Douglas Partners
Geotechnics • Environment • Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Box 324
Hunter Region Mail Centre NSW 2310
Australia

15 Callistemon Close
Warabrook NSW 2304
Phone (02) 4960 9600
Fax (02) 4960 9601
www.douglaspartners.com.au

DEW:
Project No: 39519.01
Doc Ref: P:\39519.01\Docs\39519.01.doc
3 September 2009

Eureka 1 Project 10 Pty Ltd
GPO Box 4201
SYDNEY NSW 2001

Attention: Mr Andrew Simons

Email: andrew.simons@eurekafm.com.au

Dear Sir

ADDENDUM TO
PRELIMINARY GEOTECHNICAL ASSESMENT
PROPOSED RURAL RESIDENTIAL SUBDIVISION
LOTS 93 TO 96, DP 753194, BOUNDARY ROAD, MEDOWIE

This letter is provided as an addendum to the Douglas Partners Pty Ltd (DP) Preliminary Geotechnical Assessment, Report No. 39519, November 2006, undertaken for the proposed residential subdivision at Lot 93 to 96, DP 753194, Boundary Road, Medowie. This letter was prepared at the request of Mr Andrew Simons of Eureka 1 Project 10 Pty Ltd.

We understand that a revised Concept Plan has recently been prepared for the proposed rural residential development and that Port Stephens Council (PSC) requires clarification that DP's report is still valid given the amended proposed rezoning application and timeframe since conducting the original investigation. The revised Concept Plan of the proposed development, prepared by Urbis, is attached.

The works undertaken for this addendum letter comprised the following:

- Brief review of DP's "Preliminary Geotechnical Assessment, Proposed Residential Subdivision, Lots 93 to 96, DP 753194, Boundary Road, Medowie", Project No. 39519, dated November 2006 to note the site condition at the time of reporting and conclusions/recommendations from the investigation;
- Brief site 'drive-over' by an Environmental Engineer on 1 September 2009 to assess the following;
    - The main site features including site buildings, dams, and fill stockpiles described in the original report;
    - General observations of site vegetation and current site uses;
- Preparation of this addendum letter presenting the results of the review.

As requested by the Client, the original DP report was also amended to remove references to Buildev Development NSW (CM) Pty Ltd, who we understand are no longer involved in the project. The amended report is issued as Report No. 39519 – Rev 1, dated 3 September 2009.

Based on the review of the investigation and subsequent site ‘drive-over’ inspection, it is considered that the site condition is consistent with the conditions as reported in November 2006. The southern portions of the site remain as residential development, with the site structures including dwellings, sheds etc as indicated on the site Test Location Plan (i.e. Drawing 1, copy attached).

The central, eastern and northern portions of the site additionally appear consistent with the conditions previously reported (i.e. remain as semi-dense bushland).

It is also understood that the proposed development to be submitted to PSC includes the subdivision of Lots 93 to 96 DP 753194 into 260 rural residential lots, reduced from 1050 to 1200 residential lots proposed at the time of DP’s 2006 investigation. Additionally, we note that the currently proposed development includes the retention of the “swamp sclerophyll forest” bisecting the site from the north-west to the south-east, and provision of vegetation set-backs.

The 2006 report provided comments on the following geotechnical aspects of development:

- Slope stability;
- Rock outcrops;
- Footings/subgrade conditions;
- Acid sulphate soils;
- Erosion potential; and
- Salinity potential.

Based on the current site condition and proposed 260 lot rural residential development, it is considered that the conclusions and recommendations in DP’s Preliminary Geotechnical Investigation remain valid. The site is therefore considered suitable for the proposed residential development from a geotechnical perspective, subject to appropriate engineering design and construction to address geotechnical issues outlined in the report.

Please contact the undersigned if you have any questions.

Yours faithfully
DOUGLAS PARTNERS PTY LTD

Reviewed by:

Dana Wilson
Environmental Engineer

John Harvey
Principal

Attachments:
Notes Relating to this Report
Drawing 1 – Test Location Plan, copy from Report 39519, dated 3 September 2009
North Medowie Concept Plan, by Urbis, dated 7 August 2009

Douglas Partners
Geotechnics · Environment · Groundwater

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:—

$$q_c \text{ (MPa)} = (0.4 \text{ to } 0.6) \text{ N (blows per 300 mm)}$$

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

$$q_c = (12 \text{ to } 18)\ c_u$$

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

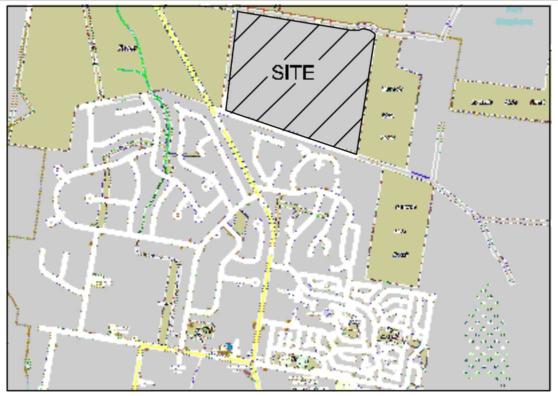
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some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

Reproduction of Information for Contractual Purposes

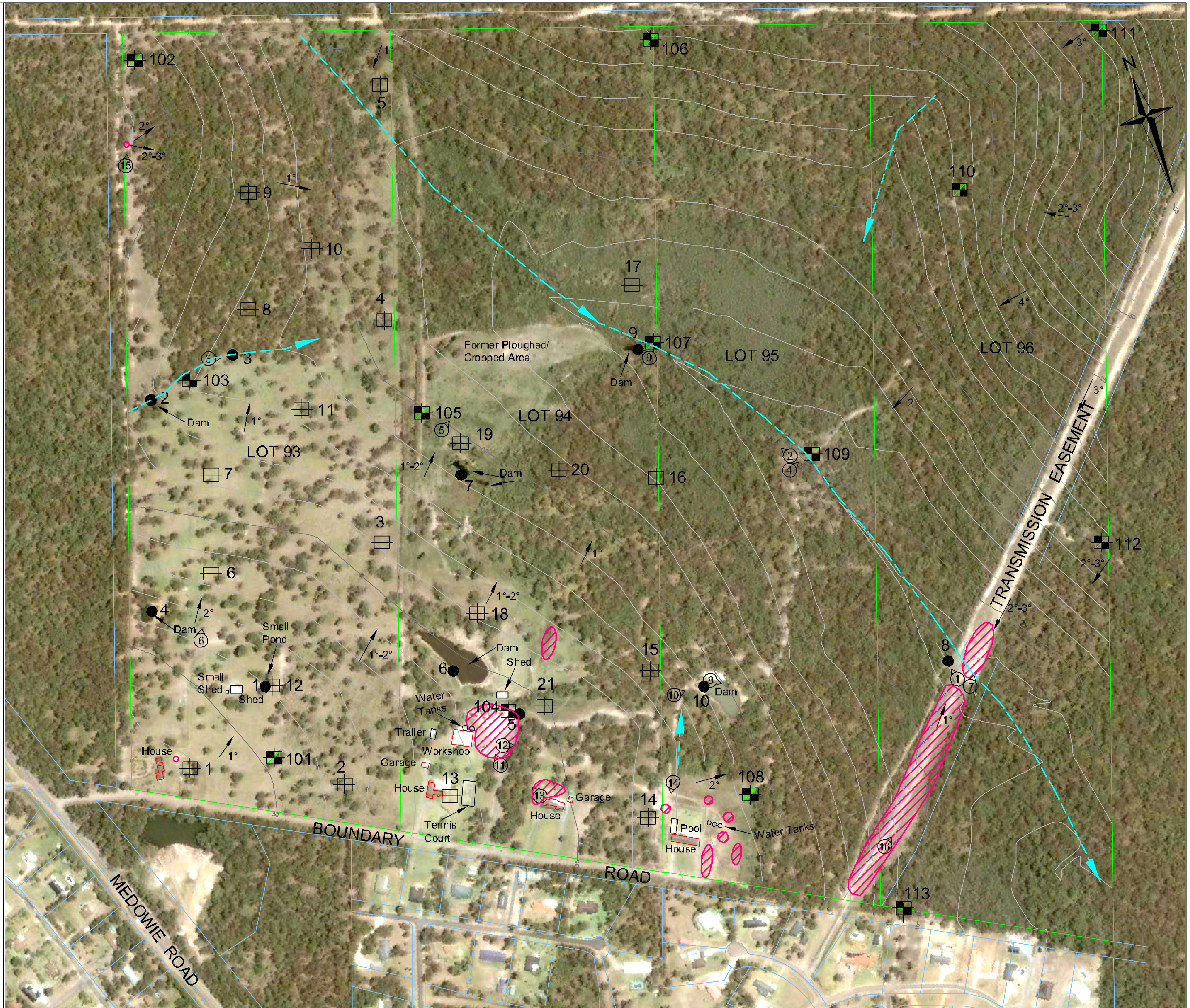
Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers, Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including 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.



LOCALITY PLAN



LEGEND

- Approximate Test Pit Location (former investigation - 1986)
- Approximate Test Pit Location (current investigation)
- Approximate Surface Water Test Location
- Approximate Slope Direction & Angle
- Approximate Photo Location & Orientation
- Approximate Location of Localised Surface Filling / Fill Stockpiles
- Approximate Surface Water Flow Path (i.e. creek/gully)

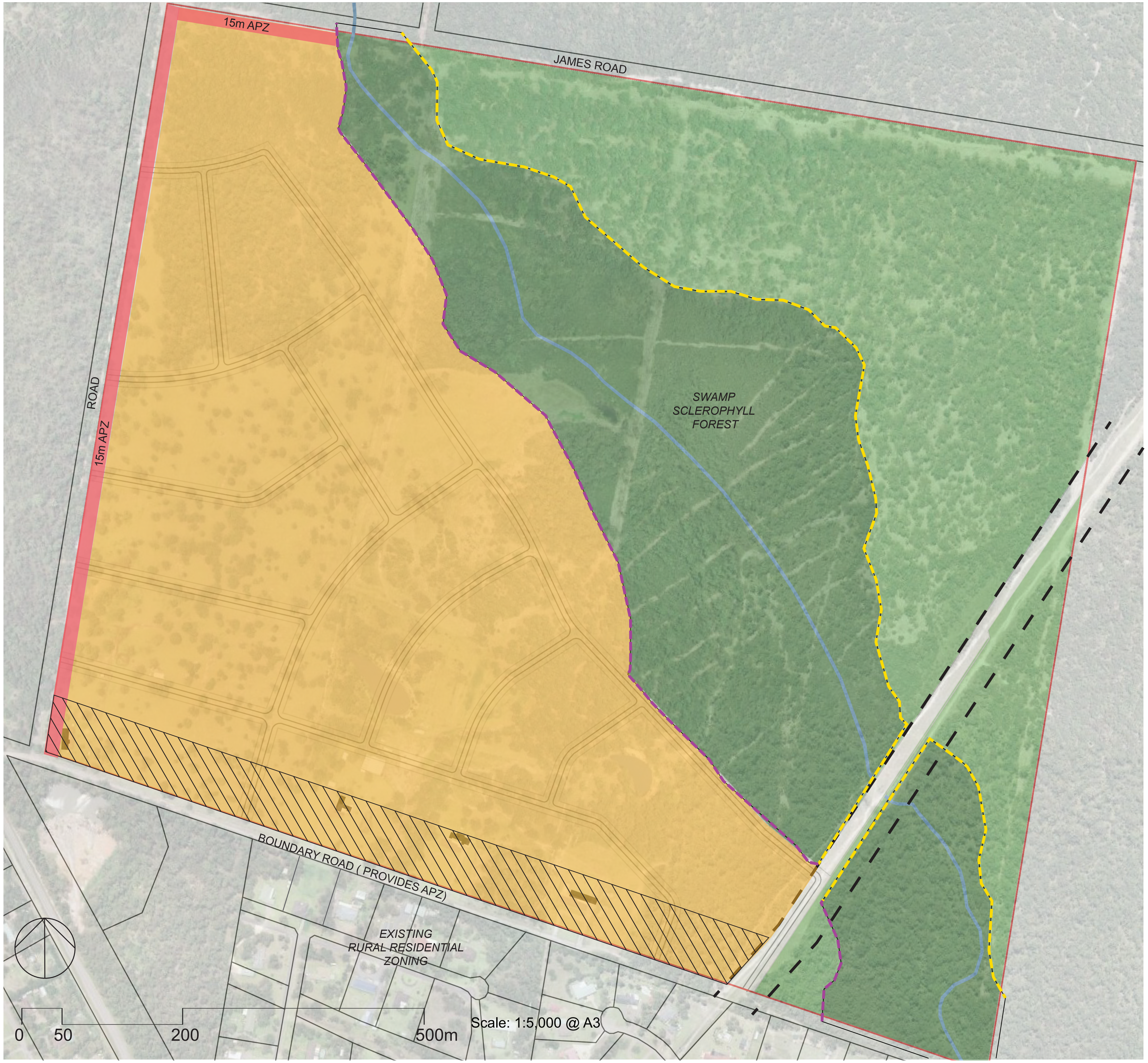
Drawing adapted from Survey Plan supplied by Buildev Developments (CM) Pty Ltd, Ref No. 0653_Bore_Hole_Plan.dwg

0 100 200 300 m

SCALE 1:5000 (A3 SHEET)

Douglas Partners Geotechnics Environment Groundwater	*Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Campbelltown, Townsville, Cairns, Wollongong, Darwin*	TITLE: TEST LOCATION PLAN PRELIMINARY GEOTECHNICAL ASSESSMENT LOTS 93 TO 96, DP 753194, BOUNDARY ROAD, MEDOWIE	CLIENT: EUREKA 1 PROJECT 10 PTY LTD REF:\P\39519\DRAWINGS\39519 DRAWN BY: PLH SCALE: 1:5000 PROJECT No: 39519 OFFICE: NEWCASTLE APPROVED BY: DATE: DRAWING No: 1

N O R T H   M E D O W I E



LEGEND

- EEC Boundary to undeveloped land
- Smoothed EEC boundary as confirmed with Council's offices
- Easement
- Drainage
- EEC
- Undeveloped Land
- APZ
- Existing Building
- Rural Small Holdings (1,000 - 1,500sqm) as per Council's Medowie Strategy
- Larger lots to be provided reflecting a similar frontage width and presentation to Boundary Road as those fronting the southern side of Boundary Road.

NOTES

1. Precise north-eastern boundary of developable area within Rural Small Holding Zoning to consider edge impacts and interface solutions such as roadways in determining an appropriate buffer to EEC (buffer of 0 - 50m, depending on solutions provided).
2. Road patterns shown is indicative only and subject to consideration of subdivision DA.
3. APZ along north-eastern boundary of developable area to be determined and subject to consideration of subdivision DA.

11 November 2009

North Medowie Neighbourhood:
Land use Plan

urbis