Central Coast Council

Planning Proposal
Lot 2 DP 605538
(11A Brisbane Street)
Noraville

RZ/3/2016
July 16

Planning Proposal
Lot 2 DP 605536
(11A Brisbane Street)
Noraville

RZ/3/2016
Date: July 16
Gateway Determination Version
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Ausgrid Depot Land

Lot 2 DP 605538 (11A Brisbane Street), Noraville

File No. RZ/3/2016

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Introduction & Locality Context

11A Brisbane Street Noraville is currently a developed site owned and operated by Ausgrid. The north eastern part of the site (not subject of this proposal) contains the Noraville Zone Substation.

The southern portion (the remainder of the site) contains buildings, storage areas and car parking associated with the former use of the site as a works depot (see figure 1). This land has become surplus to Ausgrid needs due to the consolidation of depot services (now delivered out of the Ausgrid Depot at Ourimbah). This surplus area is the land subject of this proposal.

Figure 1 Contextual Locality Plan

Part 1 Objectives or Intended Outcomes

The objective of this proposal is to rezone the southern part of Lot 2 DP 605538 (11A Brisbane Street) Noraville from SP2 Electricity - Transmission and Distribution to R2 Low Density Residential.

The intended outcome of the proposal is to enable development of the southern part of the land for low density residential development. The subject land area is approximately 11,730m^2 and is likely to yield 15 residential lots.

The northern part of the lot is proposed to remain as an electricity substation (and therefore retain the existing SP2 Electricity - Transmission and Distribution zone) and it is proposed that a separate 8,980m^2 lot will be created (via a development application) to subdivide the land.

Part 2 Explanation of Provisions

The outcome will be facilitated by an amendment to Wyong Local Environmental Plan (LEP) 2013. The following table identifies the proposed amendments:

Existing Provision	Proposed Amendment
Land Zoning Map LZN_ 019	- Apply the R2 Low Density Residential Zone to the southern part of Lot 2 DP 605538 (approx 11,730m^2).
Lot Size Map LSZ_ 019	- Apply a minimum lot size of 450m^2 to the southern part of Lot 2 DP 605538 (approx 11,730m^2).
Floor Space Ratio Map FSR_019	- Apply a maximum floor space ratio of 0.5:1 to the southern part of Lot 2 DP 605538 (approx. 11,730m^2).
Height of Building Map HOB_019	- Apply a maximum building height of 8.5 metres to the southern part of Lot 2 DP 605538 (approx. 11,730m^2).

Table 1 – Explanation of Map and Instrument Amendments

Note:- Existing vegetation buffers, varying between 6.5 metres and 20 metres in width are located to the north and south of the Ausgrid site, between private properties and the road reserve of Wilfred Barrett Drive. These RE1 Public Recreation zoned buffers are in public ownership and managed by Council. The dedication of such open space buffers is now not normal Council practice. Initial strategic analysis indicates that creation of further RE1 buffers is not required given that the existing buffers to the north and south are not utilized for any recreational function. Further investigation is recommended to determine whether such a RE1 zoned buffer is required on the subject land and if so the planning proposal will be amended accordingly to include RE1 Public Recreation zoned buffers along the eastern perimeter.

Additionally, the proposed development will require appropriate buffers and setbacks to be established accordance with codes and standards prescribed under the Australian Radiation Protection and Nuclear Safety Regulation 1999. Minor changes may be required to the position of the

proposed zone boundary location between the R2 Low Density Residential zone and the SP2 Special Uses zone to ensure that EMF set backs are fully contained within the Ausgrid zone substation site. The proposed zoning plan is to be updated prior to any plans being publicly exhibited.

Part 3 Justification

Section A – Need for the Planning Proposal

1. Is the Planning Proposal a result of any Strategic Study or report?

The intended outcome of the proposal is consistent with the vision identified for this locality by the *Toukley Planning Strategy* (TPS).

The TPS was adopted by Council in October 2010 and it provides a framework to accommodate approximately an additional 3,850 dwellings within a 20 year growth horizon to 2030.

The TPS identifies the subject site to be within "Precinct 11 – Noraville Low Density Residential". The vision and objectives for this precinct are for it to continue to serve as a low scale residential area with predominantly detached dwellings with scope for dual occupancy development. This is in contrast to other areas of the Toukley peninsula that have been rezoned for higher density residential development due to closer proximity to shops, facilities, services and transport.

The application highlights that the locality has a mix of 30 – 40 year old dwellings, in various states of renovation and repair, and also some more modern dwellings have recently been added to the area. The proposed rezoning is considered to be compatible with the neighbouring residential developments and will not impact negatively on the locality.

2. Is the planning proposal the best means of achieving the objectives or intended outcomes, or is there a better way?

The subject site is zoned SP2 Electricity Generation under *Wyong LEP 2013*. Low density residential accommodation is prohibited within this zone. An LEP amendment is the most appropriate method available to allow the intended land use to be permitted.

Section B – Relationship to strategic planning framework

3. Is the planning proposal consistent with the objectives and actions contained within the applicable regional or sub-regional strategy (including the Sydney Metropolitan Strategy and exhibited draft strategies)?

Central Coast Regional Strategy (CCRS) and Draft Central Coast Regional Plan

The CCRS identifies the Toukley region as part of "Other Centres". These areas are identified to develop further through a range of infill growth opportunities (including knockdown and rebuild developments and development of vacant parcels). There is a requirement to accommodate growth of a further 14,500 dwellings in these areas from 2006-2031 (580 additional dwellings per year). This proposal is also consistent with the current and draft CCRP.

4. Is the planning proposal consistent with the local Council's Community Strategic Plan, or other local strategic plan?

Settlement Strategy

The planning proposal is generally consistent with the aims and objectives of the Settlement Strategy. The Settlement Strategy quotes the population target contained in the Toukley Planning Study which provides for an estimated potential increase of 3,850. This proposal will facilitate a modest population increase in the order of 25 to 30 persons. This site is not listed in the Settlement Strategy as an 'Infill Development Precinct' due to the fact that at that time, the site was an operational Ausgrid Depot and therefore not identified as having potential to support infill residential development.

5. Is the planning proposal consistent with applicable state environmental planning policies?

The proposal has been considered against the relevant State Environmental Planning Policies (SEPP) as detailed below.

State Environmental Planning Policy	Comment
SEPP 55 – Remediation of Land	
Aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment (a) by specifying when consent is required, and when it is not required, for a remediation work, and (b) by specifying certain considerations that are relevant in rezoning land and in determining development applications in general and development applications for consent to carry out a remediation work in particular, and (c) by requiring that a remediation work meet certain standards and notification requirements.	A contamination report has been prepared in relation to the proposal which has been peer reviewed. The recommendations outlined in the report indicate that the proposed site is suitable for residential use, provided that the minor residual contamination concerns are addressed and validated at the construction/ subdivision phase. Further studies are therefore not required at rezoning stage.
SEPP 71 – Coastal Protection	
Aims: (a) to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast, and (b) to protect and improve existing public access to and along coastal foreshores to	The site is located within the *SEPP 71* Coastal Protection Zone. The proposal is consistent with the provisions of *SEPP 71*. The matters outlined in Clause 8 of the SEPP have been considered: • The proposal does not affect access to and along coastal foreshores,

State Environmental Planning Policy	Comment
the extent that this is compatible with the natural attributes of the coastal foreshore, and (c) to ensure that new opportunities for public access to and along coastal foreshores are identified and realised to the extent that this is compatible with the natural attributes of the coastal foreshore, and (d) to protect and preserve Aboriginal cultural heritage, and Aboriginal places, values, customs, beliefs and traditional knowledge, and (e) to ensure that the visual amenity of the coast is protected, and (f) to protect and preserve beach environments and beach amenity, and (g) to protect and preserve native coastal vegetation, and (h) to protect and preserve the marine environment of New South Wales, and (i) to protect and preserve rock platforms, and (j) to manage the coastal zone in accordance with the principles of ecologically sustainable development (within the meaning of section 6 (2) of the Protection of the Environment Administration Act 1991), and (k) to ensure that the type, bulk, scale and size of development is appropriate for the location and protects and improves the natural scenic quality of the surrounding area, and (l) to encourage a strategic approach to coastal management.	• The site is not affected by coastal processes. • The land has been fully developed for utility and depot uses and does not contain any remnant native vegetation or is likely to contain Aboriginal artefacts. • Future development of the site will be low scale and not readily visible from the lake or coastal foreshore areas.

Table 2 – SEPP Assessment

6. *Is the planning proposal consistent with applicable Ministerial Directions (s.117 directions)?*

The proposal has been considered against the relevant Ministerial Section 117 Directions as summarised below. The full assessment of these Directions is contained within the Attachments of this proposal.

No.	Direction	Applicable	Consistent
Employment & Resources			
1.1	Business & Industrial Zones	N	N/A
1.2	Rural Zones	N	N/A
1.3	Mining, Petroleum Production and Extractive Industries	N	N/A
1.4	Oyster Aquaculture	N	N/A
1.5	Rural Lands	N	N/A
Environment & Heritage			
2.1	Environmental Protection Zones	Y	Y
2.2	Coastal Protection	Y	Y
2.3	Heritage Conservation	Y	Y
2.4	Recreation Vehicle Areas	Y	Y
Housing, Infrastructure & Urban Development			
3.1	Residential Zones	Y	Y
3.2	Caravan Parks and Manufactured Home Estates	Y	Y
3.3	Home Occupations	Y	Y
3.4	Integrating Land Use & Transport	Y	TBD
3.5	Development Near Licensed Aerodromes	N	N/A
3.6	Shooting Ranges	N	N/A
Hazard & Risk			
4.1	Acid Sulfate Soils	N	N/A
4.2	Mine Subsidence and Unstable Land	Y	TBD

No.	Direction	Applicable	Consistent
4.3	Flood Prone Land	N	N/A
4.4	Planning for Bushfire Protection	Y	TBD
Regional Planning			
5.1	Implementation of Regional Strategies	Y	Y
5.2	Sydney Drinking Water Catchments	N	N/A
5.3	Farmland of State and Regional Significance on the NSW Far North Coast	N	N/A
5.4	Commercial and Retail Development along the Pacific Highway, North Coast	N	N/A
5.8	Sydney's Second Airport: Badgery's Creek:	N	N/A
Local Plan Making			
6.1	Approval and Referral Requirements	Y	Y
6.2	Reserving Land for Public Purposes	Y	Y
6.3	Site Specific Provisions	N	N/A
Metropolitan Planning			
7.1	Implementation of A Plan for Growing Sydney	N	N/A
7.2	Implementation of Greater Macarthur Land Release Investigation	N	N/A

Table 3 – S117 Ministerial Direction Compliance

Section C – Environmental, Social and Economic Impact

7. Is there any likelihood that critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal?

Flora and Fauna

Council records show that the site does not contain any critical habitat, threatened species endangered ecological communities (EECs) or habitats. It is not considered that further ecological studies area required in order to support rezoning of the site.

Existing vegetation buffers, varying between 6.5 metres and 20 metres in width are located to the north and south of the Ausgrid site, between private properties and the road reserve of Wilfred Barrett Drive. These RE1 Public Recreation zoned buffers are in public ownership and managed by Council. The dedication of such open space buffers is now not normal Council practice. Initial strategic analysis indicates that creation of further RE1 buffers is not required given that the existing buffers to the north and south are not utilized for any recreational function. It is noted that the off-road shared pathway is located on the other side of Wilfred Barrett Drive. The buffers to the south generally contain native vegetation, while to the north are generally grassed. Post Gateway determination, this planning proposal will further examine this matter to determine whether such a RE1 zoned buffer is required on the subject land and if so the planning proposal will be amended accordingly. This process will involve internal consultation with relevant sections of Council.

8. Are there any other likely environmental effects as a result of the planning proposal and how are they proposed to be managed?

Bushfire Impacts

The site is identified as bushfire prone land and is also subject to the bushfire buffer zone. As such a bushfire report will need to be provided addressing bushfire risk. Also consultation with the RFS during the state agency consultation process should be undertaken.

Contaminated Land and Acid Sulfate Soils

A contamination report has been prepared in relation to the proposal which has been peer reviewed (see Supporting Documentation).

The recommendations outlined in the report indicate that the proposed site is suitable for residential use, provided that the minor residual contamination concerns are addressed and validated at the construction/ subdivision phase. Further studies are therefore not required at rezoning stage.

The site is not identified as containing potential or actual acid sulfate soils.

Flooding and Drainage

With regard to the storm water conveyance, there are known localised overland flooding and drainage capacity issues to the north of the site at the intersection of Brisbane Street and Main Road. It is expected that the development will reduce the overall percentage of impervious surfaces and therefore reduce total runoff.

A detailed drainage analysis of the proposed development and downstream drainage network will be required post gateway determination. This analysis will identify any drainage capacity issues and ensure that the proposed development will not increase flows and adversely affect properties downstream. Detailed design is to be undertaken in accordance with Council's Civil Works Design and Construction specification.

9. Has the planning proposal adequately addressed any social and economic impacts?

Noise Impact & Amenity

The site is within proximity of two potential noise sources which need to be considered being Wilfred Barrett Drive and the existing Ausgrid substation operations. An acoustic assessment will be required to detail the noise levels which will affect the proposed development (together with recommended mitigation measures). This will be required post gateway determination.

Electro Magnetic Fields (EMF)

Additional information will be requested from the proponent to examine EMF risks in order to ensure that the proposed development has appropriate buffers and setbacks in place in accordance with codes and standards prescribed under the Australian Radiation Protection and Nuclear Safety Regulation 1999. Minor changes may be required to the position of the proposed boundary to ensure that EMF set backs are fully contained within the Ausgrid zone substation site. The proposed zoning plan is to be updated prior to any plans being publicly exhibited.

Section D – State and Commonwealth Interests

10. Is there adequate public infrastructure for the planning proposal?

Proposed development layout

The Cardno Civil Engineering Assessment report presents a number of development options for the site. The preferred option results in 15 residential parcels (see figure 2). This configuration contains lot sizes which vary between 450m^2 and 800m^2. These lot sizes comply with the minimum lot sizes applicable within the R2 Low Density Residential Zone.

The concept plan contains a proposed 'swimming pool' exclusion zone (see red buffer in Figure 2) to reduce 'earthing' related electrical shocks to acceptable levels. Further information will be sought from the proponent on this issue and it may be more appropriate for this area to be excluded from the proposed R2 Low Density Residential Zone and kept within the Ausgrid zone substation site.

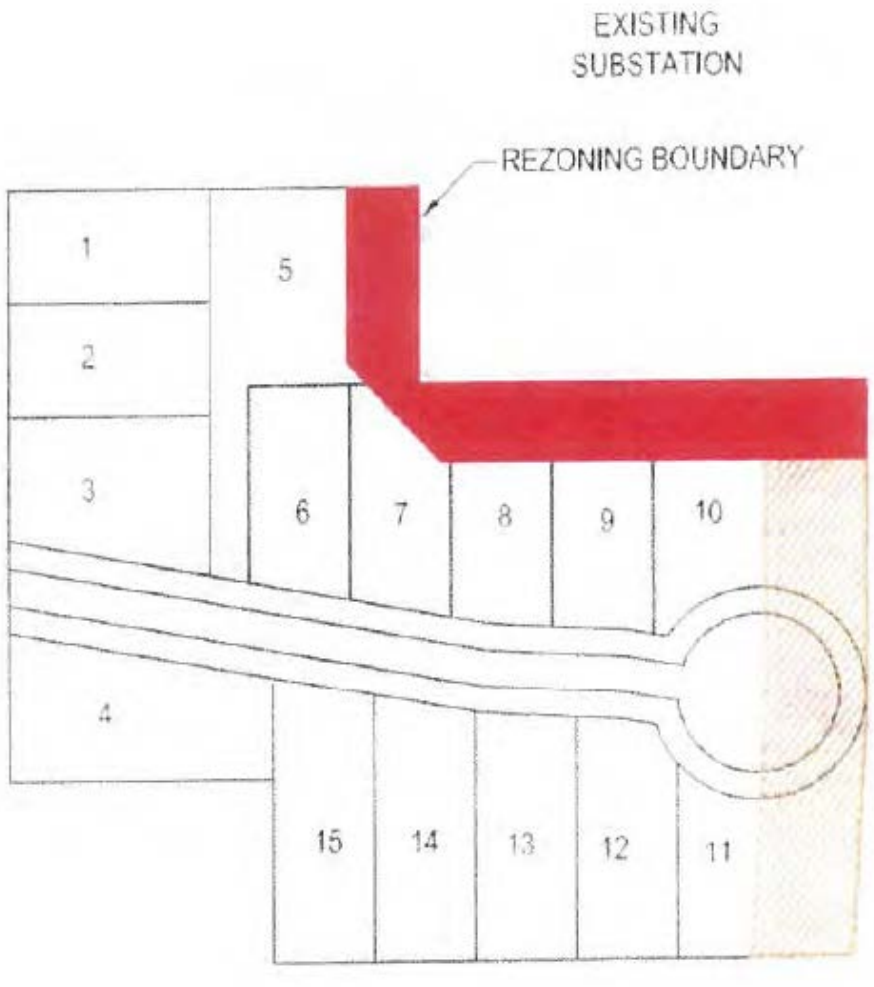


Figure 2 Low Density Subdivision Option

Subdivision and Design

Consideration is to be given to the impact of future development upon adjoining properties, particularly residential dwellings located to the south and west of the site. For the most part the provisions of Wyong DCP 2013 – Part 4 Subdivision are considered to be adequate to respond to subdivision design and residential amenity issues. However, there may be a requirement for some site specific issues concerning road noise and managing impacts arising from the adjoining Noraville Zone Substation. This may mean that site specific development matters need to be closely considered with appropriate design guidelines developed and included in an amendment to Wyong DCP 2013. This should be prepared and exhibited concurrently with the planning proposal.

Access and Road Layout

The proposal is supported by a Civil Engineering Assessment (see Supporting Documentation).

It is proposed that the existing Brisbane Street driveway access will be retained to access Ausgrid's Noraville zone substation and associated infrastructure.

Two options for providing access to any future development on the site are identified, being via Wilfred Barrett Drive or Brisbane Street. The option to access the site via Wilfred Barrett Drive is not supported by the Civil Engineering Assessment, due to the proximity of the intersection with Bungary Road and related traffic safety concerns.

The operational depot included the movements of 51 trucks, 44 light commercial vehicles and 6 motor vehicles from the site (total of 101 vehicles). The proposed rezoning may not result in an increase of traffic generation or adverse impacts to the road network because the traffic generation related to 15 dwellings is much less than the operation of the site as a depot.

The report outlines that civil road work improvements will be required to support a proposed subdivision of the site. This would include:

- Provision of an intersection of the proposed public road and Brisbane Street, and
- Upgrade works along the Brisbane Street frontage including road width expansion (up to half road), kerb and gutter and associated street storm water drainage systems (piping the existing open drain).

A Traffic and transport assessment considering existing and proposed traffic load, consideration of public transport demand and availability and also the pedestrian and cycleway network will be required post gateway determination.

Services (Water, Sewer, Gas & Electricity)

Councils engineering section have confirmed that the proposed subdivision layout could be serviced by an extension of Council's existing gravity sewer from MH GV/7 and reticulated water supply main in the Brisbane Street Frontage with appropriate contributions collected from the developer in accordance with the development servicing plan.

11. What are the views of State and Commonwealth public authorities consulted in accordance with the gateway determination?

Consultation with the following agencies is proposed, based on the identified triggers and site constraints:

Agency	Trigger/Constraint
Mine Subsidence Board	- Located within Swansea North Entrance Mine Subsidence District - S117 Direction 4.2 – Mine Subsidence and Unstable Land
NSW Rural Fire Service	- S117 Direction 4.4 – Bushfire Prone Land
NSW Trade and Investment - Crown Lands	- Adjoining land owned by Crown Land (under care and control of Council)
NSW Trade and Investment - Minerals and Petroleum	- Located within Swansea North Entrance Mine Subsidence District
Roads and Maritime Services	- Subject land adjoins Wilfred Barret Drive
Transport for NSW	- S117 Direction 4.3 – Integrating Land Use and Transport

Table 4 – Proposed Agency Consultation List

Part 4 Mapping

Map	Map Title
A.	**Locality Plan**
Existing Provision	
B.	**Land Zoning Map** (Extract of LZN_ 019)
C.	**Lot Size Map** (Extract of LSZ_ 019)
Proposed Provisions	
A.	**Land Zoning Map** (Extract of amendment to LZN_ 019)
B.	**Lot Size Map** (Extract of amendment to LSZ_ 019)
C.	**Floor Space Ratio Map** (Extract of amendment to FSR_019)
D.	**Height of Building Map** (Extract of amendment to HOB_019)

Table 5 – Existing and Proposed Provisions

Part 5 Community Consultation

The proposal will be made available for 14 days for community/agency consultation and undertaken in accordance with any determinations made by the Gateway.

It is expected that the proposal will be made available at the following locations:

- Central Coast Council Administration Building, 2 Hely Street, Wyong
- Toukley Library, Cnr Main Road & Victoria Ave, Toukley; and
- Council's website (On Exhibition page and Consultation Hub page) www.wyong.nsw.gov.au.

Additionally, notification of the exhibition of the proposal has been provided to adjoining landholders prior to its commencement.

Part 6 Project Timeline

Action	Period	Start Date	End Date
Anticipated commencement date (date of Gateway Determination)	20 July 2016	24 June 2016	20 July 2016
Anticipated timeframe for the completion of required technical information	3 months	21 July 2016	1 October 2016
Timeframe for government agency consultation (pre and post exhibition as required by Gateway determination)	21 days	7 October 2016	4 November 2016
Commencement and completion dates for public exhibition	14 days	4 November 2016	20 November 2016
Dates for public hearing (if required)	N/A	N/A	N/A
Timeframe for consideration of submissions	3 weeks	4 November 2016	21 November 2016
Timeframe for consideration of a proposal post exhibition[1]	4 weeks	21 November 2016	21 December 2016
Date of submission to the Department to finalise LEP	1 day	21 December 2016	21 December 2016
Anticipated date RPA will make the plan (if delegated)[2]	5 weeks	21 December 2016	22 January 2017
Anticipated date RPA will forward to the Department for notification	1 day	22 January 2017	22 January 2017

Table 6 – Key Project Timeframes

[1]*includes period for consideration of proposal by Council and update of Planning Proposal*
[2]*includes plan drafting and PC opinion*

Supporting Documentation

No.	Document
01 Assessment and Endorsement	
A.	Council Report and Minutes – 11 May 2016.
B.	Section 117 Ministerial Direction Assessment
C.	NSW Coastal Policy Assessment
D.	State Environmental Planning Policy 71 (Coastal Protection) Clause 8 Assessment
02 Land Use Provisions	
A.	Land Use Tables - Wyong LEP 2013
03 Agency Responses	
04 Mapping	
A.	Locality Plan
B.	**Existing Land Zoning Map** (Extract of LZN_019)
C.	**Existing Lot Size Map** (Extract of LSZ_019)
D.	**Proposed Land Zoning Map** (Extract of proposed amendment to LZN_019)
E.	**Proposed Lot Size Map** (Extract of proposed amendment to LZN_019)
05 Supporting Studies	
A.	Jacobs (2015) Environmental Site Assessment Report
B.	Cardno (2016) Planning Layout and Civil Engineering Assessment

Table 7 – Supporting Documentation to the Planning Proposal

01

Assessment & Endorsement

02

Land Use Provisions

03

Agency Responses

04

Mapping

05

Studies

3.2 Planning proposal for 11A Brisbane Street, Noraville (surplus Ausgrid Depot land) - RZ/3/2016

TRIM REFERENCE: RZ/3/2016 - D12292153
MANAGER: Tanya O'Brien, Manager
AUTHOR: Jonathan Luke; Senior Strategic Planner

SUMMARY

Council has received an application requesting an amendment to *Wyong Local Environmental Plan (LEP) 2013*, to rezone part of the existing Ausgrid Substation and Depot site at 11A Brisbane Street, Noraville to facilitate low density residential development. The request affects part of Lot 2 DP 605536, (No.11A Brisbane Street, Noraville) and proposes rezoning the land from SP2 Electricity - Transmission and Distribution to R2 Low Density Residential.

A preliminary assessment of the information submitted indicates that the proposal for low density residential development has merit.

This report recommends that a planning proposal be prepared and forwarded to the Department of Planning and Environment (DP&E) for a gateway determination.

Applicant:	Ausgrid
Owners:	Ausgrid
Proposal No.:	RZ/3/2016
Description of Land:	Lot 2 DP 605536 - 11A Brisbane Street, Noraville
Site Area:	Total – 20,700m2 Area for rezoning - 11,730m2
Existing Zoning:	SP2 Electricity - Transmission and Distribution
Zoning proposed by applicant:	R2 Low Density Residential
Existing Use:	Surplus Ausgrid Electricity Depot land

RECOMMENDATION

1 That Council prepare a planning proposal to amend Wyong Local Environmental Plan 2013, pursuant to Section 55 of the Environmental Planning and Assessment (EP&A) Act 1979 to rezone part of Lot 2 DP 605536, (11A Brisbane Street, Noraville) to R2 Low Density Residential.

2 That Council forward the planning proposal to the Department of Planning and Environment accompanied by a request for a gateway determination, pursuant to Section 56 of the EP&A Act 1979.

3 That Council request the Acting CEO to apply to accept plan making delegations for the amendment.

4 That Council undertake community and government agency consultation in accordance with the requirements of the gateway determination.

5 That Council <u>prepare</u> appropriate Development Control Plan provisions, (if required), to support the development of the land subject to this Planning Proposal.

6 That Council <u>consider</u> a further report on results of the consultation.

THE SITE

11A Brisbane Street Noraville is currently a developed site owned and operated by Ausgrid.

The north eastern part of the site (not subject of this proposal) contains the Noraville Zone Substation. This part of the lot is proposed to remain as an electricity substation.

The southern portion (the remainder of the site) contains buildings, storage areas and car parking associated with the former use of the site as a works depot (see figure 1). This land has become surplus to Ausgrid needs due to the consolidation of depot services (now delivered out of the Ausgrid Depot at Ourimbah). This surplus area is the land subject of this proposed rezoning.

Figure 1 – Aerial Photo

The site is located within the established residential area of Noraville with low density detached housing development located to the north, south and west of the site. These areas are zoned R2 Low Density Residential zone land. To the east is located Wilfred Barrett Drive, a State road and further east is the Norah Head Recreational reserve which is zoned E2 Environmental Conservation.

The site is currently zoned SP2 – Electricity Transmission and Distribution under Wyong LEP 2013 (see figure 2).

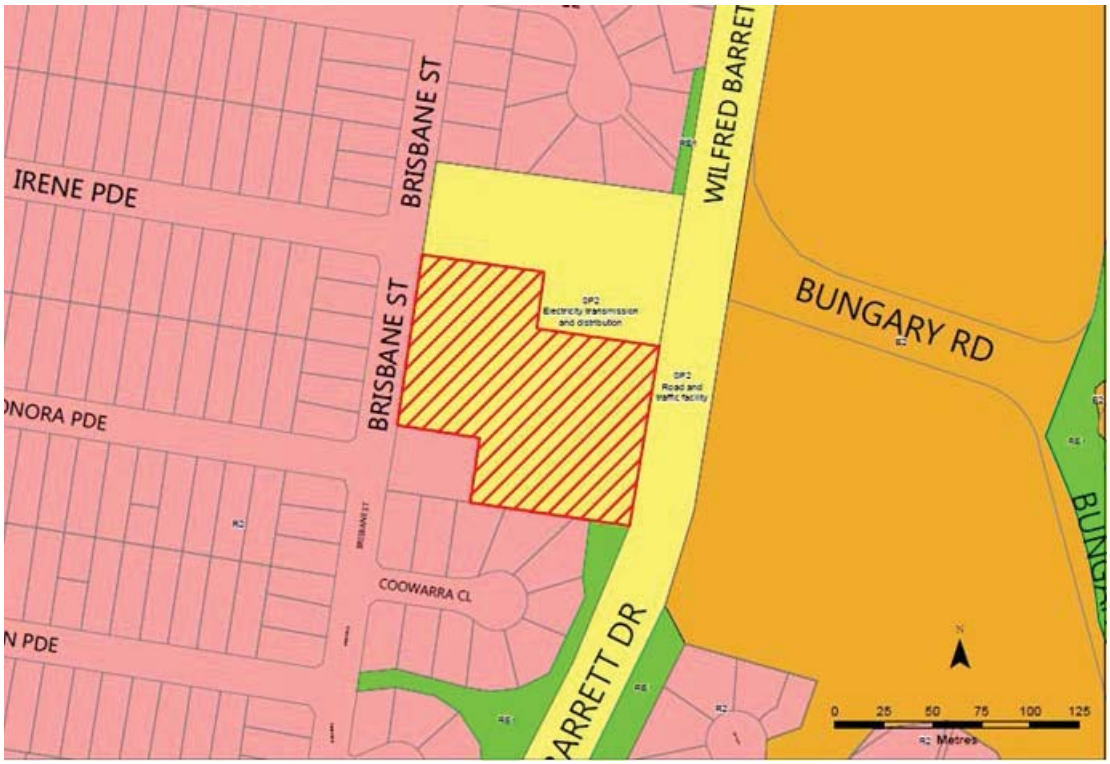


Figure 2 – Extract from Wyong LEP 2013 land use zoning map. The site subject of the proposed rezoning is shown in red hatching.

THE PROPOSAL

A proposal has been submitted to amend Wyong LEP 2013 to rezone the southern part of 11A Brisbane Street Noraville from SP2 Electricity - Transmission and Distribution to R2 Low Density Residential to facilitate low density residential development (see figure 3). The subject land area is approximately 11,730m2 and is likely to yield 15 residential lots.

The northern part of the lot is proposed to remain as an electricity substation (and therefore retain the existing SP2 Electricity - Transmission and Distribution zone) and it is proposed that a separate 8,980m2 lot will be created (via a development application) to subdivide the land.

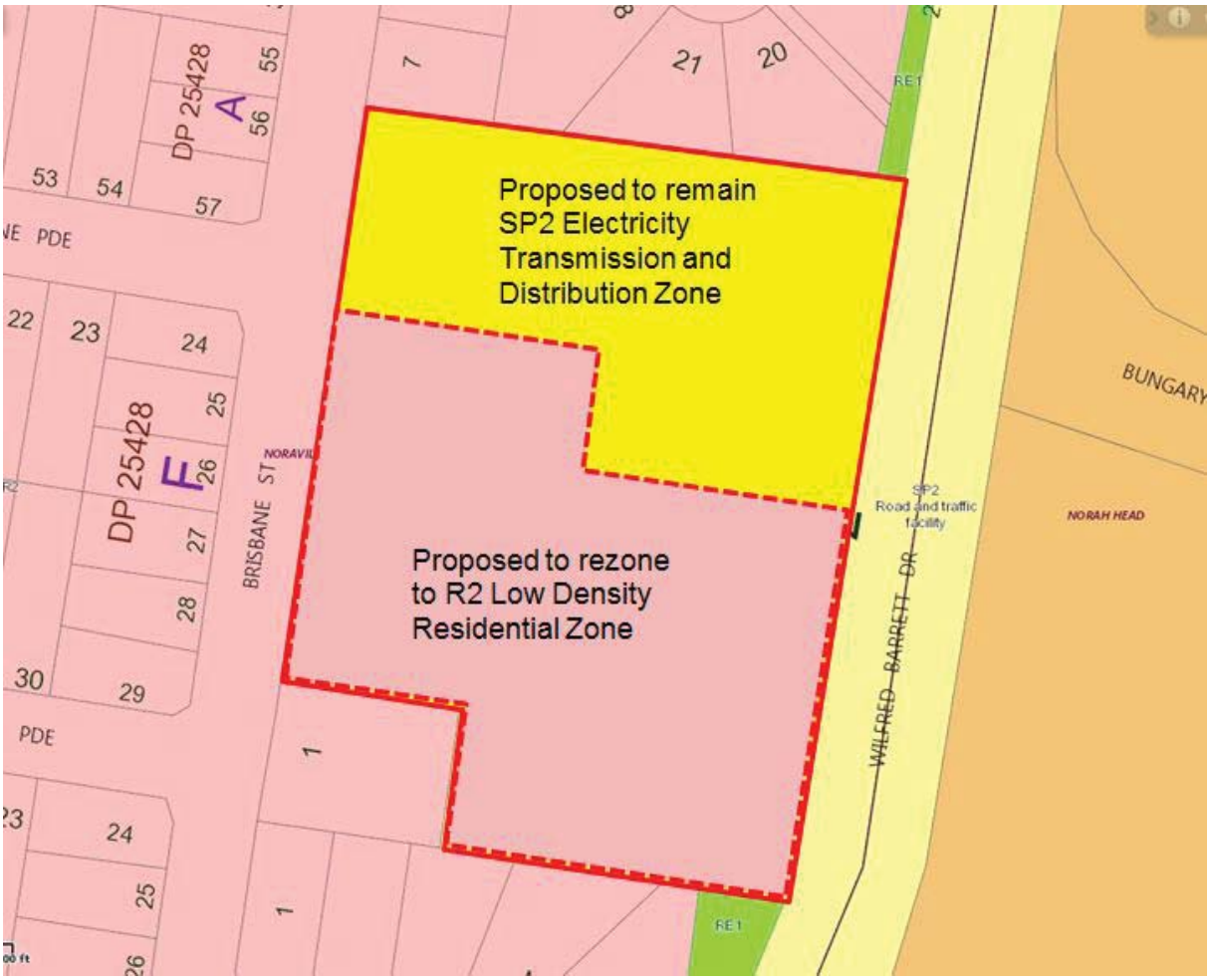


Figure 3 – Map of zoning – as proposed by applicant

ASSESSMENT

General Strategic Context

There are a number of strategic documents that apply to the Toukley peninsula. Of particular relevance are the Central Coast Regional Strategy (CCRS) and the Toukley Planning Strategy (TPS).

Central Coast Regional Strategy (CCRS) and Draft Central Coast Regional Plan

The CCRS identifies the Toukley region as part of "Other Centres". These areas are identified to develop further through a range of infill growth opportunities (including knock-down and rebuild developments and development of vacant parcels). There is a requirement to accommodate growth of a further 14,500 dwellings in these areas from 2006-2031 (580 additional dwellings per year). This proposal is also consistent with the current and draft CCRS.

Settlement Strategy

The planning proposal is generally consistent with the aims and objectives of the Settlement Strategy.

Toukley Planning Strategy (TPS)

The TPS was adopted by Council in October 2010 and it provides a framework to accommodate approximately an additional 3,850 dwellings within a 20 year growth horizon to 2030.

The TPS identifies the subject site to be within "Precinct 11 – Noraville Low Density Residential". The vision and objectives for this precinct are for it to continue to serve as a low scale residential area with predominantly detached dwellings with scope for dual occupancy development. This is in contrast to other areas of the Toukley peninsula that have been rezoned for higher density residential development due to closer proximity to shops, facilities, services and transport. The rezoning of the subject site to a low density residential zoning is consistent with the TPS.

The application highlights that the locality has a mix of 30 – 40 year old dwellings, in various states of renovation and repair, and also some more modern dwellings have recently been added to the area. The proposed rezoning is considered to be compatible with the neighbouring residential developments and will not impact negatively on the locality.

SITE CAPACITY

Access and Road Layout

The planning proposal application outlines that it is proposed that the existing Brisbane Street driveway access will be retained to access Ausgrid's Noraville zone substation and associated infrastructure.

Further the application discusses two options for providing access to any future development on the site proposed for rezoning being via Wilfred Barrett Drive or Brisbane Street.

The option to access the site via Wilfred Barrett Drive is not supported by the Civil Engineering Assessment provided with the application, due to the proximity of the intersection with Bungary Road and related traffic safety concerns.

The application states that the proposed rezoning will not result in an increase of traffic generation or adverse impacts to the road network because the traffic generation related to 15 dwellings is much less than the operation of the site as a depot. The depot operated 51 trucks, 44 light commercial vehicles and 6 motor vehicles from the site (total of 101 vehicles).

A Traffic and transport assessment considering existing and proposed traffic load, consideration of public transport demand and availability and also the pedestrian and cycleway network will be required post gateway determination.

Buffer to Wilfred Barrett Drive

Existing vegetation buffers, varying between 6.5 metres and 20 metres in width are located to the north and south of the Ausgrid site, between private properties and the road reserve of Wilfred Barrett Drive. These RE1 Public Recreation zoned buffers are in public ownership and managed by Council. The dedication of such open space buffers is now not normal Council practice. Initial strategic analysis indicates that creation of further RE1 buffers is not required given that the existing buffers to the north and south are not utilized for any recreational function. It is noted that the off-road shared pathway is located on the other side of Wilfred Barrett Drive. The buffers to the south generally contain native vegetation, while to the north are generally grassed. Post Gateway determination, this planning proposal will further examine this matter to determine whether such a RE1 zoned buffer is required on the subject land and if so the planning proposal will be amended accordingly. This process will involve internal consultation with relevant sections of Council.

Civil Works

The Planning Proposal request has been informed by a Civil Engineering Assessment undertaken by Cardno NSW P/L in 2015.

The report outlines that civil road work improvements will be required to support a proposed subdivision of the site. This would include:

- Provision of an intersection of the proposed public road and Brisbane Street, and
- Upgrade works along the Brisbane Street frontage including road width expansion (up to half road), kerb and gutter and associated street storm water drainage systems (piping the existing open drain).

Stormwater drainage management

With regard to the storm water conveyance, there are known localised overland flooding and drainage capacity issues to the north of the site at the intersection of Brisbane Street and Main Road. It is expected that the development will reduce the overall percentage of impervious surfaces and therefore reduce total runoff.

A detailed drainage analysis of the proposed development and downstream drainage network will be required post gateway determination. This analysis will identify any drainage capacity issues and ensure that the proposed development will not increase flows and adversely affect properties downstream. Detailed design is to be undertaken in accordance with Council's Civil Works Design and Construction specification.

Water & Sewer Servicing

Councils engineering section have confirmed that the proposed subdivision layout could be serviced by an extension of Council's existing gravity sewer from MH GV/7 and reticulated water supply main in the Brisbane Street Frontage with appropriate contributions collected from the developer in accordance with the development servicing plan.

Land Contamination

The planning proposal request has been informed by a contamination report by Jacobs which has been reviewed by Council's Senior Environmental Health Officer which concluded that the degree of assessment is satisfactory and that the findings of this contamination report accurately reflect the current environmental conditions for the site.

The recommendations outlined in the 'Jacobs' report indicate that the proposed site is suitable for residential use, provided that the minor residual contamination concerns are addressed and validated at the construction/ subdivision phase. Further studies are therefore not required at rezoning stage.

Noise

The site is within proximity of two potential noise sources which need to be considered being Wilfred Barrett Drive and the existing Ausgrid substation operations. An acoustic assessment will be required to detail the noise levels which will affect the proposed development (together with recommended mitigation measures). This will be required post gateway determination.

Electro Magnetic Fields (EMF)

Additional information will be requested from the proponent to examine EMF risks in order to ensure that the proposed development has appropriate buffers and setbacks in place in accordance with codes and standards prescribed under the Australian Radiation Protection and Nuclear Safety Regulation 1999. Minor changes may be required to the position of the proposed boundary to ensure that EMF set backs are fully contained within the Ausgrid zone substation site. The proposed zoning plan is to be updated prior to any plans being publicly exhibited.

Bushfire Impacts

The site is identified as bushfire prone land and is also subject to the bushfire buffer zone. As such a bushfire report will need to be provided addressing bushfire risk. Also consultation with the RFS during the state agency consultation process should be undertaken.

Proposed development layout

The Cardno Civil Engineering Assessment report presents a number of development options for the site. The planning proposal application favours "Low Density Option 2" which results in 15 residential parcels (see figure 4). This configuration contains lot sizes which vary between 450m2 and 800m2.

The concept plan contains a proposed 'swimming pool' exclusion zone (see red buffer in Figure 4) to reduce 'earthing' related electrical shocks to acceptable levels. Further information will be sought from the proponent on this issue and it may be more appropriate for this area to be excluded from the proposed R2 Low Density Residential Zone and kept within the Ausgrid zone substation site.

Figure 4 – Low Density Option 2-red area shows proposed swimming pool exclusion zone.

Subdivision and Design

Consideration is to be given to the impact of future development upon adjoining properties, particularly residential dwellings located to the south and west of the site. For the most part the provisions of Wyong Shire DCP 2013 – Part 4 Subdivision are considered to be adequate to respond to subdivision design and residential amenity issues. However, there may be a requirement for some site specific issues concerning road noise and managing impacts arising from the adjoining Noraville Zone Substation. This may mean that site specific development matters need to be closely considered with appropriate design guidelines developed and included in an amendment to Wyong DCP 2013 would be required. This should be prepared and exhibited concurrently with the planning proposal.

CONSULTATION

Internal consultation has been undertaken concerning the planning proposal with feedback utilised in the assessment of this application.

It is proposed that consultation with state agencies will be required in accordance with any future gateway determination. During such consultation it would be appropriate to seek comment from the RMS and RFS.

Further the planning proposal would also be subject of public consultation in accordance with any future gateway determination. It is noted that the matter is proposed to be reported back to Council after it has been placed on public exhibition.

Planning Proposal Considerations

The *Guide to Preparing Planning Proposals* (Department of Planning and Infrastructure 2012) provides the guidelines for the information that is to be provided by Council to the DP&E when seeking a gateway determination. Section 2.3(a) of the guide provides a list of "questions to consider when demonstrating the justification", which should be considered prior to Council's endorsement of any proposal for gateway determination. This requires that the relevant State and local planning strategies, relevant State Environmental Planning Policies (SEPP's) and Ministerial Section 117 Directions be considered.

Further detailed work will be required to fill data gaps particularly related to traffic generation, stormwater capacity, noise, EMR and bushfire. This information will be required post gateway determination but is needed to inform the planning proposal prior to public exhibition.

It is noted that additional items may be identified as part of the gateway panel review and determination.

The proposal is considered to be capable of being consistent with the relevant SEPP's and 117 Directions and is consistent with the Central Coast Regional Strategy and draft Central Coast Regional Plan, Council's Strategic Plan and Settlement Strategy, subject to appropriate supporting studies.

GOVERNANCE AND POLICY IMPLICATIONS

The processing of the planning proposal is being undertaken in accordance with Council's adopted planning proposal procedure.

Rezoning of the land is undertaken by preparing an amendment to the LEP through progressing of a planning proposal under sections 55-59 of the *Environmental Planning & Assessment Act 1979*.

Council may request delegation from the Minister for Planning for the determination of locally significant planning proposals. Given the relatively minor nature of this proposal it is recommended that in this instance delegation be sought.

The requirements for public exhibition will be set out under the gateway determination. In addition to the exhibition of a planning proposal, other associated material will require exhibition concurrently including an amendment to Wyong DCP 2013 to provide a framework and guidelines for development of the site

OPTIONS

It is considered that Council has two options in relation to considering this planning proposal as discussed below.

Option 1 – Approve the Planning Proposal - recommended

On the basis of the review of the application to date the proposal to the southern part of the existing Ausgrid Substation and Depot site would go from SP2 Electricity - Transmission and Distribution to R2 Low Density Residential to facilitate low density residential development has merit and is worthy of proceeding to gateway determination.

It is proposed that a minimum lot size of 450m^2, a building height of 8.5 metres and a FSR of 0.5:1 also be applied to the site through the planning proposal. This will match the controls of the surrounding residential land, and seek to ensure that future development is in keeping with the scale and character of the area.

This would facilitate the development of the southern part of the lot for low density housing with a potential yield of 15 residential lots, while retaining the SP2 Electricity - Transmission and Distribution zone on the northern part of the site where the Noraville zone substation is proposed to be retained.

Option 2 – Refuse the Planning Proposal – not recommended

Alternatively Council could refuse the application as submitted and seek further information related to traffic generation, stormwater capacity, noise, EMR and bushfire. The desktop assessment undertaken to date indicates that from a strategic perspective, the proposal has merit and further that physical and environmental conditions are likely to be able to be managed. It is considered that the appropriate reporting could be provided post gateway determination and therefore this option is not favoured.

Consideration of s.23A guidelines

The Chief Executive of the NSW Office for Local Government has issued guidelines titled *"Council Decision Making during Merger Proposal Periods"* pursuant to s.23A(1) of the *Local Government Act 1993* ("LG Act"). The Council must consider those guidelines when making decisions during the "merger proposal period", which commenced on 6 January 2016 and will conclude on the date on which a proclamation is made to amalgamate the Wyong and Gosford local government areas or the Minister for Local Government determines that he will not proceed with the proposal for that amalgamation: s.23A(3) of the LG Act. Councillors have been provided with a copy of those guidelines and have been given advice concerning those guidelines. The decisions that are proposed as part of this report comply with those guidelines.

CONCLUSION

Following a preliminary review, the proposal to rezone part of the existing Ausgrid Substation and Depot site at 11A Brisbane Street, Noraville to facilitate low density residential development is considered to have merit.

As such it is proposed that a planning proposal to amend the Wyong LEP 2013 be prepared to rezone the land from SP2 Electricity - Transmission and Distribution to R2 Low Density Residential, and provide appropriate minimum lot size, maximum height and FSR controls for future development of the land.

It is recommended that a planning proposal be prepared for the consideration of the DP&E requesting a gateway determination be issued, noting that following gateway additional information related to traffic generation, stormwater capacity, noise, EMR and bushfire will be required.

ATTACHMENTS

Nil.

Ministerial Section 117 Directions

Direction	Comment
Employment & Resources	
1.1 Business & Industrial Zones	
Aims to encourage employment growth in suitable locations, protect employment land in business and industrial zones and to support the viability of identified strategic centres. Applies when a planning proposal affects land within an existing or proposed business or industrial zone.	Not Applicable The subject site is not zoned for industrial purposes, nor does the proposal seek to rezone the land for such purposes.
1.2 Rural Zones	
Aims to protect the agricultural production value of rural land. Applies when a planning proposal affects land within an existing or proposed rural zone.	Not Applicable The subject site is not zoned for rural purposes, nor does the proposal seek to rezone the land for such purposes.
1.3 Mining, Petroleum Production and Extractive Industries	
Aims to ensure that the future extraction of State or regionally significant reserves of coal, other minerals, petroleum and extractive materials are not compromised by inappropriate development. Applies when a planning proposal would have the effect of prohibiting the mining of coal or other minerals, production of petroleum, or winning or obtaining of extractive materials, or restricting the potential of development resources of coal, other mineral, petroleum or extractive materials which are of State or regional significance by permitting a land use that is likely to be incompatible with such development.	Not Applicable The proposal does not seek to prohibit nor restrict the mining or potential development of resources of coal or other minerals.
1.4 Oyster Aquaculture	
Aims to ensure that Priority Oyster Aquaculture Areas and oyster aquaculture outside such an area are adequately considered, and to protect Priority Oyster Aquaculture Areas and oyster aquaculture outside such an area from land uses that may result in adverse impacts on water quality and the health of oysters and consumers. Applies when a planning proposal could result in adverse impacts on a Priority Oyster Aquaculture Areas or current oyster aquaculture lease in the	Not Applicable There are no Priority Oyster Aquaculture Areas within the Wyong LGA

Direction	Comment
national parks estate or results in incompatible use of land between oyster aquaculture in a Priority Oyster Aquaculture Area or current oyster aquaculture lease in the national parks estate and other land uses.	
1.5 Rural Lands	
Aims to protect the agricultural production value of rural land; and facilitate the orderly and economic development of rural lands for rural and related purposes. Applies to local government areas to which State Environmental Planning Policy (Rural Lands) 2008 applies and prepares a planning proposal that affects land within an existing or proposed rural or environment protection zone.	Not Applicable This Direction does not apply to the Wyong LGA
Environment & Heritage	
2.1 Environmental Protection Zones	
Aims to protect and conserve environmentally sensitive areas. Applies when the relevant planning authority prepares a planning proposal.	Applicable The subject land is not identified for environmental protection purposes. The proposal is consistent with this Direction.
2.2 Coastal Protection	
Aims to implement the principles in the NSW Coastal Policy. Applies when a planning proposal applies to land in the coastal zone as defined in the *Coastal Protection Act* 1979.	Applicable The *Coastal Policy and Coastal Design Guidelines* are implemented through *SEPP 71 – Coastal Protection*. Specifically the *Coastal Design Guidelines* state that, New development and subdivisions should be located and planned in the context of revised settlement strategies and consistent with provisions in SEPP 71. The site is located within the SEPP 71 Coastal Protection Zone. The assessment undertaken as part of this planning proposal indicates that the proposal is consistent with the provisions of SEPP 71. The matters outlined in Clause 8 of the SEPP have been considered and the proposal does not affect access

Direction	Comment
	to and along coastal foreshores, nor is the site affected by coastal processes such as erosion.
2.3 Heritage Conservation	
Aims to conserve items, areas, objects and places of environmental heritage significance and indigenous heritage significance. Applies when the relevant planning authority prepares a planning proposal.	Applicable The subject site has been occupied as an electricity substation for an extensive period (greater 30 years), The AHIMS database does not contain any records of Aboriginal sites or items on or within 200m of the subject site. The proposal is consistent with this Direction.
2.4 Recreational Vehicle Areas	
Aims to protect sensitive land or land with significant conservation values from adverse impacts from recreational vehicles. Applies when the relevant planning authority prepares a planning proposal.	Applicable The proposal does not seek to enable development of the subject land for a recreational vehicle area. The proposal is consistent with this Direction.
Housing, Infrastructure and Urban Development	
3.1 Residential Zones	
Aims to encourage a variety and choice of housing types to provide for existing and future housing needs, to make efficient use of existing infrastructure and services and ensure that new housing has appropriate access to infrastructure and services, and to minimise the impact of residential development on the environmental and resource lands. Applies when a planning proposal affects land within an existing or proposed residential zone, and any other zone in which significant residential development is permitted or proposed to be permitted.	Applicable The proposal seeks to rezone the land to enable low density residential development (R2 zone). The subject land is located within an existing urban area, consequently can be easily service by augmentation of existing infrastructure. Clause 7.9 Essential Services of Wyong Local Environmental Plan 2013 will apply to any future development proposed on the land. This clause requires that arrangements have been made with regard to the provision of water, sewer, electricity, stormwater management and vehicular access have been made prior to consent being granted. The proposal is consistent with this Direction.
3.2 Caravan Parks and Manufactured Home Estates	
Aims to provide for a variety of housing types and provide opportunities for caravan parks and manufactured home estates. Applies when the relevant planning authority	Applicable The proposal seeks to apply the existing provisions of the R2 Low Density Residential zone to the subject land.

Direction	Comment
prepares a planning proposal.	As existing provisions are not being altered to prohibit caravan parks, the proposal is consistent with this Direction.
3.3 Home Occupations	
Aims to encourage the carrying out of low impact small business in dwelling houses. Applies when the relevant planning authority prepares a planning proposal.	Applicable The proposal seeks to apply the existing provisions of the R2 Low Density Residential zone to the subject land. Home occupations are permissible within this zone without consent. The proposal is consistent with this Direction.
3.4 Integrating Land Use & Transport	
Aims to ensure that urban structures, building forms, land use locations, development designs, subdivision and street layouts to achieve: improving access to housing, jobs and services by walking, cycling and public transport; increasing choice of available transport and reducing transport on cars; reducing travel demand; supporting efficient and viable public transport services; and provide for efficient movement of freight. Applies when a planning proposal creates alters or moves a zone or provision relating to urban land, including land zoned for residential, business, industrial, village or tourist purposes.	Applicable The proposal seeks to apply an R2 Low Density Residential zone to the subject site. A Traffic and transport assessment considering existing and proposed traffic load, consideration of public transport demand and availability and also the pedestrian and cycleway network will be required post gateway determination. The consistency of the proposal with this Direction is to be determined.
3.5 Development Near Licensed Aerodromes	
Aims to ensure the effective and safe operation of aerodromes, their operation is not compromised by development which constitutes an obstruction, hazard or potential hazard to aircraft flying in the vicinity, development for residential purposes or human occupation (within the ANEF contours between 20 & 25) incorporates appropriate mitigation measures so that the development is not adversely affected by aircraft noise. Applies when a planning proposal creates, alters or removes a zone or provision relating to land in the vicinity of a licensed aerodrome.	Not Applicable The subject land is not located near a licensed aerodrome.
3.6 Shooting Ranges	
Aims to maintain appropriate levels of public safety	Not Applicable

Direction	Comment
and amenity when rezoning land adjacent to an existing shooting range, to reduce land use conflict arising between existing shooting ranges and rezoning of adjacent land, and to identify issues that must be addressed when giving consideration to rezoning land adjacent to an existing shooting range. Applies when a relevant planning authority prepares a planning proposal that will affect, create, alter or remove a zone or a provision relating to land adjacent to and/ or adjoining an existing shooting range.	The subject land is not located to nor seeks to enable development for the purposes of a shooting range.
Hazard & Risk	
4.1 Acid Sulfate Soils	
Aims to avoid significant adverse environmental impacts from the use of land that has a probability of containing acid sulfate soils. Applies when a planning proposal applies to land having a probability of containing acid sulfate soils on the Acid Sulfate Soils Planning Maps.	Not Applicable The subject land is not identified as containing acid sulfate soils.
4.2 Mine Subsidence & Unstable Land	
Aims to prevent damage to life, property and the environmental on land identified as unstable or potentially subject to mine subsidence. Applies when a planning proposal permits development on land which is within a mine subsidence district, or identified as unstable in a study or assessment undertaken by or on behalf of the relevant planning authority or other public authority and provided to the relevant planning authority.	Applicable The subject land is located within the Swansea North Entrance Mine Subsidence District. Further consultation with the Mine Subsidence Board is required to determine the consistency of the proposal with this Direction.
4.3 Flood Prone Land	
Aims to ensure: development on flood prone land is consistent with NSW Government's Flood Prone Land Policy and principles of the Floodplain Development Manual 2005; and provisions of an LEP on flood prone land are commensurate with flood hazard and include consideration of the potential flood impacts both on and off the subject land. Applies when a planning proposal creates, removes or alters a zone or provision that affects flood prone	Not Applicable The subject land is not identified as being flood liable.

Direction	Comment
land.	
4.4 Planning for Bushfire Protection	
Aims to protect life, property and the environment from bushfire hazards, and encourage sound management of bushfire prone areas. Applies when a planning proposal affects or is in proximity to land mapped as bushfire prone land.	Applicable The subject land is identified as being within a Bushfire prone land buffer. Further consultation is required to be undertaken with the NSW Rural Fire Service to determine the consistency of the proposal with this Direction.
Regional Planning	
5.1 Implementation of Regional Strategies	
Aims to give legal effect to the vision, land use strategy, policies, outcomes and actions contained within regional strategies. Applies when the relevant planning authority prepares a planning proposal that is located on land addressed within the Far North Regional Strategy, Lower Hunter Regional Strategy, Central Coast Regional Strategy, Illawarra Regional Strategy & South Coast Regional Strategy.	Applicable. The broader Toukley locality is identified as a centre by the Central Coast Regional Strategy (CCRS). The CCRS further nominates that centres support further infill development. The proposal seeks to enable infill development through the application of an R2 Low Density Residential Zone. The Proposal is consistent with this Direction.
5.2 Sydney Drinking Water Catchments	
Aims to protect water quality in the hydrological catchment. Applies when a relevant planning authority prepares a planning proposal that applies to Sydney's hydrological catchment.	Not Applicable. The proposal is not located within Sydney's hydrological catchment.
5.3 Farmland of State and Regional Significance on the NSW Far North Coast	
Aims to: ensure that the best agricultural land will be available for current and future generations to grow food and fibre; provide more certainty on the status of the best agricultural land, assisting councils with strategic settlement planning; and reduce land use conflict arising between agricultural use and non-agricultural use of farmland caused by urban encroachment into farming areas. Applies to Ballina, Byron, Kyogle, and Tweed Shire Councils, Lismore City Council and Richmond Valley Council.	Not Applicable. The proposal is not located within the Far North Coast Region.
5.4 Commercial and Retail Development along the Pacific Highway, North Coast	
Aims to manage commercial and retail development	Not Applicable.

Direction	Comment
along the Pacific Highway, North Coast. Applies to all councils between and inclusive of Port Stephens and Tweed Shire Councils.	The proposal is not located between Port Stephens and Tweed Shire Councils.
5.8 Second Sydney Airport: Badgerys Creek	
Aims to avoid incompatible development in the vicinity of any future second Sydney Airport at Badgerys Creek. Applies to land located within the Fairfield, Liverpool and Penrith City Council and Wollondilly Shire Council Local Government Areas.	Not Applicable. The proposal is not located within the Fairfield, Liverpool and Penrith City Council or Wollondilly Shire LGA.
5.9 North West Rail Link Corridor Strategy	
Aims to promote transit-oriented development and manage growth around the eight train stations of the North West Rail Link (NWRL) and ensure development within the NWRL corridor is consistent with the proposals set out in the NWRL Corridor Strategy and precinct Structure Plans. Applies to the This Direction applies to Hornsby Shire Council, The Hills Shire Council and Blacktown City Council.	Not Applicable The proposal is not located within the Hornsby, The Hills or Blacktown LGA.
Local Plan Making	
6.1 Approval and Referral Requirements	
Aims to ensure that LEP provisions encourage the efficient and appropriate assessment of development. Applies when the relevant planning authority prepares a planning proposal.	Applicable The proposal does not include provisions which require the concurrent, consultation or referral of development applications to a Minister or Public Authority. The proposal is consistent with this Direction.
6.2 Reserving Land for Public Purposes	
Aims to facilitate the provision of public services and facilities by reserving land for public purposes, and facilitate the removal of reservations of land for public purposes where land is no longer required for acquisition. Applies when the relevant planning authority prepares a planning proposal.	Applicable The subject land is not zoned or identified for acquisition for public purposes, nor does the proposal seek to enable this. The proposal is consistent with this Direction.
6.3 Site Specific Provisions	
Aims to discourage unnecessarily restrictive site	Not Applicable

Direction	Comment
specific planning controls. Applies when the relevant planning authority prepares a planning proposal to allow particular development to be carried out.	The proposal does not seek to enable a particular development to be carried out.
Metropolitan Planning	
7.1 Implementation of A Plan for Growing Sydney	
Aims to give legal effect to the planning principles, directions and priorities for sub regions, strategic centres and transport gateways contained in A Plan for Growing Sydney	Not Applicable. This Direction does not apply to Wyong LGA.
7.2 Implementation of Greater Macarthur Land Release Investigations	
Aims to ensure development within the Greater Macarthur Land Release Investigation Area is consistent with the Greater Macarthur Land Release Preliminary Strategy and Action Plan.	Not Applicable. This Direction does not apply to Wyong LGA.

NSW Coastal Policy Assessment

Principles
1 Protecting, rehabilitating and improving the natural environment of the coastal zone.
The proposal is not located immediately adjacent to the coast and will not adversely impact the objects of protecting, rehabilitating and improving the natural environment of the coastal zone.
2 Recognising and accommodating the natural processes of the coastal zone.
The proposal recognizes and will not constrain natural processes of the coastal zone.
3 Protecting and enhancing the aesthetic qualities of the coastal zone.
The proposal will have no adverse amenity impacts upon the aesthetic qualities of the coastal zone.
4 Protecting and conserving the cultural heritage of the coastal zone.
The proposal will have no adverse amenity impacts upon the cultural heritage of the coastal zone.
5 Providing for ecologically sustainable development and use of resources.
The proposal will facilitate ecologically sustainable infill development in terms of resource use.
6 Providing for ecologically sustainable human settlement in the coastal zone.
The proposal will facilitate ecologically sustainable infill development.
7 Providing for appropriate public access and use.
The proposal will not adversely impact public access and use of the coastal zone.
8 Providing information to enable effective management of the coastal zone.
The proposal will not adversely impact this objective.
9 Providing for integrated planning and management of the coastal zone.
The proposal will not adversely impact this objective.

SEPP 71 Assessment (Clause 8)

Matters for Consideration
(a) The aims of the Policy:
The proposal is consistent with the provisions of *SEPP 71*. The matters outlined in Clause 8 of the SEPP have been considered: • The proposal does not affect access to and along coastal foreshores, • The site is not affected by coastal processes. • The land has been fully developed for utility and depot uses and does not contain any remnant native vegetation or is likely to contain Aboriginal artefacts. • Future development of the site will be low scale and not readily visible from the lake or coastal foreshore areas.
(b) existing public access to and along the coastal foreshore for pedestrians or persons with a disability should be retained and, where possible, public access to and along the coastal foreshore for pedestrians or persons with a disability should be improved,
The proposal does not impact coastal access for pedestrians or persons with a disability.
(c) opportunities to provide new public access to and along the coastal foreshore for pedestrians or persons with a disability,
The proposal has no scope to significantly improve public foreshore access.
(d) the suitability of development given its type, location and design and its relationship with the surrounding area,
The proposal will facilitate development consistent with the surrounding existing low density residential development.
(e) any detrimental impact that development may have on the amenity of the coastal foreshore, including any significant overshadowing of the coastal foreshore and any significant loss of views from a public place to the coastal foreshore,
The proposal will have no adverse amenity impacts upon public places in terms of overshadowing or views to the foreshore.
(f) the scenic qualities of the New South Wales coast, and means to protect and improve these qualities,
The scenic qualities of the NSW coast will not be adversely impacted by the proposal.
(g) measures to conserve animals (within the meaning of the *Threatened Species Conservation Act 1995*) and plants (within the meaning of that Act), and their habitats,
The proposal will have no impact to conserve or adversely impact animals or plants under the TSC Act.
(h) measures to conserve fish (within the meaning of Part 7A of the *Fisheries Management Act 1994*) and marine vegetation (within the meaning of that Part), and their habitats
The proposal will not impact fish or marine vegetation under the FM Act

Matters for Consideration
(i) existing wildlife corridors and the impact of development on these corridors,
The proposal will not impact wildlife corridors.
(j) the likely impact of coastal processes and coastal hazards on development and any likely impacts of development on coastal processes and coastal hazards,
The proposal will not be impacted by nor contribute impacts relating to coastal processes and hazards.
(k) measures to reduce the potential for conflict between land-based and water-based coastal activities,
The proposal will have no impact upon land-based and water-based coastal activities.
(l) measures to protect the cultural places, values, customs, beliefs and traditional knowledge of Aboriginals,
The proposal will not impact the cultural places, values, customs, beliefs and traditional knowledge of Aboriginals.
(m) likely impacts of development on the water quality of coastal waterbodies,
The proposal will include suitable water management to protect the water quality of coastal water bodies.
(n) the conservation and preservation of items of heritage, archaeological or historic significance,
The proposal will not impact any known items of heritage, archaeological or historic significance.
(o) only in cases in which a council prepares a draft local environmental plan that applies to land to which this Policy applies, the means to encourage compact towns and cities,
The proposal is an 'infill' development consistent with surrounding development. It will have the effect of increasing residential density and in this sense encourage compact towns and cities.
(p) only in cases in which a development application in relation to proposed development is determined: (i) the cumulative impacts of the proposed development on the environment, and (ii) measures to ensure that water and energy usage by the proposed development is efficient.
Cumulative impacts of the proposed development are not likely to be significant, firstly as there are very limited opportunities for this type of infill development in Noraville, and secondly because the impacts can be adequately managed. Future development associated with this proposal will be subject to BASIX and therefore required to demonstrate and implement water and energy efficient measures.

Wyong Local Environmental Plan (LEP) 2013

The Wyong Local Environmental Plan (LEP) 2013 is the principal Environmental Planning Instrument applying to the subject land.

Land Use Tables

The land is currently zoned SP2 Infrastructure. The zone proposed is R2 Low Density Residential.

The land use tables, identifying the objectives, permissible and prohibited land uses for the existing and proposed zones are provided below:

Zone SP2 Infrastructure

1 Objectives of zone

- To provide for infrastructure and related uses.
- To prevent development that is not compatible with or that may detract from the provision of infrastructure.
- To recognise existing railway land and to enable future development for railway and associated purposes.
- To recognise major roads and to enable future development and expansion of major road networks and associated purposes.
- To recognise existing land and to enable future development for utility undertakings and associated purposes.

2 Permitted without consent

Nil

3 Permitted with consent

Roads; The purpose shown on the Land Zoning Map, including any development that is ordinarily incidental or ancillary to development for that purpose.

4 Prohibited

Any development not specified in item 2 or 3

Zone R2 Low Density Residential

1 Objectives of zone

- To provide for the housing needs of the community within a low density residential environment.
- To enable other land uses that provide facilities or services to meet the day to day needs of residents.
- To maintain and enhance the residential amenity and character of the surrounding area.
- To provide a residential character commensurate with a low density residential environment.

2 Permitted without consent

Home-based child care; Home occupations

3 Permitted with consent

Bed and breakfast accommodation; Boarding houses; Boat launching ramps; Boat sheds; Building identification signs; Business identification signs; Car parks; Child care centres; Community facilities; Dual occupancies; Dwelling houses; Emergency services facilities; Environmental facilities; Environmental protection works; Exhibition homes; Exhibition villages; Flood mitigation works; Group homes; Health consulting rooms; Home businesses; Home industries; Information and education facilities; Jetties; Neighbourhood shops; Places of public worship; Recreation areas; Respite day care centres; Roads; Secondary dwellings; Semi-detached dwellings; Shop top housing; Water recycling facilities; Water reticulation systems; Water storage facilities

4 Prohibited

Any development not specified in item 2 or 3

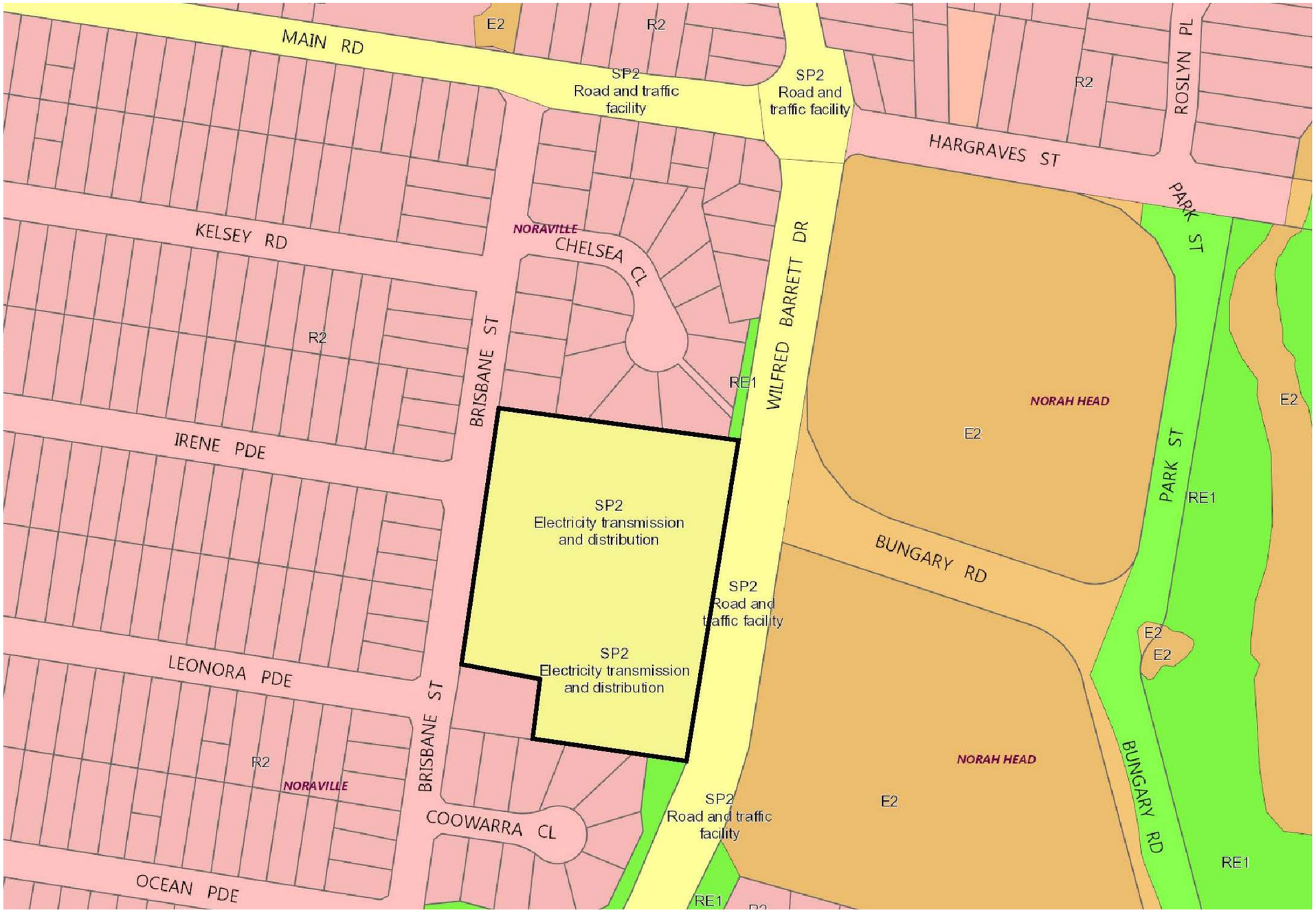
LOCALITY MAP
Lot 2 DP 605538

(11A Brisbane Street)
NORAVILLE

N

EXISTING LAND ZONING MAP WYONG LEP 2013

Lot 2 DP 605538 (11A Brisbane Street) NORAVILLE



Legend

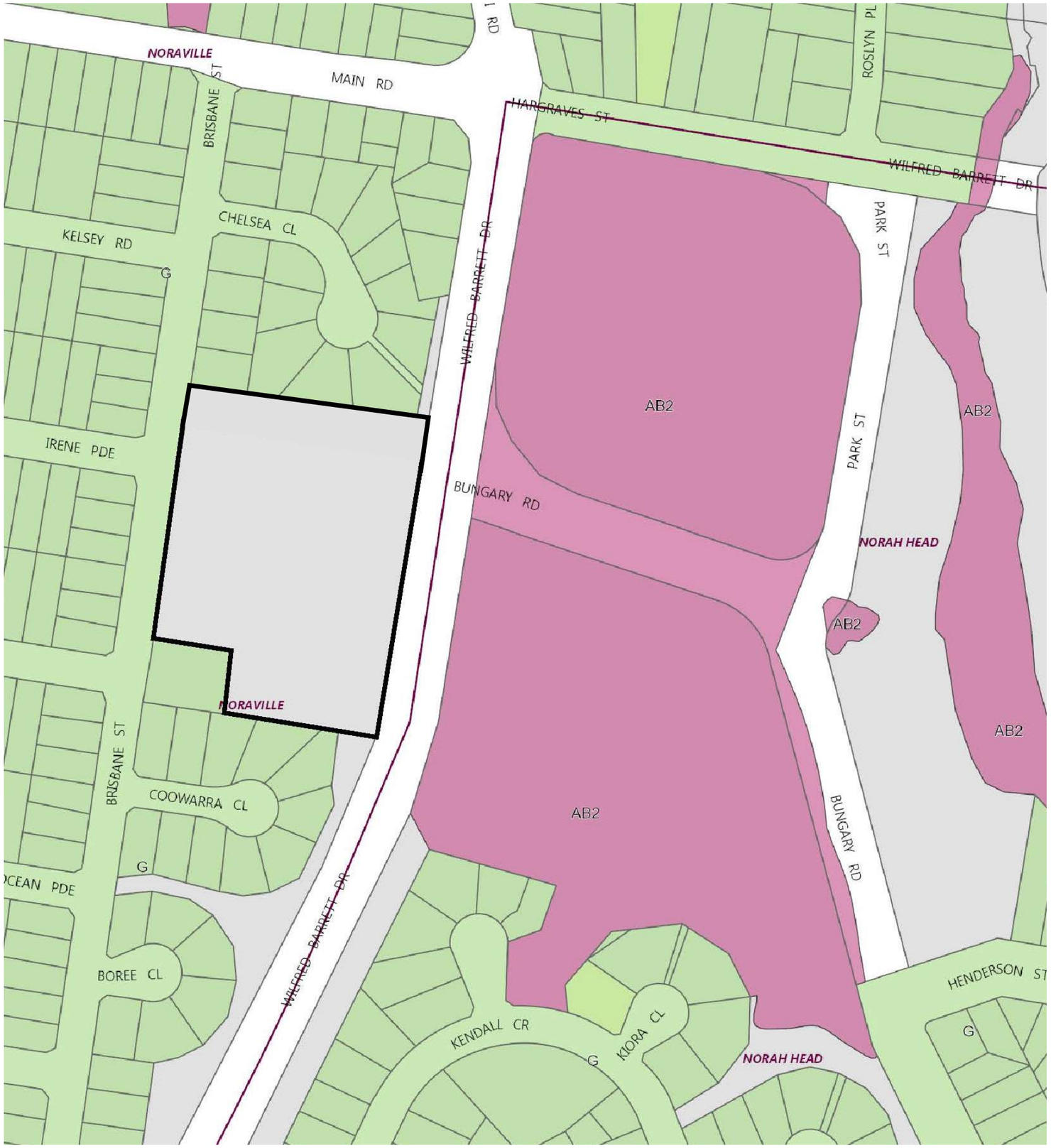
Study Boundary

Zone

- E2 Environmental Conservation
- R2 Low Density Residential
- RE1 Public Recreation
- SP2 Infrastructure

Central Coast Council

N



EXISTING MINIMUM LOT SIZE WYONG LEP 2013

Lot 2 DP 605538 (11A Brisbane Street) NORAVILLE

Legend

Study Boundary

Minimum Lot Size

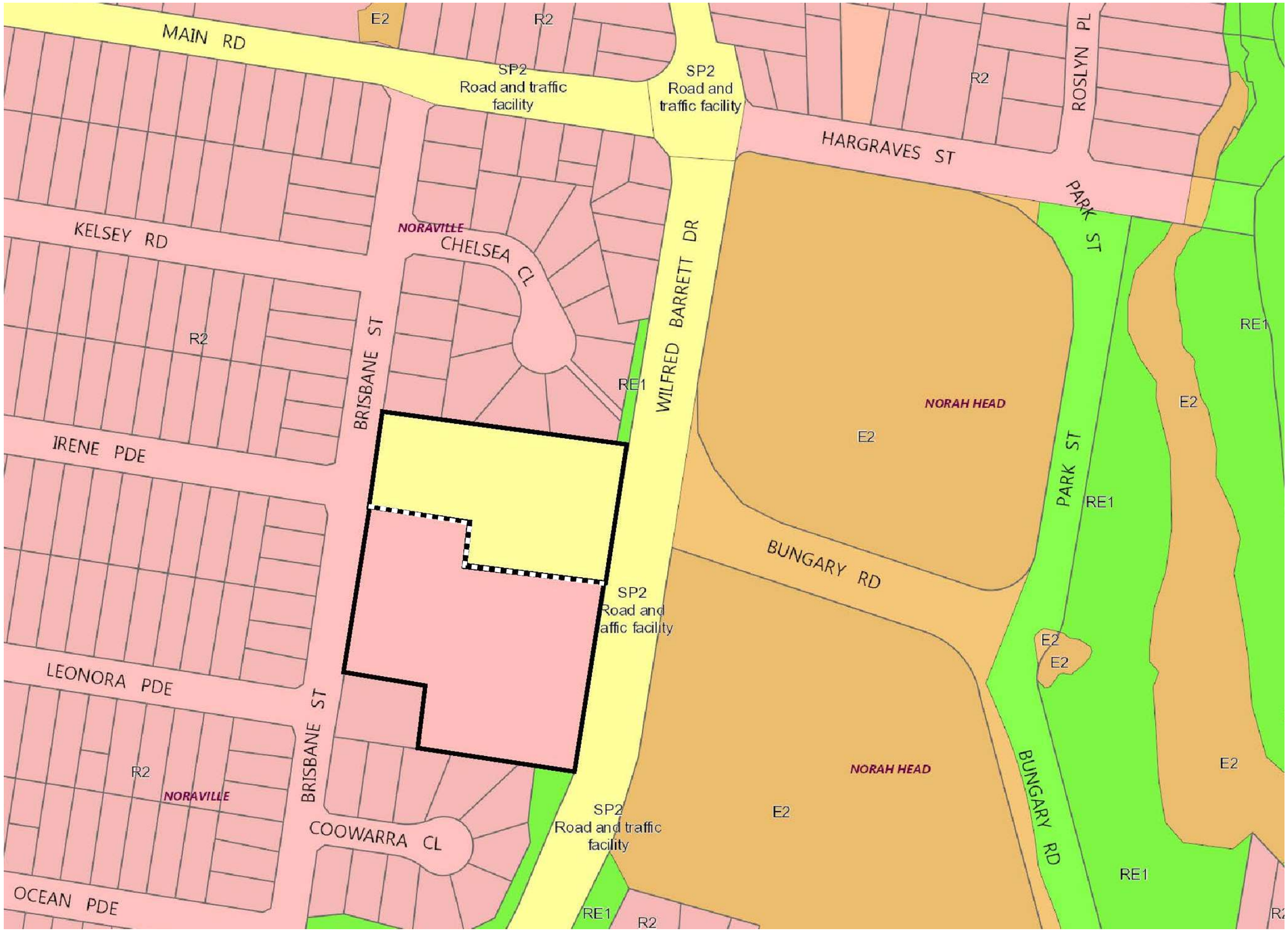
G 450 m²

AB2 40 ha

N

PROPOSED LAND ZONING MAP WYONG LEP 2013

Lot 2 DP 605538 (11A Brisbane Street) NORAVILLE



Legend

Study Boundary

Zone

- E2 Environmental Conservation
- R2 Low Density Residential
- RE1 Public Recreation
- SP2 Infrastructure

Central Coast Council

N

PROPOSED MINIMUM LOT SIZE WYONG LEP 2013

Lot 2 DP 605538 (11A Brisbane Street) NORAVILLE

Legend

Study Boundary

Minimum Lot Size

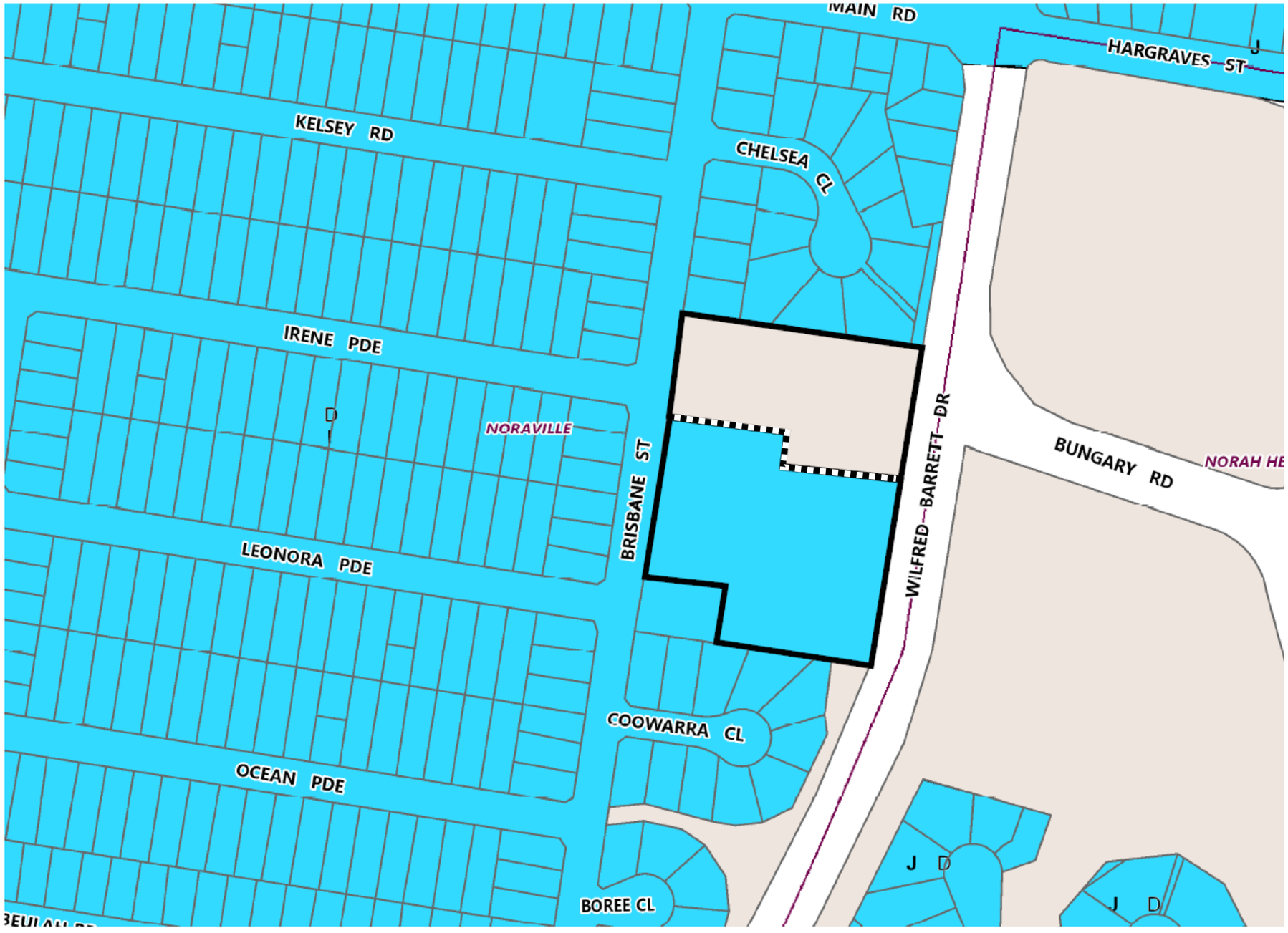
G 450 m²

AB2 40 ha

N

PROPOSED
FLOOR SPACE RATIO MAP
WYONG LEP 2013

Lot 2 DP 605538
(11A Brisbane Street)
NORAVILLE



Legend

Study Boundary

FSR

D 0.5:1

Central Coast Council

N

PROPOSED
HEIGHT OF BUILDING MAP
WYONG LEP 2013

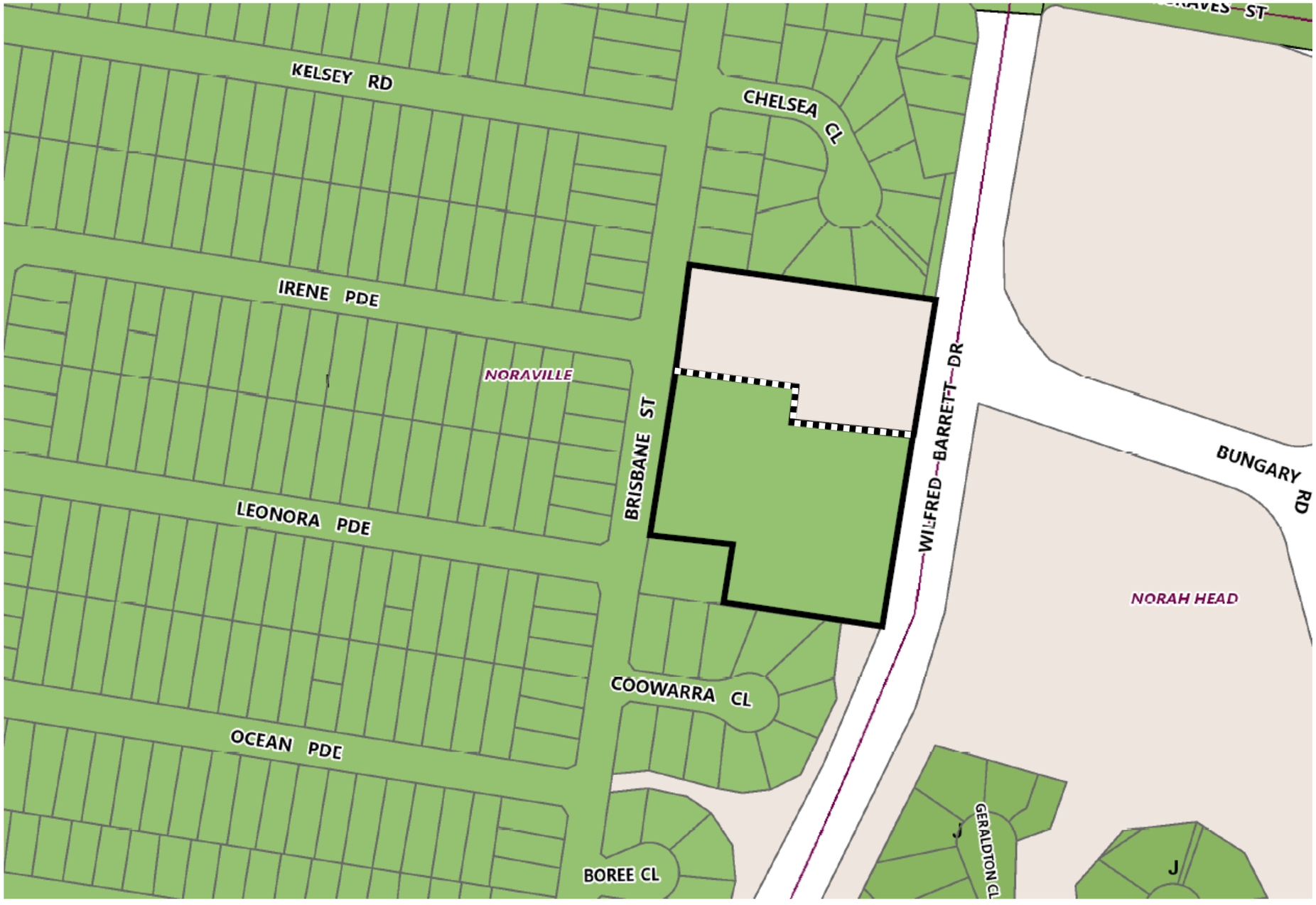
Lot 2 DP 605538
(11A Brisbane Street)
NORAVILLE

Legend

Study Boundary

HOB

I 8.5m



Central Coast Council

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Additional Environmental Site Assessment - Noraville Depot

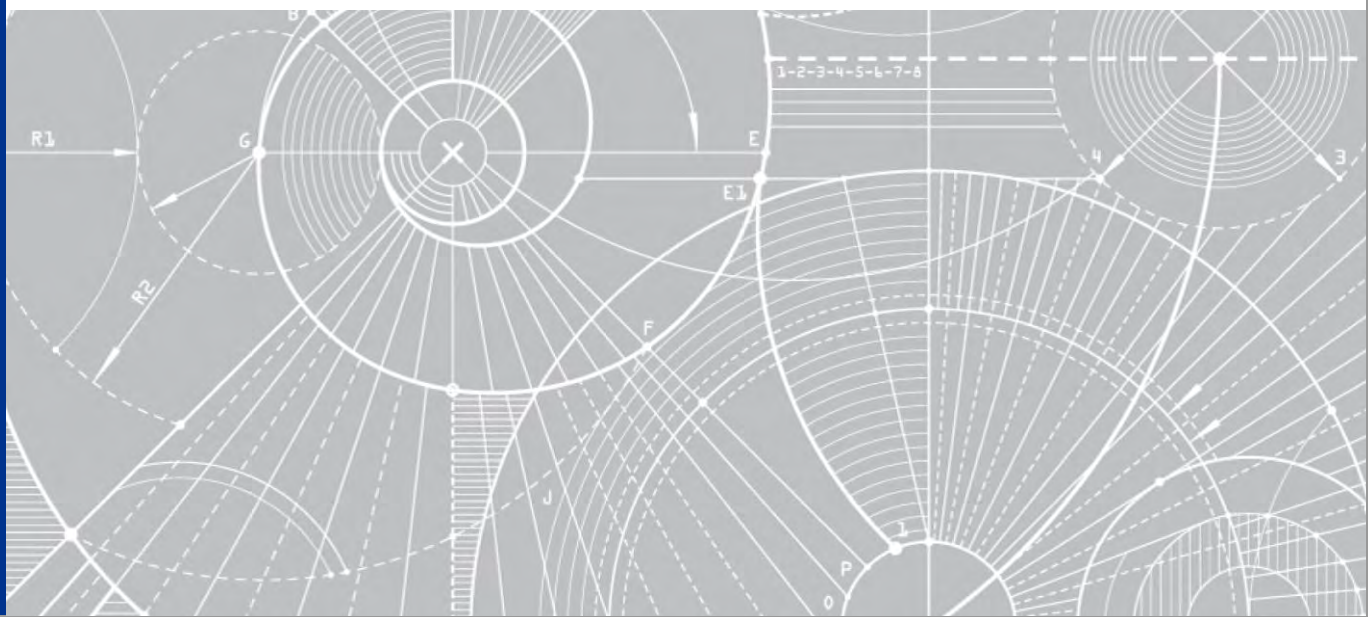
AUSGRID

Additional ESA Report

IA054000-N-CL-RP-Additional ESA Noraville | Final

CL1018

2 Feb 2015



JACOBS

Additional Environmental Site Assessment - Noraville Depot

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1. Introduction

Jacobs Group (Australia) Pty Ltd (Jacobs) was commissioned by Ausgrid Environmental Services (Ausgrid) to undertake an additional environmental site assessment (ESA) at the Ausgrid Depot on Wilfred Barrett Drive in Noraville, NSW (herein after referred to as the site). A site location and layout plan is presented as **Figure 1**.

The ESA was commissioned to assess potential contamination issues at the site which may have arisen from past activities undertaken on and/or adjacent to the site since 2002, which may represent a potential risk to human health and/or environmental receptors. The ESA was undertaken in order to assist Ausgrid in the divestment and rezoning of the site from commercial/industrial to residential land use.

This report has been prepared in general accordance with the requirements specified for a Stage 2 Detailed Site Investigation as published in the:

- NSW EPA (2000) Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites (NSW EPA, 2000).
- National Environmental Protection Council, National Environment Protection Measure (Assessment of Site Contamination) Measure 1999 (as amended 2013) (NEPC, 2013).
- Australian Standard AS 4482.1-2005 Guide to the investigation and sampling of sites with potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds (AS 4482.1-2005).

2. Objectives

The objectives of the ESA were to assess whether the activities undertaken on site since the completion of the previous ESA (PPK 2002) have contaminated soils and/or groundwater underlying the site at concentrations which exceed the NSW EPA endorsed guidelines for residential land use and protection of environmental receptors and to provide information to assist Ausgrid in addressing the following:

- minimise Ausgrid's liability in relation to the requirements of the *Contaminated Land Management Act 1997*, the *Protection of the Environment Operations Act 1997* and other relevant legislation.
- ensure no unacceptable immediate risks of off-site contamination, or to human health or the environment.
- ensure the project area is suitable for use under the current/proposed land zoning and use.
- provide in-situ waste classification for samples collected from the site in accordance with the NSW Department of Environment, Climate Change and Water (DECCW) *Waste Classification Guidelines* (2009).

3. Scope of Works

To achieve the objectives, Jacobs has undertaken the following scope of works in general accordance with the proposal *Additional Contamination Assessment and Hazardous Materials Survey – Noraville Depot CL1018* dated 5 September 2014, and the Sampling and Analysis Quality Plan (SAQP) by Jacobs dated 17 October 2014.

3.1.1 Preliminaries

- Undertake a review of existing documentation from PPK (2002), Noel Arnold & Associates (2009 & 2012), and HAZMAT Services (2012).
- Development of a SAQP for the site investigation.
- Preparation of a Safe Work Method Statement (SWMS) that identified foreseeable risks and provided strategies for removing and/or managing these risks. The SWMS was submitted to Ausgrid for approval prior to commencement of site works.
- Obtained groundwater licences prior to installation of groundwater wells[1].

3.1.2 Fieldwork

- Location of services by a qualified and Ausgrid inducted service locator (Geotrace) and Dial Before You Dig Search.
- Jacobs sampled soils from 21 locations across the site using a geoprobe push tube drill rig to facilitate the collection of soil / fill samples. Twenty one sample locations is the minimum number of sampling points detailed in the NSW EPA (1995) *Contaminated Sites – Sampling Design Guidelines* for a site with an area of 1.0 hectares (the site has an area of 1.01 hectares based on information provided by Ausgrid). Concrete coring was required at some of the proposed locations due to the presence of hardstand.
- All boreholes were drilled to 4.0 m below ground level (bgl), 1.0 m into natural material, water table or excavation method refusal (whichever was shallower).
- Jacobs installed three groundwater wells (within three of the soil sampling boreholes). Groundwater wells were constructed in anticipated up gradient (one groundwater well) and down gradient (two groundwater wells) positions. Boreholes for groundwater well construction were drilled to 10.5 metres bgl.
- Groundwater wells were constructed using 50mm Class 18UPVC screen and casing, graded sand, bentonite and completed flush with ground level with a gatic cover.
- Groundwater wells were developed following installation.
- Groundwater wells were purged and sampled using low flow sampling techniques at least 48 hours after development. Groundwater levels and chemistry were monitored during purging and samples only collected once water chemistry and levels had stabilised.
- All borehole locations were surveyed in using a hand held GPS.

3.1.3 Reporting

Preparation of an interpretative report detailing the results of the additional site investigation and laboratory analysis, and an assessment as to whether Ausgrid operations/activities have contaminated the site at concentrations exceeding endorsed criteria for residential land use and the protection of environmental

[1] During the investigation, the Department of Primary Industries advised that groundwater monitoring bores less than 40 mbgl are no longer required to be licensed. Therefore, the groundwater licence application submitted for these works is no longer required.

receptors. Where applicable, the report has been prepared in general accordance with the NSW EPA (2000) guidelines.

4. Previous Site Investigations

4.1.1 Detailed Stage 1 and Stage 2 Contamination Assessment - PPK Environment and Infrastructure 2002.

PPK Environment and Infrastructure Pty Ltd (PPK) was commissioned by Energy Australia in May 2002 to undertake an ESA of the Energy Australia property located at Brisbane Street, Noraville, NSW.

Within the limitations and constraints imposed by the study of background information, soil/water sampling programs and the laboratory procedures, the following summary and conclusions are provided:

- The review of the site history identified that Energy Australia (formerly Brisbane Water County Council) had been the registered proprietor at the site since 1975, prior to which the area was resumed for purposes of works in connection with the supply of electricity dating back to 1965. Apart from the works associated with the supply of electricity, past land uses were not considered to pose a threat to human health or the environment. The potential for contamination from Energy Australia activities included heavy metals, petroleum hydrocarbons (TPH and BTEX), organochlorine (OC) pesticides, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs) and asbestos.

- Groundwater was measured at a depth of approximately 2.6 mbgl. There were nine registered groundwater abstraction wells within a 1 kilometre radius of the site and the nearest surface water to the site was the Pacific Ocean located approximately 400 metres to the east of the site. Tuggerah Lake was also located approximately 1.5 kilometres to the south west.

- The site inspection identified the main potential areas/activities for contamination of the depot as:

    - historical land use as a depot indicating a potential for hydrocarbon and PCB contamination associated with on site activities, particularly with respect to the vehicle workshop, the areas previously used for storage of fuels in underground tanks and the wash bay area.

    - migration of potential contamination via the groundwater due to the permeable nature of the subsurface materials.

    - use of asbestos containing fibro cement sheeting in the construction of the workshop, storage and amenities facilities.

    - potential presence of contaminated fill materials (heavy metals, organic compounds and asbestos).

- The investigation typically encountered fill materials beneath the site surface in varying thicknesses. Fill was present to a maximum depth of 2 mbgl, however, in general fill materials were found to be 0.4 m to 1 m in depth or less.

- Samples of both fill material and natural soil were submitted to the laboratory for analyses including heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn and Hg), TPH (C_6-C_{36}), BTEX, PAH, OC pesticides, PCBs and asbestos. The laboratory results indicated concentrations less than the adopted assessment criteria in the majority of samples analysed.

- In summary, the soil investigation indicated that there were no widespread contamination impacts at the site. This however, was subject to the results of the asbestos testing and groundwater monitoring program showing no contamination impacts above the adopted assessment criteria. Based on the results of the investigations, PPK considered that the site was generally suitable for development for residential or commercial/industrial land use.

4.1.2 Asbestos Materials Survey and Re-inspection Reports – Noel Arnold & Associates 2009, 2010 & 2012.

In 2009, of the 16 samples collected from building materials across the site, 14 of those returned positive analysis for asbestos containing materials (i.e. chrysotile, crocidolite or amosite asbestos).

In 2010, one sample of fibre cement sheet was collected from the exterior of a demountable building. The results returned a negative result for asbestos.

In February 2012, one sample of fibre cement sheeting was collected from the exterior of building 4, adjacent to door 3. The results returned a positive result for the presence of chrysotile asbestos and organic fibres.

In June 2012, a re-inspection of the site was undertaken to assess previously identified asbestos containing materials located on site. The re-inspection involved a visual inspection of accessible and representative construction materials and the collection and analysis of materials suspected of containing asbestos.

As a result of the re-inspection, an asbestos register was created and the following actions were recommended:

- No asbestos PPE is required to be worn to enter the substation, however, prior to entering the substation always conduct a HAC risk assessment as per Technical Standard NUS-211.
- Schedule periodic reassessment of the asbestos-containing materials remaining onsite to monitor their aging/deterioration – as per Ausgrid's Asbestos Safety Management Plan and Work Health and Safety Regulation 2011 (NSW) Clause 456 (next re-inspection recommended January 2013).
- When demolition or refurbishment works are required a Destructive Hazardous Materials Inspection should be undertaken as per AS2601:2001 The Demolition of Structures.

4.1.3 Air Monitoring – HAZMAT Services 2012.

HAZMAT Services Pty Ltd (HAZMAT Services) was commissioned by Ausgrid in December 2012 to undertake background air monitoring of various locations within the Noraville Depot site. The monitoring was undertaken in accordance with the HAZMAT Services Asbestos Procedures Manual and with reference to the *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition (2005).*

The results showed that none of the 12 air monitoring locations reported observable concentrations of airborne fibres.

5. Conceptual Site Contamination Model

The following information outlines potential source/migration/receptor linkages based on our understanding of current site conditions, previous site activities and possible receptors.

5.1 Potential contamination sources and contaminants of concern

The potential sources of contamination and their associated contaminants of concern identified for the site include:

- Historical and current land use as a depot indicating a potential for hydrocarbon and PCB contamination associated with the Ausgrid activities, particularly with respect to the vehicle workshop, former underground storage tanks and the areas used for storage of fuels and transformer oils (PPK, 2002).
- Migration of potential contamination via the groundwater is considered an issue given the permeable nature of the anticipated subsurface horizons (PPK, 2002).
- Use of asbestos containing fibro cement sheeting in the construction of the offices and workshop facilities.
- Potential presence of contaminated fill materials (heavy metals, organic compounds and asbestos).

5.2 Potential contaminant migration pathways

Pathways by which the contamination sources discussed above may migrate towards potential receptors include:

- Direct human contact through dermal contact, ingestion and/or inhalation.
- Vertical/ lateral migration via groundwater.
- Vertical/lateral migration via vapour.

5.3 Potential receptors of concern

- Personnel working at the site.
- General public entering the site including future site users.
- Flora and fauna habitats present surrounding the site (including local sensitive environments).
- Buildings located on site.
- Nearby properties and residents.
- Groundwater.

6. Site Information

6.1 Site location and layout

Noraville Depot is located on Wilfred Barrett Drive in Noraville, NSW, approximately 110 kilometres from Sydney's central business district. The site is bounded by low density residential land use to the north, south and west, and Wilfred Barrett Drive to the east (Wyong Shire Council 2014).

The Noraville Depot consists of two areas; the substation, and the site, consisting of mechanic workshops, storage facilities, offices and a washbay. The portion of the depot to be divested (the site) covers an area of 1.01 hectares and is part of Lot 2 of Deposited Plan 605538.

Groundcover across the site is largely sealed, with some grassed and vegetated areas along the boundaries of the site. Buildings and structures at the site are centred around a central vehicle parking area. The washbay, historical underground storage tank and creosote area were located toward the western boundary of the sealed vehicular parking area.

The site was closed for on site activities in August 2014, and since the previous ESA in 2002 (PPK Environment and Infrastructure) activities undertaken on site included storage of building materials, a washbay, vehicle maintenance, mechanic workshop, offices, and amenities (based on anecdotal information from Ausgrid).

6.2 Environmental setting

The site is generally flat with a slight decline towards the centre of the site. Due to the large proportion of the site being covered by either buildings or sealed by pavement a significant portion of the surface water is expected to flow off site via formal on site drainage structures and into the local stormwater drainage system. The paved area between the stores and the garage is graded to provide for surface run-off of stormwater to site drains located in the middle of the hardstand area, which would in turn flow into the stormwater drains on Brisbane Street. A sediment trap had been installed to collect runoff from the adjoining sand and gravel storage bins (PPK 2002).

6.2.1 Geology and soils

The 1:250,000 Sydney Geological Series Sheet S1 56-5, indicates that the site is underlain by deposits from the Narrabeen Group consisting of claystone, sandstone and shale.

The 1:100,000 Gosford – Lake Macquarie Soil Landscape Series Sheet 9131-9231 indicates that the site is located on elevated undulating sandsheet plains to rolling dunefield sandsheets of windblown sands on coastal headlands. Limitations of the soil landscape are an extreme wind erosion hazard, high water erosion hazard and non-cohesive and highly permeable soils (PPK 2002).

The Wyong Shire Council (2014) Acid Sulfate Soils (ASS) mapping shows that the site is outside areas considered to be at risk of containing ASS.

6.2.2 Hydrogeology

The nearest water body is the Pacific Ocean, which is located approximately 400 metres to the east of the site. Lake Tuggerah is located approximately 1.5km to the west of the site (PPK 2002). The direction of groundwater flow could not be definitively assessed based on current information, although the surrounding topography suggests that groundwater would flow west towards Lake Tuggerah.

6.2.3 Sensitive local environments

Based on the available information, sensitive environments which could be potentially impacted by contamination within the site (if present) are detailed below:

- E2 – Environmental conservation area located approximately 70 metres to the east of the site (Wyong Shire Council 2014).
- SEPP 71 – Sensitive Coastal locations situated approximately 300 metres to the east, and 700 metres north of the site (Wyong Shire Council 2014).
- Marine ecosystems located within Lake Tuggerah.

6.3 Site condition and surrounding environment

The following description of the site is based on observations made by a Jacobs environmental scientist during the fieldworks program between 17 November and 19 November 2014. The site layout plan (and associated building reference system) is presented as **Figure 2**.

At the time of undertaking the ESA, the site was vacant, with the most prominent features of the site being seven single storey buildings (A – G), a washbay, vehicular parking, and large grassed area to the west of the site.

Two buildings were inaccessible at the time of the fieldworks. The mechanics workshop (Building D) was locked at the time of service location and hence no drilling was able to be undertaken within this building. The building to the north of the site (Building A) which was used for storage of building materials was also locked due to the risk of decaying asbestos containing materials. Building A is also reported to have asbestos roofing.

Subsequent to service location, Building D was able to be accessed. On inspection of the building some moderate areas of staining were present adjacent to services (sink, hot water system, waste oil collection tank, bunds for waste coolant drums, two tonne crane). The waste oil collection tank also appeared to either be leaking or had experienced a recent spill as oil was present on the hardstand of the building adjacent to the tank. The hardstand within the building was observed to be in a good condition with no major cracking or separation. In consideration of the good condition of the concrete slab within this building, the risk of oil impacting upon underlying soils in this location is likely to be low.

Anecdotal evidence suggests that underground storage tanks (USTs) were recently removed from the site. The tanks were located underneath the hardstand in the vehicular parking area adjacent to Building A. Additionally, aboveground storage tanks (ASTs) were also removed from the area near the washbay. The ASTs were reported to have stored creosote.

Buildings B and C were general amenities for the site. Both buildings were in fair condition.

Buildings E and F were previously used for vehicular parking and maintenance. Some areas of staining were observed on the hardstand within these structures.

Towards the grassed area of the site there was an area of hardstand in which there were four shallow manholes with manhole covers, and a shipping container adjacent to the hardstand. The area is said to have been used for confined space training.

Demountables on site (Building G, part of Building C and a smaller unnamed building) were owned by Ausgrid and are due to be removed and sold. There were two large water tanks located behind Building G.

Based on observations made during the fieldwork program, the areas surrounding the site include:

- North: low density residential.
- West: low density residential.
- South: low density residential.
- East: bush reserve and coastal zones.

7. Sampling and Analysis Program

Jacobs personnel attended site on the following dates to under taken the sampling and analysis program for the additional ESA:

- 7 November 2014 – service location.
- 17 – 19 November 2014 – soil sampling and well installation/development.
- 27 November 2014 – groundwater sampling.

7.1 Soil sampling program

7.1.1 Soil sampling

The soil sampling program consisted of the drilling of 21 soil boreholes, three of which were completed as groundwater wells. The soils boreholes were drilled using a geoprobe drill rig to 4.0 mbgl, and the wells were drilled from 4.0 mbgl using solid flight augers to 10.5 mbgl. BH01 and GW01 were hand augered to 1.0 mbgl on recommendation from the service locators.

The borehole locations were selected to provide coverage of the site, and to target sources of potential contamination. Borehole locations are presented as **Figure 3**.

Soil samples were collected directly from the disposable push tube liners at 0.0 – 0.2 m, 0.5 m, 1.0 m and then at 1.0 m intervals until termination of the sampling location or at other discrete locations where there was evidence of potential contamination (odorous or discoloured soils, erroneous waste or fill).

New nitrile gloves were worn during the collection of each sample. Care was taken to ensure that representative samples were obtained from the depth required and that the integrity was maintained, particularly when dealing with potentially volatile and semi-volatile compounds.

All soil samples were placed in jars provided by the primary laboratory. All sample jars were fitted with Teflon lined lids. The jars were completely filled with soil, labelled with the date, unique sampling point identification and sampler information.

The soil jars, once filled with sample and sealed, were immediately placed in an esky / cool box in which a cooling medium had been added to keep the samples below a temperature of approximately 4^{o}C.

At the end of the sampling program the samples in the cool box were transported to the laboratory. Custody seals were placed on the esky / cool box for delivery to the laboratory under Chain of Custody (CoC).

All boreholes, not used as groundwater wells, were reinstated with the excavated material. Care was taken to reinstate boreholes with materials in the order in which they were excavated.

7.1.2 Photoionisation detection

A photo ionisation detector (PID) was used to detect and quantify potential organic vapours in open air and from soils during the investigative works. A PID operates on the principal that many organic compounds can be ionised when subjected to UV light. The greater the quantity of organic vapours in the sample, the larger the reading obtained from the PID.

The PID used for this investigation was an 'IonScience Prochecker Tiger' PID. The tests were conducted during the site investigation works using headspace analysis and in open air. Headspace analysis involved placing subject soils into a ziplock bag. The bag was filled halfway with the soil which allowed air space for the potential volatile compounds to accumulate. Soil samples were allowed to reach ambient air temperature prior to undertaking the PID screening.

The screening of samples was based upon the criteria outlined in **Table 7.1**. The calibration certificate for the PID is contained in **Appendix C**.

Table 7.1 – PID Screening Criteria

PID Reading	Generalised Soli Volatiles Content *(description relating to petroleum hydrocarbon contamination)*
<20 ppm	Negligible
20 – 60ppm	Low
60 – 300ppm	Moderate
>300 ppm	Significant

7.1.3 Laboratory analysis

Samples that were selected for analysis were generally based on depth, on visual observations, or PID results. The samples were analysed for the compounds detailed below.

To assess potential impacts associated with past operations of the site, 32 (28 primary and four QA/QC samples) fill / soil samples from the sampling locations were analysed for a combination of the following analytes:

- Twenty eight samples for heavy metals, Benzene, Toluene, Ethylbenzene, Xylenes (BTEX), Total Recoverable Hydrocarbons (TRH), and Polycyclic Aromatic Hydrocarbons (PAH).
- Eleven of the above samples were additionally analysed for polychlorinated biphenyls (PCB), organochlorine pesticides (OCPs) and asbestos.
- Four QA/QC samples analysed for BTEX and TRH.
- One trip blank and trip spike sample was analysed for BTEX only.
- Two samples were analysed for soil pH, cation exchange capacity (CEC) and clay content (CC).

7.1.4 Analytical methods

Jacobs commissioned Envirolab Services as the primary laboratory and SGS Laboratories as the secondary laboratory. Both of these laboratories are National Association of Testing Authorities (NATA) accredited for the testing undertaken.

Where appropriate, the soil samples were analysed in accordance with National Environmental Protection Council (NEPC 2013) guidelines using methods based on US Environment Protection Agency (US EPA) and American Public Health Association (APHA) approved analytical methods.

7.2 Groundwater sampling program

7.2.1 Groundwater sampling

Three groundwater wells were installed at the site (one well in an anticipated up gradient location, and two in anticipated down gradient locations) to assist in the assessment of groundwater characteristics and quality beneath the site. The groundwater investigation comprised:

- Construction of groundwater wells using 50mm Class 18UPVC screen and casing, graded sand, bentonite and completed flush with ground level with a gatic cover.
- Gauging of groundwater levels within all wells to assess depth to groundwater.
- Development, purging and sampling (using low flow techniques) of all newly installed groundwater wells.

Groundwater well installation details are included in the borelogs provided in **Appendix A**.

Fieldwork was undertaken in accordance with documented Jacobs procedures by experienced staff. The groundwater wells were developed using a dedicated PVC bailer for each well. Following development, the wells were allowed to stabilise for a minimum of 48 hours before being purged and sampled.

Groundwater wells were purged and sampled using a peristaltic pump. The pump had flow control to minimise drawdown and new dedicated, disposable polyethylene and silicon tubing was used for the collection of each sample. Care was taken to minimise the potential for volatile losses during sampling.

The electrodes of a calibrated water quality meter (calibration certificates are presented as **Appendix D**) were used to measure pH, redox potential (Eh), electrical conductivity, dissolved oxygen and temperature in water purged and sampled from the wells. Samples were collected following stabilisation of these water quality parameters (generally ± 10%).

All samples were collected with new disposable nitrile gloves. Dedicated tubing was used to purge and sample all wells negating the requirement to decontaminate equipment during the groundwater sampling event.

All groundwater samples were placed within laboratory provided sample containers (unpreserved glass and plastic and preserved glass and plastic) with Teflon lids. All sample containers were labelled with the sample number, project number, date obtained and site name.

Once filled, the caps were checked to ensure that they are secure (and that there are no air bubbles/head space) then placed within an esky / cool box in which a cooling medium had been added to keep the samples below a temperature of approximately 4^{o}C. Custody seals were placed on the esky / cool box for delivery to the laboratory under CoC.

7.2.2 Laboratory analysis

To assess potential impacts associated with past operations of the site, four (three primary and one QA/QC) groundwater samples were collected from the groundwater wells and analysed for:

- Dissolved heavy metals.
- BTEX.
- TRH.

8. Site Assessment Criteria

To address potential health and environmental impacts at the site, Jacobs compared the analytical test results against a set of health and ecological based soil and groundwater investigation levels to be referred to as Site Assessment Criteria (SAC) appropriate for the proposed land use (i.e. residential). That is, the SAC have been set at levels that provide confidence that contaminant concentrations below the SAC will not adversely affect human health or terrestrial/aquatic ecosystems.

The SAC developed for the investigation was derived from Schedule B1 Guideline on Investigation levels for Soil and Groundwater (NEPC, 2013).

8.1 Soil

8.1.1 Aesthetics

Aesthetics on sites relates to the presence of observable odours, discoloration and erroneous wastes materials in soil which could possibly indicate contamination. Such olfactory evidence can point to how receptors can be impacted by vapours on and migrating from the site. Odour threshold for organic substances can be exceeded in off-site settings (through groundwater transmission of hydrocarbons) and whilst may not represent a direct health risk, could possibly prompt civil action. Aesthetics was continually assessed during the investigation and reported on the field logs (where present).

8.1.2 Ecological investigation levels

The site and surrounding areas comprise residential land use, road reserves, coastal zones, sensitive environments, and public/open space. As such, ecological investigation levels (EILs) were considered as part of this investigation.

EILs were generated using the NEPC (2013) – Volume 2 – Table 1B (1-7). For this site it has been assessed that the EILs will apply to contaminants within the top 2 metres of soil at the surface / ground level which corresponds to the root zone and habitation zone of many species. Additionally, for this site the typical background concentrations are required to be calculated in order to derive EILs. To generate the EILs for the site, Jacobs have used the methodology as described in **Appendix B** and as summarised below.

EILs were generated for heavy metals, DDT and naphthalene. Samples BH14 / 4.0 and BH16 / 2.0 were assumed to be representative of the 'background concentration' of the site due to the likelihood of the samples being taken from natural soils, the depth of the samples (4.0 and 2.0 mbgl, respectively), and that the soils are unlikely to be impacted by anthropogenic sources. The EILs were calculated (where appropriate) using the NEPC (2013) equation:

$$\mathbf{EIL = ABC^{2} + ACL^{3}}$$

A summary of the adopted EILs is presented as **Table 8.1**.

Table 8.1 Ecological Investigation Levels (expressed as mg/kg).

Substance	Ecological Investigation Limit
Arsenic	100[1]
Cadmium	3[2]
Chromium	361 [3]

[2] ABC is ambient background concentration (the soil concentration in a specified locality that is the sum of the naturally occurring background level and the contaminant levels that have been introduced from diffuse or non-point sources by general anthropogenic activity).
[3] ACL is added contaminant limit (the added concentration (above the ABC) of a contaminant above which further appropriate investigation and valuation of the impact on ecological values is required).

Copper	96 [3]
Lead	1105 [3]
Mercury	1[2]
Nickel	32 [3]
Zinc	231 [3]
DDT	180 [1]
Naphthalene	170 [1]

[1]Generic EILs for aged arsenic, DDT and Naphthalene from **Table 1B(5)** for urban residential and public open space land use.
[2]EILs from NEPM 1999 (no EILs specified for contaminants in NEPM 2013).
[3]EILs derived from NEPM 2013 equation ABC+ACL.

8.1.3 Ecological screening levels

Ecological Screening Levels (ESLs) are focused on petroleum hydrocarbon and total recoverable hydrocarbon (TRH) compounds and are compared against actual site conditions (sub-surface materials and depth) to assess the potential risk to terrestrial ecosystems. For the purposes of calculating the ESLs, the generic soil type (i.e. three broad classes of sands, silts or clays) and land use need to be defined.

Sands and clays were the predominant soil types found underlying the site during the investigation. For the purpose of this assessment, and as a conservative approach, Jacobs consider sands to be most representative for the soil profile at the site.

Given the proposed end use of the site is residential, the corresponding land use and associated ESL was used to determine the assessment criteria, summarised in **Table 8.2**.

Table 8.2 ESLs for Petroleum Based Fractions (mg/kg)

Fraction	Ecological Screening Level[1]
F1 (C_6 – C_{10})	180
F2 (>C_{10} – C_{16})	120
F3 (>C_{16} – C_{34})	300
F4 (>C_{34} – C_{40})	2800
Benzene	50
Toluene	85
Ethylbenzene	70
Xylenes	105
Benzo(a)pyrene	0.7

[1]Table 1B(6) ESLs for TPH fractions F1 – F4, BTEX and Benzo(a)pyrene in soils - NEPM (2013).

8.1.4 Health investigation levels

To address potential health impacts at the site, Jacobs compared the analytical testing results against a set of health based Soil Investigation Levels (SILs) appropriate for residential land use in context of the proposed site zoning and taken into consideration the potential for contamination in soil to impact upon groundwater and generate vapours which could impact upon on site and off site human receptors. The health based SILs are a combination of Health Investigation Levels (HILs) and Health Screening Levels (HSLs). The adopted SILs for the site are summarised in **Table 8.3**.

HILs have been developed for a broad range of metals and organic substances. The HILs are applicable for assessing human health risk via all relevant pathways of exposure. The HILs are generic to all soil types and apply generally to a depth of 3 metres below the surface for residential use.

HSLs have been developed for selected petroleum compounds and fractions and are applicable to assessing human health risk via the inhalation and direct contact pathways. The HSLs depend on specific soil physico-chemical properties, land use scenarios, and the characteristics of building structures. They apply to different soil types, and depths below surface to >4 m. Further detail on their use is provided in Friebel and Nadebaum (2011a, 2011b & 2011c).

The HSLs defined within the NEPC 2013 relate only to the volatile fractions of the petroleum hydrocarbons range i.e. BTEX, naphthalene and TRH C_6 – C_{10}, TRH C_{10} – C_{16}.

The sites proposed land use is residential and has been classed as such for the purpose of this ESA. Therefore, Jacobs has adopted the lower value from the following criteria:

- NEPC (2013) Health Investigation Levels recommended for exposure setting 'A' which includes residential with gardens and accessible soils, childcare centres, preschools and primary schools.

Table 8.3 Soil Investigation Levels (expressed as mg/kg)

Substances	Soil Investigation Levels
Metals/Metalloids	
Arsenic (total)	100 [1]
Cadmium	20 [1]
Chromium (VI)	100 [1]
Copper	6,000 [1]
Lead	300 [1]
Mercury (inorganic)	40 [1]
Nickel	400 [1]
Zinc	7,400 [1]
Polychlorinated Biphenyls (PCB)	
PCBs	1 [1]
Polycyclic Aromatic Hydrocarbons (PAH)	
Naphthalene	3 [3]
BaP TEQ	3 [1]
Total PAH	300 [1]
Total Recoverable Hydrocarbons (TRH)	
C6-C10 (F1)	180 [2] / 45 [3]
>C10-C16 (F2)	120 [2] / 110 [3]
>C16-C34 (F3)	300 [2]
>C34-C40 (F4)	2,800 [2]
Asbestos	
Fibrous asbestos and asbestos fibres	No detectable asbestos
Organochlorine Pesticides[1]	
DDT+DDE+DDD	240
Aldrin and dieldrin	6

Substances	Soil Investigation Levels			
Chlordane	50			
Endosulfan	270			
Endrin	10			
Heptachlor	6			
HCB	10			
Methoxychlor	300			
Mirex	10			
Toxaphene	20			
F1, F2 and BTEX *(based on sand soil type)* [3]				
Depth (m)	*0 – <1*	*1 – <2*	*2 – <4*	*>4*
F1 (C6-C10)	45	70	110	200
F2 (>C10-C16)	110	240	440	NL
Benzene	0.5	0.5	0.5	0.5
Toluene	160	220	310	540
Ethylbenzene	55	NL	NL	NL
Xylenes	40	60	95	170
Naphthalene	3	NL	NL	NL

1 NEPC (2013) Table 1 A (1) Health investigations levels for soil contaminants – Residential A.
2 NEPC (2013) Table 1 B (6) ESLs for TPH fractions F1-F4, BTEX and benzo(a)pyrene in soil – Urban residential and public open space, fine grained soil texture.
3 NEPC (2013) Table 1 A (3) Soil HSLs for vapour intrusion – Low – high density residential, 0m to 1m, sand.
NL – NL indicates the HSL is not limiting.

8.1.5 Asbestos

NEPM (2013) provides health based screening levels for different forms of asbestos contamination in soil. To apply these screening levels, significant investigations, excavation and sample volumes are required to assess the volume of asbestos relative to soil. Jacobs have adopted a high level criterion to assess the presence / absence of asbestos in soil samples and whether additional investigations are required to assess the risk to site users. The high level criteria adopted by Jacobs is no asbestos in any form present in soil samples or observed in excavated materials.

8.1.6 Management Limits

Within NEPC (2013) Management Limits are applied to petroleum hydrocarbons which are considered in addition to the SAC (HILs, EILs, ESLs etc.). These Management Limits reflect the nature and properties of petroleum hydrocarbons and their potential effects such as:

- Formation of observable light non-aqueous phase liquids (LNAPL).
- Fire and explosive hazards.
- Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services by hydrocarbons.

The application of the management limits will require site specific factors to be considered in more detail. These factors include, but are not limited to, depth of building basements and services and depth to groundwater in order to determine the maximum depth to which the limits should apply.

When the management limits are exceeded, further site-specific assessment and management may enable any identified risk to be addressed, as follows:

From the NEPM (2013) *"the presence of site TPH contamination at the levels of the management limits does not imply that there is no need for administrative notification or controls in accordance with jurisdiction requirements".*

Table 8.4 Management Limits: TPH fractions F1–F4 in soil (adapted from NEPC 2013 Schedule B1)

TPH fraction	Soil texture	Management Limits[1] (mg/kg dry soil)
		Residential, parkland and public open space
F1[2] C_6- C_{10}	*Coarse*	700
F2[2] >C_{10}-C_{16}	*Coarse*	1,000
F3 >C_{16}-C_{34}	*Coarse*	2,500
F4 >C_{34}-C_{40}	*Coarse*	10,000

1 Management limits are applied after consideration of relevant HSLs.
2 Separate management limits for BTEX and naphthalene are not available hence these should not be subtracted from the relevant fractions to obtain F1 and F2.

8.2 Groundwater

8.2.1 Groundwater investigation levels

Groundwater investigation levels (GILs) are the concentrations of a contaminant in groundwater above which further investigation (point of extraction) or a response (point of use) is required. GILs are based on Australian water quality guidelines and drinking water guidelines and are applicable for assessing human health risk and ecological risk from direct contact (including consumption) with groundwater.

The NSW EPA has endorsed the use of the water quality trigger levels given in the Australia and New Zealand Environment and Conservation Council (ANZECC 2000) guidelines. These guidelines provide criteria for aquatic ecosystems (marine and fresh waters), primary industries, recreational water and drinking water.

For the protection of the aquatic ecosystems below the site, the most appropriate GILs are generally the 95% protection levels for marine water given in the ANZECC (2000) guideline. Where the guideline does not provide these criteria or the guideline considers the 95% protection level is inappropriate, GILs were sourced by using:

- The 99% protection levels for marine ecosystems given in the guidelines for contaminants considered to be bioaccumulative (e.g. cadmium, mercury, nickel).
- The 99% and 95% protection levels for fresh water ecosystems provided in the ANZECC (2000) guidelines (where applicable/available).
- NEPC (2013) prescribed GILs.
- Low reliability trigger values provided in the ANZECC (2000) guidelines.
- The Dutch (2000) groundwater intervention levels for TPH fractions. The mineral oil criterion of 600µg/L was adopted for TPH (C_{10}-C_{40}) range.

During the investigation the static groundwater levels across the site were encountered between 5.8 mbgl and 8.2 mbgl. As a conservative measure, the HSLs for groundwater have been adopted from the 4 m to <8m range in Table 1A(4) Groundwater HSLs for vapour intrusion (mg/L). A summary of the adopted GILs are provided in **Table 8.5**.

Table 8.5 Groundwater investigation levels (expressed as ug/L)

Compounds	Ecosystem protection levels - Marine
Metals and metalloids	
Arsenic	24 [A]
Cadmium	0.7 [B]

Compounds	Ecosystem protection levels - Marine
Chromium	27.4 [C]
Copper	1.3 [C]
Lead	4.4 [C]
Mercury	0.1 [B]
Nickel	7 [B]
Zinc	15 [C]
Polycyclic Aromatic Hydrocarbons	
Naphthalene	50 [B]
B(a)P mg/l	0.01 [E]
PAHs	3.0 [F]
Total Recoverable Hydrocarbons	
TRH C_6-C_9	***Refer Table 8.6***
TRH C_{10}-C_{40}	600 [G]
Benzene	500 [B]
Ethylbenzene	140 [D]
Toluene	300 [D]
o-xylene	350 [A]
p-xylene	200 [A]
PCBs	
Aroclor 1242	0.3 [A]
Aroclor 1254	0.01 [A]
OCPs	
Aldrin & Dieldrin	0.0003 [E]
Atrazine	13 [A]
Chlordane	0.03 [A]
Chlorpyrifos	0.009 [B]
DDT	0.006 [A]
Endosulfan	0.005 [B]
Endrin	0.004 [B]
Heptachlor	0.01 [A]

Notes:

A - ANZECC (2000) 95% of species protected – freshwater
B - ANZECC (2000) 99% of species protected – marine water
C - ANZECC (2000) 95% of species protected – marine water
D - NSW EPA (1994) Protection of aquatic ecosystems - freshwater
E – Drinking Water Guidelines
F - ANZECC – see NSW EPA 1994 service station guidelines
G - Dutch (2000) groundwater intervention levels

Groundwater protection may be a particular concern where contamination occurs in sandy soils containing naturally low levels of organic matter, clay and trace elements. In most situations, soil contaminants at levels below appropriate EILs or HILs do not pose a threat to local groundwater sources. However, possible impacts on groundwater should always be considered particularly for sites impacted by petroleum hydrocarbons and

halogenated solvents. In some cases the soil may not reveal contaminants of concern while groundwater is affected.

HSLs for soil and soil vapour (**Table 8.3**), groundwater (**Table 8.5**), and groundwater vapour intrusion (**Table 8.6**) apply to exposure to petroleum hydrocarbons through the dominant vapour inhalation exposure pathway only.

The soil and groundwater HSLs are based on three-phase equilibrium theory and soil vapour is limited by the maximum solubility limit of the chemical in the soil pore water phase or the groundwater. The soil saturation concentration of a particular contaminant is the condition where pore water is at its solubility limit and soil vapour is at the maximum vapour concentration. When a calculated HSL in soil or groundwater exceeds this limit, the vapour in the soil or above groundwater cannot result in an unacceptable vapour risk and is denoted as NL (not limiting) in the HSL tables (Tables 1 A(3) – 1A(5)). Soil vapour HSLs are based on the vapour pressures of individual chemicals. Calculated soil vapour HSLs that exceed the possible maximums are similarly denoted as NL.

HSLs for soil, groundwater and soil vapour have been developed for sand, silt and clay soils based on the US soil texture classification system (Friebel & Nadebaum 2011a). The HSLs assume a uniform soil profile and the soil texture making up the greatest proportion of the soil profile should be used in selecting the appropriate HSLs (Friebel & Nadebaum 2011a and 2011b).

The heavier end fractions, >C_{16}-C_{34} and >C_{34}-C_{40} are not volatile and as such are not included within the groundwater HSLs for vapour intrusion.

Table 8.6 Groundwater HSLs for vapour intrusion (mg/L)

Contaminants	Groundwater investigation levels (HILs / HSLs)
	Low – high density residential (A)
F1, F2 and BTEX (*Based on a SAND soil type*) [1, #]	
Depth (m)	*4 – <8*
F1 (TRH C_6-C_{10})	1
F2 (TRH >C_{10}-C_{16})	*1*
Benzene	0.9
Toluene	*NL*
Ethylbenzene	*NL*
Xylenes	*NL*
Naphthalene	*NL*

1 NEPC (2013) Table 1 A(4) Groundwater HSLs for vapour intrusion –low – high density residential, 4 to <8m, SAND.

Soil Vapour as the primary Exposure Pathway to impact potential receptors

NL – No Limit: No limit exists for these contaminants based on the function of the solubility limit, the soil vapour and groundwater.

9. Quality Assurance and Quality Control

Field and laboratory Quality Assurance / Quality Control (QA/QC) requirements (where applicable) compliant with NEPC (2013) requirements undertaken as part of the field work program are outlined below.

All soil and groundwater samples were collected by an experienced Jacobs scientist, under established Jacobs protocols. Jacobs personnel have been trained in sample collection and handling techniques.

For the purpose of assessing the quality of data presented in this report, Jacobs collected and analysed a Quality Control (QC) sample (field QC sample), while the laboratory completed their own internal QC. This section of the report is focused on the presentation of results of these QC samples, adherence to Quality Assurance (QA) systems and discussion of deviations, if any.

9.1 Field quality assurance - soil

9.1.1 Blind replicates

Two blind duplicate samples, QAQC2 and QAQC3, (blind duplicates of primary samples GW02 / 3.0 and GW03 / 1.0, respectively) were analysed to assess the QC during the field sampling program. This equates to 7% blind replicate analysis. This blind replicate analysis is above and therefore conforms to the Australian Standard (AS 4482.1-2005) *Guide to the sampling and investigation of potentially contaminated soil – Part 1: Non-volatile and semi-volatile compounds* requirement of 5%.

The acceptable Relative Percentage Difference (RPD) range is dependent upon the concentrations of the analytes detected:

- 0 – 100% RPD (when the average concentration is < 4 times the laboratory Limit Of Reporting (LOR)).
- 0 – 50% RPD (when the average concentration is 4 to 10 times the laboratory LOR).
- 0 – 30% RPD (when the average concentration is > 10 times the laboratory LOR).

The results of the duplicate sample analysis for all analytes reported RPDs within the acceptable limits. The RPD results are presented in **Table A**.

9.1.2 Split replicates

Two split replicate samples, QAQC4 and QAQC5 (replicates of soil samples GW03 / 1.0 and BH10 / 2.0, respectively) were analysed to assess the quality control employed during the field sampling program. This equates to 7% split replicate soil analysis which conforms to the *Australian Standard (AS 4482.1 – 2005)* requirement of 5%.

The results of the split replicate sample analysis for all analytes reported RPDs within the acceptable limits. The RPD results are presented in **Table A**.

9.1.3 Trip blanks

One trip blank was submitted with the soil samples delivered to the laboratory. The trip spike sample was analysed for BTEX only. The acceptance criteria for trip blank samples is no concentrations of BTEX within the sample analysed. The concentrations of BTEX compounds in the trip blank were below the respective LORs and therefore met the acceptance criteria for trip blanks. Results of the trip blank are found in **Table C.**

9.1.4 Trip spikes

One trip spike was submitted with the soil samples delivered to the laboratory. The trip spike sample was analysed for BTEX only. The acceptance criteria for trip spikes are 70 – 130% recoveryThe trip spike returned recoveries for BTEX within the acceptable ranges. Results of the trip spike are found in **Table C.**

9.2 Laboratory quality assurance and quality control - soil

All analysis was undertaken by a NATA accredited laboratory using NATA accredited analytical methods. Laboratory QA/QC data is presented in full in the laboratory certificates in **Appendix C.**

9.2.1 Laboratory duplicates

RPDs for all laboratory duplicate samples were within the acceptable ranges for RPD results.

9.2.2 Laboratory control samples

Recoveries for laboratory control samples conformed to the ranges within the laboratory QA/QC evaluation criteria.

9.2.3 Surrogates

Recoveries for laboratory surrogate samples conformed to the laboratory acceptance criteria.

9.2.4 Matrix spikes

All matrix spike data conformed to the laboratory acceptance criteria with recorded ranges within the laboratory QA/QC evaluation criteria.

9.2.5 Method blanks

All method blanks reported analyte concentration below the laboratory LOR and therefore conformed to the laboratory acceptance criteria.

9.2.6 Sample holding times

All samples were extracted and analysed within the specified holding times.

9.2.7 Sample condition

All samples were received by the analytical laboratories in correctly preserved and chilled containers with no reported breakages. Sample receipt notifications are presented with the laboratory reports in **Appendix C**.

9.3 Field quality assurance – water

9.3.1 Blind replicates

One blind replicate, QAQC1 (replicate of water sample GW02) was analysed to assess the quality control employed during the groundwater sampling event. This equates to 33% blind replicate water analysis which exceeds and conforms to the *AS 4482.1 – 2005* standard requirement of 5%.

RPDs for the blind replicate analysis are contained in **Table B**. The results of the blind replicate sample analysis were equal or comparable (within one order of magnitude difference) to the analyte concentrations reported in the primary sample for all analytes.

No split replicates, trip blanks, or trip spikes were analysed as part of the groundwater fieldworks because of the small number of primary samples collected.

9.4 Laboratory quality assurance and quality control – water

9.4.1 Laboratory duplicates

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

9.4.2 Laboratory control samples

Recoveries for laboratory control samples conformed to the ranges within the laboratory acceptance criteria.

9.4.3 Surrogates

Recoveries for laboratory surrogate samples conformed to the laboratory acceptance criteria.

9.4.4 Matrix spikes

All matrix spike data conformed to the laboratory acceptance criteria with recorded ranges within the laboratory QA/QC evaluation criteria.

9.4.5 Method blanks

All method blanks reported analyte concentration below the laboratory LOR and therefore conformed to the laboratory acceptance criteria.

9.4.6 Sample holding times

All samples were extracted and analysed within the specified holding times.

9.5 QA/QC conclusion

It is concluded that laboratory data are of acceptable quality and are considered useable in making conclusions and recommendations regarding the site.

10. Results

Results of the additional ESA are detailed in the following section.

10.1 Site stratigraphy

The sub-surface material encountered across the site generally consisted of natural sandy and clayey materials, and fill material in the form of gravelly sands or clays with organic material and ash inclusions. The operational areas were characterised by a layer of fill material/reworked natural material overlying the natural sandy/clayey soils. The unused vegetated areas were characterised by mainly silty topsoil overlying natural sandy/clayey soils with some fill material noted in some boreholes.

Bedrock was not encountered in any of the sampling locations to a maximum depth of 10.5 mbgl.

A generalised stratigraphic log is presented as **Table 10.1**. Borelogs are presented in **Appendix A**.

Table 10.1 Generalised site stratigraphic log

Material	Depth (top of unit)	Depth (base of unit - bgl)
Natural: Sand	0.0 m (BH10, BH11, BH14)	4.0 m (BH06)
Natural: Sandy clay	0.8 m (BH18)	10.5 m (GW01, GW02, GW03)
Fill: clayey/sandy gravel	0.0 m (GW01)	1.5 m (BH03, BH07, BH13)

Soil moisture of varying degrees was present in the majority of soil bores; however groundwater was only encountered in GW01, GW02 and GW03. The groundwater depth varied between 5.8 mbgl (GW01) and 8.2 mbgl (GW02) across the site.

10.2 Intrinsic groundwater parameters

The general water quality parameters measured at the respective groundwater well locations are presented in **Table 10.2**.

Table 10.2 Intrinsic groundwater quality parameters (in field measurements sampled 27.11.14)

Location	EC (uS/cm)	pH	Redox (mV)	DO (mg/l)	Temperature (^{o}C)
GW01	1674	4.37	-14.3	0.94	19.6
GW02	228.8	4.64	138.3	2.04	20.0
GW03	555.3	4.27	143.0	2.55	19.7

The general water quality parameter measurement indicated the following:

- pH was generally acidic and ranged from 4.27 pH units in GW03 to 4.64 pH units in GW02.
- Electrical conductivity (EC) ranged from 228.8 µS/cm in GW02 to 1674 µS/cm in GW01. GW02 recorded the lowest EC, which was located towards the western portion of the site, with the highest EC level recorded in GW01 located towards the eastern portion of the site. The results indicate fresh groundwater conditions.
- Temperature ranged from 19.6^{o}C (GW01 – eastern boundary) to 20.0^{o}C (GW02 – western boundary).
- Redox potential ranged from -14.3 mV in GW01 to 143.0 mV in GW03. The redox potential results indicate a generally oxidising groundwater environment.

Groundwater field data sheets are provided in **Appendix D**.

10.3 Olfactory and visual observations

Visual and olfactory observations are provided in **Table 10.3**. The results of the headspace analysis are detailed in the borelogs within **Appendix A.** A number of aesthetic issues (i.e. presence of odours and discoloured soils) were observed during the fieldwork program as detailed in **Table 10.3**.

Table 10.3 Visual and olfactory observations

Ref	Location	Olfactory / Visual Observations
BH01	Eastern boundary, adjacent to fence line.	Malodourous material at 1.5 mbgl.
BH02	Within area of pre-existing USTs.	Malodourous material throughout soil bore (0.2 – 4.0 mbgl). Fill material observed.
BH03	Within area of pre-existing USTs.	Fill material present.
BH04	Adjacent to area with pre-existing ASTs.	Malodourous material present between 0.0 and 3.0 mbgl.
BH05	Area adjacent to Building G.	Fill material present.
BH06	Washbay	Fill and malodourous material present.
BH07	Adjacent to area with pre-existing ASTs.	Fill material present.
BH08	Adjacent to area with pre-existing ASTs.	Malodourous material present.
BH09	Within grassed area in west of site.	No evidence of contamination.
BH10	Within grassed area in west of site.	No evidence of contamination.
BH11	Within grassed area in west of site.	No evidence of contamination.
BH12	Within grassed area in west of site.	No evidence of contamination.
BH13	Adjacent to vehicle parking/maintenance in centre of site.	Fill and malodourous material present.
BH14	Within grassed area along western boundary.	No evidence of contamination.
BH15	Adjacent to vehicle parking/maintenance in centre of site.	Fill and malodourous material present.
BH16	Within centre of site.	Fill and malodourous material present.
BH17	Adjacent to vehicle parking/maintenance in centre of site.	Fill material present.
BH18	Adjacent to maintenance workshop (Building D).	Fill and malodourous material present.
GW01	Along eastern boundary.	Fill material present.
GW02	Along western boundary.	Malodourous material present in top 0.2 m.
GW03	Along western boundary.	No evidence of contamination.

During the ESA, Jacobs personnel observed all soils which were excavated and sampled. Potential Asbestos Containing Material (ACM) was not observed in the soils excavated and sampled by Jacobs personnel.

10.4 PID headspace results

Results of the PID headspace analysis ranged from 0.0 ppm to a maximum of 1812 ppm (GW01 at 0.5 mbgl). Significant concentrations (i.e. >300ppm) of vapour (as Volatile Organic Compounds) were detected across the site at varying depths.

Selected soil samples with higher PID readings were analysed for TRH C_6 – C_9 and BTEX, of which the samples returned results below the laboratory LOR for BTEX and TRH C_6 – C_9. There is the potential for moisture, water vapour, and high humidity to affect PID readings. The PID provided by the rental company did include a moisture trap. The Bureau of Meteorology reported that conditions on site for the period of works increased from 47% relative humidity to 74% over the course of the works. The soil moisture within the PID headspace sample, combined with onsite relative humidity could potentially have led to increased PID results.

10.5 Soil analytical results

Soil analytical results are presented below and in **Table D**. Laboratory certificates of analysis are presented in **Appendix C.**

10.5.1 Heavy metals

The concentrations of heavy metals in all samples analysed were below the SAC.

10.5.2 BTEX

The concentrations of BTEX compounds in all samples analysed were below the LOR and below the SAC.

10.5.3 TRH

The concentrations of TRH compounds in all samples analysed were below the LOR and SAC with the exception of those compounds found in sample BH03 / 4.0. **Table 10.4** summarises the results which exceed the adopted SAC.

Table 10.4 TRH concentrations exceeding SAC (all results in mg/kg)

Location	Depth (m)	C6-C10 (F1)	>C10-C16 (F2)	>C16-C34 (F3)	>C34-C40 (F4)	Criteria Exceeds
SAC			**120**	**300**		**ESL**
BH03	4.0	-	870	770	-	Ecological Screening Levels
SAC			**110**			**HSL**
BH03	4.0	-	870			Health Screening Levels

10.5.4 PAH

The concentrations of PAHs compounds in all samples analysed were below the SAC.

10.5.5 PCB

The concentrations of PCBs compounds in all samples analysed were below the LOR and below the SAC.

10.5.6 OCP

The concentrations of OCPs compounds in all samples analysed were below the LOR and below the SAC.

10.5.7 Asbestos

Asbestos was not detected as fragments or available fibres in all samples analysed and therefore meet the SAC.

10.6 Groundwater analytical results

Water analytical results are presented below and in **Table E**. Laboratory certificates of analysis are presented in **Appendix C.**

10.6.1 Heavy metals

The concentrations of heavy metals in all samples analysed were below the SAC and / or the LOR with the exception of copper and zinc (GW01) and nickel (GW03). GW01 recorded copper concentrations of 4 ug/L which exceeded the SAC of 1.3 ug/L, and zinc concentrations of 23 ug/L which exceeded the SAC of 15 ug/L. GW03 recorded nickel concentrations of 13 ug/L which exceeded the SAC of 7 ug/L.

10.6.2 BTEX

The concentrations of BTEX compounds in all samples analysed were below the LOR and below the SAC.

10.6.3 TRH

The concentrations of TRH compounds in all samples analysed were below the LOR and below the SAC.

10.7 Management limits for Petroleum Hydrocarbon Compounds

The management limits have been developed to assist in the assessment of petroleum hydrocarbon compounds however the application of these limits needs to take into consideration site specific factors such as depth of building basements, services, depth to groundwater in order to determine the maximum depth to which the limits should apply.

All samples analysed recorded concentrations below the management limits for petroleum hydrocarbon compounds.

11. Discussion

The following section provides a discussion of the main findings of the additional ESA based on a review of background information, asbestos clearance works, site observations and the sampling and analysis undertaken across the site.

11.1 Soil

Samples of soil / fill material collected from the boreholes were analysed for contaminants of concern which were associated with the former use of the site and were also based on previous investigation data. .

Jacobs collected soil samples at various depths to gain an indication of potential contamination distribution. The only exceedances for soil analytical results were for reported in the sample collected from BH03 at a depth of 4.0mbgl which exceeded the Ecological Screening Levels for TRH $>C_{10} – C_{16}$ and $>C_{16} – C_{34}$, and the Health Screening Levels for $>C_{10} – C_{16}$. Sample BH03 / 4.0 was taken from the area from which anecdotal evidence suggests USTs had previously been removed. The source of the TRH at this location is likely to be associated with the previous storage of petroleum products within the USTs. Sample BH02 (also taken from within this UST area) returned concentrations of TRH below the LOR, and BH04 (down gradient of BH03) returned concentrations below the SAC, indicating that elevated TRH concentrations are potentially localised within this area (i.e. in the vicinity of BH03).

Ecological Screening Levels have been developed for selected petroleum hydrocarbon compounds and TRH fractions and are applicable for assessing risk to terrestrial ecosystems. ESLs broadly apply to coarse and fine grained soils and various land uses. They are generally applicable to the top 2.0 metres of soil which corresponds to the root zone and habitation zone for many species. The risks to ecological receptors at BH03 / 4.0 is considered low given that the hydrocarbons were found at depths greater than 2.0 mbgl.

Health Screening Levels have been developed for selected petroleum compounds and fractions and are applicable to assessing human health risk via the inhalation and direct contact pathways. The HSLs apply to different soil types and depths below surface to >4.0 metres. As a conservative measure, Jacobs had adopted the HSLs for a sandy material as a general site soil material. However, considering the soil profile within BH03 (i.e. predominantly clay soil), the HSL for clay soils are likely to be more applicable for this discrete location. The HSLs for clay soils has a 'not limiting' result for soils between 2.0 mbgl and 4.0 mbgl for fine grained soils. When a calculated HSL in soil (or groundwater) exceeds the maximum solubility limit of the chemical in the soil the vapour in the soil cannot results in an unacceptable vapour risk and is denoted not limiting, hence the concentration of TRH $>C_{10} – C_{16}$ presents a low risk with respect to human health at BH03 at a depth of 4.0 mbgl.

Additionally, the TRH concentrations reported in the sample BH03 / 4.0 do not exceed the petroleum hydrocarbon management limits. However, the TRH concentrations at location BH03 / 4.0 should be considered when considering the depth of building basements, services, and underground structures with respect to aesthetic issues (i.e. hydrocarbon odours).

PID results initially indicated the presence of VOCs in some soil samples; however the laboratory analytical results recorded concentrations of BTEX and TRH C_6-C_9 compounds below the laboratory LOR. As previously mentioned in **Section 6.4** there is the potential for moisture, water vapour, and high humidity to affect PID readings. The soil moisture within the PID headspace sample, combined with on site relative humidity could potentially have led to increased PID results. Jacobs consider the laboratory analytical results to be accurate and representative of sub surface soil conditions.

Aesthetics were monitored throughout the investigation. Aesthetics on sites relates to the presence of observable odours, discoloration and erroneous wastes materials in soil which could possibly indicate contamination. As discussed in **Table 10.3** fill and malodourous materials were indiscriminately located across the site. Visual or olfactory erroneous materials were submitted for laboratory analysis. All samples recorded concentrations below the adopted SAC.

Asbestos was not detected as fragments or available fibres in the samples submitted for asbestos identification and therefore meet the SAC. During a later site walkover, pieces of potential ACM were observed at two locations across the site. At the time of the investigation, Jacobs informed Ausgrid of the location and quantity of the potential ACM. Ausgrid undertook asbestos removal works from site surface soils via internal asbestos management services with visual clearance inspection undertaken by Progressive Risk Management (PRM). Following removal works, PRM concluded that removal work area within Ausgrid Noraville depot was suitable for reoccupation. Confirmation of the removal of the on site surface asbestos can be found in the PRM (2014) Asbestos Clearance Certificate, Ausgrid Noraville Depot provided by Ausgrid which is provided in **Appendix F**.

11.2 Groundwater

Four groundwater samples (three primary samples and one QA/QC sample) were collected during this ESA from wells installed during the investigation. The wells were used to provide an indication of groundwater quality across the site both up and down gradient on potential on site contamination sources.

The groundwater was analysed for heavy metals (dissolved), TRH, and BTEX.

All groundwater samples recorded concentrations of contaminants which were below the adopted SAC (receptor based – marine ecosystems) with the exception of copper at GW01 with a concentration of 4 µg/l against the SAC of 1.3 µg/l, nickel at GW03 with a concentration of 13 µg/l against the SAC of 7 µg/l, and zinc at GW01 with a concentration of 23 µg/l against the SAC of 15 µg/l.

GW01 is located in the anticipated up gradient (i.e. background) position for the site, and hence the copper and zinc exceedances are expected to be examples of background concentrations and are considered to be a low risk for future site users.

The source of the nickel exceedance found in GW03 is unknown given that there are no apparent nickel sources originating from the site, as well as no nickel exceedances in the soil analytical results. The nickel exceeded the SAC by less than double the concentration recommended. Considering that a nickel source is unlikely to be present on the site, Jacobs do not consider that the nickel concentration detected in GW03 is likely to be associated with contamination (if present) on the site. Considering that the nearest environmental receptor for groundwater from the site is Lake Tuggerah (located over one kilometre from the site), the effects of dilution and advection are likely to influence a reduction in nickel concentrations beyond the site boundary and is unlikely to pose a risk to ecosystems within Lake Tuggerah.

12. Conclusions and Recommendations

Jacobs has undertaken an additional ESA at the Noraville Depot in Noraville, NSW to assess contamination issues at the site which may have arisen from past activities undertaken on and/or adjacent to the site since 2002, which may represent a potential risk to human health and/or environmental receptors. The ESA was undertaken in order to assist Ausgrid in the divestment and rezoning of the site from commercial/industrial to residential land use.

12.1 Conclusions

Based on the results of the additional ESA and subsequent surface ACM removal works indicate that risks to human health and the environment from past activities on site are low considering a potential residential land use or general occupancy (in terms of surface ACM). The key findings of the ESA are as follows:

- Based on the results of the investigations undertaken in 2002, PPK considered that the site was generally suitable for development for residential or commercial/industrial land use.
- Between 2009 and 2012 Noel Arnold and Associates conducted asbestos materials surveys at the Noraville Depot. The results indicated that of the 18 samples collected from building materials across the site, 15 of those returned positive analysis for asbestos containing materials (i.e. chrysotile, crocidolite or amosite asbestos).
- The results of the HAZMAT Services air quality monitoring at the site (2012) showed that none of the 12 air monitoring locations reported observable concentrations of airborne fibres.
- On inspection of Building D (mechanics workshop) some moderate areas of staining were present adjacent to services (sink, hot water system, waste oil collection tank, bunds for waste coolant drums, two tonne crane). The waste oil collection tank also appeared to either be leaking or had experienced a recent spill as oil was present on the hardstand of the building adjacent to the tank. The hardstand within the building was observed to be in a good condition with no major cracking or separation. In consideration of the good condition of the concrete slab within this building, the risk of oil impacting upon underlying soils in this location is likely to be low.
- The sub-surface material encountered across the site generally consisted of natural sandy and clayey materials, and fill material in the form of gravelly sands or clays with organic material and ash inclusions. The operational areas were characterised by a layer of fill material/reworked natural material overlying the natural sandy/clayey soils. The unused vegetated areas were characterised by mostly silty topsoil overlying natural sandy/clayey soils with some fill material noted in some boreholes.
- Groundwater quality parameters indicate that the water underlying the site is a generally acidic, oxidising, freshwater environment.
- TRH $>C_{10} – C_{16}$ and $>C_{16} – C_{34}$ concentrations exceeded the adopted SAC (ESLs and HSLs) at sample location BH03 / 4.0. The source of the TRH at this location is likely to be associated with the former storage of petroleum product within USTs in this area.
- The risks to ecological receptors from TRH concentrations reported in sample BH03 / 4.0 is considered low given that the hydrocarbon impacts were found at depths greater than 2.0 mbgl (i.e. at depths below which corresponds to the root zone and habitation zone for many terrestrial species).
- The concentration of TRH $>C_{10} – C_{16}$ reported in sample BH03/4.0 is likely to represent a low risk with respect to human health given that Jacobs have adopted the clay HSLs for this sample location which have a ‘not limiting’ result for soils between 2.0 mbgl and 4.0 mbgl for fine grained soils (i.e. the vapour in the soil cannot results in an unacceptable vapour risk).
- The TRH concentrations reported in the sample BH03 / 4.0 do not exceed the petroleum hydrocarbon management limits, however, the TRH concentrations should be addressed when considering the depth of building basements, services, and underground structures in this area with respect to aesthetic issues (i.e. hydrocarbon odours).
- Aesthetics were monitored throughout the investigation. Visual or olfactory erroneous materials were submitted for laboratory analysis. All samples recorded concentrations below the adopted SAC.

- The soil moisture within the PID headspace sample, combined with on site relative humidity could potentially have led to elevated PID results. Jacobs consider the laboratory analytical results to be accurate and representative of sub surface soil conditions.
- Asbestos was not detected as fragments or available fibres in the samples submitted for laboratory identification and therefore meet the SAC, however during the site walkover pieces of potential ACM were observed at two locations across the site. Surface ACM has subsequently been removed from the site and the site cleared as being suitable for reoccupation.
- All groundwater samples recorded concentrations of contaminants which were below the adopted SAC (receptor based – marine ecosystems) with the exception of copper at GW01 with a concentration of 4 µg/l against the SAC of 1.3 µg/l, nickel at GW03 with a concentration of 13 µg/l against the SAC of 7 µg/l, and zinc at GW01 with a concentration of 23 µg/l against the SAC of 15 µg/l.
- Exceedances in groundwater samples are considered to present a low risk with respect to contamination from on site activities and are not likely to represent a risk to off-site environmental receptors.

12.2 Recommendations

Based on the results of the additional ESA, Jacobs recommends that the site is suitable for residential land use as per the requirements outlined in NEPM 2013. With respect to asbestos, no ACM (fibres or bonded materials) were identified in any soil sample collected and submitted for asbestos identification during the additional ESA. Additionally, subsequent surface ACM removal works by Progressive Risk Management (2014) indicated that site was suitable for general occupancy (in terms of surface ACM). Jacobs also recommends the following actions to address the potential risks (albeit low) identified at the site:

- Where excavation works are required from underneath/surrounding Building D (mechanics workshop) a project Construction Environmental Management Plan (CEMP) or similar should be prepared detailing contingency measures. These measures would manage potentially contaminated materials if materials are suspected and/or encountered, and may include:
  - Stop work procedures: a suitably qualified and experienced consultant should then assess whether material is or is not contaminated.
  - Treat suspected contaminated material as actually contaminated material and employ adequate environmental and safety controls.
- The TRH concentrations at location BH03 / 4.0 and associated aesthetic issues should be addressed when considering the depth of building basements, services, and underground structures in the vicinity of this location.

13. References

Jacobs (2014) *Request for Quotation – Additional Contamination Assessment and Hazardous Materials Survey – Noraville Depot*, Jacobs, Australia.

NSW Department of Mineral Resources, *1:250,000 Sydney Geological Series Sheet S1 56-5*, Australia.

PPK Environment & Infrastructure (2002) *Detailed Site Investigation – Energy Australia Depot – Brisbane Street, Noraville, NSW*, PPK, Australia.

Soil Conservation Service of NSW, *1:100,000 Gosford – Lake Macquarie Soil Landscape Series Sheet 9131-9231*, Australia.

Wyong Shire Council (2014) *On-line Mapping – Land Zoning*, Wyong Shire Council, Australia.

PRM (December 2014) *Asbestos Clearance Certificate. Ausgrid Noraville Depot, Wilfred Barrett Drive (Central Coast Highway), Noraville NSW P099.*

Figures

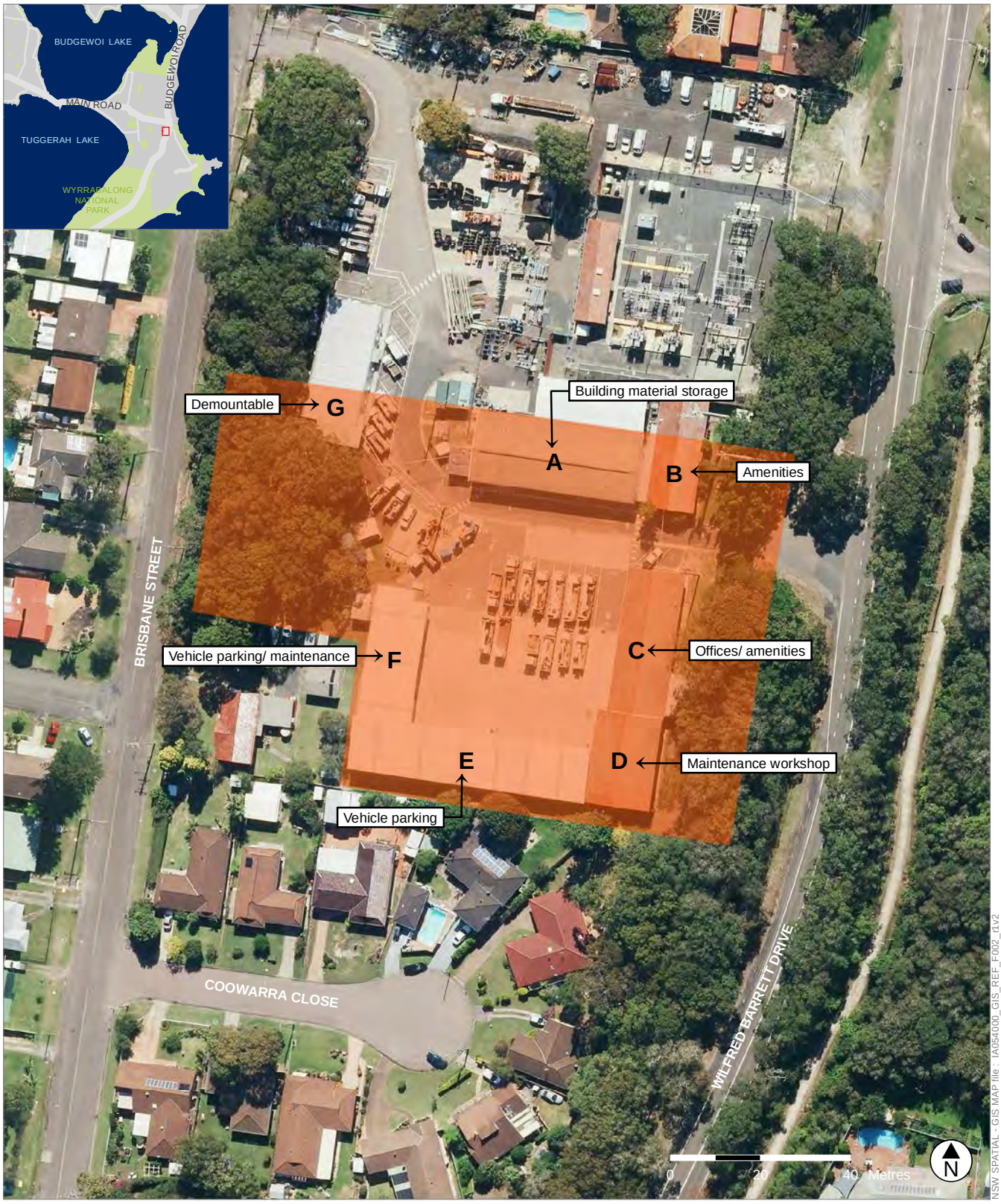
NSW SPATIAL - GIS MAP file : IA054000_GIS_REF_F001_r1v2

Study area

Park

Figure 1 - Location plan

JACOBS



Study area

Figure 2 - Site layout and Building Reference System

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Study area

Borehole

Groundwater

Figure 3 - Locations of boreholes at Noraville Depot

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Tables

TABLE A - RPD QA/QC

Noraville Depot - Additional ESA

All results in mg/kg

Lab Reference		119622	119622		119622	119622		119622	119622		119622	119622	
SAMPLE ID	**PQL**	GW02 / 3.0	QAQC2	**RPD**	GW03 / 1.0	QAQC3	**RPD**	GW03 / 1.0	QAQC4	**RPD**	BH10 / 2.0	QAQC5	**RPD**
Date of Sampling		18/11/2014	18/11/2014		18/11/2014	18/11/2014		18/11/2014	18/11/2014		19/11/2014	19/11/2014	
Matrix		Soil	Soil		Soil	Soil		Soil	Soil		Soil	Soil	
TOTAL RECOVERABLE HYDROCARBONS													
TRH C6 - C9	25	<25	<25	0%	<25	<25	0%	<25	<25	0%	<25	<25	0%
TRH C6 - C10	25 / 20	<25	<25	0%	<25	<25	0%	<25	<20	0%	<25	<20	0%
TRH C10 - C14	50 / 20	<50	<50	0%	<50	<50	0%	<50	<20	0%	<50	<20	0%
TRH C15 - C28	100 / 45	<100	<100	0%	<100	<100	0%	<100	<45	0%	<100	<45	0%
TRH C 29 - C36	100 / 45	<100	<100	0%	<100	<100	0%	<100	<45	0%	<100	<45	0%
TRH >C10 - C16	50 / 25	<50	<50	0%	<50	<50	0%	<50	<25	0%	<50	<25	0%
TRH >C16 - C34	100 / 90	<100	<100	0%	<100	<100	0%	<100	<90	0%	<100	<90	0%
TRH >C34 - C40	100 / 120	<100	<100	0%	<100	<100	0%	<100	<110	0%	<100	<110	0%
BTEX COMPOUNDS													
Benzene	0.2 / 0.1	<0.2	<0.2	0%	<0.2	<0.2	0%	<0.2	<0.1	0%	<0.2	<0.1	0%
Toluene	0.5 / 0.1	<0.5	<0.5	0%	<0.5	<0.5	0%	<0.5	<0.1	0%	<0.5	<0.1	0%
Ethylbenzene	1 / 0.1	<1	<1	0%	<1	<1	0%	<1	<0.1	0%	<1	<0.1	0%
m+p xylene	2 / 0.2	<2	<2	0%	<2	<2	0%	<2	<0.2	0%	<2	<0.2	0%
o xylene	1 / 0.1	<1	<1	0%	<1	<1	0%	<1	<0.1	0%	<1	<0.1	0%
Naphthalene	1 / 0.1	<1	<1	0%	<1	<1	0%	<1	<0.1	0%	<1	<0.1	0%

Notes:

The acceptable range depends upon the levels detected:

0 – 100% RPD (When the average concentration is < 4 times the LOR)

0 – 50% RPD (When the average concentration is 4 to 10 times the LOR)

0 – 30% RPD (When the average concentration is > 10 times the LOR)

PQL for laboratories varied: Envirolab / SGS

TABLE B - RPD QA/QC

Noraville Depot - Additional ESA

All results in ug/L

Lab Reference **SAMPLE ID** **Date of Sampling** **Matrix**	**PQL**	120042 GW02 27/11/2014 Water	120042 QAQC1 27/11/2014 Water	**RPD**
TOTAL RECOVERABLE HYDROCARBONS				
TRH C6 - C9	10	<10	<10	0%
TRH C6 - C10	10	<10	<10	0%
TRH C10 - C14	50	<50	<50	0%
TRH C15 - C28	100	<100	<100	0%
TRH C 29 - C36	100	<100	<100	0%
TRH >C10 - C16	50	<50	<50	0%
TRH >C16 - C34	100	<100	<100	0%
TRH >C34 - C40	100	<100	<100	0%
BTEX COMPOUNDS				
Benzene	1	<1	<1	0%
Toluene	1	<1	<1	0%
Ethylbenzene	1	<1	<1	0%
m+p xylene	2	<2	<2	0%
o xylene	1	<1	<1	0%
Naphthalene	1	<1	<1	0%
HEAVY METALS				
Arsenic	1	<1	<1	0%
Cadmium	0.1	<0.1	<0.1	0%
Chromium	1	<1	<1	0%
Copper	1	<1	<1	0%
Lead	1	<1	<1	0%
Mercury	0.05	<0.05	<0.05	0%
Nickel	1	1	1	0%
Zinc	1	8	8	0%

Notes:

The acceptable range depends upon the levels detected:

0 – 100% RPD (When the average concentration is < 4 times the LOR)

0 – 50% RPD (When the average concentration is 4 to 10 times the LOR)

0 – 30% RPD (When the average concentration is > 10 times the LOR)

TABLE C - Trip Blank and Trip Spike Analytical Results

Noraville Depot - Additional ESA

All results in mg/kg

Lab Reference		119622	119622
SAMPLE ID	**PQL**	Trip Blank	Trip Spike
Date of Sampling		17/11/2014	17/11/2014
Matrix		Soil	Soil
BTEX COMPOUNDS			
Benzene	0.2	<0.2	95%
Toluene	0.5	<0.5	93%
Ethylbenzene	1	<1	94%
m+p xylene	2	<2	93%
o xylene	1	<1	91%

Analyte		Units	EQL	NEPM 2013 Ecological Investigation Levels / Ecological Screening Levels	NEPM 2013 Residential A Soil	NEPM 2013 Residential, parkland and public open space, Coarse Soil	NEPM 2013 Urban residential and public open space, Fine Soil
Field_ID							
LocCode							
Sample_Depth_Range							
Sampled_Date-Time							
Matrix_Description							
Heavy Metals							
	Arsenic	mg/kg	4	100	100		
	Cadmium	mg/kg	0.4	3	20		
	Chromium (III+VI)	mg/kg	1	361	100		
	Copper	mg/kg	1	96	6000		
	Lead	mg/kg	1	1105	300		
	Mercury	mg/kg	0.1	1	40		
	Nickel	mg/kg	1	32	400		
	Zinc	mg/kg	1	231	7400		
Asbetos							
	Asbestos fibres	-		0	0	0	0
ESDAT Combined Compounds							
	Aldrin + Dieldrin	mg/kg			6		
	DDT+DDE+DDD	mg/kg			240		
	+C10 - C36 (Sum of total)	mg/kg					
	Xylene Total	mg/kg					45
Inorganics							
	pH (aqueous extract)	pH_Units					
	Moisture	%	0.1				
Organochlorine Pesticides							
	4,4-DDE	mg/kg	0.1				
	a-BHC	mg/kg	0.1				
	Aldrin	mg/kg	0.1				
	b-BHC	mg/kg	0.1				
	Chlordane (cis)	mg/kg	0.1				
	Chlordane (trans)	mg/kg	0.1				
	d-BHC	mg/kg	0.1				
	DDD	mg/kg	0.1				
	DDT	mg/kg	0.1	180			
	Dieldrin	mg/kg	0.1				
	Endosulfan I	mg/kg	0.1				
	Endosulfan II	mg/kg	0.1				
	Endosulfan sulphate	mg/kg	0.1				
	Endrin	mg/kg	0.1		10		
	Endrin aldehyde	mg/kg	0.1				
	g-BHC (Lindane)	mg/kg	0.1				
	Heptachlor	mg/kg	0.1		6		
	Heptachlor epoxide	mg/kg	0.1				
	Hexachlorobenzene	mg/kg	0.1		10		
	Methoxychlor	mg/kg	0.1		300		
Polycyclic Aromatic Hydrocarbons							
	Acenaphthene	mg/kg	0.1				
	Acenaphthylene	mg/kg	0.1				
	Anthracene	mg/kg	0.1				
	Benz(a)anthracene	mg/kg	0.1				
	Benzo(a) pyrene	mg/kg	0.05	0.7			0.7
	Benzo(a)pyrene TEQ NEPM B1	mg/kg	0.5		3		
	Benzo(b)&(k)fluoranthene	mg/kg	0.2				
	Benzo(g,h,i)perylene	mg/kg	0.1				
	Chrysene	mg/kg	0.1				
	Dibenz(a,h)anthracene	mg/kg	0.1				
	Fluoranthene	mg/kg	0.1				
	Fluorene	mg/kg	0.1				
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1				
	Naphthalene	mg/kg	0.1	170	3		
	Phenanthrene	mg/kg	0.1				
	Pyrene	mg/kg	0.1				
	Total Positive PAHs	mg/kg			300		
Polychlorinated Biphenyls							
	Arochlor 1016	mg/kg	0.1				
	Arochlor 1221	mg/kg	0.1				
	Arochlor 1232	mg/kg	0.1				
	Arochlor 1242	mg/kg	0.1				
	Arochlor 1248	mg/kg	0.1				
	Arochlor 1254	mg/kg	0.1				
	Arochlor 1260	mg/kg	0.1				
	Total PCB	mg/kg	1		1		
Total Recoverable Hydrocarbons							
	C10 - C14	mg/kg	50				
	C15 - C28	mg/kg	100				
	C29-C36	mg/kg	100				
	TRH >C10 - C16 less Naphthalene (F2)	mg/kg	50				
	TRH >C10-C16	mg/kg	50	120	440	1000	120 / 110
	TRH >C16-C34	mg/kg	100	300		2500	1300
	TRH >C34-C40	mg/kg	100	2800		10,000	5600
BTEX							
	Benzene	mg/kg	0.2	50			65
	Ethylbenzene	mg/kg	1	70			125
	Naphthalene	mg/kg	1	170	3		
	Toluene	mg/kg	0.5	85			105
	C6 - C9	mg/kg	25	180	180 / 45		
	Xylene (m & p)	mg/kg	2	105			
	Xylene (o)	mg/kg	1	105			
	C6-C10 less BTEX (F1)	mg/kg	25				
	C6-C10	mg/kg	25			700	180

Field_ID	BH01	BH01	BH02	BH02	BH03	BH04	BH05	BH05	BH06	BH06	BH07	BH07	BH08	BH09	BH10	BH11	BH12	BH12	BH13	BH14	BH14	BH15	BH16	BH16	BH17
LocCode	BH01	BH01	BH02	BH02	BH03	BH04	BH05	BH05	BH06	BH06	BH07	BH07	BH08	BH09	BH10	BH11	BH12	BH12	BH13	BH14	BH14	BH15	BH16	BH16	BH17
Sample_Depth_Range	1.5	4	0.2	4	4	0.2	0.5	4	0.25	2	0.2	3	1	0.5	2	0.2	0.5	3	1	2	4	0.2	0.5	2	3
Sampled_Date-Time	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014	18/11/2014	18/11/2014	19/11/2014	19/11/2014	19/11/2014	19/11/2014	19/11/2014	19/11/2014	19/11/2014	19/11/2014	19/11/2014	19/11/2014	19/11/2014	19/11/2014	19/11/2014	17/11/2014	17/11/2014	17/11/2014	17/11/2014
Matrix_Description																									
Heavy Metals																									
Arsenic	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	11	-	<4	<4	-	<4
Cadmium	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.5	-	<0.4	<0.4	-	<0.4
Chromium (III+VI)	6	13	9	22	24	<1	1	2	5	<1	9	3	4	<1	14	<1	5	7	13	51	-	8	13	-	10
Copper	<1	<1	8	<1	<1	<1	<1	<1	21	<1	1	<1	1	<1	<1	<1	<1	<1	<1	<1	-	3	<1	-	<1
Lead	2	5	6	6	5	5	<1	1	6	<1	6	4	4	<1	3	<1	4	1	8	7	-	7	10	-	3
Mercury	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	-	<0.1	<0.1	-	<0.1
Nickel	1	1	4	2	3	<1	<1	<1	3	<1	1	<1	<1	<1	4	<1	<1	3	1	3	-	2	1	-	2
Zinc	<1	2	16	1	1	6	<1	<1	18	1	7	<1	10	<1	1	<1	6	<1	6	1	-	19	4	-	1
Asbetos																									
Asbestos fibres	-	-	0	-	-	0	0	-	0	-	0	-	-	0	-	0	0	-	-	-	-	0	-	-	-
ESDAT Combined Compounds																									
Aldrin + Dieldrin	-	-	<0.2	-	-	<0.2	<0.2	-	<0.2	-	<0.2	-	-	<0.2	-	<0.2	<0.2	-	-	-	-	<0.2	-	-	-
DDT+DDE+DDD	-	-	<0.3	-	-	<0.3	<0.3	-	<0.3	-	<0.3	-	-	<0.3	-	<0.3	<0.3	-	-	-	-	<0.3	-	-	-
+C10 - C36 (Sum of total)	<250	<250	<250	<250	1710	185	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	<250	-	<250	<250	-	<250
Xylene Total	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	-	<3	<3	-	<3
Inorganics																									
pH (aqueous extract)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.8	-	-	5.4	-
Moisture	19	26	9.6	15	19	1.8	1.6	1.6	7.5	1.5	11	9.2	8	3	9.4	4.2	4.4	8.2	14	19	-	16	20	-	12
Organochlorine Pesticides																									
4,4-DDE	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
a-BHC	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Aldrin	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
b-BHC	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Chlordane (cis)	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Chlordane (trans)	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
d-BHC	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
DDD	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
DDT	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Dieldrin	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Endosulfan I	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Endosulfan II	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Endosulfan sulphate	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Endrin	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Endrin aldehyde	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
g-BHC (Lindane)	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Heptachlor	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Heptachlor epoxide	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Hexachlorobenzene	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Methoxychlor	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Polycyclic Aromatic Hydrocarbons																									
Acenaphthene	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1
Acenaphthylene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1
Anthracene	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1
Benz(a)anthracene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1
Benzo(a) pyrene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	<0.05
Benzo(a)pyrene TEQ NEPM B1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	<0.5
Benzo(b)&(k)fluoranthene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2	-	<0.2
Benzo(g,h,i)perylene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1
Chrysene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1
Dibenz(a,h)anthracene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1
Fluoranthene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1
Fluorene	<0.1	<0.1	<0.1	<0.1	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1
Indeno(1,2,3-c,d)pyrene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1
Naphthalene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1
Phenanthrene	<0.1	<0.1	<0.1	<0.1	1.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1
Pyrene	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	-	<0.1
Total Positive PAHs	0	0	0	0	3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	-	0
Polychlorinated Biphenyls																									
Arochlor 1016	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Arochlor 1221	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Arochlor 1232	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Arochlor 1242	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Arochlor 1248	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Arochlor 1254	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Arochlor 1260	-	-	<0.1	-	-	<0.1	<0.1	-	<0.1	-	<0.1	-	-	<0.1	-	<0.1	<0.1	-	-	-	-	<0.1	-	-	-
Total PCB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Recoverable Hydrocarbons																									
C10 - C14	<50	<50	<50	<50	360	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	<50	<50	-	<50
C15 - C28	<100	<100	<100	<100	1300	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	<100	<100	-	<100
C29-C36	<100	<100	<100	<100	<100	110	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	<100	<100	-	<100
TRH >C10 - C16 less Naphthalene (F2)	<50	<50	<50	<50	870	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	<50	<50	-	<50
TRH >C10-C16	<50	<50	<50	<50	870	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	<50	<50	-	<50
TRH >C16-C34	<100	<100	<100	<100	770	180	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	<100	<100	-	<100
TRH >C34-C40	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	<100	<100	-	<100
BTEX																									
Benzene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2	-	<0.2
Ethylbenzene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	-	<1
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	-	<1
Toluene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	<0.5
C6 - C9	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	-	<25	<25	-	<25
Xylene (m & p)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	-	<2	<2	-	<2
Xylene (o)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	<1	<1	-	<1
C6-C10 less BTEX (F1)	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	-	<25	<25	-	<25
C6-C10	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	<25	-	<25	<25	-	<25

							Field_ID	BH18	GW01	GW02	GW02	GW03	QAQC2	QAQC3	TB	TS
							LocCode	BH18	GW01	GW02	GW02	GW03	QAQC2	QAQC3	TB	TS
							Sample_Depth_Range	0.5	0.5	0.5	3	1				
							Sampled_Date-Time	17/11/2014	17/11/2014	18/11/2014	18/11/2014	18/11/2014	18/11/2014	18/11/2014	17/11/2014	17/11/2014
							Matrix_Description									
Analyte		Units	EQL	NEPM 2013 Ecological Investigation Levels / Ecological Screening Levels	NEPM 2013 Residential A Soil	NEPM 2013 Residential, parkland and public open space, Coarse Soil	NEPM 2013 Urban residential and public open space, Fine Soil									
Heavy Metals																
	Arsenic	mg/kg	4	100	100			<4	<4	<4	<4	<4	-	-	-	-
	Cadmium	mg/kg	0.4	3	20			<0.4	<0.4	<0.4	<0.4	<0.4	-	-	-	-
	Chromium (III+VI)	mg/kg	1	361	100			2	3	<1	1	12	-	-	-	-
	Copper	mg/kg	1	96	6000			<1	2	<1	<1	<1	-	-	-	-
	Lead	mg/kg	1	1105	300			1	3	<1	<1	2	-	-	-	-
	Mercury	mg/kg	0.1	1	40			<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
	Nickel	mg/kg	1	32	400			<1	1	<1	<1	2	-	-	-	-
	Zinc	mg/kg	1	231	7400			<1	5	1	<1	1	-	-	-	-
Asbetos																
	Asbestos fibres	-		0	0	0	0	-	0	0	-	-	-	-	-	-
ESDAT Combined Compounds																
	Aldrin + Dieldrin	mg/kg			6			-	<0.2	<0.2	-	-	-	-	-	-
	DDT+DDE+DDD	mg/kg			240			-	<0.3	<0.3	-	-	-	-	-	-
	+C10 - C36 (Sum of total)	mg/kg						<250	<250	<250	<250	<250	<250	<250	-	-
	Xylene Total	mg/kg					45	<3	<3	<3	<3	<3	<3	<3	<3	1.84
Inorganics																
	pH (aqueous extract)	pH_Units						-	-	-	-	-	-	-	-	-
	Moisture	%	0.1					8.6	5.4	2.5	3	7.7	4.7	10	-	-
Organochlorine Pesticides																
	4,4-DDE	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	a-BHC	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Aldrin	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	b-BHC	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Chlordane (cis)	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Chlordane (trans)	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	d-BHC	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	DDD	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	DDT	mg/kg	0.1	180				-	<0.1	<0.1	-	-	-	-	-	-
	Dieldrin	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Endosulfan I	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Endosulfan II	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Endosulfan sulphate	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Endrin	mg/kg	0.1		10			-	<0.1	<0.1	-	-	-	-	-	-
	Endrin aldehyde	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	g-BHC (Lindane)	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Heptachlor	mg/kg	0.1		6			-	<0.1	<0.1	-	-	-	-	-	-
	Heptachlor epoxide	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Hexachlorobenzene	mg/kg	0.1		10			-	<0.1	<0.1	-	-	-	-	-	-
	Methoxychlor	mg/kg	0.1		300			-	<0.1	<0.1	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons																
	Acenaphthene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
	Acenaphthylene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
	Anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
	Benz(a)anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
	Benzo(a) pyrene	mg/kg	0.05	0.7			0.7	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	-
	Benzo(a)pyrene TEQ NEPM B1	mg/kg	0.5		3			<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-
	Benzo(b)&(k)fluoranthene	mg/kg	0.2					<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	-
	Benzo(g,h,i)perylene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
	Chrysene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
	Dibenz(a,h)anthracene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
	Fluoranthene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
	Fluorene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
	Naphthalene	mg/kg	0.1	170	3			<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
	Phenanthrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
	Pyrene	mg/kg	0.1					<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-
	Total Positive PAHs	mg/kg			300			0	0	0	0	0	-	-	-	-
Polychlorinated Biphenyls																
	Arochlor 1016	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Arochlor 1221	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Arochlor 1232	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Arochlor 1242	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Arochlor 1248	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Arochlor 1254	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Arochlor 1260	mg/kg	0.1					-	<0.1	<0.1	-	-	-	-	-	-
	Total PCB	mg/kg	1		1											
Total Recoverable Hydrocarbons																
	C10 - C14	mg/kg	50					<50	<50	<50	<50	<50	<50	<50	-	-
	C15 - C28	mg/kg	100					<100	<100	<100	<100	<100	<100	<100	-	-
	C29-C36	mg/kg	100					<100	<100	<100	<100	<100	<100	<100	-	-
	TRH >C10 - C16 less Naphthalene (F2)	mg/kg	50					<50	<50	<50	<50	<50	<50	<50	-	-
	TRH >C10-C16	mg/kg	50	120	440	1000	120 / 110	<50	<50	<50	<50	<50	<50	<50	-	-
	TRH >C16-C34	mg/kg	100	300		2500	1300	<100	<100	<100	<100	<100	<100	<100	-	-
	TRH >C34-C40	mg/kg	100	2800		10,000	5600	<100	<100	<100	<100	<100	<100	<100	-	-
BTEX																
	Benzene	mg/kg	0.2	50			65	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.95
	Ethylbenzene	mg/kg	1	70			125	<1	<1	<1	<1	<1	<1	<1	<1	0.94
	Naphthalene	mg/kg	1	170	3			<1	<1	<1	<1	<1	<1	<1	-	-
	Toluene	mg/kg	0.5	85			105	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.93
	C6 - C9	mg/kg	25	180	180 / 45			<25	<25	<25	<25	<25	<25	<25	-	-
	Xylene (m & p)	mg/kg	2	105				<2	<2	<2	<2	<2	<2	<2	<2	0.93
	Xylene (o)	mg/kg	1	105				<1	<1	<1	<1	<1	<1	<1	<1	0.91
	C6-C10 less BTEX (F1)	mg/kg	25					<25	<25	<25	<25	<25	<25	<25	-	-
	C6-C10	mg/kg	25			700	180	<25	<25	<25	<25	<25	<25	<25	-	-

				Field_ID	GW01	GW02	GW03	QAQC1
				WellCode				
				Sampled_Date-Time	27/11/2014	27/11/2014	27/11/2014	27/11/2014
				Groundwater Investigation Levels				
	ChemName	Units	EQL					
Heavy Metals - dissolved								
	Arsenic (Filtered)	µg/L	1	24	<1	<1	<1	<1
	Cadmium (Filtered)	µg/L	0.1	0.7	0.2	<0.1	<0.1	<0.1
	Chromium (III+VI) (Filtered)	µg/L	1	27.4	<1	<1	3	<1
	Copper (Filtered)	µg/L	1	1.3	4	<1	<1	<1
	Lead (Filtered)	mg/L	0.001	4.4	0.003	<0.001	<0.001	<0.001
	Mercury (Filtered)	µg/L	0.05	0.1	<0.05	<0.05	<0.05	<0.05
	Nickel (Filtered)	µg/L	1	7	5	1	13	1
	Zinc (Filtered)	µg/L	1	15	23	8	8	8
TRH Water(C10-C40) NEPM								
	C10 - C14	µg/L	50		<50	<50	<50	<50
	C15 - C28	µg/L	100		<100	<100	<100	<100
	C29-C36	µg/L	100		<100	<100	<100	<100
	TRH >C10 - C16	µg/L	50	1	<50	<50	<50	<50
	TRH >C10 - C16 less Naphthalene (F2)	µg/L	50	1	<50	<50	<50	<50
	TRH >C16 - C34	µg/L	100		<100	<100	<100	<100
	TRH >C34 - C40	µg/L	100		<100	<100	<100	<100
vTRH & BTEXN in Water NEPM								
	Benzene	µg/L	1	0.9	<1	<1	<1	<1
	Ethylbenzene	µg/L	1	NL	<1	<1	<1	<1
	Naphthalene	µg/L	1	NL	<1	<1	<1	<1
	Toluene	µg/L	1	NL	<1	<1	<1	<1
	C6 - C9	µg/L	10		<10	<10	<10	<10
	Xylene (m & p)	µg/L	2	NL	<2	<2	<2	<2
	Xylene (o)	µg/L	1	NL	<1	<1	<1	<1
	C6-C10 less BTEX (F1)	mg/L	0.01	1	<0.01	<0.01	<0.01	<0.01
	C6-C10	mg/L	0.01	1	<0.01	<0.01	<0.01	<0.01

Appendix A. Borelogs

BOREHOLE No. BH01

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317693 mN
Location: Noraville, NSW | Start - Finish Date: 17/11/2014 - 17/11/2014 | Rig: Geoprobe | Eastings: 365856 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Grass | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
390.0	0	A		BH01 / 0.1	○			SAND: with some subangular gravel, dark grey, rootlets.		D	
46.1	0	A		BH01 / 0.5	○			SAND: coarse grained, dark grey, uniform.		M	Hand auger to 1.0 m.
	0	A		BH01 / 1.0	○	1		At 1.0 m colour change to light grey.		M	
0.8	4	C		BH01 / 1.5	○			At 1.5 m colour change to black with possible hydrocarbon odour.		M	
0.0	0	A		BH01 / 2.0	○	2		At 2.0 m colour change to yellow. No observed hydrocarbon odour.		M	
0.0	0	A		BH01 / 3.0	○	3		Sandy CLAY: with fine to medium subangular gravel, light yellow.		W	
0.0	0	A		BH01 / 4.0	○	4		At 4.0 m colour change to mottled white, yellow, brown. Very stiff.		W	
								End of borehole. Limit of investigation at 4.0 m.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. BH02

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317676 mN
Location: Noraville, NSW | Start - Finish Date: 17/11/2014 - 17/11/2014 | Rig: Geoprobe | Eastings: 365840 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Concrete | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								CONCRETE		D	
43.7	1	C		BH02 / 0.2	○			FILL: clayey gravelly sand, brown mottled red and white, slight hydrocarbon odour, medium to coarse subangular gravel.		D	
1.5	1	C		BH02 / 0.5	○			FILL: sand, dark brown, coarse grained.		D	
0.0	1	C		BH02 / 1.0	○	1		Possible ash inclusions. Hydrocarbon odour remains.			
34.0	1	C		BH02 / 2.0	○	2		CONCRETE.		D	
								SAND: dark brown, coarse grained, possible hydrocarbon odour.			
								At 2.5 m colour change to grey.			
								At 2.6 m colour change to brown.			
2.5	0	C		BH02 / 3.0	○	3		At 3.0 m colour change to dark brown with increased gravel content.			
								Sandy CLAY: yellow.		D	
								At 3.8 m strong hydrocarbon odour.		M	
65.4	0	D		BH02 / 4.0	○	4		END OF BOREHOLE at 4.0 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
= Water level (static)
= Water level (during drilling)
= Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
▮ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. BH03

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317687 mN
Location: Noraville, NSW | Start - Finish Date: 17/11/2014 - 17/11/2014 | Rig: Geoprobe | Eastings: 365824 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Concrete | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								CONCRETE.		D	
0.4	2	A		BH03 / 0.2	○			FILL: sandy gravelly clay, brown mottled white and red, medium to coarse angular gravel.		D	
0.1	2	A		BH03 / 0.5	○						
1.3	2	A		BH03 / 1.0	○	1					
								CONCRETE/ASPHALT		D	
0.8	3	A		BH03 / 2.0	○	2					
								SAND: dark brown.		D	
2.2	2	A		BH03 / 3.0	○	3					
								Sandy CLAY: brown, strong hydrocarbon odour.		W	
33.0	2	D		BH03 / 4.0	○	4		END OF BOREHOLE at 4.0 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
= Water level (static)
= Water level (during drilling)
= Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
▮ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. BH04

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317685 mN
Location: Noraville, NSW | Start - Finish Date: 17/11/2014 - 17/11/2014 | Rig: Geoprobe | Eastings: 365811 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Asphalt | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								ASPHALT.		D	
0.1	0	C		BH04 / 0.2	○			SAND: light grey, uniform, possible hydrocarbon odour.		D	
0.0	0	C		BH04 / 0.5	○						
0.2	0	C		BH04 / 1.0	○	1					
								At 1.5 m colour change to dark brown.			
0.1	0	C		BH04 / 2.0	○	2					
0.1	0	B		BH04 / 3.0	○	3		At 3.2 m colour change to yellow (suspected natural soils, possible hydrocarbon odour remains).			
0.0	0	A		BH04 / 4.0	○	4		At 4.0 m no hydrocarbon odour.		M	
								END OF BOREHOLE at 4.0 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
= Water level (static)
= Water level (during drilling)
= Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
▮ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. BH05

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317712 mN
Location: Noraville, NSW | Start - Finish Date: 18/11/2014 - 18/11/2014 | Rig: Geoprobe | Eastings: 365787 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Asphalt | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								ASPHALT.		D	
1700	0	A		BH05 / 0.2	○			FILL: silty, clayey sand with fine to medium subrounded gravel, yellow/brown.		D	
863.2	0	A		BH05 / 0.5	○			SAND: grey, uniform, medium grained, possible hydrocarbon odour.		D	
								At 0.8 m organic material layer.			
498.0	0	B		BH05 / 1.0	○	1					
								At 1.8 m colour change to dark brown.			
63.8	0	A		BH05 / 2.0	○	2		At 2.0 m colour change to yellow with few sandstone gravel.		M	
								At 2.2 m sand becomes uniform.		M	
443.2	0	A		BH05 / 3.0	○	3					
326.2	0	A		BH05 / 4.0	○	4		END OF BOREHOLE at 4.0 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
= Water level (static)
= Water level (during drilling)
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FIELD DATA SYMBOLS
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⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. BH06

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell | Northings: 6317687 mN
Location: Noraville, NSW | Start - Finish Date: 19/11/2014 - 19/11/2014 | Rig: Geoprobe | Eastings: 365745 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Concrete | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								CONCRETE.		D	
435.6	2	B		BH06 / 0.25	○			FILL: gravelly sand, brown, fine angular gravel, coarse grained sand, organic material, hydrocarbon odour.		D	
231.6	0	C		BH06 / 0.5	○			At 0.35 m colour change to grey.			
								At 0.6 m concrete layer.			
								FILL: sandy clay, with coarse weathered rock, brown/yellow.		D	
107.8	0	A		BH06 / 1.0	○	1					
								SAND: grey, uniform.		D	
167.0	0	A		BH06 / 2.0	○	2					
113.6	0	A		BH06 / 3.0	○	3					
								At 3.3 m with some clay, yellow mottled brown.		M	
35.5	0	A		BH06 / 4.0	○	4					
								END OF BOREHOLE at 4.0 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. BH07

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317685 mN
Location: Noraville, NSW | Start - Finish Date: 19/11/2014 - 19/11/2014 | Rig: Geoprobe | Eastings: 365787 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Concrete | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								CONCRETE.		D	
21.8	0	A		BH07 / 0.2	○			FILL: very sandy clay with some subangular gravel inclusions (weathered rock).		D	
20.0	0	A		BH07 / 0.5	○			At 0.8 m increased clay content.			
9.7	0	A		BH07 / 1.0	○	1		At 1.5 m some wood, dark grey, coarse grained.		D	
								At 1.8 m organic layer (wood).			
63.8	0	B		BH07 / 2.0	○	2		Clayey SAND: with weathered rock inclusions, yellow/brown.		D	
								SAND: dark grey, coarse grained.			
10.3	0	B		BH07 / 3.0	○	3		At 3.0 m colour change to yellow/brown.		M	
								At 3.5 m moisture change to wet with some gravel.		W	
								Sand CLAY: grey, coarse grained.		W	
								At 3.8 m increased clay content, stiffer, red mottled brown.		W	
12.6	0	A		BH07 / 4.0	○	4		END OF BOREHOLE at 4.0 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. BH08

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317676 mN
Location: Noraville, NSW | Start - Finish Date: 19/11/2014 - 19/11/2014 | Rig: Geoprobe | Eastings: 365782 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Grass | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								Silty SAND: grey, rootlets.		D	
12.5	0	C		BH08 / 0.2	○						
								SAND: brown, some gravel and rock inclusions.		D	
6.8	0	B		BH08 / 0.5	○						
4.2	1	A		BH08 / 1.0	○	1		At 1.0 m colour change to dark brown, some possible ash.		M	
								At 1.6 m increasing clay content.		M	
2.3	0	A		BH08 / 2.0	○	2					
								SAND: dark grey.		M	
								At 2.7 m colour change to black and increased clay content to 3.5 m.		M	
1.9	0	A		BH08 / 3.0	○	3					
								Sandy CLAY: brown mottled red.		M	
1.0	0	A		BH08 / 4.0	○	4					
								END OF BOREHOLE at 4.0 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
▮ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. BH09

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317684 mN
Location: Noraville, NSW | Start - Finish Date: 19/11/2014 - 19/11/2014 | Rig: Geoprobe | Eastings: 365762 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Grass | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								Silty SAND: grey/brown.		D	
1.1	0	A		BH09 / 0.2	○			SAND: grey, uniform.		M	
1.1	0	A		BH09 / 0.5	○						
1.5	0	A		BH09 / 1.0	○	1		At 1.0 m colour change to dark brown/black.		M	
								At 1.8 m colour change to yellow, consistency to compressed loose sand.		M	
0.7	0	A		BH09 / 2.0	○	2					
								Sandy CLAY: yellow/red/brown mottled grey, stiff.		M	
1.4	0	A		BH09 / 3.0	○	3					
0.5	0	A		BH09 / 4.0	○	4		END OF BOREHOLE at 4.0 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

JACOBS

BOREHOLE No. BH10

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317676 mN
Location: Noraville, NSW | Start - Finish Date: 19/11/2014 - 19/11/2014 | Rig: Geoprobe | Eastings: 365762 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Grass | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								SAND: grey, uniform, rootlets.		D	
8.3	0	A		BH10 / 0.2	○						
7.3	0	A		BH10 / 0.5	○			At 0.5 m colour change to black/dark grey.		D	
5.0	0	A		BH10 / 1.0	○	1		At 0.9 m organic material layer.		D	
								At 1.4 m colour change to yellow/brown, consistency to compressed loose sand, with weathered rock inclusions.		D	
7.3	0	A		BH10 / 2.0	○	2					
								At 2.5 m colour change to dark brown.		M	
								Sandy CLAY: red mottled white and yellow.		M	
15.9	0	A		BH10 / 3.0	○	3					
3.5	0	A		BH10 / 4.0	○	4					
								END OF BOREHOLE at 4.0 m. Limit of investigation in ntural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. BH11

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317678 mN
Location: Noraville, NSW | Start - Finish Date: 19/11/2014 - 19/11/2014 | Rig: Geoprobe | Eastings: 365761 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Grass | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	ground water field tests depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								SAND: grey, with rootlets.		D	
10.3	0	A		BH11 / 0.2	○						
9.3	1	B		BH11 / 0.5	○						
								At 0.7 m colour change to black with wood/roots.		D	
10.1	0	A		BH11 / 1.0	○	1					
								At 1.2 m colour change to light grey.			
								Clayey SAND: black to yellow/brown.		M	
10.5	0	A		BH11 / 2.0	○	2					
								At 2.3 m increased clay content.			
8.4	0	A		BH11 / 3.0	○	3		Sandy CLAY: brown mottled red.		M	
4.0	0	A		BH11 / 4.0	○	4		END OF BOREHOLE at 4.0 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. BH12

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317667 mN
Location: Noraville, NSW | Start - Finish Date: 19/11/2014 - 19/11/2014 | Rig: Geoprobe | Eastings: 365781 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Grass | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								Silty SAND: light grey, weathered rock inclusions.		D	
830.0	0	A		BH12 / 0.2	○						
1778	0	A		BH12 / 0.5	○			At 0.5 m colour change to brown.			
								SAND: compressed loose sand, yellow.		D	
708.0	0	A		BH12 / 1.0	○	1		SAND: grey, uniform.		D	
								At 1.5 m colour change to black.		M	
524.6	0	A		BH12 / 2.0	○	2					
								At 2.5 m increased clay content.		M	
748.0	0	A		BH12 / 3.0	○	3					
								Sandy CLAY: brown mottled red.		M	
152.4	0	A		BH12 / 4.0	○	4		END OF BOREHOLE at 4.0 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. BH13

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317662 mN
Location: Noraville, NSW | Start - Finish Date: 19/11/2014 - 19/11/2014 | Rig: Geoprobe | Eastings: 365796 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Concrete | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								CONCRETE			
838.4	0	C		BH13 / 0.2	○			FILL: sandy clay with some fine subangular gravel, yellow mottled red and white, possible ash inclusions, hydrocarbon odour.		M	
37.0	0	B		BH13 / 0.5	○						
374.6	1	C		BH13 / 1.0	○	1		At 1.0 m colour change to grey/black, hydrocarbon odour.			
								SAND: grey/black, possible hydrocarbon odour.		D	
270.9	0	B		BH13 / 2.0	○	2		At 2.0 m colour change to dark brown, few weathered rock/coarse gravel inclusions.			
								At 2.5 m colour change to light brown.			
								At 2.8 m increased clay content.		M	
7.0	0	B		BH13 / 3.0	○	3		Sandy CLAY: mottled yellow, red and grey.		M	
								END OF BOREHOLE at 3.5 m. Limit of investigation in natural soils.			
11.8	0	A		BH13 / 4.0	○	4					

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. BH14

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317696 mN
Location: Noraville, NSW | Start - Finish Date: 19/11/2014 - 19/11/2014 | Rig: Geoprobe | Eastings: 365755 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Grass | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type / field tests	ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								SAND: grey, rootlets.		D	
18.4	0	A		BH14 / 0.2	○			At 0.3 m colour change to light grey.			
								At 0.4 m colour change to dark grey.		M	
8.0	0	A		BH14 / 0.5	○			Clayey SAND: dark brown.			
								At 0.8 m colour change to light brown.			
7.6	0	A		BH14 / 1.0	○	1		Sandy CLAY: brown mottled red.		M	
								At 1.3 m decreased sand content, stiff.		M	
4.4	0	A		BH14 / 2.0	○	2					
								At 2.5 m colour change to mottled grey, yellow, red.		M	
3.1	0	A		BH14 / 3.0	○	3					
2.2	0	A		BH14 / 4.0	○	4		END OF BOREHOLE at 4.0 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
= Water level (static)
= Water level (during drilling)
= Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. BH15

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317661 mN
Location: Noraville, NSW | Start - Finish Date: 17/11/2014 - 17/11/2014 | Rig: Geoprobe | Eastings: 365802 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Concrete | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								CONCRETE			
6.0	0	B		BH15 / 0.2	○			FILL: sandy, clayey, gravel, yellow, fine to medium angular gravel, hydrocarbon odour.		W	
								Sandy CLAY: with gravel, yellow, fine angular gravel.		M	
7.7	0	B		BH15 / 0.5	○			At 0.7 m colour change to grey mottled red.			
0.5	1	B		BH15 / 1.0	○	1		At 1.1 m organic layer (wood), dark brown.		D	
								At 1.3 m decreased gravel content, dark brown.		D	
2.0	0	A		BH15 / 2.0	○	2		At 2.0 m colour change to brown mottled red.		D	
	0	A		BH15 / 2.7	○			END OF BOREHOLE at 2.7 m. Limit of investigation in natural soils.			
						3					
						4					

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
▮ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. BH16

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317661 mN
Location: Noraville, NSW | Start - Finish Date: 17/11/2014 - 17/11/2014 | Rig: Geoprobe | Eastings: 365827 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Concrete | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								CONCRETE			
168.9	0	B		BH16 / 0.2	○			FILL: clayey gravelly sand, yellow mottled brown, possible hydrocarbon odour.		D	
100.7	0	B		BH16 / 0.5	○			CLAY: with sand, grey mottled red, possible hydrocarbon odour.		M	
11.8	1	B		BH16 / 1.0	○	1		SAND: fine grained, black/dark grey.		D	
								Sandy CLAY: brown mottled red, very stiff.		D	
156.1	0	A		BH16 / 2.0	○	2					
3.5	0	A		BH16 / 3.0	○	3		END OF BOREHOLE at 3.0 m. Limit of investigation in natural soils.			
						4					

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

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BOREHOLE No. BH17

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317642 mN
Location: Noraville, NSW | Start - Finish Date: 17/11/2014 - 17/11/2014 | Rig: Geoprobe | Eastings: 365828 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Concrete | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								CONCRETE			
129.6	0	A		BH17 / 0.2	○			FILL: sandy clay, organic matter, brown.		M	
14.0	1	A		BH17 / 0.5	○			Clayey SAND: black.		M	
77.7	0	A		BH17 / 1.0	○	1		At 1.0 m colour change to light brown.		M	
								Sandy CLAY: light brown.		M	
								At 1.5 m colour change to grey mottled red.			
40.2	0	A		BH17 / 2.0	○	2					
								At 2.8 m organic material, red mottled grey/yellow.		D	
22.9	0	A		BH17 / 3.0	○	3					
2.9	0	A		BH17 / 4.0	○	4		END OF BOREHOLE at 4.0 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

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BOREHOLE No. BH18

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317638 mN
Location: Noraville, NSW | Start - Finish Date: 17/11/2014 - 17/11/2014 | Rig: Geoprobe | Eastings: 365834 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Concrete | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
								CONCRETE			
5.0	0	C		BH18 / 0.2	○			FILL: gravelly sand, yellow, coarse grained, fine angular gravel, possible hydrocarbon odour.		D	
								At 0.3 m colour change to black, decreased gravel content.		M	
2.4	1	C		BH18 / 0.5	○			At 0.5 m increased clay content.			
								At 0.8 m becoming wet.		W	
1.6	0	C		BH18 / 1.0	○	1		Sandy CLAY: dark brown, hydrocarbon odour.			
								Gravelly sandy CLAY: grey mottled red, white and yellow, fine to medium gravel.		M	
0.5	0	A		BH18 / 2.0	○	2					
	0	A		BH18 / 2.7	○			END OF BOREHOLE at 2.7 m. Limit of investigation in natural soils.			
						3					
						4					

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

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BOREHOLE No. GW01

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317668 mN
Location: Noraville, NSW | Start - Finish Date: 17/11/2104 - 17/11/2014 | Rig: Geoprobe | Eastings: 365861 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Grass | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
1200	0	A		GW01 / 0.1	◦			FILL: gravelly sand, light brown, medium to coarse gravel with some cobbles, fine grained sand, rootlets.		D	Cement
1812	0	A		GW01 / 0.5	◦						Bentonite
								At 0.5 m colour change to dark brown, gravel becoming coarse, subangular.		D M	
21.7	0	A		GW01 / 1.0	◦	1		At 0.6 m increased clay content with sandstone gravel. At 1.0 m colour change to orange/brown.			Hand auger finished at 1.0 m. Push tube commenced.
								SAND: black, medium grained, uniform, possible hydrocarbon odour.		M	
10.2	0	B		GW01 / 2.0	◦	2		At 2.0 m colour change to yellow, becoming wetter.		M/W	
								At 2.5 m increased clay content.			
0.0	0	A		GW01 / 3.0	◦	3		Sandy CLAY: with few angular gravel, mottled red/orange, brown and white, very stiff.		M/W	Push tube finished at 2.7 m. Solid auger commenced.
						4					
								CLAY: with some gravel, red.		M/W	Backfill
						5		Sandy CLAY: red.		W	
						6					Bentonite
						7					
						8					Filter pack
						9					
						10					Collapse
						11		END OF BOREHOLE at 10.5 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. GW02

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317718 mN
Location: Noraville, NSW | Start - Finish Date: 18/11/2014 - 18/11/2014 | Rig: Geoprobe | Eastings: 365755 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Gravel | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
8.4	0	B		GW02 / 0.2	○			ASPHALT		D	Cement
								SAND: dark brown, uniform.		D	
10.5	0	A		GW02 / 0.5	○			At 0.4 m organic material layer. At 0.5 m colour change to light grey.		D	Bentonite
11.1	0	A		GW02 / 1.0	○	1					Hand auger finished at 1.0. Push tube commenced.
8.0	0	A		GW02 / 2.0	○	2		At 2.0 m colour change to dark brown.		D/M	
35.4	0	A		GW02 / 3.0	○	3		At 2.8 m colour change to yellow/brown. At 3.0 m colour change to yellow.			Backfill
21.8	0	A		GW02 / 4.0	○	4					Push tube finished at 4.5 m. Solid auger commenced.
								At 4.5 m colour change to brown mottled red and yellow.		M	
	0	A		GW02 / 5.0	○	5					Bentonite
	0	A		GW02 / 6.0	○	6					
						7		At 7.0 m increased clay content.			Filter pack
						8 ▼		Sandy CLAY: brown, coarse grained sand.		M	
						9					
						10					Collapse
						11		END OF BOREHOLE at 10.5 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
▼ = Water level (static)
▽ = Water level (during drilling)
◄► = Outflow / Inflow

FIELD DATA SYMBOLS
× = Shear vane test
⊥ = Pocket Penetrometer test
▽ = Standard Penetration Test (SPT top = start of N blowcount)
▼ = SPT Spoon Sample (Pushed)
■ = Undisturbed Tube Sample
● = Disturbed Sample
◨ = Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

SKM ENV 1 IA054000 NORAVILLE LOGS.GPJ SKM_ENVL1.GDT 14/4/15

BOREHOLE No. GW03

Sheet 1 of

Project: Additional ESA - Noraville Depot | Client: Ausgrid | Driller: Rockwell Drilling | Northings: 6317675 mN
Location: Noraville, NSW | Start - Finish Date: 18/11/2014 - 18/11/2014 | Rig: Geoprobe | Eastings: 365745 mE | Logged: AH
Job No: IA054000 | Bore dia: 100mm | Surface Conditions: Grass | RL: | Checked: MS

FIELD DATA							SOIL DESCRIPTION		SOIL CONDITION		COMMENTS
PID (ppm)	visual ranking	odour ranking	field test XRF (ppm)	sample ID	sample type	field tests ground water depth (m)	graphic log	soil type, unified classification, colour, structure, particle characteristics, minor components	consistency/ density	moisture condition	drilling method, well construction, water and additional observations
370.6	0	A		GW03 / 0.2	◦			Silty SAND: dark brown, with rootlets.		D	Cement
157.9	0	A		GW03 / 0.5	◦						Bentonite
								At 0.6 m colour change to orange with coarse subrounded sandstone gravel.			
94.0	0	A		GW03 / 1.0	◦	1		Clayey SAND: yellow/brown, uniform, coarse grained.		M	
27.2	0	A		GW03 / 2.0	◦	2		Sandy CLAY: red mottled white and brown.		M	
8.8	0	A		GW03 / 3.0	◦	3		At 3.0 m colour change to grey mottled yellow.		D/M	Backfill
15.5	0	A		GW03 / 4.0	◦	4					Push tube finished. Solid augers commenced.
						5		At 5.0 m colour change to red.		M	Bentonite
						6					
						7					Filter pack
						8					
						9		At 9.0 m colour change to light brown.		W	
						10					Collapse
						11		END OF BOREHOLE at 10.5 m. Limit of investigation in natural soils.			

VISUAL RANKING
0 No visible evidence of contamination
1 Slight visible contamination
2 Visible contamination
3 Significant visible contamination

ODOUR RANKING
A No Non-Natural odours
B Slight Non-Natural odours
C Moderate Non-Natural odours
D Strong Non-Natural odours

FIELD DATA ABBREVIATIONS
Suv = Uncorrected vane shear (kPa)
Sup = Pocket penetrometer (kPa)
N = SPT blows per 300mm
FPM = Field permeability
PID = Photoionisation detector reading (ppm, V/V)

GROUNDWATER SYMBOLS
= Water level (static)
= Water level (during drilling)
= Outflow / Inflow

FIELD DATA SYMBOLS
= Shear vane test
= Pocket Penetrometer test
= Standard Penetration Test (SPT top = start of N blowcount)
= SPT Spoon Sample (Pushed)
= Undisturbed Tube Sample
= Disturbed Sample
= Bulk Sample

DENSITY (N-value)

VL	(very loose)	<10
L	(loose)	10 - 20
MD	(medium dense)	20 - 30
D	(dense)	30 - 50
VD	(very dense)	>50
CO	(compact)	>50/150mm

MOISTURE CONDITION
D = Dry M = Moist W = Wet

CONSISTENCY (Su)

VS	(very soft)	< 12 kPa
S	(soft)	12 - 25
F	(firm)	25 - 50
St	(stiff)	50 - 100
VSt	(very stiff)	100 - 200
H	(hard)	> 200 kPa

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Appendix B. Ecological Investigation Limits Methodology

NEPM 2013 Ecological Investigation Limits Methodology

Ecological investigation levels (EILs) for the protection of terrestrial ecosystems have been derived for common contaminants in soil based on a species sensitivity distribution (SSD) model developed for Australian conditions. EILs have been derived for As, Cu, CrIII, DDT, naphthalene, Ni, Pb and Zn.

EILs apply principally to contaminants in the top 2 metres of soil at the finished surface/ground level which corresponds to the root zone and habitation zone of many species. In arid regions, where the predominant species may have greater root penetration, specific considerations may result in their application to 3 metres depth.

The methodology assumes that the ecosystem is adapted to the ambient background concentration (ABC) for the locality and that it is only adding contaminants over and above this background concentration which has an adverse effect on the environment.

The ABC of a contaminant is the soil concentration in a specified locality that is the sum of the naturally occurring background level and the contaminant levels that have been introduced from diffuse or non-point sources by general anthropogenic activity not attributed to industrial, commercial, or agricultural activities, for example, motor vehicle emissions.

The preferred method to determine the ABC is to measure the ABC at an appropriate reference site. This approach is essential in areas where there is a high naturally occurring background level such as will occur in mineralised areas.

An added contaminant limit (ACL) is the added concentration (above the ABC) of a contaminant above which further appropriate investigation and evaluation of the impact on ecological values is required. **The EIL is derived by summing the ACL and the ABC.**

ACLs are based on the soil characteristics of pH, CEC and clay content. Empirical relationships that can model the effect of these soil properties on toxicity are used to develop soil-specific values. These soil-specific values take into account the biological availability of the element in various soils. In this approach different soils will have different contaminant EILs rather than a single generic EIL for each contaminant.

Calculating the EIL for Noraville Depot, Noraville

ACLs									
	mg/kg	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
	pH				95				230
	CEC							30	
	% clay			320					
	Generic					1100			

Information derived from **Table 1B(1)** *Soil-specific added contaminant limits for aged zinc in soils*, **Table 1B(2)** *Soil-specific added contaminant limits for aged copper in soils,* **Table 1B(3)** *Soil-specific added contaminant limits for aged chromium III and nickel in soils,* and **Table 1B(4)** *Generic added contaminant limits for lead in soils irrespective of their physicochemical properties (NEPM 2013).*

ABC									
	mg/kg	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
		n/a	n/a	41	<1	5	n/a	2	<1

Sample BH14 / 4.0 was assumed to be representative of the 'background concentration' of the site due to the depth (4.0 mbgl), and that the soils are unlikely to be impacted by anthropogenic sources.

EILs										
mg/kg	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	DDT	Naphth.
ABC + ACL			361 [3]	96 [3]	1105 [3]		32 [3]	231 [3]		
NEPM 2013	100 [1]								180[1]	170[1]
NEPM 1999		3 [2]				1 [2]				

[1]Generic EILs for aged arsenic, DDT and Naphthalene from **Table 1B(5)** for urban residential and public open space land use.
[2]EILs from NEPM 1999 (no EILs specified for contaminants in NEPM 2013).
[3]EILs derived from NEPM 2013 equation ABC+ACL.

Appendix D. Field Sheets

SKM

Site Works Form

Client: Ausgrid

Project: Norwille

Project No: IA054000

Project Manager: A. HUNTER

Site Address: Wilfred Barrett Drive.

Investigation Details			
Date	17/11/14	Weather Conditions	Sunny
Time on-site	7.00	Time off-site	3.30
Travel Time (km or hire)	2 hrs	Total Time	10.5 hrs

Personnel On-site			
SKM Representative(s)	A. HUNTER	Client Representative(s)	M. GENCUR.
Contractor(s)	ROCKWELL	Operator(s)	

Proposed Works for Day	
Proposed Works	1 GW well 6 soil locations
Work undertaken	1 GW well + 8 soil locations

Note all Correspondence: Telephone Calls/Memo's/Conversations/Instructions issued by SKM

- Drillers arrived at 8.30.

Sketch of Works Area

Sample Details					
ID	Location		Description	PID Result (ppm)	Visual Observations
	Easting	Northing			
BH01 0.1	0365856	6317693	PID readings are peaks	390.2	
0.5				46.1	
1.0				Ripped	
GW01 0.1	0365861	6317668		1200	
0.5				1812.0	
1.0				21.7	
BH01 1.5				0.8	
2.0				0.0	
3.0				0.0	
4.0				0.0	
GW01 2.0				10.2	
3.0				0.0	
BH04 0.2	0365811	6317685		0.1	
0.5				0.0	
1.0				0.2	
2.0				0.1	
3.0				0.1	
4.0				0.0	
BH02 0.2	0365840	6317676		43.7	
0.5				1.5	
1.0				0.0	
2.0				34.0	
3.0				2.5	
4.0				65.4	
BH03 0.2	0365824	6317687		0.4	
0.5				0.1	
1.0				1.3	
2.0				0.8	

Further Work Required			
Proposed Date of Works		Next Sample ID	

Other Issues/Comments

SKM

Site Works Form

Client: Ausgrid

Project: Noraville ESA Project No: IA054000

Project Manager: A. HUNTER

Site Address: Wilfred Barrett Drive

Investigation Details			
Date	18/11/14	Weather Conditions	Sunny
Time on-site	6.45	Time off-site	4.30
Travel Time (km or hire)	40 mins	Total Time	10.5 hrs

Personnel On-site			
SKM Representative(s)	A. HUNTER	Client Representative(s)	M. FITZGERALD
Contractor(s)	B. SMITH / O. BLAKE	Operator(s)	

Proposed Works for Day	
Proposed Works	2 GW Wells 6 soil bores
Work undertaken	2 wells, 1 soil bore, 4 QAQC

Note all Correspondence: Telephone Calls/Memo's/Conversations/Instructions issued by SKM

Site contact Matt arrived at 8.30am.
Happy to make up time for being late.

BH05: 0365787 6317762
BH07: 0365787 6317685
BH13: 0365796 6317662
BH14: 0365755 6317696
GW02: 0365755 6317718
BH06: 0365783 6317689
GW03: 0365745 6317675

Sketch of Works Area

		PID			PID		(ppm)	PID
BH05	0.2	1700	~~BH04~~	0.2	370.6	BH		
	0.5	863.2	GW03	0.5	157.9			
	1.0	498.0		1.0	94.0			
	2.0	63.8		2.0	27.2			
	3.0	443.2		3.0	8.8			
	4.0	326.2		4.0	15.5			
GW02	0.2	8.4	BH13	0.2				
	0.5	10.5		0.5				
	1.0	11.1		1.0				
	2.0	8.0		2.0				
	3.0	35.4		3.0				
	4.0	21.8		4.0				
	5.0	—						
	6.0	—						

Sample Details

ID	Location		Description	PID Result (ppm)	Visual Observations
	Easting	Northing			

Further Work Required

Proposed Date of Works		Next Sample ID	

Other Issues/Comments

SKM

Site Works Form

Client: Ausgrid

Project: Naraville ESA

Project No: IA054000

Project Manager: A. HUNTER

Site Address: Wifred Barrett Drive, Naraville

Investigation Details			
Date	19/11/14	Weather Conditions	overcast
Time on-site	7.00	Time off-site	2.30
Travel Time (km or hire)		Total Time	

Personnel On-site			
SKM Representative(s)	A. HUNTER	Client Representative(s)	M. FITZGERALD.
Contractor(s)	B SMITH / D. BLAKE	Operator(s)	

Proposed Works for Day	
Proposed Works	Finish works + develop wells 9 soil bores
Work undertaken	

Note all Correspondence: Telephone Calls/Memo's/Conversations/Instructions issued by SKM

GW01: DTW - 5.837
TWD - 9.948
~V - 8L

GW03: DTW - 6.557
TWD - 8.415
~V - 4L

GW02: PTW - 8.085
TWD - 9.728
~V - 3L.

BH06: 0365792 6317687

BH08: 0365782 6317676

BH10: 0365762 6317676

BH12: 0365781 6317667

BH07: 0365797 6317680

BH09: 0365762 6317684

BH11: 0365761 6317678

Sketch of Works Area

Sample Details					
ID	Location		Description	PID Result (ppm)	Visual Observations
	Easting	Northing			

Further Work Required			
Proposed Date of Works		Next Sample ID	

Other Issues/Comments

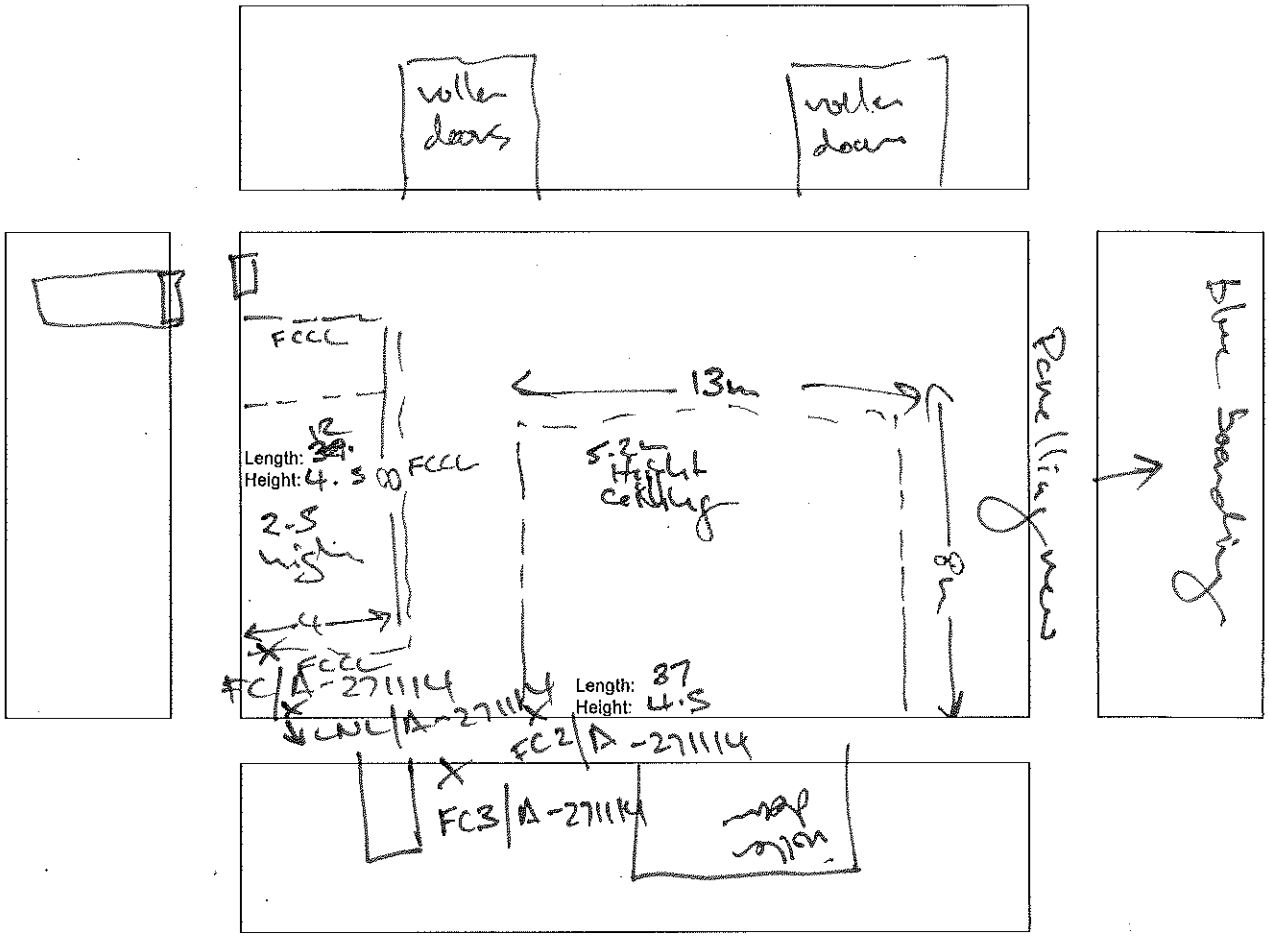
HAZARDOUS BUILOING MATERIALS REGISTER

Building: A

Project:

Room:

Date:



Construction Materials

External Wall: FCCL
Internal Wall: FCCL
Floor: Concrete.
Ceiling: ~~FCR~~ sarking.
Roof: FCR

Building Materials Key

Fibre Cement Ceiling	FCCE	Lagging	LAG	Emergency Lighting	EL
Fibre Cement Eaves	FCE	Fibre Insulation	FIN	Flouresecnt Light	FL
Fibre Cement Cladding	FCCL	Vinyl Tiles	VT		
Fibre Cement Roof	FCR	Fire Doors	FD		
Electrical Backing Board	EBB	Painted Surfaces	PS		

Notes:

Mezzanine - Metal structure, composite flooring, 2.5m above floor.

24 FL - AICO LEC 65

3 EL -

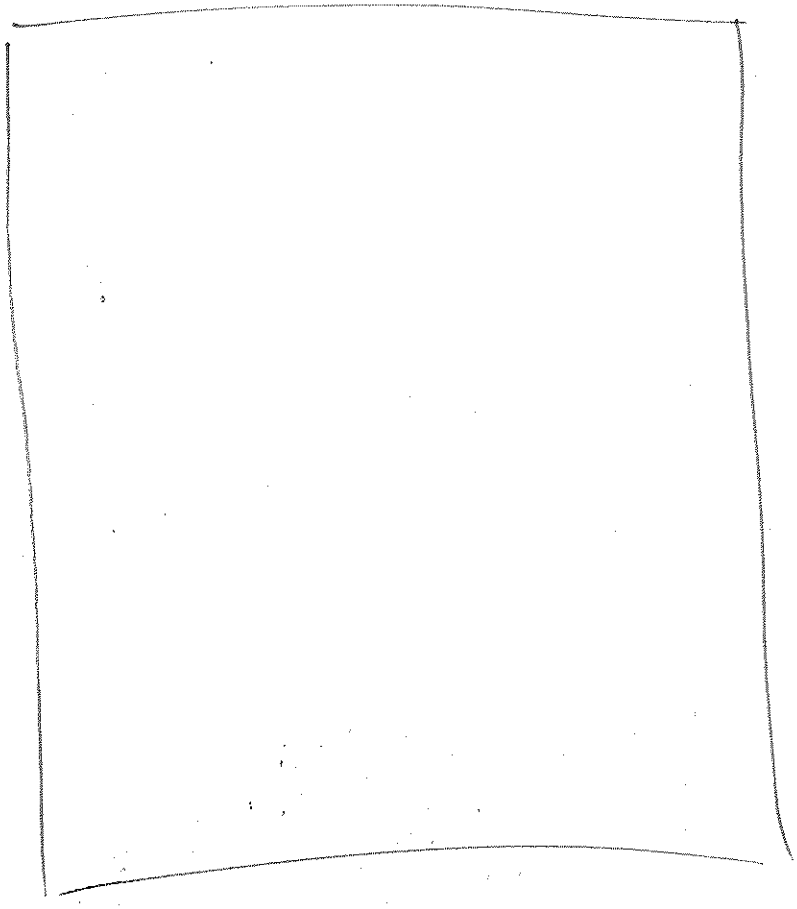
FC/A-271114: FC sheet for small office (wall)

FC2/A-271114: FC cladding.

FC3/A-271114: Fibre glass cladding.

UNL/A-271114: Unknown beneath flooring ($4m^2$).

A Building



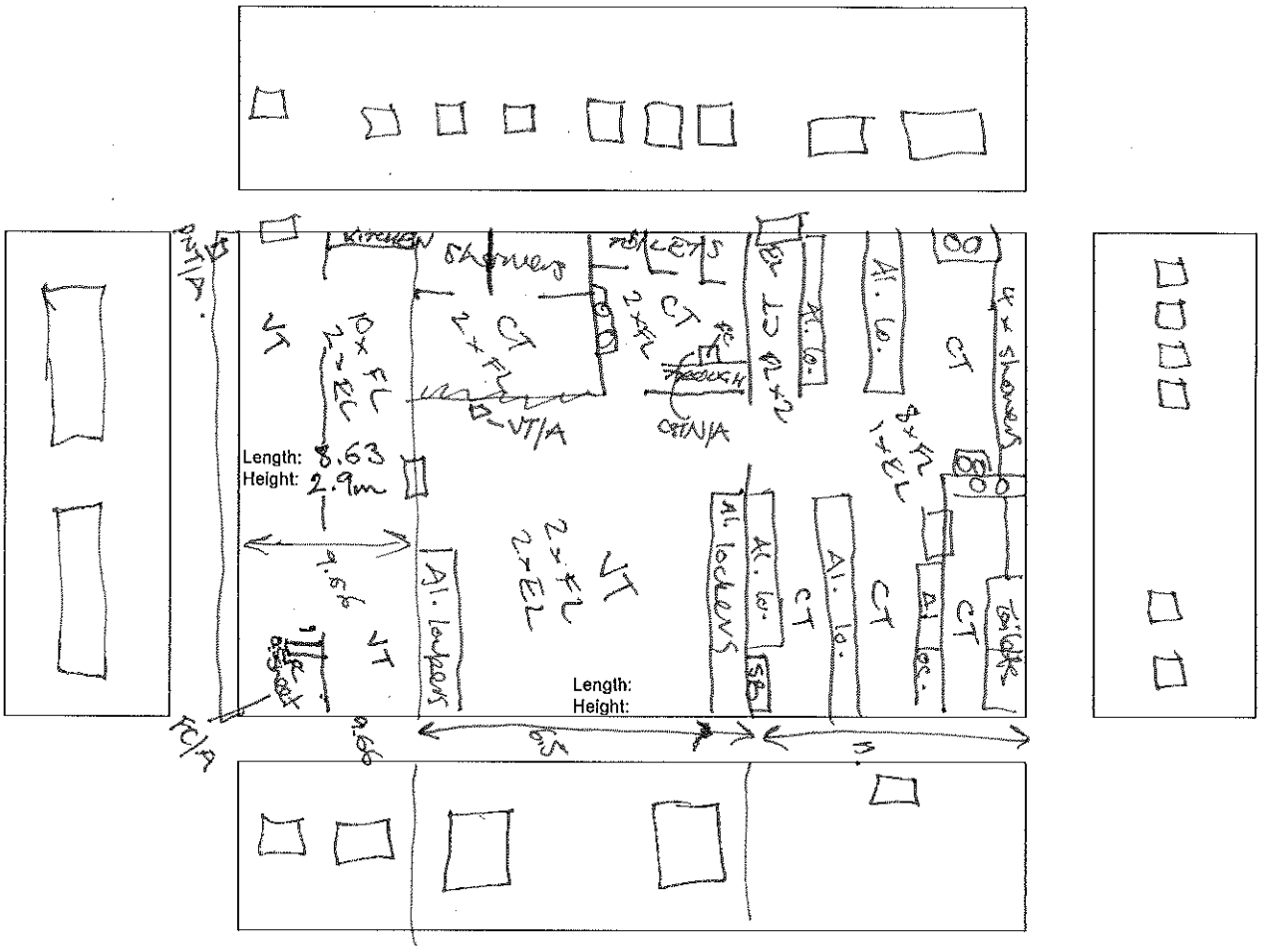
HAZARDOUS BUILDING MATERIALS REGISTER

Building: B

Project: IA054000

Room:

Date: 27/11/14



Construction Materials

External Wall: Brick
Internal Wall: Brick/cement rend.
Floor: VT.
Ceiling: SMF
Roof: CT.

Building Materials Key

Fibre Cement Ceiling	FCCE	Lagging	LAG	Emergency Lighting	EL
Fibre Cement Eaves	FCE	Fibre Insulation	FIN	Flouresecnt Light	FL
Fibre Cement Cladding	FCCL	Vinyl Tiles	VT		
Fibre Cement Roof	FCR	Fire Doors	FD		
Electrical Backing Board	EBB	Painted Surfaces	PS		

Notes:

Aluminium windows
Brick building external
Internal walls – brick/cement rendered
Paint – fair / non deteriorated.
Internal alcohol testing booth – made of FC sheet.
Vinyl tiles in first + second (half of) rooms. Ceramic tiles for remaining areas.
SB. switchboard in ~~bee~~ back room.
8 x FL in back room
1 x EL " " "
0.5 m FC eaves on front + sides
wooden fascia
PVC downpipes
metal guttering
ceramic tile roof

Insulation could have SMF.
Wooden doors
Plaster board ceiling with ceiling panels / SMF as false ceiling.

FC/A 271114 – Alcohol Booth
VT/A 271114 – VT of shower area
CSTN/A 271114 – cistern of trough in first bathroom
PNT/A 271114

FC1 271114 – Behind workshop
FC2 271114 – Behind Old A.

SINCLAIR KNIGHT MERZ

SKM

Calculation Record

Form ET2 August 96

Project No. _____ File _____

SHEET No. _____ OF _____

PREPARED BY _____ DATE _____

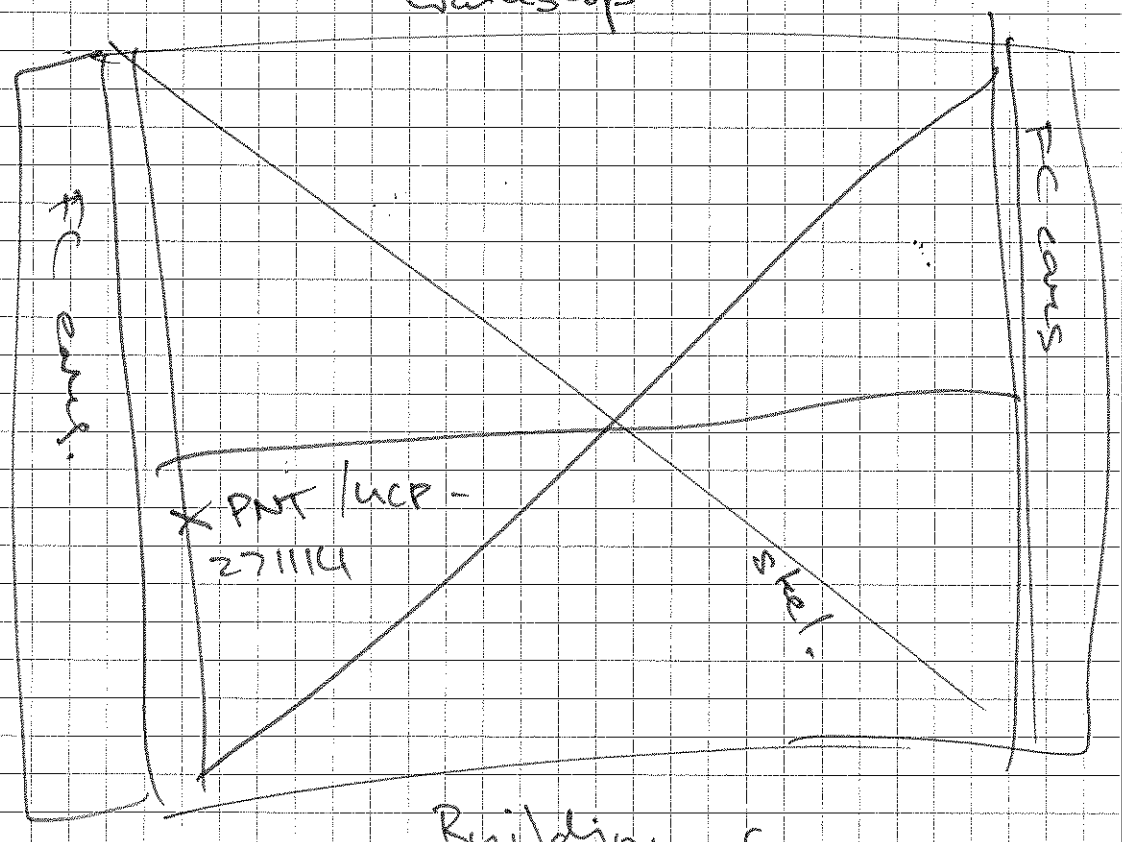
CHECKED BY _____ DATE _____

PROJECT	WORK PACKAGE
TASK	ELEMENT

~~04771 415 246~~

Undercover parking between Building C & Workshop.

- 12m x 12m.
- steel girder construction.
- Pressed metal ~~roof~~ ceiling panels. Tin roof.
- 10 double columns (too high to access).
- FC cores (approx 24m²)



PNT/UCP-271114 - Paint (beam) for steel girder.

COMMENTS ON CALCULATION RECORD:

Comments by:	Date:

HAZARDOUS BUILDING MATERIALS REGISTER

Building: Project: 120 / 070

Room: Date:

Flouro in toilet – Ferguson F140 TP 40W 250V 50Hz

4 single fluoro in toilet

5 " " in hallway

Length:
Height:

34 double fluros enclosure

Fluro in kitchen Ferguson F140 ATP C188 C322 N58 250V 50Hz

Length:
Height:

3 Emergency lights. White Light Pty Ltd N2015 XD110 AS 2293 Classification

Construction Materials	Building Materials Key					
External Wall:	Fibre Cement Ceiling	FCCE	Lagging	LAG	Emergency Lighting	EL
Internal Wall:	Fibre Cement Eaves	FCE	Fibre Insulation	FIN	Flouresecnt Light	FL
Floor:	Fibre Cement Cladding	FCCL	Vinyl Tiles	VT		
Ceiling:	Fibre Cement Roof	FCR	Fire Doors	FD		
Roof:	Electrical Backing Board	EBB	Painted Surfaces	PS		

Notes:

VT/C-271114: Linoleum flooring

FC/C-271114: FC Panel Wall

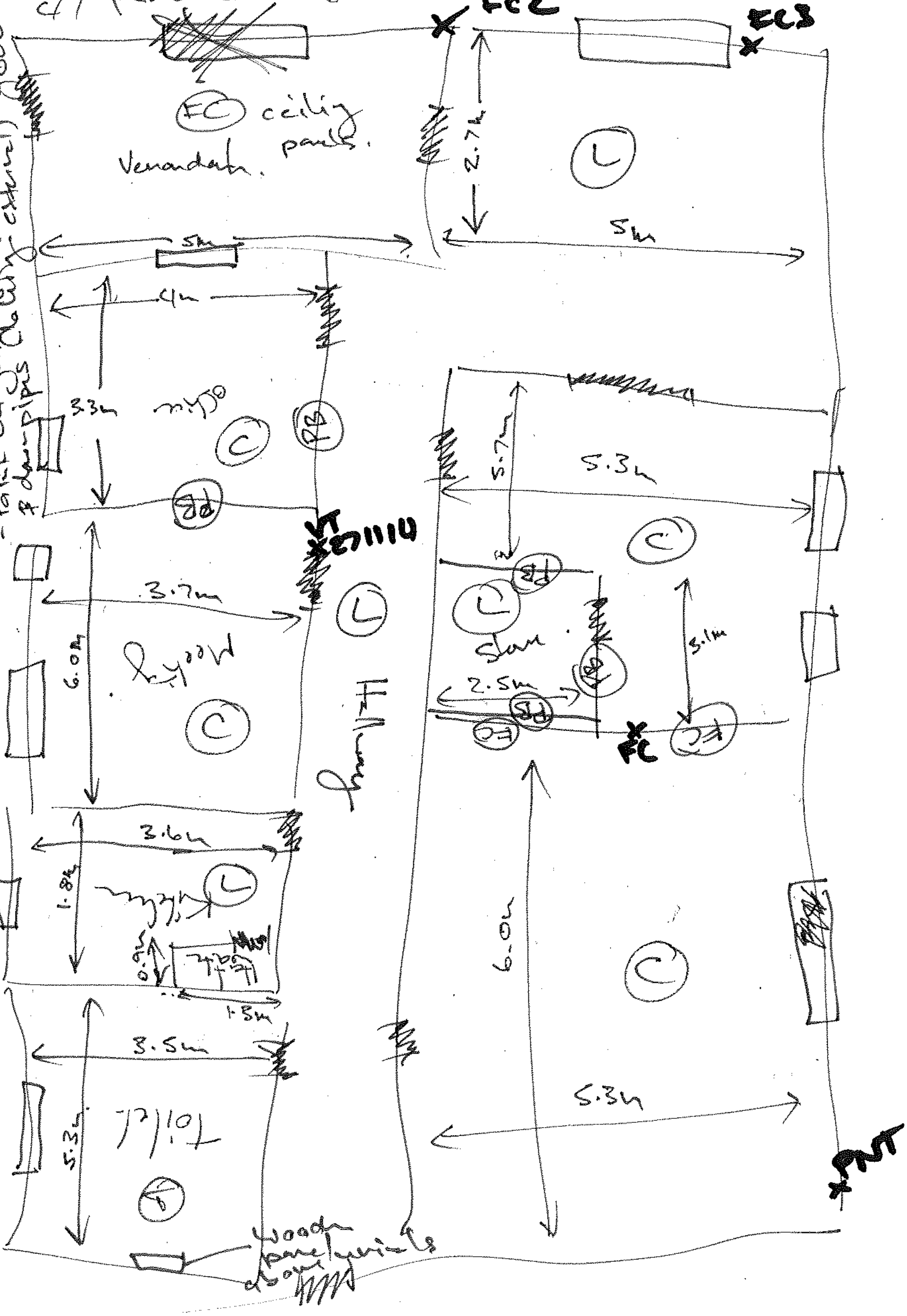
FC2/C-271114: FC Panel Fascia approx 10m²

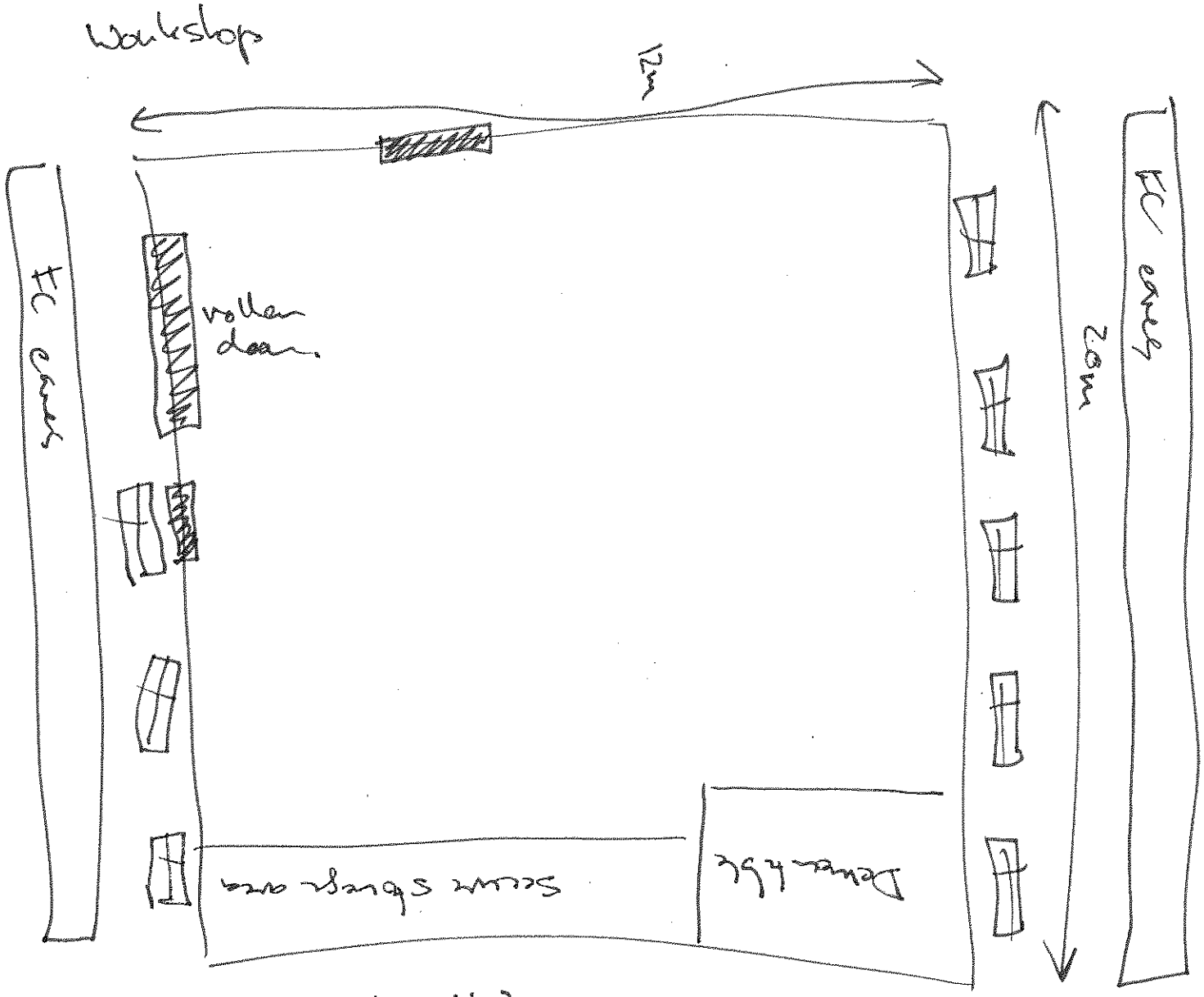
FC3/C-271114 – FC Eaves.

PNT/C-271114 – Paint from downpipe (external)

Double brick construction.
Internal walls concrete rendered.
Floors (on slab) linoleum (L), carpet (C), tiles (T)
Internal walls rendered (R), fibre cement (FC), c/l plaster board (PB).

- 2.6m high ceiling
- Internal paint in good condition
- Paint overall & fascia (external) good condition
- Paint on guttering & downpipes (peeling)
- Plasterboard ceiling panels
- Tile roof
- Metal guttering
- FC Fascia (10m²)
- FC Eaves (60m²)





- Ceiling height 4.2m
- Double brick construction, concrete slab, rendered internal walls.
- 40 double 4 lamp light fittings (too high to access)
- Aluminium windows
- 2 exit lights
- Internal paint good (non detriorated condition)
- plasterboard ceiling
- FC eaves. (too high to sample) approx 40 m²

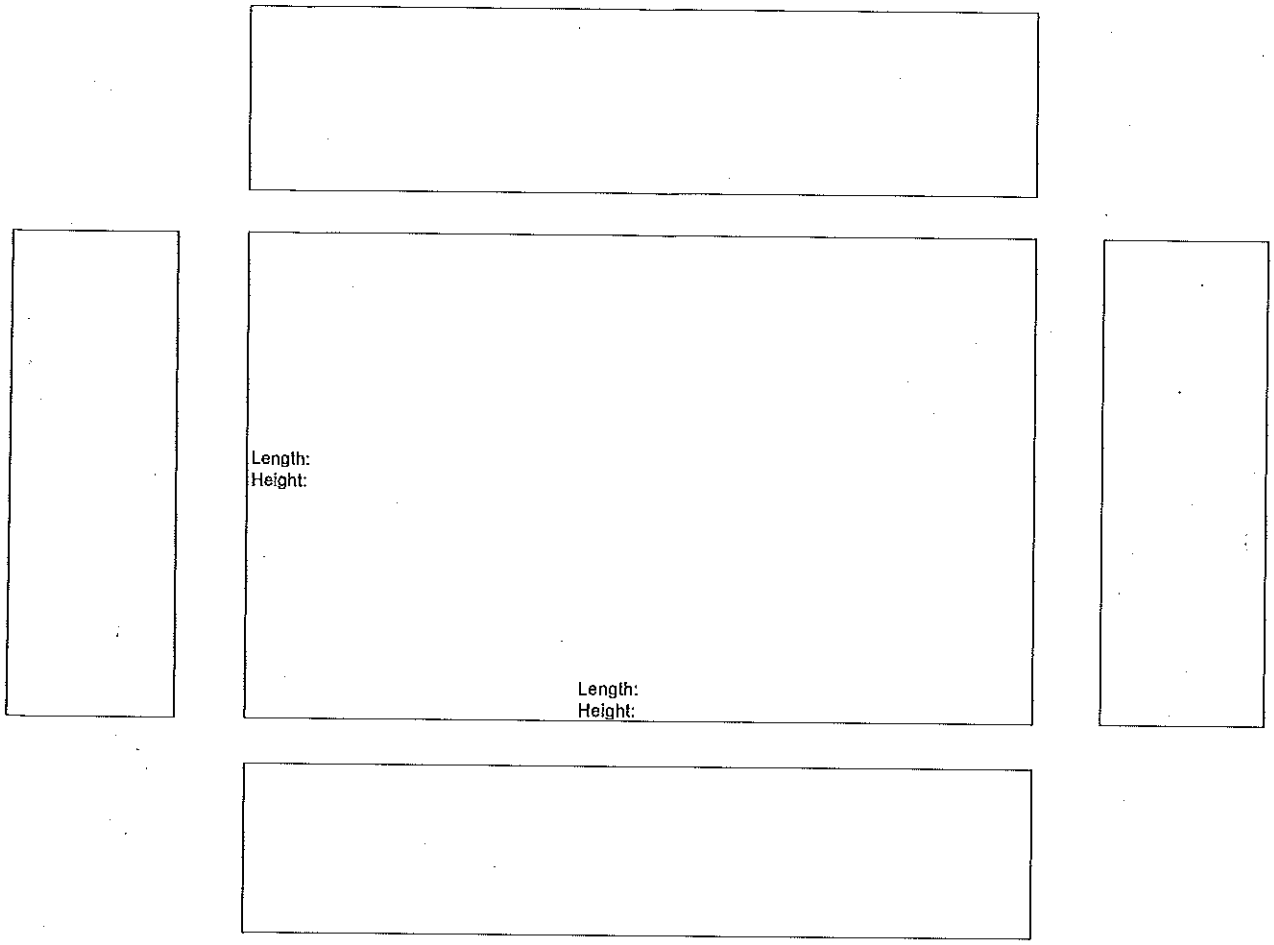
HAZARDOUS BUILDING MATERIALS REGISTER

Building:

Project:

Room:

Date:



Construction Materials

External Wall:
Internal Wall:
Floor:
Ceiling:
Roof:

Building Materials Key

Fibre Cement Ceiling	**FCCE**	Lagging	**LAG**	Emergency Lighting	**EL**
Fibre Cement Eaves	**FCE**	Fibre Insulation	**FIN**	Flouresecnt Light	**FL**
Fibre Cement Cladding	**FCCL**	Vinyl Tiles	**VT**		
Fibre Cement Roof	**FCR**	Fire Doors	**FD**		
Electrical Backing Board	**EBB**	Painted Surfaces	**PS**		

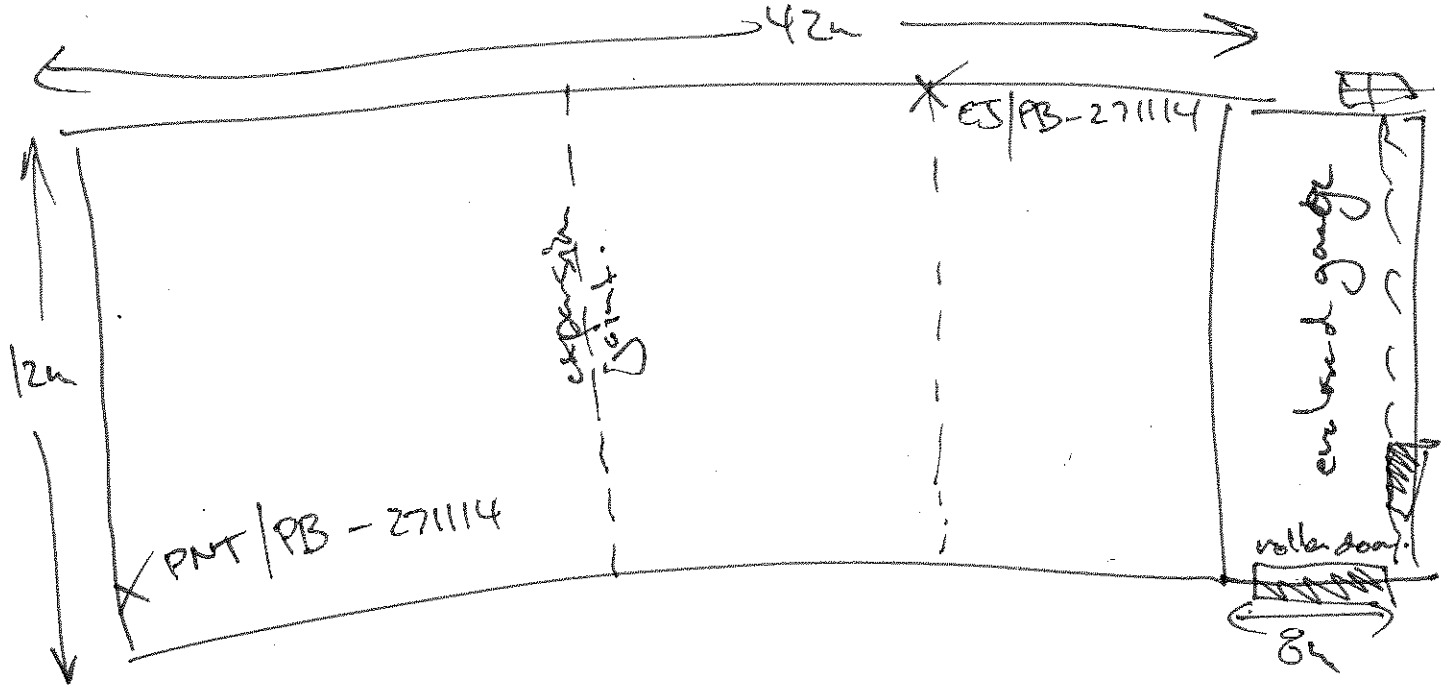
Notes:

E

2.4

1

Parking Bays / Garages



- Concrete blocks walls, concrete slab, tin roof, timber & painted steel supports, metal guttering.
- Painted block work. Some deterioration near base of walls
- 9 double fluorescent lights (too high to access)
- Painted steel work. Good non deteriorated condition.
- 9 double fluorescents in enclosed garage. Very poor condition (dangerous to dismantle).
- Roof height 4.2m

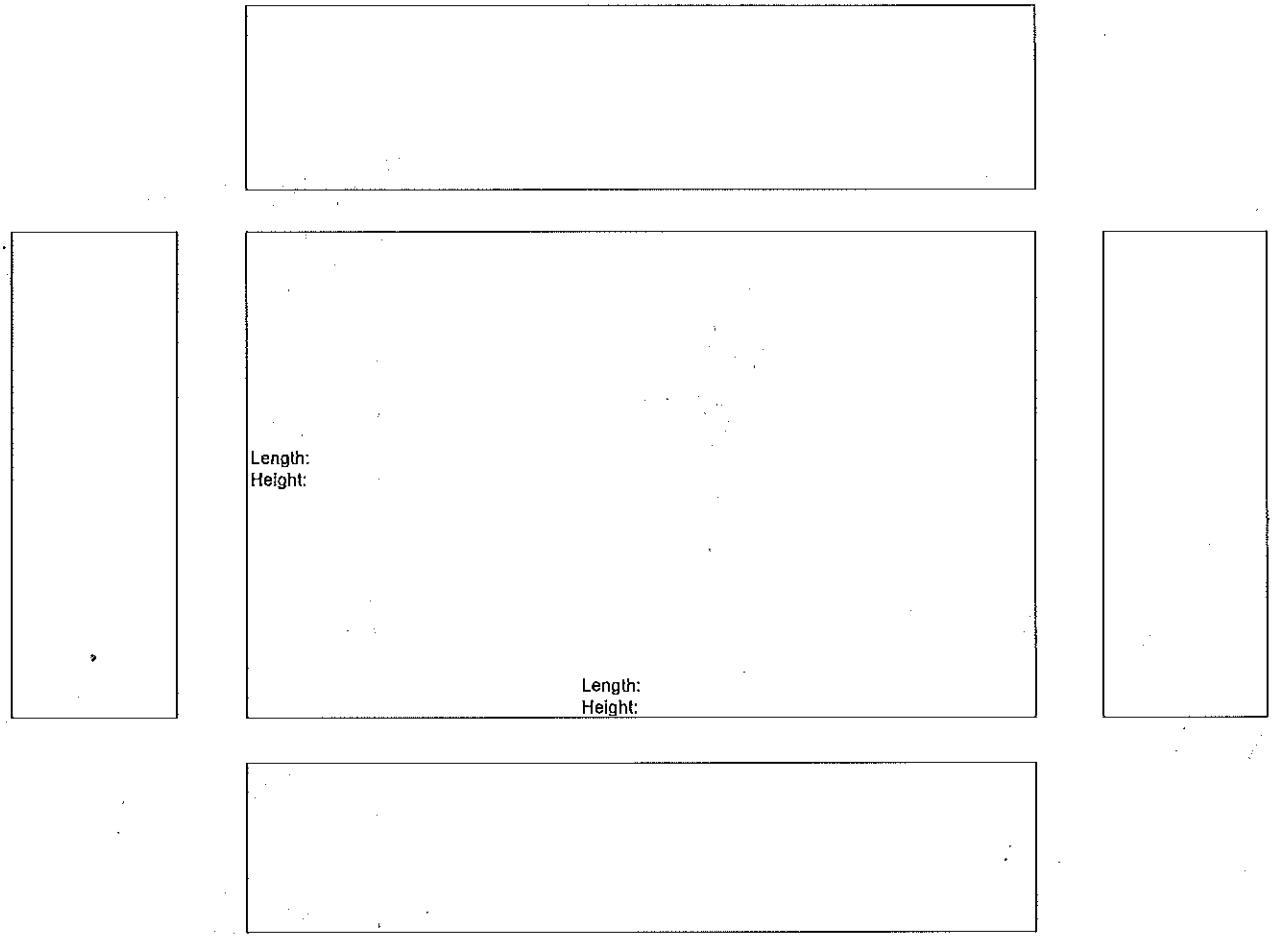
PNT/PB-271114 - Paint for base of block walls. (white)

EJ/PB-271114 - Expansion joint. (block mastic)

HAZARDOUS BUILDING MATERIALS REGISTER

Building: **Project:**

Room: **Date:**

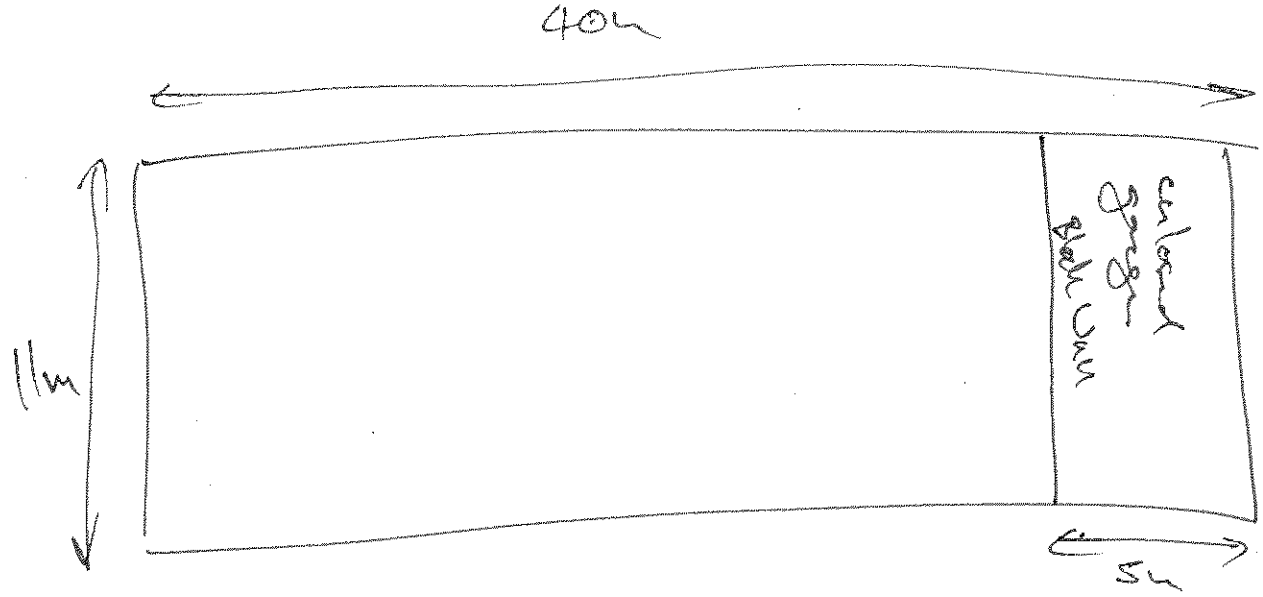


Construction Materials	***Building Materials Key***					
External Wall:	Fibre Cement Ceiling	**FCCE**	Lagging	**LAG**	Emergency Lighting	**EL**
Internal Wall:	Fibre Cement Eaves	**FCE**	Fibre Insulation	**FIN**	Flouresecnt Light	**FL**
Floor:	Fibre Cement Cladding	**FCCL**	Vinyl Tiles	**VT**		
Ceiling:	Fibre Cement Roof	**FCR**	Fire Doors	**FD**		
Roof:	Electrical Backing Board	**EBB**	Painted Surfaces	**PS**		

Notes:

F

Smaller / lower height parking bays / garage



- Construction as per parking bays garage / however roof lower (3.5m.

- 28 fluro light fittings
- Capacitor MSP CBIS 220TW 75442-020.
- ELCO 250V 50/60Hz ECL00.25
- Dan's CE36/40WLL 240V/50Hz
- AICO LEC 65
- PLESSEY P102

Appendix E. Calibration Certificates

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 11K101263

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC	✓	
	4. D.O	✓	
	5. Temp	✓	
	6. Salinity	✓	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 10.00		pH 10.00		LL1545	pH 9.97
2. pH 7.00		pH 7.00		LF1041	pH 7.00
3. pH 4.00		pH 4.00		LK2362	pH 4.05
4. mV		229.6mV		KH1997/KH1995	229.8mV
5. EC		2.76mS		LG1689	2.77mS
6. D.O		0.00ppm		230	0.00ppm
7. Temp		22.0°C		MultiTherm	22.7°C

Calibrated by: _____ **Anne Rutlidge**

Calibration date: **27/11/2014**

Next calibration due: **26/05/2015**

PID Calibration Certificate

Instrument PhoCheck Tiger
Serial No. T-105923

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
	Recharge OK?	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
Pump	Operation	✓	
	Filter	✓	
	Flow	✓	
	Valves, Diaphragm	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	PID	✓	10.6 ev
Alarms	Beeper	✓	**Low** / **High** / **TWA** / **STEL**
	Settings	✓	50ppm / 100ppm / N/A / N/A
Software	Version	✓	
Data logger	Operation	✓	
Download	Operation	✓	
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Calibration gas and concentration	Certified	Gas bottle No		Instrument Reading
PID Lamp		100ppm Isobutylene	NIST	SY45		100.2ppm

Calibrated by: Jacob Arnott

Calibration date: 14/11/2014

Next calibration due: 14/12/2014

Appendix F. Asbestos Clearance Certificate

PROGRESSIVE RISK MANAGEMENT

Asbestos Clearance Certificate

Ausgrid

Noraville Depot

Wilfred Barrett Drive (Central Coast Highway), Noraville NSW

P099

December 2014

Document Control

Project Details:	
Project Name:	Asbestos Clearance Certificate
Site Identification:	Ausgrid Noraville Depot
Site Address:	Wilfred Barrett Drive (Central Coast Highway), Noraville NSW
Specific Location:	Noraville Depots Grounds: Building exteriors, storage areas and vegetation (excluding Noraville Zone Substation)
Job Number:	P099
Client Name:	Ausgrid
Client Number:	C002

Document Review:					
Document:	Prepared by:	Reviewed by:		Authorised by:	
Final		10/12/2014		11/12/2014	
	Hamish Donovan Consultant	**Lee Brown** Senior Consultant		**Jared Clifford** Principal Consultant	

1. Introduction

Progressive Risk Management Pty Ltd (PRM) has been engaged by Ausgrid to supervise asbestos removal works and provide a visual clearance inspection of the grounds located within Ausgrid Noraville Depot (excluding Noraville Zone Substation). The depot is located on Wilfred Barrett Drive, Noraville NSW and the visual clearance inspection was conducted on Monday 8 December 2014.

The asbestos clearance certificate was completed following the removal of suspected asbestos containing fibre cement debris located on the grounds at various locations within the depot. Refer to **Appendix A** for removal locations.

This clearance certificate details the PRM scope of works and outlines the findings of the visual clearance inspection and any limitations related to the asbestos removal works.

2. Scope of Works

In order to provide clearance for the asbestos removal works undertaken at the site, the following scope of works was undertaken:

- Supervise removal works of suspected asbestos containing fibre cement debris from the grounds of the depot (excluding Noraville Zone Substation).
- Conduct a visual clearance inspection of the grounds of the depot subsequent to removal works.
- Provide on-site advice and guidance where required during the asbestos removal works.

Refer to Section 4.2 for the specific locations of where the suspected asbestos containing fibre cement debris was removed from within the Noraville Depot.

3. Methodology

3.1. Asbestos Removal Works

Removal works were performed by visual inspection of surface material followed by manual collection of suspected asbestos containing fibre cement debris throughout the Ausgrid Noraville Depot (excluding Noraville Zone Substation). Non-destructive, hand-picking (Emu-Bob) of suspected asbestos containing fibre cement debris was conducted in a grid pattern by walking multiple transects with a 90^0 directional change throughout the depot.

3.2. Bulk Sample Analysis

During removal works, representative samples of suspected asbestos containing fibre cement debris were collected and placed into sealable clip-lock plastic bags. Samples were collected at the request of the Ausgrid Technician. Samples were then analysed by an external NATA-accredited laboratory, Envirolab Services Pty Ltd, for the presence of asbestos by Polarised Light Microscopy.

3.3. Visual Clearance Inspection

Following the asbestos removal works, a visual clearance inspection was undertaken by Hamish Donovan and Lee Brown (Licenced Asbestos Assessor Licence No LAA001030) of PRM on Monday 8 December 2014. The visual clearance inspection was conducted in accordance with legislative requirements to ensure all visible suspected asbestos containing fibre cement debris within physically accessible areas associated with the scope of works (as per *Section 2 Scope of Works*) had been removed from the work area.

4. Asbestos Removal Overview

The asbestos removal works were classified as bonded asbestos removal works and were under 10 m^2, therefore an Ausgrid trained employee working under the Ausgrid Asbestos Management Unit undertook the removal works.

4.1. Personal Protective Equipment

The following Personal Protective Equipment (PPE) was utilised during the asbestos removal works by the trained Ausgrid employee and PRM consultants:

- P2 Respirator;
- Disposable gloves;
- Safety boots
- Protective eye-wear

All PPE used throughout the asbestos removal works were disposed of as asbestos waste in asbestos waste bags.

4.2. Removal Work Area

The removal works conducted by the trained Ausgrid employee included manual collection of suspected asbestos containing fibre cement debris throughout the depot via the hand-picking (Emu-Bob) method. As per *Section 2 Scope of Work*suspected asbestos containing fibre cement debris were identified and removed from the following areas:

- Between silt fences near gravel storage area along northern boundary fence;
- Near northwest footing of Building 4;
- East of Building 4 adjacent to Gas Storage facility;
- Below eave of Building 4 southern wall;
- Southern side of Building 6 next to awning;
- Below eave of Building 3 western wall next to security fence; and
- Near northeast footing of Building 2.

Refer to **Appendix A** for removal locations within the depot grounds.

4.3. Removal Methodology

The site was secured by Ausgrid by locking entry/exit gates within the depot, preventing personnel from entering the depot during removal works. No other personnel were granted access until all asbestos removal works were completed.

Removal works were performed by visual inspection of surface material followed by manual collection of suspected asbestos containing fibre cement debris. Non-destructive, hand-picking (Emu-Bob) of suspected asbestos containing fibre cement debris was performed in a grid pattern by walking multiple transects with a 90^0 directional change throughout the depot. Hand tools were utilised to remove suspected asbestos containing fibre cement debris from the soil to a depth of ~100 mm.

The hand tools used were decontaminated with wet-wiping techniques following the removal works. All associated waste was sealed and disposed of in 200µm thick plastic asbestos labelled waste bags and disposed of at a registered waste facility by an Ausgrid trained employee.

5. Legislative Requirements

The asbestos hygiene services were conducted in accordance with the following current legislation, Codes of Practice and guidance material:

- NSW Work Health and Safety Act 2011;
- Chapter 8 Asbestos of the NSW Work Health and Safety Regulation 2011;
- Code of Practice for How to Manage and Control Asbestos in the Workplace 2011;
- Code of Practice for How to Safely Remove Asbestos 2011;
- Safe Work Australia's Minor contamination' of asbestos-containing dust or debris fact sheet 2013; and
- Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition [NOHSC:3003(2005)].

5.1. Licensed Asbestos Assessor

All asbestos hygiene works were conducted by a WorkCover NSW approved Licensed Asbestos Assessor throughout the asbestos removal works. The Licensed Asbestos Assessor which was utilised during the asbestos removal works was:

- Lee Brown – LAA001030.

6. Results

6.1. Bulk Sample Analysis

Three samples of suspected asbestos containing fibre cement debris were sent to and analysed by Envirolab Services Pty Ltd for the presence of asbestos. Results are summarised as follows:

Table 1 – Bulk sample analysis results

Location	Sample Number	Material Description	Laboratory Analysis Results
Southern side of Building 6 next to awning	AS04	Brown Compressed Fibre Cement Material	No asbestos detected
Northwest footing of Building 4	AS06	Grey Compressed Fibre Cement Material	**Chrysotile asbestos detected** **Amosite asbestos detected**
Northeast footing of Building 2	AS07	Brown Compressed Fibre Cement Material	**Chrysotile asbestos detected** **Amosite asbestos detected**

6.2. Visual Clearance Inspection

Following the asbestos removal works, a visual clearance inspection was undertaken to ensure visible and physically accessible asbestos containing fibre cement debrisas per *Section 2* and *Section 4.2*, had been removed from the asbestos removal work area.

It was concluded by the PRM Licensed Asbestos Assessor, as per *Section 5.1*, there was no visible asbestos residue from the asbestos removal works in the area, or in the vicinity of the area where removal works were carried out. The asbestos containing fibre cement debris as per *Section 2* and *Section 4.2*, had been removed to a satisfactory standard

and to legislative requirements at the time the visual clearance inspection was conducted.

Refer to **Appendix B** for the photo log related to the visual clearance inspection conducted for the site.

6.3. Re-occupation of Removal Areas

Following the completion of the visual clearance inspection, PRM now deem the removal areas suitable for re-occupation.

7. Conclusion

Asbestos containing fibre cement debris associated with *Section 2 Scope of Works* and *Section 4.2 Asbestos Removal Work Area*, were observed to have been removed as per legislative requirements from the asbestos removal area and the immediate surrounding area. The asbestos removal area and immediate surrounding area are now considered free from visible asbestos contamination.

Based on the review of the visual clearance inspection, PRM deem the removal work area within Ausgrid Noraville Depot, located on Wilfred Barrett Drive, Noraville NSW is suitable for reoccupation.

If you have further questions regarding this clearance certificate please do not hesitate to contact the undersigned.

Regards,

Lee Brown

Senior Consultant – Workplace Safety Risk

NSW Licensed Asbestos Assessor: License No. LAA001030

0434 515 508

lee.brown@progressiverm.com.au

http://www.progressiverm.com.au/

8. Limitations

This Asbestos Clearance Certificate has been prepared by Progressive Risk Management Pty Ltd ("PRM") for Ausgrid ("the client") based upon a specific request made by the client for Noraville Depot located on Wilfred Barrett Drive, Noraville, NSW ("the site");

This Clearance Certificate:

- *May only be used for the purpose as a clearance certificate for asbestos remedial works performed on 2 November 2014, as per the scope of works (outline in Section 2) on the asbestos containing materials (detailed in Section 2) removed from the works areas (described in Section 4.2) outlined in this clearance certificate. This clearance certificate does not relate to remaining asbestos-containing materials, not related to the asbestos removal works to which this clearance certificate relates, which may be present within the building.*
- *May only be used in association with the work areas as outlined in Section 4.2 only of this clearance certificate. All other work areas have been excluded from this clearance certificate.*
- *Must not be copied to, used by, altered, amended or abbreviated, issued in part or issued incomplete without the prior written consent of PRM.*

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by PRM and the clearance certificate are excluded unless they are expressly stated to apply in this clearance certificate.

The services undertaken by PRM in connection with preparing this clearance certificate were limited to those specifically detailed in the Scope of Works of this clearance certificate. The opinions, conclusions and any recommendations in this certificate are based on the inspection findings and reviewed documentation only.

Subject to the paragraphs in this section of the clearance certificate, the opinions, conclusions and any recommendations in this clearance certificate are based on conditions encountered at the time of the clearance inspection and information reviewed at the time of preparation.

Please note that subsequent to the date of this report, works or site conditions may have resulted in changes to the status of any identified materials, which should have been documented and provided to PRM as a supplement to this report.

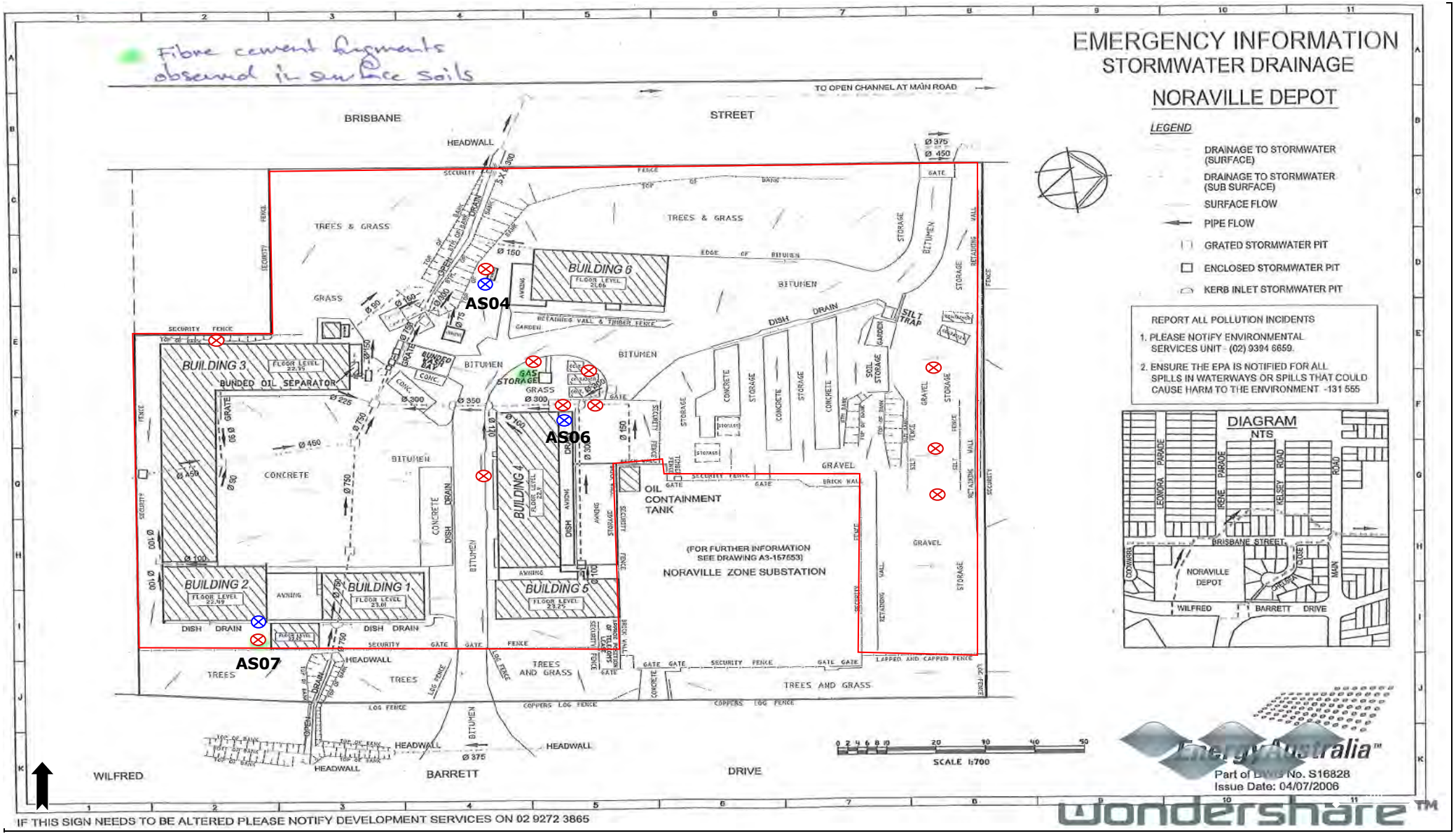
The data and advice provided herein relate only to the project and structures described in the clearance certificate and must be reviewed by a competent professional before being used for any other purpose. PRM accepts no responsibility for other use of the data.

Where a third party conducted survey work, reports (such as laboratory reports) or verbal information that has been relied upon, the data are included and used in the form provided by others. The responsibility for the accuracy of such data remains with the original entity and not with PRM.

PRM has assumed that the information reviewed is complete, accurate and reliable. PRM has not sought to independently verify those sources or the information provided by those sources (and have not presented an opinion, nor provided a warranty as to the completeness, accuracy, reliability or appropriateness of the information provided unless otherwise noted within the clearance certificate.

PRM expressly disclaims responsibility for any error in, or omission from, this clearance certificate arising from or in connection with any of the Assumptions above being incorrect.

Appendix A: Removal Locations within Noraville Depot



PRM
PROGRESSIVE RISK MANAGEMENT

LEGEND	
	Approximate extent of area of investigation
⊗	Suspected asbestos removal location
⊗	Asbestos Material Sample Location

Project Name:	Asbestos Clearance Certificate
Site Address:	Wilfred Barrett Drive, Noraville, NSW
Client Name:	Ausgrid
Project Number:	P099
Figure Name:	Noraville Depot Site Layout

Appendix B: Photographs

Project Name:	Asbestos Clearance Certificate
Project Number:	P099
Asset Name:	Ausgrid Noraville Depot
Asset Location:	Wilfred Barrett Drive (Central Coast Highway), Noraville NSW
Client Name:	Ausgrid

PROGRESSIVE RISK MANAGEMENT

Photo 1:	Suspected asbestos containing fibre cement fragment near gas storage facility in Noraville Depot.

Photo 2:	Suspected asbestos containing fibre cement fragment near gas storage facility in Noraville Depot.

Photo 3:	Non asbestos containing fibre cement fragment on south side of Building 6 near awning.

Photo 3:	Asbestos fibre cement fragments near northeast corner of Building 2.

Appendix C: NATA Accredited Laboratory Report

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 120586

Client:
Progressive Risk Management Pty Ltd
17 Ravel St
Blacktown
NSW 2147

Attention: Hamish Donovan

Sample log in details:

Your Reference:	**P099**
No. of samples:	3 Materials
Date samples received:	8/12/2014
Date completed instructions received:	8/12/2014

Analysis Details:
Please refer to the following pages for results and methodology summary.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Note, even after disintegration it can be difficult to detect the presence of asbestos in some asbestos containing bulk materials using PLM and dispersion staining. This is due to the low grade or small length or diameter of the asbestos fibres present in the material, or to the fact that very fine fibres have been distributed intimately throughout the materials. Vinyl/asbestos floor tiles, some asbestos containing epoxy resins and some ore samples are examples of these types of material, which are difficult to analyse.

Report Details:

Date results requested by:	9/12/14
Date of Preliminary Report:	Not Issued
Issue Date:	9/12/14

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Asbestos was analysed by Approved Identifier:	Lulu Guo
Asbestos was authorised by Approved Signatory:	Lulu Guo

Lulu Guo
Approved Signatory

Envirolab Ref: –	Sample ID: –	Date analysed -	Mass / Dimension of Sample -	Sample Description -	Asbestos ID in materials -
120586-1	AS04	9/12/2014	50x23x6mm	Brown compressed fibre cement material	No asbestos detected
120586-2	AS06	9/12/2014	65x35x10mm	Grey compressed fibre cement material	Chrysotile asbestos detected Amosite asbestos detected
120586-3	AS07	9/12/2014	55x35x5mm	Brown compressed fibre cement material	Chrysotile asbestos detected Amosite asbestos detected

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.

APPENDIX B: PLANNING LAYOUT AND CIVIL ENGINEERING ASSESSMENT (CARDNO NSW PTY LTD).

Our Ref: 80515861
Contact: Sara Belgrove

Cardno
Shaping the Future

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

34 / 205-207 Albany Street North
Gosford NSW 2250
Australia

Phone: 61 2 4323 2558
Fax: 61 2 4324 3251

www.cardno.com.au

12 February 2016

Manager – Real Estate Services – North
AUSGRID
Block C,
145 Newcastle Road
Wallsend NSW 2287

Attention: Mr Richard Parker

Dear Richard,

AUSGRID NORAVILLE SITE REZONING – 11A BRISBANE ST, NORAVILLE PLANNING AND CIVIL ENGINEERING REPORT

Ausgrid have reviewed their existing depot and substation site at Noraville and have determined that the southern part of their site is surplus to their ongoing needs and that if the land were to be rezoned, it could be sold.

Cardno has been engaged to undertake the preparation of planning layouts and civil engineering assessments in regards to the surplus component of the site. This report serves to summarise the outcomes of our planning and engineering assessment.

1. The Existing Site and Constraints

The existing site is bound to the east by Wilfred Barrett Drive, to the west by Brisbane St and to the north and south by existing residential allotments. Within the site, the northern-eastern corner contains the existing Noraville Zone Substation, and the remainder of the site contains storage areas and buildings that form the Noraville Ausgrid Depot. With the recent construction of Ausgrid's depot at Ourimbah, the depot component of the site has been deemed unnecessary to Ausgrid's operation in the future. Therefore, the southern part of the site is the subject of investigation with a view to rezoning for residential use and sale.

The presence of the substation on the land requires a 25m 'swimming pool' exclusion zone from the substation fence line where underground structures are not permitted due to potential earthing issues. This exclusion zone must be considered as part of the lot layout preparation.

An existing 750 mm diameter trunk stormwater pipe traverses the site from east to west, conveying flow from catchments to the east of Wilfred Barrett Drive. This pipeline and overland flow from the system must be conveyed through the site and must be considered in the proposed lot layouts.

Existing water and sewer services from the substation component of the site must be allowed for in the development of the lot layouts.

2. Planning Layouts

In order to assess the engineering constraints associated with rezoning the southern part of Ausgrid's site, concept lot layout plans were prepared. These plans are indicative of the final subdivision layout and lot yield that may be achieved, but are not intended for DA approval.

2.1 Low Density Layout Requirements

Wyong Shire Council's constraints in regards to minimum lot size are specified in their DCP 2013, Section 4 Subdivision. These constraints are as follows –

- Minimum lot size – 450 sq.m for R2 Residential zone.
- Minimum corner lot size – 700 sq.m.
- Minimum lot width – 15 m.

These dimensions have been used to establish the low density lot layout options.

2.2 Medium Density Layout Requirements

Under WLEP Clause 4.1B Exceptions to minimum lot sizes for certain residential development it states:

(1) The objectives of this clause are as follows:
(a) to provide opportunities for affordable housing in appropriate locations,
(b) to encourage housing diversity without adversely impacting on residential amenity.
(2) This clause applies to land in Zone R2 Low Density Residential.
(3) Development consent may be granted to a single development application for development on land to which this clause applies that is both of the following:
(a) the subdivision of land into 5 or more lots of a size that is less than the minimum size shown on the Lot Size Map in relation to that land,
(b) the erection of a dwelling house on each lot resulting from the subdivision.

This clause has been utilised to reduce the site width and areas in accordance with WDCP guideline 4.1.5.1 Small Lot Housing:

4.1.5.1 Small Lot Housing in the R2 Low Density Residential Zone

In accordance with WLEP 2013 Clause 4.1B - Exceptions to minimum lot sizes for certain residential development, in the R2 Low Density Residential Zone, development consent may be granted to a single development application for development that is subdivision of land into 5 or more lots and the erection of a semi-detached dwelling or a dwelling house on each lot resulting from the subdivision.

Requirements

a) Applications for Small Lot Housing must address the requirements of Clause 4.1B of WLEP 2013.
b) Building Design:
i. small lot housing development proposals shall include the submission of individual dwelling designs for each lot;
ii. applicants shall have regard for the principles within Chapter 2.1 Housing and Ancillary Structures
iii. dwelling designs shall provide for variation and architectural interest.
c) Lot Size and Design:
i. small lot housing development is to be confined to areas where the natural slope of the land is no greater than 15%;
ii. lot size is within the range of 200m2 to 450m². These lot sizes are only considered when lodged as part of a Small Lot Housing Development;
iii. lots should have a minimum lot area of 200m2 and a minimum width of 7.5m at the building line;

iv. *lots are to be generally rectangular in shape;*
v. *lots are to have sufficient area to enable the construction of an energy and water efficient dwelling house with adequate services, vehicle access and parking;*
vi. *proposals for achievement of the maximum potential lot yield are required to satisfy Council that an acceptable level of privacy and solar access will be available for residents of the site and for neighbouring sites.*

d) *Setbacks:*
   i. *proposals may seek to justify variations to the setback requirements of Chapter 2.1, based on the qualities of the design;*
   ii. *a zero side or rear boundary setback will not be permitted where the land adjoins a conventional housing lot;*
   iii. *where the development proposes (and justifies) a zero side boundary setback to an allotment within the development, no windows or openings will be permitted in that part of the wall standing on the boundary. In this circumstance, a 1.0m wide maintenance easement is to be created on the adjoining title. No gutter, downpipe, eave or the like shall project onto the adjoining lot.*

e) *Summary of Application Requirements:*
   i. *all applications for 'small lot housing development' as defined in this Part, shall include complete details of the proposal which identify:*
   ii. *site analysis;*
   iii. *proposed lot boundaries and dimensions;*
   iv. *proposed house designs;*
   v. *side and front setbacks;*
   vi. *driveway and car parking locations;*
   vii. *relationship of private open space to neighbouring properties;*
   viii. *the length of any external wall on a boundary and proposed easements for maintenance, etc.;*
   ix. *details of any retaining walls (including height, location and extent of cut and/or fill, drainage details, etc.).*

Therefore our proposed medium density lot layout is based upon:

- Lot size- 200-450sqm
- Minimum Frontage – 7.5m.

The information to be included with a subdivision application to suit the medium density layouts are outlined in item e) above.

2.3 Access Options

With regards to access to the site, three options were initially considered. These were: –

Option1	Access from Wilfred Barrett Drive with a loop road and no exit to Brisbane St. This option allows for the swimming pool exclusion zone to be located underneath the proposed loop road.
Option 2	Access from Brisbane St with a cul-de-sac and no exit to Wilfred Barrett Drive. This option allows for the swimming pool exclusion zone to be located within the each lot, which would require a Section 88B to be placed on the title to restrict the use of the site.
Option 3	A through road between the two external streets. The swimming pool exclusion zone is also within each lot in this case.

Each option was developed for a low and medium density layout.

2.4 Preliminary Bushfire Considerations

In preparing the lot layouts, preliminary investigations were undertaken and consideration was given to the vegetation adjoining the site to the east and across Wilfred Barrett Drive in particular for bushfire threat.

Given the slope of the land (upslope), vegetation type and potential link between areas of vegetation it was considered appropriate to implement an APZ of 20m to the eastern boundary of the site. If the vegetation is found to be only tall scrub and no forest vegetation type the APZ may be able to reduce to 15m.

Prior to final design and any future Development Application it is advised that a full bushfire report be undertaken.

The options were then considered in regards to the engineering issues, as outlined below. The outcome of the engineering review was then used to refine the layouts to suit engineering requirements.

The 6 layouts are included as an attachment to this letter for reference.

3. Civil Engineering

The three options were assessed on the basis of engineering constraints.

3.1 Access and Road Layout

The first assessment was based on access and road layout. It was considered that Option 3 would be the least desirable to Council and the RMS, as it would allow a run through the development, and a short-cut alternative to the Main Road/Wilfred Barrett Drive roundabout. It would therefore present traffic management issues which were not present in the other two options. Option 3 was then excluded from further assessment.

3.2 Stormwater Drainage Considerations

The two remaining layouts were reviewed in terms of the existing trunk stormwater drainage pipe that traverses the site, and the need to provide a suitable overland flow path through the site in the event of a major storm event and pipe blockage.

Council's requirement is that for pipes from 675 mm up to 1200mm in diameter, a 3 m wide easement is required where the trunk drainage traverses private property (Wyong Shire Council's Civil Works Design Guideline – Volume 1 – Section 10.8). Pipes 750mm and larger however, are not to be laid in private property and require the creation of drainage reserves. In terms of overland flow, the overland flow path must allow for conveyance of the 1% AEP event minus 50% of the pipe system capacity. Although the existing trunk drainage pipe through the site is a 750 mm diameter pipe, the downstream pipe is a 675 mm diameter pipe. We have adopted a 675 mm diameter pipe through the site to match the downstream pipe and also to allow easements to be used rather than having to create drainage reserves.

For Option 1, easements would need to be provided through the proposed lots, allowing for both the pipe and overland flow passage. Some re-alignment of the pipe would be required in order to best suit the proposed lot layout and to meet minimum lot size requirements.

Consideration was given to relaying the pipe along the boundary to the north and then east-west beneath the proposed road access from Wilfred Barrett Drive, however this alignment would mean that the pipe would be 3.5 metres deep beneath the road. The constructability and cost implications were considered significant and this option in terms of pipe alignment was not pursued.

For Option 2, easements are not required, and overland flow can be contained within the road reserve.

3.3 Assessment of Overland Flow

In order to determine the impact conveyance of overland stormwater flow would have on the lot layout, the 1% AEP (100 year ARI) flow reaching the property boundary in Wilfred Barrett Drive was determined.

The upstream catchment was assessed based on a site walkover and using topographic information from the NSW Land and Property Information's Six Viewer application. Figure 3-1 below indicates the assumed catchment.

Figure 3-1 Upstream Catchment

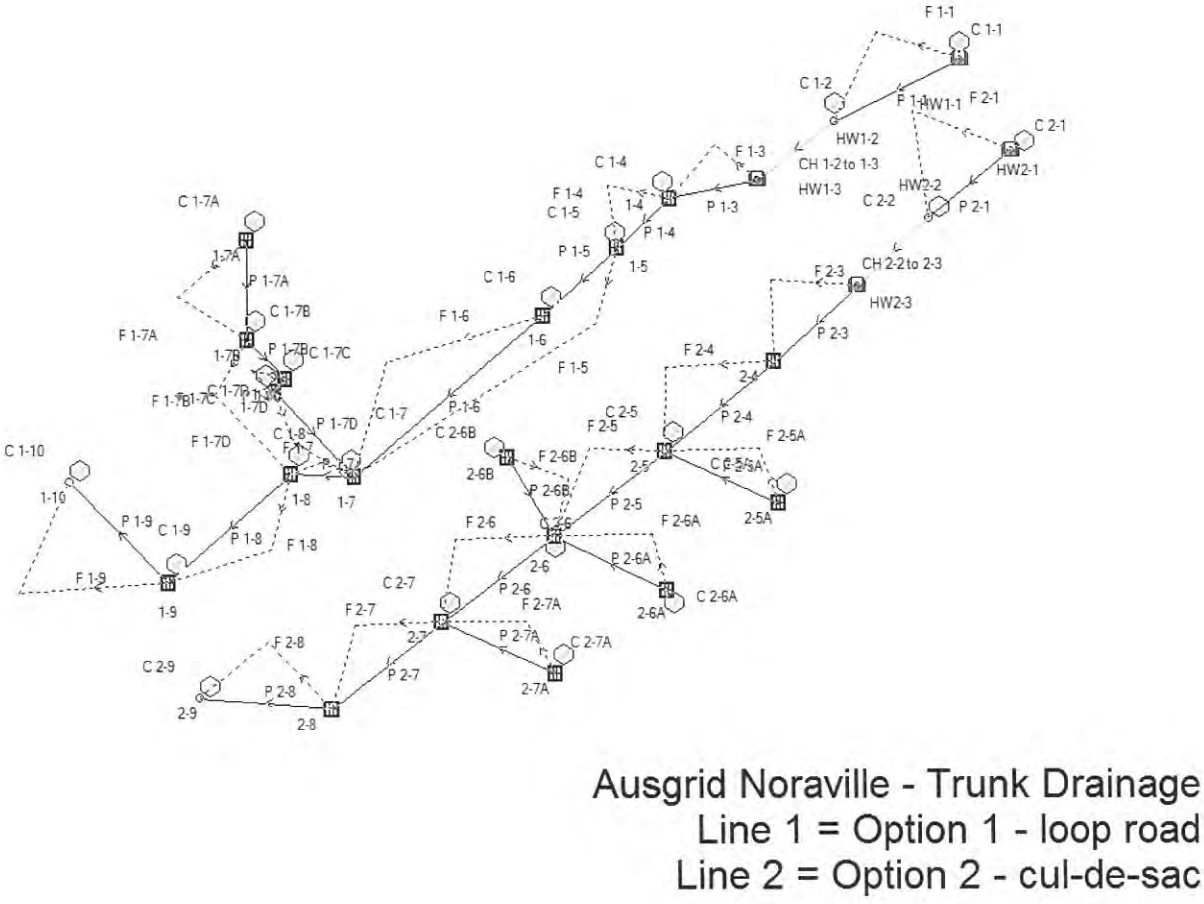
The DRAINS hydrologic and hydraulic modelling program was used to determine the catchment runoff and the upstream system capacity. Both proposed options were modelled with indicative inlets so that the quantity of overland flow could be assessed for each case. Figure 3-2 shows the DRAINS model layout.

The total flow reaching the boundary of the site is 0.594 m^3/s. To reflect 50% blockage in the 675 mm dia pipe, it has been modelled as a 525 mm dia pipe as this has half the cross-sectional area.

For Option 1, the maximum overland flow through private property is 0.152 m^3/s. A triangular grassed swale with 1V:6H sides will flow 0.192 m deep and be 2.30 m wide. This fits within the proposed 3 m wide easement and the velocity x depth product is 0.10 m^2/s, which is less than the 0.4 m^2/s allowed for safe passage of overland flow.

For Option 2, the maximum overland flow from the system is 0.206 m^3/s. This will be conveyed within the kerb and gutter of the road. Assuming 3% cross-fall on the road, the flow width will be 3.40 m at 143 mm deep. The velocity x depth product is 0.16 m^2/s, which is less than the 0.4 m^2/s allowed for safe passage of overland flow.

The quantity of overland flow between the two options varies as the layout, inlet capacity and hydraulics differ.



Ausgrid Noraville - Trunk Drainage
Line 1 = Option 1 - loop road
Line 2 = Option 2 - cul-de-sac

Figure 3-2 DRAINS Model Layout

3.4 Wyong Shire Council's Comments

The two layouts, and assessed overland flow scenarios were submitted to Council for their comment. Refer to the attached layouts in Appendix B.

Brendan Dee, one of Council's Development Engineers, provided the following comments on the two options presented on the 30th March 2015:

"The general layout of the drainage strategy for Option 1 that you have presented is preferred by Council. Containing overland flows in the road provides less potential issues than providing it through properties as flows can be obstructed/diverted by boundary fences and easements need to be created over the inter-allotment drainage for each affected lot. Options 1 provides greater lot yield from the cul-de-sac arrangement and requires the creation of an easement on one lot only.

In regards to the stormwater conveyance. There are known localised overland flooding and drainage capacity issues in the surrounding area. Easement widths are as per Council's Civil Design and Construction guidelines for proposed pipes and corresponding easement widths.

A more in depth drainage analysis of the site and contributing catchments, comparing peak discharges from the existing and proposed drainage system will need to be undertaken to ensure that the proposed development will not increase flows from the site. "

As the wording of his reply above indicates that he is supporting the cul-de-sac option, being Option 2, confirmation was sought as to which option was preferred. Brendan's response was as follows on the 18th June 2015:

"Sorry for any confusion. Option 2 with the cul-de-sac road layout was preferred by Council".

3.5 Water and Sewer Considerations

The two proposed options (Options 1 and 2) were reviewed in terms of future connection of water and sewer to the proposed subdivision. Continuity of supply to the existing substation was also allowed for. Gravity sewer connection can be obtained from the existing manhole in the south-western corner adjacent to Brisbane Street.

As Council's engineers had indicated a preference for the cul-de-sac option (Option 2), this layout was prepared in CAD and submitted to Council for review. Luke Drury, Council's Team Leader for Water and Sewer Planning provided the following comments (1/4/15):

"The proposed layout looks fine. Detail design will be to the SWC Edition of the WSA Sewerage Code of Australia with WSC Supplement.

Contributions payable will be affected by the existing credit the site holds based on the land use. At the time of lodging plans with council the status of the existing w&s facilities (bath house etc) and whether these are discontinued or remain with the switchyard will need to be documented".

The proposed layout for water and sewer connection is included in Appendix C.

4. Revised Internal Subdivision Boundary

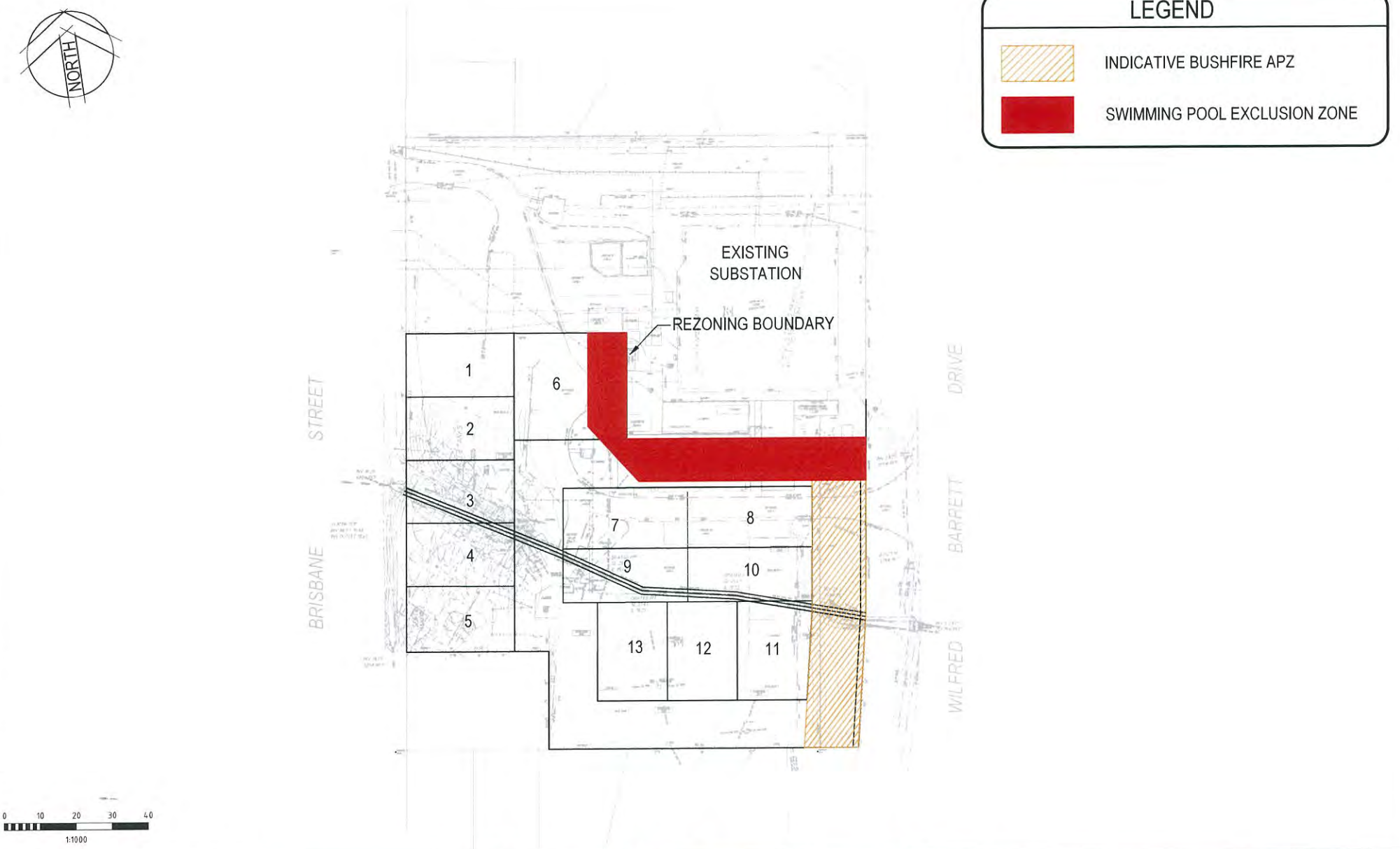
Ausgrid provided a revised internal subdivision boundary on the 5th February 2016. The 6 planning lot layouts were revised to suit. Appendix A includes the current layouts only. As the essence of the layouts remains the same as those submitted to Council for civil engineering and water and sewer input, they were not re-submitted to Council for further consideration.

If you or Council have any queries in regards to the information contained in this report, please don't hesitate to contact the undersigned.

Yours faithfully,

Sara Belgrove
Senior Civil Engineer
For Cardno
Direct Line: (02) 43201009
Email: sara.belgrove@cardno.com.au

APPENDIX A – PROPOSED LOT LAYOUT OPTIONS



DATE PLOTTED: 15 February 2016 2:55 PM BY: LAS DE BRITO

XREFs: a0515861.Civil
CAD File: N:\Projects\80\FY15\80_89 - Miscellaneous Sites Government\861 - Ausgrid Noraville\Drawings\Build\Planning\Sketch 04.dwg

Rev	Date	Description	Des.	Verif.	Appd.
A	10/2/16	New site layout with amended site boundary	NW	SJB	SJB

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		Date
Drawn	NW	10/02/2016
Checked	SJB	10/02/2016
Designed	NW	10/02/2016
Verified		Date
Approved		

Client: AUSGRID

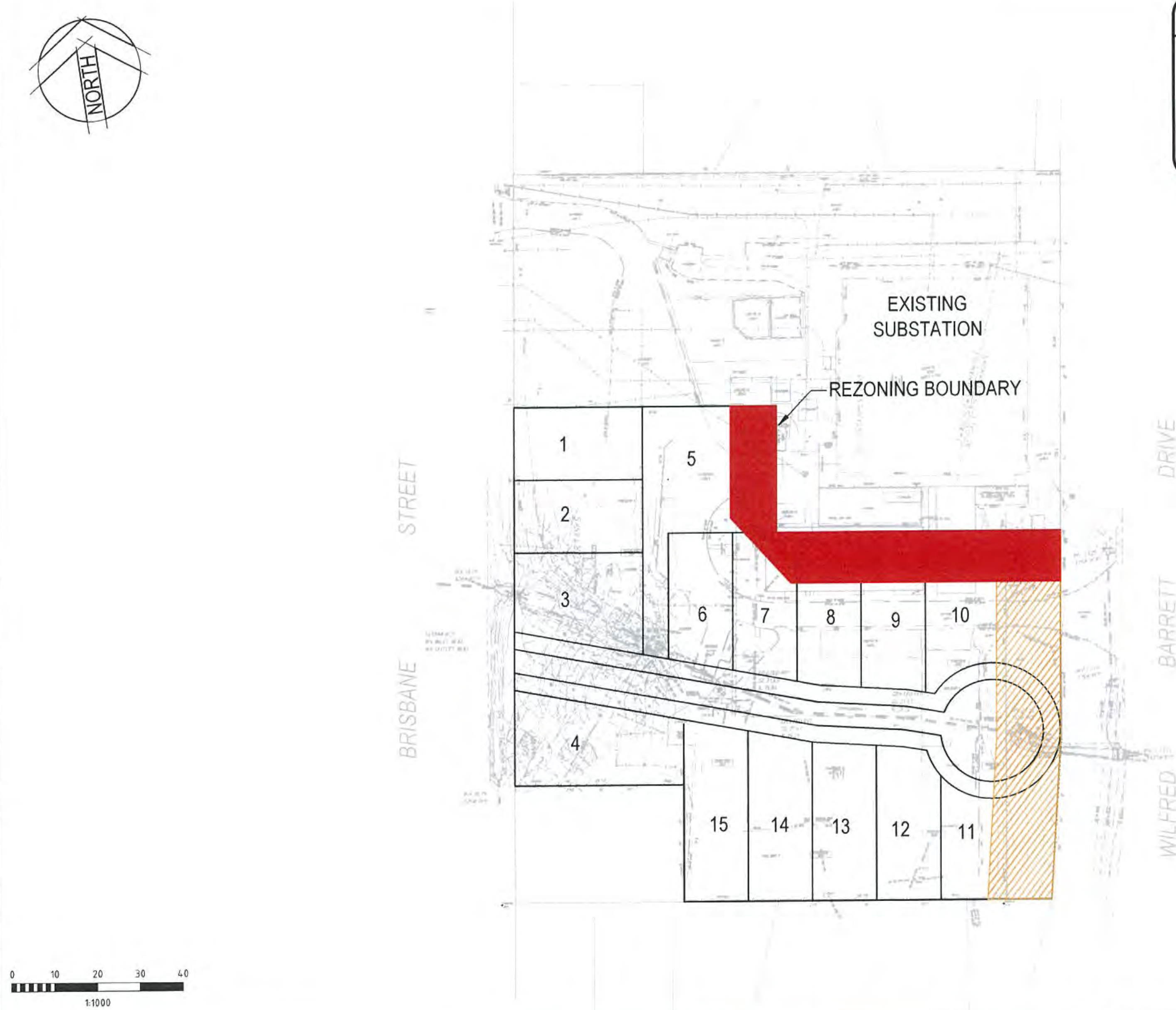
Project: AUSGRID NORAVILLE - LOT LAYOUTS FOR REZONING
LOT 2 DP 605538, 11A BRISBANE STREET
NORAVILLE, NSW

Title: LOW DENSITY OPTION 1 - 13 LOTS (revised site boundary)

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Scale: 1:1000
Size: A3

Drawing Number: 80515861-SK-004
Revision: 1



LEGEND

- INDICATIVE BUSHFIRE APZ
- SWIMMING POOL EXCLUSION ZONE

Rev	Date	Description	Des.	Verif.	Appd.
A	10/2/16	New site layout with amended site boundary	NW	SJB	SJB

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Drawn NW	Date 10/02/2016	
Checked SJB	Date 10/02/2016	
Designed NW	Date 10/02/2016	
Verified	Date	
Approved		

Client: AUSGRID

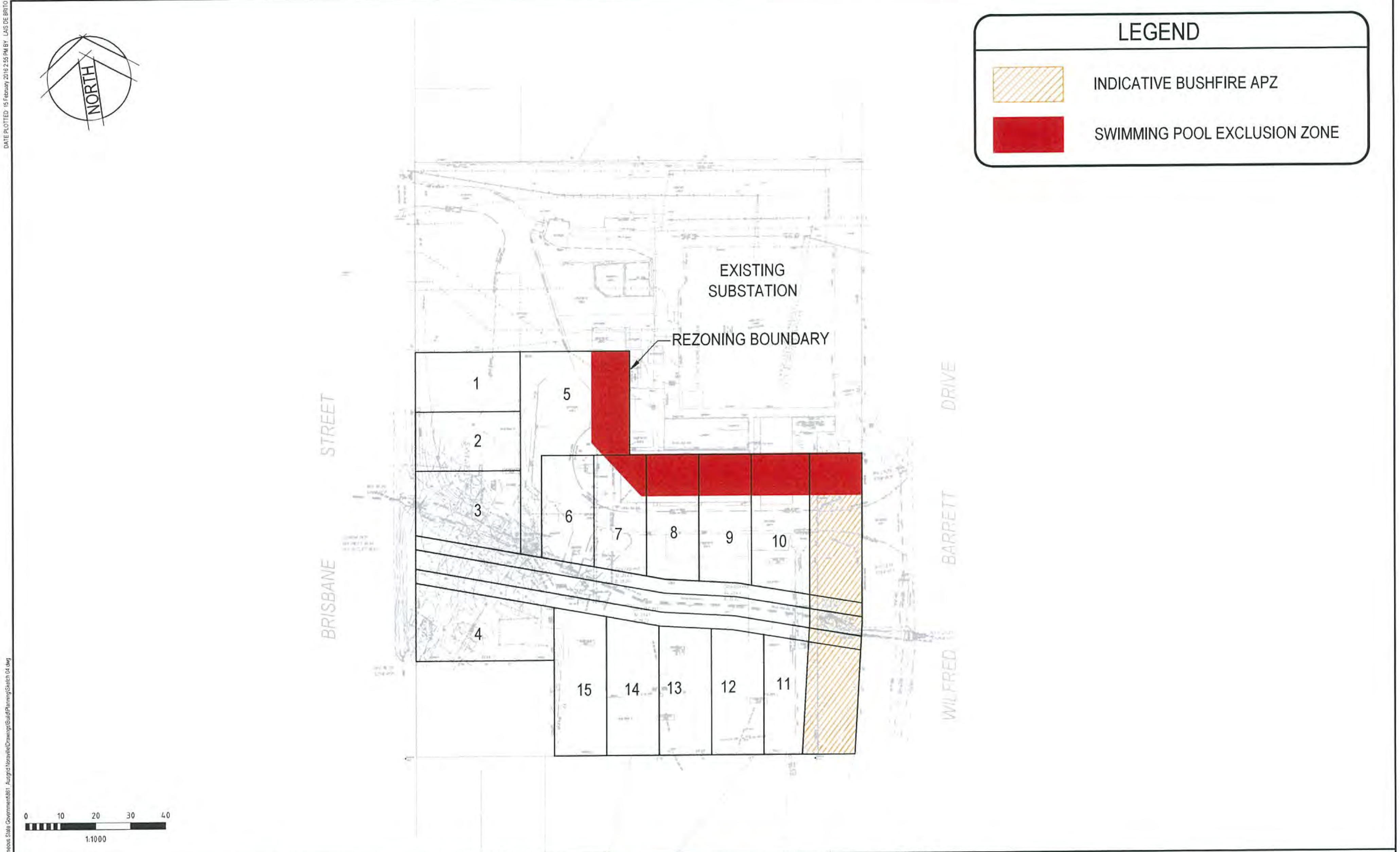
Project: AUSGRID NORAVILLE - LOT LAYOUTS FOR REZONING
LOT 2 DP 605538, 11A BRISBANE STREET
NORAVILLE, NSW

Title: LOW DENSITY OPTION 2 - 15 LOTS (revised site boundary)

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Scale: 1:1000 | Size: A3

Drawing Number: 80515861-SK-005 | Revision: 1



DATE PLOTTED 15 February 2016 2:55 PM BY LAIS DE BRITO

Rev	Date	Description	Des.	Verif.	Appd.
A	10/2/16	New site layout with amended site boundary	NW	SJB	SJB

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Web: www.cardno.com.au

Drawn NW	Date 10/02/2016	
Checked SJB	Date 10/02/2016	
Designed NW	Date 10/02/2016	
Verified	Date	
Approved		

Client: AUSGRID

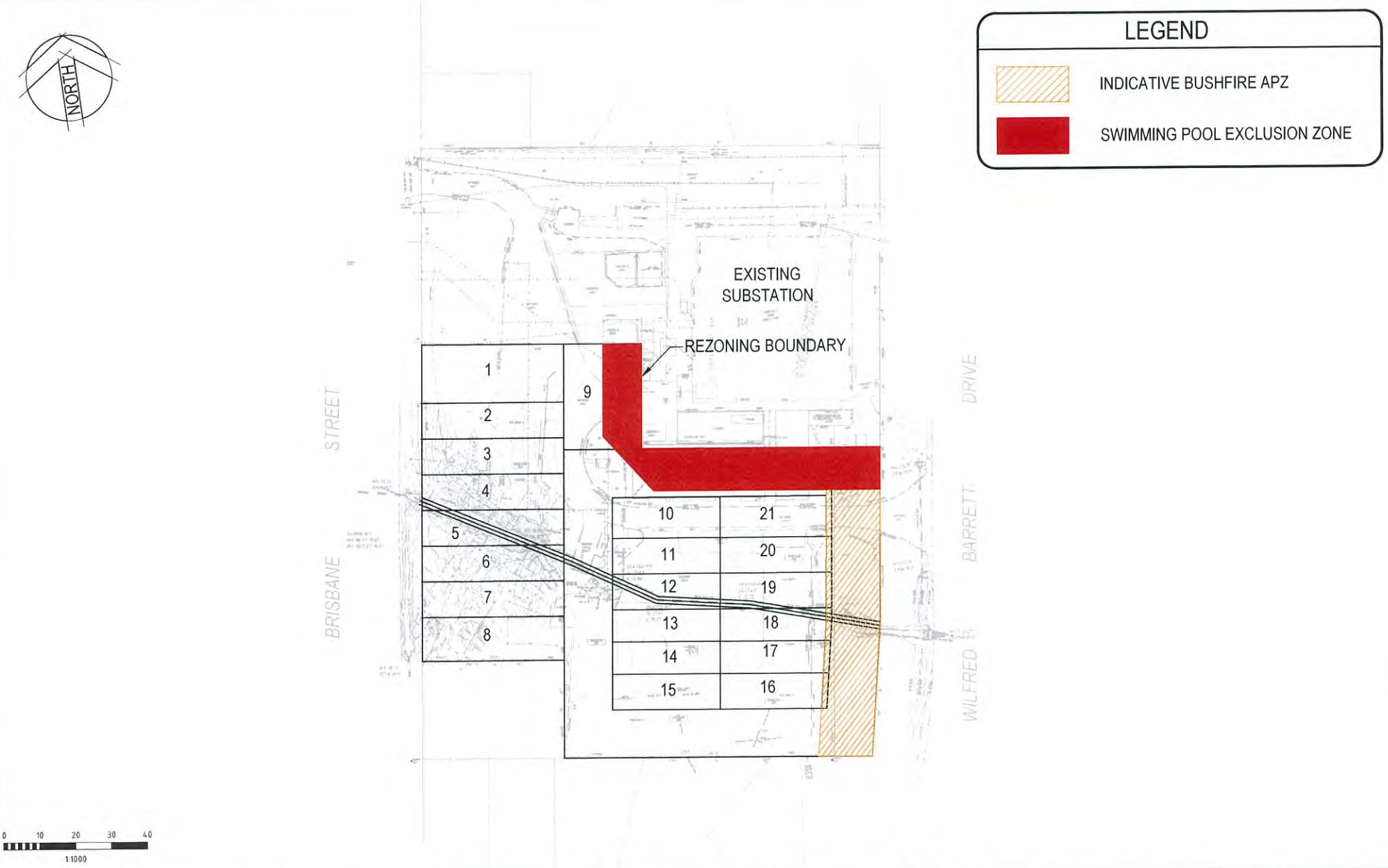
Project: AUSGRID NORAVILLE - LOT LAYOUTS FOR REZONING
LOT 2 DP 605538, 11A BRISBANE STREET
NORAVILLE, NSW

Title: LOW DENSITY OPTION 3 - 15 LOTS (revised site boundary)

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Scale: 1:1000 | Size: A3

Drawing Number: 80515861-SK-003 | Revision: 1



Rev	Date	Description	Des.	Verif.	Appd.
A	10/2/16	New site layout with amended site boundary	NW	SJB	SJB

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Cardno (NSW/ACT) Pty Ltd | ABN 95 001 145 035
34/205-207 Albany Street North
Gosford, NSW 2250
Tel: 02 4323 2558 Fax: 02 4324 3251
Web: www.cardno.com.au

		Date
Drawn	NW	10/02/2016
Checked	SJB	10/02/2016
Designed	NW	10/02/2016
Verified		Date
Approved		

Client: AUSGRID

Project: AUSGRID NORAVILLE - LOT LAYOUTS FOR REZONING
LOT 2 DP 605538, 11A BRISBANE STREET
NORAVILLE, NSW

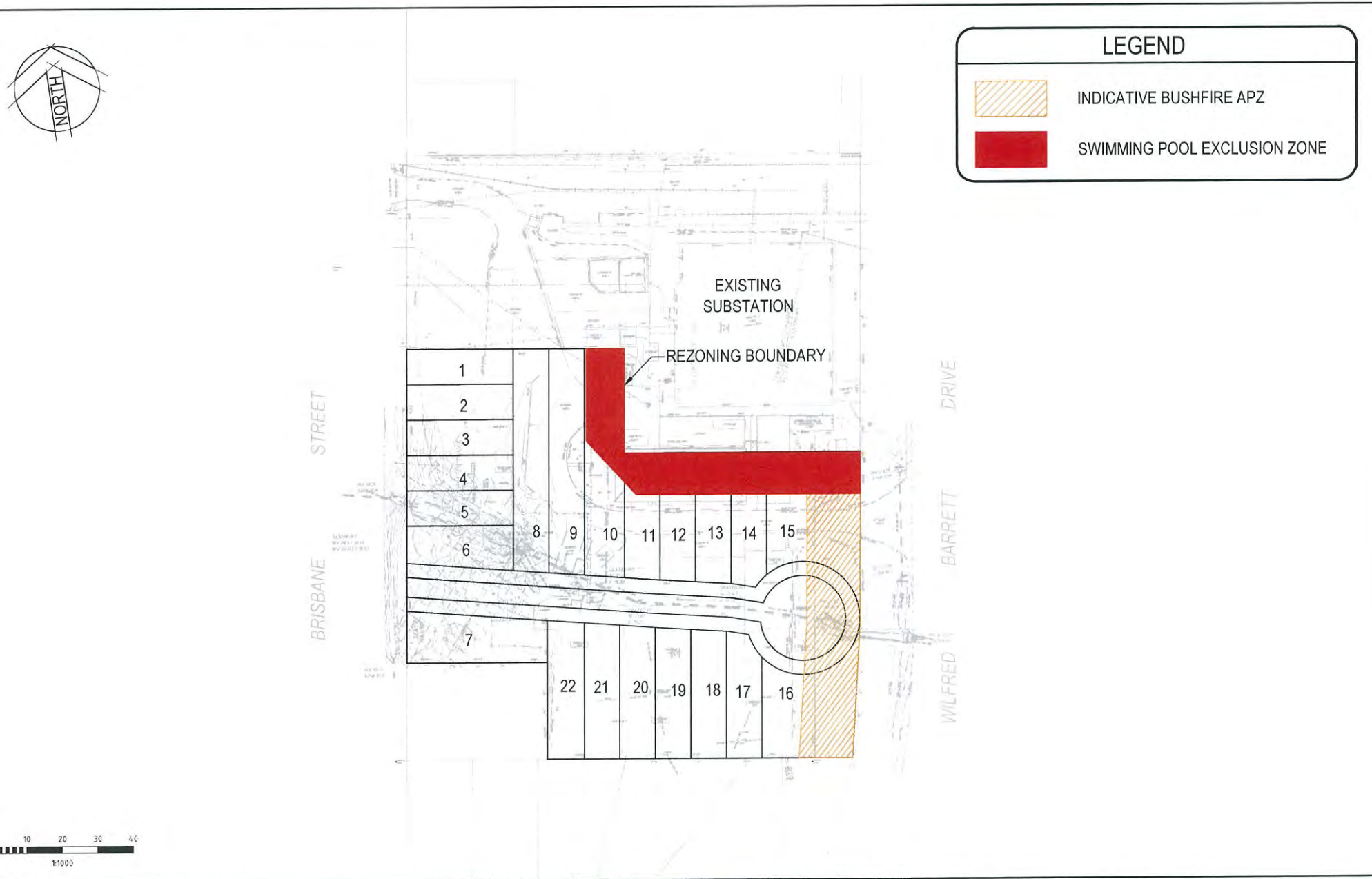
Title: MEDIUM DENSITY OPTION 1 - 21 LOTS (revised site boundary)

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Scale: 1:1000
Size: A3

Drawing Number: 80515861-SK-007
Revision: 1

DATE PLOTTED: 15 February 2016 2:55 PM By: LAS DE BRITO
XREFs: a80515861-Cvil
CAD File: N:\Projects\80515861 Ausgrid Noraville\Drawings\Build\Drawings\Sketch 04.dwg



Rev	Date	Description	Des.	Verif.	Appd.
A	10/2/16	New site layout with amended site boundary	NW	SJB	SJB

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		Date
Drawn	NW	10/02/2016
Checked	SJB	10/02/2016
Designed	NW	10/02/2016
Verified		Date
Approved		

Client: AUSGRID

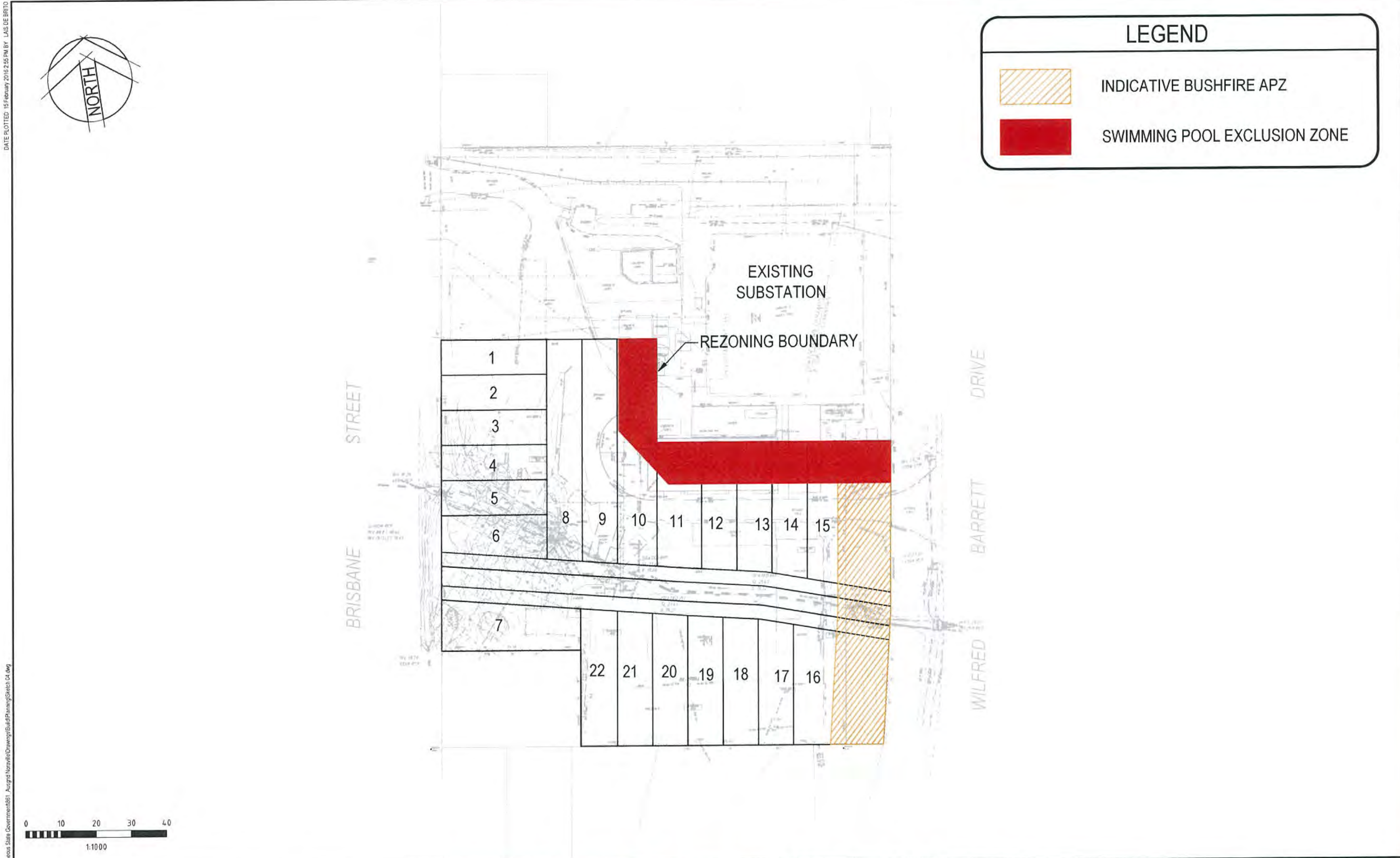
Project: AUSGRID NORAVILLE - LOT LAYOUTS FOR REZONING
LOT 2 DP 605538, 11A BRISBANE STREET
NORAVILLE, NSW

Title: MEDIUM DENSITY OPTION 2 - 22 LOTS (revised site boundary)

Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Scale: 1:1000
Size: A3

Drawing Number: 80515861-SK-008
Revision: 1



Rev	Date	Description	Des.	Verif.	Appd.
A	10/2/16	New site layout with amended site boundary	NW	SJB	SJB

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Web: www.cardno.com.au

Role	Name	Date
Drawn	NW	10/02/2016
Checked	SJB	10/02/2016
Designed	NW	10/02/2016
Verified		
Approved		

Client: AUSGRID

Project: AUSGRID NORAVILLE - LOT LAYOUTS FOR REZONING
LOT 2 DP 605538, 11A BRISBANE STREET
NORAVILLE, NSW

Title: MEDIUM DENSITY OPTION 3 - 22 LOTS (revised site boundary)

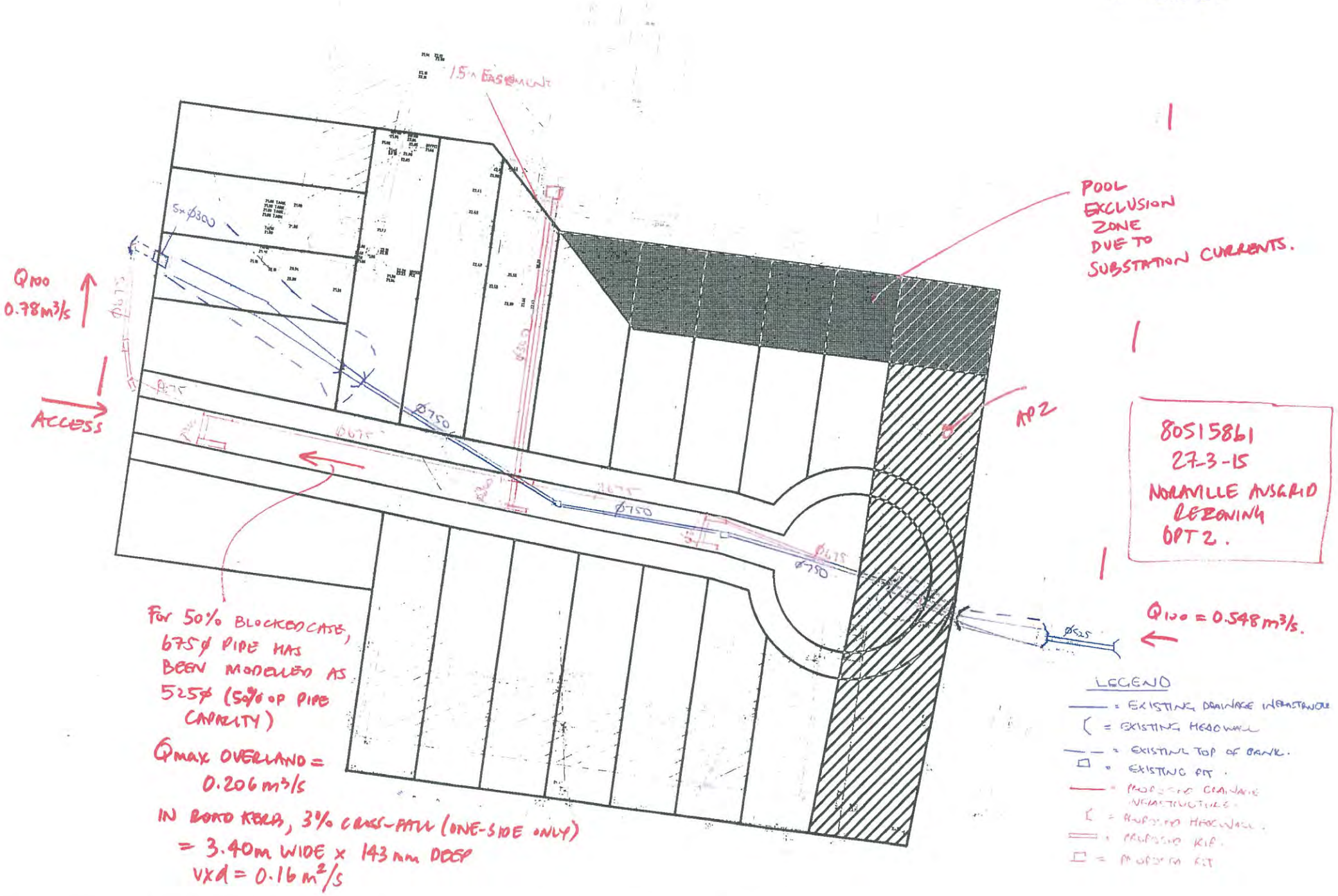
Status: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Scale: 1:1000 Size: A3

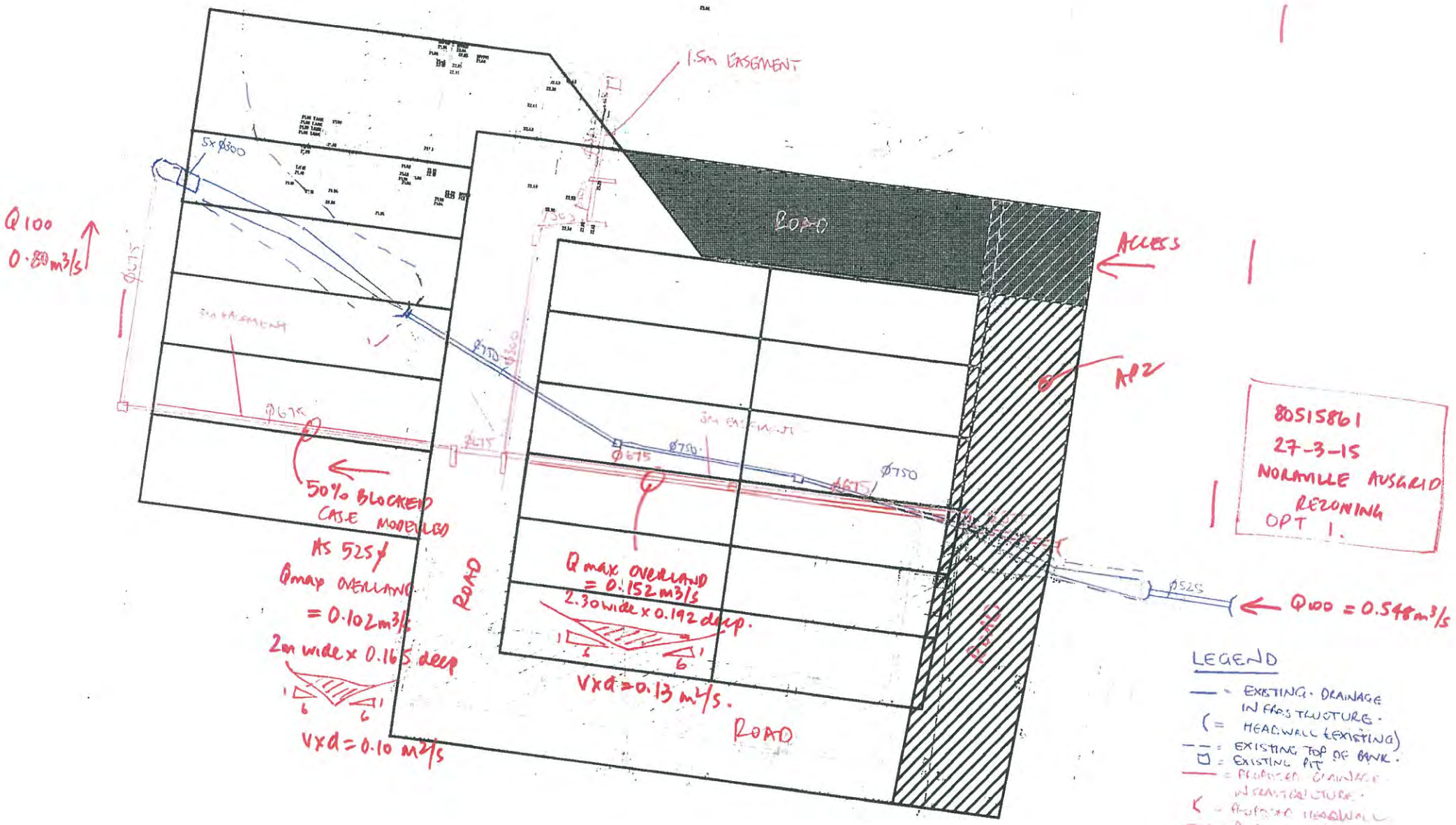
Drawing Number: 80515861-SK-006 Revision: 1

APPENDIX B – OPTIONS AS SENT TO WYONG SHIRE COUNCIL FOR ENGINEERING INPUT

OPTION 2.


15m EASEMENT
5x Ø300
Q100
0.78m³/s
ACCESS
Ø675
Ø750
Ø525
POOL EXCLUSION ZONE DUE TO SUBSTATION CURRENTS.
AP2
80515861
27-3-15
NORAVILLE AUSGRID REZONING OPT 2.
Q100 = 0.548m³/s.
For 50% BLOCKED CASE, 675ϕ PIPE HAS BEEN MODELLED AS 525ϕ (50% OF PIPE CAPACITY)
Q MAX OVERLAND = 0.206 m³/s
IN ROAD KERB, 3% CROSS-FALL (ONE-SIDE ONLY)
= 3.40m WIDE x 143mm DEEP
VXd = 0.16 m²/s
LEGEND
= EXISTING DRAINAGE INFRASTRUCTURE
= EXISTING HEADWALL
= EXISTING TOP OF BANK.
= EXISTING PIT.
= PROPOSED DRAINAGE INFRASTRUCTURE.
= PROPOSED HEADWALL.
= PROPOSED KIP.
= PROPOSED PIT

OPTION 1



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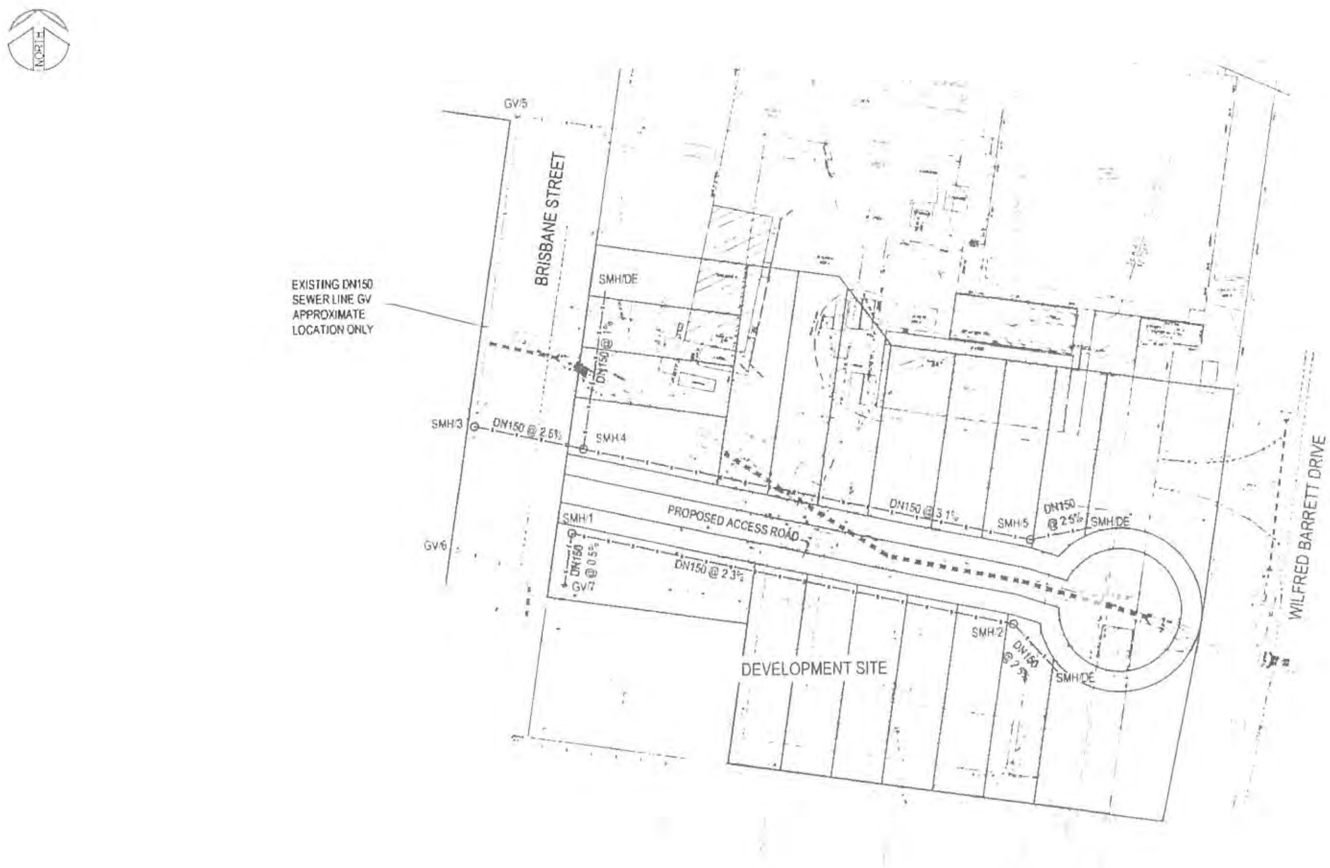
APPENDIX C – WATER AND SEWER LAYOUT AS SENT TO WYONG SHIRE COUNCIL.



ROUTE PLAN
SCALE 1:500

LEGEND

EXISTING GAS	
EXISTING TELSTRA	
EXISTING WATER	
EXISTING ELECTRICAL	
EXISTING STORMWATER	
EXISTING SEWER	
PROPOSED SEWER	

NOTES:

1. THIS DRAWING IS PROVIDED FOR INFORMATION ONLY AND IS NOT TO BE USED FOR ANY CONSTRUCTION ACTIVITIES
2. EXISTING SEWER LINES LOCATIONS ARE APPROXIMATE ONLY AND ARE TO BE CONFIRMED ONSITE
3. ALL OTHER EXISTING PUBLIC UTILITIES HAVE NOT BEEN LOCATED

NOTE:
ALL UTILITIES ARE TO BE ACCURATELY LOCATED BY CONTRACTOR PRIOR TO CONSTRUCTION

0 10 20 30 40 50m
SCALE 1:500 @A1

Rev	Date	Description			
1	27/03/2015	PRELIMINARY	PEJ	VC	VC

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Drawn	PEJ, Date 27/03/2015
Checked	PEJ, Date 27/03/2015
Designed	PEJ, Date 27/03/2015
Verified	VC, Date 27/03/2015
Approved	Date 27/03/2015
Client	AUSGRID
Project	PROPOSED RESIDENTIAL SUBDIVISION AT 11A BRISBANE STREET, NORAVILLE PART LOT 2 DP 605538
Title	GRAVITY SEWER SERVICE PLAN
Status	FOR INFORMATION ONLY — NOT TO BE USED FOR CONSTRUCTION PURPOSES
Datum	A.H.D
Date	27/03/2015
Scale	AS SHOWN
Size	A1
Drawing Number	80515861-SW-001
Revision	1

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