit 9 terminated at 1.0m, backhoe refusal					

RIG: JCB 3CX
LOGGED: Blackert
GROUND WATER OBSERVATIONS: No free groundwater observed
REMARKS: E384574, N6379187

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)
D	Disturbed sample	Wp	Plastic limit (%)
M	Moisture content	HV	Hand Vane

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SURFACE LEVEL: -

PIT No: 10
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Depth (m)	Results	Water
0.1	TOPSOIL: Light grey silty sand, M<<Wp					
	GRAVELLY SILTY SAND/SANDY SILT: Hard, light grey gravelly silty sand, dry, gravel content up to 150mm, subrounded with some sandstone gravel		D,pp	0.4	>600kPa	
0.6	SANDY CLAY (Conglomerate): Hard, grey/brown, slightly cemented sandy clay with trace fine to medium grained gravel, M<<Wp Grading to fine to coarse grained sandstone/conglomerate		D,pp	0.9	>600kPa	
1	From about 1.0m, with some sandstone cobbles					1
			D	1.6		
1.7	Test Pit 10 terminated at 1.7m, backhoe refusal on conglomerate					
2						2

RIG: JCB 3CX
LOGGED: Blackert

GROUND WATER OBSERVATIONS: No free groundwater observed

REMARKS: E384341, N6379476, High resistance to excavation from about 1m

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	pp Pocket penetrometer (kPa)
B Bulk sample	U_x Tube sample (x mm dia.)
D Disturbed sample	Wp Plastic limit (%)
M Moisture content	HV Hand Vane

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SURFACE LEVEL: -

PIT No: 11
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Sampling & Testing: Depth (m)	Sampling & Testing: Results	Water
0.05	TOPSOIL: Grey silty sand, with trace to some rootlets, dry		D	0.02		
	SILTY SAND/SANDY SILT: Light grey, fine to medium grained sandy silt, dry Grading to sandstone		D	0.3		
0.4	SANDSTONE: Extremely weathered, light grey mottled red orange sandstone		D	0.45		
0.5	Test Pit 11 terminated at 0.5m, backhoe refusal					

RIG: JCB 3CX
LOGGED: Blackert

GROUND WATER OBSERVATIONS: No free groundwater observed

REMARKS: E383947, N6379648

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)
D	Disturbed sample	Wp	Plastic limit (%)
M	Moisture content	HV	Hand Vane

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SURFACE LEVEL: -

PIT No: 12
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Depth (m)	Results	Water
0.1	TOPSOIL: Light grey silty sand, trace to some rootlets, dry					
	SANDY SILT: Hard, light grey sandy silt (partially cemented), with trace roots, dry		D,pp	0.2	>400kPa	
0.3	SANDY CLAY: Hard, brown mottled orange sandy clay, trace sandstone gravel/cobbles, M<Wp		D,pp	0.7	>400kPa	
1.1	SILTY CLAY: Very stiff to hard, light grey/yellow mottled orange silty clay, trace fine sand and rootlets, M<Wp Silt and moisture content increasing with depth		D	1.2		
	From 1.6m, becoming fractured, grading to siltstone		D	1.8		
2.3	SILTSTONE/SILTY CLAY: Extremely weathered, highly fractured, light grey mottled yellow orange siltstone with interbedded silty clay Silty clay content decreasing with depth		D	2.6		
2.8	Test Pit 12 terminated at 2.8m					

RIG: JCB 3CX Backhoe
LOGGED: Blackert
GROUND WATER OBSERVATIONS: No free groundwater observed
REMARKS: E384266, N6379838

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	pp Pocket penetrometer (kPa)
B Bulk sample	U_x Tube sample (x mm dia.)
D Disturbed sample	Wp Plastic limit (%)
M Moisture content	HV Hand Vane

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PROJECT: Preliminary Site Assessment
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SURFACE LEVEL: -

PIT No: 13
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Sampling & Testing: Depth (m)	Sampling & Testing: Results	Water
0.1	TOPSOIL: Grey sandy silt, trace to some rootlets, roots, dry		D	0.05		
	CEMENTED SAND: Light grey/grey silty sand with interbedded cemented gravelly clayey sand, with interbeded gravel/cobbles Grading to sandstone		D	0.3		
			D	0.6		
0.65	Test Pit 13 terminated at 0.65m, backhoe refusal on sandstone					

RIG: JCB 3CX Backhoe
LOGGED: Blackert
GROUND WATER OBSERVATIONS: No free groundwater observed
REMARKS: E385275, N6379199

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)
D	Disturbed sample	Wp	Plastic limit (%)
M	Moisture content	HV	Hand Vane

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
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LOCATION: North Raymond Terrace

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SURFACE LEVEL: -

PIT No: 14
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Sampling & Testing: Depth (m)	Sampling & Testing: Results	Water
0.1	TOPSOIL: Light grey gravelly sandy silt with some rootlets, dry		D	0.05		
	SILTY SAND: Grey/light grey silty sand with trace roots, dry Grading to sandstone		D,pp	0.3	450-500kPa	
0.45	SANDSTONE: Extremely weathered, light grey mottled orange, fine to coarse grained sandstone Strength increasing with depth		D,pp	0.5	>600kPa	
			D	1.0		
1.2	Test Pit 14 terminated at 1.2m, backhoe refusal					

RIG: JCB 3CX Backhoe
LOGGED: Blackert
GROUND WATER OBSERVATIONS: No free groundwater observed
REMARKS: E385820, N6379454

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	pp Pocket penetrometer (kPa)
B Bulk sample	U_x Tube sample (x mm dia.)
D Disturbed sample	Wp Plastic limit (%)
M Moisture content	HV Hand Vane

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
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SURFACE LEVEL: -

PIT No: 15
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Depth (m)	Results	Water
0.1	TOPSOIL: Light grey, fine to medium grained silty sand/sandy silt with trace to some rootlets, dry					
	SANDY SILT: Hard, grey mottled orange sandy silt, with some gravel/cobbles, dry		D,pp	0.2	>600kPa	
0.3	CLAY: Hard, grey/brown mottled orange clay with some silt and sand, trace roots, M<<Wp		D,pp	0.4	>600kPa	
0.55	SANDSTONE/CONGLOMERATE: Extremely weathered, light grey mottled orange, coarse sandstone/conglomerate with trace to some river gravel up to 100mm, dry		D	0.6		
0.75	Test Pit 15 terminated at 0.75m, backhoe refusal					

RIG: JCB 3CX Backhoe
LOGGED: Blackert
GROUND WATER OBSERVATIONS: No free groundwater observed
REMARKS: E386089, N6379825

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	pp Pocket penetrometer (kPa)
B Bulk sample	U_x Tube sample (x mm dia.)
D Disturbed sample	Wp Plastic limit (%)
M Moisture content	HV Hand Vane

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PIT No: 16
SHEET 1 **of** 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Depth (m)	Results	Water
0.1	TOPSOIL: Dark grey/brown silty clay, with trace to some rootlets, M<Wp					
	SILTY CLAY: Hard, dark brown clay, some silt, M<Wp		D,pp	0.15	>600kPa	
0.25	CLAY: Hard, red/brown clay, trace uncemented gravel up to 30mm, M<Wp Moisture content increasing with depth		D,pp	0.5	400-550kPa	
0.75	CLAY: Very stiff to hard, light grey mottled orange red clay, trace sand, M>Wp From about 1.0m, moisture content decreasing with depth, grading to siltstone		D,pp	1.1	390-420kPa	
1.4	SILTSTONE: Extremely weathered, extremely fractured, light grey mottled orange red siltstone/sandstone (possible volcanic origin)		D	1.8		
1.9	Test Pit 16 terminated at 1.9m, virtual backhoe refusal					

RIG: JCB 3CX Backhoe
LOGGED: Blackert

GROUND WATER OBSERVATIONS: No free groundwater observed

REMARKS: E386400, N6379658

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)
D	Disturbed sample	Wp	Plastic limit (%)
M	Moisture content	HV	Hand Vane

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PIT No: 17
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Depth (m)	Results	Water
	TOPSOIL: Grey sandy silt, trace to some rootlets, dry		D	0.1		
0.2	CLAY: Very stiff to hard, brown/grey clay, some silt, M>Wp Moisture content increasing with depth		D,pp	0.4	550kPa	
			pp	1.0	400kPa	
			D,pp	1.6	550kPa	
2.0	SILTY CLAY: Very stiff to hard, light grey/yellow silty clay with interbedded iron cemented gravel up to 100mm, M<Wp Grading to basalt with depth		D,pp	2.2	350->600kPa	
2.7	BASALT: Extremely weathered, highly fractured, light grey/yellow and dark grey/black basalt Test Pit 17 terminated at 3.0m		D	2.8		
3.0						

RIG: JCB 3CX Backhoe
LOGGED: Blackert

GROUND WATER OBSERVATIONS: No free groundwater observed

REMARKS: E386400, N6379658

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	pp Pocket penetrometer (kPa)
B Bulk sample	U_x Tube sample (x mm dia.)
D Disturbed sample	Wp Plastic limit (%)
M Moisture content	HV Hand Vane

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TEST PIT REPORT

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PROJECT: Preliminary Site Assessment
LOCATION: North Raymond Terrace

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SURFACE LEVEL: -

PIT No: 18
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Sampling & Testing: Depth (m)	Sampling & Testing: Results	Water
0.4	CLAY: Hard, dark brown clay, trace silt and rootlets, M<<Wp (structured)		D,pp	0.2	>600kPa	
0.95	SANDY CLAY: Hard, light yellow mottled brown sandy clay with interbedded iron cemented nodules, M<<Wp		D,pp	0.7	>600kPa	
1.6	SILTSTONE/SANDSTONE: Extremely weathered, highly fractured yellow brown mottled black siltstone/fine sandstone		D	1.3		
	Test Pit 18 terminated at 1.6m, very slow progress					

RIG: JCB 3CX Backhoe
LOGGED: Blackert
GROUND WATER OBSERVATIONS: No free groundwater observed
REMARKS: E385758, N6378648

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)
D	Disturbed sample	Wp	Plastic limit (%)
M	Moisture content	HV	Hand Vane

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SURFACE LEVEL: -

PIT No: 19
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Sampling & Testing: Depth (m)	Sampling & Testing: Results	Water
0.05	TOPSOIL: Light brown sandy silt with some rootlets, dry		D	0.02		
	SILTY CLAY: Hard, light brown mottled orange silty clay, some sand, with trace gravel, M<<Wp Grading to siltstone		D	0.3		
			pp	0.4	>600kPa	
0.5	SILTSTONE: Grey/dark grey, extremely weathered, extremely fractured siltstone/sandstone with interbedded clay Strength increasing with depth		D	0.6		
1			pp	1.0	>600kPa	
			D	0.9		
1.3	Test Pit 19 terminated at 1.3m, very slow progress					
2						

RIG: JCB 3CX Backhoe
LOGGED: Blackert
GROUND WATER OBSERVATIONS: No free groundwater observed
REMARKS: E386451, N6381395

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	pp Pocket penetrometer (kPa)
B Bulk sample	U_x Tube sample (x mm dia.)
D Disturbed sample	Wp Plastic limit (%)
M Moisture content	HV Hand Vane

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TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
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SURFACE LEVEL: -

PIT No: 20
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Sampling & Testing: Depth (m)	Sampling & Testing: Results	Water
0.1	TOPSOIL: Light grey clayey silt with some siltstone gravel and some rootlets, dry		D	0.05		
	SILTSTONE: Extremely weathered, extremely fractured, light grey orange brown siltstone with interbedded clay to 0.35m Siltstone bedded at about 40°		D	0.2		
			D	0.8		
1.2	Test Pit 20 terminated at 1.2m, very slow progress					

RIG: JCB 3CX Backhoe
LOGGED: Blackert
GROUND WATER OBSERVATIONS: No free groundwater observed
REMARKS: E386510, N6380759

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)
D	Disturbed sample	Wp	Plastic limit (%)
M	Moisture content	HV	Hand Vane

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Site Assessment
LOCATION: North Raymond Terrace

DATE: 24 January 2003
PROJECT No.: 31638
SURFACE LEVEL: -

PIT No: 21
SHEET 1 of 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing			Water
			Type	Depth (m)	Results	
	SANDY SILT: Hard, light grey sandy silt, trace fine to medium grained gravel and trace rootlets, dry		D,pp	0.2	>600kPa	
0.4	SANDY CLAY: Hard, light grey mottled yellow orange sandy clay, M<Wp		D,pp	0.6	>600kPa	
0.8	SANDSTONE: Extremely weathered, light grey orange brown sandstone		D	0.9		
0.95			D	0.97		
1.0	SILTSTONE: Extremely weathered, highly fractured, light grey orange brown siltstone					
	Test Pit 21 terminated at 1.0m, very slow progress					

RIG: JCB 3CX Backhoe
LOGGED: Blackert

GROUND WATER OBSERVATIONS: No free groundwater observed

REMARKS: E387029, N6381207

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)
D	Disturbed sample	Wp	Plastic limit (%)
M	Moisture content	HV	Hand Vane

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT REPORT

CLIENT: J W Planning Pty Ltd
PROJECT: Preliminary Site Assessment
LOCATION: North Raymond Terrace

DATE: 24 January 2003
PROJECT No.: 31638
SURFACE LEVEL: -

PIT No: 22
SHEET 1 **of** 1

Depth (m)	Description of Strata	Graphic Log	Sampling & Testing: Type	Sampling & Testing: Depth (m)	Sampling & Testing: Results	Water
	TOPSOIL: Grey clayey silt, some gravel and rootlets, dry		D	0.1		
0.25	SANDY SILTY CLAY/CLAYEY SILT: Hard, light grey sandy silty clay, with some interbedded sandstone gravel/cobbles, M<<Wp Grading to sandstone		D,pp	0.5	>600kPa	
0.8	SANDSTONE: Extremely weathered, slightly fractured, light grey orange brown, coarse sandstone		D	1.1		
1.4	Test Pit 22 terminated at 1.4m, backhoe refusal					

RIG: JCB 3CX Backhoe
LOGGED: Blackert
GROUND WATER OBSERVATIONS: No free groundwater observed
REMARKS: E384970, N6379074

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)
D	Disturbed sample	Wp	Plastic limit (%)
M	Moisture content	HV	Hand Vane

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ACN 053 980 117

Douglas Partners Pty Ltd
ABN 75 053 980 117
Box 324
HUNTER REGION MAIL CENTRE
NSW 2310 Australia
newcastle@douglaspartners.com.au

15 Callistemon Close
Warabrook, NEWCASTLE

Phone: (02) 4960 9600
Fax: (02) 4960 9601

DETERMINATION OF EMERSON CLASS NUMBER OF SOIL

CLIENT: J W Planning Pty Ltd

PROJECT NO: 31638
REPORT NO: N03-011
DATE: 30.1.03

DATE OF TESTING: 28.1.03
PAGE: 1 of 1

PROJECT: Preliminary Site Assessment
LOCATION: North Raymond Terrace

TEST METHOD: AS.1289.3.8.1-1997
TESTED BY: DM
CHECKED BY: DM

SAMPLE NO	DEPTH (m)	DATE SAMPLED	DESCRIPTION	WATER TYPE	WATER TEMP	CLASS NO.
TP 1	0.5	28.1.03	Yellow brown silty sandy clay	Distilled	30	5
TP 4	0.5	28.1.03	Grey brown clay some sand	Distilled	30	6
TP 5	0.4	28.1.03	Grey brown clay some sand/gravel	Distilled	30	5
TP 9	0.2	28.1.03	Light brown/grey sandy silty clay/clayey sandy silt	Distilled	30	8
TP 12	0.7	28.1.03	Brown mottled orange sandy clay	Distilled	30	3
TP 15	0.4	28.1.03	Grey brown mottled orange clay with some silt/sand	Distilled	30	5
TP 16	0.5	28.1.03	Red brown clay trace iron cemented gravel	Distilled	30	6
TP 17	0.4	28.1.03	Brown grey clay with some silt	Distilled	30	5
TP 19	0.3	28.1.03	Light brown mottled orange silty clay some sand	Distilled	30	5
TP 22	0.5	28.1.03	Light grey sandy silty clay/clayey silty with some siltstone gravel	Distilled	30	5

Remarks:

SIGNATORY:

D Millard
Laboratory Manager

NATA Accredited Laboratory
Number: Newcastle 1670

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its terms of accreditation. This document shall not be reproduced except in full.

Douglas Partners
Geotechnics · Environment · Groundwater

APPENDIX C

PSC BA/DA Search
NSW EPA Search
DLWC Search

Telephone Inquiries
Sustainable Planning#
Karen Fenwick
Please Quote File No:
9740.112.

Douglas Partners
Box 324
Hunter Region Mail Centre
NSW 2310

Att: Matthew Blackert

Dear Mathew

Re: Raymond Terrace Site Investigation

I refer to your fax dated 9 January 2003, please find following a list of applications received for the above investigation.

Lot 4821 DP 852073	16.2000.651.1 16.1998.2038.1 15.1997.681.1	Dam 2 Lot Subdivision Septic Tank	Approved 6/9/00 Withdrawn 19/2/99 Approved 3/6/97
Lot 4822 DP 852073	7.1996.60628.1 7.1995.11230.1	Relocate Dwelling Combined Machinery Shed & Wastewater Treatment Plant	Approved 12/6/96 Approved 4/12/95
Lot 481 DP 804971	16.1998.2058.1 15.1996.1634.1 7.1996.61629.1 7.1995.318.1	Advertising Sign Septic Tank Dwelling Communication and Solar Power Expo	Approved 1/4/99 Approved 29/1/97 Aproved 17/1/97 Approved 15/3/95
Lot 41 DP 618892	7.1983.1938.1 7.1982.1477.1 7.1982.60765.1	Conversion of existing Dwelling to Duplex Dwelling	Approved 28/7/83 Approved 3/8/82 Approved 12/8/82
Lot 5, DP 234521	16.2001.482.1 7.1994.32053.1 7.1993.60493.1 7.1992.60217.1 7.1991.5242.1 7.1990.5031.1 7.1985.2999.1	Additions to Premises Amenities Block & Viewing Area Shed (for covered riding) Hay Shed Riding Arena 3 Lot Subdivision Riding Club & Dwelling	Approved 16/5/01 Approved 30/1/95 Approved 12/5/93 Approved 10/4/92 Approved 5/6/91 Approved 6/12/90 Approved 11/11/85

	7.1990.5131.1	Subdivision – 3 Lots	Withdrawn 31/12/90

Should you have any further enquiries, please don't hesitate to contact me on 4980 0324

Yours faithfully

Karen Fenwick
EXECUTIVE ASSISTANT
SUSTAINABLE PLANNING

Telephone Inquiries
Sustainable Planning#
Karen Fenwick
Please Quote File No:
9740.112.

Douglas Partners
Box 324
Hunter Region Mail Centre
NSW 2310

Att: Matthew Blackert

Dear Mathew

Re: Raymond Terrace Site Investigation

Further to your email received today, I supply the following information.

Lot 31 DP 255228	16.1999.1712.1	Farm Shed	Approved 15.11.99
	7.1997.61690.1	Farm/Machinery Shed	Approved 10.12.97
	7.1995.61698.1	Additions to Dwelling & Pergola	Approved 14.11.95
	7.1991.60195.1		Approved 15.3.91
	7.1981.670.1	Dwelling	Approved 10.7.81
	7.1981.60865.1		Approved 30.6.81
Lot 32 DP 255228	16.2001.122.1	Change Tourist Facility to Dual Occ and Dwelling	Approved 22.3.01
	16.1998.1241.1	Tourist Facility	Approved 14/9/98
	16.1998.1112.1	Swimming Pool	Approved 15.7.98
	15.1997.850.1	Septic Tank	Approved 23/12/97
	7.1997.60850.1	Dwelling	Approved 15.7.97
	7.1997.851.1	Track & Widen Dam Wall	Withdrawn 2.7.97
	7.1994.61807	Garage	Approved 21.11.94
	7.1980.214.1	Dwelling	Approved 5.12.80
Lot 33 DP 255228	7.1985.2876.1	Dwelling	Approved 12.8.85
	7.1985.60714.1		Approved 23.8.85

Should you have any further enquiries, please don't hesitate to contact me on 4980 0324

Yours faithfully

Karen Fenwick
EXECUTIVE ASSISTANT
SUSTAINABLE PLANNING

Land and Property Information

LAND AND PROPERTY INFORMATION NSW

CENTRAL REGISTER OF RESTRICTIONS

2193X - DOUGLAS PARTNERS P/L

APPLN NO: 154825 ISSUED: 10/1/2003 8:46 AM

YOUR REFERENCE: MB-31638 PAGE 1 of 1

Certificate

REFERENCE: 41/1037411, 51/839722, 42/1037411, 4821/852073, 4822/852073, 481/804971, 105/1016640, 31/554875, 15479-238, 42/618892, 41/618892, 5/234521, NO REFS

LGA: PORT STEPHENS

PARISH: THORNTON COUNTY: GLOUCESTER
PARISH: ELDON COUNTY: GLOUCESTER

NO. OF AUTHORITIES INQUIRED OF: 1

THE FOLLOWING AUTHORITIES HAVE A POSSIBLE OR ACTUAL INTEREST IN THIS PROPERTY. YOUR INQUIRY HAS BEEN REFERRED TO THEM FOR DIRECT RESPONSE:

ENVIRONMENT PROTECTION AUTHORITY

REGISTRAR GENERAL

***** END OF CERTIFICATE *****

Land and Property Information

LAND AND PROPERTY INFORMATION NSW

CENTRAL REGISTER OF RESTRICTIONS

2193X - DOUGLAS PARTNERS P/L

APPLN NO: 157229 ISSUED: 16/1/2003 10:09 AM

YOUR REFERENCE: MB31638-1 PAGE 1 of 1

Certificate

REFERENCE: 31/255228, 32/255228, 33/255228

LGA: PORT STEPHENS

PARISH: THORNTON COUNTY: GLOUCESTER

NO. OF AUTHORITIES INQUIRED OF: 1

THE FOLLOWING AUTHORITIES HAVE NO INTEREST RECORDED IN THIS PROPERTY:

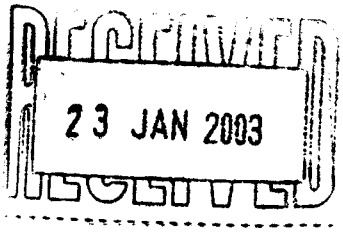
ENVIRONMENT PROTECTION AUTHORITY

THE ENVIRONMENT PROTECTION AUTHORITY CURRENTLY HAS NO STATUTORY NOTICES ISSUED UNDER THE PROVISIONS OF THE UNHEALTHY BUILDING LAND ACT.

REGISTRAR GENERAL

***** END OF CERTIFICATE *****

Your Reference : MB - 31638
Our Reference : UB1644.152580



NSW EPA

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

Re: Property at Pacific Highway Raymond Terrace. Refer to Schedule of Lots attached.

The Environment Protection Authority (EPA) currently has no statutory notices issued under the provisions of the *Unhealthy Building Land Act 1990* (the UBL Act) for the subject land.

However, records provided to the EPA by the Department of Health (the agency responsible for the administration of equivalent legislation preceding the UBL Act) indicate that Port Stephens Council on 23 March 1989 proposed to operate a landfill on part of 5//DP 37430 (now 51//DP 839722). The area of the landfill proposed at that time is shown by pink colouring on the attached diagram.

The EPA is unaware whether the land was actually used as a landfill. You should contact Port Stephens Council to ascertain whether or not a landfill formerly operated on the site. Affected parties should make their own inquiries, which may include obtaining specialist advice, to satisfy themselves that the land is suitable for its intended use.

Following commencement of the regulatory aspects of the Contaminated Land Management Act 1997 (the CLM Act) on 1 September 1998, the Environment Protection Authority no longer issues notices under s.35 or 36 of the Environmentally Hazardous Chemicals Act 1985 (the EHC Act).

The CLM Act provides that remaining current EHC Act notices, as well as current action taken under the CLM Act will now be noted on planning certificates issued by local councils under s.149(2) of the Environment Planning and Assessment Act. 1979.

Gretel Purser
Acting Manager Land & Waste Information Databases
Chemicals & Waste Branch

Date 16.01.2003

** On receipt, please check that the property details above are correct.

Environment Protection Authority
PO Box A290, SYDNEY SOUTH 1232 Telephone 9995 5495 Facsimile 9995 5962 www.epa.nsw.gov.au

Schedule of Lots Referred to in our Verification of Notices under Unhealthy Building Land Act

152580

MB - 31638

SCHEDULE :

Lot :	Portion:	Section :	DP or SP No :
41-42			DP 1037411
51			DP 839722
4821-4822			DP 852073
481			DP 804971
105			DP 1016640
31-32			DP 554875
2			DP 37430
41-42			DP 618892
5			DP 234521

** On receipt, please check that the property details above are correct.

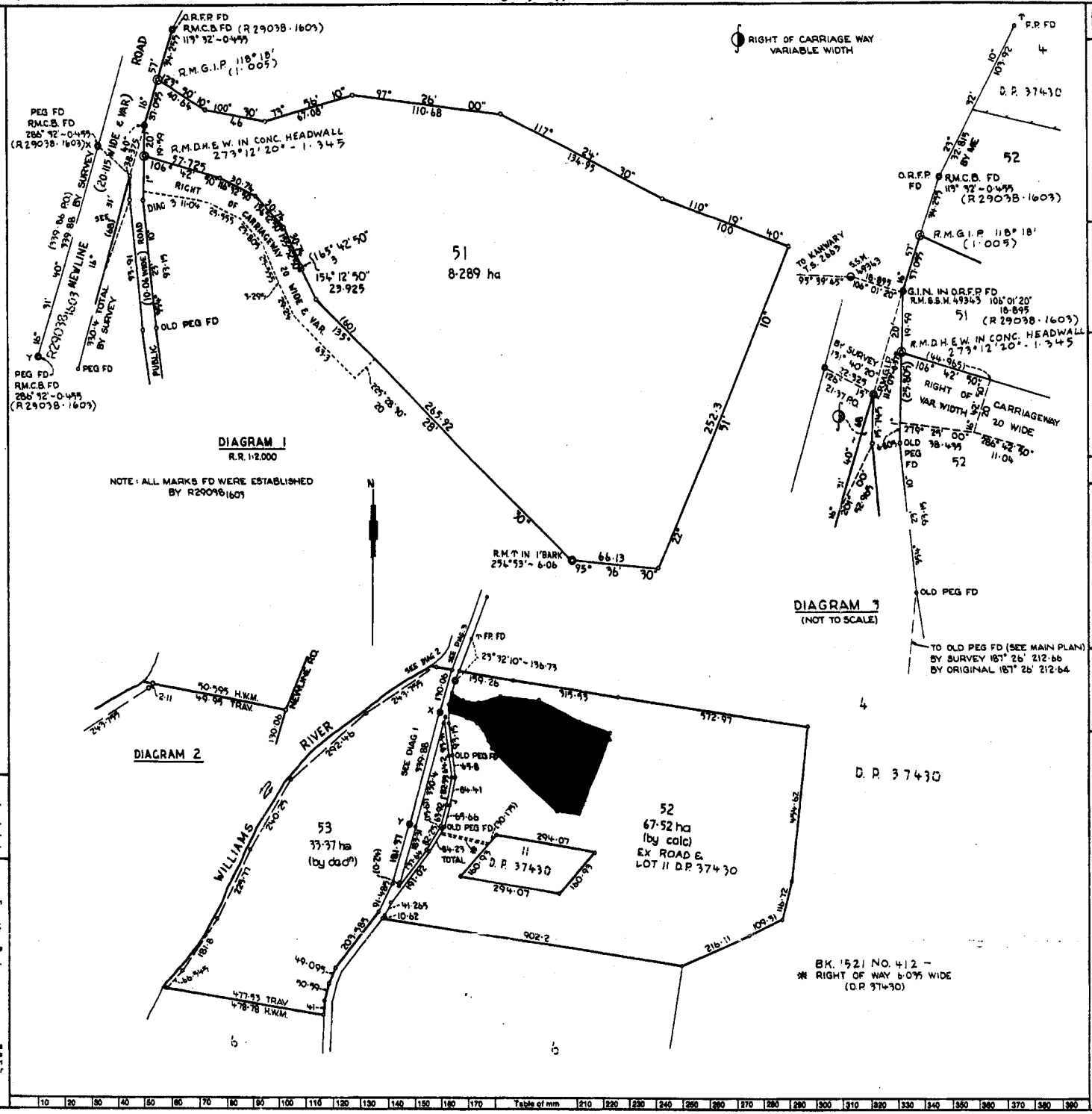
PLAN FORM 2

Plan Drawing only to appear in this space

*OFFICE USE ONLY

1644 DP 839722

SIGNATURE AND SEALS ONLY.



Crown Lands Office Approval

PLAN APPROVED .....
Authorised Officer

Land District .....

Paper No. .....

Field Book ..... pages .....

Council Clerk's Certificate

I hereby certify that —

(a) the requirements of the Local Government Act, 1919 (other than the requirements for the registration of plans), and

(b) the requirements of section 348 of the [redacted] † Hunter District Water, Sewerage, and Drainage Act, 1938, as amended

have been complied with by the applicant in relation to the proposed Subdivision.....
(insert "new road", "subdivision" or "consolidated lot") set out herein

Subdivision No. 89/23.....

dated 29th March 1989.....

(signature) .....
Deputy Council Clerk

Council File No. S2/1/88/54/7293.

*This part of certificate to be deleted where the application is only for a consolidated lot or the opening of a new road or where the land to be subdivided is wholly outside the areas of operations of the Metropolitan Water, Sewerage and Drainage Board and the Hunter District Water Board.

† Delete if inapplicable.

SURVEYOR'S REFERENCE: 87/8 M.P.D.

Registered: 23.8.1994

C.A. NO. 89/23 OF 29.3.1989

Title System: OLD SYSTEM

Purpose: SUBDIVISION

Ref. Map: U 6372 - 6 *

Last Plan: D.P. 37430 *

PLAN OF SUBDIVISION OF LOT 5 D.P. 37430

Lengths are in metres. Reduction Ratio 1: 8,000

L.G.A.

Mun./Shire/City: PORT STEPHENS

Locality: RAYMOND TERRACE

Parish: ELDON

County: GLOUCESTER

This is sheet 1 of my plan in ... sheets.
(Delete if inapplicable).

I, DONALD GEORGE BEGG
of 41 VICTORIA ST, EAST MAITLAND

a surveyor registered under the Surveyors Act, 1929, as amended, hereby certify that the survey represented in this plan WITH RESPECT TO LOT 51 ONLY is accurate and has been made in accordance with the Survey Practice Regulations, 1933 and any special requirements of the Department of Lands, and was completed on

the 20TH OCTOBER 1988

Signature D. Begg
Surveyor registered under Surveyors Act, 1929, as amended.
Datum Line of Azimuth: X – Y
insert date of survey.

Plans used in preparation of survey/compilation.

D.P. 37430 R29038 1603

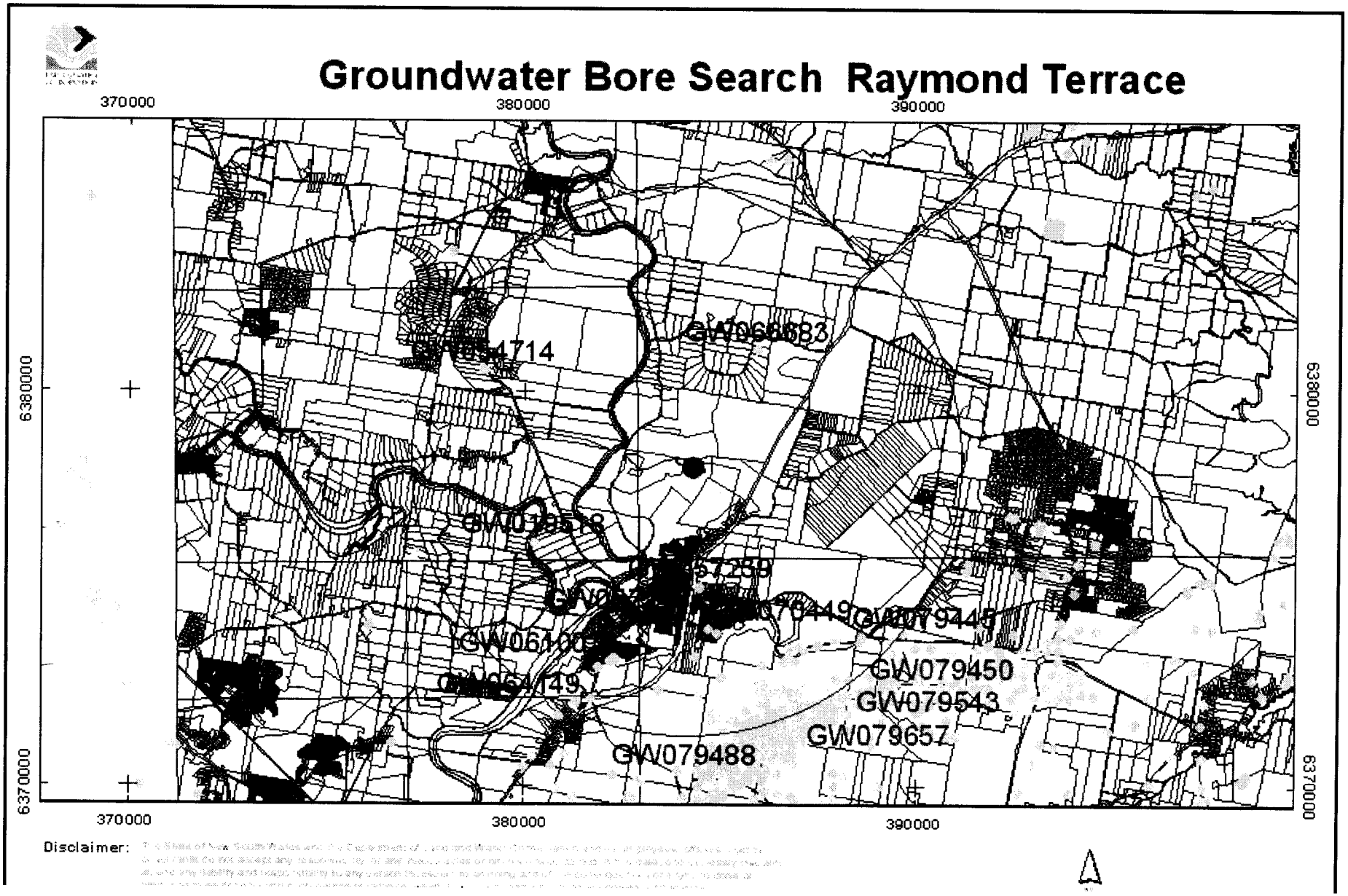
PANEL FOR USE ONLY for statements of intention to dedicate public roads or to create public reserves, drainage reserves, easements or restrictions as to user.

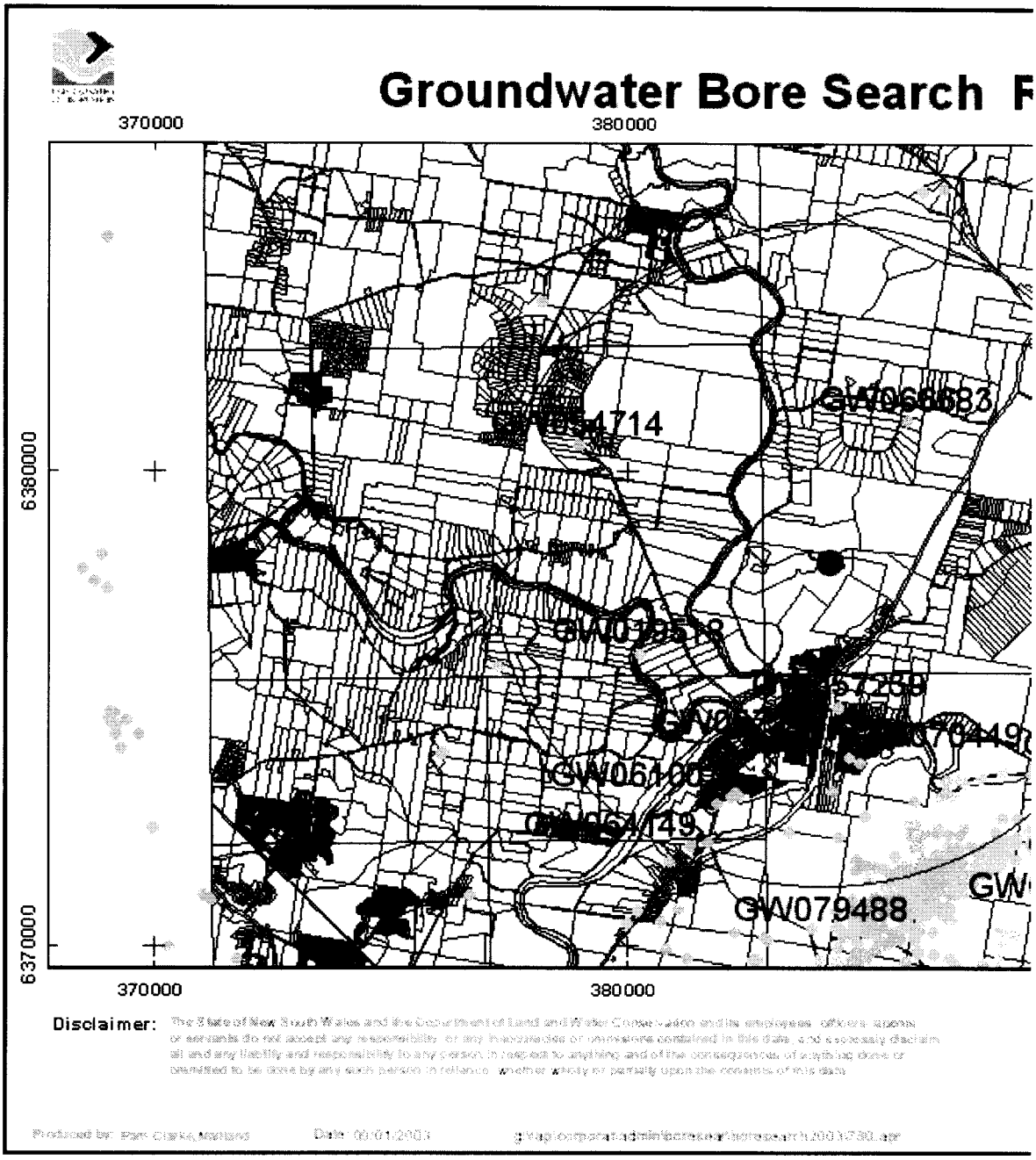
PURSUANT TO SECTION 88B OF THE CONVEYANCING ACT, 1919, IT IS INTENDED TO CREATE

1) RIGHT OF CARRIAGEWAY 20 WIDE & VARIABLE.
2) RIGHT OF CARRIAGEWAY VARIABLE WIDTH.
3) RESTRICTIONS AS TO USER.

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

9232-1-S, 9232-45 Y0023AIC


Groundwater Bore Search Raymond Terrace
370000
380000
390000
6380000
6370000
GW066683
GW064714
GW079518
GW064149
GW079488
GW079450
GW079543
GW079657
Disclaimer:


Groundwater Bore Search F
370000
380000
6380000
6370000
GW066683
GW079488
370000
380000
Disclaimer:

DEPARTMENT OF LAND & WATER CONSERVATION
Work Summary

GW066683 *Converted From HYDSYS*

License :20BL142385

Work Type :
Work Status :(Unknown)
Construct. Method :
Owner Type :

Authorised Purpose(s)
DOMESTIC
STOCK

Intended Purpose(s)

Commenced Date :
Completion Date :

Final Depth :
Drilled Depth :

Contractor Name :
Driller :

Property :
GWMA : -
GW Zone : -

Standing Water Level :
Salinity :
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	GLOUCESTER	THORNTON	56
Licensed :	GLOUCESTER	THORNTON	LT 30 DP 255228

Region :20 - HUNTER
River Basin :210 - HUNTER RIVER
Area / District :

CMA Map :
Grid Zone :
Scale :

Elevation : 38.00 m (A.H.D.)
Elevation Source : Est. Contour 8-15M.

Northing :6381013
Easting :385883

Latitude (S) :32° 42' 9"
Longitude (E) :151° 46' 57"

GS Map :0053D3 **AMG Zone :**56

Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	>From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	P.V.C.	0.00	35.00	105			Seated on Bottom
1	1	Opening	Slots - Horizontal	15.00	22.00	105		1	Mechanically Slotted; SL: 0mm; A: 3mm

Water Bearing Zones

>From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
14.00	15.00	1.00	Fractured			0.02			
20.00	21.00	1.00	Fractured			0.88			

Drillers Log

>From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

***** End of GW066683 *****

DEPARTMENT OF LAND & WATER CONSERVATION
Work Summary

GW057239 *Converted From HYDSYS*

License :20BL118691

Work Type : Bore
Work Status : Supply Obtained
Construct. Method : Auger
Owner Type : Private

Authorised Purpose(s)
DOMESTIC

Intended Purpose(s)
GENERAL USE

Commenced Date :
Completion Date :01-May-1983

Final Depth : 7.00 m
Drilled Depth : 7.00 m

Contractor Name :
Driller :

Property :
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : Brackish
Yield :

Site Details

Site Chosen By

	County	Parish	Portion/Lot DP
Form A :	GLOUCESTER	ELDON	L60 DP28473 (8)
Licensed :	GLOUCESTER	ELDON	LT 61 DP 28473

Region :20 - HUNTER
River Basin :210 - HUNTER RIVER
Area / District :

CMA Map :9232-2N WILLIAMTOWN
Grid Zone :56/1
Scale :1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6374995
Easting :384475

Latitude (S) :32° 45' 24"
Longitude (E) :151° 46' 0"

GS Map :0053D4 **AMG Zone :**56

Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

H	P	Component	Type	>From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	(Unknown)	0.00	7.00	100			(Unknown)

Water Bearing Zones

>From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

(No Water Bearing Zone Details Found)

Drillers Log

>From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	Topsoil	Topsoil	
2.00	5.00	3.00	Clay Light	Clay	
5.00	7.00	2.00	Clay Heavy Gravel	Clay	

Remarks

***** End of GW057239 *****

APPENDIX D

ADDITIONAL INVESTIGATION AREA, PART LOT 2, DP37430

Douglas Partners
Geotechnics • Environment • Groundwater

Douglas Partners Pty Ltd
ACN 053 980 117

Box 324
Hunter Region Mail Centre
NSW 2310 Australia

15 Callistemon Close
Warabrook, NEWCASTLE

Phone (02) 4960 9600
Fax (02) 4960 9601
newcastle@douglaspartners.com.au

MB:CB:plh
Project No: 31638A
P:\31638a\Docs\31638a.doc
1 July 2005

Hunter Land Pty Limited
1 Hartley Drive
THORNTON NSW 2322

Attention: Mr James Garvey

Dear Sir

ADDITIONAL INVESTIGATION AREA
PROPOSED REZONING
PART LOT 2, DP 37430, NEWLINE ROAD
NORTH RAYMOND TERRACE INVESTIGATION AREA

1. INTRODUCTION

Further to our report of March 2003 (Ref 1), this report presents the results of a site assessment for an additional parcel of land known as Part Lot 2, DP 37430, Newline Road, for the inclusion in the rezoning application of the North Raymond Terrace investigation area.

The original assessment was conducted by Douglas Partners Pty Ltd (DP) in March 2003 (Ref 1).

The current assessment comprised a site walkover of the property on 26 February 2004, review of the previous investigation (Ref 1), and review of relevant published plans and maps.

The investigation was limited to an area above RL 5 m AHD (ie approximate 100 year Flood Level) within Lot 2, DP 37430,which is located immediately to the west of Newline Road, and is shown on the attached site plan provided by Hunter Land Pty Limited.

2. FIELDWORK

Fieldwork for the above investigation comprised a brief walkover of the site by an experienced geo-environmental engineer from DP. The results of the walk-over included slope measurements, rock observations and observations for potential contamination issues.

The site generally comprises gentle slopes in the range of 1° to 5° falling to the north, west and south away from the weatherboard residence, which is situated at the entrance to the property along a spur line extending to the east across Newline Road.

Site features include a weatherboard residence with galvanised iron roof and a number of galvanised iron sheds, used to store farm machinery, vehicles, timber and some livestock feed. A cattle yard is located in the northwest portion of the site. The galvanised shed was observed to have walls partly constructed of bonded fibro sheeting. Some minor hydrocarbon staining was also observed on the ground surface within two of the galvanised iron sheds.

An in ground septic tank was also observed about 20 m west of the residential premises. Discussions with the current tenant indicate the effluent system is a pump out system with no irrigation or on-site disposal features. It was also revealed that the site has been owned by Mr Jack Windeyer for at least the last 50 years and has been utilised for cattle grazing and handling.

Minor fill stockpiles were observed in the north-western portion of the site and generally appear to contain roadbase, concrete, bricks, timber, metal and bitumen waste.

Vegetation over the site generally comprised a thick cover of grass with wet surface conditions encountered due to recent heavy rainfall.

3. URBAN CAPABILITY & POTENTIAL CONTAMINATION ISSUES

The following comments are specific to the site and are based on site observation made during the site walkover. Reference should be made to DP report of March 2003 (Ref 1) for details.

3.1 Slope stability

No overt signs of deep-seated instability were observed during the site walkover.

3.2 Erosion/Dispersion

No signs of significant erosion were observed during the site walk-over. Some minor erosion however was observed in areas with no vegetation covering, such as driveways and stock yards and is common for the near surface soils identified in the previous investigation (Ref 1).

3.3 Foundation Conditions and Depth to Rock

Subsurface investigation has not been undertaken on the site, however conditions are anticipated to comprise both deep and shallow soil profiles as described in Ref 1. Shallow bedrock was observed in the road cutting on Newline Road, adjacent to the site.

3.4 Acid Sulphate Soils

Reference to the Karuah Acid Sulphate Risk Map indicates the site (ie >5 m AHD) lies within an area of no known occurrence of acid sulphate soils. A high probability of acid sulphate soil conditions between 1 m and 3 m of the ground surface is located immediately west of the site.

3.5 Salinity

Reference to the DLWC Draft Catchment Blueprint (November 2001) indicates that the site is not located within a priority saline catchment. Refer to Reference 1 for details.

3.6 On-site Effluent Disposal

Limitations to on-site effluent disposal were observed within the site and include the following:

- Potential presence of shallow rock;
- Proximity of the site to permanent waters (north and south dams and low lying floodplains and the Williams River to the west).

3.7 Terrain Units

Based on observation made during the site walkover and review of DP previous report (Ref 1) it is anticipated that the site lies within Terrain unit 2 and 3. Refer to Reference 1 for further details.

3.8 Preliminary Contamination Issues

Issues related to potential contamination on-site are considered to be minor, and were generally limited to the following observation made during the site walkover:

- Effluent treatment system - may contain heavy metals, hydrocarbons and elevated nutrients and microbiological parameters;
- Localised fill stockpiles – may contain a range of potential contaminants, including metals, hydrocarbons etc;
- Bonded fibro sheeting within galvanised sheds – may contain asbestos;
- Localised hydrocarbon staining within galvanised sheds – may contain a range of potential contaminants including heavy metals and hydrocarbons.

4. CONCLUSIONS

The site is considered to be suitable for the proposed urban development, subject to consideration of the issues, constraints and recommendations discussed in this report and the original report (Ref 1).

Yours faithfully
DOUGLAS PARTNERS PTY LTD

Reviewed by:

Matthew Blackert
Environmental Engineer

Stephen Jones
Principal

REFERENCES

1. Douglas Partners Pty Ltd, "Report on Additional Urban Capability Assessment, Proposed Rezoning, North Raymond Terrace Investigation Area", Project 31638, March 2003.

Attached:

Site Plan

Plan of: Detail and Contour Survey of Part Lot 2 D.P. 37430

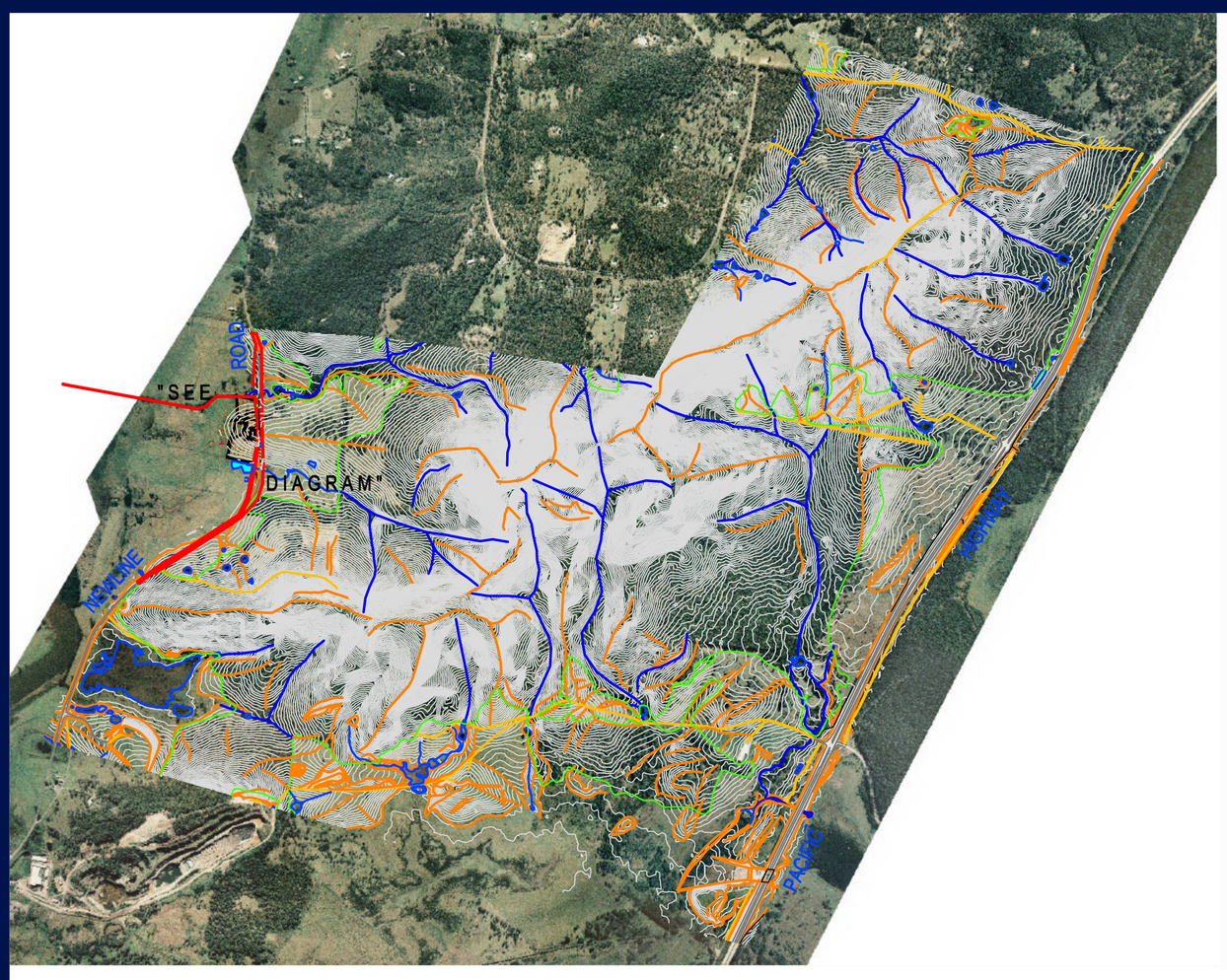
Location: Newline Road
Raymond Terrace

Council: Port Stephens

Datum: A.H.D.
Source: PM 83650 R.L. 9.078m
Projection: M.G.A. 56
North Direction: Grid
Contour Interval: 1.0 metre

Date: 3rd February 2004
Sheet: 1 of 1
Plan by: RJC
Version: A

Client: Hunterland Pty. Ltd.
Civilcad: Z:\ccad\data\11832d
AutoCad: N:\dwg\Detail\11832\11832det
Our Ref: 11832



ASQUITH & deWITT PTY LTD
SURVEYING, PLANNING, MAPPING
PROPERTY DEVELOPMENT MANAGERS

0 100 200 300 400 500 600 800 1 km 1.5 km 2 km

BAR SCALE 1: 20 000 (A1)
1: 40 000 (A1)

LEGEND

- BENCH MARK
- PP POWER POLE
- TEL TELSTRA PIT
- FENCE LINE
- OHP OVERHEAD POWER LINE
- T TELSTRA LINE
- MINOR CONTOUR LINE
- MAJOR CONTOUR LINE
- BOUNDARY LINE
- TOP & TOE OF BANKS

NOTE:-

1. BOUNDARIES HAVE BEEN DETERMINED BY PLAN DIMENSIONS ONLY, AND HAVE NOT BEEN SURVEYED.
2. SERVICES HAVE BEEN LOCATED ONLY WHERE VISIBLE, PRIOR TO EXCAVATION OR CONSTRUCTION ALL SERVICES ARE TO BE LOCATED BY RELEVANT AUTHORITY.
3. SPOT LEVELS AND CONTOURS SHOWN HEREON ARE FOR DESIGN PURPOSES ONLY AND ARE TO BE CONFIRMED ON SITE PRIOR TO EXCAVATION OR CONSTRUCTION.
4. APPROX. AREA ABOVE R.L. 5.0m = 2.859 ha.

HUNTER LAND

DIAGRAM

0m 5 10 20 30 50 100

BAR SCALE 1: 1000 (A1)
1: 2000 (A3)

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