Phase 1 Site Investigation Report

Blocks 9, 10 & 11, Section 21 Hume (Stage 3, Hume West Estate)

50516080

Prepared for
Land Development Agency (LDA)

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Contact Information

Cardno (NSW/ACT) Pty Ltd
Trading as Cardno
ABN 95 001 145 035

Level 2, 14 Wormald Street
Symonston, ACT 2609

Telephone: 02 6112 4500
Facsimile: 02 6112 4539

Canberra@cardno.com.au
www.cardno.com.au

Author(s): JHewett
Josh Hewett
Civil Engineer

Approved By:
John Samoty
Project Manager

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Buyers are required to undertake their own assessments of the site prior to purchasing the block or forwarding a Development Application with ACTPLA.

Executive Summary

Cardno NSW/ACT has been engaged by the Land Development Agency (LDA) to undertake a limited Phase 1 Site Investigation of Blocks 9, 10 & 11, Section 21 Hume (Stage 3, Hume West Estate). The purpose of the site investigation is to assess the condition of the sites for the information of potential buyers. It is understood that the site is intended to be sold 'as is' in its current condition.

The sites are located in west Hume, a major industrial suburb on the outskirts of Canberra, approximately 8.6km from the Woden Town Centre and 7.6km from the Tuggeranong Town Centre.

They are currently undeveloped and grassed with driveways and footpaths provided to each Block from Couranga Crescent. Blocks 9 and 11 have been cleared recently and are generally free from trees. The dense planting of trees within Block 10 are large and fully developed. No easements are present within the any of the blocks.

Existing services information was obtained from service authority asset data, WAE information of the site and prescribed studies, which includes stormwater drainage, sewerage, water, telecommunications, electricity, gas, trees, service easement locations and other relevant information.

The scope of works for this site investigation is listed below:

- Investigation of the following existing services:
  - Sewerage
  - Water
  - Stormwater Drainage
  - Overland Flows
  - Telecommunications
  - Gas Supply
  - Electrical and Street lighting
  - Easement and Setbacks
  - Verge works
  - Traffic, Parking and Access
  - Vegetation
  - Heritage
  - Environmental
- Literature review of the following specialist investigations:
  - Groundwater Constraints and Control Measures, Hume West, Stage C (Douglas Partners, 2012/2015)
  - Block Classifications (Douglas Partners, 2016)
- Opportunities and Constraints
- Recommendations
- Drawings of Existing Site Servicing

The report finds that the sites are currently serviced with water, sewer, stormwater and gas ties of appropriate size and has a service nearby, for electrical and communications services.

The major constraints for these blocks is the presence of groundwater issues. Douglas Partners undertook two separate investigations on Hume West Stage C, which includes Blocks 9, 10 & 11, Section 21 as well as Block 1 – 4, Section 29 on the opposite side of Couranga Street. The investigations were in response to reports of groundwater seepages and surface water issues being encountered during the construction of the earlier stages of the subdivision.

The groundwater was identified to be controllable via deep subsoil drainage measures proposed by Douglas Partners. These drains have reportedly been installed and appear to be working for the adjacent Section 29. Once these measures have been installed and can be proven to have been effective, the block classification reports indicate that this may facilitate an improvement in block classification from a P (problem) site to an M (medium reactivity) site.

It would be prudent for the successful proponent to read the reports and make their own determinations of the site and seek an independent engineer's advice prior to purchasing or developing the block following installation of the subsoil drainage.

It is noted that any required filling operations on the site may reduce the risk to problems caused by groundwater. It should also be noted that the proposed, and assumedly installed, subsoil drainage measures were to be at a depth of approximately 1.5-2.0m. While this would be sufficient for the majority of the proposed developments based on the site uses, where generally shallow footings are proposed, developments that are proposing deep cuts to around this depth, or large excavations such as basement levels, are highly likely to encounter groundwater issues. This is because the subsoil drains will only work to reduce the height of the water table to the depth they are provided.

If filling or deep cuts are proposed for the development, further geotechnical advice should be sought.

Cardno was contacted by the LDA during this investigation and advised of the presence of a drainage 'soak' or drainage blanket located within the centre of Block 11. The indicative location of the soak, as advised by the LDA, is shown on drawing **50516080-SK01**.

The presence of the soak is unexpected, but not surprising, as Douglas Partners test pit 117 located in that area was noted to be affected by groundwater seepage. This measure was likely installed by previous owners to manage groundwater in the area and would not pose a significant constraint on the site, although an attempt to better define its extent and confirm its composition should be made by prospective developers in the initial design stages.

It is noted that the soon to be installed subsoil drainage measures have the potential to mitigate the original water table issue which the soak was installed for and potentially making the soak redundant, however further investigation is required by the purchaser prior to purchasing the block to confirm this.

Recommendations

Based on the findings of this investigation the following recommendations should be undertaken:

1. Once installed by the LDA, the effectiveness of the subsoil drainage system in controlling groundwater across the site should be investigated by the developer and an independent engineer to assess the requirement for internal drainage measures, such as drainage blankets.
2. Seek project specific geotechnical advice for any development which involves significant amounts of filling or deep cuts and large excavations to determine the impact of groundwater.
3. The developer should be aware that the main requirement for Class P sites is for foundation and footing design to be undertaken by a structural engineer using sound engineering principles.
4. Remove the non-regulated trees and liaise with the ACT Tree Protection Unit regarding removal of regulated trees on Block 10.
5. Remove the existing stockpiles from Block 10. It is understood that the LDA is making arrangements to have these stockpiles removed from the site.
6. Prior to DA, liaise with ActewAGL during detailed design and submit a Request for Preliminary Network Advice (PNA) to determine the requirement for a substation at the site and location for the Point of Entry.
7. If required, the developer should consult with TaMS regarding the relocation of the 225mm pipe and headwall within Block 9.
8. The developer should attempt to better define Block 11's existing soak extent and confirm its composition in the initial design stages to determine the likelihood of the proposed subsoil drainage network mitigating the soaks need.

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Appendices

Figures

1 Introduction

Cardno has been engaged by the Land Development Agency (LDA) to undertake a limited Phase 1 Site Investigation of Blocks 9, 10 & 11, Section 21 Hume (Stage 3, Hume West Estate). Refer to **Figures 1-1** for a locality plan.

The purpose of the site investigation is to assess the condition of the sites for the information of potential buyers. It is understood that the site is intended to be sold ‘as is’ in its current condition.

The report identifies opportunities, constraints and required works, on and off the site, and includes recommendations of works to be undertaken post sale.

A detailed scope of works is listed in **Section 3**, which is generally in accordance with the Panel Arrangement for Civil Engineering Consultancy Services Relating to Site Investigations as well as project specific LDA directions.

Figure 1-1 Aerial View of Blocks 9, 10 & 11, Section 21 (2015 photography)

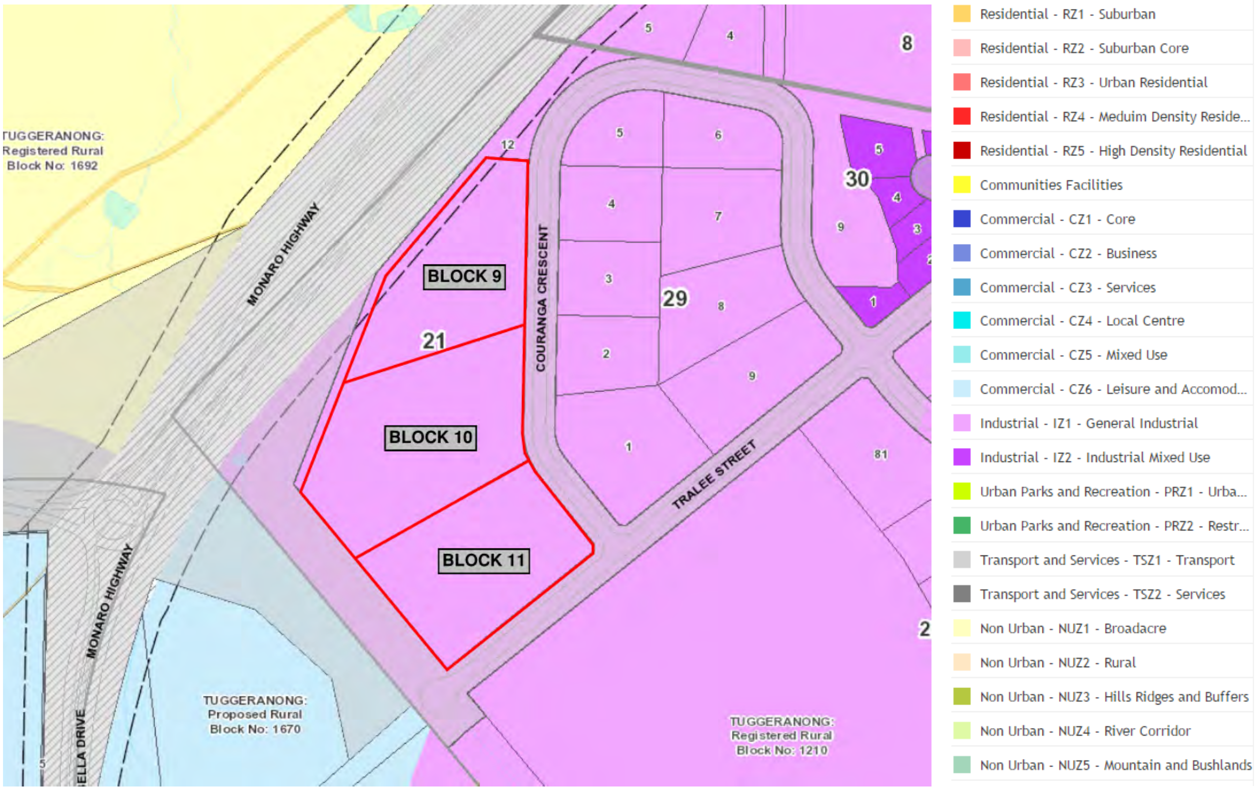
2 Land Use and Planning Framework

2.1 Overview

Blocks 9, 10 & 11 occupy an areas of approximately 22,671m^2, 32,211m^2 and 24,868m^2 and are located at 22, 30 and 36 Couranga Crescent, respectively. The Blocks are bound to the north and west by the Monaro Highway, the south and southwest by open space and rural blocks and to the east by Couranga Crescent and Blocks 1, 2, 3, 4 & 5, Section 21. Couranga Crescent is a loop road connecting to Tralee Street the main conveyance road through west Hume.

The Blocks are zoned as IZ1: General Industry in the Territory Plan, which is predominantly for industrial and trades land uses. Refer to **Appendix D** for a copy of the IZ1 Territory Plan Zoning Objectives, Permitted and Prohibited Uses.

Figure 2-1 Territory Plan Land Use Zoning



3 Investigation Scope

This report provides a preliminary investigation of the following existing conditions:

- Investigation of the following existing services:
    - Sewerage
    - Water
    - Stormwater Drainage
    - Overland Flows
    - Telecommunications
    - Gas Supply
    - Electrical and Street lighting
    - Easement and Setbacks
    - Verge works
    - Traffic, Parking and Access
    - Vegetation
    - Heritage
    - Environmental
- Literature review of the following specialist investigations:
    - Groundwater Constraints and Control Measures, Hume West, Stage C (Douglas Partners, 2012/2015)
    - Block Classifications (Douglas Partners, 2016)
- Opportunities and Constraints
- Recommendations
- Drawings of Existing Site Servicing

4 Site Description

The sites are located in west Hume, a major industrial suburb on the outskirts of Canberra, approximately 8.6km from the Woden Town Centre and 7.6km from the Tuggeranong Town Centre.

The sites are currently undeveloped and grassed with driveways and footpaths provided to each Block from Couranga Crescent. Blocks 9 and 11 have been cleared recently and are generally free from trees. The dense planting of trees within Block 10 are large and fully developed. No easements are present within the any of the blocks.

Current photos of the site (refer to **Figure 4-1**) shows a stockpile of material of unknown origin on Block 10 and a fence installed surrounding the sites to the west and along Block 9's north boundary.

Falls across the three blocks are generally gentle and to the north and east. Average grades across the blocks are around 2.5%, 2% and 3% for Blocks 9, 10 & 11, respectively. A large grassed swale runs along the western boundary of Block 11 and south western boundary of Block 10 draining to culverts underneath the Monaro Highway.

Refer to drawing **50516053-SK100** within **Appendix A** for a site plan. Site photographs showing the trees and other site features are enclosed in **Appendix B**.

Figure 4-1 Current Condition of Blocks 9, 10 & 11, Section 21 (April 2016 photography)

5 Existing Site Servicing

5.1 General

A detailed summary of the existing services information has been completed for Block 9, 10 & 11, Section 21 Hume. The detailed analysis includes Dial Before You Dig (DBYD) enquiries, WAE records, correspondence with service authorities and visual site inspections.

The existing service information has been compiled from available documentation obtained from Cardno's incumbent knowledge of the site, having designed the subdivision, as well as site inspections, information from service providers and the prescribed literature. The details, dimensions and alignments of existing services included in this report should be treated as indicative only and the accuracy of the information cannot be warranted. All services must be accurately located on site prior to any development proceeding.

It is noted that parts of the subdivision are still under construction while other blocks in the area are being developed. Any services to be constructed as part of future/current projects in the vicinity of the subject site are not included in this report. Consultation with all service authorities should be undertaken prior to the development of the Block.

All existing services described under this section are depicted on the drawings within **Appendix A** and all relevant correspondence with service authorities including DBYD is included within **Appendix C**.

5.2 Easements

Review of the ACTmapi database indicates that no easements are present within or near to Blocks 9, 10 or 11.

5.3 Sewer

The existing sewer service information compiled from subdivision design documentation, DBYD information and consultation with ICON Water indicates the following:

- A 150mm vitrified clay sewer service tie is provided to Blocks 10 and 11 while Block 9 has a 100mm vitrified clay tie. All ties drain to Couranga Crescent in the north eastern corner of the respective block.
- Although the ties are located at the low point of each block, the large size and grading of the blocks means that a small area in the north of each block has been deemed unsewerable by gravity based on the minimum grades of internal pipe required and depth of tie to AS3500. These areas should be noted and verified by prospective developers.
- The ties connect to a 150mm vitrified clay sewer main within the western Couranga Crescent verge. This main joins another 150mm main servicing the eastern Couranga Crescent verge and drains north.
- Block 11 is the start of the line for the sewer reticulation main.

Refer to drawings **50516080-SK01, 292350-3010, 292350-3011** and **292350-3013** within **Appendix A**, which detail the existing sewer services returned from DBYD, onsite inspection and WAE records.

5.4 Potable Water

The existing water supply service information compiled from subdivision design documentation, DBYD information and consultation with ICON Water indicates the following:

- Each block is provided with a 40mm HDPE potable water tie and 20mm water meter.
- These ties are connected from the 150mm DICL main which runs the length of Couranga Crescent.
- The hydrants on Couranga Crescent adjacent to the blocks are generally spaced at approximately 60m intervals or closer. The spacing appears to be consistent with an F4 fire risk category which is compliant for Light Industry / Large Institutions, however flow investigation for determination of the actual serviceable risk category was not undertaken.

- It is noted that if a development classified as Major Industry was proposed for the site the required spacing of 45m would not be achieved. Confirmation of fire risk category details and restrictions for the block should be sought from Icon Water and ACT Emergency Services.
- Water pressures available at the main, including under peak demand and firefighting draw offs have been requested from ICON Water but have not been provided at this stage.
- Refer to drawings **50516080-SK01, 292350-3010, 292350-3011** and **292350-3013** within **Appendix A**, which detail the existing potable water services returned from DBYD, onsite inspection and WAE records.

5.5 Stormwater Drainage

Design documentation for the subdivision indicates that the three blocks were to have 375mm diameter stormwater ties provided in north eastern corner of each block on Couranga Crescent. They are located at the block low point. Other WAE documentation was not available to confirm the size.

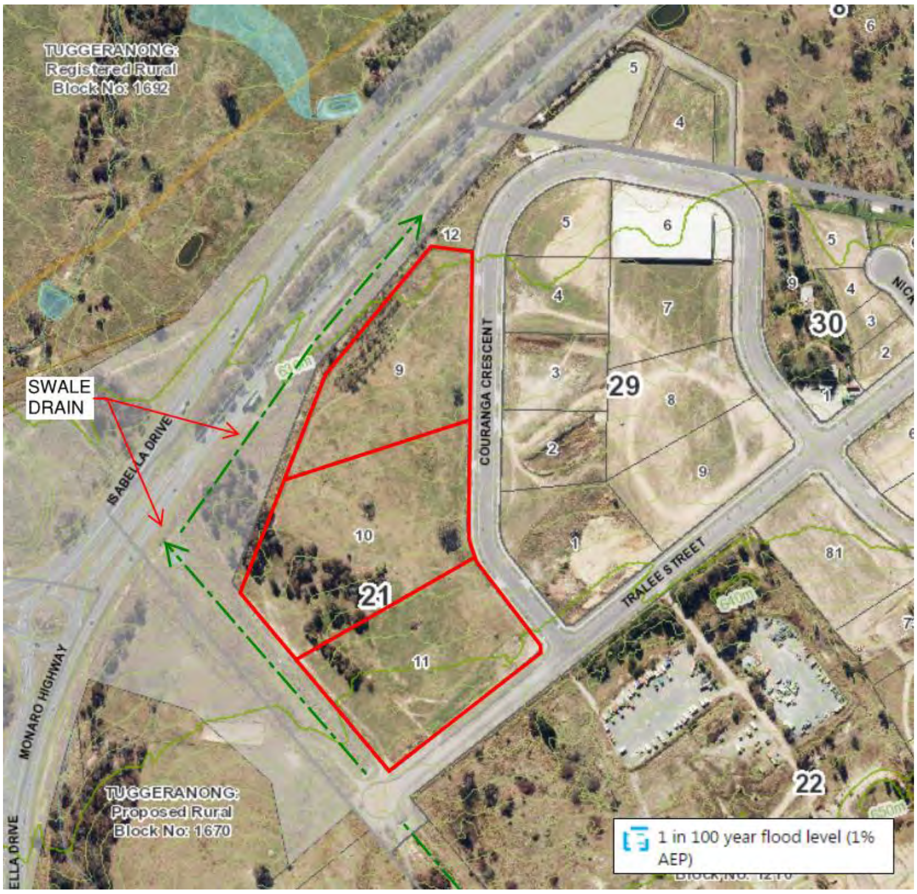
A 225mm headwall inlet was noted within the north western portion of Block 9 and drains to the swale to the northwest.

Refer to drawings **50516080-SK01, 292350-3010, 292350-3011** and **292350-3013** within **Appendix A**, which detail the existing stormwater services returned from DBYD, onsite inspection and WAE records.

5.6 Flooding and Overland Flows Characteristics

Review of the ACTmapi 1 in 100 year flood map indicates that neither Blocks 9, 10 or 11 are within a potential flood zone, refer to Figure 5-1.

Figure 5-1 Predicted 1 in 100year Flood Affected Areas (2004 ACTmapi contours)



Falls across the three blocks are generally gentle and to the north and east. Average grades across the blocks are around 2.5%, 2% and 3% for Blocks 9, 10 & 11, respectively. A large grassed swale runs along the western boundary of Block 11 and south western boundary of Block 10 draining to culverts underneath the Monaro

Highway. A separate swale runs along the Monaro Highway draining to the north. Refer to **Appendix A** for details of the EDP stormwater masterplan, design contours and overland flow paths.

5.7 Telecommunications Services

Refer to drawing **50516080-SK104** within **Appendix A** detailing existing communication services returned from DBYD and onsite inspection.

Existing services information provided by the relevant telecommunications providers indicates the following:

5.7.1 Telstra

A DBYD search has confirmed that there is Telstra cabling running along the western boundary of Blocks 9 and 10 as well as on Tralee Street up to Block 1, Section 29.

Advice from Telstra confirms that the network on Tralee Street is required to be extended up Tralee Street and Couranga Crescent to service the blocks. This work would be undertaken by Telstra at the developers' expense.

Telstra will require, for their exclusive use, 1XP100 leadin conduit from the building MDF to the property boundary. The developer will be responsible for installation of the leadin conduit from building MDF to property boundary and the cost of the network extension.

In order to initiate work for network extension and connection, the developer is required to register the proposed development via the Telstra Smart Community website at least six months prior to service required date. Online access is via Telstra Smart community website.

5.7.2 ICON

ICON have confirmed that their government fibre infrastructure is present outside of Block 9 to the west. This infrastructure crosses underneath the Monaro Highway heading west at approximately the midblock to Block 9.

5.8 Gas

The existing gas supply service information compiled from the DBYD information provided by ActewAGL indicates the following:

- Each block has been provided with a 50mm 210kPa gas service tie via a road crossing from the 50mm 210kPa main in the eastern verge of Couranga Crescent but do not have gas meters installed.
- The 50mm mains are fed from the 110mm 210kPa main on Tralee Street.
- Advice from Jemena is that the network has sufficient capacity to cater for most small/medium commercial gas users and there are no significant constraints limiting provision of the service. However, if larger demands are required they may require network upgrades or extensions. This can only be determined by Jemena upon receipt of a detailed connection request.

Refer to drawing **50516080-SK03** within **Appendix A**, which details the existing gas services returned from DBYD and onsite inspection.

5.9 Electrical

The existing electrical supply service information compiled from the DBYD information provided by ActewAGL indicates the following:

- Only the streetlighting electrical network is present on Couranga Crescent.
- Underground high voltage cabling is present along the Monaro Highway near to the western boundaries of Blocks 9 and 10. This underground network extends southeast to the south western boundary of Block 10 before resuming west as overhead cabling.
- Advice from ActewAGL confirms that they do not foresee any significant constraints limiting connection of the blocks to the greater electrical network. However, depending on the type of development and the electrical load requirements of each industrial development, there may be a need to establish a

substation on the blocks. The requirement of the substation(s) and connection points / Point of Entry will be identified during the preliminary network advice (PNA) stage during detailed design and prior to lodging a DA. Refer to **Appendix C** for correspondence between ActewAGL and Cardno.

Refer to drawing **50516080-SK02** within **Appendix A**, which details the existing electrical services returned from DBYD and onsite inspection.

5.10 Traffic, Parking and Access

The site is located in an industrial subdivision whose traffic is only those working or attending trade sites in that area catering to only a low traffic volume. The ACTive Travel Infrastructure Practitioner Tool (2015) (**Figure 5.2**) classifies Couranga Crescent as a Local Access road.

The EDP Road Hierarchy Plan prepared by Cardno in 2012 provides the capacity of this road at 0-300 vehicles per day. A copy of this drawing is provided within **Appendix A**.

Each block is provided with a 9.0m wide HD-2 driveway for access.

Figure 5-2 ACT Road Hierarchy

5.11 Verge

The nature of the adjacent road reserves and associated verges is outlined below:

Couranga Crescent

- The road reserve width is approximately 31.6m wide and is comprised of:
  - 13.6m wide road single lane.
  - 9.0m wide western verge with footpath, typical.
  - 9.0m wide eastern verge with footpath, typical.
- The road verge is grassed with concrete driveway accesses.
- Both sides of the verge are regularly planted with juvenile trees.

Tralee Street

- The road reserve width is approximately 31.6m wide and is comprised of:
  - 13.6m wide road single lane.
  - 9.0m wide northern verge with footpath, typical.

  - 9.0m wide southern verge, typical.
- Both sides of the verge are regularly planted with juvenile trees.
- The section of Tralee Street west of Couranga Crescent is currently an unsealed gravel track.

The EDP Road Hierarchy Plan prepared by Cardno in 2012 is provided within **Appendix A**.

5.12 Vegetation

The sites are currently undeveloped and grassed with driveways and footpaths provided to each Block from Couranga Crescent. A tree assessment undertaken by Indesco in May of 2014 which indicates that the majority of the trees on site are not regulated. although trees 3, 4, 5 and 6, as per the Tree Assessment Drawing, are. A copy of the tree assessment, including the plan showing tree locations, is provided within **Appendix E**.

Blocks 9 and 11 have been recently cleared and are generally free from trees. Some trees were cleared from Block 10, however, the remaining dense planting of trees are large and well developed. These clearing works appear to be in accordance with the approved tree management plan from July 2016 (attached within **Appendix A**). It is understood that the large grouping on Block 10 was retained at the request of the Conservator of Flora and Fauna during the Development Application process for the works which included approval of installation of the subsoil drains for Blocks 9-11. Of these remaining trees it appears that only trees 3, 4, 5 and 6 are regulated and would require approval prior to being removed.

It is understood that the Conservator deemed that those trees were not required to be cleared for those works and an application to remove them could be made during a subsequent DA for the development of Block 10, where the suitability of removing those trees would be re-assessed.

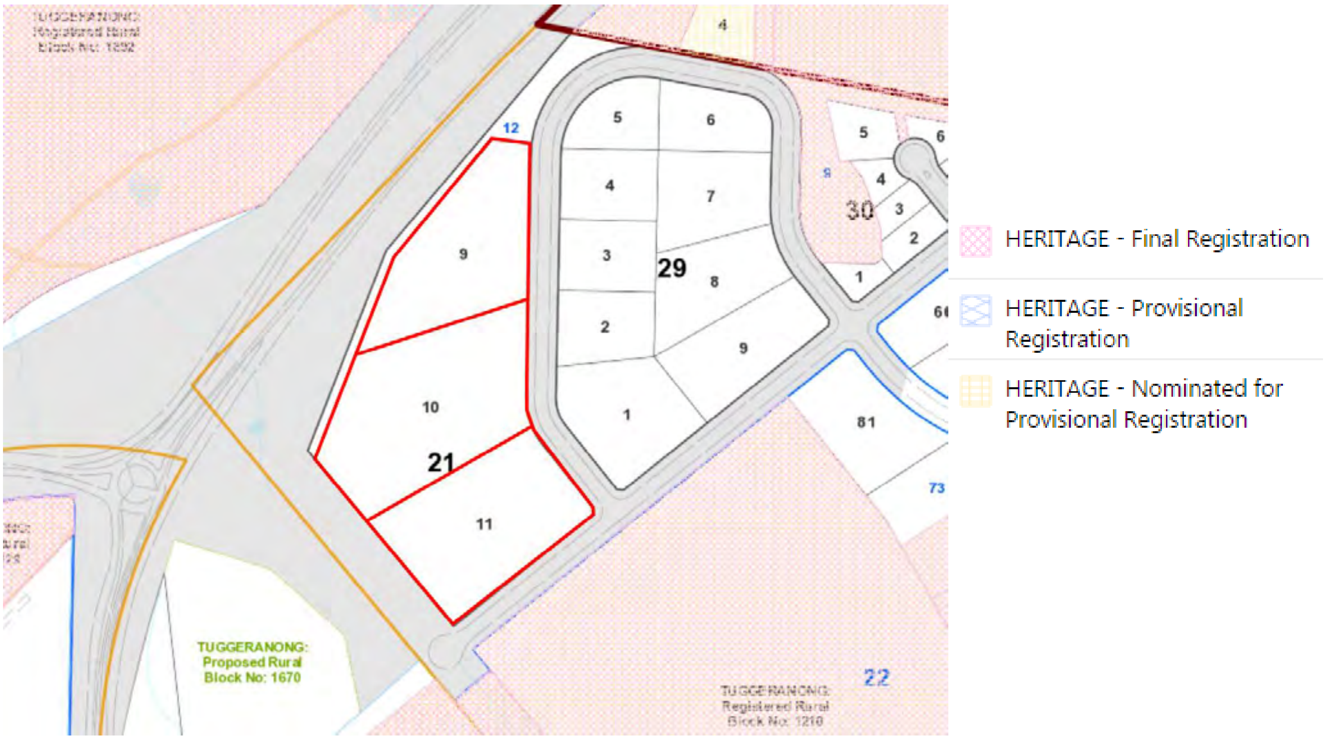
5.13 Heritage

Review of the ACTmapi Heritage Map indicates that there are no heritage listed sites within the Blocks. However, there are a number of Heritage listed places within the area. Rose Cottage is to the west, Couranga Homestead is to the east in Section 30 and the areas to the north and south of the site have been identified as containing sensitive information and aboriginal heritage sites by ACT Heritage. Additional information on these sites can be obtained from the ACT Heritage unit.

Any heritage constraints relating to the development of Blocks 9, 10 and 11 are assumed to have already been resolved during the Hume West Industrial Estate EDP submission and approval.

Correspondence with the ACT Heritage Unit is attached within **Appendix C**.

Figure 5-3 Heritage Listings in the Area



5.14 Environmental

Review of the ACTmapi Significant Species, Vegetation Communities and Registered Tree Map indicates that there are no registered trees, environmental offset zones, significant plants or animals or threatened plants within or immediately adjacent to the Blocks.

Figure 5-4 Environmental Listings in the Area

6 Specialist Investigations

Several geotechnical investigations have been undertaken both on the subject blocks and neighbouring sites. These reports have been reviewed and summarised to inform the LDA and prospective buyers. Full copies of the reports can be found in **Appendix E**.

6.1 Groundwater Constraints and Control Measures, Hume West, Stage C

Douglas Partners undertook two separate investigations on Hume West Stage C, which includes Blocks 9, 10 & 11, Section 21 as well as Block 1 – 4, Section 29 on the opposite side of Couranga Street. The investigations were in response to reports of groundwater seepages and surface water issues being encountered during the construction of the earlier stages of the subdivision.

The initial investigation (August 2012) carried out 27 test pits (101 – 127) to a depth of 2.5m across the site while the follow up investigation (September 2012) carried out an additional 12 test pits (128 – 139) to depths of 3.8m. The test pits found groundwater seepage almost site wide across Section 21 and in isolated locations around Block 1 in Section 29. **Figure 6-1** presents the test pit locations which found groundwater seepages.

6.1.1 Initial Investigation Soil Profile (Pits 101 – 127)

The typical soil profile within Pits 101-127 has been described as:

FILLING: poorly and moderately compacted, moist gravelly sandy clay in Pits 101, 112 and 127 to depths of 0.1 – 0.4m.

(Note: Fill was not observed on Section 21)

TOPSOIL: wet to moist, silty sand and clayey silty sand with rootlets to depths of 0.1 – 0.2m in Pits 102 – 107, 110, 111 and 113 – 126.

SAND, SILT & CLAY: loose to dense, cemented, or firm to very stiff, wet to moist variably sand, silt and clay with some gravel to the limit of investigation of 0.9 – 2.5m.

6.1.2 Additional Investigation Soil Profile (Pits 128 – 139)

The typical soil profile within Pits 128 - 139 has been described as:

FILLING: poorly and moderately compacted, moist, sandy gravel, silty sand and gravelly sandy clay in Pits 132 – 135 to depths of 0.3 – 1.0m. Pit 137 was excavated through a stockpile which encountered filling to 2.4m depth.

(Note: Fill was not observed on Section 21)

TOPSOIL/TOPSOIL FILLING: wet to moist, silty sand and sandy silty clay with rootlets to depths of 0.2 – 0.4m in Pits 128 – 131, 133, 134, 136, 138 and 139. Topsoil was encountered in Pit 137 underlying the filling stockpile.

(Note: Topsoil fill was not observed on Section 21)

SAND, SILT & CLAY: loose to dense, cemented, or firm to very stiff, wet to moist variably sand, silt and clay with some gravel to the limit of investigation of 1.5 – 3.8m.

6.1.3 Groundwater Conditions

The strata type, depth and rate of seepage encountered within the test pits was highly variable with depth ranges of seepage ranging from 0 – 0.3m to 1.6 – 1.8m and seepage rates from very slow to very high.

It is suggested that the variable subsurface profile is the main contributing factor to the presence of groundwater in particular areas. Groundwater seepage pathways will occur along interconnected permeable lenses and will rise and fall in depth depending on the presence of impermeable barriers such as clay layers or cemented sand layers. If seepages are blocked and cannot continue to drain, they can either become perched or if under sufficient pressure, rise to the surface to continue as surface flows.

It can therefore be a complex system to model in order to undertake remedial measures to intercept and drain these seepages in a controlled manner.

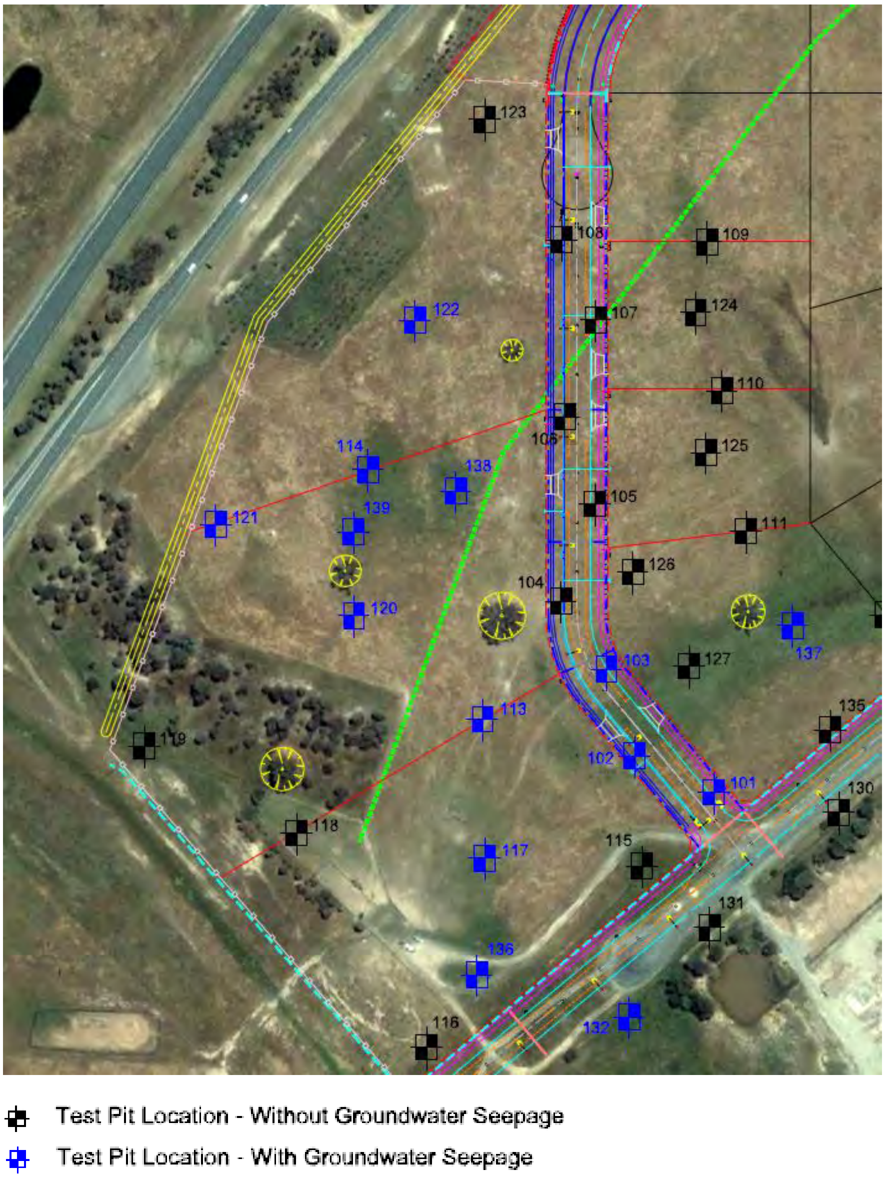
The report concludes by suggesting a network of deep subsoil drains in order to attempt to control the groundwater seepages and possibly enable conventional construction within the blocks. Given the likely concentration of flows along the south western stage boundary and the Tralee Street boundary, it is recommended that the main collector drains be installed along or under Couranga Crescent, Tralee Street and along the south western boundary of the stage with feeder drains along the side and front boundaries of the blocks.

The depth of drains, based on the seepage depths encountered, was at least 2 m deep with the inclusion of an impermeable liner such as HDPE plastic to reduce the potential for groundwater flows to pass directly across the drain through pervious sand/gravel layers.

The need for internal drainage measures such as drainage mattresses would be dependent on the effectiveness of the sub soil/cut-off drains (i.e. if the groundwater flows are horizontal and not vertical) and could not be fully assessed until the perimeter drainage system has had sufficient time to be monitored.

Cardno understands that the advice was accepted by the LDA and the subsoil drainage measures for Section 29 were installed while the measures for Blocks 9-11 are due for construction in mid-late 2016. Details of the proposed drainage system along the block boundaries is provided on **Drawing T-C0095.00** within **Appendix A**.

Figure 6-1 Test Pits Which Encountered Groundwater



6.1.4 Groundwater Remedial Measures Follow Up

While a formal re-investigation of Section 29 to determine the effectiveness of the installed subsoil drainage has not been undertaken, a subsequent geotechnical investigation was undertaken by Douglas Partners on Blocks 1-4, Section 29 in February of 2014 from which an indication on the effectiveness of those measures can be drawn for Section 21.

This investigation included the excavation of 11 test pits across the Blocks but were mainly centred on Block 1 due to the presence of groundwater in the previous studies. Investigation found that no free groundwater was observed during excavation of the pits however moist to wet conditions were observed in some natural soil layers which indicates that the installed drains have had an effect on the water flow over the site.

However, the report does note that the test pits were backfilled immediately precluding longer term groundwater monitoring and that groundwater conditions do not remain constant and are highly variable due to seasonal changes and rainfall (mention is made to the fact that the investigation was undertaken during a relatively dry period). For this reason, ground conditions during this investigation may vary compared to those experienced during construction.

Ultimately the report concludes that it is assumed that the recommended drainage measures were installed for Blocks 1-4 and that, at this stage, groundwater seepages would not be considered a constraint for those Blocks.

6.2 Blocks 9, 10 & 11, Section 21 Block Classifications

Block classifications for Blocks 9, 10 and 11 were undertaken by Douglas Partners in February 2016 based on the findings of the test pits excavated in 2012. Each Block is classified as a Class P (problem) site due to the presence of adverse groundwater conditions. The developer should be aware that the main requirement for Class P sites is for foundation and footing design to be undertaken by a structural engineer using sound engineering principles.

The classification notes that, notwithstanding the P classification, the site classification based on soil reactivity alone would be equivalent to Class M (moderately reactive) conditions. If the adverse groundwater conditions are managed by the installation of a series of subsoil drains to intercept and control the groundwater flows, the site could possibly be reclassified as Class M.

It is therefore recommended that, once installed, the effectiveness of the subsoil drainage in the area is confirmed to determine whether the site is able to be reclassified as a Class M site. It would be prudent for the successful proponent to read the reports and make their own determinations of the site and seek an independent engineer’s advice prior to purchasing or developing the block following installation of the subsoil drainage.

7 Opportunities and Constraints

The Block's are currently well serviced with water, sewer and stormwater connection ties in appropriate locations without the need for easements. It is anticipated that the 225mm diameter pipe and headwall within Block 9 would be able to be relocated from the block if required by a prospective developer. This would require consultation with TaMS.

Small areas of each block have been identified as being unsewerable by gravity with the current depth of tie, grading of the block and minimum required sewer pipe grade, however it is anticipated that these areas are small enough that they can be readily overcome if given due consideration when laying out the block.

Other services such as electricity and communications are also readily available nearby with no significant constraints preventing connection. ActewAGL has noted that given the size of the blocks, individual substations may be required depending on the intended use, however this is not an unusual or insurmountable requirement for large industrial sites. It is the responsibility of the developer to liaise with ActewAGL regarding the requirements for electrical supply during detailed design and prior to lodging an application for development approval.

Gas road crossings are available at the block boundaries ready for tie in. However, network upgrades may be required if the proposed development requires a large supply.

All blocks have a significant road frontage to Couranga Crescent with access provided via concrete HD-2 driveways. The road network should be sufficient to support development of these blocks and the heavy vehicle traffic to them.

No environmental or heritage constraints were found to be contained within the block or nearby which will prohibit development internally.

Blocks 9 and 11 have already been cleared of trees and present a bare site ready for development. However, Block 10 contains a dense scattering of mature trees at the rear of the block which would likely need removal to utilise the large industrial site to its full potential. The ability to clear those trees could be limited by the regulated trees present and liaison with the ACT Tree Protection will be required.

The large stockpile of material within Block 10 will be required to be removed from site to facilitate development. It is understood that the LDA is making arrangements to have these stockpiles removed from the site.

The major constraints for these blocks is the presence of groundwater issues. The groundwater was identified to be controllable via deep subsoil drainage measures proposed by Douglas Partners. These drains have reportedly been installed and appear to be working for the adjacent Section 29. The subsoil drainage network for Section 21 is due to be installed in mid-late 2016. Once these measures have been installed and can be proven to have been effective, the block classification reports indicate that this may facilitate an improvement in block classification from a P (problem) site to an M (medium reactivity) site.

It is recommended to confirm the subsoil drainage measures are effective once installed. It would be prudent for the successful proponent to read the reports and make their own determinations of the site and seek an independent engineer's advice prior to purchasing or developing the block following installation of the subsoil drainage.

It is noted that any required filling operations on the site may reduce the risk to problems caused by groundwater. It should also be noted that the proposed, and soon to be installed, subsoil drainage measures will be at a depth of typically 1.5-2.0m (but as shallow as 0.56m in one location in Block 9). While this would be sufficient for the majority of proposed site uses where generally shallow footings are proposed, developments that propose deep cuts to around this depth, or large excavations such as basement levels, are highly likely to encounter groundwater issues as the subsoil drains will only work to reduce the height of the water table to the depth they are provided.

If filling or deep cuts are proposed for the development geotechnical advice should be sought.

Cardno was contacted by the LDA during this investigation and advised of the presence of a drainage 'soak' or drainage blanket located within the centre of Block 11. This soak was uncovered during site grading operations however the origin, full extent or further details were not available. The indicative location of the soak as advised by the LDA is shown on drawing **50516080-SK01**. A soak is a layer of large rock 75-100mm which acts as a subsoil drain to gather groundwater to be diverted away via pipes. They are commonplace when protecting pavements.

The presence of the soak is unexpected, but not surprising, as Douglas Partners test pit 117 located in that area was noted to be affected by groundwater seepage. This measure was likely installed by previous owners to manage groundwater in the area and would not pose a significant constraint on the site, although an attempt to better define its extent and confirm its composition should be made by prospective developers in the initial design stages.

However, it should be noted that the proposed, and soon to be installed, subsoil drainage network around the block boundaries should effectively lower the groundwater table within the block. It would therefore be expected that the original watertable issues this soak was installed to manage originally should be mitigated by the presence of those drains before entering the soak thereby potentially making the soak redundant. This would be able to be confirmed following investigation into its location and composition.

8 Recommendations

Based on the findings of this investigation the following recommendations should be undertaken:

1. Once installed by the LDA, the effectiveness of the subsoil drainage system in controlling groundwater across the site should be investigated by the developer and an independent engineer to assess the requirement for internal drainage measures, such as drainage blankets.
2. Seek project specific geotechnical advice for any development which involves significant amounts of filling or deep cuts and large excavations to determine the impact of groundwater.
3. The developer should be aware that the main requirement for Class P sites is for foundation and footing design to be undertaken by a structural engineer using sound engineering principles.
4. Remove the non-regulated trees and liaise with the ACT Tree Protection Unit regarding removal of regulated trees on Block 10.
5. Remove the existing stockpiles from Block 10. It is understood that the LDA is making arrangements to have these stockpiles removed from the site.
6. Prior to DA, liaise with ActewAGL during detailed design and submit a Request for Preliminary Network Advice (PNA) to determine the requirement for a substation at the site and location for the Point of Entry.
7. If required, the developer should consult with TaMS regarding the relocation of the 225mm pipe and headwall within Block 9.
8. The developer should attempt to better define Block 11’s existing soak extent and confirm its composition in the initial design stages to determine the likelihood of the proposed subsoil drainage network mitigating the soaks need.

9 Drawings

9.1 Drawings

As part of the site investigation report the following drawings have been prepared and are provided within **Appendix A.**

Drawing No.	Description	Revision
50516080 – SK00	Site Plan	A
50516080 – SK01	Existing Hydraulic Services	B
50516080 – SK02	Existing Electrical Services	A
50516080 – SK03	Existing Gas Services	A
50516080 – SK04	Existing Communications Services	A
292350-SWMP-01	Stormwater Masterplan – Sheet 1 of 2	C
292350-RHP-01	Road Hierarchy Plan	C
5485 – TMP01	Tree Management Plan	C
292350-3010	Hydraulic Services Plans – Sewer and Water- Sheet 1 of 4	A
292350-3011	Hydraulic Services Plans – Sewer and Water- Sheet 2 of 4	A
292350-3013	Hydraulic Services Plans – Sewer and Water- Sheet 3 of 4	A
C12137-TBSA+	Tie Book Blocks 9-11 (4 sheets)	First Issue
T-C0095.00	Approved DA Plans – Subsoil Drainage Plan – Blocks 9-11	B

These drawings are to be read in conjunction with this report. The plans are based upon information and consultation provided by service providers and authorities. All services are to be confirmed on site. The existing services in the vicinity of the site are represented in an indicative format. The plans were prepared solely for the purposes of this report and for the use of the client.

Blocks 9, 10 & 11,
Section 21 Hume
(Stage 3, Hume West
Estate)

APPENDIX
A

DRAWINGS

Shaping the Future

DATE PLOTTED: 19 May 2016 2:59 PM BY : PHILLIP JEWELL

XREF's: X-BASE_HUMEWEST; x_WALKER KERBS; x_DMENT_AREA_BDRY; x_HUME_TCD_BASE; X-CGD-TUGGERANONG; 12D DESIGN CONTOURS1
CAD File: N:\Projects\505\FY16\080_B9 10 11 S22 HUME SIR\Drawings\Build\50516080-SK00-Site.dwg

0 20 40 60 80 100m

SCALE 1:1000 @A1

A	29/04/2016	DRAFT REPORT	PDJ	JH	JPS
Rev.	Date	Description	Des.	Verif.	Appd.

Cardno
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Cardno (NSW/ACT) Pty Ltd | ABN 95 001 145 035
Level 2, 14 Wormald Street
Symonston ACT 2609
Tel: 02 6112 4500 Fax: 02 6112 4599
Web: www.cardno.com.au

Drawn PDJ Date 29/04/2016
Checked GZ Date 29/04/2016
Designed JH Date 29/04/2016
Verified JH Date 29/04/2016
Approved JPS 29/04/2016

Client LAND DEVELOPMENT AGENCY

Project BLOCKS 9, 10 &11
SECTION 21
HUME, ACT

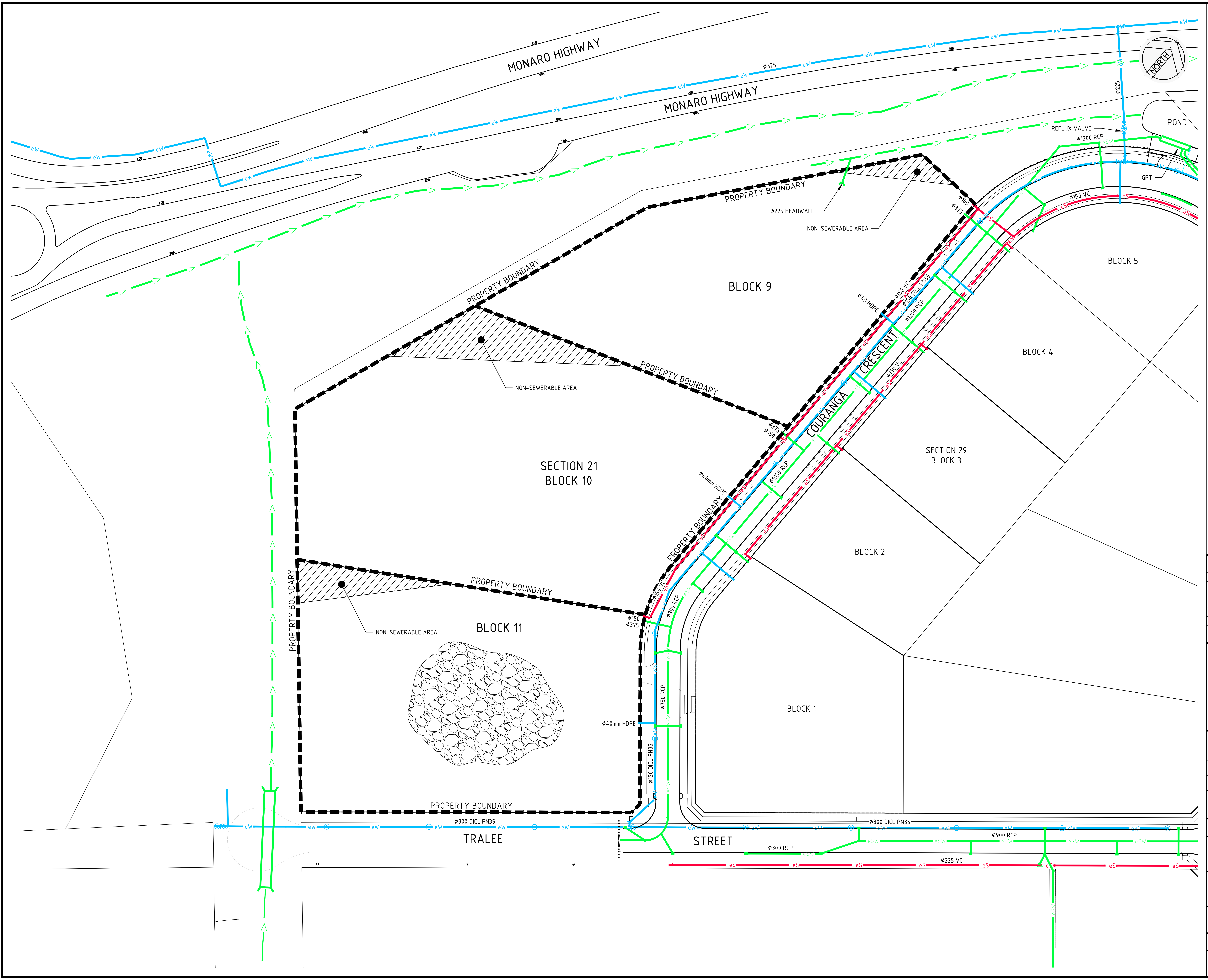
Title SITE PLAN
NEARMAP IMAGE AS AT 25 APRIL 2016

Status FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

AHD
Scale 1:1000
Size A1

Drawing Number 50516080-SK00
Revision A

DATE PLOTTED: 25 May 2016 1:28 PM BY : PHILLIP JEWELL



LEGEND

eS	EXISTING SEWER
eSW	EXISTING STORMWATER
eW	EXISTING WATER
— > — >	EXISTING SWALES
▨	INDICATIVE SOAK AREA SHOWN AS NOTED BY THE LAND DEVELOPMENT AGENCY

0 20 40 60 80 100m

SCALE 1:1000 @A1

Rev.	Date	Description	Des.	Verif.	Appd.
B	25/05/2015	SOAK AREA ADDED	PDJ	JH	JPS
A	29/04/2016	DRAFT REPORT	PDJ	JH	JPS

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Level 2, 14 Wormald Street
Symonston ACT 2609
Tel: 02 6112 4500 Fax: 02 6112 4599
Web: www.cardno.com.au

Drawn PDJ Date 29/04/2016
Checked GZ Date 29/04/2016
Designed JH Date 29/04/2016
Verified JH Date 29/04/2016
Approved JPS 29/04/2016

Client LAND DEVELOPMENT AGENCY

Project BLOCKS 9, 10 &11
SECTION 21
HUME, ACT

Title EXISTING HYDRAULIC SERVICES
SEWER - STORMWATER - WATER

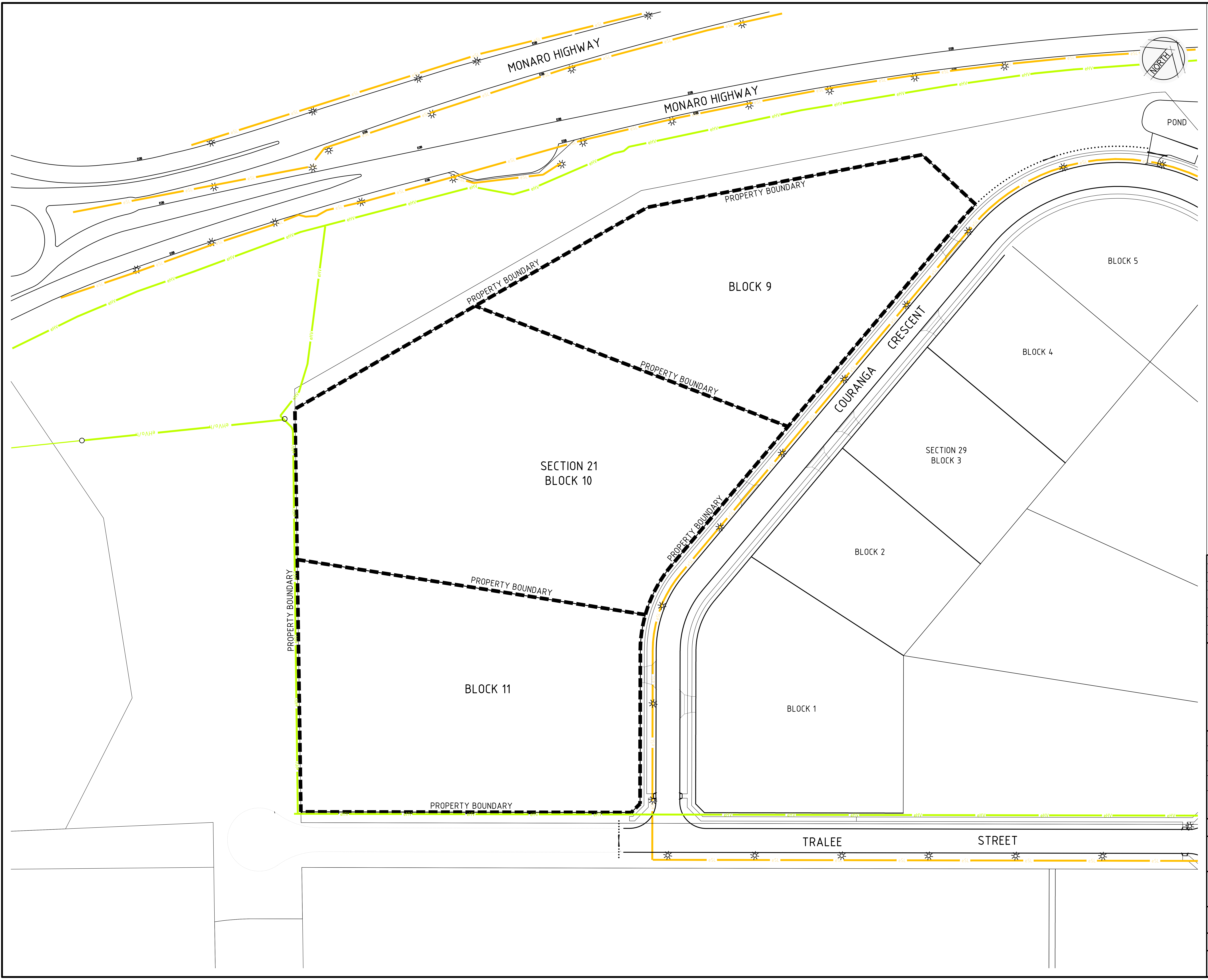
Status FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

AHD
Scale 1:1000
Size A1

Drawing Number 50516080-SK01
Revision B

XREF's: X-BASE_HUMEWEST; x_WALKER KERBS; x_DMENT_AREA_BDRY; x_HUME_TCD_BASE; X-CGD-TUGGERANONG; 12D DESIGN CONTOURS1
CAD File: N:\Projects\505\FY16\080_B9 10 11 S22 HUME SIR\Drawings\Build\50516080-SK01-Ex-Sewer-SW-Water-Services.dwg

DATE PLOTTED: 19 May 2016 3:01 PM BY : PHILLIP JEWELL



LEGEND

🟩 eHV	EXISTING UNDERGROUND (HIGH VOLTAGE)
🟨 eSL	EXISTING UNDERGROUND (STREET LIGHT)
🟩 eHVo/h	EXISTING OVERHEAD (HIGH VOLTAGE)
○ ☼	EXISTING ELECTRICAL POLE/STREETLIGHT

0 20 40 60 80 100m
SCALE 1:1000 @A1

A	29/04/2016	DRAFT REPORT	PDJ	JH	JPS
Rev.	Date	Description	Des.	Verif.	Appd.

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Level 2, 14 Wormald Street
Symonston ACT 2609
Tel: 02 6112 4500 Fax: 02 6112 4599
Web: www.cardno.com.au

Drawn PDJ	Date 29/04/2016
Checked GZ	Date 29/04/2016
Designed JH	Date 29/04/2016
Verified JH	Date 29/04/2016
Approved JPS	29/04/2016

Client LAND DEVELOPMENT AGENCY

Project BLOCKS 9, 10 &11
SECTION 21
HUME, ACT

Title EXISTING ELECTRICAL SERVICES

Status FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

AHD | Scale 1:1000 | Size A1

Drawing Number 50516080-SK02 | Revision A

XREF's: X-BASE_HUMEWEST; x_WALKER KERBS; x_DMENT_AREA_BDRY; x_HUME_TCD_BASE; X-CGD-TUGGERANONG; 12D DESIGN CONTOURS1
CAD File: N:\Projects\505\FY16\080_B9 10 11 S22 HUME SIR\Drawings\Build\50516080-SK02-Ex-Electrical Services.dwg

DATE PLOTTED: 19 May 2016 3:03 PM BY : PHILLIP JEWELL

XREF's: X-BASE_HUMEWEST; x_WALKER KERBS; x_DMENT_AREA_BDRY; x_HUME_TCD_BASE; X-CGD-TUGGERANONG; 12D DESIGN CONTOURS1

CAD File: N:\Projects\505\FY16\080_B9 10 11 S22 HUME SIR\Drawings\Build\50516080-SK03-Ex-GAS.dwg

LEGEND

EXISTING GAS

A	29/04/2016	DRAFT REPORT	PDJ	JH	JPS
Rev.	Date	Description	Des.	Verif.	Appd.

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Level 2, 14 Wormald Street
Symonston ACT 2609
Tel: 02 6112 4500 Fax: 02 6112 4599
Web: www.cardno.com.au

Drawn PDJ	Date 29/04/2016
Checked GZ	Date 29/04/2016
Designed JH	Date 29/04/2016
Verified JH	Date 29/04/2016
Approved JPS	29/04/2016

Client LAND DEVELOPMENT AGENCY

Project BLOCKS 9, 10 &11
SECTION 21
HUME, ACT

Title EXISTING GAS SERVICES

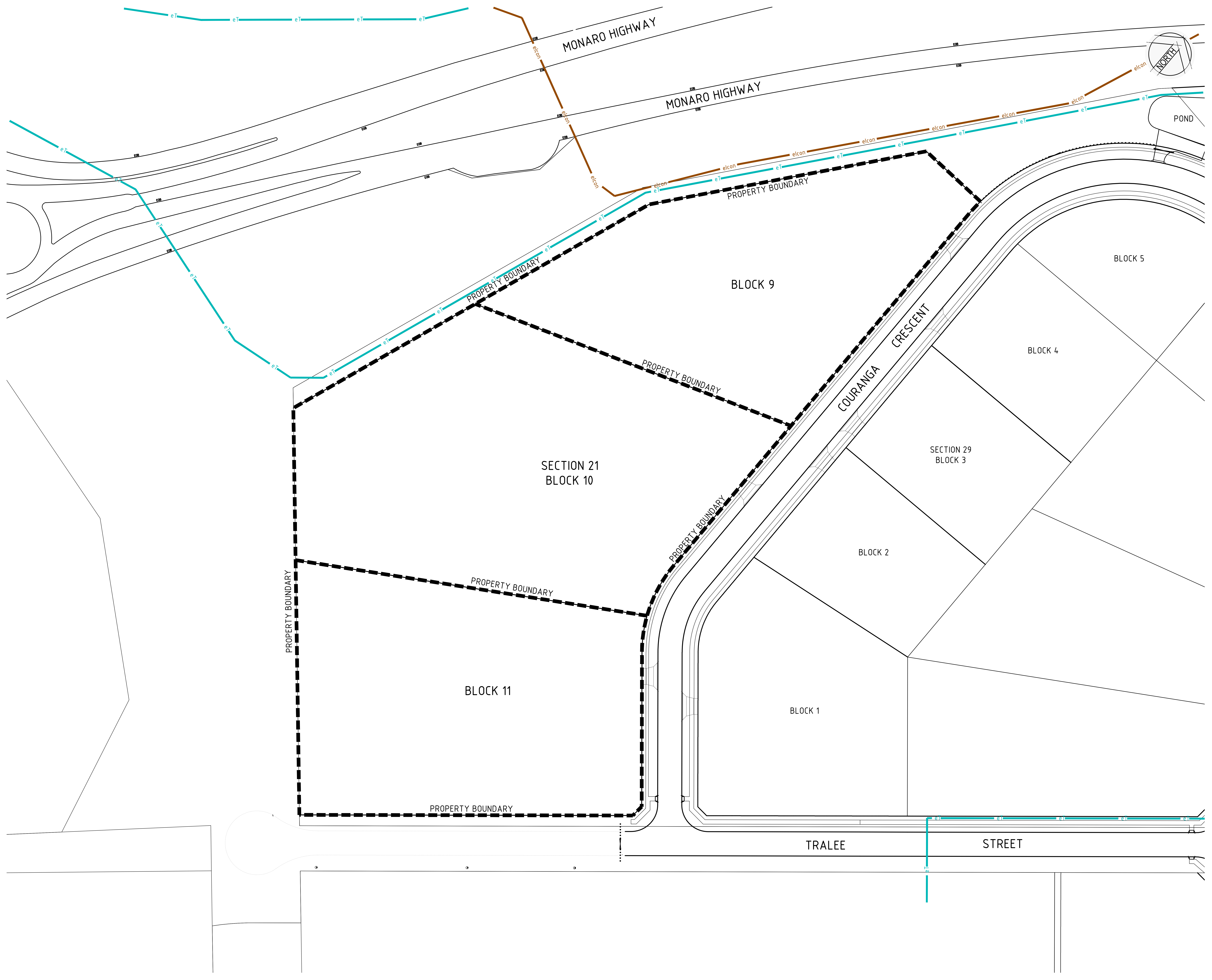
Status FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

AHD		Scale 1:1000	Size A1

Drawing Number 50516080-SK03

Revision A

DATE PLOTTED: 19 May 2016 3:04 PM BY : PHILLIP JEWELL



LEGEND

- eT EXISTING TELSTRA
- elcon EXISTING ICON

0 20 40 60 80 100m

SCALE 1:1000 @A1

Rev.	Date	Description	Des.	Verif.	Appd.
A	29/04/2016	DRAFT REPORT	PDJ	JH	JPS

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Level 2, 14 Wormald Street
Symonston ACT 2609
Tel: 02 6112 4500 Fax: 02 6112 4599
Web: www.cardno.com.au

Drawn	PDJ	Date 29/04/2016
Checked	GZ	Date 29/04/2016
Designed	JH	Date 29/04/2016
Verified	JH	Date 29/04/2016
Approved	JPS	29/04/2016

Client LAND DEVELOPMENT AGENCY

Project BLOCKS 9, 10 &11
SECTION 21
HUME, ACT

Title EXISTING TELECOMMUNICATION SERVICES

Status FOR INFORMATION ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

AHD | Scale 1:1000 | Size A1

Drawing Number 50516080-SK04 | Revision A

XREF's: X-BASE_HUMEWEST; x_WALKER KERBS; x_DMENT_AREA_BDRY; x_HUME_TCD_BASE; X-CGD-TUGGERANONG; 12D DESIGN CONTOURS1
CAD File: N:\Projects\505\FY16\080_B9 10 11 S22 HUME SIR\Drawings\Build\50516080-SK04-Ex-COMM.dwg

DO NOT SCALE

FOR CONTINUATION REFER DRG 292350-SWMP-02

Rev	Date	Description	Drawn	Appr.
C	16/06/2010	EDP RE-SUBMISSION	PDJ	IP
B	17/03/2010	EDP SUBMISSION	PDJ	IP
A	03/03/2010	CLIENT APPROVAL	PDJ	IP

Land Development Agency
CANBERRA FIRST

Cardno
Young
ABN: 24 008 579 404
Level 2, 14 Wormald Street Symonston, ACT, 2609
Ph (02) 6112 4500 Fax (02) 6112 4599
PO Box 7217, CPBC, ACT, 2610
Web: www.cardno.com.au

Quality System
Quality Endorsed Company
AS 9001 Lic. 5960
Standards Australia

Drawn	PDJ	Date 03/03/2010
Checked	JB	Date 03/03/2010
Designed	PDJ	Date 03/03/2010
Verified	IP	Date 03/03/2010
Approved	IP	Date 03/03/2010

Client
LAND DEVELOPMENT AGENCY

HUME WEST INDUSTRIAL ESTATE
SECTION 22 AND 21
HUME ACT

STORMWATER MASTER PLAN
- SHEET 1 OF 2

Status
EDP SUBMISSION

Date	Datum	Scale	Size
DEC 2009	AHD	1:2500	A1

Drawing Number
292350-SWMP-01

Revision
C

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DATE PLOTTED: 8 February 2011 4:30 PM BY : PHILLIP JEWELL (CANBERRA)

XREF's: X-CGD-TUGGERANONG; XC-23-12461-HUME_TCD_BASE; X-GRP-A1-SHT; X-ACT-A1-Logo; BASE_HUMEWEST; x_SURVEY 072180 1_DT_001; x_WALKER KERBS; x_DMENT_AREA_BDRY
CAD FILE: J:\292350\Data\Civil\EDP DWG\292350-18-SWMP.dwg

LEGEND:

▬ · ▬	SYUDY AREA
6	TREE NUMBER
G2	TREE GROUP
○	EXISTING SURVEYED TREES TO BE RETAINED
○	EXISTING TREES TO BE RETAINED (APPROX. LOCATION)
⊗	TREE TO BE REMOVED AS PART OF PROPOSED WORKS.
— · —	1.8M HIGH TEMPORARY PROTECTION FENCE TO BE MAINTAINED IN GOOD CONDITION FOR DURATION OF CONSTRUCTION

TREE DAMAGING ACTIVITY APPLICATION REQUIRED. QUALITY STATUS:

△	MEDIUM QUALITY RATING REGULATED TREE
△	POOR QUALITY RATING REGULATED TREE

REGULATED TREE: TREE ON LEASED LAND THAT MEETS ONE OR ALL OF THE FOLLOWING CRITERIA:

- IS GREATER THAN 12 M TALL.
- HAS A TRUNK CIRCUMFERENCE OF 1.5M OR MORE AT ONE METRE ABOVE GROUND.
- HAS A CANOPY SPREAD OF 12M OR MORE (EXCLUDING DEAD TREES AND WEED SPECIES).

NOTE:
ALL PRUNING OF TREES TO BE CARRIED OUT BY A TRAINED AND EXPERIENCED ARBORIST TREE SURGEON.

FOR FURTHER INFORMATION ON TREE ASSESSMENT REFER TO VEGETATION ASSESSMENT REPORT.

FOR EXTENT OF WORK WITHIN 2M OF DRIP ZONE OF TREES REFER TO CIVIL DRAWINGS, REPORTS AND TREE DAMAGING ACTIVITY APPLICATION AND APPROVALS.

PLANNING AND DEVELOPMENT ACT 2007
APPROVAL GRANTED
SUBJECT TO THE CONDITIONS SET OUT IN THE NOTICE OF DECISION PURSUANT TO SECTION 162
Delegate name CLINTON CASHEN
Date 21/4/2016

A1 PLOT 1000 20 10 0 10 20 30 40 A3 PLOT 2000

No.	AMENDMENT	APPROVED	DATE	AMENDED BY
C	ADDITIONAL TREES TO BE REMOVED	BC	22.07.15	RES
B	TREES TO BE RETAINED ADDED	BC	10.07.15	RES
A	TREE MANAGEMENT PLAN	DM	09.02.15	RS

DEVELOPMENT TEAM

CLIENT

INDESCO

CONSULT AUSTRALIA
Business | Engineering | Design

AS/NZS ISO 9001 Certified

APPROVED	DM	DATE	09.02.15
CHECKED	DM	DATE	09.02.15
DESIGNED BY			
DRAWN BY	RS		
CAD FILE	H:\5485 TA Sec 21 Sec 29 Hume\Acad\Current Drawings\5485-002 TMP.dwg		
SCALE	As shown	SHEET No.	1 of 1

PROJECT
BLOCK 1 SECTION 29
AND BLOCK 9 10 11
SECTION 21 HUME

DRAWING TITLE
TREE MANAGEMENT PLAN

PROJECT No.	DRAWING No.	AMDT
5485	TMP01	C

XREF's: XC-23-12461-HUME__TCD__BASE; X-CGD-TUGGERANONG; BASE__HUMEWEST; X-GRP-A1-SHT; X-ACT-A1-Logo; x__DMENT__AREA__BDRY; x__SURVEY 07218.01_DT__001; x__WALKER KERBS
CAD FILE: J:\292350\Data\Civil\EDP DWG\292350-06-RHP.dwg

DATE PLOTTED: 8 February 2011 4:56 PM BY : PHILLIP JEWELL (CANBERRA)

Road	Design Vehicle	Traffic Volume	ACT Code Classification	Design Speed		Reserve Width		Carridgeway Width		Verge Width		Parking Provisions		Kerb Type		Return		Property Access		Grade		Footpath	
				Required	Proposed	Required	Proposed	Required	Proposed	Required	Proposed	Required	Proposed	Required	Proposed	Max Required	Proposed	Required	Proposed	Max Required	Max Proposed	Required	Proposed
Road 1 to Road 3	25m B-Double	3000-6000	Collector Street Major	50	50		21.8		10.8		2.5m/9m	On-site or within 200m	Refer Parking Plan		Upright		20m	Access to all blocks	Access to all blocks		3.45%		Both sides 2.5m wide
Road 2	25m B-Double	1000-3000	Cul-de-Sac	40	40		29.6		17.6		6m	On-site or within 200m	Refer Parking Plan		Upright		15m	Access to all blocks	Access to all blocks		4.20%		Both sides 2.5m wide
Road 3	25m B-Double	1000-2000	Access Street	50	50		31.6m		13.6		9m	On-site or within 200m	Refer Parking Plan		Upright		15m	Access to all blocks	Access to all blocks		3.65%		Both sides 1.5m /2.5m wide
Road 4	25m B-Double	0-300	Access Street	50	50		31.6m		13.6		9m	On-site or within 200m	Refer Parking Plan		Upright		15m	Access to all blocks	Access to all blocks		3.00%		Both sides 1.5m/2.5m wide
Road 5	25m B-Double	0-300	Access Street	50	50		31.6m		13.6		9m	On-site or within 200m	Refer Parking Plan		Upright		15m	Access to all blocks	Access to all blocks		4.50%		Both sides 1.5m/2.5m wide

LEGEND

▬ ▪ ▪ ▬	DEVELOPMENT BOUNDARY
180	ESTIMATED PROPOSED AND FUTURE DAILY TRAFFIC FLOW BASED ON ASSUMED TRAFFIC CATCHMENT. REFER TRAFFIC STUDY FOR DETAILS.
◇ 1275	THROUGH TRAFFIC GENERATED BY GROUP CENTRE
═	ROADSIDE FOOTPATHS
═	PROPOSED CYCLEPATH

NOTES

1. REFER LANDSCAPE MASTER PLANS FOR TREE SPECIES.

0 50 100 150 200 250m
50 30 10
SCALE 1:2500

Rev	Date	Description	Drawn	Appr.
C	04/06/2010	EDP RE-SUBMISSION	PDJ	IP
B	17/03/2010	EDP SUBMISSION	PDJ	IP
A	03/03/2010	CLIENT APPROVAL	PDJ	IP

Land Development Agency
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Cardno
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ABN: 24 008 579 404
Level 2, 14 Wormald Street Symonston, ACT, 2609
Ph (02) 6112 4500 Fax (02) 6112 4599
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Web: www.cardno.com.au

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Quality Endorsed Company
AS 9001 Lic. 5960
Standards Australia

Drawn	PDJ	Date 03/03/2010
Checked	JB	Date 03/03/2010
Designed	PDJ	Date 03/03/2010
Verified	IP	Date 03/03/2010
Approved	IP	Date 03/03/2010

Client **LAND DEVELOPMENT AGENCY**

HUME WEST INDUSTRIAL ESTATE
SECTION 22 AND 21
HUME ACT

ROAD HIERARCHY PLAN

Status **EDP SUBMISSION**

Date	Datum	Scale	Size
DEC 2009	AHD	1:2500	A1

Drawing Number	Revision
292350-RHP-01	C

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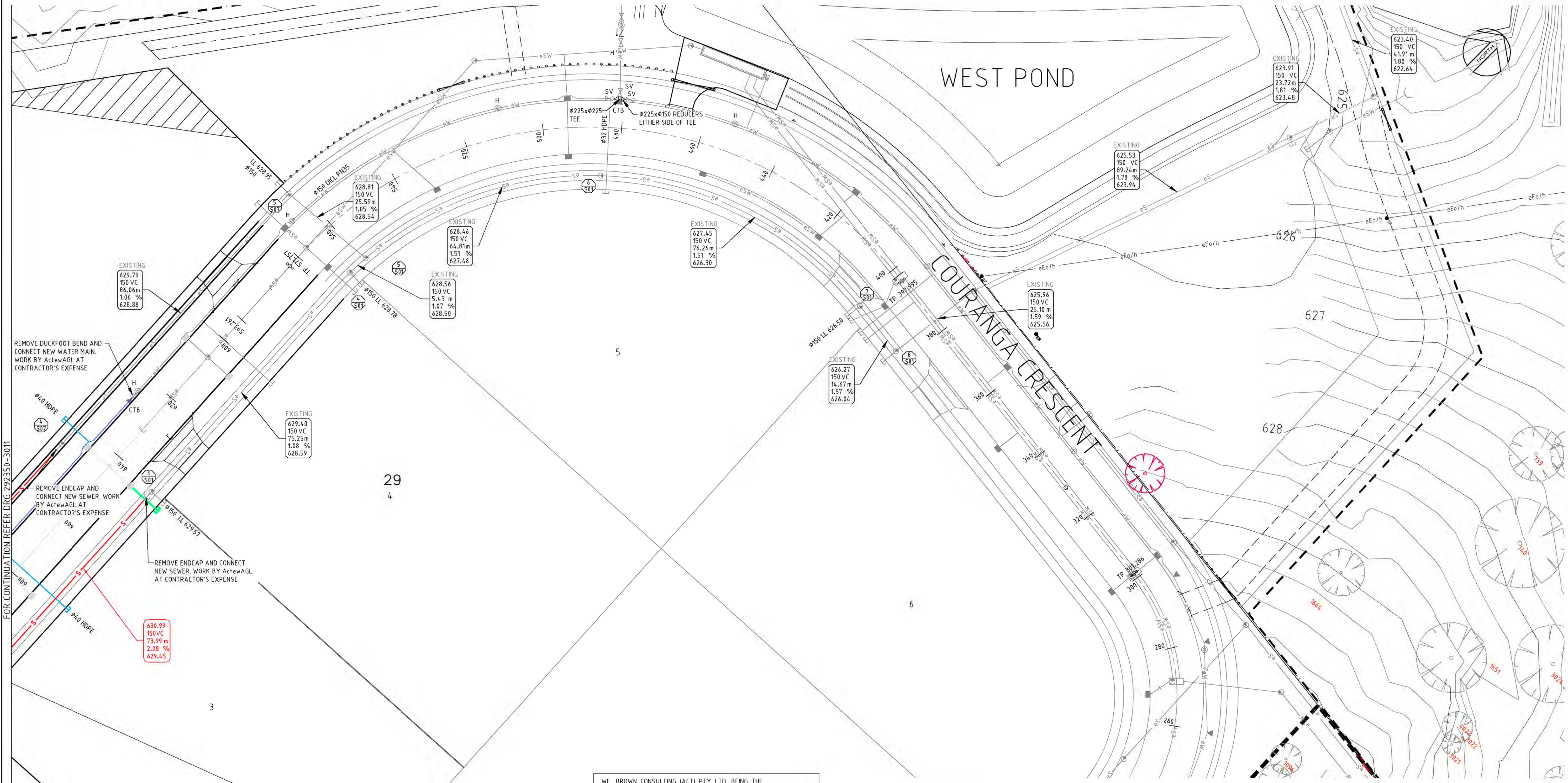
XREF's: X-CGD-TUGGERANONG; X-GRP-A1-SHT; BASE_HUMEWEST; x__WALKER KERBS; x__DMENT__AREA__BDRY; x__HUME__TCD__BASE; 12D DESIGN CONTOURS1; x__SURVEY DES CONT-STG C; X-Street names; X-ACT-A1-Logo
CAD FILE: H:\C12000\C12137\drawing\292350-3010-3013-HYD-S-W.dwg
DATE PLOTTED: 2 April 2013 2:50 PM BY : LEONARD GRIFFITHS

FOR CONTINUATION REFER DRG 292350-3011



LEGEND

▨ AREA OF BLOCK NOT ABLE TO BE SERVICED BY SEWER

WAE DATA APPLIED TO THESE DWGS BY BROWN CONSULTING. JAN. 2013
WAE NO:001288

WORKS AS EXECUTED INFORMATION PROVIDED BY BMD CONSTRUCTIONS

WE, BROWN CONSULTING (ACT) PTY LTD, BEING THE SUPERINTENDENT FOR THE PROJECT CERTIFY THAT WE HAVE UNDERTAKEN PERIODIC INSPECTIONS OF THE PROJECT DURING THE COURSE OF CONSTRUCTION INCLUDING OBSERVATIONS OF QUALITY RECORDS. THE QUALITY RECORDS ARE AVAILABLE FOR AUDIT. IT IS OUR PROFESSIONAL OPINION THAT THE WORK HAS BEEN CONSTRUCTED SUBSTANTIALLY IN ACCORDANCE WITH THE APPROVED PLANS AND THE PROJECT SPECIFICATION.

SIGNATURE: CPENG NO. 313197
T. CONNELL BE(HONS) MIE Aust
FOR AND ON BEHALF OF: BROWN CONSULTING (ACT) PTY LTD

WORK AS EXECUTED

2013/02/15
A. Connell BE(Hons), MIE Aust, CPEng. Date
BROWN CONSULTING (ACT) Pty Ltd

SEWER STRUCTURE DETAILS

LINE No	STRUC No	STRUC TYPE	EASTING	NORTHING	COVER LEVEL	REMARKS
S01	3	MH1050	212661.552	590392.875	631.544	EXISTING
	4	MH1050	212661.762	590468.12	630.064	EXISTING
	5	MH1050	212662.301	590473.523	629.951	EXISTING
	6	MH1050	212692.633	590529.132	628.703	EXISTING
	7	MH1050	212763.892	590548.641	628.100	EXISTING
	8	MH1050	212778.353	590546.193	628.253	EXISTING
	9	MH1050	212782.747	590570.906	628.109	EXISTING
	10	MH1050	212816.368	590653.566	625.415	EXISTING
	11	MH1050	212825.306	590675.542	624.668	EXISTING
S07	4	MH1050	212636.452	590386.519	631.681	EXISTING
	5	MH1050	212636.724	590472.582	630.033	EXISTING

NOTE:STRUCTURE CO-ORDINATES ARE MEASURED TO CENTER OF STRUCTURE

SHEET 2	SHEET 4
SHEET 1	SHEET 3

SHEET KEY

CAUTION:
CONTRACTOR TO CONFIRM THE LOCATION AND DEPTH OF ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF ANY WORKS
(HOLD POINT)

0 10 20 30 40 50m
10 8 6 4 2
SCALE 1:500

FOR CONTINUATION REFER DRG 292350-3012

Rev	Date	Description	Drawn	Appr.
A	16/01/2013	WAE	VVB	TC
1	02/04/2012	FOR CONSTRUCTION	PDJ	IP

Land Development Agency

Cardno Young
ABN: 24 008 579 404
Level 2, 14 Wormald Street Symonston, ACT, 2609
Ph (02) 6112 4500 Fax (02) 6112 4599
PO Box 7217, CPBC, ACT, 2610
Web: www.cardno.com.au

Quality System
Quality Endorsed Company
AS 9001 Lic. 5960 Standards Australia

Drawn	Original Signed (PDJ)	Date 22/02/2011
Designed	Original Signed (IP)	Date 22/02/2011
Checked	Original Signed (GZ)	Date 22/02/2011
Reviewed	Original Signed (GZ)	Date 22/02/2011
Approved	Original Signed (GL)	Date 22/02/2011

Client LAND DEVELOPMENT AGENCY

HUME WEST INDUSTRIAL DEVELOPMENT - STAGE C

HUME ACT

HYDRAULIC SERVICES PLANS
SEWER AND WATER - SHEET 4 OF 4

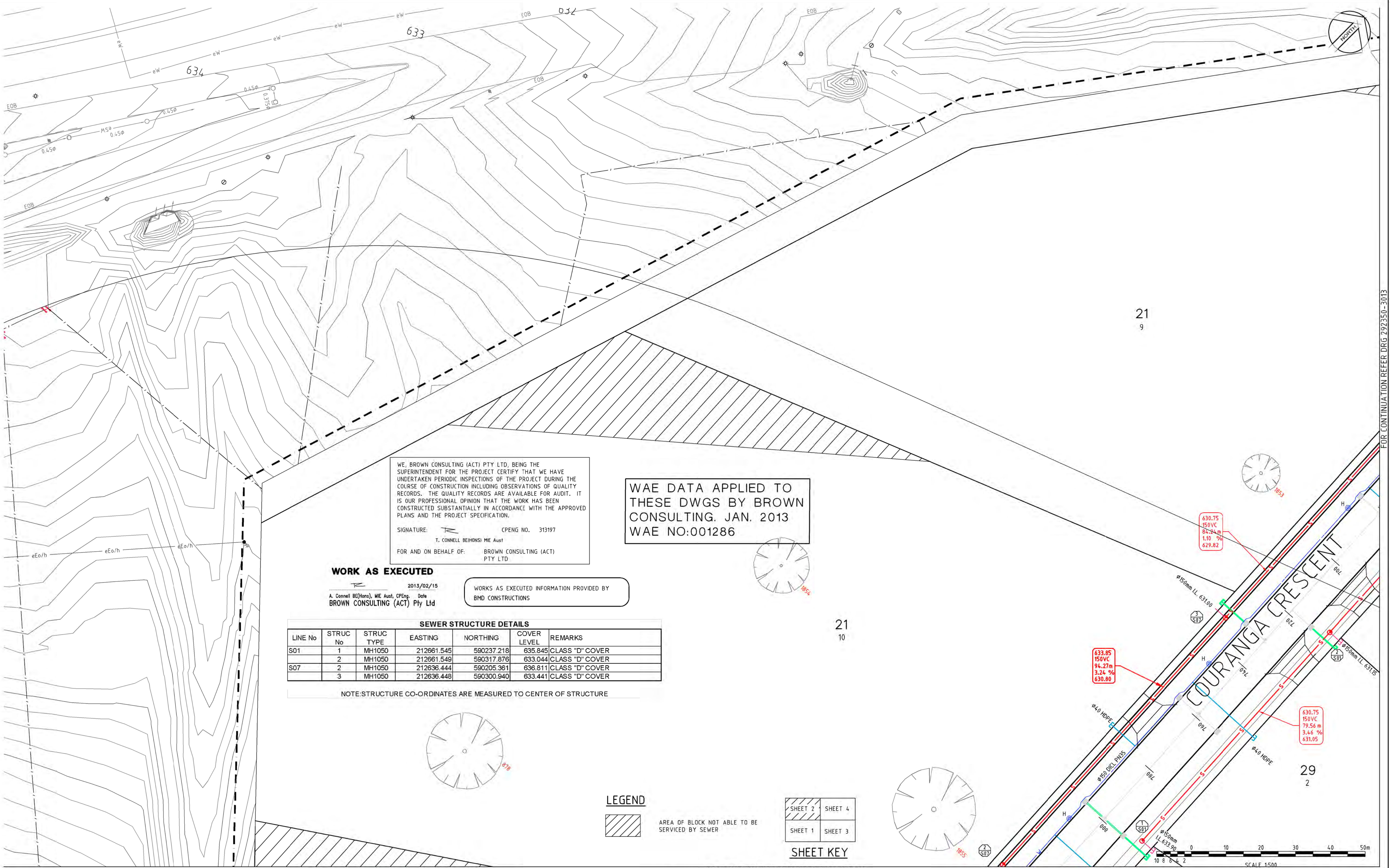
Status WORK AS EXECUTED

Date	Datum	Scale	Size
SEPT 2010	AHD	1:500	A1

Drawing Number 292350-3013
Revision A

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

XREF's: X-CGD-TUGGERANONG; X-GRP-A1-SHT; BASE_HUMEWEST; x_WALKER KERBS; x_DMENT_AREA_BDRY; x_HUME_TCD_BASE; 12D DESIGN CONTOURS1; x_SURVEY DES CONT-STG C; X-Street names; X-ACT-A1-Logo
CAD FILE: H:\C12000\C12137\drawing\292350-3010-3013-HYD-S-W.dwg
DATE PLOTTED: 2 April 2013 2:49 PM BY : LEONARD GRIFFITHS



WE, BROWN CONSULTING (ACT) PTY LTD, BEING THE SUPERINTENDENT FOR THE PROJECT CERTIFY THAT WE HAVE UNDERTAKEN PERIODIC INSPECTIONS OF THE PROJECT DURING THE COURSE OF CONSTRUCTION INCLUDING OBSERVATIONS OF QUALITY RECORDS. THE QUALITY RECORDS ARE AVAILABLE FOR AUDIT. IT IS OUR PROFESSIONAL OPINION THAT THE WORK HAS BEEN CONSTRUCTED SUBSTANTIALLY IN ACCORDANCE WITH THE APPROVED PLANS AND THE PROJECT SPECIFICATION.

SIGNATURE: CPENG NO. 313197
T. CONNELL BE(HONS) MIE Aust

FOR AND ON BEHALF OF: BROWN CONSULTING (ACT)
PTY LTD

WAE DATA APPLIED TO THESE DWGS BY BROWN CONSULTING. JAN. 2013
WAE NO:001286

WORK AS EXECUTED

2013/02/15
A. Connell BE(Hons), MIE Aust, CPEng. Date
BROWN CONSULTING (ACT) Pty Ltd

WORKS AS EXECUTED INFORMATION PROVIDED BY BMD CONSTRUCTIONS

SEWER STRUCTURE DETAILS

LINE No	STRUC No	STRUC TYPE	EASTING	NORTHING	COVER LEVEL	REMARKS
S01	1	MH1050	212661.545	590237.218	635.845	CLASS "D" COVER
	2	MH1050	212661.549	590317.876	633.044	CLASS "D" COVER
S07	2	MH1050	212636.444	590205.361	636.811	CLASS "D" COVER
	3	MH1050	212636.448	590300.940	633.441	CLASS "D" COVER

NOTE:STRUCTURE CO-ORDINATES ARE MEASURED TO CENTER OF STRUCTURE

LEGEND

▨ AREA OF BLOCK NOT ABLE TO BE SERVICED BY SEWER

SHEET 2	SHEET 4
SHEET 1	SHEET 3

SHEET KEY

FOR CONTINUATION REFER DRG 292350-3013

FOR CONTINUATION REFER DRG 292350-3010

Rev	Date	Description	Drawn	Appr.
A	16/01/2013	WAE	VVB	TC
3	02/04/2012	FOR CONSTRUCTION	PDJ	IP
2	20/01/2011	TaMS SUBMISSION	PDJ	IP
1		ACTEW SUBMISSION	PDJ	IP

Land Development Agency

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Drawn	Original Signed (PDJ) Date 22/02/2011
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Checked	Original Signed (GZ) Date 22/02/2011
Reviewed	Original Signed (GZ) Date 22/02/2011
Approved	Original Signed (GL) Date 22/02/2011

Client LAND DEVELOPMENT AGENCY

HUME WEST INDUSTRIAL DEVELOPMENT - STAGE C

HUME ACT

HYDRAULIC SERVICES PLANS
SEWER AND WATER - SHEET 2 OF 4

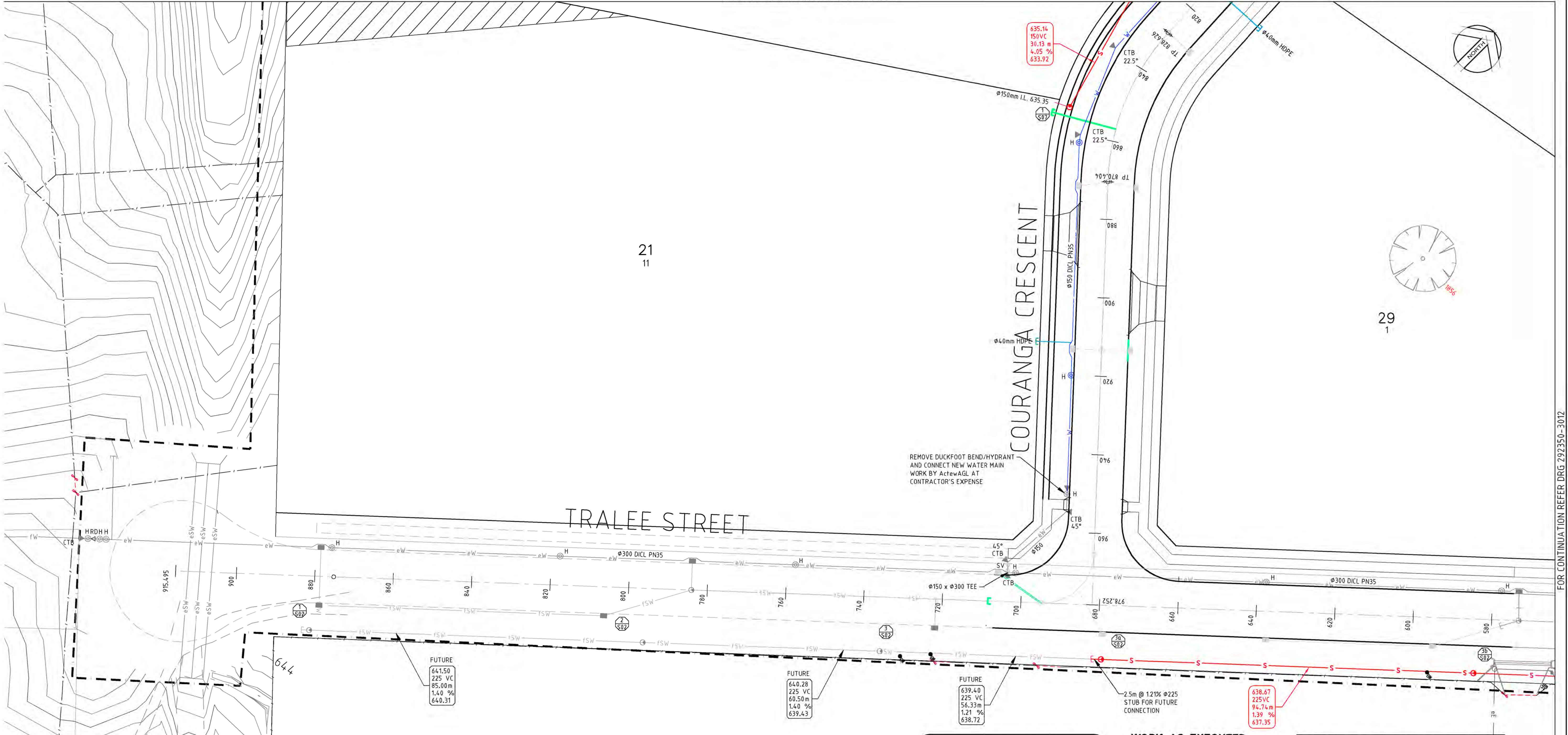
Status WORK AS EXECUTED

Date	Datum	Scale	Size
SEPT 2010	AHD	1:500	A1

Drawing Number 292350-3011
Revision A

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

FOR CONTINUATION REFER DRG 292350-3011



FOR CONTINUATION REFER DRG 292350-3012

WORKS AS EXECUTED INFORMATION PROVIDED BY
BMD CONSTRUCTIONS

WORK AS EXECUTED

2013/02/15
A. Connell BE(Hons), MIE Aust, CPEng. Date
BROWN CONSULTING (ACT) Pty Ltd

WAE DATA APPLIED TO
THESE DWGS BY BROWN
CONSULTING. JAN. 2013
WAE NO:001285

WE, BROWN CONSULTING (ACT) PTY LTD, BEING THE SUPERINTENDENT FOR THE PROJECT CERTIFY THAT WE HAVE UNDERTAKEN PERIODIC INSPECTIONS OF THE PROJECT DURING THE COURSE OF CONSTRUCTION INCLUDING OBSERVATIONS OF QUALITY RECORDS. THE QUALITY RECORDS ARE AVAILABLE FOR AUDIT. IT IS OUR PROFESSIONAL OPINION THAT THE WORK HAS BEEN CONSTRUCTED SUBSTANTIALLY IN ACCORDANCE WITH THE APPROVED PLANS AND THE PROJECT SPECIFICATION.

SIGNATURE: CPENG NO. 313197

T. CONNELL BE(HONS) MIE Aust

FOR AND ON BEHALF OF: BROWN CONSULTING (ACT) PTY LTD

LEGEND

▨ AREA OF BLOCK NOT ABLE TO BE SERVICED BY SEWER

SEWER STRUCTURE DETAILS

LINE No	STRUC No	STRUC TYPE	EASTING	NORTHING	COVER LEVEL	REMARKS
S01	3a	MH1050	212661.555	590439.730	630.620	CLASS 'D" COVER
S02	1	MH1050	212588.434	589945.869	644.010	FUTURE
	2	MH1050	212653.659	590000.373	642.860	FUTURE
	3	MH1050	212700.084	590039.167	642.044	FUTURE
	3a	MH1050	212742.988	590075.035	641.260	CLASS 'D" COVER
	3b	MH1050	212816.294	590136.408	640.137	CLASS 'D" COVER
S07	1	MH1050	212643.218	590174.814	637.614	CLASS 'D" COVER

NOTE:STRUCTURE CO-ORDINATES ARE MEASURED TO CENTER OF STRUCTURE

SHEET 2	SHEET 4
SHEET 1	SHEET 3

SHEET KEY

CAUTION:

CONTRACTOR TO CONFIRM THE LOCATION AND DEPTH OF ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF ANY WORKS (HOLD POINT)

0 10 20 30 40 50m
10 8 6 4 2
SCALE 1:500

XREF's: X-CGD-TUGGERANONG; X-GRP-A1-SHT; BASE_HUMEWEST; x_WALKER KERBS; x_DMENT_AREA_BDRY; x_HUME_TCD_BASE; 12D DESIGN CONTOURS1; x_SURVEY DES CONT-STG C; X-Street names; X-ACT-A1-Logo
CAD FILE: H:\C12000\C12137\drawing\292350-3010-3013-HYD-S-W.dwg
DATE PLOTTED: 2 April 2013 2:49 PM BY : LEONARD GRIFFITHS

Rev	Date	Description	Drawn	Appr.
A	16/01/2013	WAE	VVB	TC
3	02/04/2012	FOR CONSTRUCTION/ACTEWAGL APPROVAL	PDJ	IP
2	20/01/2011	TaMS SUBMISSION	PDJ	IP
1	22/12/2010	ACTEW SUBMISSION	PDJ	IP

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Client LAND DEVELOPMENT AGENCY

HUME WEST INDUSTRIAL DEVELOPMENT - STAGE C

HUME ACT

HYDRAULIC SERVICES PLANS
SEWER AND WATER - SHEET 1 OF 4

Status WORK AS EXECUTED

Date	Datum	Scale	Size
SEPT 2010	AHD	1:500	A1

Drawing Number 292350-3010
Revision A

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

HUME WEST
INDUSTRIAL DEVELOPMENT

Land Development Agency

PAGE 1 21 & 29 (BLOCK 1 & 11)
PAGE 2 21 & 29 (BLOCK 2 & 10)
PAGE 3 21 & 29 (BLOCK 9 & 3)

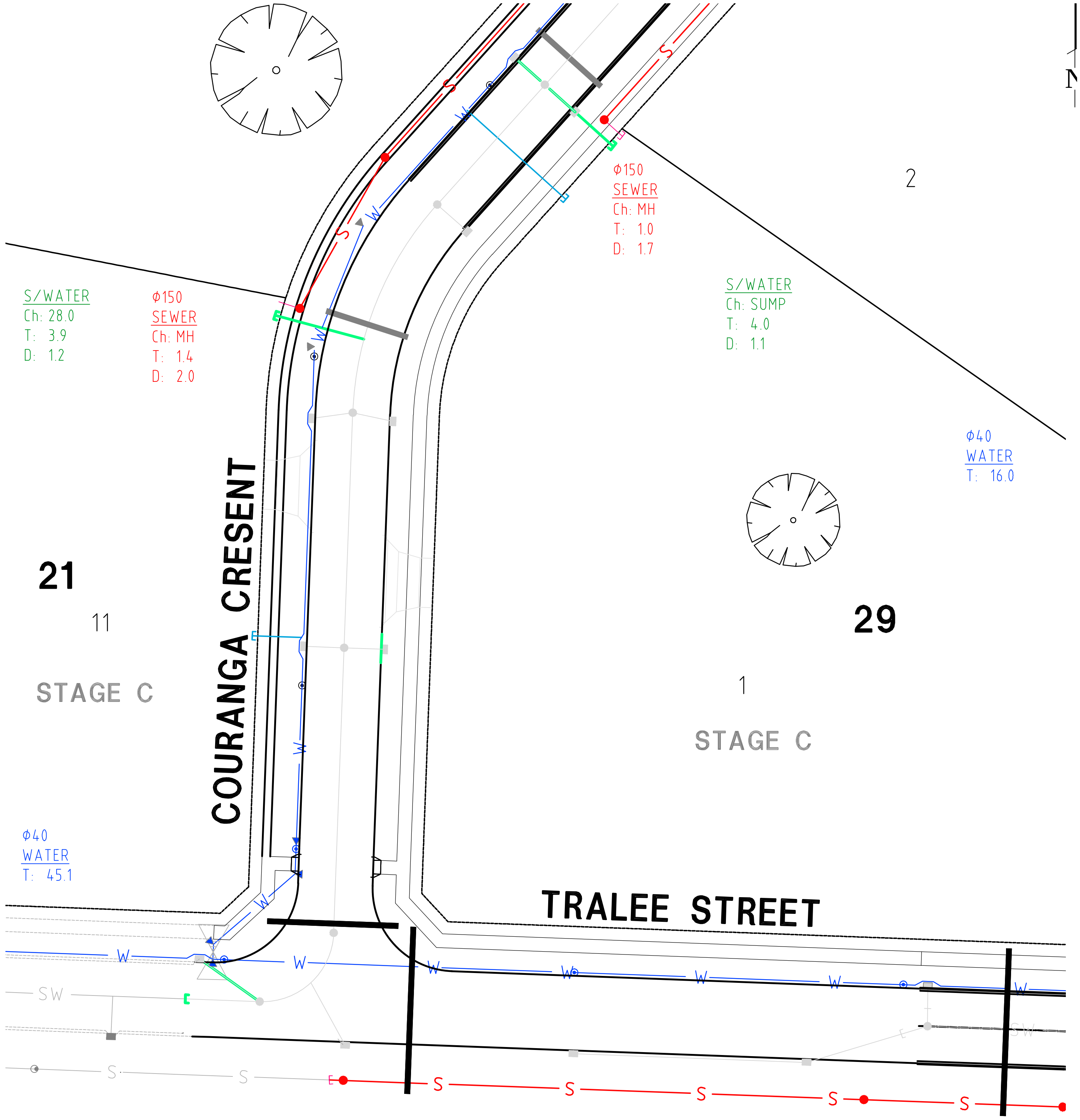
BROWN
Smart Consulting

WORKS AS EXECUTED INFORMATION PROVIDED BY
BMD CONSTRUCTIONS

C12137-TBSA+

FILE: H:\C12000\C12137\drawing\C12137#TB.dwg 19th-Feb-2013 11:15AM USER: Victor van bovene
Xref's: X-Section Numbers 1000

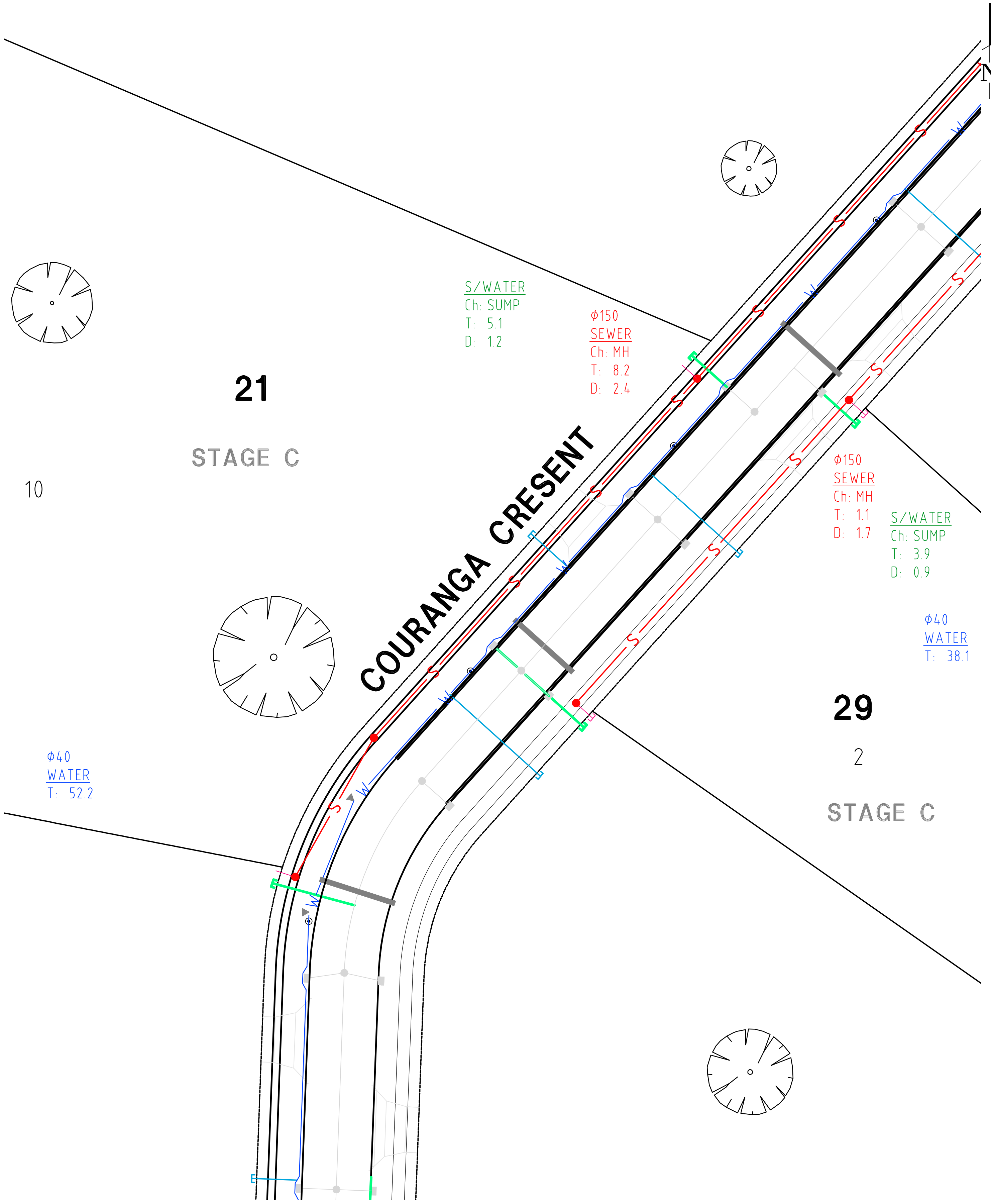
		CALCS	DRAWN	CHECK	APPROVED	DATE	AMENDMENT DETAILS
FIRST ISSUE		VVB	JB	JAB		19/02/2013	
AMENDMENTS	A						
	B						
	C						
	D						
	E						
	F						



WORKS AS EXECUTED INFORMATION PROVIDED BY
BMD CONSTRUCTIONS

SECTION 29 BLOCKS 1
SECTION 21 BLOCKS 11

HUME WEST INDUSTRIAL DEVELOPMENT - STAGE C

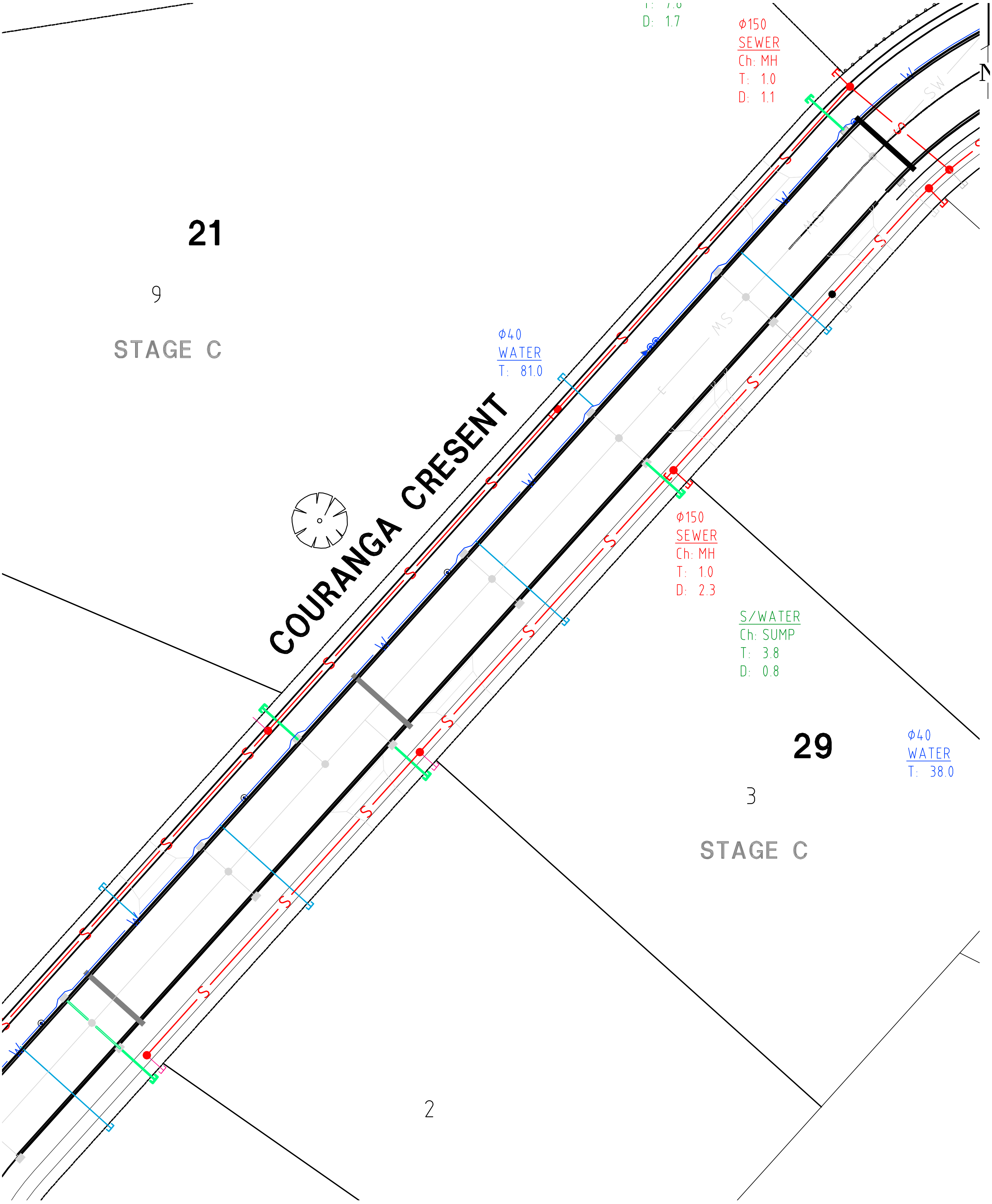


WORKS AS EXECUTED INFORMATION PROVIDED BY
BMD CONSTRUCTIONS

SECTION 29 BLOCKS 2
SECTION 21 BLOCKS 10

2

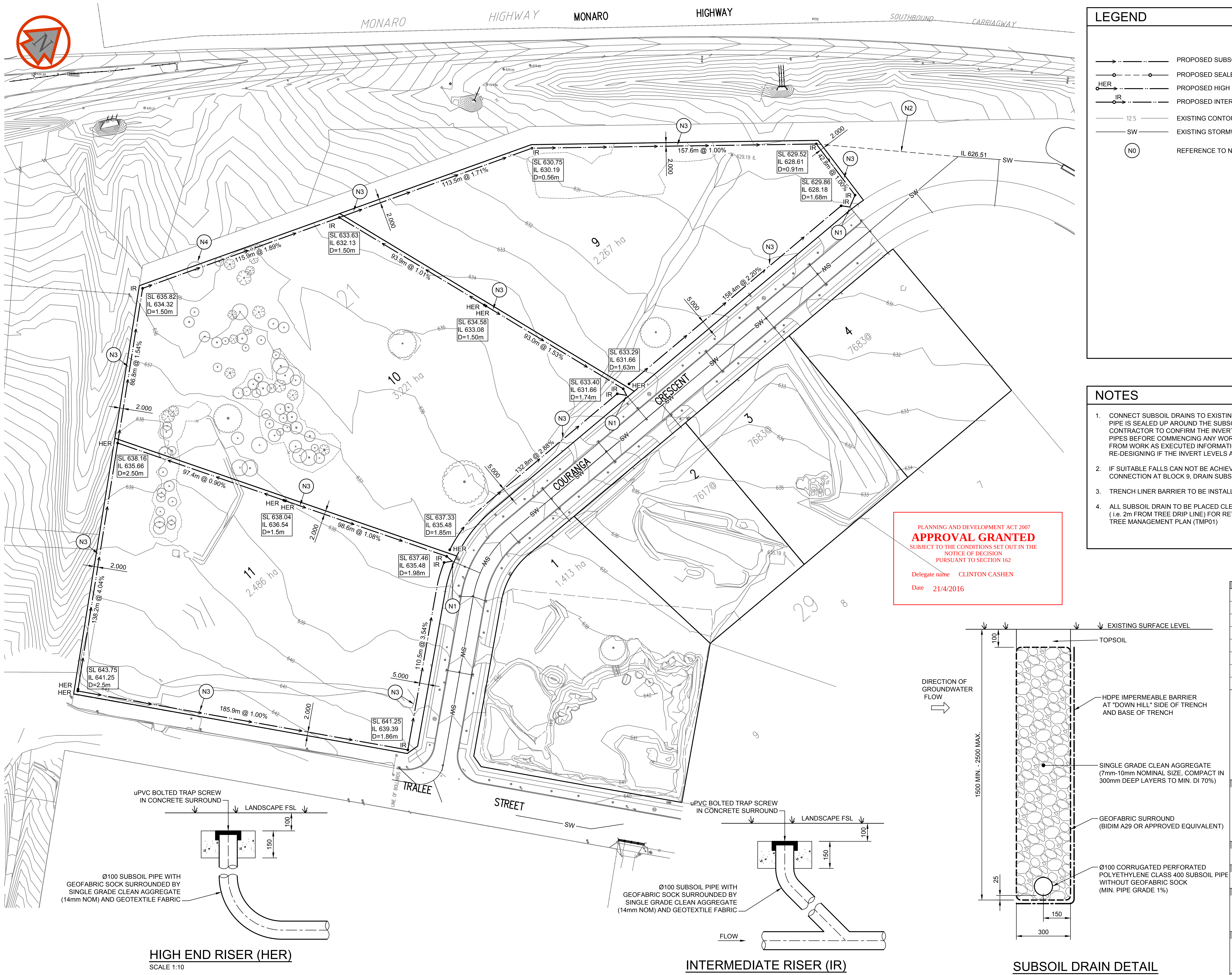
HUME WEST INDUSTRIAL DEVELOPMENT - STAGE C



WORKS AS EXECUTED INFORMATION PROVIDED BY
BMD CONSTRUCTIONS

SECTION 29 BLOCKS 3
SECTION 21 BLOCKS 9

HUME WEST INDUSTRIAL DEVELOPMENT - STAGE C



PLANNING AND DEVELOPMENT ACT 2007

APPROVAL GRANTED

SUBJECT TO THE CONDITIONS SET OUT IN THE
NOTICE OF DECISION
PURSUANT TO SECTION 162

Delegate name CLINTON CASHEN

Date 21/4/2016

LEGEND

PROPOSED SUBSOIL DRAINAGE LINE (REFER DETAIL BELOW)
PROPOSED SEALED SUBSOIL DRAINAGE LINE (Ø100 uPVC)
HER PROPOSED HIGH END RISER (REFER DETAIL BELOW)
IR PROPOSED INTERMEDIATE RISER (REFER DETAIL BELOW)
12.5 EXISTING CONTOUR
SW EXISTING STORMWATER
N0 REFERENCE TO NOTE SHOWN ON THIS DRAWING

NOTES

1. CONNECT SUBSOIL DRAINS TO EXISTING STORMWATER PROPERTY CONNECTION. ENSURE PIPE IS SEALED UP AROUND THE SUBSOIL DRAIN WITH CONCRETE. CONTRACTOR TO CONFIRM THE INVERT LEVELS OF THE EXISTING PROPERTY CONNECTION PIPES BEFORE COMMENCING ANY WORK. INVERT LEVELS SHOWN ON THE DRAWING ARE FROM WORK AS EXECUTED INFORMATION, AND SUBSOIL DRAINAGE MAY REQUIRE RE-DESIGNING IF THE INVERT LEVELS ARE HIGHER THAN ASSUMED.
2. IF SUITABLE FALLS CAN NOT BE ACHIEVED TO THE EXISTING STORMWATER PROPERTY CONNECTION AT BLOCK 9, DRAIN SUBSOIL DRAIN INTO EXISTING STORMWATER MANHOLE
3. TRENCH LINER BARRIER TO BE INSTALLED ON THIS SIDE OF TRENCH.
4. ALL SUBSOIL DRAIN TO BE PLACED CLEAR OF THE TREE PROTECTION ZONE. (i.e. 2m FROM TREE DRIP LINE) FOR RETAINED TREES. REFER TO TREE MANAGEMENT PLAN (TMP01)

HIGH END RISER (HER)
SCALE 1:10

INTERMEDIATE RISER (IR)
SCALE 1:10

SUBSOIL DRAIN DETAIL
SCALE 1:10

NOT FOR CONSTRUCTION
(ISSUED FOR DA APPROVAL)

Revision	Amendment	Approved	Revision Date
A	PRELIMINARY ISSUE	RAD	16.12.14
B	GRADING REVISED	MH	12.03.15

Land Development Agency
CANBERRA FIRST

OPUS
Canberra Office
+61 2 6133 2700

Unit 2, Level 1
99 Northbourne Avenue, Turner
ACT 2612, Australia

Designed	Approved	Approved Date
RAD	M.H.	MAR 2015

Drawn	Scale
RAD	1:1000 @ A1

Project
HUME WEST
ADDITIONAL WORKS
SUBSOIL DRAINAGE PLAN - BLOCKS 9-11

Client
LAND DEVELOPMENT AGENCY

Project No.	Sheet. No.	Revision
T-C0095.00	C0301	B

Original Sheet Size A1 [841x594] Plot Date 19 Mar 2015 @ 9:16 AM Path G:\30_Canberra_Projects\T-C0001 - T-C0099\T-C0095.00_Hume Stage C\Drawings\C_Civil\+AutoCAD\T-C0095.00_C0301.dwg C0301

Blocks 9, 10 & 11,
Section 21 Hume
(Stage 3, Hume West
Estate)

APPENDIX
B

SITE PHOTOS

Cardno
Shaping the Future

BLOCK 9

BLOCK 9

BLOCK 9

BLOCK 9

BLOCK 9

BLOCK 9

BLOCK 9

BLOCK 9

BLOCK 9

BLOCK 9

BLOCK 9

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GRAVEL ROAD ADJACENT BLOCK 11

GRAVEL ROAD ADJACENT BLOCK 11

GRAVEL ROAD ADJACENT BLOCK 11

GRAVEL ROAD ADJACENT BLOCK 11

Blocks 9, 10 & 11,
Section 21 Hume
(Stage 3, Hume West
Estate)

APPENDIX
C
CORRESPONDENCE

Josh Hewett

From: Russell, Meaghan <Meaghan.Russell@act.gov.au>
Sent: Tuesday, 3 May 2016 2:59 PM
To: Josh Hewett
Subject: RE: ACTMAPi General Enquiry [Filed 03 May 2016 18:03]
Attachments: Form_s56 Request for approval to publish.pdf

Hello Josh,

Thank you for your emails, seeking information on heritage places within – and in the immediate vicinity of – Blocks 9-11, Section 21, Hume and Blocks 76-77, Section 22, Hume.

Please note that there are a number of Aboriginal heritage places within these areas, and in order to access this restricted and sensitive information, a Section 56 application will need be submitted to the ACT Heritage Council. I have attached an application form for your reference, and this should be completed and returned to heritage@act.gov.au.

Please note that there is no cost associated with this application, and based on the number of current submissions, a response is likely to be received within 1-2 weeks.

I would also note that there are a number of non-restricted heritage sites within the search areas, and information on these heritage places can be accessed via the online ACT Heritage Register, which can be found at: http://www.environment.act.gov.au/heritage/heritage_register

Please give me a call if you have any questions at this stage.

Regards,
Meaghan

Meaghan Russell | Team Leader (Advice)
Phone: 6205 5497 I Email: meaghan.russell@act.gov.au
ACT Heritage I Environment and Planning I **ACT Government**
Dame Pattie Menzies House 16 Challis Street Dickson I GPO Box 158 Canberra ACT 2601
www.environment.act.gov.au

From: Josh Hewett [mailto:Joshua.Hewett@cardno.com.au]
Sent: Thursday, 28 April 2016 4:57 PM
To: Heritage Referrals
Subject: ACTMAPi General Enquiry

Hi,

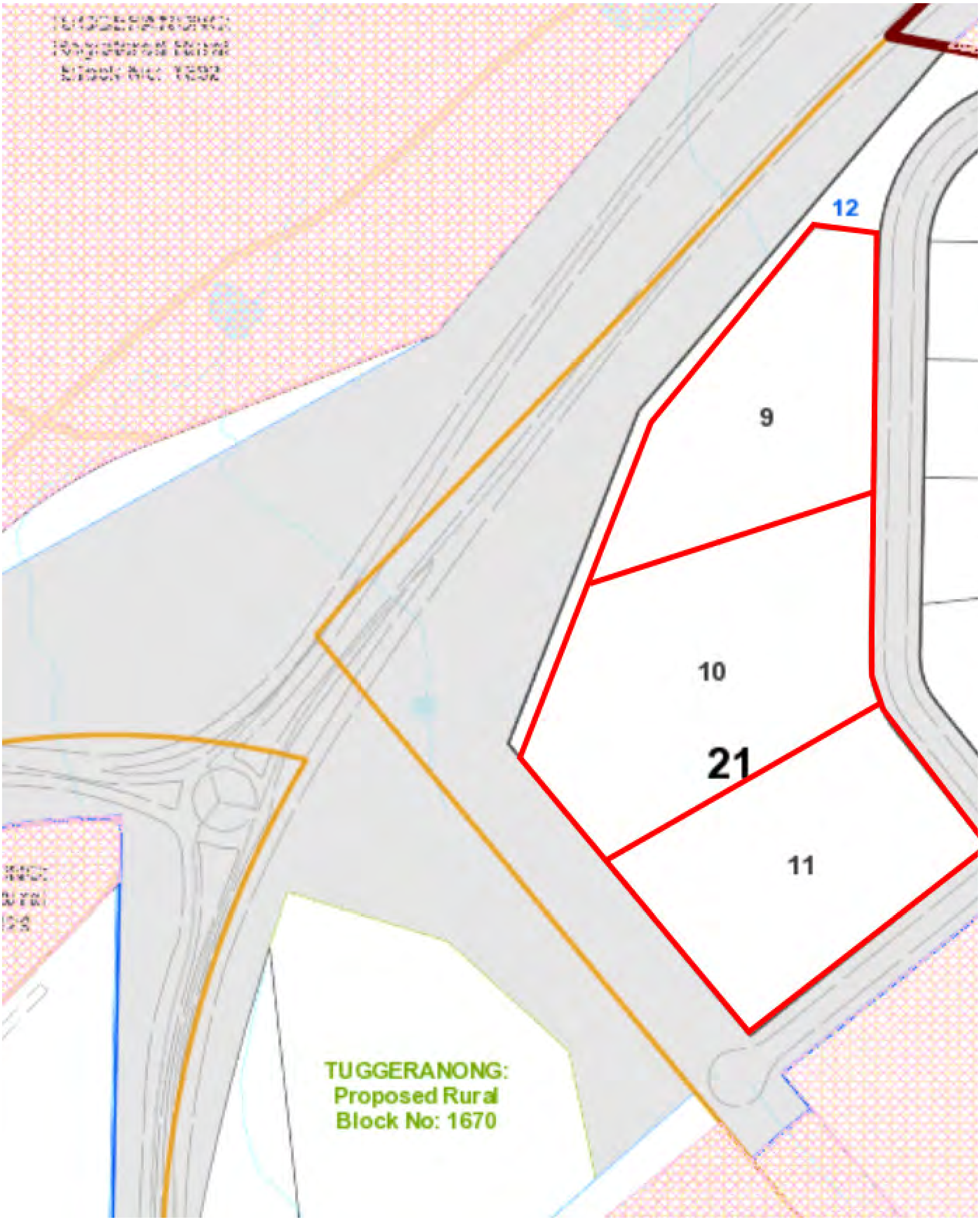
I am undertaking a site investigation on behalf of the LDA for Block 9, 10 and 11 Section 21 Hume.

I would like to request to be provided with more information on the heritage items near to the site as shown below in red. In particular whether there are any special requirements or restrictions on the development of the aforementioned blocks?

Any help with this enquiry is appreciated.

Kind regards,

Josh



Josh Hewett
CIVIL ENGINEER
CARDNO

Phone +61 2 6112 4500 Fax +61 2 6112 4599 Direct +61 2 6112 4502
Address Level 2
14 Wormald Street, Symonston, Australian Capital Territory 2609 Australia
Postal PO Box 40 Fyshwick ACT 2609
Email joshua.hewett@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO

Cardno's management systems are certified to ISO9001 (quality) and AS4801/OHSAS18001 (occupational health and safety)

Josh Hewett

From:	Havelka, Peter <Peter.Havelka@iconwater.com.au>
Sent:	Tuesday, 17 May 2016 3:46 PM
To:	Josh Hewett
Subject:	RE: SIR information request - B9, 10 & 11 S21 Hume

Hi Josh,

Contrary to what was previously advised; “The site is currently under defects liability period” is actually not the case and incorrect.
The system indicates the area to be under the defects period but after further investigation it actually is not.

I have advised the appropriate department to have this information rectified in Icon Waters system to avoid further incorrect advice

Regards
Peter

Peter Havelka
Technical Officer, Hydraulic Asset Acceptance

Icon Water
GPO Box 366 Canberra ACT 2601
T 02 6180 6015
iconwater.com.au | Twitter | YouTube | LinkedIn

From: Josh Hewett [mailto:Joshua.Hewett@cardno.com.au]
Sent: Tuesday, 3 May 2016 1:54 PM
To: Havelka, Peter
Subject: RE: SIR information request - B9, 10 & 11 S21 Hume

Much appreciated as always Peter!

Thanks again,

Josh

Josh Hewett
CIVIL ENGINEER
CARDNO

Cardno
Shaping the Future

Phone +61 2 6112 4500 Fax +61 2 6112 4599 Direct +61 2 6112 4502
Address Level 2
14 Wormald Street, Symonston, Australian Capital Territory 2609 Australia
Postal PO Box 40 Fyshwick ACT 2609
Email joshua.hewett@cardno.com.au Web www.cardno.com

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From: Havelka, Peter [mailto:Peter.Havelka@iconwater.com.au]
Sent: Tuesday, 3 May 2016 1:47 PM
To: Josh Hewett <Joshua.Hewett@cardno.com.au>
Subject: RE: SIR information request - B9, 10 & 11 S21 Hume

Hi Josh,

As per this morning's discussion this is the information I can offer you at this early stage:
Block 9:
Is currently identified as being serviced via a 100mm VC sewer tie and a 40mm water tie (including an apparent 20mm water meter)

Block 10
Is currently identified as being serviced via a 150mm VC sewer tie and a 40mm water tie (including an apparent 20mm water meter)

Block 11
Is currently identified as being serviced via a 150mm VC sewer tie and a 40mm water tie (including an apparent 20mm water meter)

All sewer ties connect into a 150mm VC Main while all water ties are coming off a 150mm CICL Main

The site is currently under defects liability period

I have requested a water pressure enquiry so I can provide you with further detail (hopefully towards the end of the week??)
In order to investigate if there is capacity in the sewer system Icon Water requires further information from you - in terms of flow rate

Regards
Peter

Peter Havelka
Technical Officer, Hydraulic Asset Acceptance

Icon Water
GPO Box 366 Canberra ACT 2601
T 02 6180 6015
iconwater.com.au | Twitter | YouTube | LinkedIn

From: Josh Hewett [mailto:Joshua.Hewett@cardno.com.au]
Sent: Thursday, 28 April 2016 8:21 AM
To: Havelka, Peter
Cc: O'Shannassy, Kieran
Subject: SIR information request - B9, 10 & 11 S21 Hume

Hi Peter/Kieran,

Cardno has been engaged for yet another Site Investigation for the LDA, this time for Blocks 9, 10 & 11, Section 21 Hume.

The blocks are intended to be sold as is for industrial and trade use but we have not been provided further details on what might actually be built at the site.

I have attached a locality plan showing the site as well as the DBYD information received.

Kieran,

Could I please receive any available WAE information for the area?

Peter,

Could you please confirm the following in regards to the above:

- Is the proposed development of these sites for industrial and trade use acceptable to Icon Water (is there capacity in the network??)
- Are there any Icon Water infrastructure requirements/constraints for the site for connection of or reticulation within the site; and
- Are there any significant constraints preventing use of the existing service connections?
- Could I please receive information relating to the available pressures at the mains outside these blocks including pressures during firefighting drawoff? Values at 40, 50, 60 and 150L/s drawoff would be most helpful.

Unfortunately, the LDA has placed tight deadlines on us for the delivery of this report due to an urgent sales request (report due next Wednesday), as such your assistance to us in meeting this objective for the Territory via a prompt reply at your earliest availability would be greatly appreciated.

Thanks again for your continued help with these investigations, feel free to give me a call if you need anything further.

Kind regards,

Josh

Josh Hewett
CIVIL ENGINEER
CARDNO

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Shaping the Future

Phone +61 2 6112 4500 Fax +61 2 6112 4599 Direct +61 2 6112 4502
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Josh Hewett

From: O'Shannassy, Kieran <Kieran.O'Shannassy@iconwater.com.au>
Sent: Monday, 2 May 2016 2:57 PM
To: Josh Hewett
Subject: RE: SIR information request - B9, 10 & 11 S21 Hume [Filed 03 May 2016 18:03]
Attachments: EW7737 (plt).pdf; EW7740 (plt).pdf; EW7811 (plt).pdf; EW7812 (plt).pdf; Hume_s21blks91011.pdf; EW7734 (plt).pdf

Josh

Hume info as requested.

Regards

Kieran

From: Josh Hewett [mailto:Joshua.Hewett@cardno.com.au]
Sent: Thursday, 28 April 2016 8:21 AM
To: Havelka, Peter
Cc: O'Shannassy, Kieran
Subject: SIR information request - B9, 10 & 11 S21 Hume

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Kind regards,

Josh

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CIVIL ENGINEER
CARDNO

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Shaping the Future

Phone +61 2 6112 4500 **Fax** +61 2 6112 4599 **Direct** +61 2 6112 4502
Address Level 2
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Postal PO Box 40 Fyshwick ACT 2609
Email joshua.hewett@cardno.com.au **Web** www.cardno.com

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DO NOT SCALE FROM DRAWINGS

GENERAL NOTES

1. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE THE CURRENT STANDARD FOR URBAN INFRASTRUCTURE AND THE SPECIFICATION (IF PROVIDED)
2. ALL CONSTRUCTION WORK SHALL BE CO-ORDINATED WITH ADJACENT CONTRACTS
3. THE LOCATION OF EXISTING SERVICES ARE SHOWN IN THEIR APPROXIMATE LOCATION ONLY. PRIOR TO ANY DEMOLITION, EXCAVATION, OR CONSTRUCTION ON SITE, THE CONTRACTOR SHALL CONTACT THE RELEVANT AUTHORITIES AND VERIFY THE LOCATION OF ALL UNDERGROUND SERVICES ON THE SITE AND OBTAIN NECESSARY CLEARANCES.
4. SURFACES WHICH LIE OUTSIDE THE GENERAL LIMITS OF LANDSCAPING AND RESTORATION WHICH ARE DISTURBED DURING THE CONSTRUCTION OF THE WORKS SHALL BE RESTORED BY THE CONTRACTOR, AT CONTRACTOR'S EXPENSE, TO AT LEAST THEIR PRE-CONSTRUCTION CONDITION. THESE SURFACES INCLUDE, BUT ARE NOT NECESSARILY LIMITED TO, PAVEMENTS, PAVING, GRASSING, ETC.
5. ALL DESIGN SUBGRADE VALUES MUST BE CONFIRMED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF CONSTRUCTION.
6. RESULTS OF SUBGRADE TESTS MUST BE MADE AVAILABLE TO THE SUPERINTENDENT WITHIN 24 HOURS OF RECEIPT. IF THE CBR IS LESS THAN CURRENTLY NOTED THEN A PAVEMENT RE-DESIGN WILL BE REQUIRED BEFORE PROCEEDING.
7. DESIGN LEVELS SHOWN ARE A.H.D.

STORMWATER PIPE NOTES

1. STORMWATER PIPES TO BE EITHER:
   a)CLASS "2" STEEL REINFORCED CONCRETE COMPLYING WITH AS4058 AND AS3725; OR
   b)CLASS "2" FIBRE REINFORCED CONCRETE COMPLYING WITH AS4139; OR
   c) uPVC SOLID WALL OR APPROVED STRUCTURED WALL IN ACCORDANCE WITH AS/NZS1260. Ø100 PIPES TO BE CLASS SN6 AND SOLVENT WELDED. Ø150 PIPES AND ABOVE TO BE CLASS SN8 RUBBER RING JOINTED.
   BACKFILL CONDITIONS TO BE AS SHOWN ON DRG No 272211-1034
2. STORMWATER PIPES UP TO AND INCLUDING Ø675 UNDER ROAD PAVEMENT TO BE RRJ. ELSEWHERE UP TO AND INCLUDING Ø375 TO BE RRJ.
3. ENDCAPS TO STORMWATER MAINS TO BE CONSTRUCTED OF LEAN MIX CONCRETE TO COMPLETELY SEAL PIPE.
4. CONNECTION TO STORMWATER PIPES WITH A BRANCH CONNECTION OF Ø100 OR Ø150 uPVC SHALL BE WITH FRC SADDLE ADAPTER OR A uPVC BRANCH.
5. MINIMUM GRADES ON Ø100 AND Ø150 uPVC STORMWATER SHALL BE 1.0% UNLESS NOTED OTHERWISE.
6. ALL PIPE LENGTHS, PIPE INVERTS AND LEVELS AND GRADES ARE MEASURED AT CENTRE OF STORMWATER STRUCTURE.
7. FOR SWALE DETAILS ADJACENT TO ROADS REFER ROAD CROSS SECTIONS.
8. SCOUR STOPS FOR STORMWATER PIPES SHALL BE CONSTRUCTED AT 5m MAXIMUM SPACING FOR ALL PIPES GREATER THAN 7%
9. STORMWATER SUMPS DEEPER THAN 900mm TO HAVE STEP IRONS AS SHOWN ON DUS STD DRG No ST-0017
10. SEWER AND STORMWATER BLOCK CONNECTION BRANCHES SHALL BE 100mm DIAMETER UNLESS SHOWN OTHERWISE
11. TERMINATION OF TIES SHALL BE FOR:-
    WATERMAIN: IN ACCORDANCE WITH ACTEW STD DRG No WSS 020.

    STORMWATER: IN ACCORDANCE WITH DUS STD DRG No ST - 0001 AND SHALL BE DEEP ENOUGH TO SERVICE THE WHOLE BLOCK WITH MINIMUM GRADE OF 0.5% AND MAXIMUM OF 10%

    SEWER IN ACCORDANCE WITH ACTEW STD DRG No WSS 054 EXCEPT THAT WHERE THE TIE IS NOT AT THE LOWEST POINT ON THE BLOCK, THE GRADE SHALL BE 2%, COVER AT THE BOUNDARY OF AT LEAST 600mm.
12. COVER LEVELS SHOWN ARE FOR GUIDANCE ONLY AND SHALL BE CONFIRMED ON SITE.
13. THE CONTRACTOR SHALL ALLOW TO CONSTRUCT THE COVER ON A PLANE TO SUIT THE FINAL SURFACE PLANE.
14. ALL BACKFILLING UNDER ROAD AND CARPARK PAVEMENTS AND PAVING SHALL BE IN ACCORDANCE WITH THE SPECIFICATION AND THE DRAWINGS.
15. EASEMENTS FOR SINGLE SERVICE SHALL BE IN ACCORDANCE WITH ACTEW STANDARDS.

SUBSOIL DRAINAGE NOTES

1. ALL SUBSOIL DRAINAGE SHALL BE 100mm DIAMETER CLASS SN20 PIPE.
2. ø100 uPVC CLASS "SN20" SHALL BE USED WHERE SUBSOIL PIPE CROSSES ROAD PAVEMENTS, MIN. GRADE 1.0%.
3. CONNECTION OF SUBSOIL DRAINS TO SUBSOIL DRAINS SHALL BE WITH MANUFACTURED FITTINGS AND DUCT TAPED TO SECURE PIPE TO FITTING.
4. GRADE SUBSOIL AT MINIMUM 1.0% FROM OUTLET POINT.
5. 7mm CRUSHED ROCK FILTER MATERIAL IN SUBSOIL DRAINS SHALL BE COMPACTED TO A DENSITY INDEX OF 70%

CONDUIT NOTES △A

1. GAS CONDUITS SHALL BE AS NOTED ON DRG 292350-1096 to 1098.
2. ELECTRICAL CONDUITS SHALL BE ø125mm HEAVY DUTY uPVC ORANGE.
3. COMMUNICATION CONDUITS SHALL BE ø100mm HEAVY DUTY uPVC WHITE.
4. ALL CONDUITS SHALL BE PROVIDED WITH DRAW WIRES AND END CAPPED AND SEALED.

WORK AS EXECUTED

Sign: Date: 20/11/12
T Connell, BE Civil(Hons) MIEAust CPEng
BROWN CONSULTING (ACT) Pty Ltd

WORKS AS EXECUTED INFORMATION PROVIDED BY
BMD CONSTRUCTIONS

WATER SUPPLY

1. ALL WORK CARRIED OUT ON, OVER OR ADJACENT TO ACTEWAGL WATERMAIN SHALL BE CARRIED OUT IN ACCORDANCE WITH ACTEW REQUIREMENTS AND CURRENT STANDARDS.

WATER PIPE NOTES

1. ALL WORK ASSOCIATED WITH WATER SUPPLY & SEWERAGE SHALL BE IN ACCORDANCE WITH ACTEW WATER SUPPLY AND SEWERAGE STANDARDS, RELEASE 2
2. WATER SUPPLY PIPES TO BE DICL CLASS PN35 COMPLYING WITH AS1477. BACKFILLED CONDITIONS TO BE AS SHOWN ON DRG No 292350-1034.
3. WATER SUPPLY PIPES SHALL HAVE A MINIMUM COVER OF 0.6m EXCEPT UNDER TRAFFICKED AREAS WHERE THE MINIMUM COVER SHALL BE 0.75m
4. ANGLES SHOWN FOR DUCTILE IRON BENDS SUIT THE NEAREST AVAILABLE FITTING. THE CONTRACTOR SHALL, WITHOUT EXTRA COST, PROVIDE THE REQUIRED ANGLE OR LAY THE ADJACENT SECTIONS OF THE MAIN SO THAT THEY INTERSECT AT THE REQUIRED BEND ANGLE
5. ALL PIPE FITTINGS FOR PIPES Ø225 AND LARGER SHALL BE SLEEVED IN POLYETHYLENE AND COMPLY WITH AS3680 AND AS3681.
6. SCOUR TRENCH STOPS FOR WATER SUPPLY PIPES SHALL BE IN ACCORDANCE WITH ACTEW STD DRG No WSS 012
7. △2 WATER SERVICE CONNECTIONS TO DICL PIPES ARE TO BE MADE USING READYTAP CONNECTORS.
8. WATER MAIN DEAD ENDS SHALL TERMINATE WITH A HYDRANT FLUSHING BEND AND ANCHOR BLOCK
9. MINIMUM BEARING PRESSURE FOR THRUST BLOCKS TO BE 50kPa. BEARING PRESSURE TO BE DETERMINED BY THE CONTRACTOR'S GEOTECHNICAL ENGINEER AND PROVIDED TO THE SUPERINTENDENT. THRUST BLOCK DIMENSIONS TO BE DETERMINED IN ACCORDANCE WITH ACTEW STD DRG No WSS 013 AND WSS 014
10. WHERE THRUST BLOCKS FROM WATERMAIN BEAR AGAINST OTHER TRENCHES, THESE TRENCHES ARE TO HAVE ENGINEERED BACKFILL FOR THE COMPLETE TRENCH DEPTH OF THE ZONE OF INFLUENCE
11. FOR DETAIL OF HYDRANT MARKERS ON ROAD REFER ACTEW STD DRG No WSS027
12. △2 ALL WATER SERVICE LINES SHALL BE A MINIMUM 40mm OD HDPE UNLESS NOTED OTHERWISE MATERIAL TO BE HDPE CLASS PN16 TO AS 4130. HDPE MUST BE LAID SO AS NOT TO KINK. APPROVED FITTINGS MAY BE REQUIRED AT BENDS TO THE SATISFACTION OF THE SUPERINTENDENT. TRACER WIRE SHALL BE TAPED TO PIPE AND CLAMPED TO STOP COCK
13. ALL DICL PIPE FITTINGS SHALL COMPLY WITH ACTEW DESIGN GUIDELINES
14. ALL CONNECTIONS AND DISCONNECTIONS TO EXISTING WATER MAINS TO BE UNDERTAKEN BY ACTEWAGL. CONTRACTOR IS TO PROVIDE MATERIALS, CARRY OUT ALL NECESSARY EXCAVATION AND PAY ALL FEES.
15. △2 THE CONTRACTOR SHALL POT HOLE THE EXISTING Ø300mm WATERMAIN EVERY 20m TO DETERMINE THE EXACT LOCATION OF THE MAIN IN RELATION TO THE NEW ROAD 4 KERB LINE. THE CONTRACTOR SHALL PROVIDE THIS INFORMATION TO THE SUPERINTENDENT AND ACTEW TO DETERMINE THE EXTENT OF EXISTING MAIN TO BE EXHUMED.

EROSION AND SEDIMENT CONTROL NOTES

1. ALL MEASURES SHALL BE IN ACCORDANCE WITH THE A.C.T. "GUIDELINES FOR EROSION AND SEDIMENT CONTROL ON BUILDING SITES" AND ENVIRONMENT ACT EROSION AND SEDIMENT CONTROL DURING LAND DEVELOPMENT.
2. PROVIDE FILTER ROLLS TO ALL NEW SUMPS AND NEW GRATED SUMPS, WHEN COMPLETED, DURING CONSTRUCTION.
3. PROVIDE SILT FENCE LOCATED AS SHOWN.
4, REMOVE STABILISED CONSTRUCTION ACCESS AT COMPLETION OF THE WORKS AND REINSTATE VERGE.

TRAFFIC CONTROL DEVICES

1. ALL TRAFFIC CONTROL DEVICES SHALL BE IN ACCORDANCE WITH A.S.1742, 1743 AND 1744. EXCEPT WHERE MODIFIED BY "THE TERRITORY AND MUNICIPAL SERVICES DESIGN STD 9 - TRAFFIC CONTROL DEVICES."
2. MANUFACTURE/ERECT/INSTALL ALL TRAFFIC CONTROL DEVICES IN ACCORDANCE WITH THE SPECIFICATION.
3. LONG LIFE MATERIAL (LLM) SUCH AS THERMOPLASTICS, COLD APPLIED PLASTIC CEMENT BASED PRODUCTS CAPABLE OF HAVING QUARTZ APPLIED, SHALL BE USED FOR PAVEMENT MARKINGS AND LINES IN ACCORDANCE WITH "THE TERRITORY AND MUNICIPAL SERVICES DESIGN STD 9 - TRAFFIC CONTROL DEVICES."

LANDSCAPING

1. ALLOW IN THE WORKS THE NECESSARY SET-DOWNS, LEVELS AND GRADES FOR LANDSCAPE FINISHES TO BE APPLIED. REFER TO LANDSCAPE ARCHITECT'S DRAWING'S FOR DETAILS OF FINISHES AND TREE REMOVAL.

EARTHWORKS

1. △A ALL FILL PLACED WITHIN BLOCK BOUNDARIES SHALL BE TO LEVEL 1 STANDARD AND COMPLY WITH CLAUSE 2.06.6 CONTROLLED FILLING : OF THE ACT STANDARD SPECIFICATION.
2. EXCAVATE EROSION GULLIES TO UNDISTURBED FIRM SUBGRADE AND BACKFILL TO DESIGN CONTOURS. COMPACT TO 95% M.M.D.D. AND IN ACCORDANCE WITH NOTE 1 ABOVE.
3. △A CONTOURS SHOWN ON DRAWINGS OTHER THAN GENERAL ARRANGEMENT AND DEMOLTION DRAWINGS ARE FINISHED LEVEL CONTOURS.

STABILISED CONSTRUCTION ENTRANCE NOTES

1. DIMENSIONS SHOWN ARE MINIMUMS ONLY. THE CONTRACTOR SHALL CONSTRUCT THE FACILITY TO A SIZE THAT WILL PERFORM IN A MANNER WHICH SATISFIES THE REQUIREMENTS OF THE CONTRACT.
2. STONE - CRUSHED STONE 50mm TO 75mm NOMINAL SIZE ON HIGH STRENGTH GEOMETRIES FABRIC.
3. WASHING DOWN OF WHEELS AND BODY SURFACES OF ALL VEHICLES AND PLANT LEAVING THE SITE TO PREVENT THE CARRIAGE OF SEDIMENT ONTO STREETS IS REQUIRED.
4. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO ADJACENT ROADS AND STREETS. THIS MAY REQUIRE PERIODIC TOP DRESSING OF THE ENTRANCE WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEARANCE OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO ROADS MUST BE REMOVED IMMEDIATELY BY THE CONTRACTOR.
5. DIVERT RUNOFF AWAY FROM ACCESS POINT.

STORMWATER STRUCTURE NOTATION

DE	DENOTES DEAD END
GPT	DENOTES GROSS POLLUTANT TRAP
GS	DENOTES GRATED SUMP REFER DUS STD DRG No ST-0013
HW	DENOTES HEADWALL REFER DUS STD DRG No ST-0022
MH	DENOTES MANHOLE REFER DUS STD DRG No ST-0014
SCMH	DENOTES SPECIAL CHAMBERED MANHOLE REFER DUS STD DRG No ST-0015
HDMH	DENOTES MANHOLE WITH HEAVY DUTY LID
R	DENOTES SUMP TYPE R REFER DUS STD DRG No ST-0011 & ST-0012
RS	DENOTES SEALED R TYPE SUMP
SS	DENOTES SURCHARGE STRUCTURE REFER DUS STD DRG No ST-0016
PS	PLANTATION SUMP REFER DUS STD DRG No ST-0013
BC	BRANCH CONNECTION
6/12	STORMWATER STRUCTURE '6' STORMWATER LINE '12'

STORMWATER PIPE NOTATION

EXISTING	NEW	FUTURE	
610.23	610.23	610.23	UPSTREAM INVERT LEVEL
450-'2'	300 -'2'	300 -'2'	PIPE DIAMETER, CLASS
3.20 m	22.25M	21.72 M	PIPE LENGTH
3.75 %	3.30 %	2.62 %	PIPE GRADE
310.110	608.78	641.521	DOWNSTREAM INVERT LEVEL

SEWER PIPE NOTES

1. ALL WORK ASSOCIATED WITH WATER SUPPLY & SEWERAGE SHALL BE IN ACCORDANCE WITH ACTEW WATER SUPPLY AND SEWERAGE STANDARDS, RELEASE 2.
2. SEWER PIPES TO BE VITRIFIED CLAY(VC) CLASS 4.
3. △2 BACKFILL CONDITIONS TO BE AS SHOWN ON DRG 292350-1034.
4. SCOUR AND TRENCH STOPS FOR SEWER PIPES SHALL BE CONSTRUCTED IN ACCORDANCE WITH ACTEW STD DRAWING WSS 0012.
5. ALL CONNECTIONS AND DISCONNECTIONS TO EXISTING COMMISSIONED SEWER MAINS TO BE UNDERTAKEN BY ACTEWAGL. CONTRACTOR IS TO PROVIDE MATERIALS, CARRY OUT ALL NECESSARY EXCAVATION, AND PAY ALL FEES.
6. THE MINIMUM PERMISSIBLE GRADE FOR SEWER TIES IS TWO PERCENT.
7. SEWER MANHOLES REQUIRING TO BE OFF-SET SHALL BE IN ACCORDANCE WITH WSS-062
8. △2 SEWER TIES SHALL BE Ø100mm UNLESS NOTED OTHERWISE
9. △2 ABANDONED SEWER LINE SHALL HAVE MANHOLE CONES REMOVED, INLET AND OUTLETS SEALED AND BARREL BACKFILLED WITH SUB-BASE OR SIMILAR.
10. △C ALL SEWER MANHOLES ARE CAST INSITU UNLESS NOTED OTHERWISE.

SEWER STRUCTURE NOTATION

MH	DENOTES MANHOLE. REFER TO ACTEW STANDARD DRAWING No.WSS 052 FOR DETAILS.
HDMH	DENOTES MANHOLE WITH HEAVY DUTY COVER
DE	DENOTES DEAD END CAPPED FOR FUTURE CONNECTION
6/S12	SEWER STRUCTURE '6' SEWER LINE '12'

ALL STRUCTURE COVERS SHALL BE DESIGNED AND INSTALLED IN ACCORDANCE WITH AS3996

SEWER PIPE NOTATION

DESIGN		EXISTING	FUTURE
609.85	UPSTREAM INVERT LEVEL	609.85	609.85
150 VC	PIPE DIAMETER, CLASS	150 VC	150 VC
65.0 m	PIPE LENGTH	65.0 m	65.0 m
1.20 %	PIPE GRADE	1.20 %	1.20 %
609.07	DOWNSTREAM INVERT LEVEL	609.07	609.07

VERGE MANAGEMENT PLAN

1. THERE SHALL BE NO PARKING, SITE SHEDS, SITE AMENITIES, BILLBOARDS OR STORAGE OF MATERIALS ON THE VERGE OR FLOODWAY OPEN SPACE UNDER ANY CIRCUMSTANCES. PROTECT ALL GRASSLAND TREES AND SHRUBS OUTSIDE THE WORKS AREA FROM DAMAGE.
2. ANY WORKS THAT ALTER OR DISTURB GRASSED FLOODWAYS, VERGE AREAS, MEDIANS OR OTHER OPEN AREAS MUST BE REINSTATED TO EXISTING CONDITION BY THE PERSON(S) RESPONSIBLE FOR THE DISTURBANCE IN ACCORDANCE WITH THE CANBERRA LANDSCAPE GUIDELINES AND TO THE SATISFACTION OF PARKS, CONSERVATION AND LANDS (PCL). IF THE DRYLAND GRASS MIXTURE USED CONTAINS TALL FESCUE, IT IS TO BE DWARF TYPE TALL FESCUE. THE RECOMMENDED DRYLAND GRASS MIXTURES ARE SPECIFIED IN THE PARKS, CONSERVATION AND LANDS (PCL) TURF MANAGEMENT MANUAL.
3. FENCING TO PROTECT EXISTING VERGE (REFER LEGEND)
   - FENCING TO BE ERECTED ON COMMENCEMENT OF SITE WORK AND REMOVED AT COMPLETION OF COMMENCEMENT OF VERGE RESTORATION.
   - THE FENCE IS TO REMAIN CONTINUOUS THROUGHOUT THE PROJECT, EXCEPT WHERE SERVICE TRENCHING OCCURS. REALIGN FENCE TO PROVIDE LANE FOR SERVICE TRENCHING BUT RE-ERECT FENCE TO ENCLOSE TREES BEFORE
   - TRENCHING COMMENCES AND ON COMPLETION OF TRENCHING RETURN TO ORIGINAL FENCE ALIGNMENT.
4. EXISTING TREES
   - ALL TREES ARE TO BE RETAINED AND KEPT UNDAMAGED UNLESS SHOWN OTHERWISE.
   - EXISTING CROWN CLEARANCE NOT TO BE ALTERED
   - ENSURE CONSTRUCTION EQUIPMENT CAN PASS BENEATH LOWEST LIMB, THROUGH DRIVEWAY ACCESS.
   - CROWNS AND APEX OF CANOPY NOT TO BE ALTERED OR REDUCED.
   - ENSURE LIFTING EQUIPMENT AND LOAD CAN CLEAR HEIGHT AND WIDTH OF TREE CROWN WITHOUT DAMAGE TO CROWN.
   - ANY SERVICE CONNECTIONS WITHIN 2m OF AN EXISTING TREE CANOPY TO BE APPROVED BY PCL.
5. PARKS, CONSERVATION AND LANDS (Ph 13 22 81) TO BE CONTACTED.
   - PRIOR TO THE COMMENCEMENT OF SITE WORKS TO OBTAIN CERTIFICATE OF COMPLIANCE FOR THE VERGE MANAGEMENT PLAN.
   - ON COMMENCEMENT AND COMPLETION OF VERGE RESTORATION
6. VERGE RESTORATION IS TO BE OVERSEEN BY A LANDSCAPE ARCHITECT.
7. EXCAVATION THAT OCCURS WITHIN THE DRIP ZONE OF A TREE MUST BE APPROVED AND IS TO BE RESTRICTED TO ONE SIDE OF THE TREE ONLY. WHERE EXCAVATION IS APPROVED THE FOLLOWING MEASURES ARE TO BE ADOPTED FOR TREE PROTECTION.
   - DO NOT SEVER LARGE ROOTS (>30mm DIA.) CLOSER THAN HALFWAY FROM THE DRIPLINE TO THE TRUNK. ALL ROOTS MUST BE CUT CLEANLY WITH EQUIPMENT SPECIFICALLY DESIGNED TO CUT ROOTS OR OTHER PRUNING EQUIPMENT.
   - ROOTS EXPOSED DURING EXCAVATION MUST BE PROTECTED FROM DESICCATION. KEEP LIGHTLY WATERED OR COVER WITH HESSIAN WHICH MUST BE KEPT MOIST.
   - WATER TREES WHICH HAVE HAD DISTURBANCE IN THEIR ROOT ZONE. THE AMOUNT AND FREQUENCY OF WATER NEEDS TO BE ADAPTED TO THE TREES' REQUIREMENT, BASED ON SEASONAL CONDITIONS.

EXISTING SERVICES

1. EXISTING SERVICES HAVE BEEN DIGITISED FROM SUPPLIED DATA. NO GUARANTEE IS GIVEN FOR THE ACCURACY OF THE DETAIL. IT IS THE CONTRACTORS RESPONSIBILITY TO ESTABLISH THE EXACT ALIGNMENT OF ALL EXISTING SERVICES WITHIN THE LIMIT OF WORKS PRIOR TO THE COMMENCEMENT OF WORKS.
2. THE CONTRACTOR WILL CONTACT, FOR EACH SERVICE AUTHORITY, THE OFFICER-IN-CHARGE OF THE AREA IN WHICH THE SITE IS LOCATED BEFORE COMMENCING WORK ON THE SITE.
3. THE CONTRACTOR WILL INSPECT THE LOCATION OF ALL EXISTING SERVICES AND NOTIFY THE SUPERINTENDENT OF ANY OMISSIONS FROM THE DRAWINGS.
4. THE CONTRACTOR WILL IMMEDIATELY NOTIFY THE SUPERINTENDENT AND THE OFFICER-IN-CHARGE OF THE AREA IN THE EVENT OF DAMAGE TO ANY WATER, GAS, STEAM, COMPRESSED AIR, ELECTRIC, DRAINAGE, SEWERAGE, TELECOMMUNICATIONS, FIRE ALARM, CONTROL CABLE OR OTHER SERVICES IN THE AREA.
5. ALL EXISTING SERVICES WHICH NEW SERVICES, PATHS, ROAD OR OTHER PARTS OF THE NEW WORKS ARE TO PASS UNDER, OVER, IN THE VICINITY OF OR CONNECT TO, ARE TO BE POTHOLED BY THE CONTRACTOR AT THE COMMENCEMENT OF WORKS IN ORDER TO DETERMINE IF THE NEW WORKS CAN BE CONSTRUCTED AS DESIGNED. THE COST OF POTHOLING IS TO BE ALLOWED FOR IN THE RATES GENERALLY. (HOLD POINT).
6. DAMAGES OR CONSEQUENTIAL DAMAGES AND DELAY DUE TO FAILURE TO ESTABLISH THE ALIGNMENT OF ALL EXISTING SERVICES ARE THE CONTRACTOR'S RESPONSIBILITY. NO PAYMENT WILL BE MADE FOR ADDITIONAL WORKS OR DAMAGES WHERE THE CONTRACTOR HAS NOT COMPLIED WITH THIS REQUIREMENT.

NOTATION

BC	BRANCH CONNECTION		LB	LOG BARRIER
BE	BULK EARTHWORKS LEVEL		LP	LOW POINT
CC	CENTRE OF CURVE		MH	MANHOLE
CEE	CYCLE PATH ENTRY/EXIT		MK	MOUNTABLE KERB
CL	COVER LEVEL		ROCI	REINFORCED OPEN CONCRETE INVERT
CSCL	CARBON STEEL CEMENT LINED		P	PAVEMENT LEVEL
DICL	DUCTILE IRON CEMENT LINED		PC	PRAM CROSSING
EJ	EXPANSION JOINT		PR	PRAM RAMP
FK	FLUSH KERB		TP	TANGENT POINT
FRC	FIBRE REINFORCED CEMENT		uPVC	UNPLASTICISED POLYVINYL CHLORIDE
FWAR	FILLET WELD ALL ROUND		RL	REDUCED LEVEL
G	GRATE LEVEL		RRJ	RUBBER RING JOINT
GS	GRATED SUMP		SCJ	SOLVENT CEMENT JOINTS
H	HYDRANT		SCMH	SPECIAL CHAMBERED MANHOLE
HD	HEAVY DUTY		SKG	SPECIAL KERB AND GUTTER
HER	HIGH END RISER		SKO	SPECIAL KERB ONLY
HP	HIGH POINT		SS	SUBSOIL DRAIN
IL	INVERT LEVEL		PC	PRAM CROSSING
IP	INTERSECTION POINT		WJ	WEAKENED PLANE JOINT
K	KERB LEVEL	△C	PCMH	PRE CAST MANHOLE
KJ	KEYED JOINT			

REFERENCE DRAWINGS:-

ACT CITY SERVICES STORMWATER SECTION

ST-0001	PIPE JUNCTIONS
ST-0011	SUMPS INLETS ON KERBS AND GUTTERS
ST-0012	TYPE R AND QS SUMP
ST-0014	1050 ND MANHOLES
ST-0015	SPECIAL CHAMBERED MANHOLES
ST-0016	SURCHARGE STRUCTURES
ST-0017	STRUCTURES MISCELLANEOUS DETAILS
ST-0032	MINOR GPT - PERPENDICULAR TO FLOODWAY
ST-0034	GPT TRASH RACKS

THE TERRITORY AND MUNICIPAL SERVICES - ACT GOVERNMENT

DS3-01	KERB AND GUTTER STANDARD DETAILS - SHEET 1
DS3-02	KERB AND GUTTER STANDARD DETAILS - SHEET 2
DS5-02	HEAVY DUTY DRIVEWAYS
DS6-01	SUBSOIL DRAINAGE STANDARD DETAILS - SHEET 1
DS6-02	SUBSOIL DRAINAGE STANDARD DETAILS - SHEET 2
DS7-01	GRAVITY RETAINING WALLS - STONE AND CLAY BRICK
DS7-02	REINFORCED CONCRETE BLOCK WALLS UP TO 2100
DS7-04	RETAINING WALLS GENERAL NOTES
DS9 - SET	TRAFFIC CONTROL DEVICES
DS13-01	PATH STANDARD DETAILS
GW/SD/DC/13	PROTECTIVE FENCES AND BARRIERS - SHEET 2

**WAE DATA APPLIED TO DWGS BY
BROWN CONSULTING. SEPT. 2012
WAE NO: 2012/001811**

Rev	Date	Description	Drawn	Appr.
C	17/01/2013	WAE-NOTE ADDED	VVB	TC
B	20/11/2012	WORK AS EXECUTED - BROWN / BMD	CO	TC
A	10/01/2011	FOR CONSTRUCTION	PDJ	IP
3	12/10/2010	FOR TENDER	PDJ	IP
2	23/09/2010	ACTEW COMMENTS	PDJ	IP
1	18/08/2010	ACTEW SUBMISSION	PDJ	IP

Land Development Agency
CANBERRA FIRST

Cardno Young
ABN: 24 008 579 404
Level 2, 14 Wormald Street Symonston, ACT, 2609
Ph (02) 6112 4500 Fax (02) 6112 4599
PO Box 7217, CPBC, ACT, 2610
Web: www.cardno.com.au

Quality Endorsed Company

Drawn Original Signed (PDJ)	Date 09/02/2011
Designed Original Signed (IP)	Date 09/02/2011
Checked Original Signed (GZ)	Date 09/02/2011
Reviewed Original Signed (GZ)	Date 09/02/2011
Approved Original Signed (GL)	Date 09/02/2011

Client ACT PLANNING & LAND AUTHORITY

HUME WEST INDUSTRIAL DEVELOPMENT - STAGE A
HUME ACT
SECTION 21 AND 22

GENERAL NOTES AND LEGEND
SHEET 1 OF 2

Status WORK AS EXECUTED

Date	Datum	Scale	Size
16/04/2010		NONE	A1

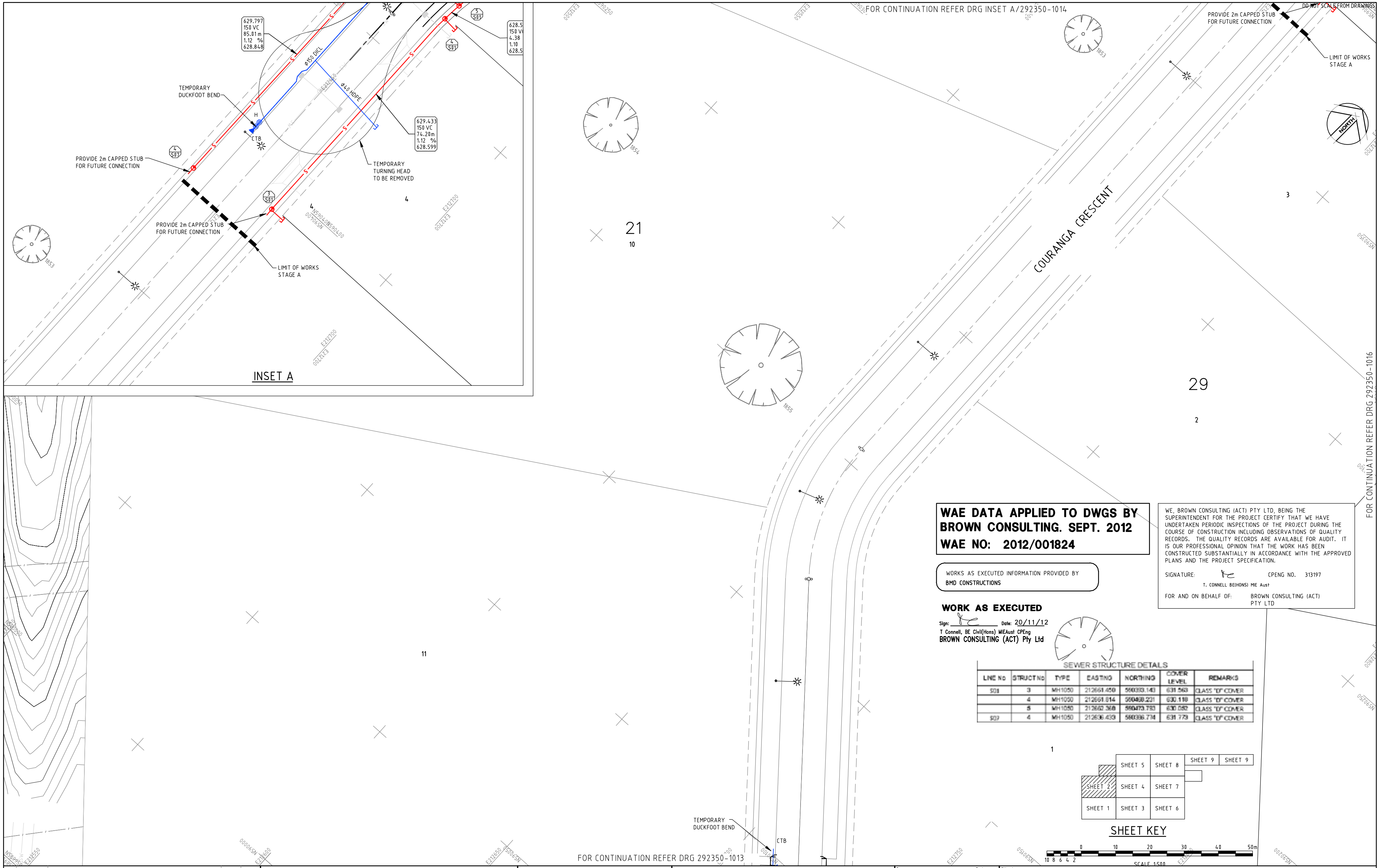
Drawing Number	Revision
292350-1001	C

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

EW7734

DATE PLOTTED: 22 January 2013 8:53 AM BY : VICTOR VAN BOVENE

XREF's: X-CGD-TUGGERANONG; X-GRP-A1-SHT; cvt_829-DCS-01-model-100706-RevA; BASE_HUMEWEST; x_SURVEY DES CONT; X-WAE-STAMP-C10107
CAD FILE: H:\C10000\C10107\drawing\292350-1013-20-HYD-S-W.dwg



WAE DATA APPLIED TO DWGS BY
BROWN CONSULTING. SEPT. 2012
WAE NO: 2012/001824

WORKS AS EXECUTED INFORMATION PROVIDED BY
BMD CONSTRUCTIONS

WORK AS EXECUTED

Sign: Date: 20/11/12
T Connell, BE Civil(Hons) MIEAust CPEng
BROWN CONSULTING (ACT) Pty Ltd

WE, BROWN CONSULTING (ACT) PTY LTD, BEING THE SUPERINTENDENT FOR THE PROJECT CERTIFY THAT WE HAVE UNDERTAKEN PERIODIC INSPECTIONS OF THE PROJECT DURING THE COURSE OF CONSTRUCTION INCLUDING OBSERVATIONS OF QUALITY RECORDS. THE QUALITY RECORDS ARE AVAILABLE FOR AUDIT. IT IS OUR PROFESSIONAL OPINION THAT THE WORK HAS BEEN CONSTRUCTED SUBSTANTIALLY IN ACCORDANCE WITH THE APPROVED PLANS AND THE PROJECT SPECIFICATION.

SIGNATURE: CPENG NO. 313197
T. CONNELL BE(HONS) MIE Aust

FOR AND ON BEHALF OF: BROWN CONSULTING (ACT)
PTY LTD

SEWER STRUCTURE DETAILS

LINE No	STRUCT No	TYPE	EASTING	NORTHING	COVER LEVEL	REMARKS
S01	3	MH1050	212661.450	590393.143	631.563	CLASS "D" COVER
	4	MH1050	212661.814	590468.231	630.118	CLASS "D" COVER
	5	MH1050	212662.368	590473.793	630.052	CLASS "D" COVER
S07	4	MH1050	212636.433	590386.774	631.779	CLASS "D" COVER

		SHEET 9	SHEET 9
	SHEET 5	SHEET 8	
SHEET 2	SHEET 4	SHEET 7	
SHEET 1	SHEET 3	SHEET 6	

SHEET KEY

Rev	Date	Description	Drawn	Appr.
B	20/11/2012	WORK AS EXECUTED - BROWN / BMD	CO	TC
A	10/01/2011	FOR CONSTRUCTION	PDJ	IP
2	12/10/2010	FOR TENDER	PDJ	IP
1	13/08/2010	ACTEW SUBMISSION	PDJ	IP

Land Development Agency
CANBERRA FIRST

Cardno Young
ABN: 24 008 579 404
Level 2, 14 Wormald Street Symonston, ACT, 2609
Ph (02) 6112 4500 Fax (02) 6112 4599
PO Box 7217, CPBC, ACT, 2610
Web: www.cardno.com.au

Quality Endorsed Company

Drawn Original Signed (PDJ)	Date 09/02/2011
Designed Original Signed (IP)	Date 09/02/2011
Checked Original Signed (GZ)	Date 09/02/2011
Reviewed Original Signed (GZ)	Date 09/02/2011
Approved Original Signed (GL)	Date 09/02/2011

Client LAND DEVELOPMENT AGENCY

HUME WEST INDUSTRIAL DEVELOPMENT - STAGE A
SECTION 22 AND 21
HUME ACT

HYDRAULIC SERVICES PLANS
SEWER AND WATER - SHEET 2 OF 9

Status WORK AS EXECUTED

Date	Datum	Scale	Size
APRIL 2010	AHD	1:500	A1

Drawing Number 292350-1014
Revision B

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

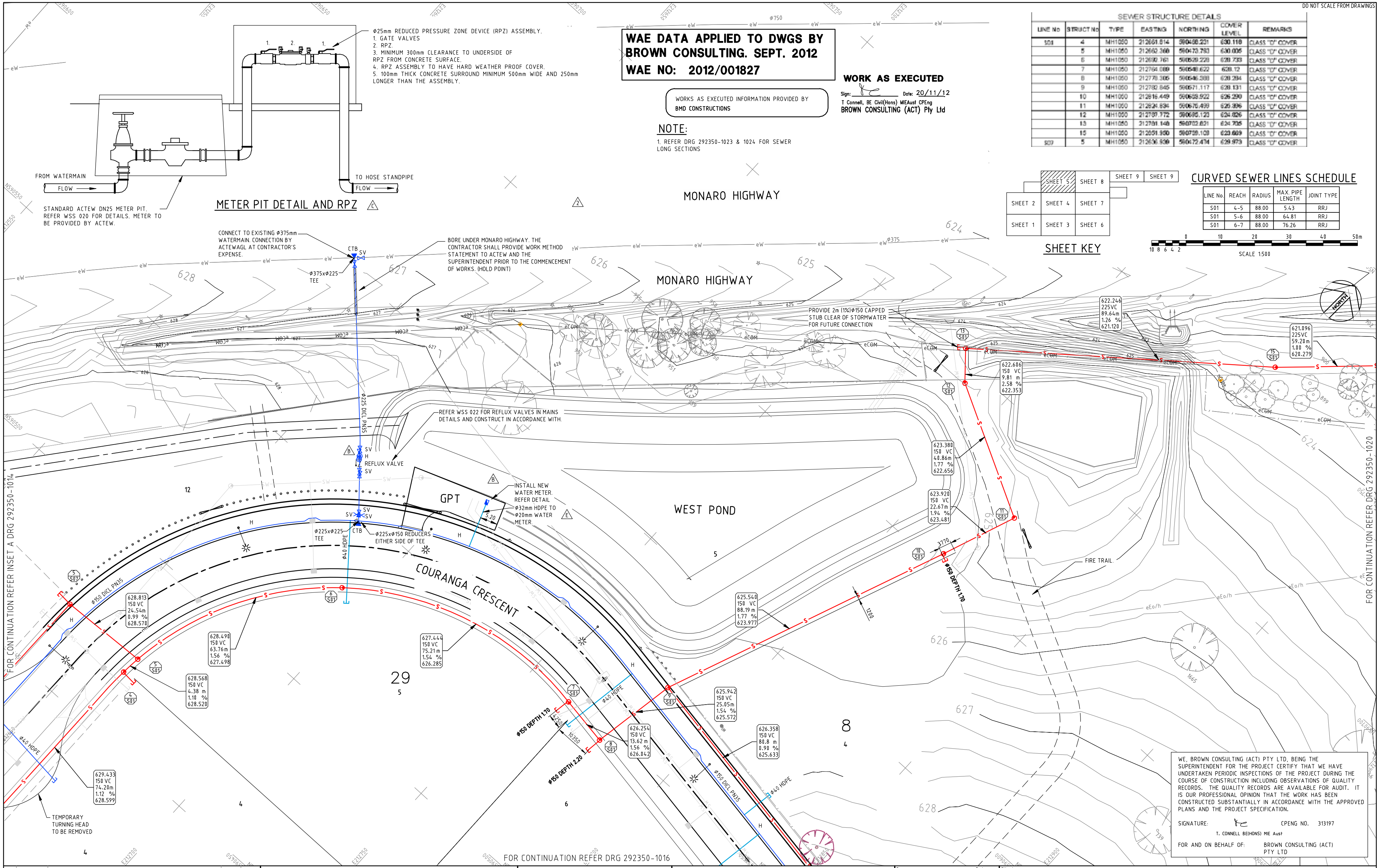
EW7737

DATE PLOTTED: 22 January 2013 8:54 AM BY : VICTOR VAN BOVENE

XREF's: X-CGD-TUGGERANONG; X-GRP-A1-SHT; cvt_829-DCS-01-model-100706-RevA; BASE_HUMEWEST; x_SURVEY DES CONT; X-WAE-STAMP-C10107

CAD FILE: H:\C10000\C10107\drawing\292350-1013-20-HYD-S-W.dwg

DO NOT SCALE FROM DRAWINGS



Ø25mm REDUCED PRESSURE ZONE DEVICE (RPZ) ASSEMBLY.
1. GATE VALVES
2. RPZ.
3. MINIMUM 300mm CLEARANCE TO UNDERSIDE OF RPZ FROM CONCRETE SURFACE.
4. RPZ ASSEMBLY TO HAVE HARD WEATHER PROOF COVER.
5. 100mm THICK CONCRETE SURROUND MINIMUM 500mm WIDE AND 250mm LONGER THAN THE ASSEMBLY.

WAE DATA APPLIED TO DWGS BY BROWN CONSULTING. SEPT. 2012
WAE NO: 2012/001827

WORKS AS EXECUTED INFORMATION PROVIDED BY
BMD CONSTRUCTIONS

WORK AS EXECUTED
Sign: Date: 20/11/12
T Connell, BE Civil(Hons) MIEAust CPEng
BROWN CONSULTING (ACT) Pty Ltd

NOTE:

1. REFER DRG 292350-1023 & 1024 FOR SEWER LONG SECTIONS

SEWER STRUCTURE DETAILS

LINE No	STRUCT No	TYPE	EASTING	NORTHING	COVER LEVEL	REMARKS
S01	4	MH1050	212661.814	590468.231	630.110	CLASS "D" COVER
	5	MH1050	212662.368	590473.793	630.006	CLASS "D" COVER
	6	MH1050	212692.761	590528.228	628.733	CLASS "D" COVER
	7	MH1050	212764.089	590548.622	628.12	CLASS "D" COVER
	8	MH1050	212778.306	590546.388	628.284	CLASS "D" COVER
	9	MH1050	212782.845	590571.117	628.131	CLASS "D" COVER
	10	MH1050	212816.449	590659.922	626.290	CLASS "D" COVER
	11	MH1050	212824.834	590676.499	625.396	CLASS "D" COVER
	12	MH1050	212787.772	590685.123	624.826	CLASS "D" COVER
	13	MH1050	212781.148	590702.821	624.705	CLASS "D" COVER
	15	MH1050	212851.930	590739.109	623.669	CLASS "D" COVER
S07	5	MH1050	212636.939	590472.474	629.973	CLASS "D" COVER

SHEET KEY

	SHEET 5	SHEET 8	SHEET 9	SHEET 9
SHEET 2	SHEET 4	SHEET 7		
SHEET 1	SHEET 3	SHEET 6		

CURVED SEWER LINES SCHEDULE

LINE No.	REACH	RADIUS	MAX. PIPE LENGTH	JOINT TYPE
S01	4-5	88.00	5.43	RRJ
S01	5-6	88.00	64.81	RRJ
S01	6-7	88.00	76.26	RRJ

0 10 20 30 40 50m
10 8 6 4 2
SCALE 1:500

WE, BROWN CONSULTING (ACT) PTY LTD, BEING THE SUPERINTENDENT FOR THE PROJECT CERTIFY THAT WE HAVE UNDERTAKEN PERIODIC INSPECTIONS OF THE PROJECT DURING THE COURSE OF CONSTRUCTION INCLUDING OBSERVATIONS OF QUALITY RECORDS. THE QUALITY RECORDS ARE AVAILABLE FOR AUDIT. IT IS OUR PROFESSIONAL OPINION THAT THE WORK HAS BEEN CONSTRUCTED SUBSTANTIALLY IN ACCORDANCE WITH THE APPROVED PLANS AND THE PROJECT SPECIFICATION.

SIGNATURE: CPENG NO. 313197
T. CONNELL BE(HONS) MIE Aust
FOR AND ON BEHALF OF: BROWN CONSULTING (ACT) PTY LTD

Rev	Date	Description	Drawn	Appr.
E	17/01/2013	WAE NOTE AMENDED	VVB	TC
D	20/11/2012	WORK AS EXECUTED - BROWN / BMD	CO	TC
C	24/08/2012	RPZ DETAIL	PDJ	IP
B	24/07/2012	REFLUX VALVE RELOCATED/ INSTALL NEW WATER METER	BGM	IP
A	10/01/2011	FOR CONSTRUCTION	PDJ	IP
3	12/10/2010	FOR TENDER	PDJ	IP
2	23/09/2010	ACTEW COMMENTS	PDJ	IP
1	13/08/2010	ACTEW SUBMISSION	PDJ	IP

Land Development Agency
CANBERRA FIRST

Cardno Young
ABN: 24 008 579 404
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Ph (02) 6112 4500 Fax (02) 6112 4599
PO Box 7217, CPBC, ACT, 2610
Web: www.cardno.com.au

Quality Endorsed Company

Drawn Original Signed (PDJ) PDJ	Date 09/02/2011
Designed Original Signed (IP)	Date 09/02/2011
Checked Original Signed (GZ)	Date 09/02/2011
Reviewed Original Signed (GZ)	Date 09/02/2011
Approved Original Signed (GL)	Date 09/02/2011

Client
LAND DEVELOPMENT AGENCY

HUME WEST INDUSTRIAL DEVELOPMENT - STAGE A
SECTION 22 AND 21
HUME ACT

HYDRAULIC SERVICES PLANS
SEWER AND WATER - SHEET 5 OF 9

Status
WORK AS EXECUTED

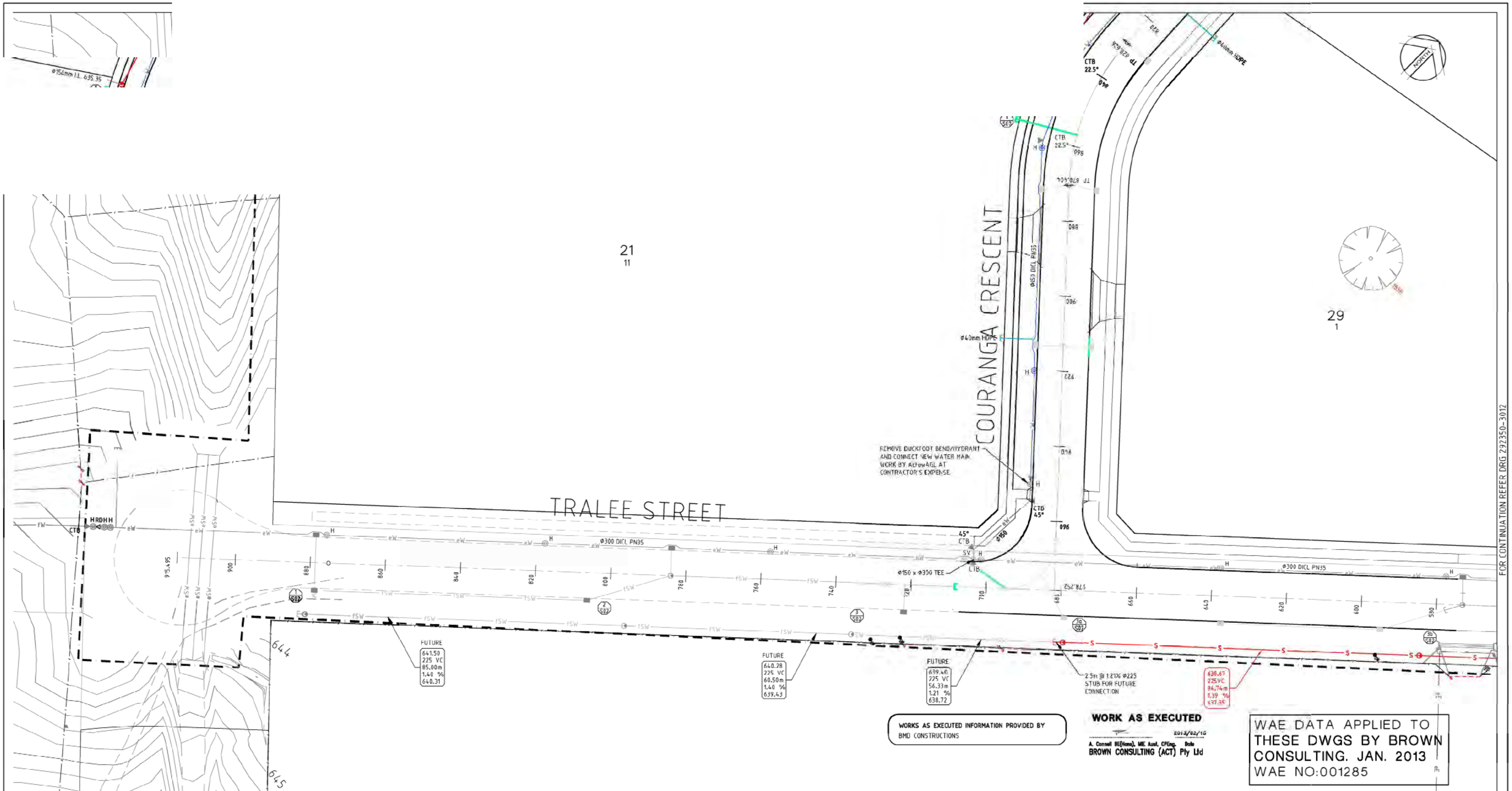
Date	Datum	Scale	Size
DEC 2009	AHD	1:500	A1

Drawing Number	Revision
292350-1017	E

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

EW7740

XREF's: X-CGD-TUGGERANONG; X-GRP-A1-SHT; BASE_HUMEWEST; x_WALKER KERBS; x_DMENT_AREA_BDRY; x_HUME_TCD_BASE: '2D DESIGN CONTOURS1; x__SURVEY DES CONT-STG C; X-Street names; X-ACT-
CAD FILE: H:\C12000\C12137\drawing\292350-3010-3013-HYD-S-w.dwg
DATE PLOTT



WORKS AS EXECUTED INFORMATION PROVIDED BY
BMD CONSTRUCTIONS

WORK AS EXECUTED

2013/02/15
A. Connell BE(Hons), ME Aust, CPEng. Date
BROWN CONSULTING (ACT) Pty Ltd

WAE DATA APPLIED TO
THESE DWGS BY BROWN
CONSULTING. JAN. 2013
WAE NO:001285

LEGEND

▨ AREA OF BLOCK NOT ABLE TO BE SERVICED BY SEWER

WE, BROWN CONSULTING (ACT) PTY LTD, BEING THE SUPERINTENDENT FOR THE PROJECT CERTIFY THAT WE HAVE UNDERTAKEN PERIODIC INSPECTIONS OF THE PROJECT DURING THE COURSE OF CONSTRUCTION INCLUDING OBSERVATIONS OF QUALITY RECORDS. THE QUALITY RECORDS ARE AVAILABLE FOR AUDIT. IT IS OUR PROFESSIONAL OPINION THAT THE WORK HAS BEEN CONSTRUCTED SUBSTANTIALLY IN ACCORDANCE WITH THE APPROVED PLANS AND THE PROJECT SPECIFICATION.

SIGNATURE: CPENG NO. 313197
T. CONNELL BE(HONS) ME Aust

FOR AND ON BEHALF OF: BROWN CONSULTING (ACT) PTY LTD

SEWER STRUCTURE DETAILS

LINE No	STRUC No	STRUC TYPE	EASTING	NORTHING	COVER LEVEL	REMARKS
S01	3a	MH1050	212661.555	590439.730	630.620	CLASS 'D" COVER
S02	1	MH1050	212588.434	589945.869	644.010	FUTURE
	2	MH1050	212653.659	590000.373	642.860	FUTURE
	3	MH1050	212700.084	590039.167	642.044	FUTURE
	3a	MH1050	212742.968	590075.035	641.260	CLASS 'D" COVER
	3b	MH1050	212816.294	590136.408	640.137	CLASS 'D" COVER
S07	1	MH1050	212643.218	590174.814	637.614	CLASS 'D" COVER

NOTE:STRUCTURE CO-ORDINATES ARE MEASURED TO CENTER OF STRUCTURE

SHEET 2	SHEET 4
▨ SHEET 1	SHEET 3

SHEET KEY

CAUTION:

CONTRACTOR TO CONFIRM THE LOCATION AND DEPTH OF ALL EXISTING SERVICES PRIOR TO THE COMMENCEMENT OF ANY WORKS (HOLD POINT)

0 10 20 30 40 50m
10 8 6 4 2
SCALE 1:500

Rev	Date	Description	Drawn	Appr.
A	16/01/2013	WAE	VVB	TC
3	02/04/2012	FOR CONSTRUCTION/ACTEWAGL APPROVAL	PDJ	IP
2	20/01/2011	TaMS SUBMISSION	PDJ	IP
1	22/12/2010	ACTEW SUBMISSION	PDJ	IP

Land Development Agency

Cardno Young
ABN 24 008 579 404
Level 2, 14 Wormald Street Symonston, ACT, 2609
Ph (02) 6112 4500 Fax (02) 6112 4599
PO Box 7217, CPDC, ACT, 2610
Web: www.cardno.com.au

Quality System
Quality Endorsed Company
AS 9001 Lic.3900 Standards Australia

Drawn Original Signed (PDJ) Date 22/02/2011
Designed Original Signed (IP) Date 22/02/2011
Checked Original Signed (GZ) Date 22/02/2011
Reviewed Original Signed (GZ) Date 22/02/2011
Approved Original Signed (GL) Date 22/02/2011

Client LAND DEVELOPMENT AGENCY

HUME WEST INDUSTRIAL DEVELOPMENT - STAGE C

HUME ACT

HYDRAULIC SERVICES PLANS
SEWER AND WATER - SHEET 1 OF 4

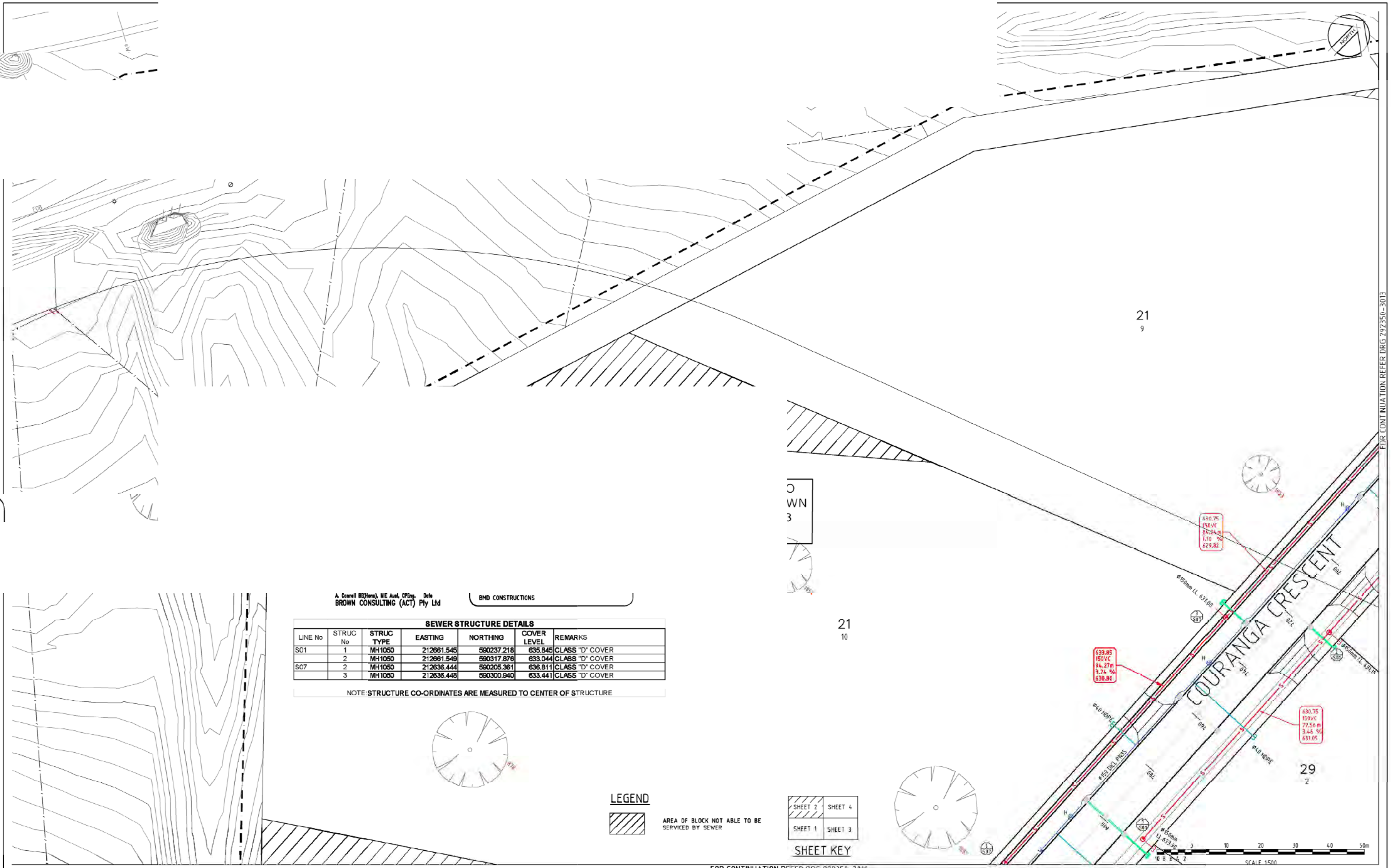
Status WORK AS EXECUTED

Date	Datum	Scale	Size
SEPT 2010	AHD	1:500	A1

Drawing Number 292350-3010
Revision A

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150mm ON A1 ORIGINAL

EW7811



XREF's: X-CGD-TUGGERANONG; X-GRP-A1-SHT; BASE_HUMEWEST; x_WALKER KERBS; x_DMENT_AF
CAD FILE: H:\C12000\C12137\drawing\292350-3010-3013-HYD-S-w.dwg

BASE_12D DESIGN CONTOURS1; x__SURVEY DES CONT-STG C; X-Street names; X-ACT-
DATE PLOTT

FOR CONTINUATION REFER DRG 292350-3013

A. Connell BE(Hons), MIE Aust, CPEng. Date
BROWN CONSULTING (ACT) Pty Ltd

BMD CONSTRUCTIONS

SEWER STRUCTURE DETAILS

LINE No	STRUC No	STRUC TYPE	EASTING	NORTHING	COVER LEVEL	REMARKS
S01	1	MH1050	212661.545	590237.218	635.845	CLASS "D" COVER
	2	MH1050	212661.549	590317.876	633.044	CLASS "D" COVER
S07	2	MH1050	212636.444	590205.361	636.811	CLASS "D" COVER
	3	MH1050	212636.448	590300.940	633.441	CLASS "D" COVER

NOTE: STRUCTURE CO-ORDINATES ARE MEASURED TO CENTER OF STRUCTURE

LEGEND

▨	AREA OF BLOCK NOT ABLE TO BE SERVICED BY SEWER

SHEET KEY

SHEET 2	SHEET 4
SHEET 1	SHEET 3

FOR CONTINUATION REFER DRG 292350-3010

Rev	Date	Description	Drawn	Appr.
A	16/01/2013	WAE	VVB	TC
3	02/04/2012	FOR CONSTRUCTION	PDJ	IP
2	20/01/2011	TaMS SUBMISSION	PDJ	IP
1		ACTEW SUBMISSION	PDJ	IP

Land Development Agency

Cardno
Young
ABN 24 008 579 404
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Ph (02) 6112 4500 Fax (02) 6112 4599
PO Box 7217, CPDC, ACT, 2610
Web: www.cardno.com.au

Quality System
Quality Endorsed Company
AS9001 Lic.3980 Standards Australia

Drawn	Original Signed (PDJ)	Date 22/02/2011
Designed	Original Signed (IP)	Date 22/02/2011
Checked	Original Signed (GZ)	Date 22/02/2011
Reviewed	Original Signed (GZ)	Date 22/02/2011
Approved	Original Signed (GL)	Date 22/02/2011

Client
LAND DEVELOPMENT AGENCY

HUME WEST INDUSTRIAL DEVELOPMENT - STAGE C

HUME ACT

HYDRAULIC SERVICES PLANS
SEWER AND WATER - SHEET 2 OF 4

Status
WORK AS EXECUTED

Date	Datum	Scale	Size
SEPT 2010	AHD	1:500	A1

Drawing Number	Revision
292350-3011	A

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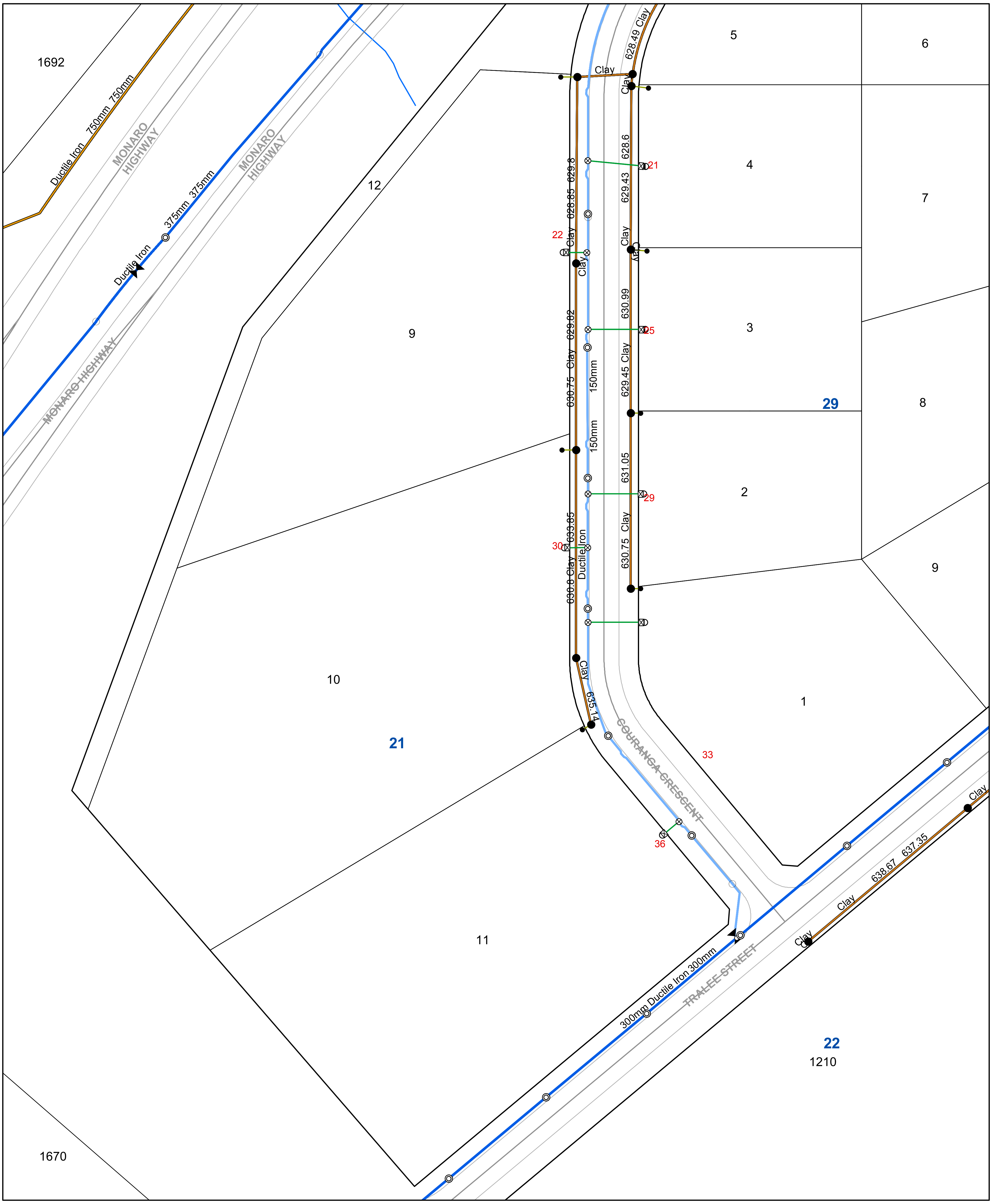
EW7812



Hume
Section 21
Blocks 9, 10 and 11

N
W E
S

0 10 20 40 60 80 M

Icon Water Network

icon
WATER

Josh Hewett

From:	Brenner, Karl <Karl.Brenner@finance.gov.au>
Sent:	Tuesday, 3 May 2016 12:03 PM
To:	Josh Hewett
Cc:	CGS - TPD - GNSB - ICON - Design; Clark, Pat
Subject:	RE: SIR information request - B9, 10 & 11 S21 Hume [SEC=UNCLASSIFIED] [Filed 03 May 2016 18:03]
Attachments:	Cardno-LDA Hume.pdf

UNCLASSIFIED

Hi Josh,
Normally I would not supply any such information without the proper Dial Before You Dig process that you should be undertaking, however, noting the time frame, I am happy to supply you with this
FOR INFORMATION ONLY indicative infrastructure location.

The infrastructure depicted in the attachment is owned by Shared Services ICT (SSICT) and ICON in a shared agreement also has Fibre cable installed in it.

Happy for this to be used to show that there is infrastructure in the area but for investigation purposes only and
NOT FOR CONSTRUCTION.
Please go through the normal Dial Before You Dig process in future.

Many thanks
K

Karl Brenner OAM | Design & Configuration Manager
Assistant Director | Government Network Services
Commercial and Government Services | Department of Finance
T: 02 6215 1852 | **F**: 02 6267 3545 | **E**: **Karl.Brenner@finance.gov.au**
A: Burns Centre, 28 National Circuit, Forrest ACT 2603
🖂: John Gorton Building, King Edward Terrace, PARKES ACT 2600

UNCLASSIFIED

UNCLASSIFIED

From: Josh Hewett [mailto:Joshua.Hewett@cardno.com.au]
Sent: Thursday, 28 April 2016 4:46 PM
To: Brenner, Karl
Subject: SIR information request - B9, 10 & 11 S21 Hume

Hi Karl,

Cardno has been engaged for yet another Site Investigation for the LDA, this time for Blocks 9, 10 & 11, Section 21 Hume.

The blocks are intended to be sold as is for industrial and trade use but we have not been provided further details on what might actually be built at the site.

I have attached a locality plan showing the site as well as the DBYD information received. The DBYD indicated that ICON infrastructure is potentially affected, could you please help us confirm:

1. Where the infrastructure is
2. Who owns it
3. Will it have an impact on the proposed development of the blocks?

Unfortunately, the LDA has placed tight deadlines on us for the delivery of this report due to an urgent sales request (report due next Wednesday), as such your assistance to us in meeting this objective for the Territory via a prompt reply at your earliest availability would be greatly appreciated.

Thanks again for your continued help with these investigations, feel free to give me a call if you need anything further.

Kind regards,

Josh

Josh Hewett
CIVIL ENGINEER
CARDNO

Phone +61 2 6112 4500 Fax +61 2 6112 4599 Direct +61 2 6112 4502
Address Level 2
14 Wormald Street, Symonston, Australian Capital Territory 2609 Australia
Postal PO Box 40 Fyshwick ACT 2609
Email joshua.hewett@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO

Josh Hewett

From: Lai, Jacob Y <Jacob.Y.Lai@team.telstra.com>
Sent: Wednesday, 4 May 2016 3:40 PM
To: Josh Hewett
Subject: RE: SIR information request - B9, 10 & 11 S21 Hume

Josh,

Telstra will provide network extension as part of the network connection. Cost will be included as part of the quote to developer.

Regards,

Jacob Y Lai Principal Planner - NSW Country South & ACT
Forecasting & Area Planning NSW and Wideband | Networks & Access Technologies | Telstra Operations
P 02 8576 9799 | M 0419 442551
| E Jacob.y.lai@team.telstra.com| W http://www.in.telstra.com.au/ism/nswareaplanning/

From: Josh Hewett [mailto:Joshua.Hewett@cardno.com.au]
Sent: Wednesday, 4 May 2016 10:11 AM
To: Lai, Jacob Y <Jacob.Y.Lai@team.telstra.com>
Subject: RE: SIR information request - B9, 10 & 11 S21 Hume

Thanks Jacob,

I assume that Telstra would provide the network extension?

Kind regards,

Josh

Josh Hewett
CIVIL ENGINEER
CARDNO

Cardno
Shaping the Future

Phone +61 2 6112 4500 Fax +61 2 6112 4599 Direct +61 2 6112 4502
Address Level 2
14 Wormald Street, Symonston, Australian Capital Territory 2609 Australia
Postal PO Box 40 Fyshwick ACT 2609
Email joshua.hewett@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO

From: Lai, Jacob Y [mailto:Jacob.Y.Lai@team.telstra.com]
Sent: Wednesday, 4 May 2016 10:06 AM
To: Josh Hewett <Joshua.Hewett@cardno.com.au>
Subject: RE: SIR information request - B9, 10 & 11 S21 Hume

Josh,

The nearest Telstra network access point is at Tralee Street. Approximately 300 metres of network extension will be required (see attached aerial view for details).

There is sufficient spare capacity in the Telstra network to service this proposed development.

Telstra will require 1XP100 leadin conduit from building MDF to property boundary at Tralee Street. Leadin conduit will be for Telstra's exclusive use.

Developer will be responsible for installation of leadin conduit from building MDF to property boundary and cost of network extension.

In order to initiate work for network extension and connection, developer will require to register proposed development via the Telstra Smart Community website at least six months prior to service required date. Online access is via Telstra Smart community website .


MONARO
TUGGERANONG:
Registered Rural
Block No: 1692
5
12
5
4
3
29
2
1
9
10
11
21
COURANGA CRESCENT
MONARO HIGHWAY
TUGGERANONG:
Proposed Rural
Block No: 1670

Regards,

Jacob Y Lai Principal Planner - NSW Country South & ACT
Forecasting & Area Planning NSW and Wideband | Networks & Access Technologies | Telstra Operations
P 02 8576 9799 | M 0419 442551
| E Jacob.y.lai@team.telstra.com| W http://www.in.telstra.com.au/ism/nswareaplanning/

From: Josh Hewett [mailto:Joshua.Hewett@cardno.com.au]
Sent: Thursday, 28 April 2016 8:46 AM
To: Lai, Jacob Y <Jacob.Y.Lai@team.telstra.com>
Subject: SIR information request - B9, 10 & 11 S21 Hume

Hi Jacob,

Cardno has been engaged for yet another Site Investigation for the LDA, this time for Blocks 9, 10 & 11, Section 21 Hume.

The blocks are intended to be sold as is for industrial and trade use but we have not been provided further details on what might actually be built at the site.

I have attached a locality plan showing the site as well as the DBYD information received.

Could you please confirm the following in regards to the above:

- Is the proposed development of these sites for industrial and trade use acceptable to Telstra (is there capacity in the network?)
- Are there any Telstra infrastructure requirements/constraints for the site for connection of or reticulation within the site; and
- Where would the likely connection point be for each block? I assume connection to each block would be made via the underground lines to the west – is that correct?

Unfortunately, the LDA has placed tight deadlines on us for the delivery of this report due to an urgent sales request (report due next Wednesday), as such your assistance to us in meeting this objective for the Territory via a prompt reply at your earliest availability would be greatly appreciated.

Thanks again for your continued help with these investigations, feel free to give me a call if you need anything further.

Kind regards,

Josh

Josh Hewett
CIVIL ENGINEER
CARDNO

Cardno
Shaping the Future

Phone +61 2 6112 4500 Fax +61 2 6112 4599 Direct +61 2 6112 4502
Address Level 2
14 Wormald Street, Symonston, Australian Capital Territory 2609 Australia
Postal PO Box 40 Fyshwick ACT 2609
Email joshua.hewett@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO

Josh Hewett

From: enworks <enworks@actewagl.com.au>
Sent: Thursday, 28 April 2016 10:43 AM
To: Josh Hewett
Subject: FW: SIR information request - B9, 10 & 11 S21 Hume [Filed 03 May 2016 17:57]
Attachments: aerial.pdf; Coversheet.pdf; Electricity.PDF; Electricity Legend.pdf

Hi Josh,

Thank you for your below email and attachments.

I would like to confirm that we do not have any issues or concerns with the proposed development as the underground HV network available adjacent to mentioned block/s. Based on the type of development and the electrical load requirements of each industrial development, we may need to establish substation/s on block/s. The requirement of the substation/s and connection points/Point of Entry will be identified during the preliminary network advice (PNA) stage.

Thank you

Regards
Kedar Vedanti
Industry Interface and Coordination Lead
Network Connection Services
Customer Connections Branch
Energy Networks - ActewAGL Distribution
t 02 6248 3582 | **f** 02 6293 5762

www.actewagl.com.au

From: Josh Hewett [mailto:Joshua.Hewett@cardno.com.au]
Sent: Thursday, 28 April 2016 8:32 AM
To: Vedanti, Kedar
Subject: SIR information request - B9, 10 & 11 S21 Hume

Hi Kedar,

Cardno has been engaged for yet another Site Investigation for the LDA, this time for Blocks 9, 10 & 11, Section 21 Hume.

The blocks are intended to be sold as is for industrial and trade use but we have not been provided further details on what might actually be built at the site.

I have attached a locality plan showing the site as well as the DBYD information received.

Could you please confirm the following in regards to the above:

- Is the proposed development of these sites for industrial and trade use acceptable to Actew (is there capacity in the network?)
- Are there any Actew infrastructure requirements/constraints for the site for connection of or reticulation within the site; and
- Where would the likely connection point be for each block? I assume connection to each block would be made via the underground HV lines to the west – is that correct?

Unfortunately, the LDA has placed tight deadlines on us for the delivery of this report due to an urgent sales request (report due next Wednesday), as such your assistance to us in meeting this objective for the Territory via a prompt reply at your earliest availability would be greatly appreciated.

Thanks again for your continued help with these investigations, feel free to give me a call if you need anything further.

Kind regards,

Josh

Josh Hewett
CIVIL ENGINEER
CARDNO

Phone +61 2 6112 4500 Fax +61 2 6112 4599 Direct +61 2 6112 4502
Address Level 2
14 Wormald Street, Symonston, Australian Capital Territory 2609 Australia
Postal PO Box 40 Fyshwick ACT 2609
Email joshua.hewett@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO

Josh Hewett

From:	Steve Donnelly <Steve.Donnelly@jemena.com.au>
Sent:	Thursday, 28 April 2016 9:49 AM
To:	Josh Hewett
Subject:	RE: SIR information request - B9, 10 & 11 S21 Hume [Filed 03 May 2016 17:57]

Hi Josh

In response to your questions, please see my responses below:

- Is the proposed development of these sites for industrial and trade use acceptable to Jemena (is there capacity in the network?)

Yes.

- Are there any Jemena infrastructure requirements/constraints for the site for connection of or reticulation within the site;

The sites have gas available from the existing 50mm road crossings (@ 210kPa). This network is capable of supplying most small/medium commercial gas users. Larger demands may require network upgrades or extensions. This can only be determined upon receipt of a detailed connection request.

- Are there any significant constraints preventing use of the existing service connections?

No (see above).

Regards

Steve Donnelly
Network Development Manager
Jemena
Unit 1, 5-7 Johns Place, Hume, ACT 2620
(02) 6203 0640 | 0427 401 803
steve.donnelly@jemena.com.au | www.jemena.com.au

From: Josh Hewett [mailto:Joshua.Hewett@cardno.com.au]
Sent: Thursday, 28 April 2016 8:23 AM
To: Steve Donnelly
Subject: SIR information request - B9, 10 & 11 S21 Hume

Hi Steve,

Cardno has been engaged for yet another Site Investigation for the LDA, this time for Blocks 9, 10 & 11, Section 21 Hume.

The blocks are intended to be sold as is for industrial and trade use but we have not been provided further details on what might actually be built at the site.

I have attached a locality plan showing the site as well as the DBYD information received.

Could you please confirm the following in regards to the above:

- Is the proposed development of these sites for industrial and trade use acceptable to Jemena (is there capacity in the network?)
- Are there any Jemena infrastructure requirements/constraints for the site for connection of or reticulation within the site; and
- Are there any significant constraints preventing use of the existing service connections?

Unfortunately, the LDA has placed tight deadlines on us for the delivery of this report due to an urgent sales request (report due next Wednesday), as such your assistance to us in meeting this objective for the Territory via a prompt reply at your earliest availability would be greatly appreciated.

Thanks again for your continued help with these investigations, feel free to give me a call if you need anything further.

Kind regards,

Josh

Josh Hewett
CIVIL ENGINEER
CARDNO

Phone +61 2 6112 4500 **Fax** +61 2 6112 4599 **Direct** +61 2 6112 4502
Address Level 2
14 Wormald Street, Symonston, Australian Capital Territory 2609 Australia
Postal PO Box 40 Fyshwick ACT 2609
Email joshua.hewett@cardno.com.au **Web** www.cardno.com

CONNECT WITH CARDNO

Job No 10596252

Phone: 1100
www.1100.com.au

Caller Details

Contact:	Mr Josh Hewett	**Caller Id:**	1508724	**Phone:**	0416912198
Company:	Cardno	**Mobile:**	Not Supplied	**Fax:**	Not Supplied
Address:	Level 2 Wormald St Symonston ACT 2609	**Email:**	joshua.hewett@cardno.com.au		

Dig Site and Enquiry Details

WARNING: The map below only displays the location of the proposed dig site and does not display any asset owners' pipe or cables. The area highlighted has been used only to identify the participating asset owners, who will send information to you directly.

User Reference: hume B 9 10 11

Working on Behalf of:
ACT Government

Enquiry Date:	**Start Date:**	**End Date:**
22/04/2016	28/04/2016	31/05/2016

Address:
Couranga Crescent
Hume ACT 2620

Job Purpose: Excavation
Onsite Activity: Mechanical Excavation
Location of Workplace: Both
Location in Road: CarriageWay,Footpath,Nature Strip

- Check that the location of the dig site is correct. If not you must submit a new enquiry.
- Should the scope of works change, or plan validity dates expire, you must submit a new enquiry.
- Do NOT dig without plans. Safe excavation is your responsibility. If you do not understand the plans or how to proceed safely, please contact the relevant asset owners.

Notes/Description of Works:
B 9 10 11 S21 hume

Your Responsibilities and Duty of Care

- If plans are not received within 2 working days, contact the asset owners directly & quote their Sequence No.
- ALWAYS perform an onsite inspection for the presence of assets. Should you require an onsite location, contact the asset owners directly. Please remember, plans do not detail the exact location of assets.
- Pothole to establish the exact location of all underground assets using a hand shovel, before using heavy machinery.
- Ensure you adhere to any State legislative requirements regarding Duty of Care and safe digging requirements.
- If you damage an underground asset you MUST advise the asset owner immediately.
- By using this service, you agree to Privacy Policy and the terms and disclaimers set out at **www.1100.com.au**
- **For more information on safe excavation practices, visit www.1100.com.au**

Asset Owner Details

The assets owners listed below have been requested to contact you with information about their asset locations within 2 working days. Additional time should be allowed for information issued by post. It is **your responsibility** to identify the presence of any underground assets in and around your proposed dig site. Please be aware, that not all asset owners are registered with the Dial Before You Dig service, so it is **your responsibility** to identify and contact any asset owners not listed here directly.
** Asset owners highlighted by asterisks ** require that you visit their offices to collect plans.
# Asset owners highlighted with a hash require that you call them to discuss your enquiry or to obtain plans.

Seq. No.	Authority Name	Phone	Status
52388525	ActewAGL / Icon Water	0262935770	NOTIFIED
52388523	Department of Finance	0262263869	NOTIFIED
52388524	Telstra NSW, South	1800653935	NOTIFIED

END OF UTILITIES LIST

commence COMMUNICATIONS PTY LTD
ACT Government
Australian Government
Department of Finance
DIAL BEFORE YOU DIG
www.1100.com.au

ON SITE BOOKING REQUIRED- PLEASE CALL

Subject: Dial Before You Dig Request – Government Fibre Optic Network

Date: **22 April 2016**

Attention: **Josh Hewett**

Email: joshua.hewett@cardno.com.au

Site Address: **Couranga Crescent Hume**

DBYD Sequence #: **52388523**

From: **Donna Wullaert**

Thank you for conducting a Dial Before You Dig request. We manage the **Government Fibre Optic Network.**

THERE IS CRITICAL GOVERNMENT FIBRE OPTIC NETWORK ASSET IN ALL OF YOUR PROPOSED AREA- ONSITE BOOKING REQUIRED

We are writing to confirm an onsite service locate is required prior to your excavation commencing.

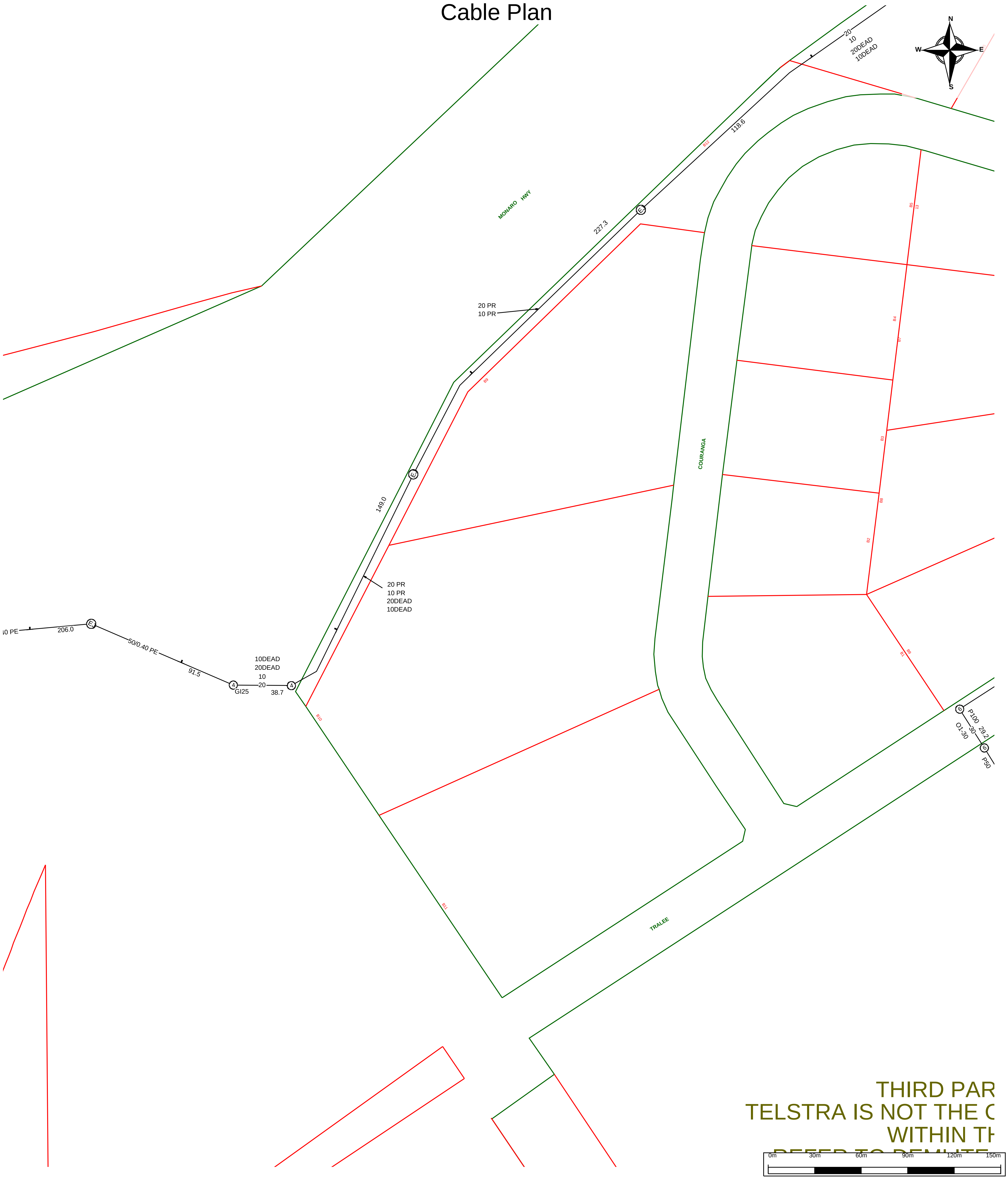
Please call Commence Communications on 02 6226 3869 to confirm a time for an on-site appointment prior to any works commencing.

Kind regards

Donna Wullaert
Commence Communications

19 Shearsby Crescent, Yass NSW 2582
P 02 6226 3869
24hr emergency: 0438 649 487
E dbydgovfibre@commencecomms.com.au
www.commencecomms.com.au
ABN 19 168 241 727

Cable Plan



Telstra	For all Telstra DBYD plan enquiries - email - Telstra.Plans@team.telstra.com For urgent onsite contact only - ph 1800 653 935 (bus hrs)	Sequence Number: 52388524
TELSTRA CORPORATION LIMITED A.C.N. 051 775 556		CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.
Generated On 22/04/2016 14:17:39		

The above plan must be viewed in conjunction with the Mains Cable Plan on the following page

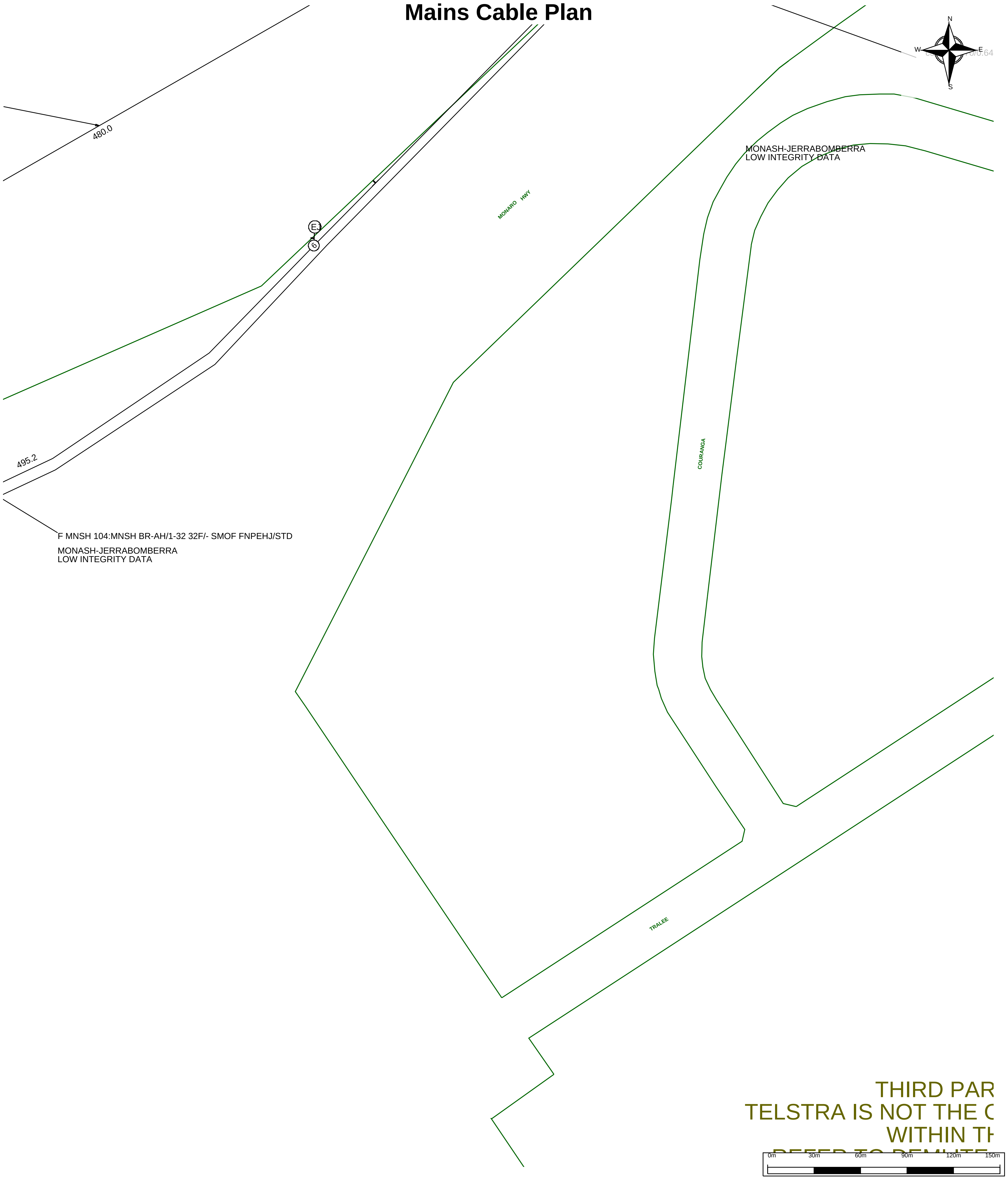
WARNING - Due to the nature of Telstra underground plant and the age of some cables and records, it is impossible to ascertain the precise location of all Telstra plant from Telstra's plans. The accuracy and/or completeness of the information supplied can not be guaranteed as property boundaries, depths and other natural landscape features may change over time, and accordingly the plans are indicative only. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for any inaccuracy shown on the plans.

It is your responsibility to locate Telstra's underground plant by careful hand pot-holing prior to any excavation in the vicinity and to exercise due care during that excavation.

Please read and understand the information supplied in the duty of care statement attached with the Telstra plans. TELSTRA WILL SEEK COMPENSATION FOR LOSS CAUSED BY DAMAGE TO ITS PLANT.

Telstra plans and information supplied are valid for 60 days from the date of issue. If this timeframe has elapsed, please reapply for plans.

Mains Cable Plan



For all Telstra DBYD plan enquiries -
email - Telstra.Plans@team.telstra.com
For urgent onsite contact only - ph 1800 653 935 (bus hrs)

TELSTRA CORPORATION LIMITED A.C.N. 051 775 556

Generated On 22/04/2016 14:17:41

Sequence Number: 52388524

CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.

WARNING - Due to the nature of Telstra underground plant and the age of some cables and records, it is impossible to ascertain the precise location of all Telstra plant from Telstra's plans. The accuracy and/or completeness of the information supplied can not be guaranteed as property boundaries, depths and other natural landscape features may change over time, and accordingly the plans are indicative only. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for any inaccuracy shown on the plans.

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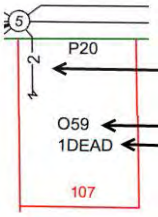
Telstra plans and information supplied are valid for 60 days from the date of issue. If this timeframe has elapsed, please reapply for plans.

LEGEND

For more info contact a Telstra Accredited Locater or Telstra Plan Services 1800 653 935

IT'S HOW
WE CONNECT

- **Exchange** (major cable present)
- **Footway access chamber** (can vary from 1-lid to 12-lid)
- ⊗ or ⊗ **Pillar/cabinet** (above the ground / free standing)
- **Above ground complex equipment housing** (eg RIM)
  Please Note: This equipment is powered by 240V electricity.
- OC **other carrier**

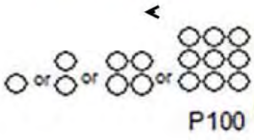


2 pair lead-in to property from pit in street

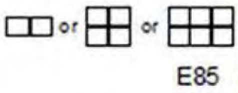
1 pair working (pair ID 059)

1 pair dead (i.e. spare, not connected)

- (6) **Cable jointing pit** (number indicating pit type)
- (EJ) **Elevated cable joint** (above ground joint on buried cable)
- **Telstra Plant in shared utility trench**
- **Aerial Cable** (above ground)
- **Aerial Cable** (attached to joint use pole e.g. power)
- **Direct buried cable**
- (M) **Marker post installed**
- (TR) **Buried transponder**
- (MT) **Marker, transponder**
- SMOF **Optical fibre cable direct buried**



Single to multiple round conduit
Configurations 1, 2, 4, 9 respectively
(Attached text denotes conduit type and size)

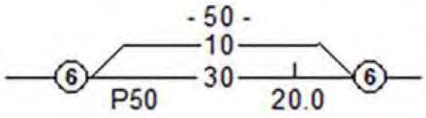


Multiple square conduit
Configurations 2, 4, 6 respectively
(Attached text denotes conduit type and size)

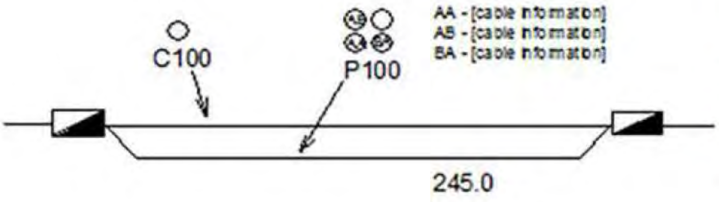
Some examples of conduit type and size:
A - Asbestos cement, P - PVC / plastic, C - Concrete, GI - Galvanised iron, E - Earthenware.
Conduit sizes *nominally* range from 20mm to 100mm.

P50	50mm PVC conduit
P100	100mm PVC conduit
A100	100mm asbestos cement conduit
E 85	85mm square earthenware conduit

Some examples of how to read Telstra plans:



One 50mm PVC conduit (P50) containing a 50-pair and a 10-pair cable between two 6-pits, 20.0m apart, with a direct buried 30-pair cable along the same route.



Two separate conduit runs between two footway access chambers (manholes) 245m apart. A nest of four 100mm PVC conduits (P100) containing assorted cables in three ducts (one being empty) and one empty 100mm concrete duct (C100) along the same route.

WARNING: Telstra plans and location information conform to Quality Level 'D' of the Australian Standard AS 5488 - Classification of Subsurface Utility Information. As such, Telstra supplied location information is indicative only. Spatial accuracy is not applicable to Quality Level D. Refer to AS 5488 for further details. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for any inaccuracy shown on the plans. FURTHER ON SITE INVESTIGATION IS REQUIRED TO VALIDATE THE EXACT LOCATION OF TELSTRA PLANT PRIOR TO COMMENCING CONSTRUCTION WORK. A plant location service is an essential part of the process to validate the exact location of Telstra assets and to ensure the asset is protected during construction works. The exact position of Telstra assets can only be validated by physically exposing it. Telstra will seek compensation for damages caused to its property and losses caused to Telstra and its customers.

DUTY OF CARE

TELSTRA CORPORATON ACN 051 775 556

IMPORTANT:

Please read and understand all the information and disclaimers provided below.

YOU MUST VALIDATE THE EXACT LOCATION OF TELSTRA PLANT PRIOR TO COMMENCING CONSTRUCTION WORK.
Telstra plan and location information conforms to Quality Level ‘D’ (QL-D) of the Australian Standard AS 5488 – Classification of Subsurface Utility Information. In accordance with AS 5488 QL-D, Telstra supplied location information is indicative only. Spatial accuracy is not applicable to AS 5488 QL-D. Telstra will seek compensation for damages caused to its property and losses caused to Telstra and its customers. Please note AS 5488 Quality Level ‘A’ is the only quality level that defines a subsurface utility as ‘validated’. Refer to AS 5488 for further details.

A Telstra Accredited Plant Locator is an essential part of the process to validate the exact location of the Telstra assets and to ensure the asset is protected during construction work. Only Telstra Accredited Plant Locators with a current photo ID card are authorised by Telstra to access Telstra network for location purposes. The exact position of Telstra assets can only then be validated (AS 5488 QL-A) by physically exposing it. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for the accuracy shown on the plans.

Telstra DBYD plans are not suitable for identifying Telstra network within a Telstra exchange site.
For advice on locating Telstra network within a Telstra exchange site contact Telstra Plan Services.

"DUTY OF CARE"

When working in the vicinity of telecommunications plant you have a "Duty of Care" that must be observed.

Works or proposed works should be planned to allow for minimal impact and appropriate protection of Telstra plant. Telstra can provide plans and sketches showing the presence of its network to assist at the design stage. Telstra will also work with you to avoid damage to Telstra’s plant during construction works.

It is your responsibility to:

1. Request plans of Telstra plant for a particular location at a reasonable time before construction begins. ***http://www.1100.com.au***
2. **Engage an Accredited Plant Locator who must have a current Telstra issued accreditation card**. A list of accredited locators is attached to this email. (Allow enough time to arrange for one).
3. After engaging a Telstra Accredited Plant Locator, validate the exact location of Telstra plant by hand digging or using non destructive water jet method (pot holing) where construction activities may be next to, damage or interfere with Telstra plant (see "Essential Precautions and Approach Distances" section for more information); and -
4. Contact Telstra's Plan Services (see below for details) if Telstra plant is wholly or partly located near planned construction activities and you require further advice about how to protect the plant or you need to relocate the plant to complete your construction activities. (***Telstra.Plans@team.telstra.com***)

Important note: *The construction of Telstra’s network dates back over many years. Some of Telstra’s pits and ducts were manufactured from asbestos-containing cement. You must take care in conducting any works in the vicinity of Telstra’s pits and ducts. You must refrain from in any way disturbing or damaging Telstra’s network infrastructure when conducting your works. We recommend that before you conduct any works in the vicinity of Telstra infrastructure that you ensure your processes and procedures eliminate any possibility of disturbing, damaging or interfering in any way with Telstra’s infrastructure. Your processes and procedures should incorporate appropriate measures having regard to the nature of this risk.*

ASSET RELOCATIONS

You are not permitted to relocate or alter or repair any Telstra assets or network under any circumstances.

For all enquiries relating to the relocation or protection of Telstra assets please phone
1800 810 443 or email **NetworkIntegrity@team.telstra.com**

Only Telstra and its contractors may access and conduct works on Telstra's network (including its plant and assets). This includes performing modification or relocation works. This requirement is to ensure that Telstra can protect the integrity of its network, avoid disruption to services and ensure that the relocation meets Telstra's requirements.

DAMAGE TO TELSTRA'S NETWORK MUST BE REPORTED TO 132203 IMMEDIATELY.

You will be held responsible for all plant damage that occurs or any impacts to Telstra's network as a result of your construction activities. This includes interfering with plant, conducting unauthorised modification works and interfering with Telstra's assets in a way that prevents Telstra from accessing or using its assets in the future.

Telstra reserves all rights to recover compensation for loss or damage to its cable network or other property including consequential losses.

EMERGENCY SITUATIONS - RECEIVING TELSTRA PLANS

Telstra's automated mapping system will provide a fast response for emergency situations. (Faster than an operator can provide manually). Automated responses are normally available 24/7.

To receive a fast automated response from Telstra your request must **-**

- be a web request lodged at DBYD (**www.1100.com.au**). The request will be then forwarded directly to Telstra.
- contain your email address so you can receive the automated email response.
- be for the purposes of 'mechanical excavation' or other ground breaking DBYD activity. (requests with activity types conveyancing, planning & design or other non digging activities may not be responded to until the next business day).
- be for an area less than 350 metres in size to obtain a PDF map (over 350 metres will default to DWF due to size) This does not include congested CBD areas where only DWF may be supplied.
- be for an area less than 2500 metres in size to obtain a DWF map (CBD's less)

NATURAL DISASTERS

Natural Disasters include (amongst other things) earthquakes, cyclones, floods and tsunamis.

In the case of such events, urgent requests for plans or information relating to the location of Telstra network can be made directly to Telstra Network Integrity Team Managers as follows:

NSW –	John McInerney	0419 485 795
QLD –	Glenn Swift	0419 660 147
VIC/TAS -	David Povazan	0417 300 947
SA/NT -	Mick Weaver	0419 828 703
WA -	Angus Beresford-Peirse	0419 123 589

TELSTRA PLAN SERVICES - for all Telstra Dial Before You Dig related enquiries

email - **Telstra.Plans@team.telstra.com**
phone - **1800 653 935** (general enquiries, business hours only)

for Telstra DBYD plan information -	Shalin	07 3455 2997
	Glen	07 3455 1011
for advice on preventing damage -	Shalin	07 3455 2997
	Lachlan	07 3455 3132
Accredited plant locator enquiries -	Mike	0477 377 036
	Taylor	07 3455 3208

(Including how to become an Telstra Accredited Plant Locator to locate Telstra network)

Road closures and easements -	Megan	07 3455 0834
	Glen	07 3455 1011

Please note - to make an enquiry the plans must be current (within 60 days of issue). If your plans have expired you will need to submit a new request via DBYD.

CONCERNING TELSTRA PLANS:

Please note the following:

- For Telstra plans contact **Dial Before You Dig** (**www.1100.com.au**) at least 2 business days prior to digging. (Note - further lead time may be required for you to arrange for a Telstra Accredited Plant Locator from the provided list)
- Fast response can be provided by Telstra if an email address is supplied. (if posted, this may take up to one week or longer to receive plans)
- Telstra plans and information provided are **valid for 60 days** from the date of issue.
- Telstra owns and retains the copyright in all plans and details provided in conjunction with the applicant's request. The applicant is authorised to use the plans and details only for the purpose indicated in the applicant's request. The applicant must not use the plans or details for any other purpose.
- Telstra plans or other details are provided only for the use of the applicant, its servants, agents or Telstra-accredited plant locators. **The applicant may not give the plans or details to any parties other than these, and may not generate profit from commercialising the plans or details.**
- Please contact **Telstra Plan Services** (see above for details) immediately should you locate Telstra assets not indicated on these plans.
- Telstra, its servants or agents shall not be liable for any loss or damage caused or occasioned by the use of plans and or details so supplied to the applicant, its servants and agents, and the applicant agrees to indemnify Telstra against any claim or demand for any such loss or damage.
- Please ensure Telstra plans and information provided remains on-site at all times throughout the inspection, location and construction phase of any works.
- Telstra plans conform to Quality Level ‘D’ of the Australian Standard (AS5488) – Classification of Subsurface Utility Information (SUI). For further information refer to AS 5488.

ESSENTIAL PRECAUTIONS AND APPROACH DISTANCES:

NOTE: If the following clearances cannot be maintained, please contact Telstra Plan Services for advice on how best to resolve this situation. (see above for contact details)

On receipt of plans and sketches and before commencing any excavation work or similar activities near Telstra's plant, you must validate the exact location of the Telstra plant. Refer to the information marked 'Important' on the cover page of this document.

1. Where Telstra's plant is in an area where road and footpaths are well defined by kerbs or other

features a minimum clear distance of 600mm must be maintained from validated Telstra assets.

In non established or unformed reserves and terrain, this approach distance must be at least 1.5 metres.

In country/rural areas which may have wider variations in reasonably presumed plant presence, the following minimum approach distances apply:

a) Parallel to major plant: 10 metres (for optic fibre and/or copper cable over 300 pairs)
b) Parallel to other plant: 5 metres

NOTE: Even manual pot-holing needs to be undertaken with extreme care, commonsense and employing techniques least likely to damage cables. For example, orientate shovel blades and trowels parallel to the cable rather than digging across the cable.

If construction work is parallel to Telstra plant, then careful hand digging or using non destructive water jet method (pot-holing) at least every 5m is required to validate the location of all plant before work commences.

2. Maintain the following minimum clearance between construction activity and **actual validated location** of Telstra Plant.

Jackhammers/Pneumatic Breakers	*Not within 1.0m of **actual validated location.***
Vibrating Plate or Wacker Packer Compactor	*Not within 0.5m of **actual validated location** of Telstra ducts.* *300mm compact clearance cover before compactor can be used across Telstra ducts.*
Boring Equipment (in-line, horizontal and vertical)	*Not within 2.0m of **actual validated location**.* *Constructor to hand dig or use non-destructive water jet method (pot-hole) and expose plant.*
Heavy Vehicle Traffic (over 3 tonnes)	*Not to be driven across Telstra ducts (or plant) with less than 600mm cover.* *Constructor to check actual depth via hand digging.*
Mechanical Excavators, Farm ploughing and Tree Removal	*Not within 1.0m of **actual validated location.*** *Constructor to hand dig or use non-destructive water jet method (pot-hole) and expose plant.*

All Telstra pits and manholes should be a minimum of 1.2m in from the back of kerb after the completion of your work.

All Telstra conduit should have the following minimum depth of cover after the completion of your work:-

Footway 450mm

Roadway 450mm at drain invert and 600mm at road centre crown

For clearance distances relating to Telstra pillars, cabinets and RIMs/RCMs please contact Telstra Plan Services (see above for details).

FURTHER ASSISTANCE:

Assistance can be obtained by contacting Telstra Plan Services (see contact details above)

Where on-site location is provided, you are responsible for all hand digging or use non-destructive water jet method (pot-holing) to visually locate and expose Telstra plant for validation purposes. (For advice on damage prevention please contact Telstra Plan Services)

If plant location plans or visual location of Telstra plant by digging reveals that the location of Telstra plant is situated wholly or partly where you plan to work, then Telstra's Network Integrity Group must be contacted to discuss possible engineering solutions.
Please phone **1800 810 443** or email **NetworkIntegrity@team.telstra.com**

NOTE:

If Telstra relocation or protection works are part of the agreed solution, then payment to Telstra for the cost of this work shall be the responsibility of the principal developer, constructor or person for whom the work is performed. The principal developer or constructor will be required to provide Telstra with the details of their proposed work showing how Telstra's plant is to be accommodated and these details must be approved by the Regional Network Integrity Manager prior to the commencement of site works.
Please phone **1800 810 443** or email **NetworkIntegrity@team.telstra.com**

RURAL LANDOWNERS

Where Telstra owned cable crosses agricultural land, Telstra may provide on-site assistance with cable location. The Telstra Plan Services operator will provide assistance in determining eligibility.

Please note:

- If eligible, the location assistance must be approved and organised by Telstra. Telstra will not fund location assistance that has not been approved and facilitated by Telstra. (e.g. when a customer engages the locator directly and then requests that Telstra pay the costs retrospectively)
- The exact location, including depth of cables, must be verified by pot holing, which may not be covered by this service.
- This service is only available to assist private rural land owners.
- This service normally covers one hour on-site only. Any time required in addition to Telstra funded time can be purchased directly from the assigned Telstra Accredited Plant Locator.

For further information including terms and conditions, please contact Telstra Plan Services.

PRIVACY NOTE

Your information has been provided to Telstra by DBYD to enable Telstra to respond to your DBYD request. Telstra keeps your information in accordance with its privacy statement entitled "Protecting Your Privacy" which can be obtained from Telstra either by calling 1800 039 059 or visiting our website at www.telstra.com.au/privacy

DATA EXTRACTION FEES

In some instances a data extraction fee may be applicable for the supply of Telstra information. Typically a data extraction fee may apply to large projects or requests to be supplied in non standard formats. For further details contact Telstra Plan Services.

ELECTRONIC PLANS - PDF AND DWF MAPS

If you have received Telstra maps via email you will have received the maps as either a PDF file (for smaller areas) or DWF file (for larger area requests). If you are unable to launch any one of the softcopy files for viewing and printing, you may need to download and install one or more of the free viewing and printing products such as Adobe Acrobat Reader (for PDF files) or Autodesk Design Review (for DWF files) available from the internet.

PDF files

PDF is the default softcopy format for all requests for areas up to approx *350m in length. (*depends on geographic location of request). The PDF file is formatted to A3 portrait sheet however it can be printed on any size sheet including from A4 to AO, either as the full sheet or selected areas to suit needs and legibility. (to print a selected area zoom up and print 'current view') If there are multiple layers of Telstra network you may receive up to 2 sheets in the single PDF file attachment supplied. There are three types or layers of network normally recorded - local network, mains cables or a combined layer of local and mains (usually displayed in rural or semi rural areas). If mains cable network is present in addition to local cables (i.e. as separate layer in a particular area), the mains will be shown on a separate sheet. The mains cable information should be read in conjunction with the local cable information.

DWF files

This is the default softcopy format for all requests for areas that are over 350m in length. Maximum length for a DWF automated response is approx 2500m - depending on geographic location of request (manually-processed plans may provide larger coverage). The DWF files differ from PDF in that DWF are vector files made up of layers that can be turned on or off and are not formatted to a specific sheet size. This makes them ideal for larger areas and for transmitting over email etc.

How to view Telstra DWF files -

Telstra DWF files come with all layers turned on. You may need to turn individual layers on or off for viewing and printing clarity. Individual layer names are CC (main cable/conduit), DA (distribution or local area network) and sometimes a combined layer - CAC. Layer details can be viewed by either picking off the side menu or by selecting 'window' then 'layers' off the top menu bar. Use 'layers' to turn individual layers off or on. (double click or right click on layer icon.)

How to print Telstra DWF files -

DWF files can be printed on any size sheet. They can be printed in their entirety or by selected areas of interest. Some DWF coverage areas are large and are not suited to printing legibly on a single A4 sheet - you may need several prints if you only have an A4 printer. Alternatively, an A3, A1 or larger printer could be used. To print, zoom in or out and then, by changing the 'print range' settings, you can print what is displayed on your screen to suit your paper size. If you only have a small printer, e.g. A4, you may need to zoom until the text is legible on your screen for it to be legible on the print. (which is why you may need several prints). To print what is displayed on your screen the 'view' setting should be changed from 'full page' to 'current view'. The 'current sheet' setting should also be selected. You may need to print layers separately for clarity and legibility. (Details above on how to turn layers on or off)

How to change the background colour from white to black (when viewing) Telstra DWF files -

If using Autodesk Design Review the background colour can be changed by selecting 'Tools' then 'options' then 'sheet'. Tick the box 'override published paper colours' and select the colour required using the tab provided.

Telstra Automated Mapping System (TAMS)

Telstra provides an automated plan response for the majority of DBYD requests received.

Requestors must supply a current email address on their request to DBYD and must also be able to accept a standard format of PDF or DWF. An automated response can be provided much faster than the alternative of a mailed hardcopy, and can avoid unnecessary delays in waiting for plans to arrive. Being softcopy, it can easily be sent directly to a worksite and can be available 7 days a week. The automated system can be configured for individual requestors to receive either PDF/DWF (where small requests are PDF and larger requests are DWF) or, alternatively, all in DWF (both small and large requests). Please contact Plan Services for further details or to have your preferences updated. **Please note that all requests over *350m (approx.) in size or congested CBD areas can only be supplied in DWF format** and there are size limits on what can be provided. (* actual size depends on geographic location of requested area)

TELSTRA ACCREDITED PLANT LOCATORS (For your area)

All Accredited Plant Locators locating Telstra network must have a current identification card issued by Telstra. A list of Telstra Accredited Plant Locators is provided with the Telstra Dial Before You Dig plans.

Telstra does not permit external parties (non-Telstra) to access or conduct work on our network. Only Telstra staff, Telstra contractors or locators who are correctly accredited are authorised to work on or enter our manholes, pits, ducts, cables etc. This is for safety as well as for legal reasons.

Please note it is a criminal offence under the *Criminal Code Act 1995* (Cth) to tamper or interfere with communication facilities owned by a carrier. Heavy penalties may apply for breach of this prohibition, and any damages suffered, or costs incurred by Telstra as a result of any such unauthorised works may be claimed against you.

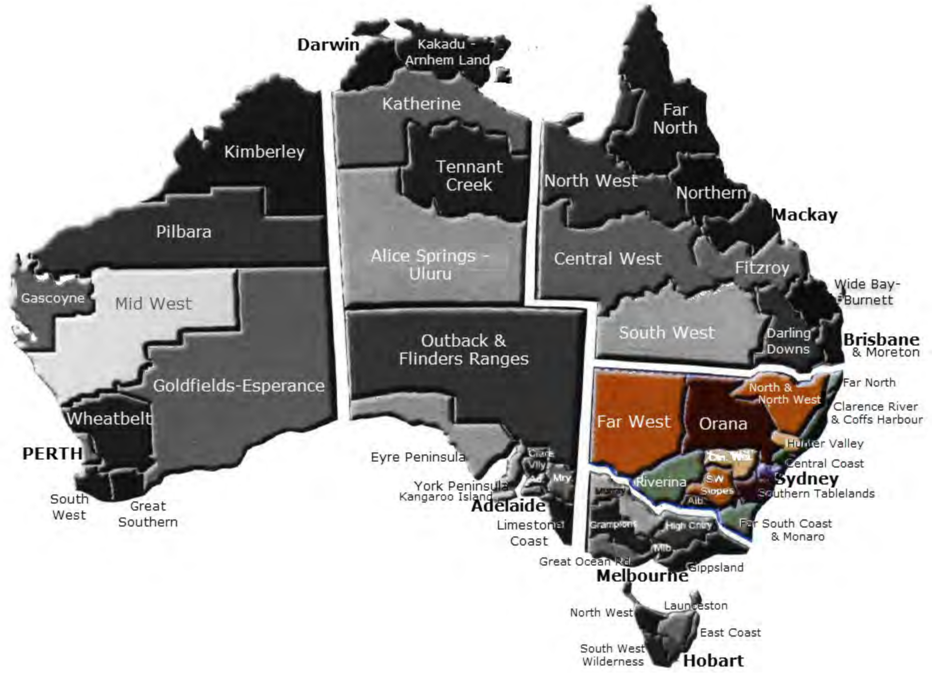
The provided list contains the names and contact details for Accredited Plant Locators who service your area and can provide you with assistance in locating Telstra assets for validation purposes. These organisations have been able to satisfy Telstra that they have a sound knowledge of telecommunications plant and its sensitivity to disturbance; appropriate equipment for locating telecommunications plant and competent personnel who are able to interpret telecommunications plans and sketches and understand safety issues relevant to working around telecommunications plant.

Please Note:

- Optic fibre cable locations must be performed by a locator with Telstra optic fibre cable location accreditation. (Not all copper accredited locators have optic fibre accreditation). The locators with additional optic fibre cable location accreditation are indicated by a 'yes' in the column headed 'Fibre' in the lists of locators that are published with the DBYD plans. Telstra Accredited Plant Locators that are DBYD Certified Locators are also fibre accredited. Inspection of photo ID cards will confirm whether locators are just copper accredited or copper + fibre accredited.
- An Accredited Plant Locator is NOT permitted to provide depth of communications plant unless it is physically exposed by hand digging. An electronic derived depth measurement cannot be relied on as being accurate.
- The details of any contract, agreement or retainer for site assistance to locate telecommunications plant shall be for you to decide and agree with the organisation engaged. Telstra is not a party to any contract entered into between you and an Accredited Plant Locator. The Accredited Plant Locators are able to provide guidance concerning the extent of site investigations required.
- Payment for the site assistance will be your responsibility and payment details should be agreed before the engagement is confirmed.
- Telstra does not accept any liability or responsibility for the performance of or advice given by an Accredited Plant Locator. Accreditation is an initiative taken by Telstra towards the establishment and maintenance of competency standards. However, performance and the advice given will always depend on the nature of the individual engagement.
- You have the right to request the organisation you engage to show their Telstra issued ID card.
- Neither the Accredited Plant Locator nor any of its employees are an employee or agent for Telstra. Telstra is not liable for any damage or loss caused by the Accredited Plant Locator or its employees.

Telstra offers free Cable Awareness Presentations & Advanced Cable Reading Presentations, if you believe you or your company would benefit from this offer please contact Network Integrity on 1800 810 443 or **NetworkIntegrity@team.telstra.com**

*For details on how to become an Accredited Plant Locator to be able to locate Telstra network please contact Telstra Plan Services – Mike (0477 377 036) ***mugl@dominoapp.in.telstra.com.au***



TELSTRA ACCREDITED PLANT LOCATORS – NEW SOUTH WALES. SOUTHERN REGION

Region NSW South

Telstra plans are intended to be indicative only. A plant location service (Telstra accredited) is required to identify the exact location of the plant and ensure that the asset is protected during construction work. It is your responsibility as part of your "Duty of Care" to engage an Accredited Plant Locator.

<u>*Optic fibre cable locations</u> must be performed by a locator with Telstra optic fibre location accreditation.

Locators with Telstra optic fibre cable location accreditation are indicated by either a 'yes' in the 'Fibre' column or the DBYD Certified Locator Symbol.

DIAL BEFORE YOU DIG
CERTIFIED
LOCATOR

Please contact a Telstra accredited locator from the pages following (fees apply).

Telstra Accredited Plant Locators – New South Wales. SOUTH

NSW South.

Company Name & service areas	*Fibre	Contact	
A1 Hydro Excavation Central West NSW	YES	02 6331 9588 ibm2003@bigpond.net.au 	Phone Mobile Fax Email Web
Accurate Locating Pipes & Cables Adelaide, Adelaide Hills, Barossa Valley and all regions of SA. Western and North Western Victoria, South West NSW, Southern N.T.	YES	 0407 464 882 08 8524 4945 precisedetection@yahoo.com 	Phone Mobile Fax Email Web
Advanced Ground Locations Newcastle, Hunter Valley, Central Coast	DIAL BEFORE YOU DIG CERTIFIED LOCATOR	02 4930 3195 0412 497 488 02 49303222 steve_agl@hotmail.com www.advancedgroundlocations.com	Phone Mobile Fax Email Web
All About Pipes All of NSW	YES	1300 634 200 0408 790 010 02 9606 2325 work@allaboutpipes.com.au www.allaboutpipes.com.au	Phone Mobile Fax Email Web
Australian Locating Services Pty Ltd All of NSW	YES	1300 761 545 0412 227 434 02 9531 2169 admin@locating.com.au www.locating.com.au	Phone Mobile Fax Email Web
Australian Subsurface Pty Ltd All of NSW	YES	02 6100 8324 0427 879 600 admin@australiansubsurface.com www.australiansubsurface.com	Phone Mobile Fax Email Web
Australian Underground Utility Locations Eurobodalla Shire, Bega Valley Shire, Snowy River Shire, Batemans Bay to Vic border, Far South Coast NSW	YES	02 6494 4955 0418 329 370 moceanfabrications@gmail.com www.auul.com.au	Phone Mobile Fax Email Web
A.U.S. (Australian Underground Surveys) NSW southern regions	NO	 0417 458 803 02 6231 1762 barryfowler@grapevine.com.au 	Phone Mobile Fax Email Web
Bega Bobcats Bega Valley Shire	YES	02 6492 0283 0427 260 423 02 6492 0283 zzbobcat@bigpond.net.au 	Phone Mobile Fax Email Web
Billy Charnock Electrical Swan Hill and surrounding districts	YES	03 5032 1866 03 5033 1866 admin@charnock.net.au www.billycharnockelectrical.com.au	Phone Mobile Fax Email Web
Boorowa Council Boorowa district	NO	02 6385 3303 council@boorowa.nsw.gov.au 	Phone Mobile Fax Email Web
Capogreco Excavations Pty Ltd Mildura, Wentworth, Gol Gol, Dareton, Ouyen, Robinvale, Merbein	YES	03 5022 2070 0428 356 269 03 5022 7002 info@capoex.com.au www.capoex.com.au	Phone Mobile Fax Email Web
Cardno ACT	NO	1300 224 664 cardnoaus@cardno.com.au 	Phone Mobile Fax Email Web

Telstra Accredited Plant Locators – New South Wales. SOUTH

Coastal Cable Locators Pty Ltd		02 4457 1258	Phone
Wollongong to Eden, Braidwood, Bungendore, Goulburn	YES	0427 975 777	Mobile
		02 4457 1258	Fax
		skomalley@bigpond.com	Email
			Web
Cobram Electrical and Data		03 5871 2807	Phone
North East Victoria and NSW	YES	0438 503 973	Mobile
		03 5871 2907	Fax
		info@cobramelectricalanddata.com	Email
		www.cobramelectricalanddata.com	Web
Commence Communications Pty Ltd		02 6226 3869	Phone
Canberra, Yass, Bungendore, Goulburn and surrounding regional areas.	YES	0428 595 620	Mobile
			Fax
		admin@commencecomms.com.au	Email
		www.commencecomms.com.au	Web
D-Tech Services		02 6278 7548	Phone
	NO	0438 693 660	Mobile
		02 4278 7548	Fax
		dtech@webone.com.au	Email
			Web
DATATEKS Pty Ltd		02 6971 777	Phone
All NSW	YES	0408 693 660	Mobile
			Fax
		gilbertcook@datateks.com.au	Email
		www.datateks.com.au	Web
Digitin Coms Pty Ltd		02 6297 4120	Phone
Southern NSW	NO	0407 406 766	Mobile
		02 6299 2410	Fax
		digitincoms@grapevine.com.au	Email
		www.digitin.com.au	Web
Down Under Detection Services		02 9371 7744	Phone
	YES		Mobile
			Fax
		downunderdetections@bigpond.com	Email
Down Under Pipeline Surveys Pty Ltd		02 4653 1286	Phone
	NO	0418 675 374	Mobile
		02 4653 1747	Fax
		office@dups.com.au	Email
		www.dups.com.au	Web
Echuca & District Cable Locations			Phone
Northern VIC, Southern NSW	YES	0419 001 843	Mobile
		03 5482 5005	Fax
		denniscompton@bigpond.com	Email
			Web
Eiicon Pty Ltd			Phone
Wodonga, Albury, Wagga Wagga, Wangaratta, Touong Shire, Alpine Shire, Indigo Shire	YES	0419 568 331	Mobile
		02 6027 5231	Fax
		phil.butler@eiicon.com	Email
		www.eiicon.com	Web
Far West Communications		08 8087 3577	Phone
NSW areas – Cobar, Broken Hill, Menindee, Tibbaburra, Ivanhoe and surrounding areas	YES	0439 350 355	Mobile
		08 8087 3588	Fax
SA areas – Eastern regions of SA including Mingary & Cockburn		peterclark1@bigpond.com	Email
			Web
Fletcher Plumbing & Co		02 6057 1100	Phone
Southern NSW and North East Victoria	NO	0404 030 305	Mobile
		02 6025 3353	Fax
		enquiries@fletcherplumbingandco.com	Email
Fulton Hogan Construction Pty Ltd			Phone
Southern NSW	YES	0488 998 369	Mobile
		02 8346 9444	Fax
		John.herbert@fultonhogan.com.au	Email
			Web
G B Geotechnics (Australia) Pty Ltd		02 9890 2122	Phone
All areas of New South Wales	NO	0403 153 651	Mobile
			Fax
		jamie@gbgoz.com.au	Email
			Web

Telstra Accredited Plant Locators – New South Wales. SOUTH

G & C McCorkindale Dubbo, Young, Wagga, Yass, Goulburn, Bathurst, Orange, Temora, West Wyalong & most NSW country regions	DIAL BEFORE YOU DIG CERTIFIED LOCATOR	0488 520 482	Phone
		0408 822 428	Mobile
		02 6382 2639	Fax
		locatelt@bigpond.net.au	Email
			Web
Geoscope Utility Detection Services Pty Ltd Sydney areas and parts of NSW	YES		Phone
		0432 296 323	Mobile
			Fax
		info@geoscopelocating.com.au	Email
		www.geoscopelocating.com.au	Web
Geotrace Pty Ltd All Areas, Hills District, Sydney, Wollongong, Newcastle, ACT, Sutherland, Bankstown, Richmond, Burwood, Rose Bay, Balmain	YES	02 8824 6654	Phone
		0417 147 945	Mobile
		02 8824 5637	Fax
		antony@geotrace.com.au	Email
		www.geotrace.com.au	Web
Ground Scan Locating Bathurst, Central West	YES		Phone
		0414 640 640	Mobile
		02 6332 2599	Fax
		gscan1@bigpond.com	Email
			Web
GVS Irrigation Enterprises Wagga Wagga and surrounding areas	YES	02 6921 6747	Phone
		0427 075 547	Mobile
		02 6971 9016	Fax
		gerry@gvsirrigation.com.au	Email
		www.gvsirrigation.com.au	Web
Hunter Smith Management Pty Ltd NSW & ACT	NO	02 8090 2695	Phone
		0422 224 761	Mobile
		02 8282 5056	Fax
		hntersmith@iprimus.com.au	Email
			Web
Hydro Digga All of NSW, ACT & South East Qld	YES		Phone
		0447 774 000	Mobile
			Fax
		locator@hydrodigga.com	Email
			Web
Landmark Surveys Pty Ltd Southern NSW and ACT areas	YES	02 6280 9608	Phone
		0413 832 038	Mobile
		02 6280 9696	Fax
		phil@landmarksurveys.com.au	Email
		www.landmarksurveys.com.au	Web
Laneyrie Electrical Pty Ltd Helensburgh to Ulladulla, Southern Highlands	YES	02 4262 8166	Phone
		0412 079 079	Mobile
		02 4260 9193	Fax
		gazza7979@gmail.com	Email
			Web
Laser Electrical Goulburn Goulburn and surrounding regional area	NO	02 4822 7742	Phone
		0417 392 273	Mobile
			Fax
		goulburn@laserelectrical.com.au	Email
		www.laserelectrical.com.au	Web
Lynco Pty Ltd t/as Lyntet Communications Dubbo, Forbes, Grenfell, Parkes, Bourke, Bourke North, Nyngan, Coonabarabran, Coonamble, Mudgee, Narromine, Wellington, Orange, Molong, Yeoval, Coolah, Dunedoo, Gilgandra, Mendooran	YES		Phone
		0409 811 673	Mobile
		02 6882 9856	Fax
		lyntet@bigpond.com.au	Email
			Web
MIA Pipe & Cable Layers Pty Ltd Griffith, Leeton, Narrandera and surrounding areas.	NO	02 6964 0083	Phone
		0418 501 050	Mobile
		02 6964 7877	Fax
		kb@miapcl.com.au	Email
			Web
Mr Mac Group Bathurst, Orange, Yass and Goulburn.	DIAL BEFORE YOU DIG CERTIFIED LOCATOR		Phone
		0447 818 260	Mobile
			Fax
		locatemrmac@gmail.com	Email
			Web
Murray Valley Locating and Electrical Cobram, Murray Valley, North East Victoria, South NSW	YES		Phone
		0417 426 731	Mobile
			Fax
		officemvle@gmail.com	Email
			Web

Telstra Accredited Plant Locators – New South Wales. SOUTH

Neil Macklin Communications Griffith	NO	 0417 417 921 neilgailmacklin@bigpond.com 	Phone Mobile Fax Email Web
On Point Utility Locating Pty Ltd Sydney, Parramatta, Penrith, Wollongong, Central Coast, Highlands, Goulburn, Blue Mountains	YES	 0405 149 529 troy@onpointlocating.com.au 	Phone Mobile Fax Email Web
Online Pipe & Cable Locating Pty Ltd Sydney, Newcastle, Canberra, Central Coast, Wollongong, Blue Mountains and Port Macquarie	YES	1300 665 384 0418 402 234 02 9676 6127 office@onlinepipe.com.au 	Phone Mobile Fax Email Web
Peter Ellsmore and Associates Wollongong, Illawarra, South Coast & Southern Highlands	YES	02 4253 5616 0439 423 708 02 4253 4660 Ian.brown@ellsmore.com.au www.ellsmore.com.au	Phone Mobile Fax Email Web
Riverina Cable Location Pty Ltd Wagga Wagga and surrounding areas	YES	02 6931 6565 0428 958 632 desdammefencing@msn.com 	Phone Mobile Fax Email Web
Rubicof Pty Ltd Gosford, Newcastle, Taree	YES	02 4990 5718 0418 683 451 02 4991 2600 rubicof@optusnet.com.au 	Phone Mobile Fax Email Web
Rutherford Electrical Engineering Services	NO	02 4932 7344 02 4932 5219 kmaher@ruthelect.com.au 	Phone Mobile Fax Email Web
Signal Support Services Pty Ltd Goulburn, Southern Highlands, Canberra.	NO	02 4821 8334 0409 719 390 02 4821 0203 ted@signalsupport.com.au 	Phone Mobile Fax Email Web
Southern Cable Services Pty Ltd	NO	02 6226 5201 0417 255 573 02 6226 5675 southerncables@gmail.com 	Phone Mobile Fax Email Web
Spot On Group Central & North East Victoria, Southern NSW	NO	1300 531 431 0407 505 226 03 5032 1173 dale@spotongroup.com.au 	Phone Mobile Fax Email Web
Steger & Associates Registered Land Surveyors NSW & ACT	YES	02 6296 4089 02 6296 4090 enquiries@leachsteger.com.au 	Phone Mobile Fax Email Web
Tim Barnes Communications Riverina and surrounding areas, Wagga, Albury, West Wyalong, Hay Temora	YES	 0428 534 476 02 6953 4460 tbarnes7@bigpond.net.au 	Phone Mobile Fax Email Web
TR Civils ACT – Southern Tablelands, Goulburn, Snowy Mountains areas	YES	02 6249 6818 0402 442 068 admin@trcivils.com.au 	Phone Mobile Fax Email Web
UES (Victoria) Pty Ltd Northern Victoria, Goulburn Valley, Southern Riverina	YES	 0407 120 201 03 5852 1577 jarrod@undergroundengineeringsolutions.com.au	Phone Mobile Fax Email

Telstra Accredited Plant Locators – New South Wales. SOUTH

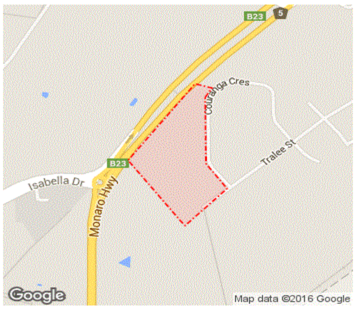
Utility I.D.			Phone
All areas Queensland and New South Wales	YES	0401 202 515	Mobile
			Fax
		info@utilityid.com.au	Email
		www.utilityid.com.au	Web
Utility Locating Pty Ltd t/as Suresearch		1300 884 520	Phone
Sydney, Penrith, Richmond, Wollongong, Katoomba, Macarthur, Central Coast, Newcastle, Maitland, Hunter Valley, Port Macquarie	YES	0408 221 046	Mobile
		02 8915 1487	Fax
		info@suresearch.com.au	Email
			Web
Vac Group Operations Pty Ltd t/as Earthspy		1300 822 834	Phone
	YES	0447 466 022	Mobile
			Fax
			Email
			Web
Vacsafe		02 6372 2823	Phone
	NO	0414 810 652	Mobile
		02 6372 4753	Fax
		info@vacsafe.com.au	Email
			Web
Vertex Power & Process			Phone
Broken Hill and Western NSW	YES	0419 847 760	Mobile
			Fax
		admin@vertexpp.com.au	Email
			Web
Wagga Directional Drilling		02 6925 4660	Phone
Riverina and surrounds	YES	0418 800 196	Mobile
		02 6925 4941	Fax
		paulkeough@bigpond.com	Email
			Web
Watters Electrical		03 5821 3944	Phone
	YES	0427 505 247	Mobile
		03 5831 1101	Fax
		Kevin.beanham@watters.com.au	Email
		www.watters.com.au	Web
ZNX Pty Ltd			Phone
ACT & surrounding areas	NO	0402 060 474	Mobile
			Fax
		Jimmy.bland@zinfra.com.au	Email
			Web

Asset Location Information

Applicant/Contractor **Job No.** 10596252 **DBYD Sequence No.** 52388525

Company: Cardno
Contact: Mr Josh Hewett
Telephone: 0416912198 **Mobile:** Not Supplied **Fax:** Not Supplied
Address: Level 2 Wormald St Symonston ACT 2609
Email: joshua.hewett@cardno.com.au

Work Details



Suburb: Hume
Address: Couranga Crescent
UBD Ref: 89M10,89M8,89M9,89N10,89N8,89N9
Description: B 9 10 11 S21 hume

Enquiry Date: 22-Apr-2016 **Issue Date:** 22-Apr-2016

Information

The approximate location of ActewAGL or Icon Water assets in the area-of-enquiry are shown on the attached maps.

Please review all attached maps to check whether there are ActewAGL or Icon Water utility assets within your work area.

Please refer to your Dial Before You Dig (DBYD) enquiry information to ensure that you have received asset maps from all relevant utility owners before you commence work.

Note that there may be additional pages attached dependent on what assets are found in the area; and that maps might be on pages of different sizes.

Individual customer gas connections are generally not shown on any attached ActewAGL Gas Network map.
For information regarding individual gas connections we recommend that you request a site meeting / inlet service location as per Item 6 in the Disclaimer.

HIGH PRESSURE CRITICAL GAS NETWORK ASSETS HAVE BEEN DETECTED WITHIN YOUR SEARCH AREA

As High Pressure critical gas assets are present, you must not commence **any** works without first contacting Jemena Land Services on (02) 9397 9000 (see Item 12 in Disclaimer for further information).

Comments

This information is valid from **22-Apr-2016** to **22-Jul-2016**

IN CASE OF EMERGENCY OR TO REPORT DAMAGE PHONE:
13 10 93 ELECTRICITY | **13 11 93** WATER AND SEWER | **13 19 09** GAS

Please read the following important information (overleaf)

The Essential First Step

Disclaimer

1. General location only

The Applicant acknowledges that:

(a) while Icon Water and ActewAGL have used reasonable endeavours to keep Asset location records current, neither party makes any warranty, guarantee or representation as to the accuracy, currency or completeness of the information contained in the attached Asset Plans.

(b) Asset Plans:

  i. may not show all assets in the work area;

  ii. show only the general and approximate location of Assets;

  iii. may show the position of Assets relative to fences, buildings, property lines, kerbs and/or other points of reference that existed at the time the Assets were installed. Any subsequent alterations to those fences, buildings etc may not have been updated on the Asset Plans. Persons should not rely on such things as a point of reference to estimate location of the Assets.

2. Limitation of liability

To the maximum extent permitted by law:

(a) subject to paragraph 2(b), Icon Water, Jemena and ActewAGL and the officers, employees and agents of each accept no responsibility or liability for any loss, damage, liability, cost, expense, claim or proceeding of whatever nature and howsoever arising, incurred by or awarded against the Applicant or its officers, employees, agents, contractors or subcontractors, arising out of, connected with or as a consequence of use of the Asset Plans or any inaccuracies in the Asset Plans;

(b) where:

  i. a Jemena or ActewAGL representative has, at the Applicants request, attended the work site to mark the location of Assets prior to commencement of any works on the work site, and

  ii. the Jemena or ActewAGL representative has been proven to be negligent in marking the Asset location

then Icon Water, Jemena and ActewAGL's liability, and the liability of the officers, employees and agents of each, is limited, at Icon Water / Jemena / ActewAGL's option, to re-attending the work site to re-mark the Asset location or paying the costs of having a third party attend the work site to re-mark the Asset location.

3. Electricity cables to be treated as LIVE

ALL electricity cables and conductors identified on the attached Asset Plans, including those marked as 'Abandoned', **MUST** be treated as 'LIVE' and dangerous until such time that they are tested and proven to be 'DE-ENERGISED'. ActewAGL recommends that cables identified as 'Abandoned' and which may be impacted, severed, damaged and/or removed by excavation works be proven 'DE-ENERGISED' and safe before commencing full-scale excavations.

4. Location of Assets may change

Assets may be moved, or additional Assets may be installed at any time. Persons using the attached Asset Plans are advised to be alert for changed locations or new installations performed after the Issue Date. If work extends for a period of 3 months beyond the Issue Date, a new application MUST be made to Dial Before You Dig for up to date Asset Location Information.

5. Work to be undertaken without interference or damage to assets

Any work undertaken near Assets, including without limitation excavation, structures, material storage, heavy vehicle parking, blasting or change of surface level, must be performed in a way that does not interfere with the reliability of, or access to Icon Water or ActewAGL Assets, including electricity lines or plant. Persons excavating are required to exercise care if Assets are indicated on Asset Plans and will be held responsible for any damage caused through failure to exercise such care. Icon Water or ActewAGL (as applicable) will pursue the person responsible for causing the damage or interference to their Assets to recover costs and expenses incurred in remedying such damage or interference.

6. Asset location marking

You may request our representative to visit the work site to mark the approximate location of Assets by calling **02 6293 5770** (Water and Electricity) or **02 6203 0660** (Gas) between 7:30 am and 4 pm. Irrespective of any mandatory directions given in this notice, ActewAGL recommends that a site visit be conducted before commencing any works near Assets. Appointments will be accepted only if the Asset Location Information Sequence Number is supplied. The location and marking of Assets will not take place unless the Asset Location Advice and attached Asset Plans are in colour and to the same scale as supplied, and are at the work site. ActewAGL does not charge for these site visits. Alternatively, the Applicant may wish to engage a private underground Asset locator, at the Applicant's expense.

You are responsible for maintaining the presence / visibility of all markings and to ensure that all workers on site are aware of:

- the presence of Icon Water / ActewAGL infrastructure in the vicinity of the intended work and
- Icon Water, Jemena and ActewAGL's requirements.

NB: Arranging for marking of approximate Asset locations by either an ActewAGL representative or private underground asset locator will not relieve the Applicant and persons working on their behalf of responsibility to exercise care when working near ActewAGL / Icon Water Assets or for any damage they cause to ActewAGL / Icon Water Assets while performing works.

7. Underground Assets must be located by potholing

Potholing or other non-destructive techniques must be used until underground Assets are located. When located, excavation may commence provided that persons carrying out the excavation work must follow ActewAGL's recommended specifications concerning minimum safety distances when excavating within the vicinity of Icon Water or ActewAGL's networks. Unless otherwise approved by Jemena, **under no circumstances can mechanical excavation be carried out within 1.0 metres of a gas main without a Jemena Representative on site.**

8. Water, Sewer and Effluent Mains

Icon Water requires mandatory supervision by authorised Icon Water personnel when potholing and excavating within the vicinity of critical water and sewer network assets (as determined by Icon Water) or Icon Water mains with a diameter of 300mm and above.

To arrange please call Icon Water 6248 3111 during business hours. In an emergency call 13 11 93.

9. Substation Earthing Conductors

The information does not include details of substation earthing conductors that are usually installed within the vicinity of pole and ground mounted substations. General information only can be provided upon request.

10. Indications of the Presence of Cables

The presence of cables or conduits may be indicated by the following warning and marking devices

- Letter "E" inscriptions on Kerbs or "Electrical" inscriptions on pit lids
- Danger signs on above ground posts, walls etc
- Thin Orange "Caution Electrical Cables" Warning Tape
- Orange /Black PLASTIC Polymeric slab (3-6mm thick x 200mm wide)
- Concrete Bricks or slabs (approx 200mm x 500mm)
- Orange PVC or white Asbestos Cement (AC) Conduit or Galvanized Pipe
- Cylindrical concrete "ACTEA Electric Cable" markers
- Weak Concrete encasement directly around cables / conduits
- Texture/ colour change of excavated material (bedding sand, cracker dust, clean fill)

Note that some cables may have been installed without the presence of such marking devices.

11. Gas mains

(a) ActewAGL gas mains are operated by Jemena Asset Management Pty Ltd.

(b) Mandatory stand-by / supervision by Jemena personnel is required when excavating within the vicinity of critical gas network assets OR where mechanical excavation is required within 1.0 metres of the gas network. Your activity around critical gas assets will be supervised by Jemena at no charge for the first two hours. This supervision is to ensure the integrity of ActewAGL's assets is maintained.

Note: Charges may apply if stand-by is required for longer than two hours.

Please contact Jemena on **02 6203 0660** between 7.30 am and 4 pm if you require a stand-by person.

12. High Pressure Gas Network Assets

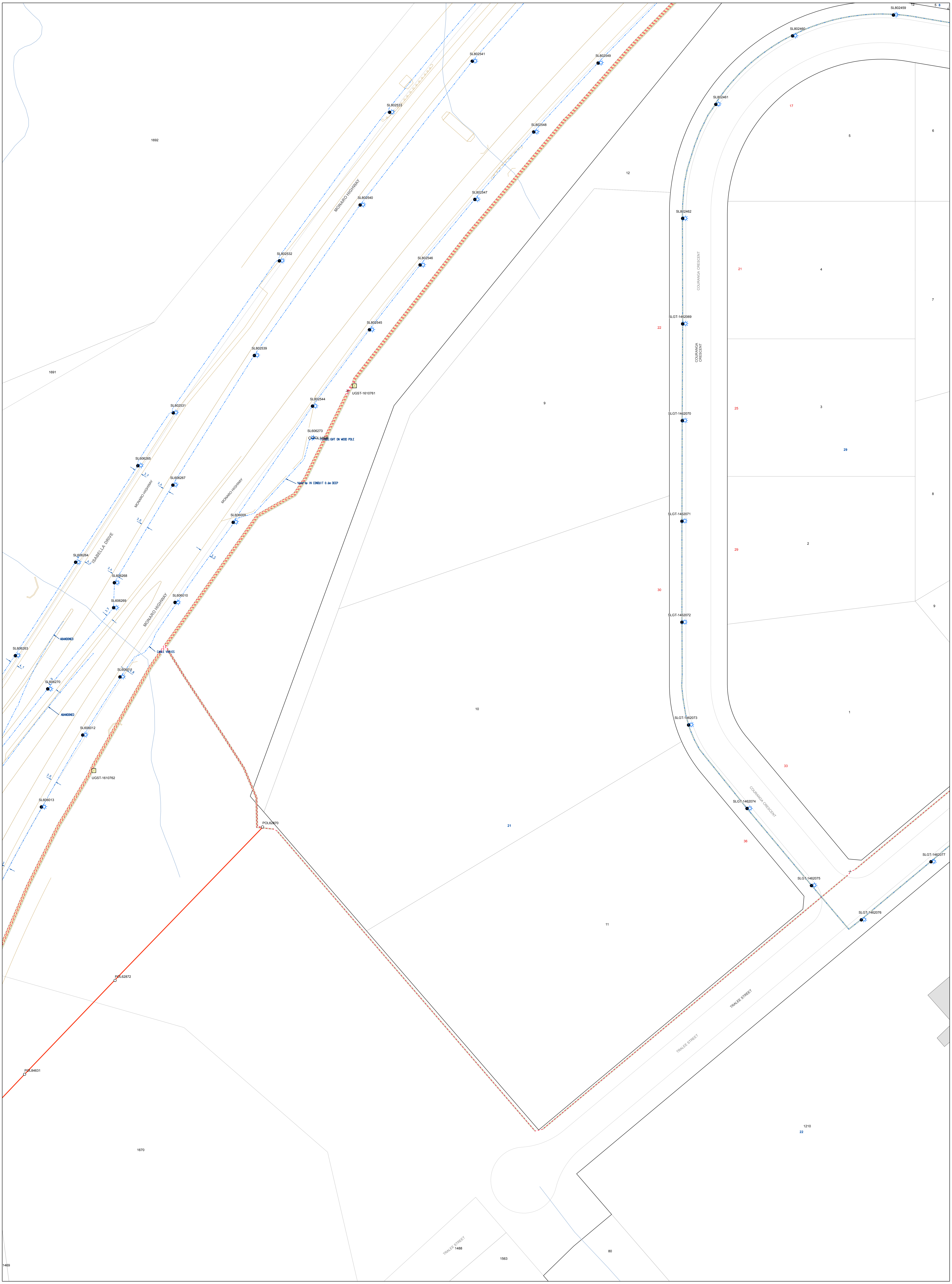
You must supply Jemena with your proposal of works including a written outline of your works and design plans for review. It may take up to four weeks for Jemena to review your works proposal. Following review, we will advise you of Jemena's requirements for protecting the High Pressure gas main.

Please mail your proposed works details to:

Jemena Asset Management Pty Ltd
Attention: Land Services Department
PO Box 6507
Silverwater NSW 2128

Please note that a duty of care exists to ensure that this gas main is not compromised or damaged during future development or construction work.

THIS DOCUMENT AND ASSOCIATED ASSET PLANS MUST BE KEPT AT THE WORK SITE.



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Couranga Crescent, Hume

ActewAGL Electricity Network

ActewAGL

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Creation Date: 22-Apr-2016

ELECTRICITY NETWORK LEGEND

Support Structure (Distribution)

○ Pole
● Streetlight-Only Pole

Support Structure (Transmission)

○ Pole
◧ Tower
◩ Yard Structure

Underground Structure

☒ Pit

Recloser

▣ Recloser

Transmission Line

— Overhead Transmission Line
- - - - Underground Transmission Line

Building

🟪 Zone Building
🟩 Standalone Chamber

Switches

⊟ Air Break
▣ Load Break
⊟ Overhead Link

Fuse

⊟ Drop Out Fuse

HV Electric Lines

— Overhead HV Electric Line
- - - - Underground HV Electric Line

LV Electric Lines

— Overhead LV Electric Line
-·-·- Underground LV Electric Line

Streetlight

☼ Streetlight
◑ Streetlight Controller
⊗ Streetlight Photoelectric Controller
● Other Streetlight Support
● Streetlight Column

Streetlight Cable

— Overhead Streetlight Line
-··- Underground Streetlight Line

Joint

× Cable Joint

Service Lines

— Overhead Service Line
-·-·- Underground Service Line

Service Point

● Service Point

Fibre Communication Cable

— Fibre Communication Cable

Copper Communication Cable

-·-·- Pilot Cable

Underground Earth Cable

— Underground Earth Cable

Ground Mounted Structure

🟦 Streetlight Control Cubicle
🟦 Distribution Box
🟦 Point-Of-Entry Cubicle
🟪 HV Switching Station
🟧 Kiosk
🟧 Padmount
🟫 Link Pillar
🟩 Micro Pillar
🟩 Mini Pillar
🟨 Pregnant Column
🟪 Communication Cubicle
🟪 SCADA Cubicle

Electric Supply Site

🟨 132kV Switching Station
🟨 Bulk Supply Station
🟨 Mobile Zone Substation
🟨 Zone Substation
🟩 Overhead Substation
🟪 Chamber Substation
🟪 Stockade

IMPORTANT NOTE:

- The term 'ABANDONED' is utilised to identify an underground cable that has been physically disconnected from the ActewAGL electricity network, is not in service and cannot readily be put back into service without specific augmentation and/or reconnection works. Cable(s) identified by ActewAGL as 'ABANDONED' have been discarded in-situ by ActewAGL. ALL cables should be treated as 'LIVE' and Dangerous until proven de-energised and safe.

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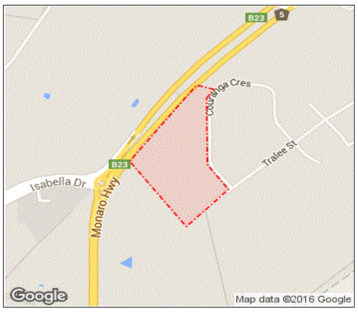
ActewAGL House 40 Bunda Street Canberra ACT 2600 | GPO Box 366 Canberra ACT 2601
t 13 14 93 | **f** 02 6249 7237 | *actewagl.com.au*

WARNING – HIGH PRESSURE GAS PIPELINE IN THE VICINITY

Applicant/Contractor **Job No.** **10596252** **DBYD Sequence No.** **52388525**

Company: Cardno
Contact: Mr Josh Hewett
Telephone: 0416912198 **Mobile:** Not Supplied **Fax:** Not Supplied
Address: Level 2 Wormald St Symonston ACT 2609
Email: joshua.hewett@cardno.com.au

Work Details



Suburb: Hume
Address: Couranga Crescent
UBD Ref: 89M10,89M8,89M9,89N10,89N8,89N9
Description: B 9 10 11 S21 hume

Enquiry Date: 22-Apr-2016 **Issue Date:** 22-Apr-2016

The records of ActewAGL Gas Networks indicate that High Pressure Underground Assets/Pipes ARE present in the vicinity of and/or surrounding area of the above enquiry. Please read all the information and conditions below.

No excavations within 15 metres of this asset are permitted without the prior approval of Jemena PHONE (02) 6203 0660

IN THE EVENT OF A GAS EMERGENCY CALL 13 19 09 (24 hours)

CONDITIONS FOR WORKS IN THE VICINITY OF ActewAGL GAS NETWORK ASSETS

Any information provided is valid only for 90 days from the date of issue. If the work operation extends beyond this period, or if the designs are altered in any way, you are requested to re-submit your proposal for re-assessment.

Consistent with the requirements of Part 2 General – Section 8 of the Utility Networks (Public Safety) Regulations 2001 No. 28, ActewAGL require that:

- The requestor shall ensure that all workers on site are aware of the presence of natural gas.
- The requestor shall ensure that under no circumstances will mechanical excavation be carried out within 1.0 metres of a gas main without there being a Jemena Representative on site.
- The requestor shall be responsible to maintain the presence / visibilities of all gas markings.
- **No live or Isolated gas pipes shall be cut, altered or removed without APPROVAL from Jemena.**

Note: Individual customer gas connections are generally not shown on the accompanying maps. For information regarding individual gas connections we recommend that you request a site meeting / inlet service location.

You can obtain additional information or arrange a site meeting by contacting Jemena on **(02) 6203 0660**. **Note that 24 hours notice is required for site meetings.**

1. High Pressure Pipelines

No excavations or heavy construction are permitted within 15m of these pipelines without notification to and authorisation from Jemena. If separation distance is 15m or less, you are required to notify Jemena of your works.

Prior to commencing works near or over the High Pressure Gas Mains you must supply Jemena with your proposal of works including design plans. You must allow four weeks for Jemena to review your works. Please mail your proposed works details to: Jemena Asset Management Pty Ltd, Land Services Dept, PO Box 6507, Silverwater, NSW, 2128.

Once Jemena has reviewed your proposal and design plans and you have received Jemena's approval to proceed, you must organise for a Pipeline Technician to be on Stand-by during your works (charges may apply).

To arrange for a Pipeline Technician to be on site please call the High Pressure Coordinator on 1300 665 380 two working days prior to the works commencing.

2. High Pressure Steel and Large Diameter Medium Pressure Plastic Pipelines

You **must** contact a Pipeline Technician to conduct a survey **before** commencing any work in this area. You can arrange a survey by contacting the High Pressure Response Coordinator on **1300 665 380**. **Please note that two working days notice is required to arrange a survey.** For all works in the vicinity of High Pressure Gas Mains you are required to arrange for a Pipeline Technician to attend. Charges apply for attendance of any works outside the hours of 7am to 4pm, Monday to Friday ("Standard Business Hours") and for any attendance during Standard Business Hours that is longer than 2 hours.

WARNING. It is essential that ALL these documents be handed to the principal contractor carrying out the work. A photocopy may be taken for office records. All documents must be on site at the time of excavation. The information provided is to be used as guide only and does not absolve third parties in their "Duty of Care" obligations to take additional precautions where the work has the potential to impact on gas assets and the safety of people.

All work that may impact upon the ActewAGL Gas Network should be carefully planned with notification to Jemena well in advance of commencement. This includes excavation of gas pipelines, crossings of pipelines by other underground infrastructure (drains, power cables, etc), road works or structural installations.

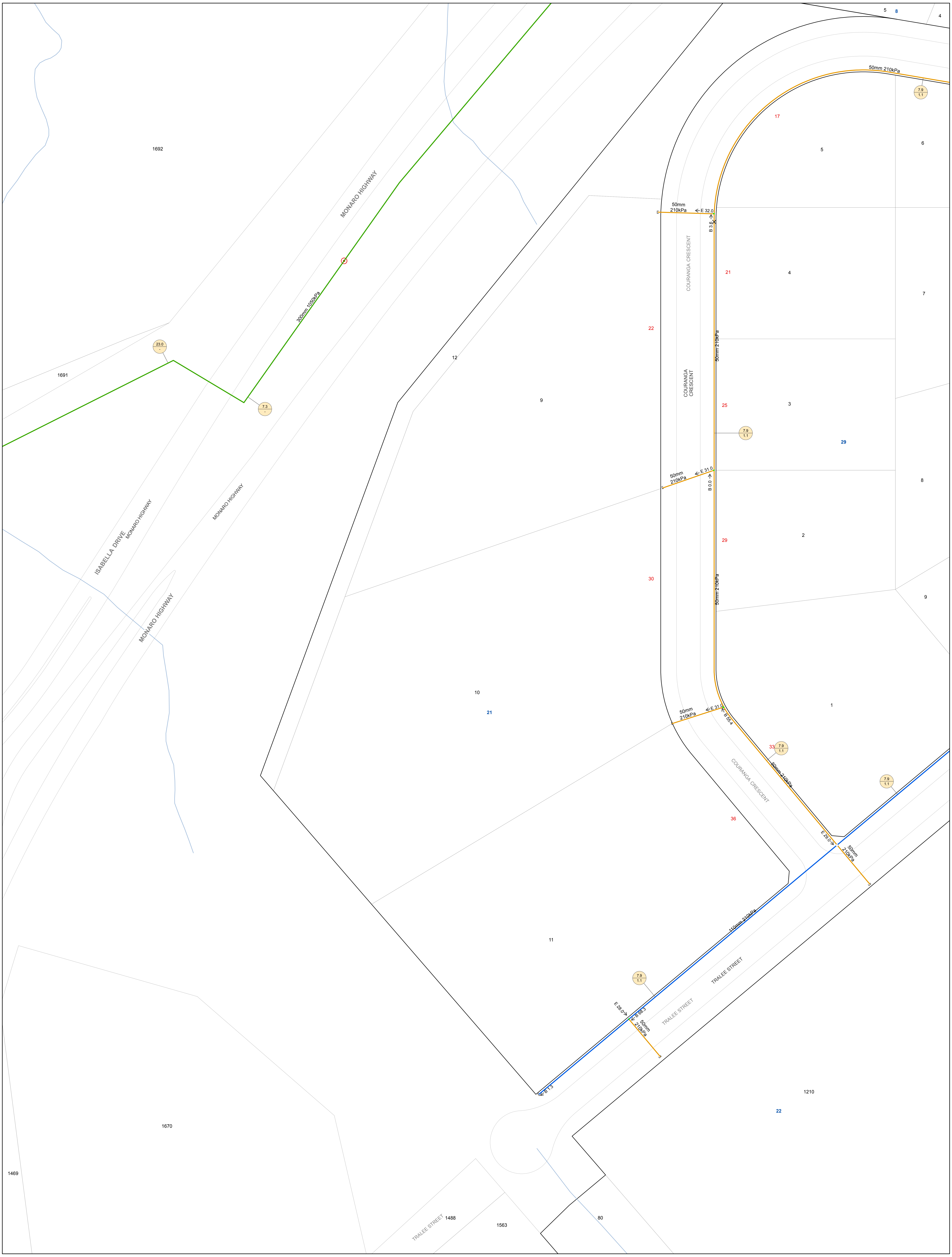
ActewAGL plans have been provided to show the position of underground gas mains and equipment in public gazetted roads only. Individual customers' services are not generally included on these plans. These plans have been prepared solely for ActewAGL's own use and indicate the position of underground mains and installations relative to boundaries and kerbs as at the time the mains were installed, and do not necessarily reflect any subsequent changes eg: changes to road alignments.

ActewAGL and / or Jemena will accept no liability for inaccuracies in the information or lack of information on such plans for any cause whatsoever arising. Persons excavating or carrying out other earthworks will be held responsible for any damage caused to underground mains and equipment, and the costs associated with replacement or repair.

Please note that the information contained on the map provided is not a method of determining gas availability for the purposes of connection to a natural gas supply. Please contact a gas retailer to determine the availability of gas as an energy source.

IN THE EVENT OF A GAS EMERGENCY CALL 13 19 09 (24 hours)

Extinguish all sources of ignition and keep the area clear of all persons. Any attempt by third parties to repair damaged gas mains or services may result in prosecution under the Utility Networks (Public Safety) Regulations 2001.



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Couranga Crescent, Hume

ActewAGL Gas Network

ActewAGL

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Creation Date: 22-Apr-2016

Legend - ActewAGL Gas Networks

GasStation CRITICAL

- ▭ DistrictRegulator
- ■ TrunkReceivingStation
- ▣ PrimaryRegulatingStation
- ▲ BulkMeteringStation
- ● PressureMonitoringStation
- ▲ ScraperStation
- B R BoundaryRegulatorSet
- BRS SecondaryBoundaryRegulatorSet
- ⋈ ValveStation

GasDevice

- ⋈ <all other values>
- ⋈ IsolationValve
- ● Odouriser
- ○ Siphon
- ■ WaterbathHeater
- ■ Filter
- ■ Catalyst Heater
- ▲ Silencer
- ◎ Regulator

GasDevice High Risk Valve CRITICAL

- ⋈ HighRiskAreaIsolation

GasMeter

- ⊗ DomesticMeter
- ● IndustCommMeter
- ◎ SecondaryMeterSet

GasFitting

-] EndCap
- • Tee
- ▯ ExpansionJoint
- | Flange
- △ Reducer
- ○ Cross
- • ServiceSaddle
- ⊠ InsulationJoint
- ⊗ GaugingPoint

CPAnode

- ■ AnodeGroundBed
- ■ SacrificialAnode

CPRectifier

- R TransformerRectifier

CPCable

- — CPRectifierCable
- •—• CPGroundBedCable

Conduit

- ▭ Conduit

GasStructure

- ▭ <all other values>
- ▭ CPKiosk
- ▭ Pit
- ▭ StationStructure

GasService

- — <all other values>
- — Gas Service IN USE
- - - - - Gas Service NOT IN USE

GasService STEEL or MAOP>=1050 OR DIA >=75mm CRITICAL

- — Gas Service IN SERVICE
- - - - - Gas Service NOT IN SERVICE

GasPipe

- — <all other values>
- — DistributionMain, Nylon, InService
- - - - - Gas Pipe NOT IN USE
- — DistributionMain, PE, InService
- — DistributionMain, Copper, InService

GasPipe STEEL OR MAOP>=1050 OR DIA>=75mm CRITICAL

- — DistributionMain, Copper, InService
- — DistributionMain, Nylon, InService
- — DistributionMain, PE, InService
- — PrimaryMain, Steel, InService
- - - - - PrimaryMain, Steel, Proposed
- — SecondaryMain, Steel, InService
- - - - - SecondaryMain, Steel, Proposed
- — TransmissionMain, Steel, InService
- - - - - Gas Pipe NOT IN USE

R 10.0 = DISTANCE TO ROAD
B 10.0 = DISTANCE TO BOUNDARY
E 10.0 = DISTANCE TO END
C 10.0 = DISTANCE TO CHANGE OF DIRECTION

4.4 = DISTANCE FROM MAIN TO KERB
0.6 = DISTANCE FROM MAIN TO BOUNDARY

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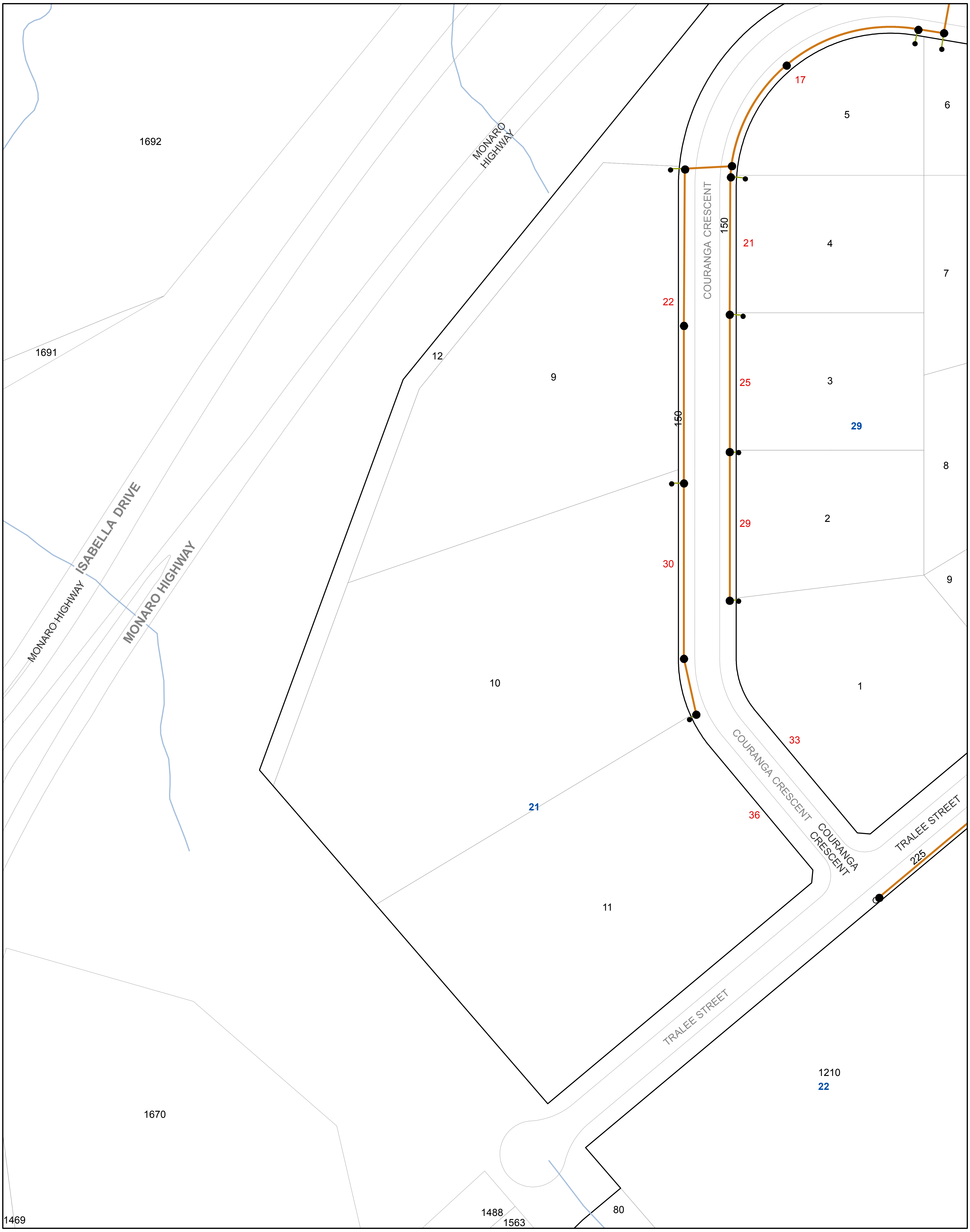

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Couranga Crescent, Hume

Sewer Network

icon WATER

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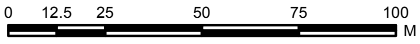

Seq #: 52388525

Couranga Crescent, Hume

Effluent Network

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Template: EffluentA3Portrait

Creation Date: 22-Apr-2016

SEWER NETWORK LEGEND

MaintenanceHole

- ● <all other values>
- ● Abandoned
- ● De-Commissioned
- ● Operational
- ● Planned

NonAssetFitting

- BVR ● BuriedVerticalRiser
- ● Riser
- ⊘ SlopeJunction

AssetFitting

- ○ DeadEnd
- ▶ Reducer
- ● Tee

InspectionShaft

- SIS ● SpecialInspectionShaft
- RP ● RoddingPoint
- SMS ● Standard 225

ProtectionValve

- ⚲ AirValve
- ⇄ Reflux

SystemControlValve

- ⋈ SCOUR ScourValve
- ⋈ Ball
- PLUG ⋈ Plug
- ⋈ Gate
- SL ⋈ StopLog
- P ⋈ Penstock

Pump

- ● Centrifugal
- ● PositiveDisplacement
- ● VariableSpeed

GravityMain

- ── <all other values>
- ── Reticulation, Operational
- ── Trunk, Operational
- ══ Tunnel, Operational
- ── Siphon, Operational
- ── Overflow, Operational
- ── Inline,OPERATIONAL
- ━ ━ Reticulation, Planned
- ━ ━ Trunk, Planned
- ‐‐·‐‐·‐‐ Reticulation, Abandoned
- ‐‐·‐‐·‐‐ Reticulation, De-Commissioned
- ‐‐·‐‐·‐‐ Trunk, Abandoned
- ‐‐·‐‐·‐‐ Trunk, De-Commissioned

PressureMain

- ── <all other values>
- ── Scour, Operational
- ‐‐‐‐‐‐‐‐ RisingMain, Planned
- ‐‐‐‐‐‐‐‐ RisingMain, Operational
- ‐‐·‐‐·‐‐ RisingMain, De-Commissioned
- ‐‐·‐‐·‐‐ RisingMain, Abandoned

SewerStructure

- 🟫 DiversionChamber
- ▨ DiversionPoint
- 🟨 PumpStation
- ⬜ SplitManhole
- 🟫 StorageBasin
- ⬛ TreatmentPlant
- 🟧 DischargeStructure
- ⬜ PipeBridge

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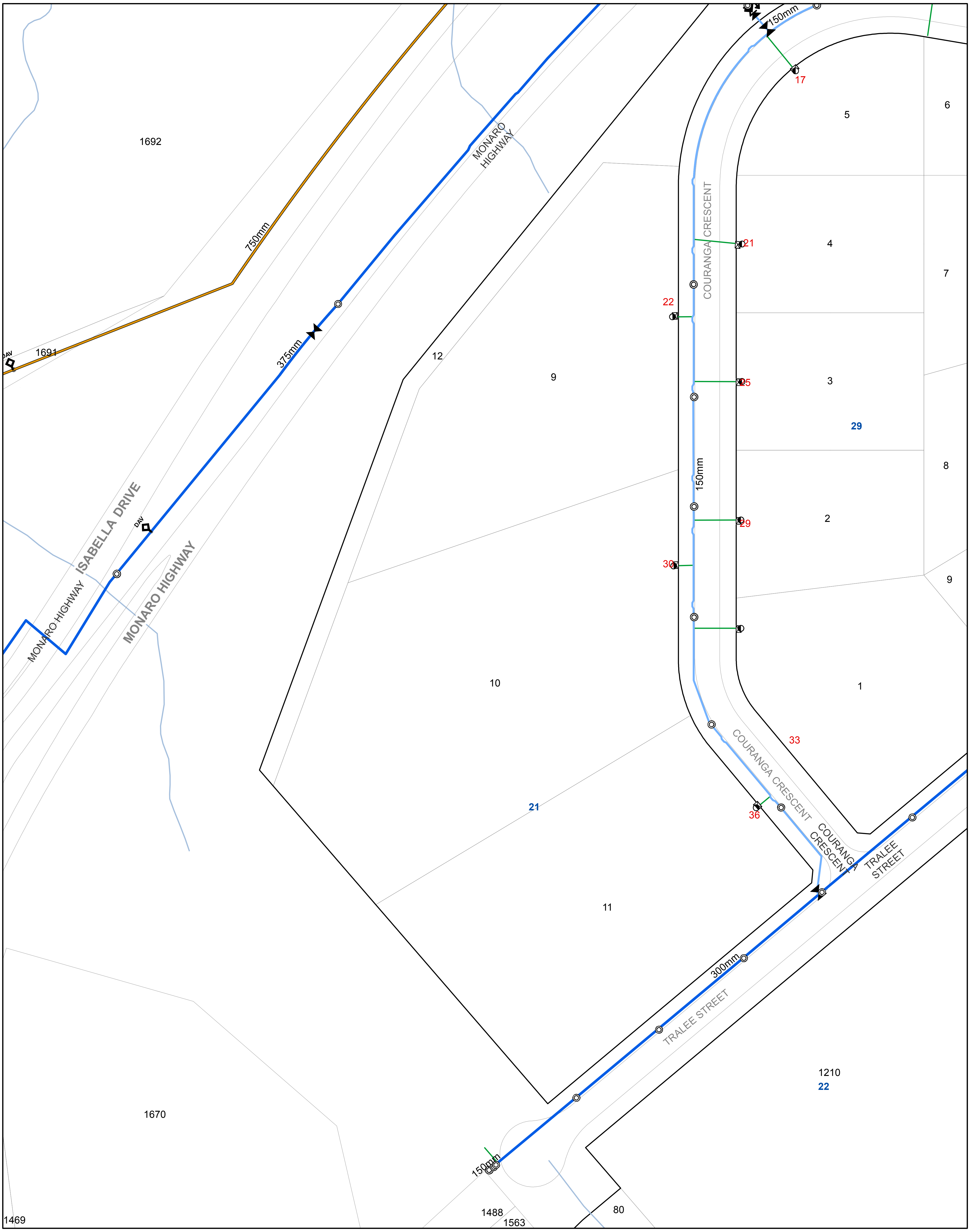

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Couranga Crescent, Hume

Water Network

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Template: WaterA3Portrait

Creation Date: 22-Apr-2016

WATER NETWORK LEGEND

Hydrant

- ◎ <all other values>
- ◎ SpringHydrant
- HC ◎ HighCapacity
- P ◎ PillarHydrant
- M ◎ MillCock
- OH ◎ OverheadFillingPoint

Main

- —·· Rising Main - Abandoned
- – – – Rising Main
- — Bulk Supply Main
- —·· Bulk Supply Main - Abandoned
- — Distribution Main
- —·· Distribution Main - Abandoned
- —·· Reticulation Main - Abandoned
- — Reticulation Main

ProtectionValve

- ⧓ <all other values>
- ⇄ Reflux Valve
- AV ◇ Single Air Valve
- DAV ◇ Double Air Valve
- RPZD ○ RPZ Valve
- DCV ○ Double Check Valve
- ⧓ Pressure Relief Valve
- ⧓ Float Valve

Meter

- ◐ <all other values>
- FE FlowElement
- ◪ BillingLargeDiameter
- ◐ BillingSmallDiameter

MiscellaneousDevice

- ⊘ <all other values>
- ○ SamplingPoint
- ⊘ FlowRecordingDevice
- ⊘ PressureRecordingDevice

SystemValve

- ⧓ <all other values>
- ⧓ SCOUR Scour Valve
- ⧓ Ball Valve
- ⧓ Needle Valve
- ⊲ Cone Valve
- ⊲ ALT Altitude Cone Valve
- ⧓ FAV Flow Rate Altitude Combination Globe Valve
- ⧓ PRV Pressure Reducing Globe Valve
- ⧓ PCV Pump Control Globe Valve
- ⧓ OCV Outlet Control Globe Valve
- ⧓ PSV Pressure Sustaining Globe Valve
- ⧓ BAV Backup Altitude Globe Valve
- ⧓ ALT Altitude Globe Valve
- ⧓ FRCV Flow Rate control Globe Valve
- |⟋| ALT Altitude Butterfly Valve
- |⟋| BAV Backup Altitude Butterfly Valve
- |⟋| PCV Pump Control Butterfly Valve
- ⊘ Normally Closed Butterfly Valve
- |⟋||⟋| FRCV Dual Flow Rate control Butterfly Valve
- |⟋| Butterfly Valve
- M |⟋| Motorised Butterfly Valve
- ⊘ Zone Valve (Butterfly)
- |⟋| FRCV Flow Rate Control Butterfly Valve
- |⟋| FAV Flow Rate Altitude Combination Butterfly Valve
- ⧓ Temporary Zone Valve
- ⧓ ALT Altitude Gate Valve
- ⧓ Gate Valve
- M ⧓ Motorised Gate Valve
- ⧓ Normally Closed Gate Valve
- ⧓ BAV Backup Altitude Gate Valve
- ⧓ Zone Valve

AirVesselDevice

- 0 <all other values>
- 0 AirVessel

Fitting

- ○ <all other values>
- ⊗ MainCock
- ○ Tee
- ○ ServiceTee
- ● DualServiceTee
- ○ Cross
- ▷ Reducer
- [EndCap
- ↻ GibaultJoint
- ○ OpenEnd
- | BlankFlange
- MH MaintenanceHole
- ⁞ OrificePlate
- ⊠ StopCock
- ▫ TappingBand_Bend
- ▣ TappingBand_Valve

ServiceLine

- — DomesticService
- — FireService

SystemProtectionLine

- — Scour
- — OverFlow
- — Drain
- — WashDown

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Blocks 9, 10 & 11,
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(Stage 3, Hume West
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APPENDIX
D

IZ1 ZONE
OBJECTIVES AND

Cardno
Shaping the Future

IZ1 - General Industrial Zone

Zone Objectives

a) Support the diversification and expansion of the ACT's industrial base and employment growth

b) Facilitate investment in a wide range of industrial and related activities, with efficient land utilisation and provision of infrastructure

c) Provide convenient access for ACT and regional residents to industrial goods, services and employment opportunities

d) Make provision for transport-related businesses in locations accessible to major road, rail and air links

e) Encourage the clustering of industrial activities according to the principles of industrial ecology

f) Ensure that industrial development achieves high environmental standards of cleaner production, waste disposal, noise and air quality

g) Encourage the design and construction of industrial and commercial buildings that are energy efficient, functional and flexible

h) Ensure that development along major approach routes and major roads meets appropriate standards of urban design

i) Make provision for manufacturing, warehouse and transport land uses requiring large land areas accessible to main interstate road and rail connections

j) Ensure that the use of the land for predominantly industrial purposes is not jeopardised by the uncontrolled development of higher rent commercial uses such as retailing and offices

k) Provide small-scale services to meet the needs of the local workforce

IZ1 – General Industrial Zone Development Table

EXEMPT DEVELOPMENT

Development approval is not required. Building approval may be required.
On leased land, development must be authorised by a lease.

Development identified in the Planning and Development Act 2007 as exempt (see sections 133 and 134 of the Act and section 20 and schedule 1 of the Planning and Development Regulation 2008)

ASSESSABLE DEVELOPMENT

Development application required.
On leased land, development must be authorised by a lease.

MINIMUM ASSESSMENT TRACK
CODE

Development listed below requires a development application and is assessed in the code track

Development

No development identified.

MINIMUM ASSESSMENT TRACK
MERIT

Development listed below requires a development application and is assessed in the merit track, unless specified in schedule 4 of the Planning and Development Act 2007 (as impact track) or specified as prohibited development in a precinct map.

Development

ancillary use	MAJOR UTILITY INSTALLATION
bulk landscape supplies	minor road
car park	minor use
caretaker's residence	municipal depot
communications facility	offensive industry
COMMUNITY USE	parkland
consolidation	pedestrian plaza
craft workshop	plant and equipment hire establishment
defence installation	public transport facility
demolition	railway use
development in a location and of a type indentified in a precinct map as additional merit track development	recyclable materials collection
emergency services facility	recycling facility
freight transport facility	scientific research establishment
general industry	service station
hazardous industry	sign
hazardous waste facility	store
incineration facility	subdivision
indoor recreation facility	temporary use
industrial trades	transport depot
light industry	warehouse
liquid fuel depot	waste transfer station
major road	

MINIMUM ASSESSMENT TRACK
IMPACT

Development listed below requires a development application and is assessed in the impact track

1. Development that is not:
    a. Exempt code track or merit track development; or
    b. Prohibited development other than development that is permitted under s137 of the Planning and Development Act 2007.

2. Development specified in schedule 4 of the Planning and Development Act 2007 and not listed as a prohibited use in this table.
3. Development that is authorised by a lease and listed as a prohibited use in this table.
4. Development declared under section 124 or section 125 of the Planning and Development Act 2007 and not listed as a prohibited development in this table.
5. Varying a lease to add a use assessable under the impact track.

PROHIBITED DEVELOPMENT

Development listed below is prohibited development unless the development is identified elsewhere in this development table as assessable under the code, merit or impact track.

agriculture	nature conservation area
airport	NON-RETAIL COMMERCIAL USE
animal care facility	outdoor recreation facility
animal husbandry	overnight camping area
aquatic recreation facility	place of assembly
boarding house	plantation forestry
bulky goods retailing	playing field
caravan park/camping ground	produce market
cemetery	residential care accommodation
civic administration	restaurant
club	retirement village
COMMERCIAL ACCOMMODATION USE	sand and gravel extraction
corrections facility	secondary residence
development in a location and of a type identified in a precinct map as additional prohibited development	serviced apartment
drink establishment	shop
drive-in cinema	single dwelling housing
farm tourism	special dwelling
funeral parlour	stock/sale yard
group or organised camp	supportive housing
home business	tourist facility
indoor entertainment facility	varying a lease to add a use listed as “prohibited development” in this development table
land fill site	vehicle sales
land management facility	veterinary hospital
mining industry	woodlot
mobile home park	zoological facility
multi-unit housing	

RELEVANT CODE

Development proposals must comply with the Industrial Zones Development Code.

NOTE ABOUT ANCILLARY, MINOR AND TEMPORARY USE

Some development that would otherwise be prohibited may be assessed under the merit track if they can be defined as *ancillary*, *minor or temporary use*. For example, a *dwelling house* alone is prohibited, but could be considered if it is ancillary to a *general industry* (i.e. as caretaker’s residence) which is an assessable development under the merit track.

Blocks 9, 10 & 11,
Section 21 Hume
(Stage 3, Hume West
Estate)

APPENDIX E

SPECIALIST INVESTIGATION

Cardno
Shaping the Future

Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Geotechnical Investigation

Groundwater Constraints and Control Measures
Hume West, Stage C

Prepared for
Land Development Agency

Project 50660.01
August 2012

Douglas Partners
Geotechnics | Environment | Groundwater

Document History

Document details

Project No.	50660.01	Document No.	2
Document title	Report on Geotechnical Investigation Groundwater Constraints and Control Measures		
Site address	Hume West, Stage C		
Report prepared for	Land Development Agency		
File name	P:\50660.01 Hume West, Groundwater Conditions (LDA)\Docs\50660.01 Groundwater Constraints and Control Measures, Hume West.doc		

Document status and review

Revision	Prepared by	Reviewed by	Date issued
0	C Reid	M Jones	

Distribution of copies

Revision	Electronic	Paper	Issued to
0	1		Land Development Agency

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.

	Signature	Date
Author		
Reviewer		

Table of Contents

Report on Geotechnical Investigation
Groundwater Constraints and Control Measures
Hume West, Stage C

1. Introduction

This report presents the results of a geotechnical investigation carried out within Stage C of the Hume West industrial subdivision development. The work was carried out for the Land Development Agency (LDA), owners and developers of the site.

It is understood that previous stages of the development have encountered groundwater and surface water issues during construction and that the LDA, is endeavouring to identify the constraints and control measures prior to commencement of the Stage C works. The investigation was carried out to assess the likely extent of groundwater throughout the site and provide comment on possible control measures.

The investigation comprised the logging and sampling of test pits followed by preparation of an engineering report. Details of the work undertaken and the results obtained are given in the report.

Details provided by the client for the investigation included a preliminary sketch plan of the site.

This report must be read in conjunction with the notes “About this Report” which are included in Appendix A.

2. Site Location and Regional Geology

The site is located within Blocks 1 – 3 Section 29 and Blocks 9 – 11 Section 21 in the Hume West subdivision development and covers an approximate area of about 12 hectares. The site is bounded to the southeast by Tralee Street, to the northwest by the Monaro Highway, to northeast by the existing Hume West development and vacant land to southwest.

At the time of the investigation, the site was heavily grassed with scattered trees and shrubs and some boggy areas. A sediment pond and several stockpiles were also present.

Reference to the Canberra 1:100 000 Geological Series Sheet (Ref 1) indicates that the site is underlain by rock units of the Deakin Volcanics. The Deakin Volcanics typically comprise dacitic ignimbrite with minor volcaniclastic and argillaceous sedimentary rocks. From previous experience, the Hume area is generally underlain by thick alluvial deposits comprising sand, silt, clay and gravel.

3. Field Work Methods

The field work comprised the excavation of 27 test pits (Pits 101 – 127) to depths of 0.9 – 2.5 m using a Kubota KX57-4 mini – excavator fitted with a 450 mm bucket. The pits were logged onsite by an experienced technical officer and incorporated the collection of disturbed samples to assist in strata identification. The approximate locations of the test pits are shown on Drawing 1 (Appendix B).

4. Field Work Results

The test pit logs are given in Appendix C together with important notes that define classification methods and descriptive terms. The test pits encountered variable subsurface conditions underlying the site with the principal succession of strata broadly summarised as follows:

- FILLING: poorly and moderately compacted, moist gravelly sandy clay in Pits 101, 112 and 127 to depths of 0.1 – 0.4 m.
- TOPSOIL: wet to moist, silty sand and clayey silty sand with rootlets to depths of 0.1 – 0.2 m in Pits 102 – 107, 110, 111 and 113 – 126.
- SAND, SILT & CLAY: loose to dense, cemented, or firm to very stiff, wet to moist variably sand, silt and clay with some gravel to the limit of investigation of 0.9 – 2.5 m.

Groundwater seepage was encountered in Pits 101 – 104, 113, 114, 117, 120, 121 and 122 at depths 0.0 – 2.3 m. For safety reasons, the test pits were backfilled immediately following excavation precluding longer term monitoring of groundwater levels. Groundwater conditions rarely remain constant and can change seasonally due to variations in rainfall and other factors. For these reasons, it is noted that the moisture condition of the site soils may vary considerably from the time of the investigation compared to at the time of construction. Table 1 below summarises the groundwater conditions encountered.

Table 1: Summary of Groundwater Conditions

Pit No	Depth (m)	Seepage Rate	Strata Encountered
101	1.7 – 2.2	Moderate	Silty Sand
102	1.0 – 1.2	Very Fast	Gravelly Silty Sand
103	0.0 – 0.3	Slow	Sandy Silt/Silty Sand
104	0.0 – 0.2	Very Slow	Sandy Silt/Silty Sand
113	2.3	Fast	Silty Sand
114	0.5 – 1.3	Moderate	Silty Sand

Table 1 (con't): Summary of Groundwater Conditions

Pit No	Depth (m)	Seepage Rate	Strata Encountered
117	0.8 – 1.1	Very Fast	Silty Sand
120	1.4 – 1.5	Moderate	Silty Sand
121	0.0 – 0.3	Very Slow	Sandy Clayey Silt
122	1.0 – 1.1	Moderate	Silty Sand

5. Comments

The results of the investigation has indicated that the presence of groundwater was encountered in 10 of the 27 excavated pits and that the subsurface conditions ranged from highly permeable sandy/gravelly soils to relatively impermeable cemented sands and clay soils.

It is suggested that the variable subsurface profile is the main contributing factor to the presence of groundwater in particular areas. Groundwater seepage pathways will occur along interconnected permeable lenses and will rise and fall in depth depending on the presence of impermeable barriers such as clay layers or cemented sand layers. If seepages are blocked and cannot continue to drain, they can either become perched or if under sufficient pressure, rise to the surface to continue as surface flows.

It can therefore be a complex system to model in order to undertake remedial measures to intercept and drain these seepages in a controlled manner.

A review of aerial photographs from Google Earth has indicated a history of the presence of moisture (groundwater) in parts of the site. The aerial photograph shown in Drawing 1 (Appendix B) shows bright green areas across the site which roughly correlates with the presence of groundwater seepages encountered in the current test pits.

In order to attempt to control the groundwater seepages and possibly enable conventional construction within the blocks, the first stage of remedial measures is suggested to comprise a series of subsoil/cut-off drains installed along block boundaries. Given the likely concentration of flows along the Tralee Street boundary and the orientation of the blocks, it is recommended that the main collector drains be installed along or under Couranga Crescent and Tralee Street and potentially along the south western boundary of the stage with feeder drains along the side and front boundaries of the blocks. Careful attention to levels will be critical to enable the system to self drain.

The depth of drains, based on the seepage depths encountered, would have to be at least 2 m deep with the inclusion of an impermeable liner such as HDPE plastic to reduce the potential for groundwater flows to pass directly across the drain through pervious sand/gravel layers.

The need for internal drainage measures such as drainage mattresses would be dependent on the effectiveness of the sub soil/cut-off drains (i.e. if the groundwater flows are horizontal and not vertical) and cannot be fully assessed until the perimeter drainage system has had sufficient time to be monitored.

6. References

1. Geology of Canberra 1:100 000 Geological Series Sheet 8727, Bureau of Mineral Resources, (1992).

7. Limitations

Douglas Partners (DP) has prepared this report for the investigation within the Stage C area of the Hume West subdivision development. The report is provided for the exclusive use of Land Development Agency for this project only and for the purpose(s) described in the report. It should not be used for other projects 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 only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic 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 limited by undetected variations in ground conditions between sampling 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 notes 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 given 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

Introduction

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

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

Copyright

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

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

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

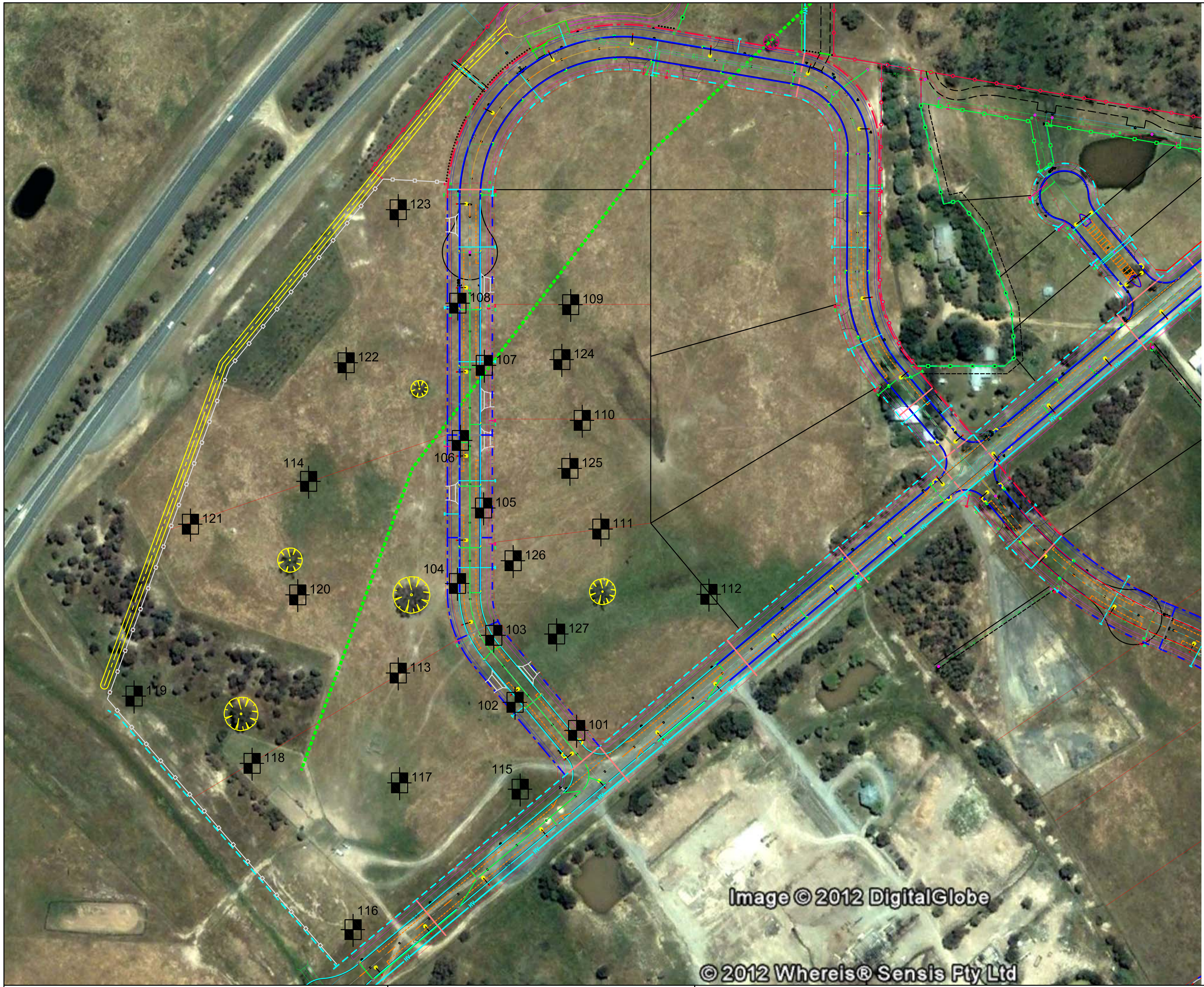
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate 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 – Test Pit Location



NOTE: Base image from Google Earth Pro
(imagery dated 22 February 2006)

LEGEND

✚ Test Pit Location

SCALE 0 50 100 150m
1:2500

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Geotechnics | Environment | Groundwater

CLIENT: Land Development Agency		TITLE: **Test Pit Locations**	PROJECT No: 50660.01
OFFICE: Canberra	DRAWN BY: JRB	**Groundwater Constraints & Control Measures**	DRAWING No: 1
SCALE: As shown	DATE: 22.08.2012	**Hume West, Stage C**	REVISION: A

Appendix C

Explanatory Notes
Results of Fieldwork (Test Pits 101 – 127)

Sampling Methods

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

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 Descriptions

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

Symbols & Abbreviations

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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

July 2010

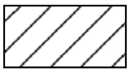
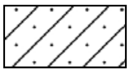
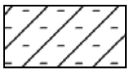
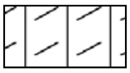
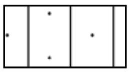
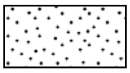
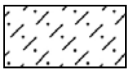
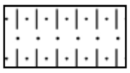
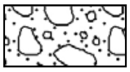
Symbols & Abbreviations

Graphic Symbols for Soil and Rock

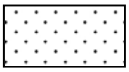
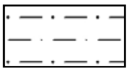
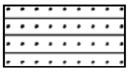
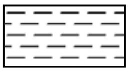
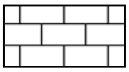
General

■	Asphalt
	Road base
	Concrete
	Filling

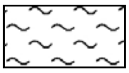
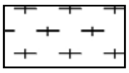
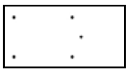
Soils

	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

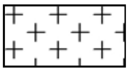
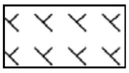
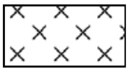
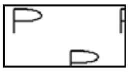
Sedimentary Rocks

	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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 101
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
		FILLING - moderately compacted, moist, brown-yellow medium plasticity gravelly sandy clay										
	0.4	SILTY SAND - cemented, dry to moist, grey fine to coarse grained silty sand										
	0.8	SILTY SAND - medium dense, moist, purple brown fine to coarse grained silty sand - loose, wet from 1.7m				▷						
	2.0	CLAYEY SILTY SAND - cemented, dry, light grey clayey silty sand										
	2.2	Bore discontinued at 2.2m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: Moderate seepage from 1.7 - 2.2m
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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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 102
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
		TOPSOIL - dark brown silty sand with rootlets										
	0.15	SILTY SAND - loose to medium dense, moist, grey fine to coarse grained silty sand										
	0.6	GRAVELLY SILTY SAND - loose, wet, grey brown mottled fine to coarse grained gravelly silty sand				▷						
	1.2	SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained silty sand										
	1.6	Bore discontinued at 1.6m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: Very fast seepage from 1.0 - 1.2m
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:	Land Development Agency	**SURFACE LEVEL:**	--	**BORE No:**	103
PROJECT:	Groundwater Constraints & Control Measures	**EASTING:**		**PROJECT No:**	50660.01
LOCATION:	Hume West, Stage C	**NORTHING:**		**DATE:**	26/7/2012
		DIP/AZIMUTH:	90°/--	**SHEET**	1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing Type	Core Rec. %	RQD %	Test Results & Comments
	0.1	TOPSOIL - wet, dark brown sandy silt/silty sand with rootlets				▷						
	0.25	CLAYEY SAND - loose, wet, brown grey fine to coarse grained clayey sand										
	0.8	SANDY CLAY - stiff, moist, grey medium to high plasticity sandy clay										
	1.2	SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained silty sand with some clay										
		Bore discontinued at 1.2m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:** **LOGGED:** JRB **CASING:**

TYPE OF BORING:

WATER OBSERVATIONS: Slow seepage from 0 - 0.25m

REMARKS: Excavated on edge of boggy area with tussock grass vegetation

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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 104
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01 0.05 0.10 0.50 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
	0.1	TOPSOIL - wet, dark brown sandy silt/silty sand with rootlets				▷						
	0.25	CLAYEY SAND - loose, wet, brown grey fine to coarse grained clayey sand										
	0.8	SANDY CLAY - stiff, moist, grey medium to high plasticity sandy clay										
	1.2	SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained silty sand with some clay										
		Bore discontinued at 1.2m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: Very slow seepage from 0 - 0.2m
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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 105
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01 0.05 0.10 0.50 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.15	TOPSOIL - brown clayey silty sand with rootlets										
	0.25	CLAYEY SAND - loose to medium dense, moist, brown orange mottled fine to coarse grained clayey sand										
	0.6	SANDY CLAY - stiff, moist, grey-brown brown-yellow mottled medium plasticity sandy clay										
	1.2	CLAYEY SILTY SAND - dense, moist to dry, grey brown mottled fine to coarse grained clayey silty sand - cemented from 1.0m										
		Bore discontinued at 1.2m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: No free groundwater 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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 106
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
	0.13	TOPSOIL - brown silty sand with rootlets										
	0.4	SILTY SAND - medium dense, dry to moist, brown fine to coarse grained silty sand										
	0.6	SILTY SAND - dense, dry, grey-brown mottled fine to coarse grained silty sand										
	0.9	SANDY CLAY - very stiff, dry to moist, grey brown-yellow mottled medium plasticity sandy clay							D			
	1.2	CLAYEY SILTY SAND - cemented, dry, grey brown mottled fine to coarse grained clayey silty sand										
		Bore discontinued at 1.2m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: No free groundwater 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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 107
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low Very Low Low Medium High Very High Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		TOPSOIL - brown silty sand with rootlets										
	0.15	SILTY SAND - medium dense, dry to moist, brown fine to coarse grained silty sand										
	0.4	CLAYEY SILTY SAND - dense, dry to moist, grey brown mottled fine to coarse grained clayey silty sand										
	1											
		- cemented from 1.1m							D			
	1.7	Bore discontinued at 1.7m - near refusal										
	2											
	3											
	4											

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: No free groundwater 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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 108
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		CLAYEY SILTY SAND - medium dense, moist, brown grey fine to coarse grained clayey silty sand										
	0.25	SILTY SAND - cemented, dry, light grey-brown fine to coarse grained silty sand										
	0.4	CLAYEY SILTY SAND - cemented, dry, grey brown mottled fine to coarse grained clayey silty sand										
	0.9	Bore discontinued at 0.9m - near refusal										
	1											
	2											
	3											
	4											

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: No free groundwater 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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 109
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		SANDY CLAY - very stiff, moist, grey grey-brown mottled medium to high plasticity sandy clay							D			
	0.7	SILTY SAND - cemented, dry, light grey brown fine to coarse grained silty sand										
	1.1	Bore discontinued at 1.1m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: No free groundwater 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:	Land Development Agency	**SURFACE LEVEL:**	--	**BORE No:**	110
PROJECT:	Groundwater Constraints & Control Measures	**EASTING:**		**PROJECT No:**	50660.01
LOCATION:	Hume West, Stage C	**NORTHING:**		**DATE:**	26/7/2012
		DIP/AZIMUTH:	90°/--	**SHEET**	1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01 0.05 0.10 0.50 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
	0.1	TOPSOIL - brown silty sand with rootlets										
	0.25	SILTY SAND - loose to medium dense, moist, brown fine to coarse grained silty sand										
	0.9	SANDY CLAY - very stiff, moist, grey-brown brown-yellow mottled medium to high plasticity sandy clay										
	1.3	SILTY SAND - cemented, dry, light grey brown fine to coarse grained silty sand										
		Bore discontinued at 1.3m - near refusal										

Depth scale: 1, 2, 3, 4

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:** **LOGGED:** JRB **CASING:**

TYPE OF BORING:

WATER OBSERVATIONS: No free groundwater 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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 111
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		TOPSOIL - dark brown clayey sandy silt with rootlets										
	0.2	SANDY CLAY - stiff, moist, grey-brown brown-yellow mottled medium to high plasticity sandy clay										
	0.7	CLAYEY SILTY SAND - cemented, dry, grey brown mottled fine to coarse grained clayey silty sand										
	1											
	1.1	Bore discontinued at 1.1m - near refusal										
	2											
	3											
	4											

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB **CASING:**
TYPE OF BORING:
WATER OBSERVATIONS: No free groundwater 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)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 112
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
		FILLIING - compacted, moist, brown-yellow medium plasticity gravelly sandy clay										
	0.3	SILTY SAND - cemented, dry, light grey brown fine to coarse grained silty sand										
	0.7	SILTY SAND - medium dense, dry to moist, grey fine to coarse grained silty sand with some gravel										
	1.3	CLAYEY SILTY SAND - cemented, dry, grey-brown brown-yellow mottled fine to coarse grained clayey silty sand										
	1.8	Bore discontinued at 1.8m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: No free groundwater 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)

Douglas Partners
Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 113
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Type	Core Rec. %	RQD %	Test Results & Comments
		TOPSOIL - brown silty sand with rootlets										
	0.2	SILTY SAND - medium dense, dry to moist, grey brown fine to coarse grained silty sand with some gravel - moist to dry from 0.5m - moist from 1.8m - wet from 2.3m				▷						
	2.5	Bore discontinued at 2.5m - limit of investigation										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: Fast seepage from 2.3m
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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Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Land Development Agency	**SURFACE LEVEL:** --	**BORE No:** 114
PROJECT: Groundwater Constraints & Control Measures	**EASTING:**	**PROJECT No:** 50660.01
LOCATION: Hume West, Stage C	**NORTHING:**	**DATE:** 26/7/2012
	DIP/AZIMUTH: 90°/--	**SHEET** 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		TOPSOIL - wet, dark brown sandy silt/silty sand with rootlets										
	0.15	SILTY SAND - loose to medium dense, moist, grey brown mottled fine to coarse grained silty sand - loose, wet from 0.5m				▷						
	1.3	CLAYEY SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained clayey silty sand										
	1.6	Bore discontinued at 1.6m - limit of investigation										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:** **LOGGED:** JRB **CASING:**

TYPE OF BORING:

WATER OBSERVATIONS: Moderate seepage from 0.5 - 1.3m

REMARKS: Excavated in boggy area on a slight rise with slightly higher elevation than surrounds

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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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 115
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low Very Low Low Medium High Very High Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		TOPSOIL - brown silty sand with rootlets										
	0.3	SILTY SAND - medium dense, dry to moist, grey brown fine to coarse grained silty sand										
	1.1	GRAVELLY SILTY SAND - dry to moist, grey brown mottled fine to coarse grained gravelly silty sand										
	2.1	Bore discontinued at 2.1m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: No free groundwater 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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 116
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		TOPSOIL - brown silty sand with rootlets										
	0.2	SILTY SAND - medium dense, dry to moist, grey brown fine to coarse grained silty sand										
	0.4	SANDY CLAY/CLAYEY SAND - stiff, moist, grey-brown brown-yellow mottled medium plasticity sandy clay/clayey sand										
	1.2	GRAVELLY SILTY SAND - dry to moist, grey brown mottled fine to coarse grained gravelly silty sand										
	1.4	Bore discontinued at 1.4m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: No free groundwater 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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 117
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		TOPSOIL - dark brown sandy silty clay with rootlets										
	0.2	CLAYEY SILTY SAND - loose, moist to wet, grey fine to coarse grained clayey silty sand										
	0.8	SILTY SAND - loose, wet, brown fine to coarse grained silty sand				▷						
	1.1	CLAYEY SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained clayey silty sand										
	1.4	Bore discontinued at 1.4m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: Very fast seepage from 0.8 - 1.1m
REMARKS: Excavated among tussock grass

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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 118
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.1	TOPSOIL - brown silty sand with rootlets										
	0.5	SILTY SAND - medium dense, dry to moist, grey brown fine to coarse grained silty sand										
	1.3	SILTY SAND - medium dense, moist, brown fine to coarse grained silty sand with some clay										
	1.5	SILTY SAND - cemented, dry, light grey brown fine to coarse grained silty sand										
		Bore discontinued at 1.5m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB **CASING:**
TYPE OF BORING:
WATER OBSERVATIONS: No free groundwater 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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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 119
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Water	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
	0.1	TOPSOIL - brown silty sand with rootlets						
	0.5	SILTY SAND - loose to medium dense, moist, grey brown fine to coarse grained silty sand						
	0.9	SANDY CLAY - stiff, moist, brown-orange brown grey-brown mottled medium plasticity sandy clay						
1	1.0	SILTY SAND - cemented, dry, grey brown fine to coarse grained silty sand						
		Bore discontinued at 1.0m - refusal						
2								
3								
4								

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB **CASING:**
TYPE OF BORING:
WATER OBSERVATIONS: No free groundwater 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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 120
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01 0.05 0.10 0.50 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.15	TOPSOIL - brown silty sand with rootlets										
	1.0	SILTY SAND - loose to medium dense, moist to dry, grey brown fine to coarse grained silty sand - moist from 0.7m										
1	1.7	SILTY SAND - cemented, dry, grey brown mottled fine to coarse grained silty sand - wet permeable lense in south of pit from 1.4 - 1.5m				▷						
		Bore discontinued at 1.7m - near refusal										
2												
3												
4												

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB **CASING:**
TYPE OF BORING:
WATER OBSERVATIONS: Moderate seepage through permeable lense in south of pit from 1.4 - 1.5m
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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 121
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		TOPSOIL - wet, dark brown sandy clayey silt with rootlets				▷						
	0.15	CLAYEY SANDY SILT - soft, wet, grey brown medium plasticity clayey sandy silt										
	0.3	SANDY CLAY - stiff, moist, grey brown mottled medium plasticity sandy clay grading to clayey silty sand										
	0.9	CLAYEY SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained clayey silty sand										
	1.3	Bore discontinued at 1.3m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: Very slow seepage from 0 - 0.3m
REMARKS: Excavated in boggy area with tussock

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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 122
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.2	TOPSOIL - dark brown silty sand with rootlets										
	1.1	SILTY SAND - loose, moist, grey brown fine to coarse grained silty sand - wet from 0.5m				▷ (1.0)						
	1.4	SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained silty sand										
		Bore discontinued at 1.4m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: Moderate seepage from 1.0 - 1.1m
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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 123
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01 0.05 0.10 0.50 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.1	TOPSOIL - brown silty sand with rootlets										
		SILTY SAND - loose to medium dense, moist, grey brown fine to coarse grained silty sand										
	0.5	SILTY SAND - cemented, dry, grey fine to coarse grained silty sand with some gravel										
	0.9	Bore discontinued at 0.9m - near refusal										

Depth scale: 1, 2, 3, 4

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: No free groundwater 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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 124
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.2	TOPSOIL - brown silty sand with rootlets										
	0.8	SANDY CLAY - very stiff, moist to dry, brown-yellow grey-brown mottled medium plasticity sandy clay - grey brown from 0.4m										
	1 1.2	CLAYEY SILTY SAND - dense, dry, grey brown mottled fine to coarse grained clayey silty sand										
	1.9	SILTY SAND - cemented, dry, grey brown fine to coarse grained silty sand										
	2	Bore discontinued at 1.9m - near refusal										
	3											
	4											

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:** **LOGGED:** JRB **CASING:**

TYPE OF BORING:

WATER OBSERVATIONS: No free groundwater 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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 126
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low, Very Low, Low, Medium, High, Very High, Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		TOPSOIL - brown silty sand with rootlets										
	0.15	SILTY SAND - medium dense, dry to moist, grey brown fine to coarse grained silty sand										
	0.4	CLAYEY SILTY SAND - medium dense, moist, grey brown mottled fine to coarse grained clayey silty sand with some gravel										
	1	- dense from 1.0m										
		- cemented from 1.6m										
	1.9	Bore discontinued at 1.9m - near refusal										
	2											
	3											
	4											

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: No free groundwater 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: Land Development Agency
PROJECT: Groundwater Constraints & Control Measures
LOCATION: Hume West, Stage C

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

BORE No: 127
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering EW HW MW SW FS FR	Graphic Log	Rock Strength Ex Low Very Low Low Medium High Very High Ex High	Water	Fracture Spacing (m) 0.01 0.05 0.10 0.50 1.00	Discontinuities B - Bedding J - Joint S - Shear F - Fault	Sampling & In Situ Testing Type	Core Rec. %	RQD %	Test Results & Comments
	0.1	FILLING - poorly compacted, moist, brown medium plasticity gravelly sandy clay										
	1.2	CLAYEY SILTY SAND - loose to medium dense, moist, grey fine to coarse grained clayey silty sand										
	1.8	SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained silty sand with some clay and gravel										
		Bore discontinued at 1.8m - near refusal										

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **DRILLER:**
LOGGED: JRB
CASING:
TYPE OF BORING:
WATER OBSERVATIONS: No free groundwater observed
REMARKS: Excavated adjacent to surface spring

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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Report on
Additional Geotechnical Investigation

Groundwater Constraints and Control Measures
Hume West, Stage C

Prepared for
Land Development Agency

Project 50660.01
September 2012

Integrated Practical Solutions

Document History

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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.

	Signature	Date
Author		21/09/12
Reviewer		21/09/12

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Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 2, 73 Sheppard Street
Hume ACT 2620
PO Box 1487
Fyshwick ACT 2609
Phone (02) 6260 2788
Fax (02) 6260 1147

Table of Contents

Report on Additional Geotechnical Investigation
Groundwater Constraints and Control Measures
Hume West, Stage C

1. Introduction

This report presents the results of an additional geotechnical investigation carried out within Stage C of the Hume West industrial subdivision development. The work was carried out for the Land Development Agency (LDA), owners and developers of the site.

It is understood that previous stages of the development have encountered groundwater and surface water issues during construction and that the LDA, is endeavouring to identify the constraints and control measures prior to commencement of the Stage C works. The additional investigation was carried out to further supplement the existing geotechnical investigation prepared by Douglas Partners Pty Ltd in August 2012. The purpose of the investigation was to assess the likely extent of groundwater throughout the site and provide comment on possible control measures.

The investigation comprised the logging and sampling of test pits followed by preparation of an engineering report. Details of the work undertaken and the results obtained are given in the report.

Details provided by the client for the investigation included a preliminary sketch plan of the site.

This report must be read in conjunction with the notes “About this Report” which are included in Appendix A.

2. Previous Investigation

The Stage C area was previously investigated by Douglas Partners Pty Ltd in August 2012 by the excavation of 27 test pits (Pits 101 – 127) to depths of 0.9 – 2.5 m. The test pits encountered a highly variable alluvial soil profile with groundwater seepage observed in 10 test pits. The results of the investigation were summarised in a report dated 27 August 2012 (Project 50660.01). The location of the test pits are shown on Drawing 1 in Appendix B with the test pit logs provided in Appendix C.

3. Site Location and Regional Geology

The site is located within Blocks 1 – 3 Section 29 and Blocks 9 – 11 Section 21 in the Hume West subdivision development and covers an approximate area of about 12 hectares. The site is bounded to the southeast by Tralee Street, to the northwest by the Monaro Highway, to northeast by the existing Hume West development and vacant land to southwest.

At the time of the investigation, the site was heavily grassed with scattered trees and shrubs and some boggy areas. A sediment pond and several stockpiles were also present.

Reference to the Canberra 1:100 000 Geological Series Sheet (Ref 1) indicates that the site is underlain by rock units of the Deakin Volcanics. The Deakin Volcanics typically comprise dacitic ignimbrite with minor volcaniclastic and argillaceous sedimentary rocks. From previous experience, the Hume area is generally underlain by thick alluvial deposits comprising sand, silt, clay and gravel.

4. Current Field Work Methods

The current field work comprised the excavation of 12 test pits (Pits 128 – 139) to depths of 1.5 – 3.8 m using a Kubota KX57-4 mini – excavator fitted with a 450 mm bucket. The pits were logged onsite by an experienced technical officer and incorporated the collection of disturbed samples to assist in strata identification. The approximate locations of the test pits are shown on Drawing 1 (Appendix B).

5. Current Field Work Results

The current test pit logs are given in Appendix C together with important notes that define classification methods and descriptive terms. The test pits encountered variable subsurface conditions underlying the site with the principal succession of strata broadly summarised as follows:

- FILLING: poorly and moderately compacted, moist, sandy gravel, silty sand and gravelly sandy clay in Pits 132 – 135 to depths of 0.3 – 1.0 m. Pit 137 was excavated through a stockpile which encountered filling to 2.4 m depth.
- TOPSOIL/TOPSOIL FILLING: wet to moist, silty sand and sandy silty clay with rootlets to depths of 0.2 – 0.4 m in Pits 128 – 131, 133, 134, 136, 138 and 139. Topsoil was encountered in Pit 137 underlying the filling stockpile.
- SAND, SILT & CLAY: loose to dense, cemented, or firm to very stiff, wet to moist variably sand, silt and clay with some gravel to the limit of investigation of 1.5 – 3.8 m.

Groundwater seepage was encountered in Pits 128, 132 and 136 – 139 at depths 0.7 – 3.5 m. For safety reasons, the test pits were backfilled immediately following excavation precluding longer term monitoring of groundwater levels. Groundwater conditions rarely remain constant and can change seasonally due to variations in rainfall and other factors. For these reasons, it is noted that the moisture condition of the site soils may vary considerably from the time of the investigation compared to at the time of construction. Table 1 below summarises the groundwater conditions encountered in both the previous and current investigations.

Table 1: Summary of Groundwater Conditions

Pit No	Depth (m)	Seepage Rate	Strata Encountered
101	1.7 – 2.2	Moderate	Silty Sand
102	1.0 – 1.2	Very Fast	Gravelly Silty Sand
103	0.0 – 0.3	Slow	Sandy Silt/Silty Sand
104	0.0 – 0.2	Very Slow	Sandy Silt/Silty Sand
113	2.3	Fast	Silty Sand
114	0.5 – 1.3	Moderate	Silty Sand
117	0.8 – 1.1	Very Fast	Silty Sand
120	1.4 – 1.5	Moderate	Silty Sand
121	0.0 – 0.3	Very Slow	Sandy Clayey Silt
122	1.0 – 1.1	Moderate	Silty Sand
128	1.3 – 1.4	Slow	Silty Sand
132	1.2 – 1.6	Fast	Silty Sand
136	1.6 – 1.8	Very Fast	Gravelly Sand
137	3.4 – 3.5	Moderate	Gravelly Silty Sand
138	0.7 – 1.0	Very Fast	Gravelly Silty Sand
139	0.8 – 1.1	Moderate	Gravelly Sand

6. Comments

The results of the investigation has indicated that the presence of groundwater was encountered in 16 of the 39 excavated pits and that the subsurface conditions ranged from highly permeable sandy/gravelly soils to relatively impermeable cemented sands and clay soils. The seepages were generally encountered in the southern and western parts of the site as shown on Drawing 1 (Appendix B) by the different coloured test pit symbols. Based on the observed direction of seepages within the test pits, it is highly likely that the flows are horizontal and the presence of springs should be isolated.

It is suggested that the variable subsurface profile is the main contributing factor to the presence of groundwater in particular areas. Groundwater seepage pathways will occur along interconnected permeable lenses and will rise and fall in depth depending on the presence of impermeable barriers such as clay layers or cemented sand layers. If seepages are blocked and cannot continue to drain, they can either become perched or if under sufficient pressure, rise to the surface to continue as surface flows.

It can therefore be a complex system to model in order to undertake remedial measures to intercept and drain these seepages in a controlled manner.

A review of aerial photographs from Google Earth has indicated a history of the presence of moisture (groundwater) in parts of the site. The aerial photograph shown in Drawing 1 (Appendix B) shows bright green areas across the site which roughly correlates with the presence of groundwater seepages encountered in the current test pits.

In order to attempt to control the groundwater seepages and possibly enable conventional construction within the blocks, the first stage of remedial measures is suggested to comprise a series of subsoil/cut-off drains installed along block boundaries. Given the likely concentration of flows along the south western stage boundary and the Tralee Street boundary, it is recommended that the main collector drains be installed along or under Couranga Crescent, Tralee Street and along the south western boundary of the stage with feeder drains along the side and front boundaries of the blocks. Careful attention to levels will be critical to enable the system to self drain.

The depth of drains, based on the seepage depths encountered, would have to be at least 2 m deep with the inclusion of an impermeable liner such as HDPE plastic to reduce the potential for groundwater flows to pass directly across the drain through pervious sand/gravel layers.

The need for internal drainage measures such as drainage mattresses would be dependent on the effectiveness of the sub soil/cut-off drains (i.e. if the groundwater flows are horizontal and not vertical) and cannot be fully assessed until the perimeter drainage system has had sufficient time to be monitored.

7. References

1. Geology of Canberra 1:100 000 Geological Series Sheet 8727, Bureau of Mineral Resources, (1992).

8. Limitations

Douglas Partners (DP) has prepared this report for the additional investigation within the Stage C area of the Hume West subdivision development. The report is provided for the exclusive use of Land Development Agency for this project only and for the purpose(s) described in the report. It should not be used for other projects 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 only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic 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 limited by undetected variations in ground conditions between sampling 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 notes 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 given 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

Introduction

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

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

Copyright

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

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

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

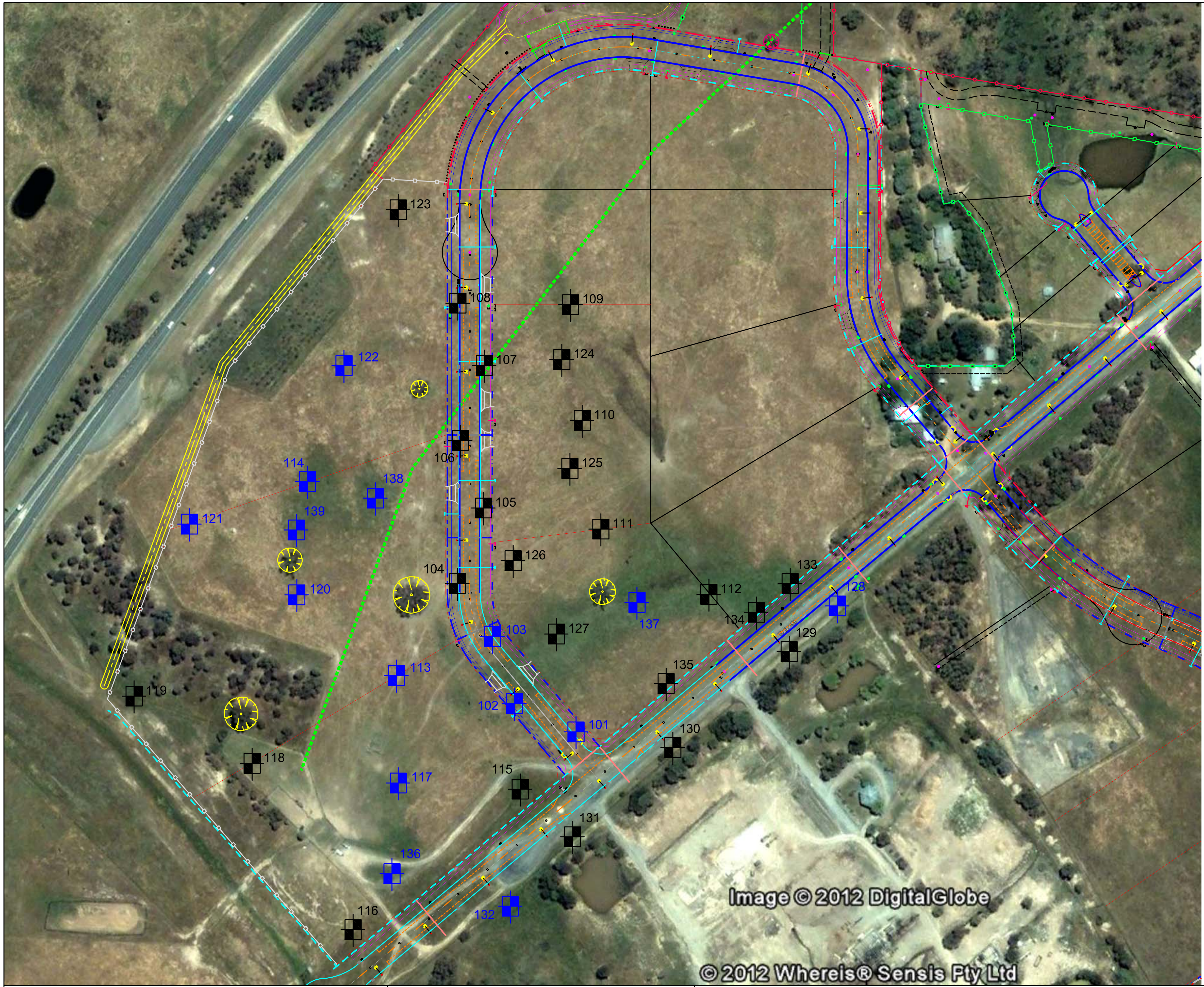
Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate 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 – Test Pit Location



LEGEND

- ▣ Test Pit Location - Without Groundwater Seepage
- ▣ Test Pit Location - With Groundwater Seepage

NOTE: Base image from Google Earth Pro
(imagery dated 22 February 2006)

SCALE
0 50 100 150m
1:2500

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Land Development Agency
OFFICE: Canberra
DRAWN BY: JRB
SCALE: As shown
DATE: 14.09.2012

TITLE: **Test Pit Locations**
Groundwater Constraints & Control Measures
Hume West, Stage C

N

PROJECT No: 50660.01
DRAWING No: 1
REVISION: B

Appendix C

Explanatory Notes
Results of Previous Field Work (Test Pits 101 – 127)
Results of Current Field Works (Test Pits 128 – 139)

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

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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.

Symbols & Abbreviations

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

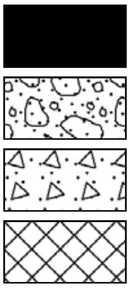
Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

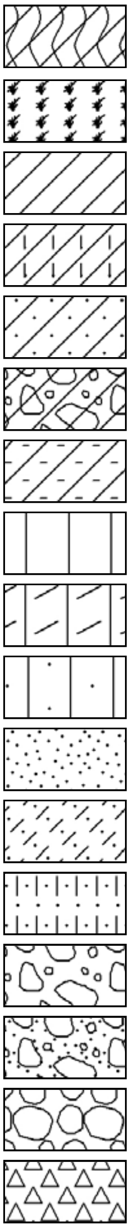
Graphic Symbols for Soil and Rock

General



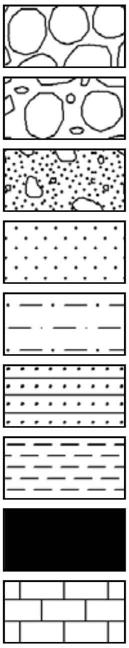
- Asphalt
- Road base
- Concrete
- Filling

Soils



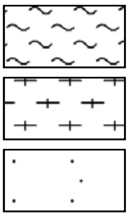
- Topsoil
- Peat
- Clay
- Silty clay
- Sandy clay
- Gravelly clay
- Shaly clay
- Silt
- Clayey silt
- Sandy silt
- Sand
- Clayey sand
- Silty sand
- Gravel
- Sandy gravel
- Cobbles, boulders
- Talus

Sedimentary Rocks



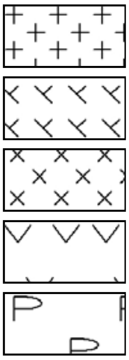
- Boulder conglomerate
- Conglomerate
- Conglomeratic sandstone
- Sandstone
- Siltstone
- Laminite
- Mudstone, claystone, shale
- Coal
- Limestone

Metamorphic Rocks



- Slate, phyllite, schist
- Gneiss
- Quartzite

Igneous Rocks



- Granite
- Dolerite, basalt, andesite
- Dacite, epidote
- Tuff, breccia
- Porphyry

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 101
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING - moderately compacted, moist, brown-yellow medium plasticity gravelly sandy clay	☒						
	0.4	SILTY SAND - cemented, dry to moist, grey fine to coarse grained silty sand							
1	0.8	SILTY SAND - medium dense, moist, purple brown fine to coarse grained silty sand - loose, wet from 1.7m						▷	1
2	2.0	CLAYEY SILTY SAND - cemented, dry, light grey clayey silty sand	▨						2
	2.2	Pit discontinued at 2.0m - near refusal							
3									3
4									4

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: Moderate seepage from 1.7 - 2.2m

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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 102
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - dark brown silty sand with rootlets							
	0.15	SILTY SAND - loose to medium dense, moist, grey fine to coarse grained silty sand							
	0.6	GRAVELLY SILTY SAND - loose, wet, grey brown mottled fine to coarse grained gravelly silty sand						▷	
	1.2	SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained silty sand							
	1.6	Pit discontinued at 1.6m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket
LOGGED: JRB
SURVEY DATUM:

WATER OBSERVATIONS: Very fast seepage from 1.0 - 1.2m

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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 103
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - wet, dark brown sandy silt/silty sand with rootlets						⊳	
	0.1	CLAYEY SAND - loose, wet, brown grey fine to coarse grained clayey sand							
	0.25	SANDY CLAY - stiff, moist, grey medium to high plasticity sandy clay							
	0.8	SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained silty sand with some clay							
	1								1
	1.2	Pit discontinued at 1.2m - near refusal							
	2								2
	3								3
	4								4

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **LOGGED:** JRB **SURVEY DATUM:**

WATER OBSERVATIONS: Slow seepage from 0 - 0.25m

REMARKS: Excavated on edge of boggy area with tussock grass vegetation

☐ 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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 104
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.1	TOPSOIL - wet, dark brown sandy silt/silty sand with rootlets						▷	
	0.25	CLAYEY SAND - loose, wet, brown grey fine to coarse grained clayey sand							
		SANDY CLAY - stiff, moist, grey medium to high plasticity sandy clay							
	0.8	SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained silty sand with some clay							
	1.2	Pit discontinued at 1.2m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket
LOGGED: JRB
SURVEY DATUM:

WATER OBSERVATIONS: Very slow seepage from 0 - 0.2m

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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 105
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)
				Type	Depth	Sample	Results & Comments		5 10 15 20
		TOPSOIL - brown clayey silty sand with rootlets							
	0.15	CLAYEY SAND - loose to medium dense, moist, brown orange mottled fine to coarse grained clayey sand							
	0.25	SANDY CLAY - stiff, moist, grey-brown brown-yellow mottled medium plasticity sandy clay							
	0.6	CLAYEY SILTY SAND - dense, moist to dry, grey brown mottled fine to coarse grained clayey silty sand - cemented from 1.0m							
	1.2	Pit discontinued at 1.2m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket
LOGGED: JRB
SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 106
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		TOPSOIL - brown silty sand with rootlets							
	0.13	SILTY SAND - medium dense, dry to moist, brown fine to coarse grained silty sand							
	0.4	SILTY SAND - dense, dry, grey-brown mottled fine to coarse grained silty sand							
	0.6	SANDY CLAY - very stiff, dry to moist, grey brown-yellow mottled medium plasticity sandy clay		D	0.7				
	0.9	CLAYEY SILTY SAND - cemented, dry, grey brown mottled fine to coarse grained clayey silty sand							
	1.2	Pit discontinued at 1.2m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 107
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - brown silty sand with rootlets							
	0.15	SILTY SAND - medium dense, dry to moist, brown fine to coarse grained silty sand							
	0.4	CLAYEY SILTY SAND - dense, dry to moist, grey brown mottled fine to coarse grained clayey silty sand							
		- cemented from 1.1m		D	1.2				
	1.7	Pit discontinued at 1.7m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT:	Land Development Agency	**SURFACE LEVEL:**	--	**PIT No:**	108
PROJECT:	Groundwater Investigation	**EASTING:**		**PROJECT No:**	50660.01
LOCATION:	Hume West	**NORTHING:**		**DATE:**	26/7/2012
		DIP/AZIMUTH:	90°/--	**SHEET**	1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		CLAYEY SILTY SAND - medium dense, moist, brown grey fine to coarse grained clayey silty sand							
	0.25	SILTY SAND - cemented, dry, light grey-brown fine to coarse grained silty sand							
	0.4	CLAYEY SILTY SAND - cemented, dry, grey brown mottled fine to coarse grained clayey silty sand							
	0.9	Pit discontinued at 0.9m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **LOGGED:** JRB **SURVEY DATUM:**

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3

☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 109
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
		SANDY CLAY - very stiff, moist, grey grey-brown mottled medium to high plasticity sandy clay	▨	D	0.5				
	0.7	SILTY SAND - cemented, dry, light grey brown fine to coarse grained silty sand	░						
	1.1	Pit discontinued at 1.1m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 110
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)
				Type	Depth	Sample	Results & Comments		5 10 15 20
		TOPSOIL - brown silty sand with rootlets							
	0.1	SILTY SAND - loose to medium dense, moist, brown fine to coarse grained silty sand							
	0.25	SANDY CLAY - very stiff, moist, grey-brown brown-yellow mottled medium to high plasticity sandy clay							
	0.9	SILTY SAND - cemented, dry, light grey brown fine to coarse grained silty sand							
	1.3	Pit discontinued at 1.3m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 111
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
		TOPSOIL - dark brown clayey sandy silt with rootlets	▨						
	0.2	SANDY CLAY - stiff, moist, grey-brown brown-yellow mottled medium to high plasticity sandy clay	▨						
	0.7	CLAYEY SILTY SAND - cemented, dry, grey brown mottled fine to coarse grained clayey silty sand	▨						
	1.1	Pit discontinued at 1.1m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 112
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLIING - well compacted, moist, brown-yellow medium plasticity gravelly sandy clay	▩						
	0.3	SILTY SAND - cemented, dry, light grey brown fine to coarse grained silty sand	⁞						
	0.7	SILTY SAND - medium dense, dry to moist, grey fine to coarse grained silty sand with some gravel	⁞						
	1.3	CLAYEY SILTY SAND - cemented, dry, grey-brown brown-yellow mottled fine to coarse grained clayey silty sand	▨						
	1.8	Pit discontinued at 1.8m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket
LOGGED: JRB
SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 113
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
		TOPSOIL - brown silty sand with rootlets							
	0.2	SILTY SAND - medium dense, dry to moist, grey brown fine to coarse grained silty sand with some gravel - moist to dry from 0.5m - moist from 1.8m - wet from 2.3m						▷	
	2.5	Pit discontinued at 2.5m - limit of investigation							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: Fast seepage from 2.3m

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)

Douglas Partners
Geotechnics | Environment | Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 114
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
		TOPSOIL - wet, dark brown sandy silt/silty sand with rootlets							
	0.15	SILTY SAND - loose to medium dense, moist, grey brown mottled fine to coarse grained silty sand - loose, wet from 0.5m						▷	
	1.3	CLAYEY SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained clayey silty sand							
	1.6	Pit discontinued at 2.5m - limit of investigation							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **LOGGED:** JRB **SURVEY DATUM:**

WATER OBSERVATIONS: Moderate seepage from 0.5 - 1.3m

REMARKS: Excavated in boggy area on a slight rise with slightly higher elevation than surrounds

☐ 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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 115
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - brown silty sand with rootlets							
	0.3	SILTY SAND - medium dense, dry to moist, grey brown fine to coarse grained silty sand							
	1.1	GRAVELLY SILTY SAND - dry to moist, grey brown mottled fine to coarse grained gravelly silty sand							
	2.1	Pit discontinued at 2.1m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 116
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)
				Type	Depth	Sample	Results & Comments		5 10 15 20
		TOPSOIL - brown silty sand with rootlets							
	0.2	SILTY SAND - medium dense, dry to moist, grey brown fine to coarse grained silty sand							
	0.4	SANDY CLAY/CLAYEY SAND - stiff, moist, grey-brown brown-yellow mottled medium plasticity sandy clay/clayey sand							
	1.2	GRAVELLY SILTY SAND - dry to moist, grey brown mottled fine to coarse grained gravelly silty sand							
	1.4	Pit discontinued at 1.4m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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)

Douglas Partners
Geotechnics | Environment | Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 117
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		TOPSOIL - dark brown sandy silty clay with rootlets							
	0.2	CLAYEY SILTY SAND - loose, moist to wet, grey fine to coarse grained clayey silty sand							
	0.8	SILTY SAND - loose, wet, brown fine to coarse grained silty sand						▷	
	1.1	CLAYEY SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained clayey silty sand							
	1.4	Pit discontinued at 1.4m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: Very fast seepage from 0.8 - 1.1m

REMARKS: Excavated among tussock

☐ 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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 118
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
		TOPSOIL - brown silty sand with rootlets							
	0.1	SILTY SAND - medium dense, dry to moist, grey brown fine to coarse grained silty sand							
	0.5	SILTY SAND - medium dense, moist, brown fine to coarse grained silty sand with some clay							
	1.3	SILTY SAND - cemented, dry, light grey brown fine to coarse grained silty sand							
	1.5	Pit discontinued at 1.5m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **LOGGED:** JRB **SURVEY DATUM:**

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 119
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - brown silty sand with rootlets							
	0.1	SILTY SAND - loose to medium dense, moist, grey brown fine to coarse grained silty sand							
	0.5	SANDY CLAY - stiff, moist, brown-orange brown grey-brown mottled medium plasticity sandy clay							
	0.9	SILTY SAND - cemented, dry, grey brown fine to coarse grained silty sand							
1	1.0	Pit discontinued at 1.0m - refusal							1
								▷	
2									2
3									3
4									4

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: Moderate seepage through permeable lense in south of pit from 1.4 - 1.5m

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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 120
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.15	TOPSOIL - brown silty sand with rootlets							
	1.0	SILTY SAND - loose to medium dense, moist to dry, grey brown fine to coarse grained silty sand - moist from 0.7m							
	1.7	SILTY SAND - cemented, dry, grey brown mottled fine to coarse grained silty sand - wet permeable lense in south of pit from 1.4 - 1.5m							
		Pit discontinued at 1.7m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 121
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - wet, dark brown sandy clayey silt with rootlets	▨					▷	
	0.15	CLAYEY SANDY SILT - soft, wet, grey brown medium plasticity clayey sandy silt	▨						
	0.3	SANDY CLAY - stiff, moist, grey brown mottled medium plasticity sandy clay grading to clayey silty sand	▨						
	0.9	CLAYEY SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained clayey silty sand	▨						
	1.3	Pit discontinued at 1.3m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: Very slow seepage from 0 - 0.3m

REMARKS: Excavated in boggy area with tussock

☐ 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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 122
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
		TOPSOIL - dark brown silty sand with rootlets							
	0.2	SILTY SAND - loose, moist, grey brown fine to coarse grained silty sand - wet from 0.5m							
	1							▷	
	1.1	SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained silty sand							
	1.4	Pit discontinued at 1.4m - near refusal							
	2								
	3								
	4								

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: Moderate seepage from 1.0 - 1.1m

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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 123
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - brown silty sand with rootlets							
	0.1	SILTY SAND - loose to medium dense, moist, grey brown fine to coarse grained silty sand							
	0.5	SILTY SAND - cemented, dry, grey fine to coarse grained silty sand with some gravel							
	0.9	Pit discontinued at 0.9m - near refusal							
	1								1
	2								2
	3								3
	4								4

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 124
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - brown silty sand with rootlets							
	0.2	SANDY CLAY - very stiff, moist to dry, brown-yellow grey-brown mottled medium plasticity sandy clay - grey brown from 0.4m							
	0.8	CLAYEY SILTY SAND - dense, dry, grey brown mottled fine to coarse grained clayey silty sand							
	1.2	SILTY SAND - cemented, dry, grey brown fine to coarse grained silty sand							
	1.9	Pit discontinued at 1.9m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **LOGGED:** JRB **SURVEY DATUM:**

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT:	Land Development Agency	**SURFACE LEVEL:**	--	**PIT No:**	126
PROJECT:	Groundwater Investigation	**EASTING:**		**PROJECT No:**	50660.01
LOCATION:	Hume West	**NORTHING:**		**DATE:**	26/7/2012
		DIP/AZIMUTH:	90°/--	**SHEET**	1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.15	TOPSOIL - brown silty sand with rootlets	▨						
	0.4	SILTY SAND - medium dense, dry to moist, grey brown fine to coarse grained silty sand	▨						
	1	CLAYEY SILTY SAND - medium dense, moist, grey brown mottled fine to coarse grained clayey silty sand with some gravel - dense from 1.0m - cemented from 1.6m	▨						1
	1.9	Pit discontinued at 1.9m - near refusal							
	2								2
	3								3
	4								4

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **LOGGED:** JRB **SURVEY DATUM:**

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3

☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 127
PROJECT No: 50660.01
DATE: 26/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING - poorly compacted, moist, brown medium plasticity gravelly sandy clay							
	0.1	CLAYEY SILTY SAND - loose to medium dense, moist, grey fine to coarse grained clayey silty sand							
	1.2	SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained silty sand with some clay and gravel							
	1.8	Pit discontinued at 1.8m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Excavated adjacent to surface spring

☐ 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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 128
PROJECT No: 50660.01
DATE: 12/9/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
		TOPSOIL FILLING - brown silty sand							
	0.3	SILTY SAND - dense, dry, grey brown mottled fine to coarse grained silty sand							
	1	- moist from 1.0m							1
		- wet from 1.3 - 1.4m - cemented from 1.4m		D	1.35			▷	
	1.6	Pit discontinued at 1.6m - near refusal							
	2								2
	3								3
	4								4

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: Slow horizontal seepage from 1.3 - 1.4m

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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 129
PROJECT No: 50660.01
DATE: 12/9/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
	0.2	TOPSOIL FILLING - brown silty sand							
	2.1	SILTY SAND - dense, dry, grey brown mottled fine to coarse grained silty sand - moist from 1.4m - cemented, dry from 1.4m		D	1.8				
		Pit discontinued at 2.1m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 130
PROJECT No: 50660.01
DATE: 12/9/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
		TOPSOIL FILLING - brown silty sand							
	0.35	SILTY SAND - medium dense, moist, brown fine to coarse silty sand - wet to moist from 1.0 - 1.2m		D	1.1				
	1.2	CLAYEY SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained clayey silty sand							
	1.5	Pit discontinued at 1.5m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 131
PROJECT No: 50660.01
DATE: 12/9/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Sampling & In Situ Testing Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		TOPSOIL FILLING - brown silty sand						
	0.15	SILTY SAND - medium dense, moist, brown fine to coarse silty sand						
	0.5	CLAYEY SAND - loose, wet, grey fine to medium grained clayey sand	D	0.8				
1	0.9	CLAYEY SILTY SAND - loose to medium dense, moist to wet, brown fine to medium grained clayey silty sand						
	1.3	SILTY GRAVELLY SAND - loose, wet, grey fine to coarse grained silty gravelly sand	D	1.6				
	1.7	CLAYEY SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained clayey silty sand						
2	2.0	Pit discontinued at 2.0m - near refusal						
3								
4								

RIG: Kubota KX57-4 mini-excavator - 450mm bucket
LOGGED: JRB
SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 132
PROJECT No: 50660.01
DATE: 12/9/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING - well compacted, dry to moist, grey fine to coarse grained sandy gavel	☒						
	0.2	FILLING - moderately compacted, moist, brown fine to coarse grained silty sand	☒						
	0.4	SILTY SAND - dense, dry to moist, grey brown mottled fine to coarse grained silty sand	·|·|						
	0.9	SILTY SAND - loose, wet, grey fine to coarse grained silty sand with some gravel	·|·|					▷	
	1.6	SILTY SAND - cemented, dry to moist, grey brown mottled fine to coarse grained silty sand with iron nodules	·|·|						
	1.8	Pit discontinued at 1.8m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: Fast horizontal seepage from 1.2 - 1.6m

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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 133
PROJECT No: 50660.01
DATE: 12/9/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL FILLING - brown silty sand	☒						
	0.25	FILLING - well compacted, dry to moist, brown medium plasticity gravelly sandy clay - moist from 0.9m	☒						
1	1.0	CLAYEY SAND - dense, dry to moist, grey brown mottled fine to coarse grained clayey sand - cemented from 1.3m	▨						1
	1.6	Pit discontinued at 1.6m - near refusal							
2									2
3									3
4									4

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 134
PROJECT No: 50660.01
DATE: 12/9/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL FILLING - brown silty sand	▩						
	0.25	FILLING - well compacted, dry to moist, brown medium plasticity gravelly sandy clay	▩						
1	1.0	SILTY SAND - cemented, dry, grey brown mottled fine to coarse grained silty sand	·|·|						1
	1.7	Pit discontinued at 1.7m - near refusal							
2									2
3									3
4									4

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 135
PROJECT No: 50660.01
DATE: 12/9/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
		FILLING - well compacted, dry to moist, brown medium plasticity gravelly sandy clay	▨						
	0.3	SILTY SAND - medium dense, moist to dry, grey brown fine to coarse grained silty sand	·|·|·|						
1									1
2	2.0	Pit discontinued at 2.0m - limit of investigation							2
3									3
4									4

RIG: Kubota KX57-4 mini-excavator - 450mm bucket
LOGGED: JRB
SURVEY DATUM:

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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)

Douglas Partners
Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 136
PROJECT No: 50660.01
DATE: 12/9/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL FILLING - brown silty sand							
	0.2	SANDY SILT - very stiff, moist to dry, light brown low plasticity sandy silt							
	0.6	SILTY SAND - medium dense, moist, grey brown fine to coarse grained silty sand							
	1.6	GRAVELLY SAND - loose to medium dense, wet, grey brown fine to coarse grained gravelly sand						▷	
	1.8	SILTY SAND - cemented, dry, light grey brown fine to coarse grained silty sand							
	2.2	Pit discontinued at 2.2m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket
LOGGED: JRB
SURVEY DATUM:

WATER OBSERVATIONS: Very fast horizontal seepage from 1.6 - 1.8m

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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 137
PROJECT No: 50660.01
DATE: 12/9/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
		FILLING - well compacted, dry to moist, brown medium plasticity gravelly sandy clay with topsoil pockets							
	2.4	ORIGINAL TOPSOIL							
	2.6	GRAVELLY SILTY SAND - loose to medium dense, moist, grey fine to coarse grained gravelly silty sand							
		- wet from 3.3m		D	3.4			▷	
		- cemented from 3.5m							
	3.8	Pit discontinued at 3.8m - near refusal							

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: Moderate horizontal seepage from 3.4 - 3.5m

REMARKS: Pit excavated on stockpile

☐ 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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 138
PROJECT No: 50660.01
DATE: 12/9/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL - wet, dark grey brown sandy silty clay with rootlets and tussock							
	0.2	SILTY SAND - loose to medium dense, moist to wet, grey fine to coarse grained silty sand							
	0.7	GRAVELLY SILTY SAND - loose, wet, grey brown fine to coarse grained gravelly silty sand							
1	1.0	CLAYEY SAND - medium dense, moist, grey brown mottled fine to coarse grained clayey sand						▷	1
	1.5	Pit discontinued at 1.5m - limit of investigation							
2									2
3									3
4									4

RIG: Kubota KX57-4 mini-excavator - 450mm bucket

LOGGED: JRB

SURVEY DATUM:

WATER OBSERVATIONS: Very fast horizontal seepage from 0.7 - 1.0m

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

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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Geotechnics / Environment / Groundwater

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Groundwater Investigation
LOCATION: Hume West

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

PIT No: 139
PROJECT No: 50660.01
DATE: 12/9/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.2	TOPSOIL - wet, dark grey brown sandy silty clay with rootlets and tussock							
	1	SILTY SAND - loose to medium dense, moist to wet, grey fine to coarse grained silty sand Thin gravelly sand layer Thin gravelly sand layer						▷	1
	1.8	Pit discontinued at 1.8m - limit of investigation							
	2								2
	3								3
	4								4

RIG: Kubota KX57-4 mini-excavator - 450mm bucket **LOGGED:** JRB **SURVEY DATUM:**

WATER OBSERVATIONS: Moderate horizontal seepage through thin gravelly sand layers at 0.8m and 1.1m

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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Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 2, 73 Sheppard Street
Hume ACT 2620
PO Box 1487
Fyshwick ACT 2609
Phone (02) 6260 2788
Fax (02) 6260 1147

Project 50660.05
5 May 2015
AZR

Land Development Agency
Level 7, Trans ACT House
470 Northbourne Avenue
Dickson ACT 2602

Attention: Mr Stephan Docherty

Email: stephan.docherty@act.gov.au

Dear Sir

Report on Geotechnical Investigation
Geotechnical Testing and Earthworks Advice
Block 1 – 3, Section 29, Hume West

1. Introduction

This report presents the results of a geotechnical investigation carried out on stockpiled soil materials located on Block 1 Section 29, Hume. The testing was requested by Mr Stephan Docherty of the Land Development Agency, owners and developers of the site.

It is understood that the investigation was required to further aid an assessment of the suitability of the stockpiled material to be used as controlled filling for the development of Blocks 1 – 3, Section 29, Hume such that they will have a Class M (moderately reactive) site classification. It is further understood that site preparation and earthworks advice is also required.

The investigation comprised the logging and sampling of test pits followed by laboratory testing on selected samples and preparation of an engineering report. Details of the work undertaken and the results obtained are given in the report.

This report must be read in conjunction with the attached notes “About this Report”.

2. Background

Previous investigation of the site has been undertaken by Douglas Partners (DP) August and September 2012 (Project 50660.01) and most recently in February 2014 (Project 77384.00). The purpose of the February 2014 investigation was to identify potential development constraints and comment on material reuse.

3. Site Location

The site is located in Hume and is bounded by vacant blocks to the north and east, Tralee Street to the south and Couranga Crescent to the west.

4. Field Work Methods

The field work comprised the excavation of 12 test pits (Pits 1 – 12), to depths of 0.2 – 4.0 m using a Kubota KX057-4 mini-excavator fitted with a 450mm wide bucket. The pits were located within existing stockpiled material and were logged onsite by a geotechnical engineer who incorporated bulk disturbed samples from various depths for laboratory testing purposes. The locations were chosen to get broad coverage of the stockpiles and are shown on the attached Drawing 1.

5. Field Work Results

The test pit logs are attached together with explanatory notes that define classification methods and descriptive terms.

The test pits generally encountered a thin (0.2 m) layer of rootlet affected soil then gravelly and clayey soils with some silt and sand. Several test pits encountered cobbles and some boulders. Two test pits encountered rootlets beyond the upper 0.2 m (Pits 5 and 10). Moisture contents were generally moist with some wet pockets.

6. Laboratory Testing

Three samples were tested for measurement of Atterberg limits, particle size distribution, modified compaction and soaked California Bearing Ratio (CBR) The laboratory test report sheets are attached with the results summarised in Tables 1 – 3 below.

Table 1: Results of Plasticity Testing

Pit No.	Depth (m)	LL (%)	PL (%)	PI (%)	LS (%)	Field Description
2	0.6 – 0.8	47	19	28	12.0	Filling –Sandy Clay/Clayey Sand
10	1.5 – 1.7	28	15	13	7.0	Filling – Clayey Sandy Gravel
12	1.0 – 1.2	29	20	9	5.0	Filling – Silty Sandy Gravel

Where:
LL = liquid limit
PL = plastic limit
PI = plasticity index
LS = linear shrinkage

Table 2: Results of Particle Size Distribution

Pit No.	Depth (m)	% Passing 2.36 mm Sieve	% Passing 0.425 mm Sieve	% Passing 0.075 mm Sieve	Field Description
2	0.6 – 0.8	84	60	40	Filling –Sandy Clay/Clayey Sand
10	1.5 – 1.7	66	41	26	Filling – Clayey Sandy Gravel
12	1.0 – 1.2	57	39	29	Filling – Silty Sandy Gravel

Table 3: Results of Compaction/CBR Testing

Pit No.	Depth (m)	FMC (%)	OMC (%)	MDD (t/m^3)	CBR (%)	Field Description
2	0.6 – 0.8	20.9	15.1	1.89	4.0	Filling –Sandy Clay/Clayey Sand
10	1.0 – 1.2	11.0	9.7	2.08	25	Filling – Clayey Sandy Gravel
12	1.5 – 1.7	10.8	9.2	2.00	45	Filling – Silty Sandy Gravel

Where:
MDD = maximum dry density
CBR = California Bearing Ratio
OMC = optimum moisture content
FMC = field moisture content

7. Comments

7.1 Re-Use of Stockpiled Material (Block 1)

The results of the field work and laboratory has indicated the presence of predominately sandy, gravelly and clayey soils with some silt in the stockpiles of material on Block 1. It is considered that most of this material would be considered suitable for re-use as an engineering material based on the following conditions:

- All vegetation, rootlet affected soils and topsoil are stripped from the current stockpiles and stockpiled separately for possible landscaping purposes.
- Prior to commencement of any excavation/transportation works, DP marks onsite which stockpiles or parts of stockpiles, are likely to be feasible for reuse. Reassessment would be required on a regular basis as the soil is being excavated to check material quality and for the presence of unsuitable fractions.
- Unsuitable fractions such as topsoil pockets, grass clumps, roots and oversize cobbles and boulders are to be removed during excavation.
- Cobbles and boulders could be attempted to be broken down under compaction equipment however if they are not able to be the must be cast aside for disposal.

- Approximately 20 – 25% by volume of silty sandy material could be blended with clayey and/or weathered rock material to produce a suitable soil mixture for reuse as controlled filling.

7.2 Re-Use of Existing Uncontrolled Filling (Blocks 2 and 3)

The existing uncontrolled filling on Blocks 2 and 3 was predominately sandy and though technically feasible to reuse as controlled filling, careful moisture control must be exercised during placement as not to over wet it. Blending with the stockpiled soils on Block 1 would be recommended to add some clay and weathered rock.

7.3 Site Preparation and Filling Placement

The following should be followed to achieve a Class M site classification on Blocks 1 – 3:

- Strip all filling, topsoils, vegetation and other deleterious materials (such as tree roots) and remove to spoil or stockpile for later re-use in landscaping;
- Test roll the prepared surface in the presence of a geotechnical engineer. Any areas exhibiting significant deflections under test rolling should be appropriately treated by the methods suggested by a geotechnical engineer;
- Filling to achieve subgrade levels must be undertaken as Level 1 Controlled Filling. For a Class M classification, the filling material should not contain high plasticity clays, organic matter or oversize material (in excess of 100 mm);
- Appropriate material should be placed in near horizontal layers of maximum loose thickness of 250 mm and compacted to achieve at least 95% modified maximum dry density ratio and a moisture content within the range of ±2% of modified optimum at the time of placement.

Groundwater seepages are considered not to be an issue at the site due to the installation of sub-soil drains in the area, however it is noted that minor seepages have been encountered in the area in previous investigations, and should be anticipated following rainfall.

It must be observed by the client the extra costs associated with the reuse of this material when compared to conventional bulk earthworks. Additional costs would be required for sorting unsuitable fractions and blending/mixing operations with better quality material.

We trust the above is in accordance with your present requirements. Should you have any questions at this stage please contact the undersigned.

Yours faithfully
Douglas Partners Pty Ltd

Alexandra Radulovich
Geotechnical Engineer

Reviewed by:

Michael Jones
Senior Associate

Attachments:	About this Report and Explanatory Notes Test Pit Logs (Pits 1 – 12) Laboratory Test Reports (7 Pages) Drawing 1

About this Report

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.

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

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

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.

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 Descriptions

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:

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

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

Stratification Spacing

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

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

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

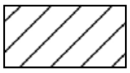
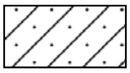
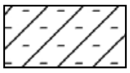
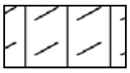
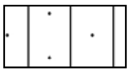
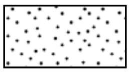
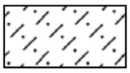
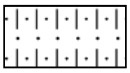
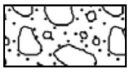
Symbols & Abbreviations

Graphic Symbols for Soil and Rock

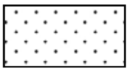
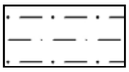
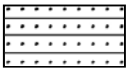
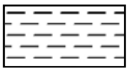
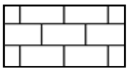
General

■	Asphalt
	Road base
	Concrete
	Filling

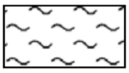
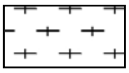
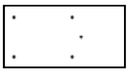
Soils

	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

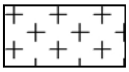
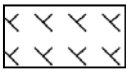
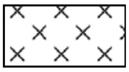
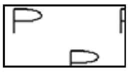
Sedimentary Rocks

	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

TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Geotechnical Testing and Earthworks Advice
LOCATION: Blocks 1 - 3 Section 29, Hume West

SURFACE LEVEL: --
EASTING:
NORTHING:

PIT No: 1
PROJECT No: 50660.05
DATE: 2/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
		FILLING - generally comprising moist to dry, brown sandy clay gravel, with cobbles and boulders up to 500mm							
1	1.0	FILLING - generally comprising moist, orange brown, medium plasticity silty gravely clay		D	1.4				1
2	1.9	SANDY SILT - moist to dry, light grey, low plasticity, traces of rootlets (remnant topsoil)							2
	2.2	Pit discontinued at 2.2m							
3									3
4									4

RIG: Kubota KX057-4 Mini Excavator fitted with a 450mm bucket **LOGGED:** APH **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Geotechnical Testing and Earthworks Advice
LOCATION: Blocks 1 - 3 Section 29, Hume West

SURFACE LEVEL: --
EASTING:
NORTHING:

PIT No: 2
PROJECT No: 50660.05
DATE: 2/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
		TOPSOIL FILLING - dry to moist, light grey-brown silty gravelly sand, with rootlets							
	0.2	FILLING - generally comprising moist, light brown orange brown, medium plasticity sandy clay/clayey sand, some gravels		B	0.6 0.8				
	0.9	FILLING - generally comprising, brown/red-brown, moist to wet, medium plasticity sandy gravelly clay, minor debris (a piece of wooden stake and a metal plate)							
1									1
2									2
	2.1	TOPSOIL - dark grey sandy silt, with rootlets							
	2.3	Pit discontinued at 2.3m - limit of investigation							
3									3
4									4

RIG: Kubota KX057-4 Mini Excavator fitted with a 450mm bucket **LOGGED:** AZR **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Geotechnical Testing and Earthworks Advice
LOCATION: Blocks 1 - 3 Section 29, Hume West

SURFACE LEVEL: --
EASTING:
NORTHING:

PIT No: 3
PROJECT No: 50660.05
DATE: 2/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		TOPSOIL FILLING - dry to moist, light grey-brown silty gravelly sand, with rootlets						
	0.1	FILLING - generally comprising moist, brown orange-brown silty sandy clay & gravel, some cobbles						
	2.9	TOPSOIL - moist, dark brown clayey silt, with grass and rootlets						
	3.1	Pit discontinued at 3.1m - limit of investigation						

RIG: Kubota KX057-4 Mini Excavator fitted with a 450mm bucket **LOGGED:** AZR **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Geotechnical Testing and Earthworks Advice
LOCATION: Blocks 1 - 3 Section 29, Hume West

SURFACE LEVEL: --
EASTING:
NORTHING:

PIT No: 4
PROJECT No: 50660.05
DATE: 2/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING - generally comprising dry to moist, grey silty gravel & cobbles (siltstone)	▨						
	0.9	FILLING - generally comprising moist, brown, medium plasticity sandy gravelly clay	▨	B	1.5 1.7				
	3.0	TOPSOIL- moist, dark brown clayey silt with rootlets	≋						
	3.2	Pit discontinued at 3.2m - limit of investigation							

RIG: Kubota KX057-4 Mini Excavator fitted with a 450mm bucket **LOGGED:** AZR **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Geotechnical Testing and Earthworks Advice
LOCATION: Blocks 1 - 3 Section 29, Hume West

SURFACE LEVEL: --
EASTING:
NORTHING:

PIT No: 5
PROJECT No: 50660.05
DATE: 2/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm)
				Type	Depth	Sample	Results & Comments		5 10 15 20
		FILLING - generally comprising moist to dry, light brown silty sandy gravel, rootlets to 0.2 m - from 0.6 - 0.9m rootlets							
	1.9	TOPSOIL - moist, dark brown clayey silt							
	2.1	Pit discontinued at 2.1m - limit of investigation							

RIG: Kubota KX057-4 Mini Excavator fitted with a 450mm bucket

LOGGED: AZR

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Geotechnical Testing and Earthworks Advice
LOCATION: Blocks 1 - 3 Section 29, Hume West

SURFACE LEVEL: --
EASTING:
NORTHING:

PIT No: 6
PROJECT No: 50660.05
DATE: 2/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL FILLING - dark brown silty sandy gravel, some cobbles, roots and rootlets							
	0.2	TOPSOIL - dark brown clayey silt with rootlets							
	0.4	SILTY SAND - dense, dry to moist, light grey/white silty sand							
	0.5	Pit discontinued at 0.5m - limit of investigation							
	1								1
	2								2
	3								3
	4								4

RIG: Kubota KX057-4 Mini Excavator fitted with a 450mm bucket

LOGGED: AZR

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Geotechnical Testing and Earthworks Advice
LOCATION: Blocks 1 - 3 Section 29, Hume West

SURFACE LEVEL: --
EASTING:
NORTHING:

PIT No: 7
PROJECT No: 50660.05
DATE: 2/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
	0.1	TOPSOIL - dark brown, clayey silt with rootlets							
	0.2	SILTY SAND - dense, dry to moist, light grey/white silty sand							
		Pit discontinued at 0.2m - limit of investigation							
	1								1
	2								2
	3								3
	4								4

RIG: Kubota KX057-4 Mini Excavator fitted with a 450mm bucket

LOGGED: AZR

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Geotechnical Testing and Earthworks Advice
LOCATION: Blocks 1 - 3 Section 29, Hume West

SURFACE LEVEL: --
EASTING:
NORTHING:

PIT No: 8
PROJECT No: 50660.05
DATE: 2/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
		FILLING - generally comprising moist, brown silty sand							
	0.8	FILLING - generally comprising wet, grey brown, silty clayey sand		D	1.0				
	1.3	TOPSOIL - dark grey clayey silt, with grass and rootlets							
	1.4	Pit discontinued at 1.4m - limit of investigation							

RIG: Kubota KX057-4 Mini Excavator fitted with a 450mm bucket **LOGGED:** AZR **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Geotechnical Testing and Earthworks Advice
LOCATION: Blocks 1 - 3 Section 29, Hume West

SURFACE LEVEL: --
EASTING:
NORTHING:

PIT No: 9
PROJECT No: 50660.05
DATE: 2/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING - generally comprising moist to dry, brown clayey sandy gravel, some cobble, rootlets to 0.3m		D	1.0				
	1.2	TOPSOIL - dry to moist, light grey, some silt with rootelts							
	1.4	Pit discontinued at 1.4m - limit of investigation							

RIG: Kubota KX057-4 Mini Excavator fitted with a 450mm bucket **LOGGED:** AZR **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Geotechnical Testing and Earthworks Advice
LOCATION: Blocks 1 - 3 Section 29, Hume West

SURFACE LEVEL: --
EASTING:
NORTHING:

PIT No: 10
PROJECT No: 50660.05
DATE: 2/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING - generally comprising dry to moist, brown clayey sandy gravel, some cobbles							
	1			B	1.0 1.2				
	1.8	FILLING - generally comprising moist, grey silty sandy gravel, some clay and rootlets, some zones of grass							
	2			D	2.5				
	3								
	3.4	SILTY SAND - moist, light grey silty sand, trace of rootlets							
	3.5	Pit discontinued at 3.5m - limit of investigation							
	4								

RIG: Kubota KX057-4 Mini Excavator fitted with a 450mm bucket
LOGGED: AZR
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Geotechnical Testing and Earthworks Advice
LOCATION: Blocks 1 - 3 Section 29, Hume West

SURFACE LEVEL: --
EASTING:
NORTHING:

PIT No: 11
PROJECT No: 50660.05
DATE: 2/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
				Type	Depth	Sample	Results & Comments		
		FILLING - generally comprising dry to moist, light grey silty sandy gravel with some silty clay zones							
1	1.0	FILLING - generally comprising moist to dry, brown gravelly sandy clay with some silt		D	1.3				1
2									2
3	3.0	TOPSOIL - moist, dark brown, clayey silt with roots and rootlets							3
	3.1	Pit discontinued at 3.1m - limit of investigation							
4									4

RIG: Kubota KX057-4 Mini Excavator fitted with a 450mm bucket **LOGGED:** AZR **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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TEST PIT LOG

CLIENT: Land Development Agency
PROJECT: Geotechnical Testing and Earthworks Advice
LOCATION: Blocks 1 - 3 Section 29, Hume West

SURFACE LEVEL: --
EASTING:
NORTHING:

PIT No: 12
PROJECT No: 50660.05
DATE: 2/4/2015
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Sampling & In Situ Testing: Depth	Sampling & In Situ Testing: Sample	Sampling & In Situ Testing: Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING - generally comprising moist to dry, red brown silty clay, with gravel and rootlets		D	0.6				
1	1.0	FILLING - generally comprising moist, brown silty sandy gravel		B	1.2 1.4				1
2		- from 2.0m some clay zones							2
	2.4	TOPSOIL - moist, dark brown sandy silt, with rootlets							
	2.5	Pit discontinued at 2.3m - limit of investigation							
3									3
4									4

RIG: Kubota KX057-4 Mini Excavator fitted with a 450mm bucket **LOGGED:** AZR **SURVEY DATUM:** MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_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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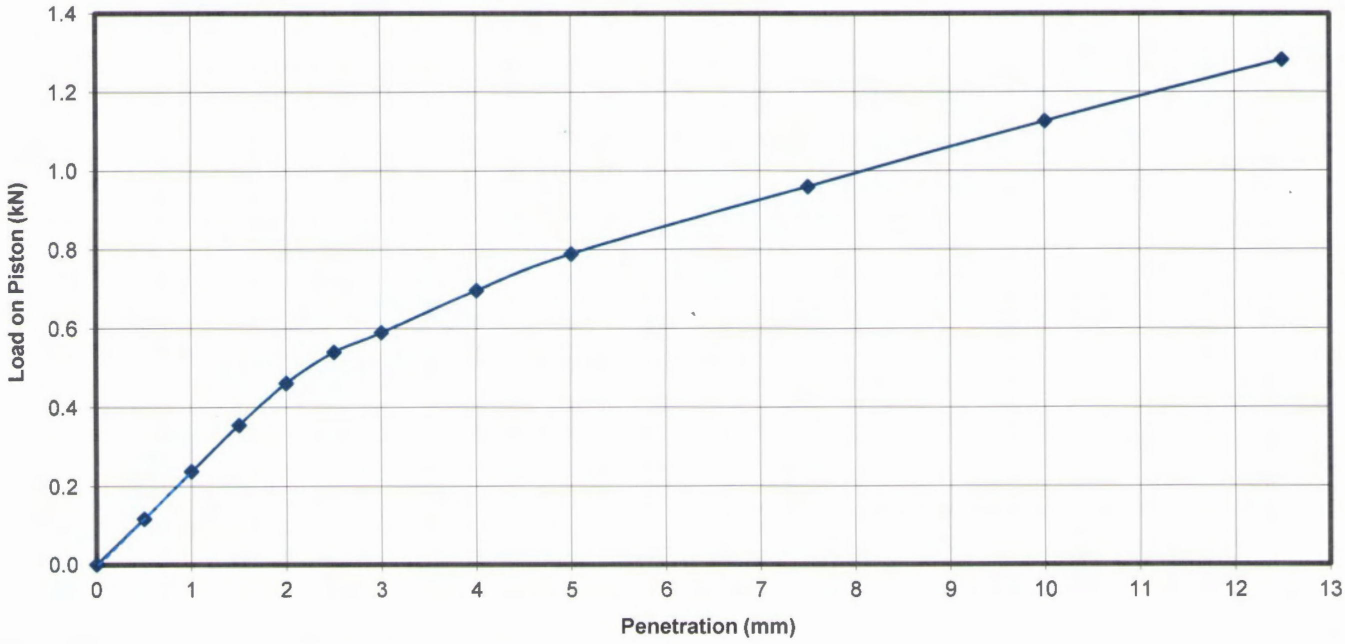
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 1, 1 Luso Drive
PO Box 486
Unanderra NSW 2526
Phone (02) 4271 1836
Fax (02) 4271 1897

Result of California Bearing Ratio Test

Client :	Douglas Partners Pty Ltd	**Project No. :**	50660.05
		Report No. :	GL15-028A
Project :	Exisiting Stockpiles	**Report Date :**	29/04/2015
		Date Sampled :	2/04/2015
Location :	Hume West	**Date of Test:**	21/04/2015
Test Location :	Pit 2		
Depth / Layer :	0.6 - 0.8m	**Page:**	1 of 1



Description: Brown Silty Sandy Clay

Sampling Method(s): Sampled by Canberra Engineering Department
Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Remarks: -

Percentage > 19mm: 0.0%

LEVEL OF COMPACTION: 94% of MOD MDD
MOISTURE RATIO: 104% of MOD OMC
SURCHARGE: 4.5 kg
SOAKING PERIOD: 4 days
SWELL: 3.1%

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		15.7	1.77
After soaking		21.0	1.72
After test	Top 30mm of sample	24.3	-
	Remainder of sample	20.9	-
Field values		20.9	-
Modified Compaction	(OMC/MDD)	15.1	1.89

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5mm**	**4.0**

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory Number: 828

Tested:	TG
Checked:	TL

T. Lethbridge
Tim Lethbridge
Laboratory Manager

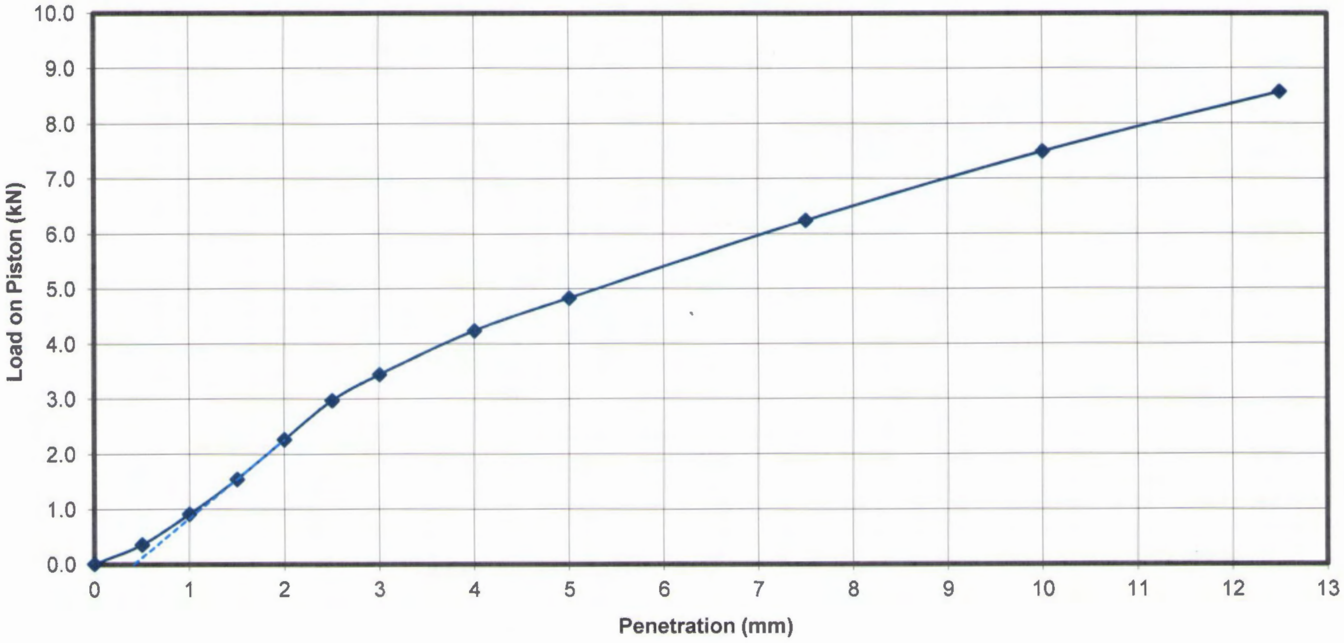
FORM R019 REV 8 OCTOBER 2013

Douglas Partners
Geotechnics | Environment | Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 1, 1 Luso Drive
PO Box 486
Unanderra NSW 2526
Phone (02) 4271 1836
Fax (02) 4271 1897

Result of California Bearing Ratio Test

Client : Douglas Partners Pty Ltd
Project No. : 50660.05
Report No. : GL15-028B
Project : Exisiting Stockpiles
Report Date : 29/04/2015
Date Sampled : 2/04/2015
Location : Hume West
Date of Test: 21/04/2015
Test Location : Pit 10
Depth / Layer : 1.0 - 1.2m
Page: 1 of 1



Description: Clayey Sandy Gravel

Sampling Method(s): Sampled by Canberra Engineering Department
Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Remarks: -

Percentage > 19mm: 21.4% (Excluded)

LEVEL OF COMPACTION: 95.5% of MOD MDD
SURCHARGE: 4.5 kg
SWELL: 0.5%
MOISTURE RATIO: 105% of MOD OMC
SOAKING PERIOD: 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		10.2	1.99
After soaking		13.5	1.98
After test	Top 30mm of sample	13.8	-
	Remainder of sample	23.4	-
Field values		11.0	-
Modified Compaction	(OMC/MDD)	9.7	2.08

RESULTS		
TYPE	PENETRATION	CBR (%)
TOP	5.0mm	25

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory Number: 828

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

Tested:	TG
Checked:	TL

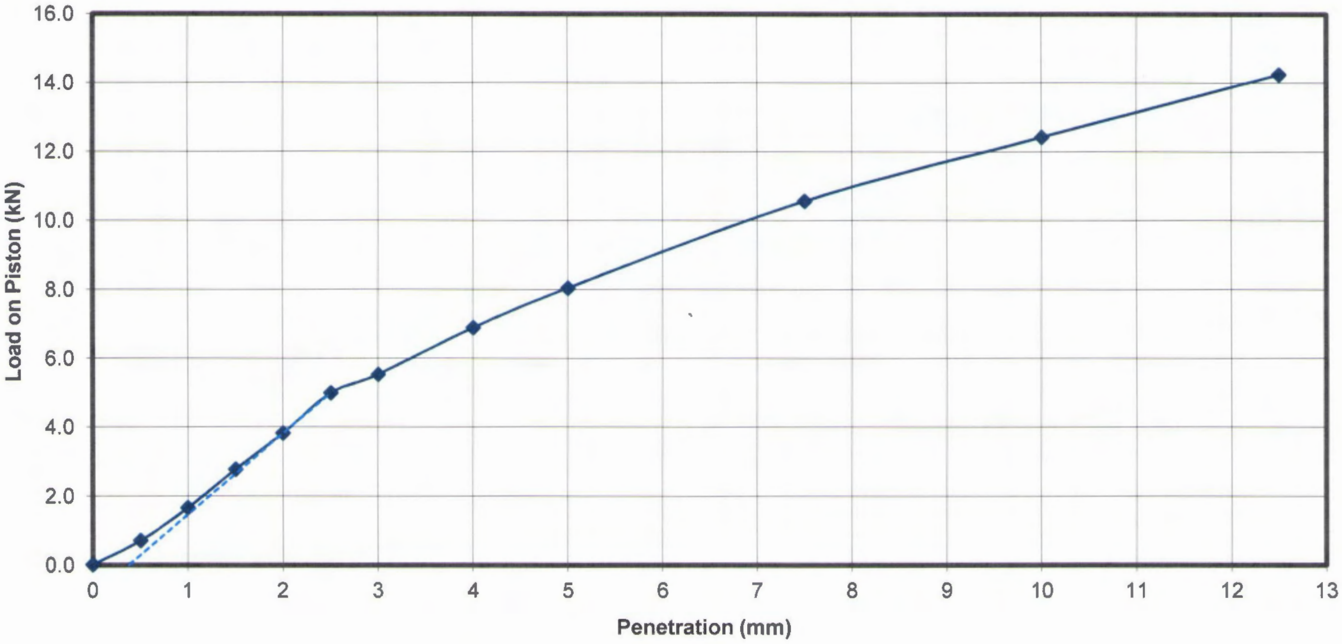
T. Lethbridge
Tim Lethbridge
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 1, 1 Luso Drive
PO Box 486
Unanderra NSW 2526
Phone (02) 4271 1836
Fax (02) 4271 1897

Result of California Bearing Ratio Test

Client :	Douglas Partners Pty Ltd	**Project No. :**	50660.05
		Report No. :	GL15-028C
Project :	Exisiting Stockpiles	**Report Date :**	29/04/2015
		Date Sampled :	2/04/2015
Location :	Hume West	**Date of Test:**	21/04/2015
Test Location :	Pit 12		
Depth / Layer :	1.2 - 1.4	**Page:**	1 of 1



Description:	Silty Sandy Gravel
Sampling Method(s):	Sampled by Canberra Engineering Department
Test Method(s):	AS 1289.6.1.1, AS 1289.2.1.1
Remarks:	-

Percentage > 19mm: 27.6% (Excluded)

LEVEL OF COMPACTION: 96% of MOD MDD

MOISTURE RATIO: 96% of MOD OMC

SURCHARGE: 4.5 kg

SOAKING PERIOD: 4 days

SWELL: 0.3%

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		8.8	1.92
After soaking		12.5	1.91
After test	Top 30mm of sample	13.5	-
	Remainder of sample	11.9	-
Field values		10.8	-
Modified Compaction	(OMC/MDD)	9.2	2.00

RESULTS		
TYPE	PENETRATION	CBR (%)
TOP	**5.0mm**	**45**

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Accredited for compliance with ISO/IEC 17025

Tested:	TG
Checked:	TL

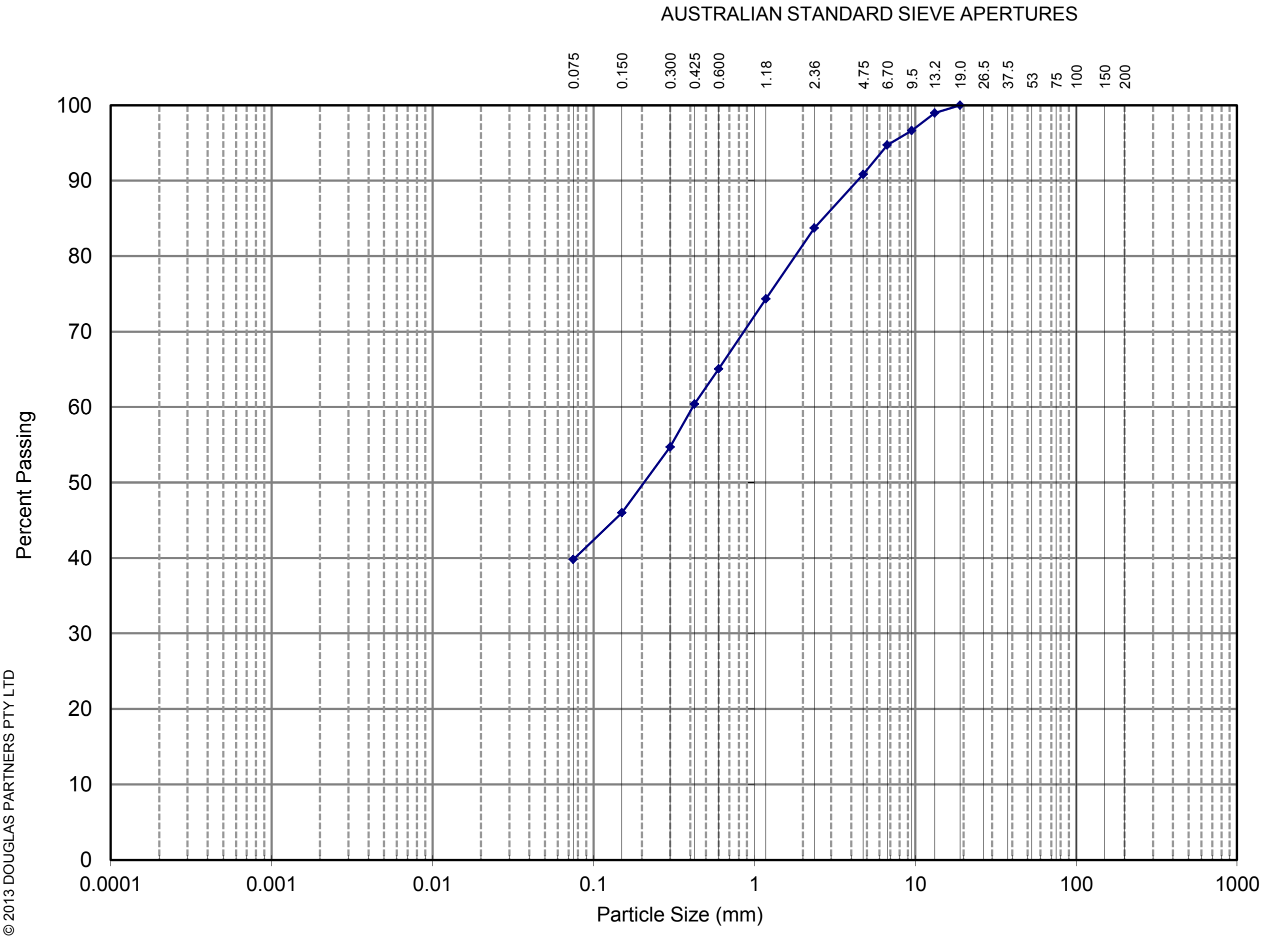
T. Lethbridge
Tim Lethbridge
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
1 Farquhar Street
PO Box 180
Goulburn NSW 2580
Phone 0417 498 504

Results of Particle Size Distribution

Client :	Douglas Partners Pty Ltd	**Project No. :**	50660.05
		Report No. :	GL15-028I
Project :	Existing Stockpiles	**Report Date :**	29/04/2015
Location :	Hume West	**Date Sampled:**	02/04/2015
Test Location:	Pit 2	**Date of Test:**	21/04/2015
Depth / Layer:	0.6 - 0.8m	**Page:**	1 of 1



Sieve Size (mm)	% Passing
75.0	~
53.0	~
37.5	~
26.5	~
19.0	**100%**
13.2	**99%**
9.5	**97%**
6.7	**95%**
4.75	**91%**
2.36	**84%**
1.18	**74%**
0.600	**65%**
0.425	**60%**
0.300	**55%**
0.150	**46%**
0.075	**40%**

CLAY FRACTION	SILT FRACTION			SAND FRACTION			GRAVEL FRACTION			COBBLES
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

0.002 0.006 0.02 0.06 0.2 0.6 2.0 6.0 20 60

Description: Silty Sandy Clay

Test Method(s): AS 1289.3.6.1

Sampling Method(s): Sampled by Canberra Engineering Department

Remarks: -

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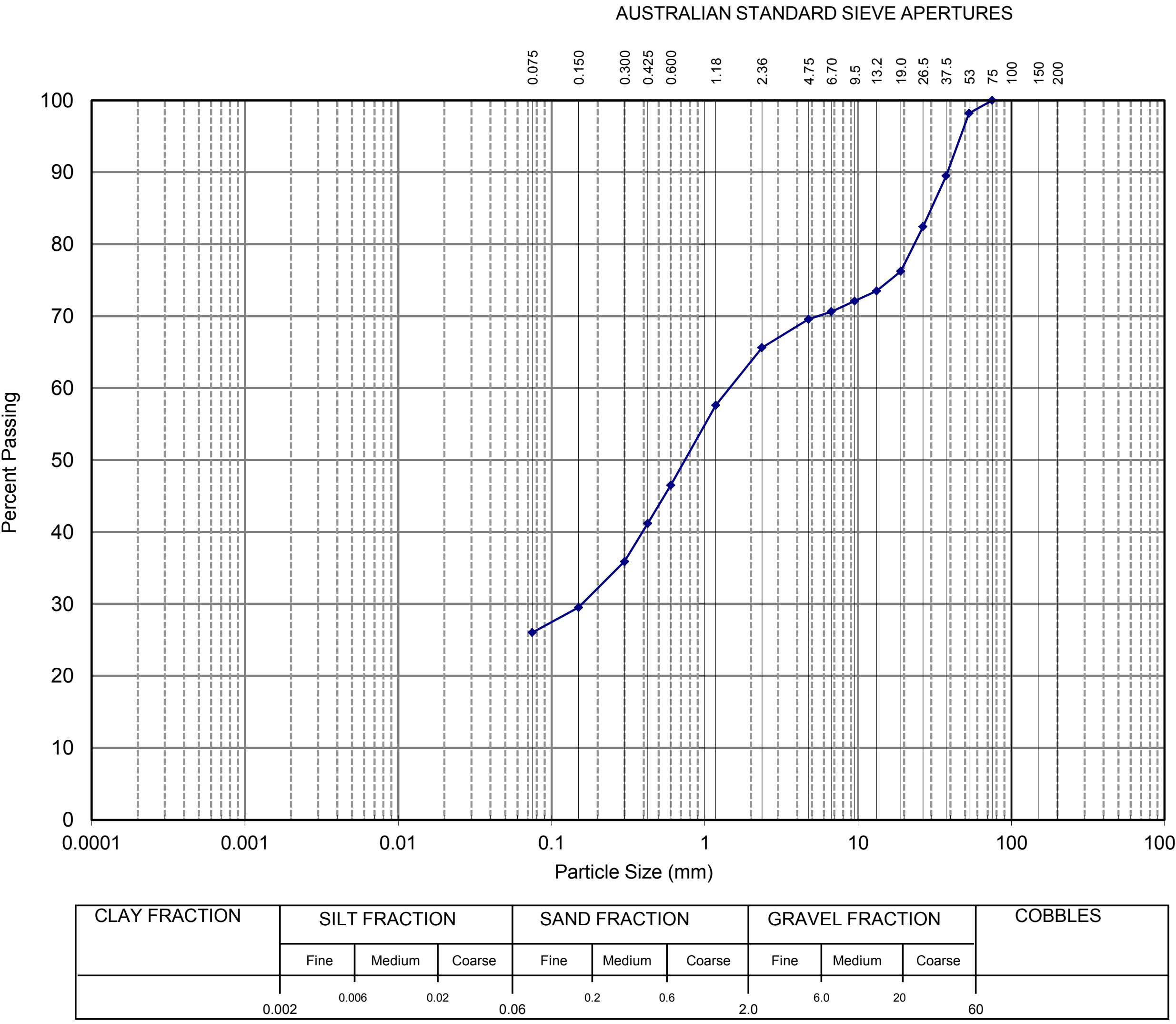
Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
1 Farquhar Street
PO Box 180
Goulburn NSW 2580
Phone 0417 498 504

Results of Particle Size Distribution

Client : Douglas Partners Pty Ltd
Project No. : 50660.05
Report No. : GL15-028J
Project : Existing Stockpiles
Report Date : 29/04/2015

Location : Hume West
Date Sampled: 02/04/2015
Test Location: Pit 10
Date of Test: 22/04/2015
Depth / Layer: 1.0 - 1.2
Page: 1 of 1



Sieve Size (mm)	% Passing
75.0	**100%**
53.0	**98%**
37.5	**90%**
26.5	**82%**
19.0	**76%**
13.2	**74%**
9.5	**72%**
6.7	**71%**
4.75	**70%**
2.36	**66%**
1.18	**58%**
0.600	**47%**
0.425	**41%**
0.300	**36%**
0.150	**30%**
0.075	**26%**

Description: Clayey Sandy Gravel

Test Method(s): AS 1289.3.6.1

Sampling Method(s): Sampled by Canberra Engineering Department

Remarks:

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Tested:	MM
Checked:	TL

T. Lethbridge

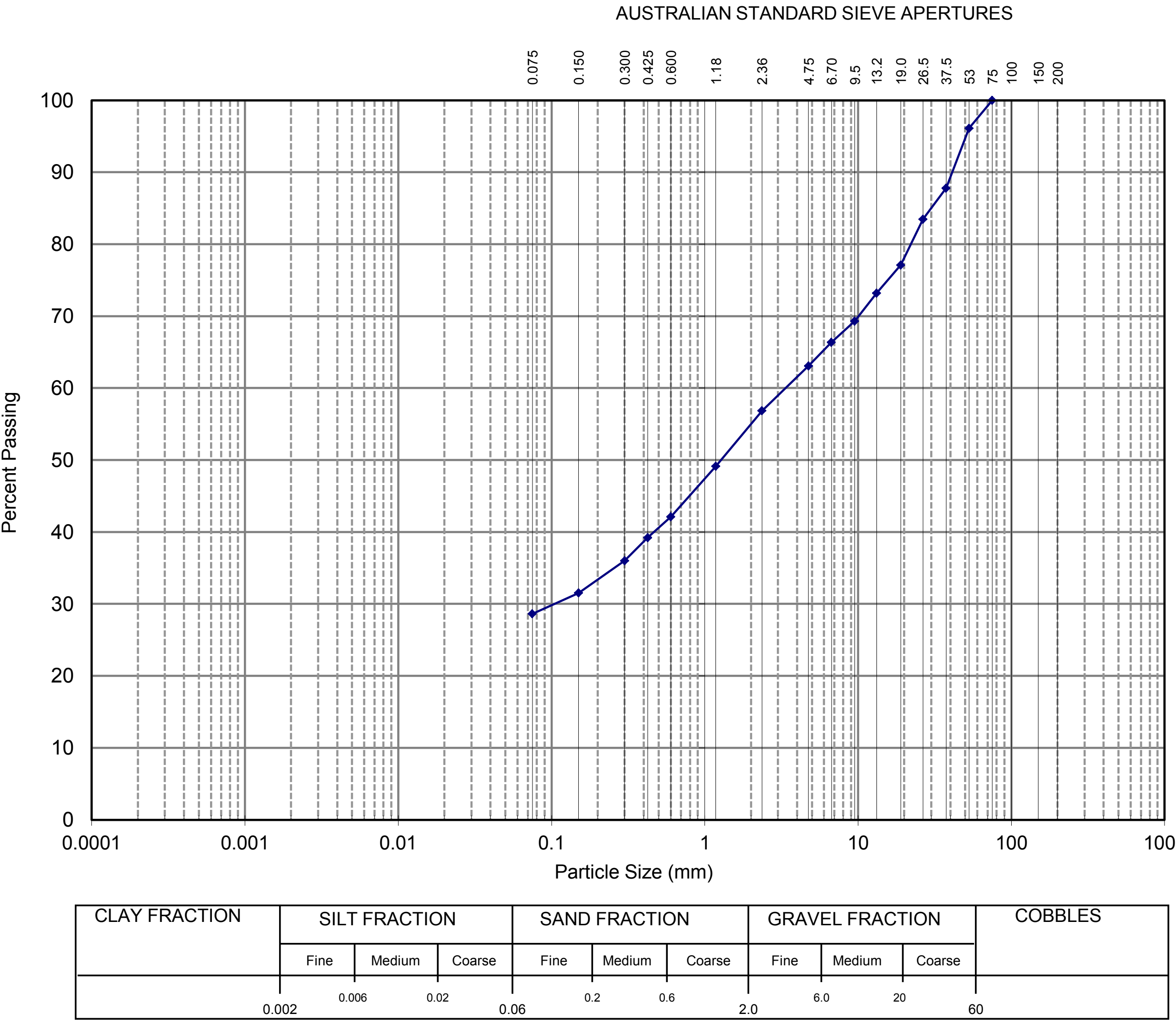
Tim Lethbridge
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
1 Farquhar Street
PO Box 180
Goulburn NSW 2580
Phone 0417 498 504

Results of Particle Size Distribution

Client :	Douglas Partners Pty Ltd	**Project No. :**	50660.05
		Report No. :	GL15-028K
Project :	Existing Stockpiles	**Report Date :**	29/04/2015
Location :	Hume West	**Date Sampled:**	02/04/2015
Test Location:	Pit 12	**Date of Test:**	16/04/2015
Depth / Layer:	1.2 - 1.4	**Page:**	1 of 1



Sieve Size (mm)	% Passing
75.0	**100%**
53.0	**96%**
37.5	**88%**
26.5	**83%**
19.0	**77%**
13.2	**73%**
9.5	**69%**
6.7	**66%**
4.75	**63%**
2.36	**57%**
1.18	**49%**
0.600	**42%**
0.425	**39%**
0.300	**36%**
0.150	**32%**
0.075	**29%**

Description: Silty Sandy Gravel

Test Method(s): AS 1289.3.6.1

Sampling Method(s): Sampled by Canberra Engineering Department

Remarks: -

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Checked:	TL

T. Lethbridge
Tim Lethbridge
Laboratory Manager

Douglas Partners
Geotechnics | Environment | Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
1 Farquhar Street
PO Box 180
Goulburn NSW 2580
Phone 0417 498 504

Results of Moisture Content, Plasticity and Linear Shrinkage Tests

Client:	**Douglas Partners Pty Ltd**	**Project No:**	50660.05
		Report No:	GL15-028Q
Project:	Existing Stockpiles	**Report Date:**	29/04/2015
		Date Sampled:	02/04/2015
		Date of Test:	29/04/2015
Location:	Hume West	**Page:**	1 of 1

Test Location	**Depth** (m)	**Description**	**Code**	**W_F %**	**W_L %**	**W_P %**	**PI %**	***LS %**
Pit 2	0.6 - 0.8	Silty Sandy Clay	2,3,5	-	47	19	28	12.0
Pit 10	1.0 - 1.2	Clayey Sandy Gravel	2,3,5	-	28	15	13	7.0
Pit 12	1.2 - 1.4	Silty Sandy Gravel	2,3,5	-	29	20	9	5.0
Pit 14	1.4 - 1.6	Silty Gravelly Sand	2,3,5	-	23	17	7	4.0
Pit 16	1.6 - 1.8	Sandy Clayey Gravel	2,3,5	-	32	13	18	7.0
Pit 17	1.5 - 1.7	Clayey Gravelly Samd	2,3,5	-	29	11	18	7.0
Pit 18	1.1 - 1.3	Silty Gravelly Sand	2,3,5	-	24	14	9	5.0

Legend:

W_F	Field Moisture Content
W_L	Liquid limit
W_P	Plastic limit
PI	Plasticity index
LS	Linear shrinkage from liquid limit condition (Mould length250mm)

Test Methods:

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

Code:

Sample history for plasticity tests
1. Air dried
2. Low temperature (<50ºC) oven dried
3. Oven (105ºC) dried
4. Unknown

Method of preparation for plasticity tests
5. Dry sieved
6. Wet sieved
7. Natural

*Specify if sample crumbled CR or curled CU

Sampling Methods: Sampled by Canberra Engineering Department

Remarks: -

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory Number: 828

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Tested: MM,TG
Checked: TL

T. Lethbridge

Tim Lethbridge
Laboratory Manager

LEGEND

⊞	Approximate Test Pit Location

NOTE: Base drawing from www.nearmap.com

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CLIENT: Land Development Agency		TITLE: **Test Location Plan**		PROJECT No: 50660.05
OFFICE: Canberra	DRAWN BY: AZR	**Geotechnical Testing and Earthworks Advice**		DRAWING No: 1
SCALE: NTS	DATE: 07.04.2015	**Blocks 1 - 3 Section 29, Hume West**	N MGA	REVISION: 0

SITE CLASSIFICATION REPORT SUMMARY

BLOCK: 9 **SECTION:** 21 **SUBURB:** Hume
JOB No: 50660.08 **DATE:** February 2016
CLIENT: Land Development Agency

CLASSIFICATION PROCEDURES:
EXISTING SUBSURFACE CONDITIONS:

Test Pit 106: Located at the south eastern corner of Block 9 Section 21. Silty sand topsoil to 0.13 m, medium dense silty sand to 0.4 m, dense silty sand to 0.6 m, very stiff sandy clay to 0.9 m overlying cemented clayey silty sand to near refusal at 1.2 m depth.

Test Pit 108: Located centrally on the eastern boundary of Block 9 Section 21. Medium dense clayey silty sand to 0.25 m, cemented silty sand to 0.4 m overlying cemented clayey silty sand to near refusal at 0.9 m depth.

Test Pit 114: Located centrally on the southern boundary of Block 9 Section 21. Wet sandy silt topsoil to 0.15 m, loose to medium dense silty sand to 1.3 m overlying cemented clayey silty sand to slow progress at 1.6 m depth. Moderate groundwater seepage was observed between 0.5 – 1.3 m depth.

Test Pit 121: Located at the south western corner of Block 9 Section 21. Wet sandy clayey silt topsoil to 0.15 m, soft, wet clayey sandy silt to 0.3 m, stiff, moist sandy clay to 0.9 m overlying cemented clayey silty sand to near refusal at 1.3 m depth. Slow groundwater seepage between 0.0 – 0.3 m depth.

Test Pit 122: Located centrally within Block 9 Section 21. Silty sand topsoil to 0.2 m, loose, moist silty sand to 1.1 m overlying cemented silty sand to near refusal at 1.4 m depth. Moderate groundwater seepage was observed between 1.0 – 1.1 m depth.

Test Pit 123: Located at the northern end of Block 9 Section 21. Silty sand topsoil to 0.1 m, loose to medium dense silty sand overlying cemented silty sand to near refusal at 0.9 m depth.

SITE CLASSIFICATION: **Class P (problem site)** based on limited subsurface information and determined in general accordance with the requirements of AS2870-2011 (Ref 1), due to the presence of adverse groundwater conditions. The main requirement for Class P sites is for design to be undertaken by a structural engineer using sound engineering principles. Notwithstanding the above P classification, the site classification based on soil reactivity would be equivalent to Class M (moderately reactive) conditions. If the adverse groundwater conditions are managed by the installation of a series of subsoil drains to intercept and control the groundwater flows, the site could possibly be reclassified as Class M. The classification must be reassessed should the soil profile change either by adding fill or removing soil from the block and/or if the presence of service trenches or retaining walls are within the zone of influence of the block. Reference should be made to the comments provided below.

FOOTING SYSTEMS: Reference must be made to AS2870-2011 (Ref 1) which indicates footing systems that are appropriate for each site classification. All footings must found within a uniform bearing stratum of suitable strength/material, below the zone of influence of any service trenches, backfill zones, retaining walls or underground structures. Masonry walls should be articulated in accordance with current best practice. Footing systems must be confirmed by a structural engineer taking into consideration any onsite or offsite constraints.

MAINTENANCE GUIDELINES: CSIRO Sheet BTF 18 'Foundation Maintenance & Footing Performance' (attached). Refer to comments about gardens, landscaping and trees on the performance of foundation soils.

COMMENTS/ LIMITATIONS:

Development specific geotechnical investigations must be undertaken.

Additional topsoils / filling may have been spread subsequent to the investigation.

Site preparation prior to construction should include removal of all vegetation, topsoil, loose/wet material and any uncontrolled filling.

All new filling must be placed under controlled conditions (AS 3798-2007).

Some variability in subsurface conditions must be anticipated.

Moisture condition of site soils and/or the presence of groundwater may vary considerably from time of investigation compared to at the time of construction.

Depending on the depth of site cut and trenches, excavation of cemented soils may be required.

It is recommended that footing excavations be inspected by a geotechnical engineer.

This report must be read in conjunction with the attached notes "About this Inspection Report".

REFERENCES:

1. AS 2870-2011 '*Residential Slabs and Footings,*' Standards Association of Australia.

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About this Inspection Report

Introduction

These notes are provided to amplify DP's inspection report in regard to the limitations of carrying out inspection work. Not all notes are necessarily relevant to this report.

Standards

This inspection report has been prepared by qualified personnel to current engineering standards of interpretation and analysis.

Copyright and Limits of Use

This inspection report is the property of DP and is provided for the exclusive use of the client for the specific project and purpose as described in the report. It should not be used by a third party for any purpose other than to confirm that the construction works addressed in the report have been inspected as described. Use of the inspection report is limited in accordance with the Conditions of Engagement for the commission.

DP does not undertake to guarantee the works of the contractors or relieve them of their responsibility to produce a completed product conforming to the design.

Reports

This inspection report may include advice or opinion that is based on engineering and/or geological interpretation, information provided by the client or the client's agent, and information gained from:

- an investigation report for the project (if available to DP);
- inspection of the work, exposed ground conditions, excavation spoil and performance of excavating equipment while DP was on site;
- investigation and testing that was carried out during the site inspection;
- anecdotal information provided by authoritative site personnel; and
- DP's experience and knowledge of local geology.

Such information may be limited by the frequency of any inspection or testing that was able to be practically carried out, including possible site or cost constraints imposed by the client/ contractor(s). For these reasons, the reliability of this inspection report is limited by the scope of information on which it relies.

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

- unexpected variations in subsurface conditions that are not evident from the inspection; and
- the actions of contractors responding to commercial pressures.

Should these issues occur, then additional advice should be sought from DP and, if required, amendments made.

This inspection report must be read in conjunction with any attached information. This inspection report should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions from review by others of this inspection report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this inspection report.

Foundation Maintenance and Footing Performance:

A Homeowner's Guide

BTF 18 replaces Information Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction

There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion

All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation

This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume – particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil

All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure

This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.
- In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

Tree root growth

Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation

Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpends).

Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

Seasonal swelling/shrinkage in clay

Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

Trees can cause shrinkage and damage

As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots

In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself

Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures

Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures

Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation cause a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures

Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem.
Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.
- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870.

AS 2870 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing

Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage

In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

Protection of the building perimeter

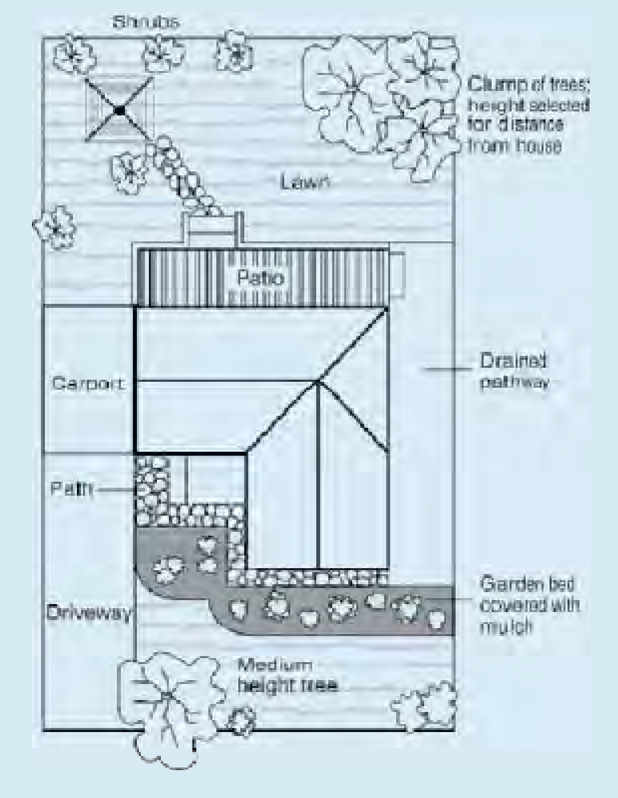
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted	15–25 mm but also depend on number of cracks	4

Gardens for a reactive site



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

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SITE CLASSIFICATION REPORT SUMMARY

BLOCK: 10 **SECTION:** 21 **SUBURB:** Hume
JOB No: 50660.08 **DATE:** February 2016
CLIENT: Land Development Agency

CLASSIFICATION PROCEDURES:

EXISTING SUBSURFACE CONDITIONS:

Test Pit 104: Located towards the south eastern corner of Block 10 Section 21. Wet sandy silt topsoil to 0.1 m, loose, wet clayey sand to 0.25 m, stiff sandy clay to 0.8 m overlying cemented, dry to moist silty sand to near refusal depth of 1.2 m. Slow groundwater seepage was observed between 0.0 – 0.2 m depth.

Test Pit 106: Located at the north eastern corner of Block 10 Section 21. Silty sand topsoil to 0.13 m, medium dense silty sand to 0.4 m, dense silty sand to 0.6 m, very stiff sandy clay to 0.9 m overlying cemented clayey silty sand to near refusal at 1.2 m depth.

Test Pit 113: Located towards the south eastern corner of Block 10 Section 21. Silty sand topsoil to 0.2 m, medium dense silty sand to the limit of investigation at 2.5 m depth. Fast groundwater seepage was observed from 2.3 m depth.

Test Pit 114: Located centrally on the northern boundary of Block 10 Section 21. Wet sandy silt topsoil to 0.15 m, loose to medium dense silty sand to 1.3 m overlying cemented clayey silty sand to slow progress at 1.6 m depth. Moderate groundwater seepage was observed between 0.5 – 1.3 m depth.

Test Pit 118: Located towards the south western corner of Block 10 Section 21. Silty sand topsoil to 0.1 m, medium dense silty sand to 0.5 m, medium dense, moist silty sand to 1.3 m overlying cemented silty sand to near refusal at 1.5 m depth.

Test Pit 119: Located at the western corner of Block 10 Section 21. Silty sand topsoil to 0.1 m, loose to medium dense silty sand to 0.5 m, stiff sandy clay to 0.9 m overlying cemented silty sand to near refusal at 1.0 m depth. Moderate seepage between 1.4 – 1.5 m depth.

Test Pit 120: Located centrally within Block 10 Section 21. Silty sand topsoil to 0.15 m, loose to medium dense silty sand to 1.0 m overlying cemented silty sand to near refusal at 1.7 m depth. Slow groundwater seepage between 1.4 – 1.5 m depth.

Test Pit 121: Located at the north western corner of Block 10 Section 21. Wet sandy clayey silt topsoil to 0.15 m, soft, wet clayey sandy silt to 0.3 m, stiff, moist sandy clay to 0.9 m overlying cemented clayey silty sand to near refusal at 1.3 m depth. Slow groundwater seepage between 0.0 – 0.3 m depth.

SITE CLASSIFICATION: **Class P (problem site)** based on limited subsurface information and determined in general accordance with the requirements of AS2870-2011 (Ref 1), due to the presence of adverse groundwater conditions. The main requirement for Class P sites is for design to be undertaken by a structural engineer using sound engineering principles. Notwithstanding the above P classification, the site classification based on soil reactivity would be equivalent to Class M (moderately reactive) conditions. If the adverse groundwater conditions are managed by the installation of a series of subsoil drains to intercept and control the groundwater flows, the site could possibly be reclassified as Class M. The classification must be reassessed should the soil profile change either by adding fill or removing soil from the block and/or if the presence of service trenches or retaining walls are within the zone of influence of the block. Reference should be made to the comments provided below.

FOOTING SYSTEMS: Reference must be made to AS2870-2011 (Ref 1) which indicates footing systems that are appropriate for each site classification. All footings must found within a uniform bearing stratum of suitable strength/material, below the zone of influence of any service trenches, backfill zones, retaining walls or underground structures. Masonry walls should be articulated in accordance with current best practice. Footing systems must be confirmed by a structural engineer taking into consideration any onsite or offsite constraints.

MAINTENANCE GUIDELINES: CSIRO Sheet BTF 18 'Foundation Maintenance & Footing Performance' (attached). Refer to comments about gardens, landscaping and trees on the performance of foundation soils.

COMMENTS/ LIMITATIONS:

Development specific geotechnical investigations must be undertaken.

Additional topsoils / filling may have been spread subsequent to the investigation.

Site preparation prior to construction should include removal of all vegetation, topsoil, loose/wet material and any uncontrolled filling.

All new filling must be placed under controlled conditions (AS 3798-2007).

Some variability in subsurface conditions must be anticipated.

Moisture condition of site soils and/or the presence of groundwater may vary considerably from time of investigation compared to at the time of construction.

Depending on the depth of site cut and trenches, excavation of cemented soils may be required.

It is recommended that footing excavations be inspected by a geotechnical engineer.

This report must be read in conjunction with the attached notes "About this Inspection Report".

REFERENCES:

1. AS 2870-2011 '*Residential Slabs and Footings,*' Standards Association of Australia.

Douglas Partners
Geotechnics / Environment / Groundwater

About this Inspection Report

Douglas Partners

Introduction

These notes are provided to amplify DP's inspection report in regard to the limitations of carrying out inspection work. Not all notes are necessarily relevant to this report.

Standards

This inspection report has been prepared by qualified personnel to current engineering standards of interpretation and analysis.

Copyright and Limits of Use

This inspection report is the property of DP and is provided for the exclusive use of the client for the specific project and purpose as described in the report. It should not be used by a third party for any purpose other than to confirm that the construction works addressed in the report have been inspected as described. Use of the inspection report is limited in accordance with the Conditions of Engagement for the commission.

DP does not undertake to guarantee the works of the contractors or relieve them of their responsibility to produce a completed product conforming to the design.

Reports

This inspection report may include advice or opinion that is based on engineering and/or geological interpretation, information provided by the client or the client's agent, and information gained from:

- an investigation report for the project (if available to DP);
- inspection of the work, exposed ground conditions, excavation spoil and performance of excavating equipment while DP was on site;
- investigation and testing that was carried out during the site inspection;
- anecdotal information provided by authoritative site personnel; and
- DP's experience and knowledge of local geology.

Such information may be limited by the frequency of any inspection or testing that was able to be practically carried out, including possible site or cost constraints imposed by the client/ contractor(s). For these reasons, the reliability of this inspection report is limited by the scope of information on which it relies.

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

- unexpected variations in subsurface conditions that are not evident from the inspection; and
- the actions of contractors responding to commercial pressures.

Should these issues occur, then additional advice should be sought from DP and, if required, amendments made.

This inspection report must be read in conjunction with any attached information. This inspection report should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions from review by others of this inspection report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this inspection report.

Foundation Maintenance and Footing Performance:

A Homeowner's Guide

BTF 18 replaces Information Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction

There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion

All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation

This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume – particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil

All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure

This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.
- In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

Tree root growth

Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation

Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpends).

Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

Seasonal swelling/shrinkage in clay

Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

Trees can cause shrinkage and damage

As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots

In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself

Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures

Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures

Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation cause a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures

Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem.

Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.
- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

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AS 2870 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

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Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage

In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

Protection of the building perimeter

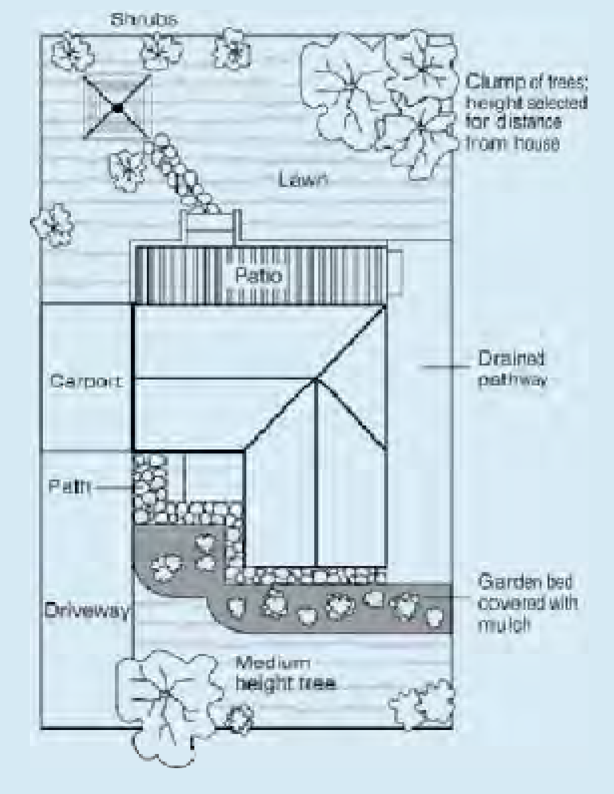
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted	15–25 mm but also depend on number of cracks	4

Gardens for a reactive site



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

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Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

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Email: publishing.sales@csiro.au

SITE CLASSIFICATION REPORT SUMMARY

BLOCK: 11 **SECTION:** 21 **SUBURB:** Hume

JOB No: 50660.08 **DATE:** February 2016

CLIENT: Land Development Agency

CLASSIFICATION PROCEDURES:

EXISTING SUBSURFACE CONDITIONS:

Test Pit 102: Located centrally along the eastern boundary of Block 11 Section 21 Silty sand topsoil to 0.15 m, loose to medium dense silty sand to 0.6 m, loose, wet gravelly silty sand to 1.2 m overlying cemented, dry to moist silty sand to near refusal at 1.6 m depth. Very fast groundwater seepage was observed between 1.0 – 1.2 m depth.

Test Pit 113: Located towards the north eastern corner of Block 11 Section 21. Silty sand topsoil to 0.2 m, medium dense silty sand to the limit of investigation at 2.5 m depth. Fast groundwater seepage was observed from 2.3 m depth.

Test Pit 115: Located towards the south eastern corner of Block 11 Section 21. Silty sand topsoil to 0.3 m, medium dense silty sand to 1.1 m overlying medium dense gravelly silty sand to near refusal at 2.1 m depth.

Test Pit 116: Located towards the south western corner of Block 10 Section 21. Silty sand topsoil to 0.2 m, medium dense silty sand to 0.4 m, stiff, moist sandy clay to 1.2 m overlying dense gravelly silty sand to near refusal at 1.4 m depth.

Test Pit 117: Located centrally within Block 11 Section 21 sandy silty clay topsoil to 0.2 m, loose, moist to wet clayey silty sand to 0.8 m, loose wet silty sand to 1.1 m overlying cemented clayey silty sand to near refusal at 1.4 m depth. Very fast groundwater seepage was observed between 0.8 – 1.1 m depth.

Test Pit 118: Located towards the north western corner of Block 11 Section 21. Silty sand topsoil to 0.1 m, medium dense silty sand to 0.5 m, medium dense, moist silty sand to 1.3 m overlying cemented silty sand to near refusal at 1.5 m depth.

Test Pit 136: Located towards the south western corner of Block 10 Section 21. Silty sand topsoil filling to 0.2 m, very stiff sandy silt to 0.6 m, medium dense, moist silty sand to 1.6 m, loose to medium dense wet gravelly sand overlying cemented silty sand to near refusal at 2.2 m depth. Very fast groundwater seepage between 1.6 - 1.8 m depth.

SITE CLASSIFICATION: **Class P (problem site)** based on limited subsurface information and determined in general accordance with the requirements of AS2870-2011 (Ref 1), due to the presence of adverse groundwater conditions. The main requirement for Class P sites is for design to be undertaken by a structural engineer using sound engineering principles. Notwithstanding the above P classification, the site classification based on soil reactivity would be equivalent to Class M (moderately reactive) conditions. If the adverse groundwater conditions are managed by the installation of a series of subsoil drains to intercept and control the groundwater flows, the site could possibly be reclassified as Class M. The classification must be reassessed should the soil profile change either by adding fill or removing soil from the block and/or if the presence of service trenches or retaining walls are within the zone of influence of the block. Reference should be made to the comments provided below.

FOOTING SYSTEMS: Reference must be made to AS2870-2011 (Ref 1) which indicates footing systems that are appropriate for each site classification. All footings must found within a uniform bearing stratum of suitable strength/material, below the zone of influence of any service trenches, backfill zones, retaining walls or underground structures. Masonry walls should be articulated in accordance with current best practice. Footing systems must be confirmed by a structural engineer taking into consideration any onsite or offsite constraints.

MAINTENANCE GUIDELINES: CSIRO Sheet BTF 18 'Foundation Maintenance & Footing Performance' (attached). Refer to comments about gardens, landscaping and trees on the performance of foundation soils.

COMMENTS/ LIMITATIONS:

Development specific geotechnical investigations must be undertaken.

Additional topsoils / filling may have been spread subsequent to the investigation.

Site preparation prior to construction should include removal of all vegetation, topsoil, loose/wet material and any uncontrolled filling.

All new filling must be placed under controlled conditions (AS 3798-2007).

Some variability in subsurface conditions must be anticipated.

Moisture condition of site soils and/or the presence of groundwater may vary considerably from time of investigation compared to at the time of construction.

Depending on the depth of site cut and trenches, excavation of cemented soils may be required.

It is recommended that footing excavations be inspected by a geotechnical engineer.

This report must be read in conjunction with the attached notes "About this Inspection Report".

REFERENCES: 1. AS 2870-2011 '*Residential Slabs and Footings,*' Standards Association of Australia.

Douglas Partners

Geotechnics / Environment / Groundwater

About this Inspection Report

Introduction

These notes are provided to amplify DP's inspection report in regard to the limitations of carrying out inspection work. Not all notes are necessarily relevant to this report.

Standards

This inspection report has been prepared by qualified personnel to current engineering standards of interpretation and analysis.

Copyright and Limits of Use

This inspection report is the property of DP and is provided for the exclusive use of the client for the specific project and purpose as described in the report. It should not be used by a third party for any purpose other than to confirm that the construction works addressed in the report have been inspected as described. Use of the inspection report is limited in accordance with the Conditions of Engagement for the commission.

DP does not undertake to guarantee the works of the contractors or relieve them of their responsibility to produce a completed product conforming to the design.

Reports

This inspection report may include advice or opinion that is based on engineering and/or geological interpretation, information provided by the client or the client's agent, and information gained from:

- an investigation report for the project (if available to DP);
- inspection of the work, exposed ground conditions, excavation spoil and performance of excavating equipment while DP was on site;
- investigation and testing that was carried out during the site inspection;
- anecdotal information provided by authoritative site personnel; and
- DP's experience and knowledge of local geology.

Such information may be limited by the frequency of any inspection or testing that was able to be practically carried out, including possible site or cost constraints imposed by the client/ contractor(s). For these reasons, the reliability of this inspection report is limited by the scope of information on which it relies.

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

- unexpected variations in subsurface conditions that are not evident from the inspection; and
- the actions of contractors responding to commercial pressures.

Should these issues occur, then additional advice should be sought from DP and, if required, amendments made.

This inspection report must be read in conjunction with any attached information. This inspection report should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions from review by others of this inspection report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this inspection report.

Foundation Maintenance and Footing Performance:

A Homeowner's Guide

BTF 18
replaces
Information
Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction

There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion

All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation

This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume – particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil

All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure

This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.
- In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

Tree root growth

Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation

Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpends).

Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

Seasonal swelling/shrinkage in clay

Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

Trees can cause shrinkage and damage

As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots

In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself

Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures

Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures
Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation cause a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures
Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem.
Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.
- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870.

AS 2870 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing
Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage
In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

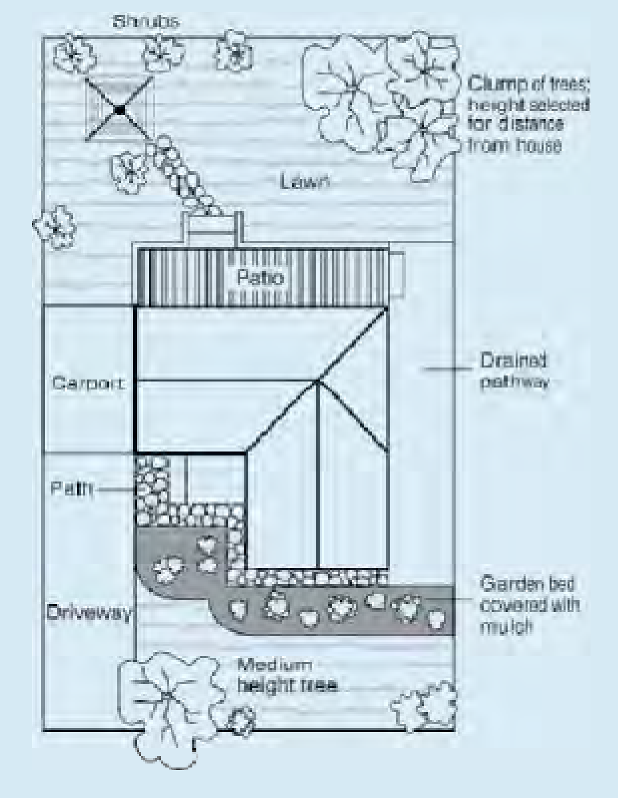
Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted	15–25 mm but also depend on number of cracks	4

Gardens for a reactive site



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

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Information on trees, plants and shrubs

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Email: publishing.sales@csiro.au

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TREE ASSESSMENT

REVISION A

MAY 2014

CANBERRA
6A Thesiger Court
DEAKIN ACT 2600
Phone: (02) 6285 1022
Fax: (02) 6285 2618

SYDNEY
Level 7, 80 George St
Parramatta NSW 2150
Phone: (02) 9633 2273
Fax: (02) 6285 2618

ABN: 37 008 581 066
ACN: 008 581 066
Web: www.Indesco.com.au
Email: Indesco@Indesco.com.au

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1. SUMMARY OF FINDINGS

Typical of the Canberra region the soils, climate and exposure of this ex-pasture site are not conducive to robust tree growth.

The trees fall into three categories:

- Old remnant trees
- A forward planting along the boundary
- A group of poor trees
- A younger well-grown double row of trees.

For the most part the old remnant trees are in poor condition with the exception of tree 3, located at the end of the row of trees, which has been rated High. It has good structure even though the canopy is somewhat weak due to insect predation. The crown should be rebalanced if the tree is retained.

The planting along the boundary, Group 4, appears to be a forward planting. The trees are stunted and of poor form. Even if thinned the condition of is unlikely to improve.

Groups 2 and 3 are of similar age and condition. Group 3 extends outside the new fence and some trees have canopies within 2m of the fence line. The overall impression of the two groups of trees is that they have grown to the limit of the site and will not improve in the future. They are, as a group, rated Low for Urban Amenity.

Group 1 is a more recent planting of quite well spaced trees with a central row of acacias. The trees appear to have been better planted and maintained in their early development, as they display better form. The acacias may have contributed nitrogen to the site and provided better edaphic conditions for the trees. Removal of the acacias would reduce competition for the eucalypts.

2. TREE ASSESSMENT METHODOLOGY

2.1 ASSESSMENT INFORMATION AND CODES

The following provides detail information on the codes used in the Tree Assessment data collection form.

Tree Number/Group: Reference Number. Each tree/group is numbered to link to the plan and report.

2.2 GENERAL DATA

Assessment Date: Date field assessment was carried out.

Assessor: Name or initials of the field assessor.

Tree Location: Accurate location, ACT grid coordinates, Stromlo projection, Northing's and Easting's of tree position.

Species: Tree species identification, Botanical and Common Name.

Height: Tree height in metres.

Canopy Spread: Tree canopy diameter in metres shown as the maximum crown width of tree,

Trunk Circumference: Tree trunk circumference in millimetres, measures 1 metre above ground level.

Number of Trunks: Number of trunks at 1 metre above ground level.

2.3 QUALITY CLASSIFICATION

Regulated Tree: regulated tree in accordance with the *ACT Tree Protection ACT, 2005*

Y – Yes

N – No

2.3.1 Arboricultural Assessment

E Exceptional tree. Mature specimen. Grand appearance and stature. Well balanced. Little or no epicormic growth and/or deadwood.

H Mature specimen. Good appearance and structure. Little or no epicormic growth and/or dead wood.

Juvenile or adolescent specimen or group of trees or regeneration that does not meet the requirements of the *Act* but which is of good form and health with potential to become a Regulated tree or the potential to contribute to the landscape or urban amenity in the future.

M Mature specimen. Sparse or pale foliage. Epicormic growth and/or dead wood throughout crown. Evidence of some branch fall. Less than desirable form.

Juvenile or adolescent specimen or group of trees or regeneration that does not meet the requirements of the *Act* which has some negative characteristics but with cost effective maintenance and/or management has the potential to become a regulated tree or the potential to contribute the landscape or urban amenity in the future.

P Mature, senescent or other specimen tree of poor form or with significant die back or sparse foliage. Disease, decay, hollows, large limb drop, included bark forks, Short life expectancy.

2.3.2 Urban Amenity Contribution

E Exceptional quality. A tree that meets at least two of the following qualities -

- H Visual/Scenic Quality
- H Unique Species
- H Habitat Quality
- H Cultural/Heritage Value
- H Social Value
- H Scientific Value

(Note: A tree, as an example, maybe considered 'Exceptional' on the basis of high scientific importance but be of poor form and condition and represent a significant hazard.)

H High quality. A tree of good form and condition without significant defects and which when managed does not represent a significant hazard or an unreasonable financial impost.

M Medium quality. A tree of reasonable form, structure and health and not likely to represent a significant hazard

P Poor quality. A tree of poor form, structure or health or in decline or likely to represent a significant hazard.

2.4 ARBORCULTURAL CHARACTERISTICS

Canopy Density: Relative density of canopy foliage:

3 – Full canopy (80% to 100%)

2 – Part canopy (20% to 80%)

1 – Sparse canopy (<20%)

Canopy Dead Wood: Amount of dead wood in the canopy as a % of the canopy:

3 – 0% to 20%

2 – 20% to 60%

1 – 60% to 100%

Insect Occurrence: Evidence of insect attack:

3 – None

2 – Moderate

1 – Significant

Disease: Evidence of disease present:

3 – None

2 – Moderate

1 – Significant

Epicormic Growth: Presence of epicormic growth:

3 – None

2 – Moderate

1 – Significant

Mistletoe: Presence of mistletoe in canopy:

3 – None

2 – Up to 5 clumps moderate

1 – More than 5 clumps

Form: Canopy balance and distribution of the relative to the normal habit of the tree species:

4 – Typical of species

3 – Stunted

2 – Unbalanced/ lopsided canopy

1 – Trunk lean approx. 30° or more off vertical

Age: Approximate age:

4 – Juvenile

3 – Adolescent

2 – Mature

1 – Senescent

Habitat Value: Habitat value provided by tree eg. Considering nesting hollows, seed pods etc

4 – Food source or nesting hollows for endangered species.

3 – Limited habitat potential

2 – No identifiable habitat

1 – Potential for harbouring pest species.

Disturbance Tolerance: Tolerance to disturbance within the tree protection zone based on species characteristics and site conditions:

3 – High, tree species generally tolerant of some disturbance

2 – Medium, tree species that may tolerate limited disturbance

1 – Low, tree species generally highly sensitive to disturbance.

Risk Potential: Risk potential, structural integrity, associated with trunk and major branches:

3 – Low risk potential, good structural integrity with low risk potential and may require minimal or no horticulturalist maintenance.

2 – Medium risk potential, poor branch unions, narrow angle branch forks, or multiple leaders etc where risk can be mitigated by tree surgery and horticultural maintenance techniques.

1 – Significant risk potential, decay within trunk or major branches, prevalence of hollows or decay, depressed sections of the trunk, storm damage etc where risk can be mitigated by extensive tree surgery or horticultural techniques

Health/Condition: Overall health and condition of the tree based on arboricultural assessment of crown and trunk of the tree

4 – Excellent

3 – Good

2 – Fair

1 – Poor

2.5 URBAN AMENITY CHARACTERISTICS

Contribution to Existing Landscape: What level of contribution does the tree make to the existing landscape setting?

3 – Significant

2 – Moderate

1 – None

Contribution to Future Landscape: What level of contribution does the tree potentially have for future landscape settings?

3 – Significant

2 – Moderate

1 – None

Visual/Scenic: visual and scenic quality of the tree when viewed from within and beyond the site based on form, condition, species, health and size:

3 – Significant

2 – Moderate

1 – Low

Unique Species: Based on the rarity or commonness of the species in the region or growing at the extent or outside of its normal range and the abundance of the species within its geographical range:

2 – Rare

1 – Common

Habitat Quality: Based on the potential to retain or attract native fauna:

3 – Provides significant habitat to native birds or arboreal animals

2 – Ability to retain or attract native birds or arboreal animals

1 – No habitat opportunity for native fauna or known to harbour exotic pests

Cultural Value: Does the tree have cultural/heritage value?

2 – Yes

1 – No

Social Value: Does the tree possess social benefit? Eg. is there community connection to its planting or location?

2 – Yes

1 – No

Scientific Value: Does the tree possess scientific interest? Eg. Genetic, stunted growth/habitat, climate range.

2 – Yes

1 – No

Remnant Species: Is the tree a remnant species?

2 – Yes

1 – No

2.6 TREE PROTECTION / MANAGEMENT

Tree Protection Zone and Conditions: The tree protection zone defines the minimum distance from the outer edge of the tree canopy or the face of the trunk of the tree for any groundwork under the canopy of the tree that is likely to harm the tree including building, trenching, material storage, changing soil levels, compacting or contaminating the soil. The tree protection zones are based on the Quality Classification ratings.

3 – For **Exceptional Quality Trees** – erect 1.8m high chain link fence at least 5m from the canopy or 4m from the trunk, whichever is greater

2 – For **High Quality Trees -** erect 1.8m high chain link fence at least 2m from the canopy or 4m from the trunk, whichever is greater

1 – For **Medium Quality Trees** - erect 1.8m high chain link fence at least 2m from the canopy or 4m from the trunk, whichever is greater.

Condition for the establishment and maintenance of the tree protection zones should include the following:

(a) For especially tall and/or slender trees or trees noted as having exposed roots as recorded in arboriculture notes

(b) Tree protection zone fenced prior to commencement of any demolition/construction.

(c) Fencing to be maintained during construction phase

(d) No storage of materials or machinery within the Tree protection Zone

Potential to Reduce Risk: Are there arboricultural/horticultural works that can be carried out to reduce potential risks?

3 – Significant works

2 – Moderate works

1 – None

Potential to Improve Amenity Value: Are there arboricultural/horticultural works that can be carried out to improve the potential amenity value of the trees.

3 – Significant works

2 – Moderate works

1 – None

2.7 ARBORCULTURAL NOTES

Detailed notes on specific arboricultural issues associated with the tree if not covered in the characteristics assessment.

2.8 AMENITY NOTES

Detailed notes on specific landscape amenity values of the tress if not covered in the characteristics assessment.

2.9 LANDSCAPE TREE GROUPS

The assessment of landscape trees that are clearly identifiable as dense uniform landscape groups to be assessed as groups for their potential contribution to future urban amenity. The groups are to be considered and assessed on the same bases as individual trees

3 – An identifiable group of trees that when considered as a whole meet at least one of the values for Tree Quality Classification of Exceptional Quality.

2 – A clearly identifiable group of landscape trees that includes trees that meet the requirements for assessment under the Tree Protection Act, 2005 and has the potential to contribute to the future urban amenity

1 – A clearly identifiable group of landscape trees that may include trees that do not meet the requirements for assessment under the Tree Protection Act, 2005 and has the potential to contribute to the future Urban Amenity.

3. NOTES / DISCLAIMER

3.1 LIMITATIONS ON THE USE OF THIS REPORT

This report is to be utilised in its entirety only. Any written or verbal submission, report or presentation that includes statements taken from the findings, discussions, conclusions or recommendations made in this report, may only be used where the whole of the original report (or a copy) is referenced.

The Vegetation Assessment Report is in four parts:

Part 1 – Summary of findings

Part 2 – Tree Assessment Methodology

Part 3 – Tree Assessment Sheets

Part 4 – Tree Assessment Plan

3.2 UNLESS STATED OTHERWISE

Information contained in this report covers only those trees that were examined and reflects the condition of those trees at the time of inspection indicated on the Tree Assessment Sheets

The inspection was limited to visual examination of the subject trees without dissection, excavation, probing or coring.

There is no warranty or guarantee, expressed or implied, that problems or deficiencies with the subject trees may not arise in the future.

The findings of this report may not necessarily agree with reports prepared by others, including the Government Conservator of Trees.

Attachment A

Tree Assessment Sheets

SUMMARY

TREE NUMBER/GROUP	**1**
REGULATED TREE	**N**
REGISTERED TREE	

TREE ASSESSMENT

ARBORCULTURAL ASSESSMENT	**M**
URBAN AMENITY ASSESSMENT	**M**

RECOMMENDATION	NAME	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Fraxinus oxycarpa 'Raywood'
Common Name	Claret Ash

LOCATION

E:		**N:**	
Height (M)	7	**Canopy (M)**	8
Trunk Circum	900	**No of Trunks**	1

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	1
POTENTIAL TO IMPROVE AMENITY	1

NOTES

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	**3**
Canopy Dead Wood	**3**
Insect Attack	**3**
Disease	**3**
Epicormic Growth	**3**
Mistletoe	**3**
Form	**4**
Age	**3**
Tolerance to Disturbance	**3**
Risk Potential	**3**
Health / Condition	**3**

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	**2**
Potential Contribution to Future Landscape	**1**
Visual/ Scenic	**2**
Unique Species	**1**
Habitat Quality	**1**
Habitat Value	**2**
Cultural Value	**1**
Social Value	**1**
Scientific Value	**1**
Remnant Species	**1**
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	**2**
REGULATED TREE	**N**
REGISTERED TREE	

TREE ASSESSMENT

ARBORICULTURAL ASSESSMENT	**M**
URBAN AMENITY ASSESSMENT	**M**

RECOMMENDATION	NAME	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Platanus acerifolia
Common Name	London plane

LOCATION

E:		**N:**	
Height (M)	7	**Canopy (M)**	5
Trunk Circum	700	**No of Trunks**	1

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	1
POTENTIAL TO IMPROVE AMENITY	1

NOTES

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	**3**
Canopy Dead Wood	**3**
Insect Attack	**3**
Disease	**3**
Epicormic Growth	**3**
Mistletoe	**3**
Form	**4**
Age	**3**
Tolerance to Disturbance	**3**
Risk Potential	**3**
Health / Condition	**3**

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	**2**
Potential Contribution to Future Landscape	**1**
Visual/ Scenic	**2**
Unique Species	**1**
Habitat Quality	**1**
Habitat Value	**2**
Cultural Value	**1**
Social Value	**1**
Scientific Value	**1**
Remnant Species	**1**
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	3
REGULATED TREE	Y
REGISTERED TREE	

TREE ASSESSMENT

ARBORCULTURAL ASSESSMENT	H
URBAN AMENITY ASSESSMENT	H

RECOMMENDATION	NAME	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Eucalyptus blakelyi
Common Name	Blakelys Red Gum

LOCATION

E: 212499.479		N: 590125.612	
Height (M)	19	Canopy (M)	19
Trunk Circum	3800	No of Trunks	1

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	3
POTENTIAL TO IMPROVE AMENITY	3

NOTES

Slightly aysmmetrical canopy

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	2
Canopy Dead Wood	3
Insect Attack	2
Disease	3
Epicormic Growth	3
Mistletoe	3
Form	4
Age	2
Tolerance to Disturbance	1
Risk Potential	2
Health / Condition	2

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	3
Potential Contribution to Future Landscape	2
Visual/ Scenic	3
Unique Species	1
Habitat Quality	3
Habitat Value	4
Cultural Value	1
Social Value	1
Scientific Value	1
Remnant Species	2
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	**4**
REGULATED TREE	**Y**
REGISTERED TREE	

TREE ASSESSMENT

ARBORCULTURAL ASSESSMENT	**M**
URBAN AMENITY ASSESSMENT	**M**

RECOMMENDATION	NAME	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Eucalyptus polyanthemos
Common Name	Red Box

LOCATION

E:		**N:**	
Height (M)	13	**Canopy (M)**	4
Trunk Circum	1800	**No of Trunks**	2

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	2
POTENTIAL TO IMPROVE AMENITY	2

NOTES

Acute angled unions

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	**3**
Canopy Dead Wood	**3**
Insect Attack	**4**
Disease	**4**
Epicormic Growth	**4**
Mistletoe	**3**
Form	**4**
Age	**3**
Tolerance to Disturbance	**2**
Risk Potential	**2**
Health / Condition	**3**

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	**2**
Potential Contribution to Future Landscape	**2**
Visual/ Scenic	**2**
Unique Species	**1**
Habitat Quality	**2**
Habitat Value	**4**
Cultural Value	**1**
Social Value	**1**
Scientific Value	**1**
Remnant Species	**1**
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	**5**
REGULATED TREE	**Y**
REGISTERED TREE	

TREE ASSESSMENT

ARBORCULTURAL ASSESSMENT	**M**
URBAN AMENITY ASSESSMENT	**M**

RECOMMENDATION	NAME	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Eucalyptus rubida
Common Name	Candle Bark Gum

LOCATION

E:		**N:**	
Height (M)	13	**Canopy (M)**	9
Trunk Circum	1700	**No of Trunks**	1

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	2
POTENTIAL TO IMPROVE AMENITY	2

NOTES

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	**2**
Canopy Dead Wood	**3**
Insect Attack	**3**
Disease	**3**
Epicormic Growth	**3**
Mistletoe	**3**
Form	**4**
Age	**3**
Tolerance to Disturbance	**2**
Risk Potential	**2**
Health / Condition	**2**

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	**2**
Potential Contribution to Future Landscape	**2**
Visual/ Scenic	**2**
Unique Species	**1**
Habitat Quality	**2**
Habitat Value	**3**
Cultural Value	**1**
Social Value	**1**
Scientific Value	**1**
Remnant Species	**1**
Landscape Tree Group	

SUMMARY	
TREE NUMBER/GROUP	6
REGULATED TREE	Y
REGISTERED TREE	

TREE ASSESSMENT	
ARBORCULTURAL ASSESSMENT	M
URBAN AMENITY ASSESSMENT	M

RECOMMENDATION	NAME	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA	
Assessment Date	30.4.14
Species	Eucalyptus bridgesiana
Common Name	Apple Box

LOCATION			
E:		N:	
Height (M)	10	Canopy (M)	10
Trunk Circum	1800	No of Trunks	1

TREE MANAGEMENT	
POTENTIAL TO REDUCE RISK	2
POTENTIAL TO IMPROVE AMENITY	2
NOTES	

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	3
Canopy Dead Wood	3
Insect Attack	3
Disease	3
Epicormic Growth	3
Mistletoe	2
Form	3
Age	3
Tolerance to Disturbance	2
Risk Potential	2
Health / Condition	3

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	2
Potential Contribution to Future Landscape	2
Visual/ Scenic	2
Unique Species	1
Habitat Quality	2
Habitat Value	3
Cultural Value	1
Social Value	1
Scientific Value	1
Remnant Species	1
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	**7**
REGULATED TREE	**Y**
REGISTERED TREE	

TREE ASSESSMENT

ARBORCULTURAL ASSESSMENT	**P**
URBAN AMENITY ASSESSMENT	**L**

RECOMMENDATION	NAME	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Eucalyptus blakelyi
Common Name	Blakelys Red Gum

LOCATION

E: 212531.516		**N: 590226.373**	
Height (M)	10	**Canopy (M)**	11
Trunk Circum	2300	**No of Trunks**	1

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	2
POTENTIAL TO IMPROVE AMENITY	2

NOTES

Previous tag 1854

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	1
Canopy Dead Wood	2
Insect Attack	1
Disease	2
Epicormic Growth	3
Mistletoe	2
Form	3
Age	1
Tolerance to Disturbance	3
Risk Potential	1
Health / Condition	1

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	2
Potential Contribution to Future Landscape	2
Visual/ Scenic	2
Unique Species	1
Habitat Quality	2
Habitat Value	3
Cultural Value	1
Social Value	1
Scientific Value	1
Remnant Species	2
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	**8**
REGULATED TREE	**Y**
REGISTERED TREE	

TREE ASSESSMENT

ARBORCULTURAL ASSESSMENT	**M**
URBAN AMENITY ASSESSMENT	**H**

RECOMMENDATION	**NAME**	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Eucalyptus blakelyi
Common Name	Blakelys Red Gum

LOCATION

E: 212610.892		**N: 590203.321**	
Height (M)	19	**Canopy (M)**	21
Trunk Circum	3700	**No of Trunks**	1

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	2
POTENTIAL TO IMPROVE AMENITY	2

NOTES

Previoius tag 1855 Exposed dead roots

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	**3**
Canopy Dead Wood	**2**
Insect Attack	**1**
Disease	**2**
Epicormic Growth	**1**
Mistletoe	**2**
Form	**4**
Age	**1**
Tolerance to Disturbance	**3**
Risk Potential	**2**
Health / Condition	**2**

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	**3**
Potential Contribution to Future Landscape	**2**
Visual/ Scenic	**2**
Unique Species	**1**
Habitat Quality	**2**
Habitat Value	**4**
Cultural Value	**1**
Social Value	**1**
Scientific Value	**1**
Remnant Species	**2**
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	**9**
REGULATED TREE	**Y**
REGISTERED TREE	

TREE ASSESSMENT

ARBORCULTURAL ASSESSMENT	**P**
URBAN AMENITY ASSESSMENT	**L**

RECOMMENDATION	NAME	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Eucalyptus blakelyi
Common Name	Blakelys Red Gum

LOCATION

E: 212616.123		**N: 590338.257**	
Height (M)	12	**Canopy (M)**	12
Trunk Circum	2700	**No of Trunks**	1

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	3
POTENTIAL TO IMPROVE AMENITY	3

NOTES

Previous tag 1853 Major structural cracks and rot

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	**2**
Canopy Dead Wood	**2**
Insect Attack	**1**
Disease	**2**
Epicormic Growth	**2**
Mistletoe	**2**
Form	**4**
Age	**1**
Tolerance to Disturbance	**3**
Risk Potential	**1**
Health / Condition	**1**

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	**2**
Potential Contribution to Future Landscape	**1**
Visual/ Scenic	**2**
Unique Species	**1**
Habitat Quality	**2**
Habitat Value	**2**
Cultural Value	**1**
Social Value	**1**
Scientific Value	**1**
Remnant Species	**2**
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	**10**
REGULATED TREE	**Y**
REGISTERED TREE	

TREE ASSESSMENT

ARBORCULTURAL ASSESSMENT	**M**
URBAN AMENITY ASSESSMENT	**M**

RECOMMENDATION	**NAME**	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Eucalyptus melliodora
Common Name	Yellow Box

LOCATION

E:		**N:**	
Height (M)	11	**Canopy (M)**	10
Trunk Circum	3000	**No of Trunks**	2

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	2
POTENTIAL TO IMPROVE AMENITY	2

NOTES

Canopy within 2m of new fence

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	3
Canopy Dead Wood	3
Insect Attack	3
Disease	2
Epicormic Growth	3
Mistletoe	3
Form	3
Age	3
Tolerance to Disturbance	2
Risk Potential	2
Health / Condition	3

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	2
Potential Contribution to Future Landscape	2
Visual/ Scenic	2
Unique Species	1
Habitat Quality	2
Habitat Value	3
Cultural Value	1
Social Value	1
Scientific Value	1
Remnant Species	1
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	**11**
REGULATED TREE	**Y**
REGISTERED TREE	

TREE ASSESSMENT

ARBORCULTURAL ASSESSMENT	**P**
URBAN AMENITY ASSESSMENT	**L**

RECOMMENDATION	NAME	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Eucalyptus melliodora
Common Name	Yellow Box

LOCATION

E:		**N:**	
Height (M)	15	**Canopy (M)**	7
Trunk Circum	1600	**No of Trunks**	1

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	2
POTENTIAL TO IMPROVE AMENITY	2

NOTES

Major scars at base

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	**3**
Canopy Dead Wood	**2**
Insect Attack	**2**
Disease	**3**
Epicormic Growth	**3**
Mistletoe	**3**
Form	**4**
Age	**3**
Tolerance to Disturbance	**2**
Risk Potential	**2**
Health / Condition	**2**

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	**2**
Potential Contribution to Future Landscape	**2**
Visual/ Scenic	**2**
Unique Species	**1**
Habitat Quality	**2**
Habitat Value	**2**
Cultural Value	**1**
Social Value	**1**
Scientific Value	**1**
Remnant Species	**1**
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	**12**
REGULATED TREE	**Y**
REGISTERED TREE	

TREE ASSESSMENT

ARBORCULTURAL ASSESSMENT	**M**
URBAN AMENITY ASSESSMENT	**M**

RECOMMENDATION	**NAME**	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Eucalyptus melliodora
Common Name	Yellow Box

LOCATION

E:		**N:**	
Height (M)	15	**Canopy (M)**	9
Trunk Circum	2400	**No of Trunks**	1

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	2
POTENTIAL TO IMPROVE AMENITY	2

NOTES

Several branches removed, just inside new fence

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	**3**
Canopy Dead Wood	**3**
Insect Attack	**3**
Disease	**3**
Epicormic Growth	**3**
Mistletoe	**3**
Form	**3**
Age	**3**
Tolerance to Disturbance	**2**
Risk Potential	**2**
Health / Condition	**2**

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	**2**
Potential Contribution to Future Landscape	**2**
Visual/ Scenic	**2**
Unique Species	**1**
Habitat Quality	**2**
Habitat Value	**3**
Cultural Value	**1**
Social Value	**1**
Scientific Value	**1**
Remnant Species	**1**
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	**13**
REGULATED TREE	**Y**
REGISTERED TREE	

TREE ASSESSMENT

ARBORCULTURAL ASSESSMENT	**P**
URBAN AMENITY ASSESSMENT	**L**

RECOMMENDATION	NAME	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Eucalyptus blakelyi
Common Name	Blakelys Red Gum

LOCATION

E: 212735.841		**N: 590205.598**	
Height (M)	11	**Canopy (M)**	12
Trunk Circum	2800	**No of Trunks**	1

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	2
POTENTIAL TO IMPROVE AMENITY	2

NOTES

Scar and rot at base

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	2
Canopy Dead Wood	2
Insect Attack	1
Disease	2
Epicormic Growth	1
Mistletoe	3
Form	4
Age	1
Tolerance to Disturbance	1
Risk Potential	2
Health / Condition	1

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	2
Potential Contribution to Future Landscape	1
Visual/ Scenic	1
Unique Species	1
Habitat Quality	2
Habitat Value	2
Cultural Value	1
Social Value	1
Scientific Value	1
Remnant Species	2
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	G1
REGULATED TREE	N
REGISTERED TREE	

TREE ASSESSMENT

ARBORICULTURAL ASSESSMENT	H
URBAN AMENITY ASSESSMENT	H

RECOMMENDATION	NAME	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Mixed Eucalypts
Common Name	

LOCATION

E:		N:	
Height (M)	11	Canopy (M)	6
Trunk Circum	1000	No of Trunks	1

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	1
POTENTIAL TO IMPROVE AMENITY	1

NOTES

A group of good trees

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	3
Canopy Dead Wood	3
Insect Attack	3
Disease	3
Epicormic Growth	3
Mistletoe	3
Form	4
Age	3
Tolerance to Disturbance	2
Risk Potential	3
Health / Condition	4

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	3
Potential Contribution to Future Landscape	3
Visual/ Scenic	3
Unique Species	1
Habitat Quality	2
Habitat Value	3
Cultural Value	1
Social Value	1
Scientific Value	1
Remnant Species	1
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	**G2**
REGULATED TREE	**N**
REGISTERED TREE	

TREE ASSESSMENT

ARBORCULTURAL ASSESSMENT	**M**
URBAN AMENITY ASSESSMENT	**L**

RECOMMENDATION	NAME	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Mixed Eucalypts
Common Name	

LOCATION

E:		**N:**	
Height (M)	11	**Canopy (M)**	7
Trunk Circum	1300	**No of Trunks**	0

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	2
POTENTIAL TO IMPROVE AMENITY	2

NOTES

Early row planting with little potential

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	3
Canopy Dead Wood	3
Insect Attack	3
Disease	2
Epicormic Growth	3
Mistletoe	3
Form	3
Age	3
Tolerance to Disturbance	2
Risk Potential	2
Health / Condition	2

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	2
Potential Contribution to Future Landscape	2
Visual/ Scenic	2
Unique Species	1
Habitat Quality	2
Habitat Value	3
Cultural Value	1
Social Value	1
Scientific Value	1
Remnant Species	1
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	G3
REGULATED TREE	N
REGISTERED TREE	

TREE ASSESSMENT

ARBORCULTURAL ASSESSMENT	M
URBAN AMENITY ASSESSMENT	L

RECOMMENDATION	NAME	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Mixed Eucalypts
Common Name	

LOCATION

E:		N:	
Height (M)	11	Canopy (M)	7
Trunk Circum	1300	No of Trunks	0

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	2
POTENTIAL TO IMPROVE AMENITY	2

NOTES

Early row planting with little potential

ARBORICULTURAL CHARACTERISTICS

	RATING
Canopy Density	3
Canopy Dead Wood	3
Insect Attack	3
Disease	2
Epicormic Growth	3
Mistletoe	3
Form	3
Age	3
Tolerance to Disturbance	2
Risk Potential	2
Health / Condition	2

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	2
Potential Contribution to Future Landscape	2
Visual/ Scenic	2
Unique Species	1
Habitat Quality	2
Habitat Value	3
Cultural Value	1
Social Value	1
Scientific Value	1
Remnant Species	1
Landscape Tree Group	

SUMMARY

TREE NUMBER/GROUP	**G4**
REGULATED TREE	**N**
REGISTERED TREE	

TREE ASSESSMENT

ARBORCULTURAL ASSESSMENT	**P**
URBAN AMENITY ASSESSMENT	**L**

RECOMMENDATION	NAME	
Arborist	J.L. & S.T.	
Landscape Architect	Indesco	

GENERAL TREE DATA

Assessment Date	30.4.14
Species	Mixed Eucalypts
Common Name	

LOCATION

E:		**N:**	
Height (M)	4	**Canopy (M)**	2
Trunk Circum	700	**No of Trunks**	0

TREE MANAGEMENT

POTENTIAL TO REDUCE RISK	2
POTENTIAL TO IMPROVE AMENITY	2

NOTES

Close planted, stunted, poor form

ARBORICULTURAL CHARACTERISTICS

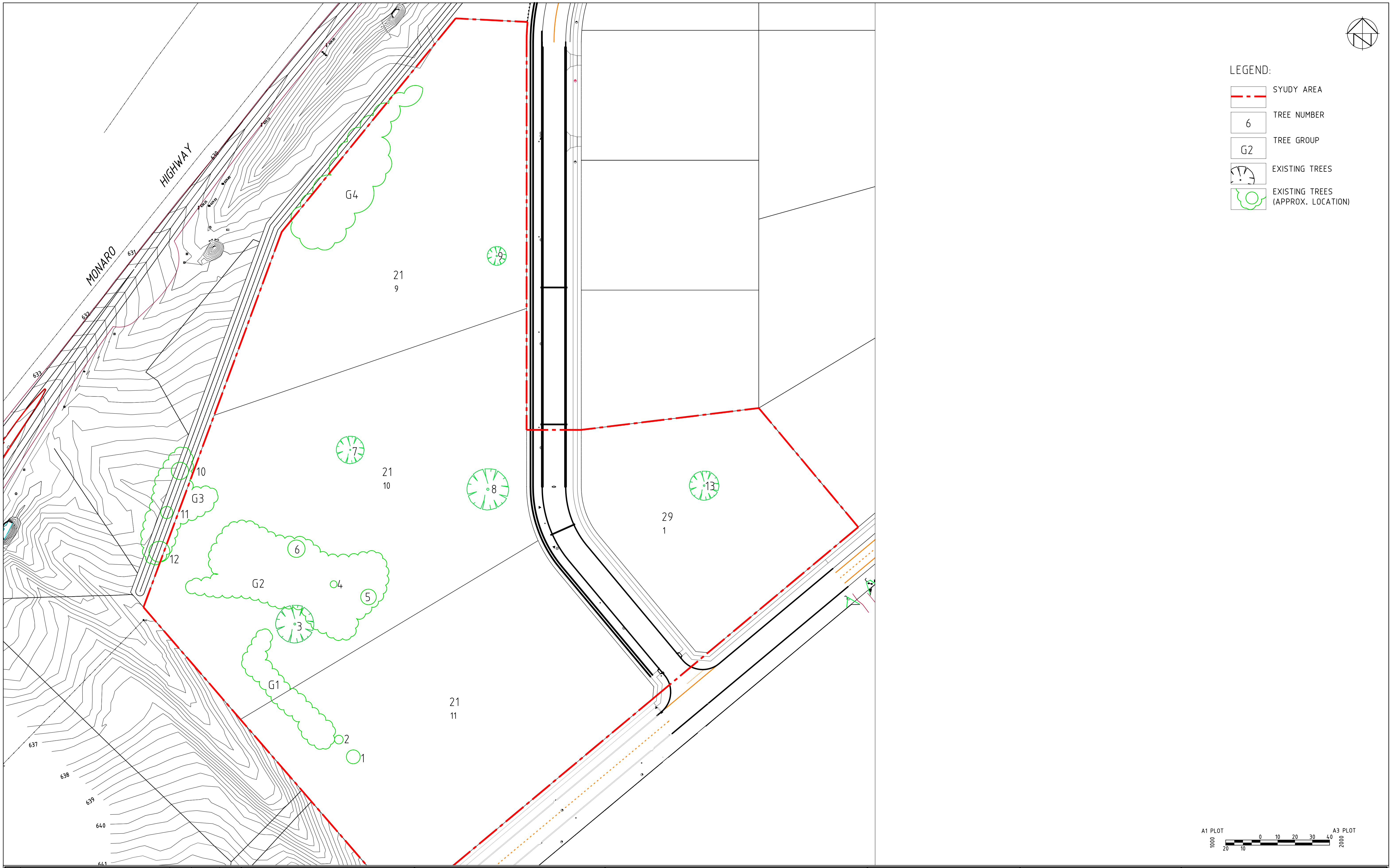
	RATING
Canopy Density	2
Canopy Dead Wood	3
Insect Attack	2
Disease	2
Epicormic Growth	3
Mistletoe	2
Form	3
Age	3
Tolerance to Disturbance	2
Risk Potential	3
Health / Condition	2

URBAN AMENITY CHARACTERISTICS

	RATING
Contribution to Existing Landscape	2
Potential Contribution to Future Landscape	1
Visual/ Scenic	1
Unique Species	1
Habitat Quality	2
Habitat Value	2
Cultural Value	1
Social Value	1
Scientific Value	1
Remnant Species	1
Landscape Tree Group	

Attachment B

Tree Assessment Plan



No.	AMENDMENT	APPROVED	DATE	AMENDED BY
A	TREE ASSESSMENT	DM	08.05.14	RS

DEVELOPMENT TEAM

CLIENT

INDESCO

CONSULT AUSTRALIA

AS/NZS ISO 9001 Certified

APPROVED DM DATE 08.05.14

CHECKED DM DATE 08.05.14

DESIGNED BY

DRAWN BY RS

CAD FILE H:\5485 TA Sec 21 Sec 29 Hume\Acad\Current Drawings\5485-001TA.dwg

SCALE As shown

SHEET No. 1 of 1

PROJECT

BLOCK 1 SECTION 29
AND BLOCK 9 10 11
SECTION 21 HUME

DRAWING TITLE

TREE ASSESSMENT

PROJECT No. 5485

DRAWING No. TA01

AMDT A