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Report on
Phase 2 Contamination Assessment
With Limited Sampling

Proposed Wollongong Hospital Redevelopment
Loftus Street, Wollongong

Prepared for
Health Infrastructure

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

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Executive Summary

This report presents the results of a Phase 2 Contamination Assessment with limited sampling carried out within Wollongong Hospital, Loftus Street, Wollongong, NSW (the Hospital site) for due diligence purposes prior to the proposed redevelopment. It is understood the redevelopment will occur in three regions within the Hospital site and include new or updated buildings for the Emergency Department (ED site), the Ambulance Care Unit and Elective Surgical Service (AC&IESS site) and Illawarra Cancer Care Centre (ICCC site).

The scope of work included a site history review, drilling of 26 boreholes across the three regions of redevelopment and the hospital site, laboratory analysis of soils and groundwater and review of the results for contamination, preliminary waste classification and acid sulphate soil purposes.

A review of site history information confirmed that the site has been used as a hospital from as early as 1952. Aerial photographs indicated that some building demolition and construction had occurred within the western portion of the AC&IESS site between 1974 - 1984 and the majority of the ICCC site between 1974 - 1984.

A judgemental sampling pattern was adopted within the three regions which was largely restricted by the nature of the Hospital site and a vast array of underground services, A total of 26 bore locations were placed across the Hospital site (ED site: 3 locations evenly spaced across the site, AC&IESS site: 12 locations placed in the central section of the AC&IESS site, ICCC site: 5 locations located adjacent to the southern boundary of the ICCC site and six locations were drilled outside of the sites' boundaries, however, they were located as close as practicable to the respective site boundary and are considered close enough to provide additional information. Samples were collected at multiple depths within fill and natural material to allow for evaluation of the various strata. The bores were extended until refusal on sandstone in all locations, which was encountered between 0.24 and 10.25 m below ground level (bgl).

Filling was encountered in the majority of the boreholes overlying residual clay and tuffaceous sandstone. Four of the boreholes were converted into wells, however groundwater was only encountered in one of these wells.

Soil and groundwater analysis was conducted at a NATA accredited laboratory (Envirolabs) for a range of common contaminants. All of the results were within the adopted SAC for soils with the exception of benzo(a)pyrene (B(a)p) in bore 3 at depth range of 0.5 to 0.6 m, where a concentration of 7.5 mg/kg was recorded. This exceeds the HIL (5 mg/kg), however, it is not considered a hot spot. The 95% Upper Confidence Limit (UCL) of all the benzo(a)pyrene concentrations recorded was 3.7 mg/kg which was below the HIL, therefore, the detected concentration is not considered to be significant under the proposed land-use.

All of the results for groundwater were within the GIL with the exception of cadmium, copper, nickel and zinc, as detailed in Section 9.3. These exceedances are not considered a cause of environmental concern based and most likely representative region background levels and not likely associated with contamination from the site. Detectable concentrations of total petroleum hydrocarbons, C_6-C_9 (35 µg/L and 24 µg/L) and C_{10}-C_{14} (160 µg/L and 120 µg/L) in the primary and replicate samples respectively, however, the concentrations were well below the GIL (600 µg/L). The primary sample was re-analysed using a silica gel clean up method which reduces the amount of non petroleum based hydrocarbons from the test result. The results of the testing indicate that no detectable concentrations

of TPH C_{10} - C_{36} were recorded. A detection of C_6 – C_9 was recorded at a level of 18 µg/L, well below the GIL. Further to this, total xylenes (14 µg/L and 13 µg/L) in the primary and replicate samples, respectively, were well below the GIL (550 µg/L). Xylenes were also retested in the primary sample with no detections recorded.

The results of the preliminary waste classification assessment indicates that the fill would most likely be classified as general solid waste and the natural soils and rock would most likely be classifiable as virgin excavated natural material, pending further assessment during earthworks.

An assessment for acid sulphate soils (ASS) was also carried out. Screening tests were carried out on 12 samples and identified the potential for the soil to be acidic with measured level of pH_{FOX} being classified as neither positive or negative indicators of ASS. Two of these samples were then analysed at a NATA accredited laboratory for the full chromium suite. The results of the acid sulphate soil assessment indicate that at least some of the soil from the site can be identified as being acid, but not acid sulphate soil.

Based on the results of the assessment, the ED, AC&IESS and ICC sites appear to be compatible for the continued use as part of Wollongong Hospital. It is recommended however that an additional groundwater monitoring event with the addition of VOC to the analytical suite is undertaken to confirm the TPH and xylene concentrations in groundwater.. Further investigation in areas inaccessible at the time of this assessment would also be required when access becomes available.

Whilst not part of the scope of work for this assessment, it is recommended that a hazardous building materials assessment is undertaken in the different buildings or parts thereof.

The results of the preliminary waste classification assessment indicates that the fill is likely to be classified as general solid waste and the natural soils and rock would most likely be classifiable as virgin excavated natural material, pending confirmation during earthworks. Any variation to the descriptions of fill and natural soil encountered during excavation will require a reassessment of the classification including the presence of asbestos-based materials.

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Report on Phase 2 Contamination Assessment with Limited Sampling
Proposed Wollongong Hospital Redevelopment
Loftus Street, Wollongong

1. Introduction

This report presents the results of a Phase 2 Contamination Assessment with limited sampling carried out within Wollongong Hospital, Loftus Street, Wollongong, NSW (the Hospital site) for due diligence purposes prior to the proposed redevelopment. It is understood the redevelopment will occur in three regions within the Hospital site and include new or updated buildings for the Emergency Department (ED site), the Ambulance Care Unit and Elective Surgical Service (AC&IESS site) and Illawarra Cancer Care Centre (ICCC site). The regions of the Hospital site being assessed are shown in Drawing 1, Appendix B. The assessment was commissioned in an email dated 28 April 2011 by Mr Troy Harvey of Health Infrastructure and was carried out in liaison with Taylor Thomson Whitting (NSW) Pty Ltd, consulting engineers for the project. The work was undertaken in general accordance with Douglas Partners Pty Ltd's (DP) proposal WOL110104_Rev2 dated 18 April 2011.

The assessment aims to:

- identify past and present potentially contaminating activities;
- identify potential contamination types;
- investigate identified areas of potential environmental concern;
- provide information of the likely type, extent and level of contamination at each site
- provide information regarding the presence or otherwise of acid sulphate soils;
- provide a preliminary waste classification of underlying soils; and
- assess the need for further investigations or remediation.

2. Scope of Works

The scope of work included the following:

- a site history investigation including review of:
  - groundwater bore search;
  - previous site ownership conducted through the Land Titles Office;
  - Office of Environment and Heritage NSW (OEH, formerly DECCW) public registers maintained under the *Contaminated Land Management Act* 1997 and the *Protection of the Environment Operations Act* 1997;
  - readily accessible Council records and Section 149(2&5) certificates; and
  - historical aerial photography obtained through the Land Information Section of the Department of Planning.

- assessment of acid sulphate soil potential;
- sample collection from geotechnical bore locations;
- analysis of selected soil samples for the following common contaminants at a NATA accredited laboratory;
  - field pH testing and confirmatory acid sulphate soil testing (if deemed required);
  - heavy metals (arsenic, cadmium, copper, lead, mercury, nickel, zinc);
  - total petroleum hydrocarbons (TPH);
  - monocyclic aromatic hydrocarbons (benzene, toluene, ethylbenzene and xylene – BTEX);
  - polycyclic aromatic hydrocarbons (PAH);
  - phenols;
  - organochlorine pesticides (OCP), organophosphorus pesticides (OPP) and polychlorinated biphenyls (PCB);
  - asbestos;
  - heavy metals and PAH leachability for waste classification purposes;
- measurement of groundwater level and collection of groundwater samples from one groundwater well;
- analysis of groundwater samples for the following common contaminants at a NATA accredited laboratory:
  - heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc);
  - TPH;
  - BTEX;
  - PAH;
  - phenols;
  - OCP, OPP and PCB; and
  - hardness.
- Preparation of a Phase 2 contamination assessment with limited sampling report detailing the methodology and results of the assessment commenting on contamination issues.

Whilst this assessment includes both subsurface soils and groundwater sampling, the number of sample points was limited by access constraints based on the nature of the hospital site, namely a functioning hospital with operational buildings occupying a large part of each site and a myriad of buried services.

3. Site Description and Regional Geology

The Hospital site consists of Lots 58 to 68 inclusive and Lot 95 Section 3 in Deposited Plan 1258, Lot 13 in Deposited Plan 884182 and Lot 69 in Deposited Plan 1012072 and comprises an irregular shape of some 2.7 ha with maximum plan dimensions of approximately 200 m by 180 m, as shown in Drawing 1 in Appendix B. The site is located along and around Hospital Road, an internal road which runs through the hospital, and the drop-off/pick-up entrance by the main entrance and is bounded by Loftus, Darling and Crown Streets and New Dapto Road.

The ED and AC&IESS sites are located between Elouera House and the existing Emergency Department and Block A – Clinical Services Building in Lot 95 Section 3 in Deposited Plan 1258 in the central eastern part of the Hospital site. The central eastern portion of the site is characterised by grassed areas with a number of large trees on both sides of the road including two mature Fig trees on the crest of the hill. Retaining walls between the loading dock, main entrance and Elouera House separate the various levels on the site.

The ICCC site comprises of the existing Cancer Care Building and Hospital Road and is located in Lots 59 - 63 and 95 Section 3 in Deposited Plan 1258. This area comprises a brick building and bitumen pavement with brick and concrete footpaths on either side and small interspersed gardens, particularly towards the western end.

Site levels, relative to the Australian Height Datum (AHD), fall from the highest part of the site, RL 52.5 on the crest of the hill by the mature Fig trees, in various directions to RL 39.6 in the loading dock, RL 47.2 at the western exit of Hospital Road onto New Dapto Road and RL 43.0 by the entrance to Hospital Road off Darling Street. Site grades have been formed from a combination of utilising the natural surface and filling, particularly using retaining walls to separate the different building floor levels. Hospital Road, between the AC&IESS and ICCC site, falls to the southwest at relatively gentle grades of approximately 1 in 40 to 1 in 200 increasing to 1 in 16 towards the western exit of Hospital Road onto New Dapto Road. Hospital Road between Elouera House and the western end of the Clinical Services building falls to the southeast at grades of approximately 1 in 10 to 1 in 15. The drop-off area by the main entrance to the Clinical Services building falls towards the northeast and northwest at relatively gentle grades of 1 in 30 to 1 in 40, increasing to 1 in 10 towards the entrance/exit to Loftus Street.

Reference to the Geology and Natural Slope Stability Zones in the City of Greater Wollongong indicates that the site is underlain by the Budgong Sandstone belonging to the Shoalhaven Group of Permian age. This formation typically comprises litho-feldspathic, quartzlithic, lithic and minor quartzose sandstone which weather to form clays of high plasticity. The fieldwork was consistent with the geological mapping, with tuffaceous sandstone encountered in all bores.

4. Proposed Development

The proposed redevelopment of the site will include new or upgraded buildings for the Wollongong Emergency Department (ED site), Wollongong Ambulatory Care Unit and Wollongong Elective Surgical Services (AC&IESS site) and Illawarra Cancer Care Centre (ICCC site) .

It is understood that the redevelopment will comprise two and three storey buildings and new pavements with excavations to achieve design levels on the multi-levelled site floor. It is further understood that floor levels for the new buildings and extensions will be at the same level as the current floor levels and expected excavations of up to 1.3 m and 5.9 m in depth are expected for the ED and AC&IESS sites respectively.

5. Review of Site History Information

The site history investigation is undertaken to identify potential areas of environmental concern which may arise from the presence of demolished or partly demolished buildings, soil stockpiles, land filling, waste disposal, previous uses and other potentially contaminating activities. The following sections summarise the results of the investigation. It is noted that the majority of the site history information refers to the entire Hospital site as it is often difficult to define specific areas within lot boundaries when obtaining the information.

5.1 Groundwater Bore Database

A search of the groundwater bore database administered by the OEH indicated that seven bores were located within a 2 km radius of the site. Of the seven bores identified:

- two were private wells at total depths of 30.5 m with no further information available;
- two were monitoring wells on Rail Corp property. The depths of these bores were 6.2 m and 6.0 m with soil indentified as comprising fill to 1.5 m and then brown to dark brown clay; and
- three were monitoring wells on Hertz Australia Pty Ltd's property. The depths of these bores were 6.0 m, 5.0 m and 6.0 m. No further information was available on these bores.

5.2 Previous Site Ownership

A title deeds search for the entire site was conducted by Service First Registration Pty Ltd, Legal Agents. The title information can assist in the identification of previous land uses through the recorded occupation of individual land owners or by a descriptive company name. This may, therefore, establish potentially contaminating activities occurring at the site. A summary of the results of the site history and title deeds search are shown in Table 1. The full results of the search are given in Appendix C.

Table 1: Previous Site Ownership

Term held	Owner and Occupation	Inferred land use
1886 to 1900	William Wiley (Gentleman)	Residential
1900 to 1902	Harold Cox (Solicitor)	Residential
1902 to 1925	Archibald Campbell (Journalist) Walter Graham Robertson (Bank Manager) William John Wiseman (Gentleman)	Residential
1925 to 1925	Walter Graham Robertson (Bank Manager)	Residential
1925 to 1927	Walter Graham Robertson (Bank Manager) John Australia Mayo (Auctioneer) William Parkinson (Cordial Maker)	Residential
1927 to 1952	Walter Graham Robertson (Retired Bank Manager) William Parkinson (Cordial Maker) Standish Richard Musgrave (Journalist)	Residential
1952 to 1952	William Parkinson (Cordial Maker)	Residential
1952 to 2002	The Wollongong District Hospital (Then The Wollongong Hospital) (Now Illawarra Area Health Service)	Industrial (Health)
2002 to Date	Health Administration Corporation	Industrial (Health)

The title deeds search indicates that the site has been used as a Hospital since 1952 and that prior to this date the site was only used for residential purposes. This is also supported by other sources such as the aerial photographs (refer to Section 5.5).

5.3 NSW OEH Public Registers

A search on 8 April 2011, for Statutory Notices current under the *Contaminated Land Management Act 1997* and *Protection of the Environment Operation Act 1997* available on the OEH website showed that a licence for the generation or storage of >100 – 500 t hazardous, industrial or group A waste was held by the South Eastern Sydney and Illawarra Area Health Service between 26 August 2003 and 26 August 2006. A review of the licence indicated that only clinical and related wastes and grease trap wastes were permitted to be generated/stored at the site. The licence states that waste generated from other sites were not permitted to be received. There were no non compliances listed for the duration of the licence period.

5.4 Review of Council Records

A review of the available council records was undertaken and the results are summarised below:

- Numerous extensions and modifications across the entire site have occurred from as early as 1972. These extensions and modifications included a shelter shed for car park security, a chapel,

a 1000 gallon (approximately 3785 L) petrol tank and bowsers, extensions and alterations to amenities, a radiotherapy clinic and other various clinical services, a helipad, and an engineering and maintenance workshop.

- In addition to extensions, extensive internal modifications were also on record with the main materials used being identified as metal and timber.
- Lodgements of complaints were also on record with the primary concern being noise pollution created as a result of the Hospital's use of a helipad.

Further review of the information pertaining to the petrol tank indicated that it was to be installed to service hospital vehicles and a sketch drawing showed the proposed location of the tank (refer to Drawing 1, Appendix B). No other information was available to indicate whether the tank was actually installed, if it was above or below ground, decommissioned or removed during building demolition and renovations. It is noted, however, that the proposed location of the tank was in the middle of a car park, hence it may be assumed that the tank was most likely an underground storage tank, if it was ever actually installed. The proposed location of the tank is outside and up-gradient of the three regions under consideration in this assessment.

Also in the files, in a Statement of Environmental Effects for an application dated 1988, it was noted that the laundry services had 'recently' ceased within the laundry building located on the site at that time. It is understood that the laundry was a wet laundry and did not undertake dry cleaning practices (Information provided by Mr Greg Showell of Wollongong Hospital, 13 July 2011).

Included in the development applications and approvals were plans of the hospital grounds, identifying various buildings on the site, the information from these plans dated 1971, 1975, 1977, 1980, 1989, 1994 and 2001 has been included in the historical aerial photography review in the following section. The council records were concurrent with the titles deeds indicating the site was used as a Hospital for some time.

5.5 Historical Aerial Photography

Aerial photographs were examined to identify any changes to the landscape which may indicate potentially contaminating land uses or significant environmental features. Five aerial photographs were examined from the years 1961, 1974, 1984, 1994 and 2006, and copies are included in Appendix D. A summary of findings is given below. The aerial photograph review was focussed on the three redevelopment regions of the site namely the Emergency Department (ED site), the Ambulance Care Unit & Elective Surgical Service (AC&IESS site) and Illawarra Cancer Care Centre (ICCC site) across the hospital grounds.

7 July 1961, Run 7: The AC & IESS site appeared to be vegetated with trees and other vegetation with some existing buildings observed in the east (Nurses Home) and adjacent to the western boundary within the region (T. B. Unit and Isolation buildings). The ED site appeared to be primarily overlain with grass and shrubs/small trees, there also appeared to be a road/footpath through the middle of the region. The ICCC appeared to be almost fully developed with an assortment of buildings (laundry, boiler house and workshops) and some vegetation in the south western corner.

15 October 1974, Run 8: The AC&IESS and ED sites appeared to have remained relatively unchanged. The ICCC site also appeared to remain relatively unchanged however there appeared to be a change in the surrounding vegetation, in particular the trees that were observed just north of the region appeared to have been removed.

12 May 1984, Run 7: The aerial is not clear however the AC&IESS and EC sites appeared to remain unchanged. There appeared to have been some demolition of the structures previously identified in the ICCC site. The ICCC site now appeared to be primarily undeveloped with some scattered vegetation.

5 January 1994, Run 11: The AC&IESS and EC sites appeared to have remained relatively unchanged. The ICCC site appeared to be covered with one large building (existing Cancer Care Centre) across the majority of the area. The reminder of the Hospital site appeared relatively unchanged, however the building in the southern section of the Hospital site appeared to have been demolished and the area disturbed.

9 April 2006, Run 7: The AC&IESS, EC and ICCC sites appeared to have remained relatively unchanged. There was significant development observed in the remainder of the hospital site with a circular glass roofed structure (current main entry to Clinical Services Building) observed as well as a paved driveway providing access to the site in the northern part of the Hospital Site. In the southern portion of the Hospital site there was observed to have been a large structure (Clinical Services Building) built that covered the majority of the area.

The aerial photograph review is in agreement with the title deeds and Council's records indicating that the site has been used as a hospital since 1952.

5.6 Section 149(2) and (5) Certificates

A review of the Section 149 Planning Certificates for the site (dated 6 April 2011, Appendix E) indicated that there were no contamination issues listed under the *Contaminated Land Management Act* 1997. The certificates indicated the site as being zoned SP1 Hospitals Medical Research and Development

The certificates did not record whether the site has been filled or partially filled.

Acid Sulphate Soils were identified as being mapped on the land.

6. Potential for Contamination

A review of site history information indicated a potential for contamination identified from historical aerial photographs and Council's records. The site history review indicates that the Hospital site has been used as a hospital from as early as 1952 which is supported by information in the title deeds records, Council's files and aerial photograph review. The Council files and aerial photograph review indicates that, since 1972, building demolition and construction has occurred within the AC&IESS and ICCC sites. The Council files also indicated that there may have been a petrol tank installed in the

Hospital site, to the south of the ICCC, AC & IESS sites, within the current Clinical Services building footprint.

From the above it is considered that a potential for contamination at the site would include:

- Potential for petroleum hydrocarbon contamination arising from leakage from the possible petrol tank While the petrol tank was indentified to be installed outside the three regions, there may be potential for the migration of any hydrocarbons that may have leaked from the tank or associated pipe work and bowsers, particularly via groundwater movement considering the tank was located in an up-gradient location;
- Remnant building materials from previously demolished buildings; and
- Fill during construction of new buildings/roads.

7. Data Quality Objectives

The scope of the Phase 2 contamination assessment with limited sampling has been devised generally in accordance with the seven step data quality objective (DQO) process, as defined in Australian Standard *Guide to the investigation and sampling of sites with potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds* (AS 4482.1 – 2005). The DQO process is outlined as follows:

(a) State the Problem

The “proble” is to characterise the nature and extent of contamination, if any, within the three redevelopment regions, and to determine if the ED, AC&IESS and ICCC sites are suitable for the proposed redevelopment and/or identify the need for remediation that would render the ED, AC&IESS and ICCC sites suitable for the proposed redevelopment.

(b) Identify the Decision

The suitability of the site for redevelopment and the scope of the required remedial works will be assessed against the site assessment criteria (SAC) and groundwater investigation levels (GIL).

(c) Identify Inputs to the Decision

The primary inputs in assessing the suitability of the site for the proposed redevelopment will be:

- Available site information regarding activities undertaken on the sites and the surrounding area;
- Results from the current investigation as detailed in the scope of works;
- The local geology, topography and hydrology;
- Potential contaminants;
- Published guidelines for assessing soil and groundwater quality;
- Background concentrations of specific contaminants based on both published Australian values and local conditions based on natural soil samples; and

- Field observations/measurements, field mapping and analytical results.

(d) Define the Boundary of the Assessment

The boundaries of the assessment are defined as:

- Emergency Department (ED site) - Lot 95 Section 3 in Deposited Plan 1258 in the central eastern part of the Hospital site;
- Ambulance Care Unit and Elective Surgical Service (AC&IESS site) - Lot 95 Section 3 in Deposited Plan 1258 in the central eastern part of the Hospital site; and
- Illawarra Cancer Care Centre (ICCC site) - Lots 59 - 63 and 95 Section 3 in Deposited Plan 1258 comprises of the existing Cancer Care Building and Hospital Road.

The regions of the Hospital site being assessed are shown in Drawing 1, Appendix B.

(e) Develop a Decision Rule

The decision rule is the comparison of the analytical results against relevant published guideline criteria including:

- NSW DEC's *Guidelines for the NSW Site Auditor Scheme* 2nd Edition (2006);
- NSW EPA's *Guidelines for Assessing Service Station Sites* (1994); and
- ANZECC *Guidelines for Fresh and Marine Water Quality* (2000).

Assessment Criteria For Soils

The analytical results have been compared against the relevant site assessment criteria (SAC) to verify the general suitability of the site for the proposed redevelopment. In this regard, the relevant land use category (from a contamination assessment standpoint) is commercial/industrial. Thus, the health-based investigation levels (HIL) for commercial or industrial sites from the Department of Environment and Conservation (now OEH) *Guidelines for the NSW Site Auditor Scheme (2nd Edition)*, 2006 (HIL Column 4, Appendix II) will be adopted as the SAC. With regard to BTEX and TPH, the threshold concentration for sensitive land use specified in the NSW EPA's Contaminated Sites series *Guidelines for Assessing Service Station Sites* 1994 will be adopted as the SAC. In the absence of criteria for OPP and individual VOC, the US EPA (2010) Regional Screening Levels (RSL) have been adopted.

It is noted that the OEH also sets provisional phytotoxicity-based investigation levels (PPIL, Column 5) for the protection of plants in the appropriate setting. The PPIL are not relevant to commercial or industrial properties.

The adopted site assessment criteria for soils are shown in results summary tables, Appendix G.

A contaminant concentration in soil/filling material is considered to be significant if:

- The concentration of the contaminant is more than 2.5 times the site assessment criteria (SAC). Any location more than 2.5 times the SAC is classified as a 'hotspot', requiring further assessment/ management;

- For a data of like material, with respect to the health-based criteria, the calculated 95% Upper Confidence Limit of average concentrations (excluding any 'hotspot' concentrations) exceeds the SAC; and
- The standard deviation of the results is greater than 50% of the health-based investigation levels (HIL).

From a health risk standpoint, providing that the 95% Upper Confidence Limit (UCL) of average concentrations is within the SAC, and no concentrations of the contaminants are at hotspot level, minor exceedances of the SAC may be considered to pose an insignificant human health risk under the proposed land-use.

Assessment of Groundwater

The levels of contaminants in groundwater have been assessed against Groundwater Investigation Levels (GIL) adopted from applicable guidelines, specifically, the ANZECC 2000 *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. ANZECC 2000 provides guidelines for the assessment of fresh water quality. The ANZECC 2000 Guidelines are provided in Appendix H. Guidelines for fresh waters will be adopted due to the location of a tributary of Fairy Creek located approximately 500 m north and down-gradient of the Hospital Site.

(f) Specify Acceptable Limits on Decision Errors

In order to ensure the quality of the soil and groundwater data, appropriate and adequate quality assurance and quality control (QA/QC) measures and evaluations will be incorporated into the sampling and testing regime as follows:

- A field and laboratory QA/QC regime, comprising the collection and analysis of intra-laboratory replicate samples and trip blanks were implemented to meet the requirements associated with the following data quality indicators (DQI);
- conformance with specified holding times;
- accuracy of spiked samples within the laboratory's acceptable range (typically 70-130% for inorganic contaminants and greater for some organic contaminants);
- field replicate and laboratory duplicate samples will have a precision average of +/- 30% relative percent difference (RPD) for inorganic analytes and +/- 50% RPD for organic analytes; and
- field replicates will be collected at a frequency of at least 10% of all samples.

(g) Optimise the Design for Obtaining Data

The purpose of the current investigation is to provide representative information across the proposed redevelopment regions across the Hospital Site. In order to optimise the design for obtaining appropriate data, a sampling and analysis plan was developed as described in the following section.

8. Sampling and Analysis Plan

The sampling and analysis plan is described in the following sections.

8.1 Sampling Pattern

A judgemental sampling pattern was adopted within the three regions which was largely restricted by the nature of the Hospital site and a vast array of underground services. The sampling locations are shown in Drawing 1, Appendix B.

8.2 Sample Density

The NSW EPA *Contaminated Sites: Sampling Design Guidelines*, provide guidance with regards to site areas and the minimum number of samples locations using as systematic sampling pattern, however, based on the nature of the Hospital site, systematic sampling was not possible. The following sampling densities were however achieved:

- ED site (approximately 0.06 ha): 3 locations evenly spaced across the site;
- AC&IESS site (approximately 0.27 ha): 12 locations placed in the central section of the AC&IESS site; and
- ICCC site (approximately 0.26 ha, majority covered with existing Cancer Care Building): 5 locations located adjacent to the southern boundary of the ICCC site. No access was available within the existing building.

In addition to the above, another six locations were drilled outside of the sites' boundaries (due to access limitation), however they were located as close as practicable to the respective site boundary and are considered close enough to provide additional information (refer to Drawing 1 Appendix B).

8.3 Sample Depths

Samples were collected at multiple depths within fill and natural material to allow for evaluation of the various strata. The bores were extended until refusal on sandstone in all locations, which was encountered between 0.24 and 10.25 m below ground level (bgl). Refer to the logs provided in Appendix F for specific sampling depths.

8.4 Analytical Scheme

The analytical scheme was designed to provide preliminary advice on contamination and on the various strata encountered at the site i.e. fill, topsoil and natural clays.

8.5 Sample Collection

Environmental sampling was conducted according to standard operating procedures described in the DP *Field Procedures Manual* as summarised in the following sections.

8.5.1 Soils

Bores were drilled 4 – 9 May 2011 using a combination of a Bobcat, a Kubota KX41-3V and hand tools. Soil for analysis was recovered from auger returns, with care taken not to collect soil in contact with the auger.

Samples were transferred into new laboratory prepared glass jars, and sealed with a Teflon lined lid. Sample containers were labelled with individual and unique identification including project number, sample location and depth. These were placed in a chilled, enclosed and secure chamber for transport to the laboratory.

8.5.2 Groundwater

Groundwater wells were installed in bores 1, 5, 7 and 9 with details of construction shown on the bore logs, Appendix F. Following completion of drilling, 50 mm diameter acid washed class 18 PVC casing and machine slotted well screens were installed.

Groundwater was collected using a low flow micro purge kit to minimise the loss of volatiles during the extraction. Samples were transferred into laboratory prepared bottles with appropriate preservatives as required. Sample bottles were labelled with individual and unique identification including project number and sample location. All equipment used in the groundwater sampling was decontaminated using Decon 90 and distilled water.

9. Results

9.1 Field Observations

Details of the subsurface conditions encountered during the field investigation are given on the bore logs in Appendix F, together with notes defining classification methods and descriptive terms.

The fieldwork indicated variable cut and fill profiles underlying the site, with the succession of strata broadly summarised as follows:

PAVEMENTS:	Comprising a concrete and bituminous concrete surfaces overlying: heavily bound base course, gravel base course and concrete to depths in the range of 0.2 m to 1.0 m.
FILLING:	Filling of variable composition and relative density to typical depths in the range of 0.3 m to 1.0 m. No anthropogenic inclusions in fill or other signs of contamination such as odours or staining were observed in any of the bores
RESIDUAL SOIL:	Typically stiff to very stiff clay, silty clay and sandy clay, grading into weathered at depths in the range of 1.1 m to 2.6 m.
BEDROCK:	Initially extremely low strength tuffaceous sandstone becoming low to medium strength at refusal of the TC-bit at depths in the range 0.2 m to 4.0 m. Core samples were extremely low to high strength to termination depths in the range from 0.2 m to 10.3 m.

No free groundwater was observed in bores during auger drilling for the short period they were left open. Subsequent monitoring of installed groundwater wells indicated the groundwater level at depths below ground level in the range of 9.6 m to 10.0 m in bore 9 between 16 May 2011 and 2 June 2011 and generally dry conditions in bores 1, 5 and 7 for the same period, however, groundwater levels were observed at 5.4 m in bore 1 and 4.2 m in bore 5 on 2 June 2011 following incremental rain.

9.2 Laboratory Results – Soils

A summary of all the laboratory test results undertaken on soil samples is provided in Table G1, Appendix G.

All of the results were within the adopted SAC with the exception of benzo(a)pyrene (B(a)p) in bore 3 at depth range of 0.5 to 0.6 m, where a concentration of 7.5 mg/kg was recorded. This exceeds the HIL (5 mg/kg) however is not considered a hot spot. The 95% Upper Confidence Limit (UCL) of all the benzo(a)pyrene concentrations recorded was 3.7 mg/kg which was below the HIL, therefore, the detected concentration is not considered to be significant under the proposed land-use. The sample was collected from a fill horizon which was described as grey brown mottled orange slightly clayey gravelly (fine to medium slag, sandstone and latite), the elevated B(a)p concentrations is possibly due to the slag content of the material.

9.3 Laboratory Results – Groundwater

A summary of all the laboratory test results undertaken of groundwater samples is provided in Table H1, Appendix H.

Only one groundwater well, GW09, was observed to have any recoverable sample at the date of sampling, 24 May 2011. All of the results were within the adopted SAC for the primary sample and its replicate with the following exceptions:

- Cadmium, 1 µg/kg and 0.9 µg/kg were recorded compared to the hardness adjusted guideline value of 0.3 µg/L;
- Copper, 11 µg/kg was recorded in both samples compared to the hardness adjusted guideline value of 2 µg/L;
- Nickel, 24 µg/kg and 26 µg/kg were recorded compared to the hardness adjusted guideline value of 18 µg/L; and
- Zinc, 100 µg/kg was recorded in both samples compared to the hardness adjusted guideline value of 13 µg/L.

Detectable concentrations of total petroleum hydrocarbons, C_6-C_9 (35 µg/L and 24 µg/L) and C_{10}-C_{14} (160 µg/L and 120 µg/L) in the primary and replicate samples respectively, however, the concentrations were well below the GIL (600 µg/L). The primary sample was re-analysed using a silica gel clean up method which reduces the amount of non petroleum based hydrocarbons from the test result. The results of the testing indicate that no detectable concentrations of TPH C_{10} - C_{36} were recorded. A detection of C_6 – C_9 was recorded at a level of 18 µg/L, well below the GIL.

Further to this, total xylenes (14 µg/L and 13 µg/L) in the primary and replicate samples, respectively, were well below the GIL (550 µg/L). Xylenes were also retested in the primary sample with no detections recorded.

Detailed laboratory result sheets and chain-of-custody information is included in Appendix I for both soils and groundwater.

9.4 Preliminary Waste Classification

As part of the assessment, the results of the laboratory analysis for soils were compared against the NSW DECC's *Waste Classification Guidelines Part 1: Classifying Waste*, dated December 2009. The results of the soil testing showed that most of the results were within the specific contaminant concentration for classification without TCLP for general solid waste with the exception of three samples. These samples were subject to leachability analysis, the results of which were within the specific contaminant concentration and the leachable concentration for general solid waste.

The results of the analysis of natural soils were compared against published background ranges. All of the samples were within these ranges.

The results indicate that the fill would most likely be classified as general solid waste and the natural soils and rock would most likely be classifiable as virgin excavated natural material, pending further assessment during earthworks.

9.5 Acid Sulphate Soils Assessment

The assessment for acid sulphate soils (ASS) comprised:

- initial ASS screening of 12 samples for measurement of pH in water (pH_F) and pH following oxidation with hydrogen peroxide (pH_{FOX}); and
- analysis of two test samples, 11/1.0-1.1 and 11/1.75, selected on the basis of indicators for acid soil potential using the chromium suite – acid based analysis method.

The following observations are made on the basis of the screening tests:

- pH_F values are not positive indicators of the presence of Actual Acid Sulphate Soil (AASS) conditions;
- Two of the pH_F values were indicative of acidic soil; and
- pH_{FOX} values are not positive indicators of Potential Acid Sulphate Soil (PASS) conditions. However, two of the samples had pH_{FOX} values that are defined as being neither positive or negative indicators of PASS.

pH_F and pH_{FOX} are shown in Table J1, Appendix J.

The laboratory chromium suite results indicate that, when assessed against the NSW Acid Sulphate Soils Management Advisory Committee (ASSMAC) *Acid Sulphate Soils Assessment Guidelines* (1998) texture based action criteria the net acidity was above the action criteria and non-detectable

levels of S_{CR} were recorded in both samples, as shown in Table J1, Appendix J. Detailed laboratory report sheets and chain-of-custody information are included in Appendix I.

When assessed in accordance with the ASSMAC guidelines and the Queensland Acid Sulphate Soil Investigation Team (QASSIT) Management of Acid, Non-Acid Sulphate Soils, it is considered that, on the basis of the analytical findings and site investigation:

- a significant portion of the site is underlain by residual clay soils and bedrock (tuffaceous sandstone) which are inconsistent with the presence of estuarine ASS;
- the recorded ground surface levels of the site are all above RL 5 above which there is typically no requirement for assessment of the potential for estuarine ASS;
- both test samples indicated S_{CR} values less than the action criteria for ASS; and
- some tuffaceous sandstone from bore 11 is assessed as being acidic soil, rather than PASS or AASS.

9.6 QA/QC Procedures and Results

A quality assurance/quality control (QA/QC) assessment is provided in Appendix K. On the basis of the QA/QC results it is considered that the results are representative of the conditions of the site, and are suitable for use in this assessment.

10. Discussion

A review of site history information confirmed that the site has been used as a hospital from as early as 1952. Aerial photographs indicated that some building demolition and construction had occurred within the western portion of the AC&IESS site between 1974 - 1984 and the majority of the ICCC site between 1974 - 1984. It is noted that access for sampling within the building footprints was not available hence the potential for contamination generally or cross contamination of soils from hazardous building materials following demolition of former buildings across all of each site, is not known. It is therefore recommended that any areas which were not accessible during fieldwork are further investigated when access becomes available.
The subsurface investigation indicated that filling was encountered in the majority of the bores overlying residual clay and tuffaceous sandstone. Four of the bores were converted into wells, however, groundwater was only encountered in one of these wells.

Soil and groundwater analysis was conducted at a NATA accredited laboratory (Envirolabs) for a range of common contaminants. The results for soils were all within the adopted SAC with the exception of benzo(a)pyrene (B(a)P) in bore 3 at a depth of 0.5 to 0.6 m, where 7.5 mg/kg was recorded. This exceeds the HIL (5 mg/kg), however this is not considered a hot spot and does not pose a significant human health risk under the proposed land-use.

All of the results for groundwater were within the GIL with the exception of cadmium, copper, nickel and zinc, as detailed in Section 9.3. These exceedances are not considered significant. The cadmium exceedance is marginally above the guideline and the concentrations of copper, nickel and

zinc at GW09 are commonly found in the Wollongong area, are most likely representative of regional background levels and not likely associated with contamination from the site as high copper, nickel and zinc concentrations have not been found in the soil.

There were also detectable concentrations of total petroleum hydrocarbons, C_6-C_9 (35 µg/L and 24 µg/L) and C_{10}-C_{14} (160 µg/L and 120 µg/L) and total xylenes (14 µg/L and 13 µg/L) in the primary and replicate samples respectively, however, the concentrations were well below the GIL (600 µg/L and 550 µg/L respectively). The C_6-C_9 concentration is largely as a result of the xylene detection. The primary sample was retested using a silica gel clean up method which reduces the amount of non petroleum based hydrocarbons from the test result. No detection of TPH C_{10}-C_{36} was recorded. Whilst the recorded concentration is well below the GIL, it is recommended that an additional round of groundwater sampling be undertaken to further assess the concentrations and to confirm water levels in the other wells that were unable to be sampled. If the wells have made water, then they should be sampled and analysed. The source of the of the xylene is not known. The recommended additional sampling should therefore include additional investigation into potential sources by the inclusion of volatile organic compound (VOC) analysis in the analytical suite.

An assessment for acid sulphate soils (ASS) was also carried out. Screening tests were carried out on 12 samples and identified the potential for the soil to be acidic with measured level of pH_{FOX} being classified as neither positive or negative indicators of ASS. Two of these samples were then analysed at a NATA accredited laboratory for the full chromium suite. The results of the acid sulphate soil assessment indicate that at least some of the soil from the site can be identified as being acid, but not acid sulphate soil. In order to reduce the potential for corrosion on proposed structures appropriate lime treatment should be conducted on soil identified as being likely acidic in order to neutralise the soil.

11. Conclusion and Recommendations

Based on the results of the assessment, the ED, AC&IESS and ICC sites appear to be compatible for the continued use as part of Wollongong Hospital. It is recommended, however, that an additional groundwater monitoring event with the addition of VOC to the analytical suite is undertaken to confirm TPH and xylene concentrations in the groundwater. Further investigation in areas inaccessible at the time of this assessment would also be required when access becomes available.

Whilst not part of the scope of work for this assessment, it is recommended that a hazardous building materials assessment is undertaken in the different buildings or parts thereof.

The results of the preliminary waste classification assessment indicates that the fill is likely to be classified as general solid waste and the natural soils and rock would most likely be classifiable as virgin excavated natural material, pending confirmation during earthworks. Any variation to the descriptions of fill and natural soil encountered during excavation will require a reassessment of the classification including the presence of asbestos-based materials.

12. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Wollongong Hospital in accordance with DP's proposal dated 15 April 2011 and acceptance received from Mr Troy Harvey dated 28 April 2011. The work was carried out under RTF/Contract No HI11082, 28 April 2011. This report is provided for the exclusive use of Health Infrastructure for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

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

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

Douglas Partners Pty Ltd

Appendix A

About this Report

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

Appendix B

Drawing 1

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: Health Infrastructure	TITLE: Locations of Boreholes and Wells Phase 2 Contamination Assessment with Limited Sampling Proposed Wollongong Hospital Redevelopment Loftus St, Wollongong	PROJECT No: 48773.05
	OFFICE: Wollongong / DRAWN BY: KGH		DRAWING No: 1
	SCALE: As shown / DATE: 13 July 2011		REVISION: A

Appendix C

Results of Title Deed Search

Service First Registration Pty Ltd

ACN: 108 037 029
Ph: 02 9233 1314
Fax: 9233 2878

Suite 102, Level 1, 64 Castlereagh Street
Sydney 2000
PO Box 1539 Sydney 2000
DX 189 Sydney

Summary of Owners Report

LPMA Sydney

Re: Wollongong Hospital – Crown Street, Wollongong

Description: - Lots 58 to 68 inclusive and Lot 95 Section 3 D.P. 1258
Also Lot 13 D.P. 884182 and Lot 69 D.P. 1012072

Date of Acquisition and term held	Registered Proprietor(s) & Occupations where available	Reference to Title at Acquisition and sale
05.02.1886 (1886 to 1900)	William Wiley (Gentleman)	Vol 775 Fol 179
10.12.1900 (1900 to 1902)	Harold Cox (Solicitor)	Vol 775 Fol 179
24.09.1902 (1902 to 1925)	Archibald Campbell (Journalist) Walter Graham Robertson (Bank Manager) William John Wiseman (Gentleman) (? Trustees of the Hospital)	Vol 775 Fol 179
24.12.1925? (1925 to 1925)	Walter Graham Robertson (Bank Manager)	Vol 775 Fol 179
19.11.1925 (1925 to 1927)	Walter Graham Robertson (Bank Manager) John Australia Mayo (Auctioneer) William Parkinson (Cordial Maker)	Vol 775 Fol 179
26.10.1927 (1927 to1952)	Walter Graham Robertson (Retired Bank Manager) William Parkinson (Cordial Maker) Standish Richard Musgrave (Journalist)	Vol 775 Fol 179 now Vol 4090 Fol 189
09.12.1952? (1952 to 1952)	William Parkinson (Cordial Maker)	Vol 4090 Fol 189
[illegible].11.1952 (1952 to 2002)	The Wollongong District Hospital (Then The Wollongong Hospital) (Now Illawarra Area Health Service)	Vol 4090 Fol 189 now Auto Consol 4090-189
03.12.2002 (2002 to date)	# Health Administration Corporation	Auto Consol 4090-189

# Denotes Current Registered Proprietor

Leases: -

08.09.1969. To Illawarra County Council – Substation No. 419, now expired

07.07.1999. to Illawarra County Council – Substation 3189. Expires 30.06.2012

The leases to the phone carriers have not been investigated

Email: grolly1@bigpond.net.au

Service First Registration Pty Ltd
ACN: 108 037 029
Ph: 02 9233 1314
Fax: 9233 2878
Suite 102, Level 1, 64 Castlereagh Street
Sydney 2000
PO Box 1539 Sydney 2000
DX 189 Sydney

Easements: -

- 01.10.2002: - (1) Easement for Underground Cables 1 wide (D.P. 1045385) – Affects Lot 69 D.P. 1012072
  (2) Easement for Underground Cables 1.5 wide (D.P. 1045385) - Affects Lot 65 Section 3 D.P. 1258
  (3) Easement for Indoor Substation No. 21348 - Affects Lot 65 Section 3 D.P. 1258

Yours Sincerely
Mark Groll
6 April 2011
(Ph: 0412 199 304)

Email: grolly1@bigpond.net.au

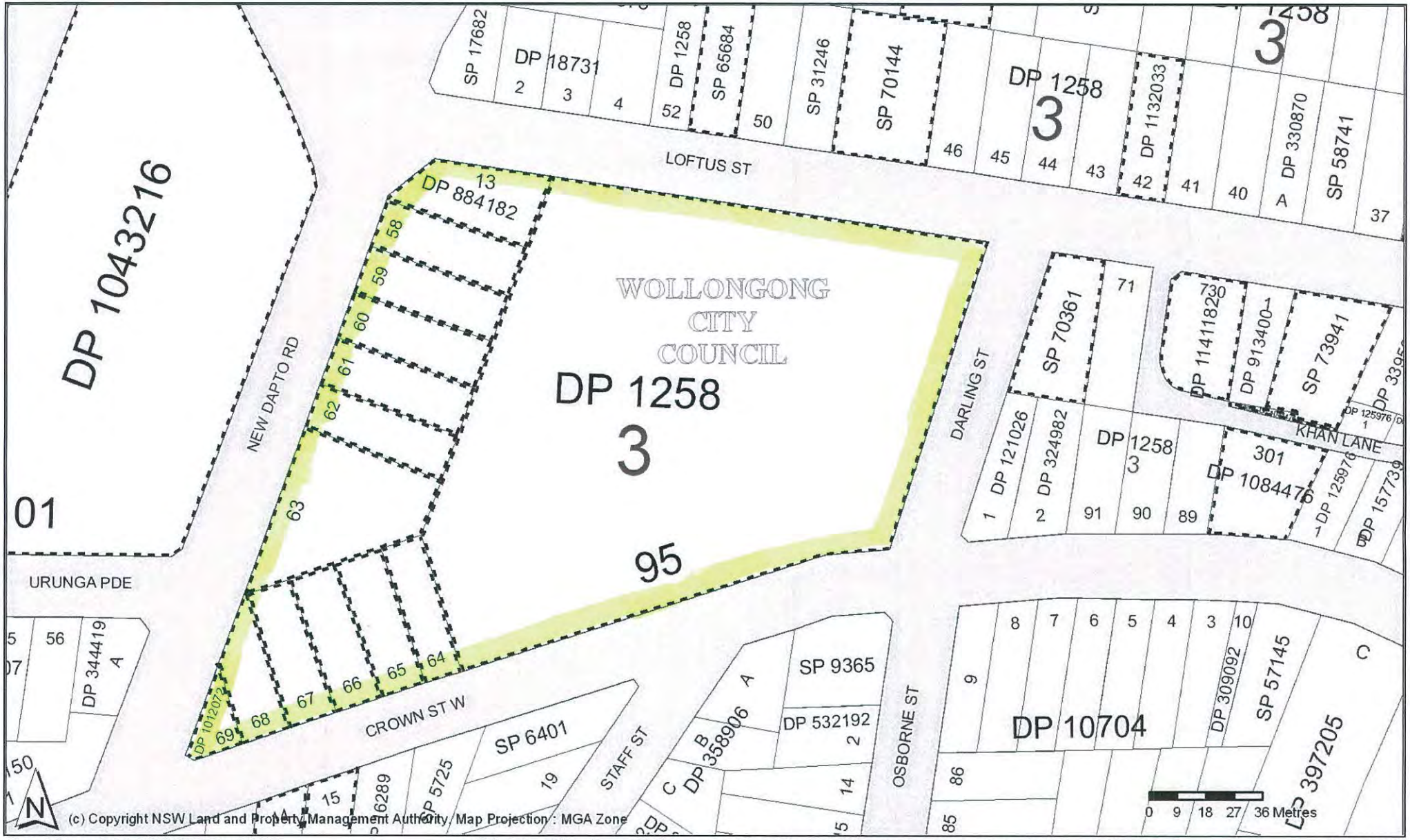
Land & Property Management Authority
Land & Property Information

Cadastral Records Enquiry Report

Ref : surv:scim-grollm

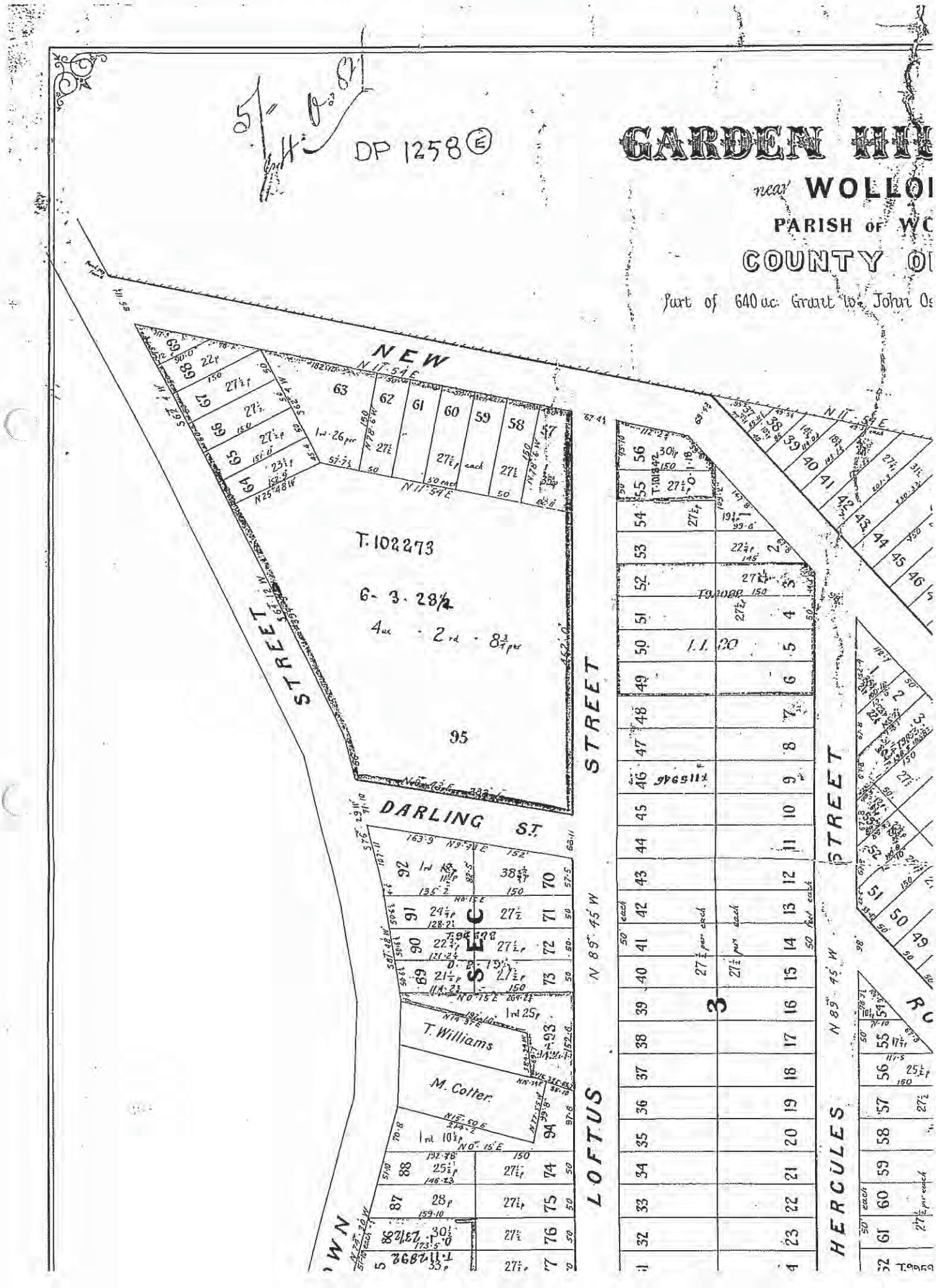
Requested Parcel : Lot 95 Section 3 DP 1258 **Identified Parcel :** Lot 95 Section 3 DP 1258

Locality : WOLLONGONG **LGA :** WOLLONGONG **Parish :** WOLLONGONG **County :** CAMDEN



Report Generated 1:24:33 PM, 5 April, 2011

This information is provided as a searching aid only. While every endeavour is made to ensure the current cadastral pattern is accurately reflected, the Registrar General cannot guarantee the information provided. For all ACTIVITY PRIOR to SEPT 2002 you must refer to the RGs Charting and Reference Maps.



Lodged by
a Beckett

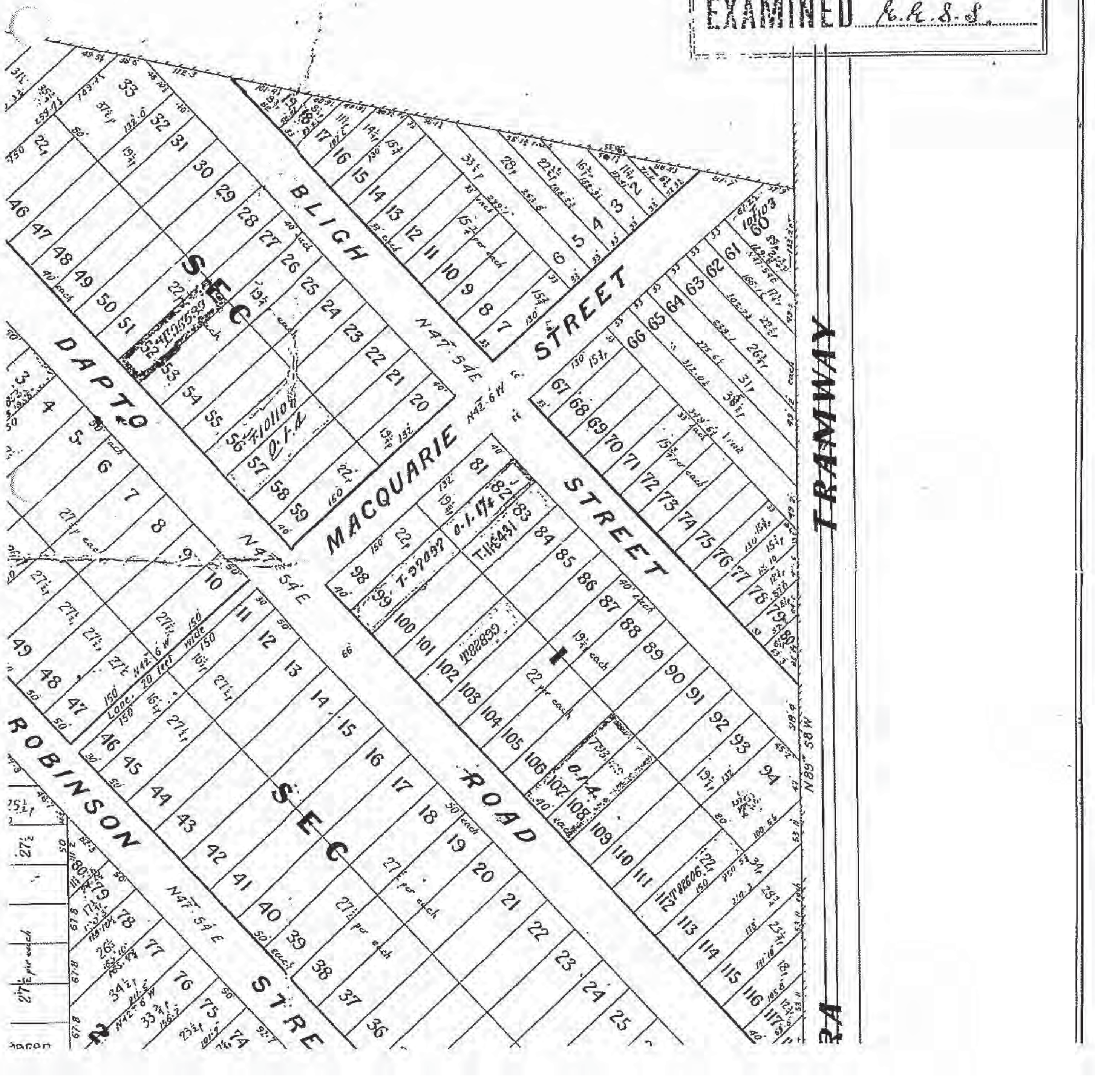
DP 1258

ILL ESTATE
ONGONG
WOLLONGONG
OF CAMDEN
t Osborne 19th October 1831.

Vol: 698 fol: 19

1258

COPY MADE L.M.B. 19-2-87
EXAMINED E.E.S.S.

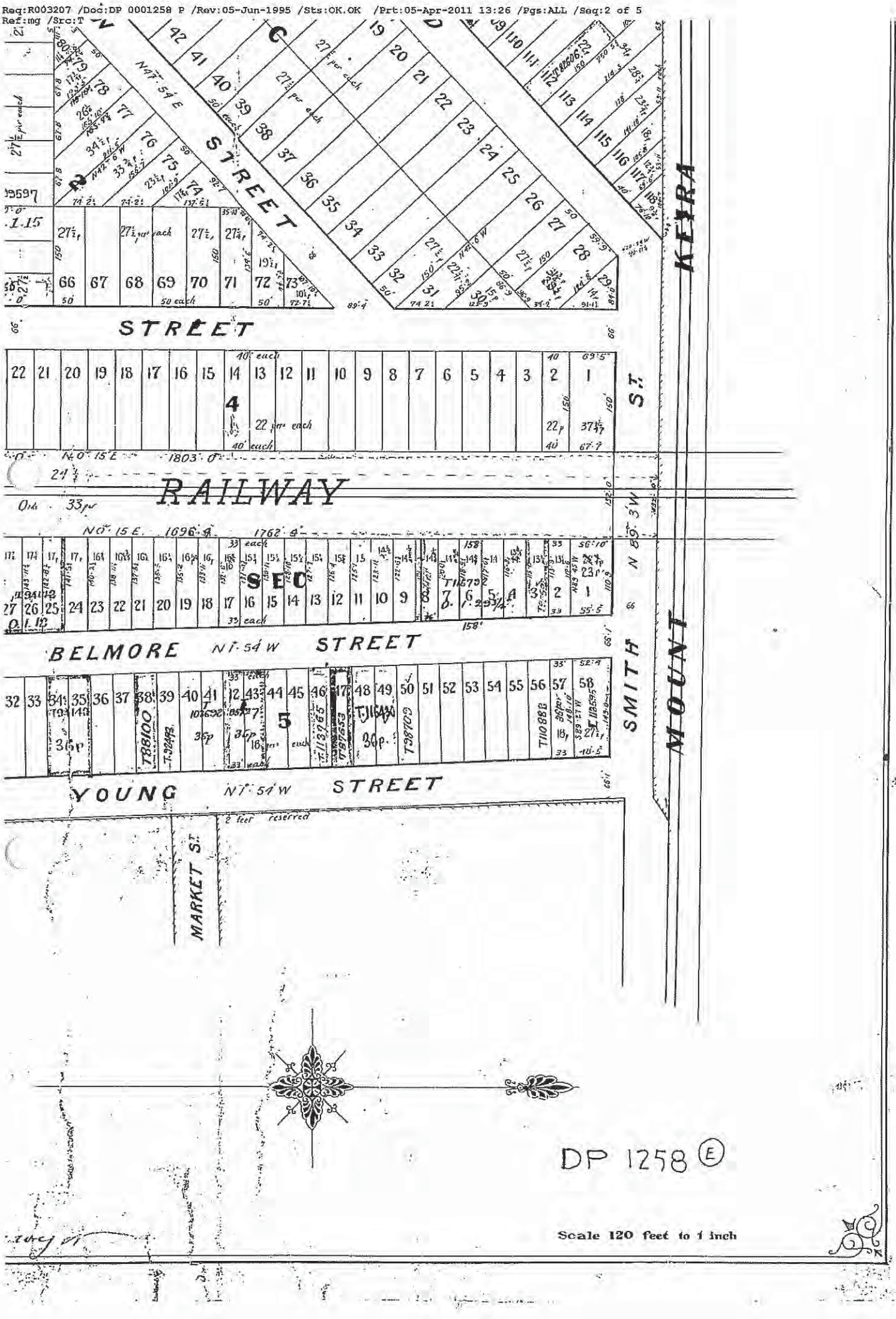


This is the plan marked 'A' referred to in the declaration of A. W. Stephen L. S. made before me at Sydney this 21 day of May 1884.

J.P.

DP1258 (E)

Geo. Stephens
Licensed Surveyor



DP 1258 (E)

Scale 120 feet to 1 inch

CONVERSION TABLE ADDED IN REGISTRAR GENERAL'S DEPARTMENT

DP 1258

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2	1	0.635
4	6	1.37
5	-	1.525
6	-	1.83
7	10	2.39
9	2	2.795
14	2	4.32
14	5	4.395
17	1	5.205
18	6 1/2	5.65
20	10 1/2	6.365
22	2	6.755
22	6	6.86
26	9 1/4	8.16
29	-	8.84
30	-	9.145
31	-	9.45
33	-	10.06
33	4 1/2	10.175
35	10	10.92
35	11	10.945
36	9	11.2
37	9	11.505
38	2 1/2	11.645
38	6	11.735
38	10	11.835
39	2	11.94
39	8	12.09
40	-	12.19
40	5	12.32
40	6	12.345
40	9 1/2	12.435
42	10	13.055
43	8	13.31
44	5	13.54
44	6	13.565
45	2	13.765
45	4	13.82
47	-	14.325
48	5	14.755
48	7	14.81
48	10 1/2	14.895
49	2	14.985
49	5	15.06
49	5 1/4	15.07
50	-	15.24
50	6 1/2	15.405
51	10	15.8
52	3 1/2	15.94
52	4	15.95
55	3	16.89
55	11 1/4	17.05
55	11 1/2	17.055
56	1 3/4	17.115
56	10	17.325
57	2	17.425
57	3	17.5
57	7 1/2	17.565
58	11 1/4	17.965
58	11 1/2	17.97
59	6	18.135
59	9	18.21
61	-	18.595
62	1 3/8	18.93
63	3	19.28
65	7	19.99
66	-	20.115
66	0 1/2	20.13
66	1	20.14
66	8	20.32
66	11	20.395
67	2 1/2	20.485
67	2 7/8	20.495
67	4 1/2	20.535
67	7	20.6
67	8	20.625

CONVERSION TABLE ADDED IN REGISTRAR GENERAL'S DEPARTMENT

DP 1258 CONTINUED

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71	10	21.895
71	11	21.92
72	7 1/2	22.135
74	2 1/2	22.62
74	8	22.76
75	1 1/2	22.9
75	10	23.115
76	10	23.42
77	-	23.47
77	7 3/4	23.665
78	1	23.8
78	9 1/2	24.015
79	7 3/4	24.275
80	-	24.385
80	11	24.665
81	-	24.69
81	7	24.865
82	-	24.995
82	3	25.07
82	5	25.12
82	6 5/8	25.16
83	2 1/2	25.36
83	11	25.58
84	-	25.605
85	-	25.91
85	1 1/4	25.94
85	1 1/2	25.945
85	11 1/4	26.195
86	9	26.44
86	11	26.49
87	-	26.52
88	11 1/4	27.11
89	3	27.205
89	4	27.23
90	-	27.43
91	1 1/2	27.775
92	7	28.22
92	10 1/2	28.31
94	5 1/2	28.79
95	2	29.005
97	-	29.565
97	6	29.72
98	-	29.87
98	4	29.97
99	-	30.175
99	6	30.33
99	8	30.38
100	5 1/4	30.615
100	7	30.66
100	10	30.735
101	2	30.835
101	4 1/2	30.9
101	9	31.015
102	6	31.24
105	8	32.205
106	6	32.46
107	6	32.765
107	10 1/2	32.88
107	11	32.895
109	2	33.275
109	4 1/2	33.335
110	9	33.755
111	2	33.885
112	2 3/4	34.205
112	3	34.215
112	6	34.29
112	7	34.315
113	9	34.67
114	0 1/4	34.755
114	0 1/2	34.76

CONVERSION TABLE ADDED IN REGISTRAR GENERAL'S DEPARTMENT

DP 1258 CONTINUED

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117	4 1/2	35.775
117	5	35.79
117	6 1/4	35.82
118	9 3/8	36.205
118	9 1/2	36.21
120	0 1/2	36.59
120	3	36.65
121	2 1/2	36.945
121	3 3/4	36.975
122	6 3/4	37.355
123	11	37.77
124	8	38
125	1	38.125
125	9	38.33
126	4	38.505
127	7	38.885
128	2 1/4	39.07
128	9	39.245
128	10	39.27
129	8	39.52
130	-	39.625
130	1 1/4	39.655
130	1 1/2	39.66
131	1 3/4	39.975
131	4 3/4	40.05
131	7 3/4	40.125
132	-	40.235
132	8	40.435
133	2	40.59
133	11	40.82
134	6	40.995
134	10	41.095
135	2	41.2
136	5	41.58
137	1	41.785
137	5 1/2	41.895
137	7 1/2	41.95
137	8 1/4	41.965
138	11 1/4	42.35
140	2 1/2	42.735
141	5 1/2	43.115
141	10	43.23
142	8 3/4	43.505
143	1 1/2	43.625
143	11 1/4	43.87
143	11 3/4	43.885
145	"	44.195
145	8	44.4
146	3	44.575
146	6	44.655
147	8	45.01
147	10	45.06
148	1	45.135
148	10	45.365
149	-	45.415
150	-	45.72
150	8 1/2	45.935
151	-	46.025
152	-	46.33
152	4	46.43
152	6	46.48
152	9	46.56
152	10	46.585
153	2	46.685
156	7	47.725
158	-	48.16
159	10	48.715
162	9 1/2	49.62
163	9	49.91
164	4 1/4	50.1

CONVERSION TABLE ADDED IN REGISTRAR GENERAL'S DEPARTMENT

DP 1258 CONTINUED

FEET	INCHES	METRES
165	10	50.35
166	1 1/4	50.63
166	1 1/2	50.63
169	7 1/2	51.7
170	3 1/2	51.9
172	2 1/4	52.48
173	5	52.86
177	4 1/2	54.06
178	-	54.25
179	2	54.61
182	10	55.73
187	1	57.02
193	8	59.03
197	10	60.3
200	0 1/2	60.97
201	3	61.34
202	7 1/4	61.75
208	2 3/4	63.47
211	5	64.44
214	2	65.28
214	3	65.3
215	2	65.58
226	9	69.11
230	3 1/4	70.19
230	3 3/4	70.2
233	5	71.15
239	1	72.87
250	5 1/4	76.33
253	8	77.32
259	4 1/4	79.05
264	2 3/4	80.54
275	6 1/2	83.99
277	-	84.43
299	-	91.14
299	1	91.16
301	9	91.97
312	0 1/2	95.11
333	1	101.52
348	6 1/2	106.24
377	9	115.14
394	9	120.32
462	-	140.82
635	-	193.55
637	-	194.16
659	-	200.86
1696	4	517
1737	-	529.4
1762	4	537.2
1803	-	549.6

AC	RD	P	SQ M
-	-	.17	4.3
-	-	6 1/2	164.4
-	-	6 3/4	170.7
-	-	7 3/4	196
-	-	8 1/2	215
-	-	8 3/4	221.3
-	-	9 3/4	246.6
-	-	10 1/4	259.3
-	-	10 1/2	265.6
-	-	10.55	266.8
-	-	11 1/4	284.5
-	-	11 1/2	290.9
-	-	12	303.5
-	-	12 1/4	309.8
-	-	12 3/4	322.5
-	-	13 1/2	341.5
-	-	13 3/4	347.8
-	-	14	354.1
-	-	14 1/4	360.4
-	-	14 1/2	366.7
-	-	15	379.4
-	-	15 1/4	385.7
-	-	15 1/2	392
-	-	15 3/4	398.4
-	-	16	404.7

CONVERSION TABLE ADDED IN REGISTRAR GENERAL'S DEPARTMENT

DP 1258A CONTINUED

AC	RD	P	SQ M
-	-	16 1/4	411
-	-	16 1/2	417.3
-	-	16 3/4	423.7
-	-	17	430
-	-	17 1/4	436.3
-	-	17 1/2	442.6
-	-	17 3/4	448.9
-	-	18	455.3
-	-	18 3/4	474.2
-	-	19 1/4	486.9
-	-	19 1/2	493.2
-	-	19 3/4	499.5
-	-	20 1/2	518.5
-	-	21	531.1
-	-	21 1/2	543.8
-	-	22	556.4
-	-	22 1/4	562.8
-	-	22 1/2	569.1
-	-	22 3/4	575.4
-	-	23	581.7
-	-	23 1/4	588.1
-	-	23 1/2	594.4
-	-	24 1/4	613.4
-	-	24 3/4	626
-	-	25	632.3
-	-	25 1/2	645
-	-	25 3/4	651.3
-	-	26 1/4	663.9
-	-	26 3/4	676.6
-	-	27 1/4	689.2
-	-	27 1/2	695.6
-	-	28	708.2
-	-	28 3/4	727.2
-	-	30 1/2	771.4
-	-	31	784.1
-	-	31 1/4	790.4
-	-	31 1/2	796.7
-	-	31 3/4	803
-	-	33	834.7
-	-	33 1/2	847.3
-	-	33 3/4	853.6
-	-	34	860
-	-	34 1/2	872.6
-	-	35 1/4	891.6
-	-	35 1/2	897.9
-	-	35 3/4	904.2
-	-	36	910.5
-	-	36 3/4	929.5
-	-	37 1/2	948.5
-	-	38 1/2	973.8
-	1	-	1012
-	1	4	1113
-	1	10 1/2	1277
-	1	11 1/2	1303
-	1	12	1315
-	1	15	1391
-	1	22 3/4	1587
-	1	25	1644
-	1	26	1669
-	1	27 1/4	1701
1	-	5	4173

AC	RD	P	HA
4	2	8 3/4	1.843

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE
6/4/2011 11:49AM

FOLIO: AUTO CONSOL 4090-189

Recorded	Number	Type of Instrument	C.T. Issue
23/3/2000	6664882	CONSOL HISTORY RECORD CREATED FOR AUTO CONSOL 4090-189	EDITION 1
		PARCELS IN CONSOL ARE: 58-68/3/1258, 95/3/1258, 4/2/5507, 16-17/2/5507, 13/884182, 69/1012072.	
6/3/2001	7398279	TRANSFER OF LEASE	
1/10/2002	DP1045385	DEPOSITED PLAN	
10/10/2002	8943303	DETERMINATION OF LEASE	
10/10/2002	8943304	LEASE	
10/10/2002	8943305	LEASE	
10/10/2002	8943306	LEASE	
3/12/2002	9024711	TRANSFER	
13/12/2002	9213218	4/2/5507 EXCISED	
13/12/2002	9213218	16/2/5507 EXCISED	
13/12/2002	9213218	17/2/5507 EXCISED	EDITION 2
11/8/2005	AB516651	LEASE	EDITION 3
7/12/2005	AB951987	LEASE	EDITION 4
9/7/2009	AE757546	LEASE	EDITION 5

*** END OF SEARCH ***

mg PRINTED ON 6/4/2011

**ANY ENTRIES PRECEDED BY AN ASTERISK DO NOT APPEAR ON THE CURRENT EDITION OF THE CERTIFICATE OF TITLE. WARNING: THE INFORMATION APPEARING UNDER NOTATIONS HAS NOT BEEN FORMALLY RECORDED IN THE REGISTER.*

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: AUTO CONSOL 4090-189

SEARCH DATE	TIME	EDITION NO	DATE
5/4/2011	1:22 PM	5	9/7/2009

LAND

LAND DESCRIBED IN SCHEDULE OF PARCELS
AT WOLLONGONG
LOCAL GOVERNMENT AREA WOLLONGONG
PARISH OF WOLLONGONG COUNTY OF CAMDEN
TITLE DIAGRAM SEE SCHEDULE OF PARCELS

FIRST SCHEDULE

HEALTH ADMINISTRATION CORPORATION (T 9024711)

SECOND SCHEDULE (11 NOTIFICATIONS)

1 RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2 A289873 COVENANT
3 O313819 LEASE TO ILLAWARRA COUNTY COUNCIL OF SUBSTATION NO 3189 TOGETHER WITH RIGHT OF CARRIAGEWAY AND EASEMENTS SHOWN IN DP646275. EXPIRES: 30/6/2012.
4 DP1045385 EASEMENT FOR UNDERGROUND CABLES 1 METRE(S) WIDE AFFECTING THE PART OF LOT 69 IN DP1012072 SHOWN IN DP1045385
5 DP1045385 EASEMENT FOR UNDERGROUND CABLES 1.5 METRE(S) WIDE AFFECTING THE PART OF LOT 65 SECTION 3 IN DP1258 SHOWN IN DP1045385
6 DP1045385 EASEMENT FOR INDOOR SUBSTATION NO.21348 AFFECTING THE PART OF LOT 65 SECTION 3 IN DP1258 SHOWN IN DP1045385
7 8943305 LEASE TO OPTUS MOBILE PTY LIMITED OF PART OF WOLLONGONG HOSPITAL AS SHOWN IN PLAN (PAGE 19) WITH 8943305. COMMENCING 24/8/2003. EXPIRES: 23/8/2008.
8 8943306 LEASE TO OPTUS MOBILE PTY LIMITED OF PART OF WOLLONGONG HOSPITAL AS SHOWN IN PLAN (PAGE 19) WITH 8943306. COMMENCING 24/8/2008. EXPIRES: 23/8/2013.
9 AB516651 LEASE TO THE AUSTRALIAN RED CROSS SOCIETY OF PART GROUND & LOWER GROUND FLOORS, LAWSON HOUSE, DARLING STREET, WOLLONGONG SHOWN HATCHED IN PLAN WITH AB516651. EXPIRES: 28/8/2014.
10 AB951987 LEASE TO TELSTRA CORPORATION LIMITED OF THE PART SHOWN HATCHED IN PLAN (PAGE 30) WITH AB951987. EXPIRES: 21/9/2010. OPTION OF RENEWAL: TWO OPTIONS EACH OF 5 YEARS.
11 AE757546 LEASE TO VODAFONE NETWORK PTY LIMITED OF PART SHOWN HATCHED IN PLAN WITH AE757546. EXPIRES: 25/8/2014.

END OF PAGE 1 - CONTINUED OVER

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Service First Registration

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: AUTO CONSOL 4090-189 PAGE 2

NOTATIONS

UNREGISTERED DEALINGS: NIL

SCHEDULE OF PARCELS	TITLE DIAGRAM
LOTS 58-68 SEC. 3 IN DP1258	DP1258
LOT 95 SEC. 3 IN DP1258	DP1258
LOT 13 IN DP884182	DP884182
LOT 69 IN DP1012072	DP1012072.

*** END OF SEARCH ***

mg PRINTED ON 5/4/2011

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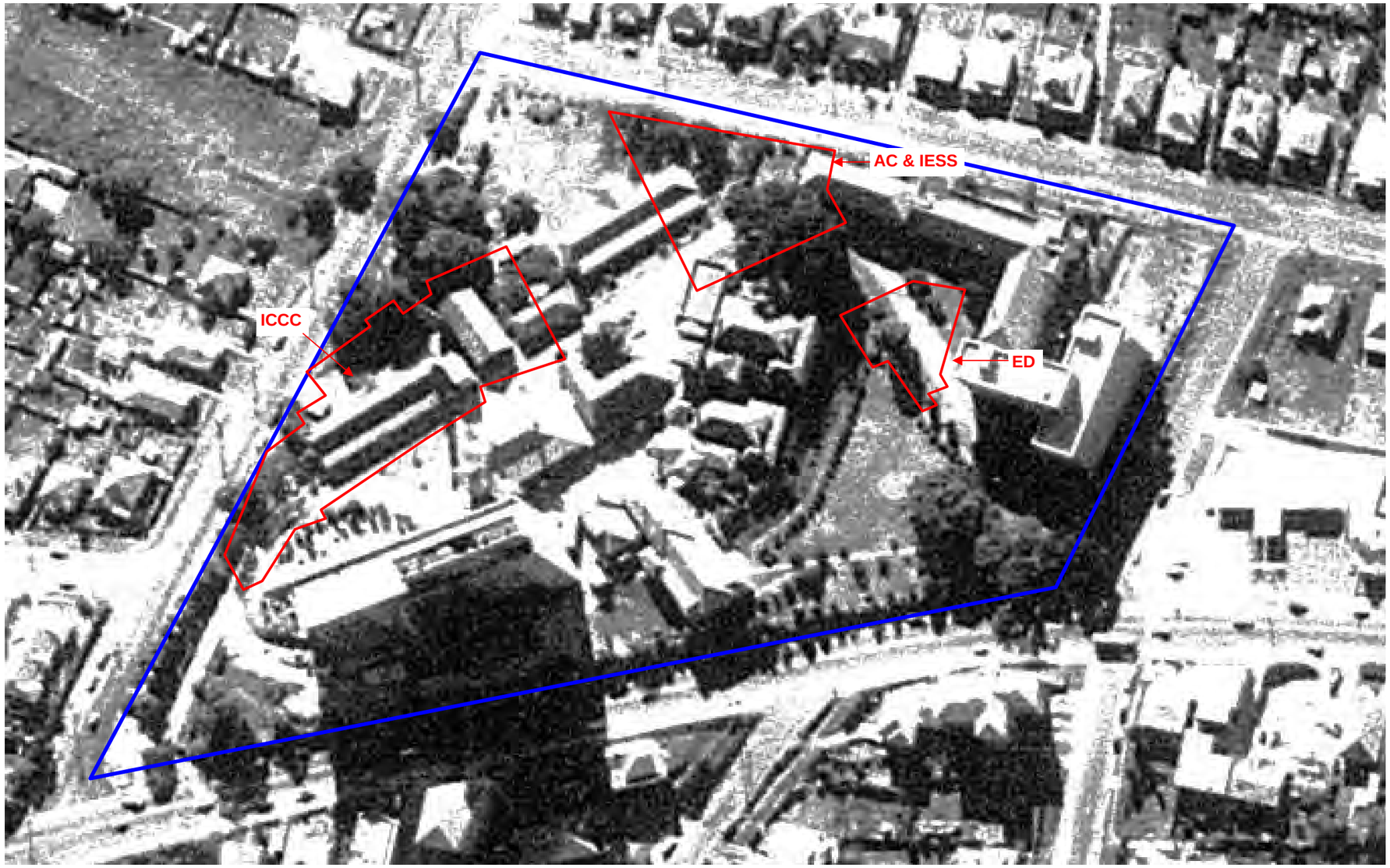
Appendix D

Historical Aerial Photographs



Approximate Regions of Development

Approximate Boundary of the Hospital

Douglas Partners
Geotechnics / Environment / Groundwater

Client:	Health Infrastructure		
Office:	Wollongong	Drawn by:	KGH
Scale:	NTS	Date:	Jul-11

Aerial Photograph 1961
Report on Phase 2 Contamination Assessment
Wollongong Hospital, Crown Street, Wollongong

Project No.	48773.05
Plate no	1
Revision:	A

Approximate Regions of Development

Approximate Boundary of the Hospital

Douglas Partners Geotechnics / Environment / Groundwater	Client: Health Infrastructure		Aerial Photograph 1974	Project No.	48773.05
	Office: Wollongong	Drawn by: KGH	Report on Phase 2 Contamination Assessment	Plate no	1
	Scale: NTS	Date: Jul-11	Wollongong Hospital, Crown Street, Wollongong	Revision:	A

Approximate Regions of Development

Approximate Boundary of the Hospital

Douglas Partners Geotechnics / Environment / Groundwater	Client: Health Infrastructure	Aerial Photograph 1984	Project No. 48773.05
	Office: Wollongong; Drawn by: KGH	Report on Phase 2 Contamination Assessment	Plate no 1
	Scale: NTS; Date: Jul-11	Wollongong Hospital, Crown Street, Wollongong	Revision: A

Approximate Regions of Development

Approximate Boundary of the Hospital

Douglas Partners
Geotechnics / Environment / Groundwater

Client:	Health Infrastructure		
Office:	Wollongong	Drawn by:	KGH
Scale:	NTS	Date:	Jul-11

Aerial Photograph 1994

Report on Phase 2 Contamination Assessment

Wollongong Hospital, Crown Street, Wollongong

Project No.	48773.05
Plate no	1
Revision:	A

Approximate Regions of Development

Approximate Boundary of the Hospital

Douglas Partners
Geotechnics / Environment / Groundwater

Client:	Health Infrastructure		
Office:	Wollongong	Drawn by:	KGH
Scale:	NTS	Date:	Jul-11

Aerial Photograph 2006

Report on Phase 2 Contamination Assessment

Wollongong Hospital, Crown Street, Wollongong

Project No.	48773.05
Plate no	1
Revision:	A

Appendix E

Section 149(2) and (5) Certificates

wollongong
city of innovation

WOLLONGONG CITY COUNCIL

Address 41 Burelli Street Wollongong • **Post** Locked Bag 8821 Wollongong DC NSW 2500
Phone (02) 4227 7111 • **Fax** (02) 4227 7277 • **Email** council@wollongong.nsw.gov.au
Web www.wollongong.nsw.gov.au • ABN 63 139 525 939 - GST Registered

013

Douglas Partners Pty Ltd
PO BOX 486
UNANDERRA NSW 2526

CERTIFICATE	201101698
Issued	6 April 2011
Fee	**$ 100.00**
Receipt	
Your Reference 48773.05:43344	
Council Property Reference	300309

CERTIFICATE

PLANNING CERTIFICATE

Issued Under Sections 149(2) and 149(5) of the Environmental Planning and Assessment Act 1979

PROPERTY DETAILS **(Refer to page 2 for map location)**

Legal Description	Lot 58 Sec 3 DP 1258, Lot 59 Sec 3 DP 1258, Lot 60 Sec 3 DP 1258, Lot 61 Sec 3 DP 1258, Lot 62 Sec 3 DP 1258, Lot 63 Sec 3 DP 1258, Lot 64 Sec 3 DP 1258, Lot 65 Sec 3 DP 1258, Lot 66 Sec 3 DP 1258, Lot 67 Sec 3 DP 1258, Lot 68 Sec 3 DP 1258, Lot 95 Sec 3 DP 1258, Lot 69 DP 1012072, Lot 13 DP 884182
Location	Wollongong Hospital 348-352 Crown Street WOLLONGONG NSW 2500

TABLE OF CONTENTS

wollongong
city of innovation

WOLLONGONG CITY COUNCIL

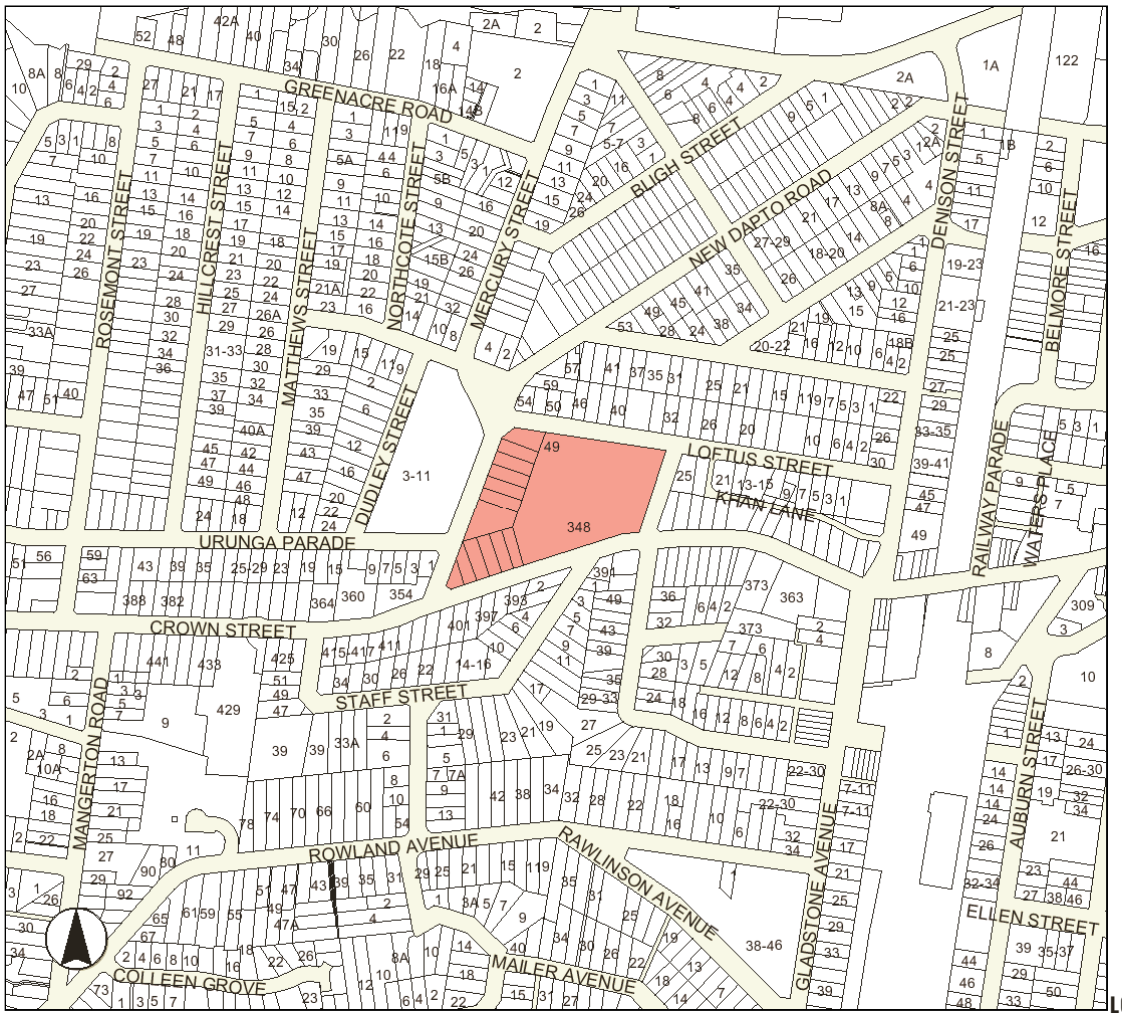
Address 41 Burelli Street Wollongong • **Post** Locked Bag 8821 Wollongong DC NSW 2500
Phone (02) 4227 7111 • **Fax** (02) 4227 7277 • **Email** council@wollongong.nsw.gov.au
Web www.wollongong.nsw.gov.au • ABN 63 139 525 939 - GST Registered

▶ Coastal Hazard	1.25

This certificate provides information on how a property (such as land and buildings) may be used and the limits on its development.
The certificate contains information Council is aware of through its records and environmental plans, along with data supplied by the State Government.

CERTIFICATE

CERTIFICATE



LOCATION MAP

1 SECTION 149(2) DETAILS

As at the date of this certificate, the following prescribed matters under section 149(2) of the Act relate to the abovementioned land:

1.1 RELEVANT PLANNING INSTRUMENT

The following local environmental planning instruments apply to the land:

- **Wollongong Local Environmental Plan 2009**.

1.1.1 Zones Applying to the Land

SP1 Hospitals Medical Research & Development

The objectives for and the uses permissible and prohibited by Wollongong Local Environmental Plan 2009

For land in the Zone No. SP1 – Special Activities – Hospital and Medical Research and Development

The objectives of the zone are:

- To provide for special land uses that are not provided for in other zones.
- To provide for sites with special natural characteristics that are not provided for in other zones.
- To facilitate development that is in keeping with the special characteristics of the site or its existing or intended special use, and that minimise any adverse impacts on surrounding land.

The purpose for which development may be carried out with and without consent and for which development is prohibited are:

WITHOUT CONSENT: Building identification signs; Business identification signs.

ONLY WITH DEVELOPMENT CONSENT:

The purpose shown on the Land Zoning Map, including any development that is ordinarily incidental or ancillary to development for that purpose; Advertisements; Advertising structures; Child care centres; Community facilities; Information and education facilities; Recreation areas; Recreation facilities (indoor); Recreation facilities (major); Recreation facilities (outdoor).

PROHIBITED: Any development not permitted in item 2 or 3

Note: For subdivision consent requirements see Clause 2.6, of Wollongong Local Environmental Plan 2009.

Note: Demolition of a building or work requires consent see Clause 2.6AA of Wollongong Local Environmental Plan 2009.

Note: Development below the mean high water mark requires consent see Clause 5.7, of Wollongong Local Environmental Plan 2009.

Note: The Wollongong Local Environmental Plan 2009 should be consulted to ascertain its full effect on the land.

1.1.2 Other Relevant Provisions of Wollongong Local Environmental Plan 2009

The Group of Fig Trees are a Heritage Item.

The Nurses Home Hickman House is listed on the State Heritage Register. The Nurses Home is a Heritage Item listed in Schedule 5 Part 1 of Wollongong Local Environmental Plan 2009.

1.2 PLANNING PROPOSALS

Nil

1.3 STATE ENVIRONMENTAL PLANS

State Environmental Planning Policy No. 6 – Number of Storeys in a Building

State Environmental Planning Policy No. 10 – Retention of Low-Cost Rental Accommodation

State Environmental Planning Policy No. 21 – Caravan Parks

State Environmental Planning Policy No. 22 – Shops and Commercial Premises

State Environmental Planning Policy No. 30 – Intensive Agriculture

State Environmental Planning Policy No. 32 - Urban Consolidation (Redevelopment of Urban Land)

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

State Environmental Planning Policy No. 36 – Manufactured Home Estates

State Environmental Planning Policy No. 50 – Canal Estates

State Environmental Planning Policy No. 55 – Remediation of Land

State Environmental Planning Policy No. 62 – Sustainable Aquaculture

State Environmental Planning Policy No. 64 – Advertising and Signage

State Environmental Planning Policy No. 65 – Design Quality of Residential Flat Development

State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004

State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004

State Environmental Planning Policy (Major Development) 2005

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

State Environmental Planning Policy (Temporary Structures) 2007

State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Affordable Rental Housing) 2009

State Environmental Planning Policy (Exempt and Complying Development Codes) 2008

Complying Development **must not** be carried out under State Environmental Planning Policy (Exempt and Complying Codes) 2008 for development specified for the;

General Housing Code

Rural Housing Code - *(unless complying development is carried out on the part of the lot to which clause 1.19 of SEPP Exempt and Complying Development Codes 2008 does not apply).*

Clause 1.19(6)(b) has identified the land as being reserved for a public purpose in an environmental planning instrument.

Complying Development **may** be carried out under State Environmental Planning Policy (Exempt and Complying Development) 2008 for development specified for the

Housing Alterations Code

General Development Code

General Commercial and Industrial Code

Subdivision Code

Demolition Code.

Note: Refer to Local Environmental Plan, Part 3 (3.1,3.2,3.3) for additional land exclusions (Exempt and Complying Development).

State Environmental Planning Policy (Exempt and Complying Development Codes) 2008

Complying Development **must not** be carried out under State Environmental Planning Policy (Exempt and Complying Codes) 2008 for development specified for:

General Housing Code

Rural Housing Code

Housing Alterations Code

General Development Code

General Commercial and Industrial Code

Subdivision Code

Demolition Code.

Clause 1.17A (d)(ii) has identified the land as land that comprises, or on which there is, an item of Environmental Heritage that is identified as such an item in an Environmental Planning Instrument.

Note: Refer to Wollongong Local Environmental Plan 2009, Part 3 (3.1,3.2,3.3) for additional land exclusions (Exempt and Complying Development).

State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.

Complying Development **must not** be carried out under State Environmental Planning Policy (Exempt and Complying Codes) 2008 for development specified for the;

General Housing Code

Rural Housing Code

Housing Alterations Code

General Development Code

General Commercial and Industrial Code

Subdivision Code

Demolition Code

Clause 1.17A (d) (i) has identified the land as land on which there is an item of Environmental Heritage that is subject to an Interim Heritage Order under the Heritage Act 1977, or that is listed on the State Heritage Register under that Act.

Note: Refer to Wollongong Local Environmental Plan 2009, Part 3 (3.1,3.2,3.3) for additional land exclusions (Exempt and Complying Development).

1.4 PROPOSED STATE ENVIRONMENTAL PLANS

Nil

1.5 DEVELOPMENT CONTROL PLANS

Land use based controls apply to this land see Chapter D13 (Wollongong City Centre)

Wollongong Development Control Plan 2009.

Development Control Plan 2009

Wollongong Development Control Plan 2009, contains detailed development controls which supplement the provisions of Wollongong Local Environmental Plan 2009.

Note: The Wollongong Development Control Plan 2009 should be consulted to ascertain its full effect on the land.

1.6 PROPOSED LOCAL ENVIRONMENTAL PLANS

Nil.

1.7 DECLARED STATE SIGNIFICANT DEVELOPMENT

The Minister has declared the following development to be State Significant Development:

- Developments identified as State Significant Development by State Environmental Planning Policy - Major Developments 2005.
- Under clause 17(1) of the Environmental Planning and Assessment (Savings and Transitional) Regulation 1998, all section 101 directions in existence before 1 July 1998. Under these directions the Minister is the consent authority for development of canals and other artificial waterways and new coal mines requiring new coal leases.

1.8 COASTAL PROTECTION

The Department of Services, Technology and Administration has not notified Council that the land is affected by the operation of sections 38 and 39 of the *Coastal Protection Act 1979*.

4A Certain Information Relating to Beaches and Coasts

4A(1). Whether an order has been made under Part 4D of the *Coastal Protection Act 1979* in relation to emergency coastal protection works (within the meaning of that Act) on the land (or on public land adjacent to that land), except where the council is satisfied that such an order has been fully complied with.

Nil.

4A(2)(a) Whether the council has been notified under section 55X of the *Coastal Protection Act 1979* that emergency coastal protection works (within the meaning of the Act) have been placed on the land (or on public land adjacent to that land)

Nil.

4A(2)(b) Whether the council is satisfied that the works referred to in 4A(2)(a) have been removed and the land restored in accordance with the *Coastal Protection Act 1979*.

Not Applicable.

4A(3) Whether the council has been notified of any information as is required by the regulations under section 56B of the *Coastal Protection Act 1979* to be included in the planning certificate.

Nil.

4B Annual Charges Under Local Government Action 1993 for Coastal Protection Services that Relate to Existing Coastal Protection Works.

Whether the owner (or any previous owner) of the land has consented in writing to the land being subject to annual charges under section 496B of the *Local Government Act 199*3 for coastal protection services that relate to existing coastal protection work (within the meaning of section 553B of that Act)

Not Applicable.

Note: "Existing Coastal Protection Works" to reduce the impact of coastal hazards on land (such as sea walls, revetments, groynes and beach nourishment) that existed before the commencement of section 553B of the Local Government Act 1993.

1.9 MINE SUBSIDENCE

The land is not proclaimed to be a mine subsidence district within the meaning of section 15 of the Mine Subsidence Compensation Act 1961.

1.10 ROAD WIDENING AND ROAD REALIGNMENT

Council has no record that the land is affected by any Road Widening or Road Realignment under:

1. Division 2 of Part 3 of the *Roads Act 1993*, or
2. any environmental planning instrument, or
3. any resolution of the Council.

The land may be affected by a Roads & Traffic Authority Road Widening or Road Realignment proposal. Contact that Authority for advice.

1.11 DEVELOPMENT OR HAZARD RISK RESTRICTIONS

Council has adopted "Wollongong Development Control Plan 2009 – Chapter E12 Geotechnical Assessment"

There are no policies that restrict the development of land because of tidal inundation, acid sulphate soils or any other risk not identified in this certificate.

1.12 FLOOD RELATED DEVELOPMENT CONTROLS INFORMATION

Development on the land or part of the land for the purposes of dwelling houses, dual occupancies, multi dwelling housing or residential flat buildings (not including development for the purposes of group homes or seniors housing) is subject to flood related development controls as contained in Wollongong Development Control Plan 2009.

Development on the land or part of the land for any other purpose is subject to flood related development controls as contained in Wollongong Development Control Plan 2009.

1.13 LAND RESERVED FOR ACQUISITION

Nil.

1.14 CONTRIBUTION PLANS

Wollongong City Council Section 94A Contributions Plan (2009)

The purposes of this contributions plan are:

- To authorise the imposition of a condition on certain development consents and complying development certificates requiring the payment of a contribution pursuant to section 94A of the EP&A Act 1979.
- To assist the council to provide the appropriate public facilities which are required to maintain and enhance amenity and service delivery within the area.
- To publicly identify the purposes for which the levies are required.

1.15 MATTERS ARISING UNDER THE CONTAMINATED LAND MANAGEMENT ACT 1997

Council has not been advised that :

a) The land is significantly contaminated land within the meaning of the Contaminated Land Management Act 1997

b) The land is subject to a management order within the meaning of the Contaminated Land Management Act 1997

c) The land is subject to an approved voluntary management proposal within the meaning of the Contaminated Land Management Act 1997

d) The land is subject to an ongoing maintenance order within the meaning of the Contaminated land Management Act 1997

e) The land is subject to a site audit statement within the meaning of the Contaminated land Management Act 1997

1.16 BUSH FIRE PRONE LAND

The land is not recorded in Council's records as bushfire prone land.

1.17 PROPERTY VEGETATION PLAN

The Southern Rivers Catchment Management Authority has not notified Council that the land is affected by a Property Vegetation Plan issued under the Native Vegetation Act 2003.

1.18 ORDERS UNDER TREES (DISPUTES BETWEEN NEIGHBOURS) ACT 2006

Nil.

1.19 DIRECTIONS UNDER PART 3A

Nil

1.20 SITE COMPATIBILITY CERTIFICATES

1.20.1 Site Compatibility Certificate and Conditions

State Environmental Planning Policy (Housing for Seniors or People with a Disability)2004

Nil.

1.20.2 Site Compatibility Certificate

State Environmental Planning Policy (Infrastructure) 2007

Nil.

1.20.3 Site Compatibility Certificate

State Environmental Planning Policy (Affordable Rental Housing) 2009

Nil

1.21 NOTIFICATION OF EXEMPTIONS AND AUTHORISATIONS - NATION BUILDING AND JOBS PLAN (STATE INFRASTRUCTURE DELIVERY) ACT 2009

Nil.

1.22 ACID SULPHATE SOILS

Acid Sulphate Soils (classes 3, 4 or 5) have been mapped on this land, refer to Clause 7.5 of Wollongong Local Environmental Plan 2009.

1.23 BIODIVERSITY CERTIFIED LAND

Nil.

1.24 BIOBANKING AGREEMENT

Nil.

1.25 COASTAL HAZARD

Nil

2 SECTION 149(5) DETAILS

As at the date of this certificate, the following additional information, provided in good faith pursuant to section 149(5) of the Act, relate to the abovementioned land. Council has selected these matters as those most likely to be of concern but they do not comprise an exhaustive list of matters likely to affect the land.

When information pursuant to section 149(5) is requested the Council is under no obligation to furnish any of the information supplied herein pursuant to that section. Council draws your attention to section 149(6) which states that a council shall not incur any liability in respect of any advice provided in good faith pursuant to subsection (5). The absence of any reference to any matter affecting the land shall not imply that the land is not affected by any matter referred to in this certificate.

2.1 RESOLUTION TO PREPARE PROPOSED LOCAL ENVIRONMENTAL PLAN

Council resolved to prepare a Planning Proposal to amend the Wollongong Local Environmental Plan 2009.

It is proposed to amend zonings by:

i) Rezoning the southern part of 5-9 Molloy Street, Bulli, and part of Molloy Street from IN2 Local Industry to B2 Local Centre, and amending the floor space ratio to 1.5.1 and removing the minimum lot size.

ii) Rezoning Lot 107, DP 751299, Cliff Road, Wollongong from R1 general Residential to RE1 Public Recreation and removing the minimum lot size, floor space ratio and height of building controls.

It is proposed to amend Land Use tables by inserting home-based childcare as being permissible with development consent in the RU2, RU4, R1, R2, R3, R4, R5, B1, E3 and E4 zones.

It is proposed to amend Clause 4.1 Minimum Lot Size to allow lots containing split zones to be subdivided along the minimum lot size boundary, or that any residual land be excluded from the minimum lot size requirements.

It is proposed to amend Clause 7.9 Development in Flight Paths to reflect the Department of Planning current model clause "Airspace Operations"

It is proposed to amend Clause 8.6 Building Separation by inserting the following subclause:- "Despite subclause (1) (c), if a building contains a dwelling that is located within the street frontage height, the building may be separated from any other building at the street frontage height".

It is proposed that Schedule 1 Additional Use, item 1 be amended by correcting the spelling of "Buttershaw" Drive to "Buttenshaw" Drive.

It is proposed that Schedule 5- Environmental Heritage be amended by:

i) Replacing the listing of the Commonwealth Bank building at "31-40" Wentworth Street, Port Kembla to "31-33" Wentworth Street, Port Kembla.

ii) Deleting "(adjacent to Tourist Information Bureau)" from the listing of the Norfolk Island pine 93 Crown Street, Wollongong

2.2 PROPOSED DEVELOPMENT CONTROL PLAN

The following plans have been placed on exhibition pursuant to the provisions of section 72 of the Environmental Planning and Assessment Act 1979:

Nil.

2.3 FILLED LAND

Council has no records to indicate that the land has been filled or partially filled during the course of subdivision works approved by Council. Council's records are incomplete and therefore Council does not certify that the land has not been filled. If you have any doubt as to whether or not the land is affected by fill material the services of a suitably qualified engineer should be obtained.

2.4 LAND STABILITY

Council's land constraint/stability assessment maps do not show that the land is located in an area where landslip and/or subsidence have occurred, or where land instability is suspected. If you have any doubt as to whether the land is affected by landslip and/or subsidence the services of a suitably qualified engineer should be obtained.

Note: the advice provided by Council in respect of the stability of the land is based on information contained in Council's land constraint maps. The maps have been compiled from data received by Council and considered by Council to be reasonably reliable. Council does not warrant that its land constraint maps contain all information ever received by Council relating to the stability of the land.

2.5 FLOOD AND DRAINAGE

Council's flood maps do not show that the land is located in an area where flooding has occurred or is suspected. If you have any doubt as to whether the land is affected by flooding the services of a suitably qualified engineer should be obtained.

Note 1: Some land may experience water inundation as a result of the creation of stormwater detention basins or channels or flow paths in the course of development of the land.

Note 2: Advice given by Council relating to the likelihood of land being flooded or the nature or extent of such flooding is based on information contained in Council's flood maps. The maps are compiled from data received by Council and/or studies prepared by Council and considered by Council to be reasonably reliable. Council does not warrant that its flood maps contain all information ever received by Council relating to the likelihood of land being flooded or the nature or extent of any such flooding.

2.6 EROSION

Nil

2.7 CONTAMINATED LAND

Nil.

2.8 OTHER HERITAGE MATTERS KNOWN TO COUNCIL

Nil.

2.9 BUILDING LINES

Note: Where development control plans applying to the land contain specific building line requirements those requirements take precedence over the building lines listed below.

Wollongong Development Control Plan 2009 details the setbacks applicable to the land.

2.10 DEVELOPMENT HISTORY

Application may be made for a Building Certificate under section 149B of the Environmental Planning and Assessment Act 1979 if written certification of existing buildings on the land is required.

The history of development consent approval applicable to the land may be obtained by consulting the Development Consent Register. Enquiries concerning the register may be made at the City Planning Division Level 4 Council Administration Building, 41 Burelli Street Wollongong during office hours.

2.11 OTHER INFORMATION

Illawarra Regional Strategy

The Minister for Planning released the Illawarra Regional Strategy on 1 February 2007. The strategy is the NSW Government 25 year land use strategy for the Illawarra Region.

2.12 GENERAL INFORMATION

The following general information is brought to the attention of land owners.

2.12.1 Tree Management Control Plan

The Wollongong Tree Management Control Plan allows assessment of environmental importance and viability of trees before being pruned, removed or damaged. The control plan applies to all trees in the City of Wollongong other than:

- Trees in State Forests or on other Crown-timber lands within the meaning of the Forestry Act, 1916
- Trees lopped in accordance with the Electrical Supply (General) Regulation 2001
- Trees within water catchment areas except such parts as vested in or leased by persons other than the Crown
- Commercial or domestic fruit trees
- The following tree species:

Botanical Name	Common Name
Salix Species	Willow
Erythrina X Sykesii	Coral Tree
Cupressus Macrocarpa "Brunniana"	Golden Cypress
Laganuria Pattersonii	Itchy Pod Tree
Harpephyllum Caffrum	Kaffir Plum
Syagrus Romanzoffina	Cocos Palm
Poplar Species	Poplar
Ficus Elastica "Decora" and hybrids	Ornamental Rubber Tree
Ligustrum Lucidum	Large Leafed Privet
Cinnamomum Camphora	Camphor Laurel
Schefflera Actinophylla	Umbrella Tree
False Acacia	Black Locust
Peppercorn	Pepper Tree
Alnus	Alder
Acer negundo	Box Elder
Oleo Africana	African Olive
Phoenix Canariensis	Canary Island Date Palm

Liquidamber Styraciflua	Liquid Amber
Nerium Oleander	Oleander
Pinus Radiate	Radiata Pine
Grevillea Robusta	Silky Oak
Cotoneaster Spp.	Cotoneaster

The control plan prohibits, without written consent of Wollongong City Council, ringbarking, cutting down, topping, lopping, removing, injuring or destruction of any tree to which the control plan applies, including the roots of a tree, if it

- is 3 metres or more in height; or
- has a girth of 200 mm or more at a height of 1 metre from the ground; or
- has a branch spread of 3 metres or more.

Any person acting on a consent issued under the tree management control plan must comply with all conditions of that consent.

A person who breach or causes or permits a breach of the tree management control plan is guilty of an offence under the Environmental Planning and Assessment Act.

Enquiries concerning pruning, removal or damage to trees may be made at the Customer Service Centre, Ground floor Council Administration Building, 41 Burelli Street Wollongong or by telephoning direct on 4227 7233 during office hours.

Applications for consent under the tree management control must be made in writing to

The General Manager
Wollongong City Council
Locked Bag 8821
WOLLONGONG NSW 2500

Applications for trees on **private property only**, can be lodged electronically on Council's website www.wollongong.nsw.gov.au, alternatively, Application forms and scheduled fee information are available from the Customer Service Centre. All applications must clearly identify the applicable tree or trees, state fully the reasons why such consent is sought and be accompanied by the appropriate fee. The process is outlined in Chapter E17 of Wollongong Development Control Plan 2009.

2.12.2 Termite Management for Buildings

Australian Standards 3660.1-1995 – protection of Buildings Against Subterranean Termites, recommends that buildings be inspected and be maintained in order to achieve termite management of buildings. Licensed Pest Control Contractors should be contacted to achieve necessary termite control.

2.12.3 Leaded Paint and Building Renovations

Your attention is drawn to the hazards associated with lead-based paints during building renovation. Suitable precautions should be taken when removing flaking paint or sanding painted surfaces suspected to have been treated with lead-based paint to prevent contamination of the immediate environment and associated health risk from lead dust.

2.12.4 Sewage Management Systems

Where a property has an on-site sewage management system (this includes septic tanks, disposal trenches, aerated waste water treatment systems, composting toilets and pump out systems) the new owner must obtain an "Approval to Operate" from Council within 3 months of land ownership being transferred or otherwise conveyed.

2.12.5 Siting of Telecommunications and Radiocommunications Facilities

This policy was adopted by Council 4 June 2007.

For further information, please contact Council's City Planning Division on (02) 4227 7500.

This letter is authorised by

Sally Anderson
Customer Service Officer - Certificates
Wollongong City Council
Direct Line (02) 4227 7306

Appendix F

Sampling Methods
Soil Descriptions
Rock Descriptions
Symbols and Abbreviations
Borehole Logs

Sampling Methods

Douglas Partners

Sampling

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

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

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

Test Pits

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

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

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

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

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

The test results are reported in the following form.

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

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

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

Soil Descriptions

Douglas Partners

Description and Classification Methods

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

Soil Types

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

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

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

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

The proportions of secondary constituents of soils are described as:

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

Definitions of grading terms used are:

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

Cohesive Soils

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

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

Cohesionless Soils

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

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

Soil Descriptions

Soil Origin

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

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

Transported soils may be further subdivided into:

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

Rock Strength

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

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

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

Degree of Weathering

The degree of weathering of rock is classified as follows:

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

Degree of Fracturing

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

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

Rock Descriptions

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

Douglas Partners

Introduction

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

Drilling or Excavation Methods

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

Water

▷	Water seep
▽	Water level

Sampling and Testing

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

Description of Defects in Rock

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

Defect Type

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

Orientation

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

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

Coating or Infilling Term

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

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General


Asphalt


Road base


Concrete


Filling

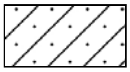
Soils


Topsoil

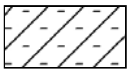

Peat


Clay

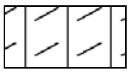

Silty clay

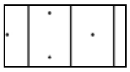

Sandy clay

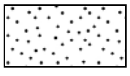

Gravelly clay

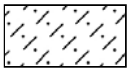

Shaly clay

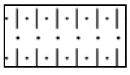

Silt


Clayey silt


Sandy silt

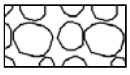

Sand

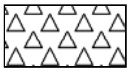

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

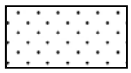

Talus

Sedimentary Rocks

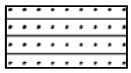

Boulder conglomerate

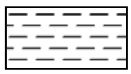

Conglomerate


Conglomeratic sandstone

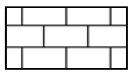

Sandstone


Siltstone


Laminite

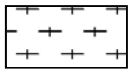

Mudstone, claystone, shale

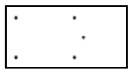

Coal


Limestone

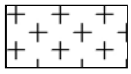
Metamorphic Rocks

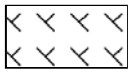

Slate, phyllite, schist

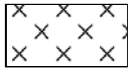

Gneiss

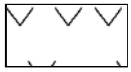

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 45.8 AHD
EASTING: 305576
NORTHING: 6188713
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 48773.05
DATE: 4/5/2011
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		CONCRETE- light grey concrete							Concrete
	0.15	FILLING - well compacted, dark grey, slightly cemented slag recovered as sandy, fine to medium gravel		D+E	0.2				Bentonite
	0.42	FILLING - orange brown, slightly silty clay, damp		D+E	0.5				Casing
	0.52	- 50mm metal pipe at 0.7m		D+E	0.6				
		FILLING - dark grey to orange brown, slightly silty, fine to medium sand, damp							
45	0.86	CLAY - very stiff, light grey light mottled orange brown, slightly sandy clay, humid to damp (RESIDUAL)			1.0				1
	1			S+E*			6,6,11 N = 17		
					1.45				
44	2 2.0	TUFFACEOUS SANDSTONE - typically low to medium strength, highly weathered to moderately weathered, fractured to slightly fractured, white to orange brown, fine to medium grained, tuffaceous sandstone with some extremely low to very low strength, extremely weathered to highly weathered bands			2.0				2
	2.15								
43	3			C	2.8		PL(A) = 1.5		3
					3.27		PL(A) = 0.4		
					3.7				Sand
42	4								Slotted
					4.03		PL(A) = 1.5		4
41				C					
	4.92								
	5	TUFFACEOUS SANDSTONE - high strength, fresly stained becoming fresh, unbroken, orange grey to grey, fine to medium grained, tuffaceous sandstone							5
					5.39		PL(A) = 2.4		
40									

RIG: Bobcat **DRILLER:** Ground Test (Steve) **LOGGED:** BNG/RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: Conc. core to 0.15m, hand tools to 1.0m, Rotary (water) to 2.0m and core (NMLC) to 6.8m **CASING:** HW to 2.0m

WATER OBSERVATIONS: No free ground water observed

REMARKS: Standpipe piezometer installed, screen interval on 1.0 - 6.8m, sand interval 0.5 - 6.8m
E* - only glass jar collected

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 45.8 AHD
EASTING: 305576
NORTHING: 6188713
DIP/AZIMUTH: 90°/--

BORE No: 1
PROJECT No: 48773.05
DATE: 4/5/2011
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
39		TUFFACEOUS SANDSTONE - high strength, fresly stained becoming fresh, unbroken, orange grey to grey, fine to medium grained, tuffaceous sandstone *(continued)*		C	6.07		PL(A) = 3		
	6.8	Bore discontinued at 6.8m Limit of investigation			6.8				
	7								7
38									
	8								8
37									
	9								9
36									
	10								10
35									
	11								11
34									

RIG: Bobcat **DRILLER:** Ground Test (Steve) **LOGGED:** BNG/RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: Conc. core to 0.15m, hand tools to 1.0m, Rotary (water) to 2.0m and core (NMLC) to 6.8m **CASING:** HW to 2.0m

WATER OBSERVATIONS: No free ground water observed

REMARKS: Standpipe piezometer installed, screen interval on 1.0 - 6.8m, sand interval 0.5 - 6.8m
E* - only glass jar collected

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 47.8 AHD
EASTING: 305569
NORTHING: 6188748
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 48773.05
DATE: 4/5/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
47	0.2	FILLING - dark grey, sandy, silty clay with some fine to medium gravel (siltstone), roots and rootlets, humid to damp		D+E	0.1				
	0.3	(TOPSOIL)		D+E	0.2				
	0.4	FILLING - dark grey mottled orange brown clay with some sand, silt, roots and rootlets			0.3				
		FILLING - yellow grey mottled white grey, slightly sandy to sandy, fine to coarse gravel (sandstone), humid to damp		D+E	0.5 0.6				
	0.9	TOPSOIL - dark brown clay with some silt and trace roots and rootles, humid to damp		D+E	0.9 1.0				
1	1.1	CLAY - stiff, orange brown clay with some silt, roots and rootlets (RESIDUAL)							
		TUFFACEOUS SANDSTONE - extremely low strength, extremely weathered, orange brown and light grey, tuffaceous sandstone		D	1.5				
	1.7	Bore discontinued at 1.7m Refusal on low to medium strength, tuffaceous sandstone							
46	2								
45	3								
44	4								
43	5								
42									

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

RIG: Kubota KX41-3V
DRILLER: J & M Boers (John)
LOGGED: RLG
SURVEY DATUM: MGA94

TYPE OF BORING: Hand tools to 0.8m, 150mm power anger to 1.7m
CASING: uncased

WATER OBSERVATIONS: No free ground water observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 52 AHD
EASTING: 305546
NORTHING: 6188748
DIP/AZIMUTH: 90°/--

BORE No: 3
PROJECT No: 48773.05
DATE: 4/5/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
52	0.2	FILLING - dark brown, slightly silty clay with some roots and rootlets and trace fine to medium sand, humid		D+E	0.1				
				D+E	0.2				
	0.4	FILLING - orange brown, slightly sandy clay with some silt and trace roots and rootlets, humid to damp			0.3				
		FILLING - grey brown mottled orange, slightly clayey, gravelly (fine to medium slag, sandstone, latite) sand, humid		D+E	0.5				
	0.7				0.6				
		CLAY - very stiff, red brown to orange yellow clay with trace sand, roots and rootlets, humid to damp		D+E	0.7				
					0.8				
				D+E	0.9				
51	1	(RESIDUAL)			1.0				1
	1.3	TUFFACEOUS SANDSTONE - extremely low strength, extremely weathered, orange brown and light grey, tuffaceous sandstone		D	1.4				
					1.5				
		- becoming extremely low to very low strength, extremely to highly weathered below 1.6m							
				D+E	1.8				
	1.9	Bore discontinued at 1.9m			1.9				
50	2	Refusal on low to medium strength, tuffaceous sandstone							2
49	3								3
48	4								4
47	5								5

RIG: Kubota KX41-3V
DRILLER: J & M Boers (John)
LOGGED: BNG/RLG
SURVEY DATUM: MGA94

TYPE OF BORING: Hand tools to 0.8m, 150mm power anger to 1.9m
CASING: uncased

WATER OBSERVATIONS: No free ground water observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 51.1 AHD
EASTING: 305532
NORTHING: 6188771
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 48773.05
DATE: 4/5/2011
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
51	0.0	FILLING - brown to black, sandy clay with trace silt, roots and rootlets, humid to damp		D+E	0.1				
	0.3			E	0.3				
	0.35	FILLING - yellow grey, fine grained sand, damp							
		FILLING - dark brown, slightly silty clay with some sand and trace rootlets, damp		D+E	0.5				
	0.9								
50	1	CLAY - stiff, dark brown clay with trace sand and silt, humid to damp (RESIDUAL)		D+E	1.0				1
					1.05				
	1.2								
		SILTY CLAY - very stiff, orange brown mottled light grey, silty clay with some sand, humid to damp (RESIDUAL)		S+E*			6,10,14 N = 24		
					1.5				
49	2								2
	2.5			S	2.5		24/30mm refusal		
	2.6	TUFFACEOUS SANDSTONE - extremely low strength, extremely weathered, orange brown to light grey, fine to medium grained, tuffaceous sandstone			2.58				
					2.6				
		TUFFACEOUS SANDSTONE - interbedded low to medium and high strength, highly weathered to slightly weathered and slightly weathered to freshly stained, slightly fractured, orange brown to light grey, fine to medium grained, tuffaceous sandstone with some extremely low to very low strength, extremely weathered to highly weathered bands			2.79		PL(A) = 0.9		
48	3			C					3
					3.4		PL(A) = 4		
					3.82		PL(A) = 0.8		
	4				3.95				4
47									
					4.89		PL(A) = 1.7		
	5			C					5
46									
					5.4		PL(A) = 1.3		

RIG: Bobcat **DRILLER:** Ground Test (Steve) **LOGGED:** BNG/RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: Hand tools to 1.0m, SFA (TC bit) to 2.6m and coring (NMLC) to 7.0m **CASING:** HW to 2.6m

WATER OBSERVATIONS: No free ground water observed

REMARKS: E* - only glass jar collected

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 51.1 AHD
EASTING: 305532
NORTHING: 6188771
DIP/AZIMUTH: 90°/--

BORE No: 4
PROJECT No: 48773.05
DATE: 4/5/2011
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
45		TUFFACEOUS SANDSTONE - interbedded low to medium and high strength, highly weathered to slightly weathered and slightly weathered to freshly stained, slightly fractured, orange brown to light grey, fine to medium grained, tuffaceous sandstone with some extremely low to very low strength, extremely weathered to highly weathered bands *(continued)*		C					
	7 7.0	Bore discontinued at 7.0m Limit of investigation			7.0				7
44									
43	8								8
42	9								9
41	10								10
40	11								11

RIG: Bobcat **DRILLER:** Ground Test (Steve) **LOGGED:** BNG/RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: Hand tools to 1.0m, SFA (TC bit) to 2.6m and coring (NMLC) to 7.0m **CASING:** HW to 2.6m

WATER OBSERVATIONS: No free ground water observed

REMARKS: E* - only glass jar collected

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 51 AHD
EASTING: 305524
NORTHING: 6188761
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 48773.05
DATE: 6/5/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
51	0.05	BITUMINOUS CONCRETE - dark grey, bituminous concrete		D+E*	0.1				Concrete
		FILLING - well compacted, dark grey, slightly sandy gravel (fine to medium blue metal), humid to damp							
		- becoming dark grey gravel (fine to medium blue metal), with some sand below 0.5m		D+E	0.5				
	0.8	CLAY - red brown clay with some silt, humid to damp (RESIDUAL)		D+E**	0.9				Backfill
50	1				1.0				1
	1.1			E*	1.1				
	1.2	TUFFACEOUS SANDSTONE - extremely low to medium strength, highly weathered to moderately weathered, orange brown, fine to medium grained, tuffaceous sandstone			1.2				Casing
		TUFFACEOUS SANDSTONE - extremely low to low strength, extremely weathered to moderately weathered, fractured, white to orange brown, fine to medium grained, tuffaceous sandstone			1.53		PL(A) = 0.2		
				C	1.75		PL(A) = 0.7		Bentonite
49	2								2
	2.05	TUFFACEOUS SANDSTONE - interbedded medium and high strength, moderately weathered to slightly weathered and fresh, slightly fractured, orange brown to light grey, fine to medium grained, tuffaceous sandstone			2.3		PL(A) = 3.1		
					2.5				
					2.79		PL(A) = 1		
48	3								3
					3.77		PL(A) = 0.9		Sand
47	4			C					4
									Slotted
					4.47		PL(A) = 0.8		
46	5								5
					5.25		PL(A) = 1		
	5.6	Bore discontinued at 5.6m Limit of investigation			5.6				

RIG: Bobcat **DRILLER:** Ground Test (Steve) **LOGGED:** RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: Conc. core to 0.05m, hand tools to 0.9m, SFA (TC bit) to 1.2m and core (NMLC) to 5.6m **CASING:** HW to 1.2m

WATER OBSERVATIONS: No free ground water observed

REMARKS: Standpipe piezometer installed, screen interval on 2.6 - 5.6m, sand interval 2.0 - 5.6m
E* - only glass jar collected, E** - only plastic bag collected, duplicate sample BD5

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 51 AHD
EASTING: 305516
NORTHING: 6188766
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 48773.05
DATE: 5/5/2011
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
51	0.05	BITUMINOUS CONCRETE - dark grey, bituminous concrete							
		FILLING - well compacted, dark grey, slightly sandy, fine to medium gravel (blue metal), humid to damp		D+E	0.2				
	0.8	CLAY - very stiff, red brown clay with some silt, humid to damp (RESIDUAL)		D+E*	0.9				
50	1				1.0				1
				S+E*			3,7,14 N = 21		
		- becoming orange brown, slightly silty clay below 1.35m			1.45				
	1.8	TUFFACEOUS SANDSTONE - extremely low strength, extremely weathered, orange brown, fine grained tuffaceous sandstone with some very low to low strength bands							
49	2				2.0				2
				A					
					2.5				
				S+E*			7,20 refusal		
					2.75				
	2.8	TUFFACEOUS SANDSTONE - typically medium strength, moderately weathered to slightly weathered, fractured, orange brown to orange grey, fine to medium grained, tuffaceous sandstone with some extremely low to very low strength, extremely weathered to highly weathered bands			2.8		PL(A) = 0.6		
48	3				2.83				3
				C					
47	4								4
					4.28		PL(A) = 0.4		
	4.53	TUFFACEOUS SANDSTONE - high strength, fresly stained becoming fresh, slightly fractured to unbroken, orange brown to light grey, fine to medium grained, tuffaceous sandstone			4.33				
					4.75		PL(A) = 1.5		
46	5			C					5

RIG: Bobcat **DRILLER:** Ground Test (Steve) **LOGGED:** RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: Conc. core to 0.05m, hand tools to 0.9m, SFA (TC bit) to 2.8m, core (NMLC) to 7.3m **CASING:** HW to 2.8m

WATER OBSERVATIONS: No free ground water observed

REMARKS: E* - only glass jar collected

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 51 AHD
EASTING: 305516
NORTHING: 6188766
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 48773.05
DATE: 5/5/2011
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
45		TUFFACEOUS SANDSTONE - high strength, fresly stained becoming fresh, slightly fractured to unbroken, orange brown to light grey, fine to medium grained, tuffaceous sandstone *(continued)*		C					
44	7								7
	7.33	Bore discontinued at 7.33m Limit of investigation			7.33				
43	8								8
42	9								9
41	10								10
40	11								11

RIG: Bobcat **DRILLER:** Ground Test (Steve) **LOGGED:** RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: Conc. core to 0.05m, hand tools to 0.9m, SFA (TC bit) to 2.8m, core (NMLC) to 7.3m **CASING:** HW to 2.8m

WATER OBSERVATIONS: No free ground water observed

REMARKS: E* - only glass jar collected

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 45.4 AHD
EASTING: 305499
NORTHING: 6188780
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 48773.05
DATE: 9/5/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
45	0.045	BITUMINOUS CONCRETE - dark grey, bituminous concrete							Concrete
	0.2	HEAVILY BOUND BASECOURSE - light to mid grey, heavily bound basecourse (slag)		D+E	0.3				
	0.36	FILLING - light grey, slightly sandy, fine to medium gravel (blue metal), humid		E*	0.4				Bentonite
	0.7	TUFFACEOUS SANDSTONE - low strength, moderately weathered, orange brown, fine to medium grained, tuffaceous sandstone			0.7				
44	1	TUFFACEOUS SANDSTONE - typically medium to high strength, freshly stained, fractured to slightly fractured, orange brown and light to mid grey, fine to medium grained, tuffaceous sandstone with some extremely low to medium strength, extremely weathered to moderately weathered bands			1.26		PL(A) = 2.1		Casing
43	2			C	2.0		PL(A) = 1.2		
					2.59		PL(A) = 1		
	2.89	TUFFACEOUS SANDSTONE - high strength, fresh, unbroken, light to mid grey, fine to medium grained, tuffaceous sandstone							Sand
42	3				3.5		PL(A) = 1.5		
					3.8				Slotted
41	4			C	4.5		PL(A) = 2.5		
	5								
	5.2	Bore discontinued at 5.2m Limit of investigation			5.2				
40									

RIG: Bobcat **DRILLER:** Ground Test (Steve) **LOGGED:** RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: Conc. core to 0.05m, hand tools to 0.4m, SFA (TC bit) to 0.7mm, core (NMLC) to 5.2m **CASING:** HW to 0.7m

WATER OBSERVATIONS: No free ground water observed

REMARKS: Standpipe piezometer installed, screen interval on 2.2 - 5.2m, sand interval 0.5 - 5.2m
E* - only glass jar collected

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 41.2 AHD
EASTING: 305476
NORTHING: 6188784
DIP/AZIMUTH: 90°/--

BORE No: 8
PROJECT No: 48773.05
DATE: 9/5/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
41	0.24	HEAVILY BOUND BASECOURSE - light grey, heavily bound basecourse (slag) -becoming slightly weathered below 0.13m			0.24				
		TUFFACEOUS SANDSTONE - typically high strength, fresh stained to fresh, slightly fractured, orange brown to light grey, fine to medium grained, tuffaceous sandstone		C	0.8				
40	1				1.2		PL(A) = 1.4		
					1.63		PL(A) = 0.7		
39	2			C	2.47		PL(A) = 2		
38	3				3.39		PL(A) = 3.2		
	3.9	Bore discontinued at 3.9m Limit of investigation			3.9				
37	4								
36	5								

RIG: Bobcat **DRILLER:** Grount Test (Steve) **LOGGED:** RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: 300mm concrete core to 0.68m and core(NMLC) to 3.9m **CASING:** uncased

WATER OBSERVATIONS: No free ground water observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 49.7 AHD
EASTING: 305416
NORTHING: 6188677
DIP/AZIMUTH: 90°/--

BORE No: 9
PROJECT No: 48773.05
DATE: 6/5/2011
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
49	0.03	BITUMINOUS CONCRETE - dark grey, bituminous concrete		E	0.1				Concrete
	0.29	FILLING - well compacted, grey, fine to medium gravel (blue metal) with some sand, humid		E	0.35				Bentonite
		SAND - yellow brown, fine to medium grained sand with some cobble (sandstone) bands (RESIDUAL)		E	0.5				
	1								1
				E	1.5				
48				S			6,9,11 N = 20		
	2				1.95				2
									Casing
					2.5				
47				E*/S			3,4,7 N = 11		
	3				2.95				3
46	4	4.0 TUFFACEOUS SANDSTONE - typically medium to high strength, moderately weathered to fresh, fractured, orange brown to grey, fine to medium grained, tuffaceous sandstone with some extremely low to very low strength, extremely to highly weathered bands			4.0 4.03		PL(A) = 4.1		4
		4.32							
45	5			C	5.04		PL(A) = 0.9		5
									Sand
44					5.63		PL(A) = 2.9		
		5.89 TUFFACEOUS SANDSTONE - banded extremely low to							

RIG: Bobcat **DRILLER:** Ground Test (Steve) **LOGGED:** RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: Conc. core to 0.03m, hand tools to 0.85m, SFA (TC-bit) to 4.0m, core (NMLC) to 10.25m **CASING:** HW to 3.80m

WATER OBSERVATIONS: No free ground water observed

REMARKS: E* - only glass jar collected, duplicate sample BD6

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 49.7 AHD
EASTING: 305416
NORTHING: 6188677
DIP/AZIMUTH: 90°/--

BORE No: 9
PROJECT No: 48773.05
DATE: 6/5/2011
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	6.1	medium strength, extremely to moderately weathered, fractured, white to orange brown, fine grained, tuffaceous sandstone			6.0				
				C	6.31		PL(A) = 1.3		
43	7								7
									Slotted
42					7.8				
	8				8.07		PL(A) = 0.2		8
41	8.74	TUFFACEOUS SANDSTONE - medium to high strength, moderately to slightly weathered, fractured, orange and red brown to grey, fine to medium grained, tuffaceous sandstone		C					
	9				9.32		PL(A) = 0.7 PL(D) = 1.5		9
40	10								10
	10.25	Bore discontinued at 10.25m Limit of investigation			10.25				
39	11								11
38									

RIG: Bobcat **DRILLER:** Ground Test (Steve) **LOGGED:** RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: Conc. core to 0.03m, hand tools to 0.85m, SFA (TC-bit) to 4.0m, core (NMLC) to 10.25m **CASING:** HW to 3.80m

WATER OBSERVATIONS: No free ground water observed

REMARKS: E* - only glass jar collected, duplicate sample BD6

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 49.5 AHD
EASTING: 305410
NORTHING: 6188667
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 48773.05
DATE: 9 - 10/5/2011
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.06	BITUMINOUS CONCRETE - dark grey, bituminous concrete							
		FILLING - well compacted, brown grey, slightly sandy, fine to coarse gravel (blue metal), humid		E	0.3				
	0.4								
49		FILLING - brown, slightly gravelly to gravelly (fine to coarse grained sandstone) clay, humid to damp		E	0.5				
	0.54								
		TUFFACEOUS SANDSTONE - extremely low to very low strength, extremely to highly weathered, orange brown, fine grained, tuffaceous sandstone							
	0.8				0.8				
	1	TUFFACEOUS SANDSTONE - typically high strength, moderately to slightly weathered, slightly fractured, white to orange brown and light grey, fine grained, tuffaceous sandstone with some extremely low to very low strength, extremely to highly weathered bands			1.0		PL(A) = 2.6		1
48				C	1.72		PL(A) = 1.4		
	2								2
					2.19		PL(A) = 0.08		
47					2.5				
	3				2.95		PL(A) = 1.2		3
46									
	4			C	4.0		PL(A) = 2.2		4
45									
	4.93								
	5	TUFFACEOUS SANDSTONE - typically low to medium strength, highly to moderately weathered, fractured to slightly fractured, white to orange brown and light grey, fine grained, tuffaceous sandstone with some extremely low to very low strength, extremely to highly weathered bands			5.1		PL(A) = 0.8		5
					5.35				
44				C	5.65		PL(A) = 0.2		

RIG: Bobcat **DRILLER:** Ground Test (Steve) **LOGGED:** RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: Conc. core to 0.06m, hand tools to 0.54m, SFA (TC-bit) to 0.8m, core (NMLC) to 8.3m **CASING:** HW to 0.8m

WATER OBSERVATIONS: No free ground water observed

REMARKS: Duplicate sample BD7 taken at 0.1m

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 49.5 AHD
EASTING: 305410
NORTHING: 6188667
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 48773.05
DATE: 9 - 10/5/2011
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
43	7	TUFFACEOUS SANDSTONE - typically low to medium strength, highly to moderately weathered, fractured to slightly fractured, white to orange brown and light grey, fine grained, tuffaceous sandstone with some extremely low to very low strength, extremely to highly weathered bands *(continued)*		C	6.29		PL(A) = 0.3		7
					7.17		PL(A) = 0.6		
42	8				7.54		PL(A) = 2.6		8
	8.3	Bore discontinued at 8.3m Limit of investigation			8.3				
41	9								9
40	10								10
39	11								11
38									

RIG: Bobcat **DRILLER:** Ground Test (Steve) **LOGGED:** RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: Conc. core to 0.06m, hand tools to 0.54m, SFA (TC-bit) to 0.8m, core (NMLC) to 8.3m **CASING:** HW to 0.8m

WATER OBSERVATIONS: No free ground water observed

REMARKS: Duplicate sample BD7 taken at 0.1m

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 46.7 AHD
EASTING: 305569
NORTHING: 6188726
DIP/AZIMUTH: 90°/--

BORE No: 11
PROJECT No: 48773.05
DATE: 4/5/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
46	0.05	BITUMINOUS CONCRETE - dark grey, bituminous concrete							
		HEAVILY BOUND BASECOURSE - light ot mid grey, heavily bound basecourse (slag)							
	0.45	CLAY - very stiff, brown mottled red brown clay with trace sand and rootlets, damp (RESIDUAL)		D*+E	0.5				
	0.8	TUFFACEOUS SANDSTONE - extremely low to very low strength, extremely weathered to highly weathered, orange brown, tuffaceous sandstone		D*	0.8				
	1			D*	1.0				
				D*	1.1				
				D*	1.25				
		- becoming extremely low to low strength, extremely weathered to highly weathered below 1.4m		D*+E*	1.4				
45					1.5				
				D*	1.75				
	2 2.0	Bore discontinued at 2.0m Refusal on low to medium strength, tuffaceous sandstone		D*	2.0				
44	3								
43	4								
42	5								
41									

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

RIG: Kubota KX41-3V **DRILLER:** J & M Boers (John) **LOGGED:** RLG **SURVEY DATUM:** MGA94

TYPE OF BORING: 300mm concrete core to 0.45m, hand tools to 0.6m, 150mm power anger to 2.0m **CASING:** uncased

WATER OBSERVATIONS: No free ground water observed

REMARKS: D* - acid sulphate sample, E* - only glass jar collected, duplicate sample BD1

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

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 47.6 AHD
EASTING: 305564
NORTHING: 6188733
DIP/AZIMUTH: 90°/--

BORE No: 12
PROJECT No: 48773.05
DATE: 4/5/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
47	0.02	BITUMINOUS CONCRETE - dark grey, bituminous concrete							
	0.2	CONCRETE - light grey concrete		D+E	0.25				
	0.4	FILLING - dark red brown, clayey gravel (sandstone) with some sand		D+E	0.4				
	0.6	FILLING - brown mottled orange brown, slightly gravelly (latite, sandstone), sandy clay, humid to damp		D+E	0.65				
		CLAY - stiff, red orange brown clay with trace sand, humid to damp			0.9				
	1	(RESIDUAL)		D+E	1.0				1
	1.1	TUFFACEOUS SANDSTONE - extremely low strength, extremely weathered, orange brown and light grey, tuffaceous sandstone							
46				D	1.4				
		- becoming extremely low to very low strength, extremely weathered to highly weathered below 1.5m			1.5				
				D	1.7				
	1.8	Bore discontinued at 1.8m			1.8				
		Refusal on low to medium strength, tuffaceous sandstone							
	2								2
45									
	3								3
44									
	4								4
43									
	5								5
42									

RIG: Kubota KX41-3V **DRILLER:** J & M Boers (John) **LOGGED:** RLG **SURVEY DATUM:** MGA94

TYPE OF BORING: 300mm concrete core to 0.2m, hand tools to 0.7m, 150mm power anger to 1.8m **CASING:** uncased

WATER OBSERVATIONS: No free ground water observed

☐ Sand Penetrometer AS1289.6.3.3

REMARKS:

☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 49.2 AHD
EASTING: 305562
NORTHING: 6188754
DIP/AZIMUTH: 90°/--

BORE No: 13
PROJECT No: 48773.05
DATE: 4/5/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
49	0.0	FILLING - dark brown, gravelly (sandstone, latite), silty sand with some clay, humid to damp		D+E	0.0 - 0.1				
	0.25	(TOPSOIL)							
	0.3	FILLING - light brown sand with some silt, humid to damp		D+E	0.3				
		CLAY - stiff, brown, friable, slightly sandy clay with some sand, humid to damp (RESIDUAL)		D+E	0.6				
	0.85	TUFFACEOUS SANDSTONE - extremely low strength, extremely weathered, orange brown, tuffaceous sandstone		D	1.0 - 1.1		pp = 250 - 320		
48	1	- becoming extremly low to very low strength, extremely weathered to highly weathered below 1.4		D	1.4 - 1.5				
	1.8	Bore discontinued at 1.8m Refusal on low to medium strength, tuffaceous sandstone							
47	2								
46	3								
45	4								
44	5								

RIG: Kubota KX41-3V
DRILLER: J & M Boers (John)
LOGGED: RLG
SURVEY DATUM: MGA94

TYPE OF BORING: Hand tools to 0.7m, 150mm power auger to 1.8m
CASING: uncased

WATER OBSERVATIONS: No free ground water observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 49 AHD
EASTING: 305559
NORTHING: 6188750
DIP/AZIMUTH: 90°/--

BORE No: 14
PROJECT No: 48773.05
DATE: 5/5/2011
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
49	0.05	BITUMINOUS CONCRETE - dark grey, bituminous concrete		D+E	0.1				
	0.3	FILLING - well compacted, dark grey, sandy, typically medium gravel (blue metal), humid to damp		D+E	0.4				
	0.5	FILLING - dark brown mottled red brown clay with some gravel (fine to coarse sandstone, latite), sand and trace silt, humid to damp		D+E	0.6				
		CLAY - red brown clay with trace rootlets, humid (RESIDUAL)							
48	1								1
		- becoming very stiff, orange brown, slightly silty clay below 1.5m			1.5				
				S+E*			4,6,14 N = 20		
47	2				1.95				2
	2.6	TUFFACEOUS SANDSTONE - banded extremely low and low to medium strength, extremely weathered and highly weathered to moderately weathered, fractured to slightly fractured, orange brown, fine to medium grained, tuffaceous sandstone			2.6				
46	3			C	3.25		PL(A) = 0.5		3
					3.75		PL(A) = 1.3		
	3.88	TUFFACEOUS SANDSTONE - high strength, freshly stained becoming fresh, unbroken, orange brown to light grey, fine to medium grained, tuffaceous sandstone			3.95				
45	4				4.44		PL(A) = 2		4
44	5			C					5
					5.46		PL(A) = 2.7		

RIG: Bobcat **DRILLER:** Ground Test (Steve) **LOGGED:** BNG/RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: Conc. core to 0.05m, hand tools to 0.6m, Rotary (water) to 2.6m and core (NMLC) to 7.0m **CASING:** HW to 2.6m

WATER OBSERVATIONS: No free ground water observed

REMARKS: E* - only glass jar collected

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 49 AHD
EASTING: 305559
NORTHING: 6188750
DIP/AZIMUTH: 90°/--

BORE No: 14
PROJECT No: 48773.05
DATE: 5/5/2011
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
43		TUFFACEOUS SANDSTONE - high strength, freshly stained becoming fresh, unbroken, orange brown to light grey, fine to medium grained, tuffaceous sandstone *(continued)*		C	6.62		PL(A) = 2.6		
42	7 7.0	Bore discontinued at 7.0m Limit of investigation			7.0				7
41	8								8
40	9								9
39	10								10
38	11								11

RIG: Bobcat **DRILLER:** Ground Test (Steve) **LOGGED:** BNG/RJH **SURVEY DATUM:** MGA94

TYPE OF BORING: Conc. core to 0.05m, hand tools to 0.6m, Rotary (water) to 2.6m and core (NMLC) to 7.0m **CASING:** HW to 2.6m

WATER OBSERVATIONS: No free ground water observed

REMARKS: E* - only glass jar collected

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 52.4 AHD
EASTING: 305539
NORTHING: 6188745
DIP/AZIMUTH: 90°/--

BORE No: 15
PROJECT No: 48773.05
DATE: 4/5/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
52	0.0	FILLING - brown, slightly gravelly (sandstone), sandy clay with some roots and rootlets, humid to damp		D+E	0.0				
	0.15	(TOPSOIL)		D+E	0.15 0.2				
		FILLING - brown mottled orange brown, sandy, gravelly (sandstone, brick, latite) clay with some silt and trace rootlets, humid to damp							
	0.65	- with some cobbles (sandstone) below 0.4m		D+E	0.6				
		CLAY - stiff, brown clay with some sand, humid to damp (RESIDUAL)							
51	1	- becoming red orange brown and slightly sandy below 0.8m		D+E	0.9 1.0				1
	1.1	TUFFACEOUS SANDSTONE - extremely low to very low strength, extremely weathered to highly weathered, orange brown, tuffaceous sandstone		D+E*	1.4 1.5				
50	2			D+E	1.9 2.0				2
				D	2.4 2.5				
				D+E*	2.7				
	2.85	Bore discontinued at 2.85m			2.85				
49	3	Refusal on low to medium strength, tuffaceous sandstone							3
48	4								4
47	5								5

RIG: Kubota KX41-3V **DRILLER:** J & M Boers (John) **LOGGED:** RLG **SURVEY DATUM:** MGA94

TYPE OF BORING: Hand tools to 0.8m, 150mm power auger to 2.85m **CASING:** uncased

WATER OBSERVATIONS: No free ground water observed

REMARKS: E* - only glass jar collected

☐ Sand Penetrometer AS1289.6.3.3

☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 52.6 AHD
EASTING: 305526
NORTHING: 6188748
DIP/AZIMUTH: 90°/--

BORE No: 16
PROJECT No: 48773.05
DATE: 4/5/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
52.6	0.0	FILLING - brown mottled orange yellow clay with some sand, roots and rootlets and trace silt		D+E	0.1				
52	0.5	TOPSOIL - dark brown grey, slightly silty clay with trace sand, roots and rootlets, humid to damp		D+E	0.6				
	0.8	CLAY - stiff to very stiff, red brown to orange yellow clay with trace sand and rootlets, humid to damp (RESIDUAL)		D+E	0.9				
51	1.2	TUFFACEOUS SANDSTONE - extremely low strength, extremely weathered, orange brown and light grey, tuffaceous sandstone		D	1.5				
				E	1.6				
	1.7	- becoming extremely low to very low strength, extremely weathered to highly weathered below 1.6m			1.7				
		Bore discontinued at 1.7m Refusal on low to medium strength, tuffaceous sandstone							
50									
49									
48									
47									

RIG: Kubota KX41-3V
DRILLER: J & M Boers (John)
LOGGED: BNG/RLG
SURVEY DATUM: MGA94

TYPE OF BORING: Hand tools to 0.9m, 150mm power auger to 1.7m
CASING: uncased

WATER OBSERVATIONS: No free ground water observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 51.1 AHD
EASTING: 305519
NORTHING: 6188751
DIP/AZIMUTH: 90°/--

BORE No: 17
PROJECT No: 48773.05
DATE: 5/5/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
51	0.2	FILLING - dark brown, sandy clay with some fine to medium gravel (blue metal) and trace silt, humid to damp		D*+E*	0.1				
		FILLING - well compacted, dark grey, sandy, typically medium gravel (blue metal), humid to damp		D*+E	0.25				
				D*+E	0.5				
	0.6								
	0.75	TUFFACEOUS SANDSTONE - extremely low to very low strength, extremely weathered to highly weathered orange brown, tuffaceous sandstone		D*+E	0.7				
50	1	Bore discontinued at 0.75m Refusal on low to medium strength, tuffaceous sandstone							
49	2								
48	3								
47	4								
46	5								

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

RIG: Kubota KX41-3V
DRILLER: J & M Boers (John)
LOGGED: BNG/RLG
SURVEY DATUM: MGA94

TYPE OF BORING: Hand tools to 0.7m, 150mm power auger to 0.75m
CASING: uncased

WATER OBSERVATIONS: No free ground water observed

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

REMARKS: D* - acid sulphate sample, E* - only glass jar collected, duplicate sample BD3 taken at 0.1m

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 51.1 AHD
EASTING: 305524
NORTHING: 6188767
DIP/AZIMUTH: 90°/--

BORE No: 18
PROJECT No: 48773.05
DATE: 4/5/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
51	0.05	BITUMINOUS CONCRETE - dark grey, bituminous concrete							
		FILLING - well compacted, dark grey, slightly sandy, fine to medium gravel (blue metal), humid to damp		D+E	0.5				
	0.7	SILTY CLAY - very stiff, brown, silty clay with some roots and rootlets, humid		D+E	0.8				
	0.9	(RESIDUAL)							
50	1	TUFFACEOUS SANDSTONE - extremely low to very low strength, extremely weathered to highly weathered, orange brown, tuffaceous sandstone							
	1.4			D	1.4				
		Bore discontinued at 1.5m Refusal on low to medium strength, tuffaceous sandstone			1.5				
49	2								
48	3								
47	4								
46	5								

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

RIG: Kubota KX41-3V **DRILLER:** J & M Boers (John) **LOGGED:** BNG/RLG **SURVEY DATUM:** MGA94

TYPE OF BORING: 300mm concrete core to 0.05m, hand tools to 0.8m, 150mm power anger to 1.5m **CASING:** uncased

WATER OBSERVATIONS: No free ground water observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed Wollongong Hospital Redevelopment
LOCATION: Loftus Street, Wollongong

SURFACE LEVEL: 50.8 AHD
EASTING: 305519
NORTHING: 6188776
DIP/AZIMUTH: 90°/--

BORE No: 19
PROJECT No: 48773.05
DATE: 4/5/2011
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
50	0.4	FILLING - dark grey to black, slightly silty sand, with some clay, fine to medium gravel (siltstone), roots and rootlets, humid to damp		D+E*	0.1				
		FILLING - light grey, typically medium gravel (slag), humid		D+E	0.6				
1	1.0	SANDY CLAY - stiff, orange brown, sandy clay with trace gravel (sandstone), humid to damp (RESIDUAL)		D+E	1.0				
				D	1.4 1.5				
	1.6	- becoming very stiff below 1.5m							
49		TUFFACEOUS SANDSTONE - extremely low strength, extremely weathered, orange brown and light grey, tuffaceous sandstone		D+E	1.9 2.0				
2				D	2.4 2.5				
48		- becoming extremely low to very low strength, extremely weathered to highly weathered below 2.5m							
3	3.0	Bore discontinued at 3.0m Refusal on low to medium strength, tuffaceous sandstone		D+E	2.9 3.0				
47									
4									
46									
5									
45									

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

RIG: Kubota KX41-3V
DRILLER: J & M Boers (John)
LOGGED: BNG/RLG
SURVEY DATUM: MGA94

TYPE OF BORING: Hand tools to 0.9m, 150mm power auger to 3.0m
CASING: uncased

WATER OBSERVATIONS: No free ground water observed

REMARKS: E* - only glass jar collected, duplicate BD2

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

SAMPLING & IN SITU TESTING LEGEND

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

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