REPORT TO

AUSTRALIAN EXECUTIVE APARTMENTS PTY LTD

ON

GEOTECHNICAL ASSESSMENT

FOR

PROPOSED REDEVELOPMENT
OF ROBERTSON HOTEL

AT

1 FOUNTAINDALE ROAD, ROBERTSON, NSW

Date: 18 February 2020
Ref: 32853PHrpt

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DOCUMENT REVISION RECORD

Report Reference	Report Status	Report Date
32853PHrpt	Final Report	19 December 2019
32853PHrpt Rev1	Updated architectural drawings	18 February 2020

Table of Contents

ATTACHMENTS

1 INTRODUCTION

This report presents the results of our geotechnical assessment of the site for the proposed redevelopment of the Robertson Hotel at 1 Fountaindale Road, Robertson, NSW. The location of the site is shown on the attached Figure 1. The assessment was commissioned by Mr Con Kotis of Australian Executive Apartments Pty Ltd, by return of a signed 'Acceptance of Proposal' form dated 18 November 2019. The assessment was carried out on the basis of our proposal, Ref. 'P49746PZH Rev1', dated 2 July 2019.

The site was inspected by our Senior Associate level geotechnical engineer on 25 June 2019 at proposal stage and later on 29 November 2019, in order to assess the stability of the site and the effect on stability of the proposed redevelopment.

The proposed development comprises a hotel extension, community health centre and residential villas and cabins, with associated facilities. Typical structural loads for this type of development have been assumed.

This geotechnical assessment was carried out in conjunction with a review of the potential for adverse impacts on any watercourse, drinking water catchment and environmentally sensitive area by our environmental division, JK Environments (JKE). Reference should be made to Appendix C for the separate report prepared by JKE, Ref: 32853Blet, for the results of that review.

2 PROPOSED DEVELOPMENT

The supplied architectural drawings by XPACE Design Group (Project No. 18x015, Drawing Nos. 01 to 09, 1.10 to 1.16, 2.01 to 2.06), show that the proposed redevelopment will include the following:

1. A new six-storey hotel extension on the northern and eastern sides of the existing hotel. The existing hotel will remain and is to be refurbished. The lowest basement level (Level 2) will be at RL768.08m, requiring excavation to a maximum depth of about 7m below existing surface levels.
2. A three-storey community leisure and health centre, incorporating an indoor pool, to the north-east of the existing hotel. The lowest level (Level 1) will be at RL761.50m. A tunnel and lift are proposed on the southern side of the centre to provide access into the hotel extension, requiring excavation to a maximum depth of about 6m below existing surface levels. Due to the sloping site, the lower eastern side of the centre will be above the existing surface levels.
3. A loading dock on the eastern side of the existing hotel.
4. Eight eco cabins on the north-eastern side of the hotel extension, suspended above existing surface levels.
5. Nine eco cabins on the western side of the site, which will have floor levels at, or above, existing surface levels.
6. Three villas with courtyards at the north-eastern corner of the site with floor levels between about 2m and 4.5m above existing surface levels.
7. A reception venue towards the northern corner of the site.

8. A bus/coach parking area at the southern corner of the site, off Fountaindale Road, requiring excavation to an assumed maximum depth of about 4m below exiting surface levels.
9. Several new internal roads and 'eco walk' tracks connecting the proposed buildings. On-grade car parking areas are also proposed near the main entrance into the site off Illawarra Highway. The proposed surface levels of these are not shown, but we assume that due to the sloping site, cut-to-fill earthworks to maximum depths/heights of about 2m may be required.
10. The existing dam and pond over the northern portion of the site are to remain.

For ease of reference, the proposed Master Plan architectural drawing (Drawing No. 01) is presented in the attached Appendix D.

3 ASSESSMENT METHODOLOGY

The stability assessment is based upon an inspection of the topographic, surface drainage and geological conditions of the site and its immediate environs. We note that our observations were limited to areas where the ground surface was assessed to be safe to walk over on foot, and where the vegetation cover was sparse. Large areas of the site, particularly over the northern portion, were inaccessible due to dense vegetation, however, based on the general visible conditions, we do not expect any concealed features would significantly alter our landslide risk assessment.

The attached Appendix A defines the terminology adopted for the risk assessment together with a flowchart illustrating the Risk Management Process based on the guidelines given in AGS 2007c (Reference 1).

A summary of our observations is presented in Section 4 below. Our specific recommendations regarding the proposed development are discussed in Section 8 following our geotechnical assessment.

The attached Figure 2 presents a geotechnical site plan showing the principal geotechnical features present at the site. Figure 2 is based on a survey plan prepared by CEH Consulting Pty Ltd (Drawing No. A1-D218228-Contours, dated 27 July 2018). Additional features on Figure 2 have been measured by hand held clinometer and tape measure techniques and hence are only approximate. Figure 3 presents an explanation of the geotechnical mapping symbols used in Figure 2.

4 SUMMARY OF OBSERVATIONS

We recommend that the summary of observations which follow be read in conjunction with the attached Figure 2. The blue circled numbers on Figure 2, refer to specific features and are referred to in the text below.

The site is located in elevated undulating topography in the Southern Highlands of NSW, and is bound by the Illawarra Highway to the north-west, Fountaindale Road to the south and the Unanderra-Moss Vale Railway Line to the south-east and east. The Illawarra Highway was relatively flat to gently sloping, whilst Fountaindale Road sloped down to the south and south-east between about 3° and 6°.

The site is relatively large and irregular shaped being about 400m long (north-south) and up to about 200m wide (east-west).

The neighbouring property to the east was vacant and predominantly covered with dense vegetation.

We have presented our observations in two parts; the first part comprises the southern portion of the site where the existing hotel is located at the crest of a hill, whilst the second part comprises the northern portion of the site, which is mostly vacant and spans a gully feature.

Southern Portion of Site

The southern portion of the site was characterised by a hill with a relatively flat crest at about RL774.0m. The existing Robertson Hotel, which comprises a one to three-storey rendered brick building, was located along the crest of the hill, and appeared to be in generally good external condition, based on a cursory inspection from ground surface level within the site. Refer to Plate 1 below. The area on the western side of the hotel had been filled to a maximum height of about 1m and regraded to form two gently sloping lawn areas. The fill batter shown in Plate 1 below, graded at about 16° (Blue circle 1).

Plate 1: View looking east from the western side of the Robertson Hotel.

The northern and southern sides of the hill sloped down to the north and south, respectively, at moderate gradients generally between about 8° and 15°. The slopes were locally steeper, up to about 27°, adjacent to the railway line, where excavation into the hill had likely occurred to construct the railway. The hillside slopes were often covered with dense vegetation comprising tall trees with a thick undergrowth (refer to Plate 2 below), though in some areas where the vegetation cover was sparse, the ground was grass covered.

Plate 2: View looking north at the intersection of Fountaindale Road & the railway line, showing dense vegetation cover within site.

The toe level of the hillside at its southern corner was at about RL754.0m, so there is a maximum elevation relief of up to about 20m in that portion of the site.

Adjacent to the railway line towards the toe of the hill and amongst the dense vegetation, were some rock outcrops. However, due to the steep ground and dense vegetation, we were unable to inspect the rock and therefore confirm its type, strength and weathering.

At the time of our inspections, we did not observe any groundwater seepage emanating from the hillside slopes over the southern portion of the site.

A single storey timber clad building was located towards the southern corner of the site and was in a dilapidated condition (Blue circle 3). An in-ground pool was located mid-length along the eastern side of the site. An approximate 1m high brick retaining wall supported the ground surface to the south. Surrounding the hotel were several asphaltic concrete (AC) or gravel surfaced internal roads, and some were in poor condition, with potholes and cracking observed. Some areas had been regraded and filled slightly for landscaping purposes, with these areas supported by stone and timber retaining walls generally to a maximum height of about 1m, but locally to a maximum height of about 1.5m. The retaining walls were often in poor condition, with localised collapsed sections, blocks and timber panels missing (Blue circles 2, 4 and 5) exposing the backfill, and sections which had rotated outward. Refer to Plate 3 below.

Plate 3: View looking north showing localised collapsed of retaining wall (Blue circle 2).

Apart from the retaining wall instability observed, we did not observe any obvious signs of fill batter slope instability (such as slumping, tension cracks behind the crests, etc), deep-seated hillside instability or near-surface instability (such as slumping, tension cracks, etc) or signs of hillside creep (such as leaning or basal curvature of trees).

Northern Portion of Site

The northern portion of the site is characterised by an east-west oriented gully feature; the southern and northern sides of the gully slope down towards its floor, generally between about 5° and 15°. We estimate that less than about 50% of the northern portion of the site was accessible, due to dense vegetation cover.

The Illawarra Highway along the southern end of the western site boundary, sloped down to the south at about 2°. The eastern side of the highway was supported on a fill embankment, ranging in height from about 1m at its southern end, to about 4m high mid-length along the western site boundary and then appears to taper away toward the northern end of the western boundary. Where the embankment was visible from the entrance into Robertson Hotel, the sides sloped down to the east at between 32° and 35°. As the embankment extended further to the north, the toe of the embankment extended into the site and it became more difficult to inspect due to the dense vegetation. Refer to Plate 4 below (Blue circle 6). We did not observe any obvious signs of fill batter slope instability, such as slumping, tension cracks behind the crest, etc, though our observations were largely obscured by dense vegetation.

Plate 4: View looking north along Illawarra Highway from the hotel entrance, showing the eastern side of the fill embankment.

Toward the northern corner of the site was a dam (Blue circle 7), with the embankment on its south-eastern side, which was up to about 2.5m high. The crest width ranged between about 2m and 5m. The downstream shoulder graded at between about 14° and 17°. The north-western (high) side of the dam was obscured by dense vegetation. The storage area contained water, with the water level being within about 0.8m of the crest of the downstream shoulder. There was no formal spillway and the outlet comprised a small diameter PVC pipe, which discharged water directly onto the ground, immediately along the toe of the downstream shoulder. The downstream shoulder was vegetated with grass and small to medium sized trees. Sections of the downstream shoulder, as well as the area immediately beyond the downstream toe of the embankment was 'boggy' under foot, indicating dam leakage. Refer to Plates 5 & 6 below.

Plate 5: View looking east across dam from its western end.

Plate 6: View looking west along toe of the downstream shoulder, showing water discharge directly onto ground surface.

A large pond (Blue circle 8) was located along the base of gully, as well as several 'dry' creek beds. The eastern side of the pond was supported by a 2m high concrete wall, which appeared to be in good condition, based on a cursory inspection. The storage area contained water and reeds, with the water level just below the crest of the wall. The southern, western and northern sides of the pond were inaccessible and could not be inspected, due to dense vegetation. The ground surface on the southern side of the pond was slightly hummocky, but we attribute this to likely disturbance from to livestock, rather than instability.

5 ANTICIPATED SUBSURFACE CONDITIONS

The 1:50,000 geological map of Roberston (Geological Series Sheet 9028-IV) indicates the site to be underlain by Roberston Basalt over Wianamatta Group mudstone and sandstone. The upper zone of the basalt can be quite weathered comprising corestones of up to medium and high strength in a matrix of soil strength material and fragmented, low strength rock. The basalt can often be highly fractured with numerous joint sets.

Residual red brown clays were exposed in a shallow excavation (estimated to be less than about 1.5m deep) within a property on the western side of Illawarra Highway, opposite Fountaindale Road. The excavation was 'dry'. From our experience, residual soils derived from basalt are generally of high plasticity and have a high potential for shrink-swell reactivity with changes in moisture content.

We expect that the subsurface conditions at the site would comprise 2m to 3m of clayey soils, probably of at least very stiff strength, over basalt, then possible mudstone and/or sandstone at depth.

During our site visits, we did not observe any groundwater seepage emanating from the hillside slope at the lower south-eastern corner of the site, adjacent to the rail corridor. In this regard, we do not expect significant groundwater inflows into the excavations over the higher, southern portion of the site.

However, the northern portion of the site spans a gully feature, and higher groundwater inflows should be expected into the excavations in that area of the site, particularly during heavy and/or prolonged rainfall.

6 EXISTING DAM AND POND

6.1 Existing Dam

Based on the results of our inspection, we consider that the existing dam located towards the northern corner of the site is in poor condition for the following reasons:

1. **Presence of trees and other vegetation on the embankment:** Existing trees on the embankment can cause seepage, internal erosion and ultimately piping failure along decaying tree roots. An abundance of tree roots through the embankment can also result in loosening of the earthfill and increased surface erosion. Furthermore, trees which topple over as a result of strong winds and/or bushfire, could remove support, or cause a breach of the embankment. The vegetation may also attract burrowing animals into the embankment and obscure the entrances.

2. **Evidence of seepage through the embankment and foundation material:** There was evidence of seepage through the embankment and foundation material. Based on the nature of the dam, it is unlikely that any measures to control seepage and erosion through the foundation (eg. cut-off trench, etc.) were ever constructed. The implication of the seepage and the likely elevated pore pressures below the embankment relates to the stability of the downstream shoulder. If the pore pressures are high, then uplift pressures below the embankment may be present, thus potentially compromising stability. Furthermore, internal erosion and ultimately piping failure though the foundation material and/or earthfill material may occur. These factors could cause a breach of the embankment.

3. ***Lack of a formal spillway***: The dam did not have a formal spillway structure, and water from the dam was being discharged in an uncontrolled manner through a PVC pipe along the toe of the embankment, both of which can cause scour and erosion of the downstream shoulder, and ultimately a breach of the embankment. The erosion would be exacerbated if trees toppled during the discharge due to erosion.

In our opinion, if the existing dam is to incorporated into the proposed development, then significant rehabilitation will be required. It is possible that a breach could occur at anytime, though would be more likely during or shortly following a storm event. We strongly recommend that the embankment be replaced with a properly engineered embankment.

Alternatively, the dam could be drained and a suitable impermeable liner installed. A formal spillway would still need to be installed.

The design of the new embankment will depend on its height and nature of the earthfill materials.

A geotechnical investigation will be required for the design and construction of a new embankment and should include:

1. Test pits within designated borrow areas, with an appropriate laboratory test program (eg. dispersion testing, particle size distribution and hydrometer testing, Atterberg Limits testing, Standard compaction and permeability testing, etc.) on representative samples to assess the soil properties for design.
2. Test pits and boreholes to assess the nature of the foundation materials.
3. Geometric design, including stability analyses. As a guide, for a minimum crest width of 3m and shoulders that grade no steeper than 1 Vertical on 3 Horizontal, can be assumed for preliminary design purposes for an embankment up to about 4m high.
4. Advice on the embankment foundation (including cut-off), subgrade preparation, outlet pipes/culverts through the foundation material and/or earthfill materials, material and compaction specifications for earthfill (including around outlet pipes/culverts and/or adjacent to spillway structures), filter design (if appropriate), and erosion protection.
5. Design of the spillway by a water resources engineer.

6.2 Existing Pond

At the time of inspection, the pond located along the base of the gully was obscured by dense vegetation.

We strongly recommend that as part of the geotechnical investigation for the new dam, the vegetation surrounding the pond be removed or at least thinned by removal of the undergrowth, so an inspection of the pond can be made. Further, we recommend that the stored water be removed, if permitted, prior to the inspection, so that the concrete wall supporting the eastern side of the pond can be formally inspected and to check whether there is a liner along the base of the pond. The investigation would include excavation of test pits along the downstream toe of the wall to assess the footing details and foundation materials.

A spillway must also be installed, the design of which would need to be carried out by a water resources engineer.

7 GEOTECHNICAL RISK ASSESSMENT

Noting our observations and anticipated subsurface conditions, a geotechnical risk assessment for the proposed development has been carried out. The methodology adopted is in accordance with the Australian Geomechanics Society (2007c) 'Practice Note Guidelines for Landslide Risk Management', risk classification system.

For the purpose of the geotechnical risk assessment, we assume that:

1. Prior to construction, a detailed geotechnical investigation would be carried out to confirm the subsurface conditions in the development areas, so that geotechnical advice can be provided on

excavation techniques and equipment, vibrations, drainage, shoring design, footing design, dam/pond rehabilitation and external pavements, and that such advice would be adopted.

2. All existing retaining walls, the majority of which were in poor condition, would be demolished and replaced with properly designed engineered retaining walls.

7.1 Potential Landslide Hazards

Based on site observations and understanding of the proposed redevelopment, we consider that the following potential landslide hazards are associated with the site and the proposed redevelopment:

A Instability of the hillside slope and fill batter slopes to 28°

B Instability of the hillside slope (slow creep movement).

C Instability of existing and proposed retaining walls

D Instability of the Illawarra Highway fill embankment

E Breach of the existing dam

F Instability of the concrete wall supporting the pond

G Instability of permanent batter slopes.

7.2 Risk Analysis

The attached Tables A and B, respectively, present the results of our assessment of risk to property and life for the potential landslide hazards A to G and our assessment of factors and assumptions relevant to the risk assessments.

The attached Table A summarises our qualitative assessment of each potential landslide hazard and of the consequences to property should the potential landslide hazard occur under existing conditions and following redevelopment. Based on the above, the qualitative risks to property have been determined. The terminology adopted for this qualitative assessment is in accordance with Table A1 given in Appendix A.

Table A indicates the assessed risk to property following redevelopment is Very Low and Low, which would be considered to be 'Acceptable' in accordance with the Australian Geomechanics Society (2007c) risk classification system.

We have also used the indicative probabilities associated with the assessed likelihood to calculate the risk to life for the person most at risk for each of the potential landslide hazards after the redevelopment. The results of our assessment are presented in Table B, which also includes are our assessed temporal, spatial, evacuation and vulnerability factors that have been used for the risk calculation.

The resulting risk for the person most at risk is less than 10^{-6}, which would be considered to be 'Acceptable' in accordance with the Australian Geomechanics Society (2007c) risk classification system.

7.3 Risk Assessment

It should be recognised that, due to the many complex factors that can affect a site, the subjective nature of a risk analysis, and the imprecise nature of the science of geotechnical engineering, the risk of instability for a site and/or development cannot be completely removed. It is, however, essential that risk be reduced to at least that which could be reasonably anticipated by the community in everyday life and that landowners are made aware of reasonable and practical measures available to reduce risk as far as possible.

We have also assumed that no activities on surrounding land which may affect the risk on the subject site would be carried out. We have further assumed that all buried services within and surrounding the site are, and will be, regularly maintained to remain in good condition.

8 PRELIMINARY COMMENTS AND RECOMMENDATIONS

The comments and recommendations provided in this report are based on a walkover inspection of the site and immediate surrounding area where access was possible and therefore must be considered to be generalised.

For the purpose of this report, we have assumed a subsurface profile comprises shallow fill over residual silty clays to a maximum depth of about 3m, with basalt then sedimentary rock.

Prior to carrying out the structural design, a geotechnical investigation including the drilling of cored boreholes in the areas requiring deep excavation and high footing loads must be completed to confirm the subsurface profile across the proposed development footprint. The recommendations provided in this report will then need to be reviewed and updated accordingly as part of the geotechnical investigation. We can provide a fee proposal for the investigation, if requested.

Reference should also be made to Appendix B which presents some Guidelines on Hillside Construction.

8.1 Suitability of the Site for Redevelopment

In our opinion, we consider that the proposed redevelopment to be geotechnically feasible, provided the comments and recommendations below are adopted in their entirety and the geotechnical investigation is completed prior to carrying out the structural design.

The proposed development will incorporate common construction techniques and methodologies that have been completed on many sites throughout greater Sydney and surrounds.

8.2 Excavation

Prior to any excavation commencing, reference should be made to the Safe Work Australia 'Excavation Work Code of Practice' dated July 2015.

Following demolition of any existing pavements and retaining walls and removal of vegetation within the development footprint, any deleterious fill should be stripped and disposed appropriately off-site.
Excavation of fill, natural soils and weathered basalt of up to very low strength may be carried out using a bucket attached to a large (ie. at least 20 tonne) hydraulic excavator, with assistance using a ripping tyne to break any low or medium strength bands that are no thicker than about 0.3m.

Bedrock of low or higher strength (possibly even up to very high where basalt is present) will require the use of rock excavation equipment. Such equipment could include hydraulic rock hammers, rotary grinders, rock saws or ripping tynes, the selection of which can only be made following completion of the geotechnical investigation at which time rock strength will be known. Nevertheless, excavation productivity is expected to be slow and bit wear rates high, particularly through the basalt.

Rock excavation using hydraulic rock hammers will generate vibrations, however, in most areas of the site this is not expected to be an issue as there are currently no immediate neighbouring buildings. Consideration should be given however to carrying out some vibration monitoring on the existing hotel during any demolition and rock excavation in that area, as a precaution against possible vibration induced damage. Further comments on vibrations issues would be provided as part of the report following the geotechnical investigation.

8.3 Groundwater

During our walkover inspections, we did not observe any groundwater seepage from the lower southern corner of the site, so no significant groundwater inflows are expected within the excavations for the proposed hotel extension and community leisure and health centre. However, the northern portion of the site spans a gully feature, so groundwater inflows should be expected into any excavations in that area as local seepage flows within fill, at the fill/natural soil and soil/bedrock interfaces, and through joints and bedding partings within the bedrock, if encountered, particularly during heavy or prolonged rain.

Further advice on groundwater inflows and managing those inflows should be provided as part of the detailed geotechnical investigation. However, assuming seepage does occur, it is likely that in most areas where excavation is required, it will be of a small flowrate and controlled during construction, and in the long term, by sump and pump methods or gravity drainage downslope.

Drainage should be provided behind all retaining walls, and below the basement floor slabs. The completed excavations should be inspected by the hydraulic consultant to assess if the designed drainage system is adequate for actual seepage flows.

Though unlikely based on our site observations, following completion of the detailed investigation, it may be necessary to undertake seepage analysis and obtain a dewatering licence from Water NSW to allow construction dewatering to be carried out. If such a licence cannot be obtained, it may be necessary to 'tank' the basements.

8.4 Shoring

Where excavations through soil and any extremely weathered rock are less than about 3m deep and sufficient space is available within the site well away from any existing structures which are to remain, temporary batters may be used provided they are no steeper than 1 Vertical (V) in 1 Horizontal (H). All surcharge loads, including construction loads and excavated materials, must be kept well clear of the crest of these temporary batters. All stormwater runoff should be directed away from the temporary batters to reduce erosion.

Where excavations through soil and weathered rock are deeper than 3m, or there is insufficient space within the site for battering, or where batters are not preferred, a shoring system to support the soils and more weathered bedrock to very low strength will need to be installed, prior to the commencement of excavation. Soldier pile walls with reinforced shotcrete infill panels are envisaged, with more closely spaced soldiers where the excavation abuts the existing hotel building.

Until the detailed geotechnical investigation is completed and rock quality assessed, it is not possible at this stage to determine whether the soldier piles can be terminated above bulk excavation level, or whether the piles will need to be socketed below bulk excavation level.

Should any good quality bedrock of low and higher strength with no adversely oriented defects be encountered, it may be possible to cut this rock vertically, subject to frequent geotechnical inspections of the cut faces. However, localised stabilisation measures, such as rock bolts, shotcrete, etc, may be necessary if adverse defects, such as inclined joints are found.

Retaining walls of no more than 3m height may be designed as cantilevered walls using a triangular lateral earth pressure distribution with either an 'active' (K_a) or 'at rest' (K_0) earth pressure coefficient, of 0.33 or 0.5, respectively; if the movements are to be reduced, then the K_0 value should be adopted. A bulk unit weight of 20kN/m^3 for the soil and weathered rock is applicable. For excavations in soil and weathered rock up to very low strength which are deeper than 3m, the walls may need to be anchored or internally propped, as the excavation proceeds to reduce deflections. Such anchoring or propping should be expected for deep excavations immediately adjacent to the existing hotel.

Propped or anchored retaining walls may be provisionally designed based on a trapezoidal lateral earth pressure distribution of 6H kPa for the retained profile, where 'H' is the retained height of soil and weathered rock in metres. This pressure should be assumed to be uniform over the central 50% of the pressure distribution, tapering to zero at the crest and toe of the wall. For the excavation immediately adjacent to the existing hotel, it may be necessary to increase the lateral pressure distribution to 8H kPa for the retained profile, to reduce the wall movements.

8.5 Footings

We expect the structural loads for the proposed hotel extension and community leisure and health centre will be relatively high. Further, bedrock is expected at bulk excavation level within the deepest parts of the proposed excavations for these structures. Therefore, for uniformity of support, we recommend that all footings for these structures be founded within the bedrock.

Pad and strip footings and any perimeter shoring piles founded in bedrock may be provisionally designed for an allowable end bearing pressure of 1,000kPa, provided a selected number of footing excavations are inspected by a geotechnical engineer prior to pouring. Higher allowable (serviceability) bearing pressures may be possible following completion of the detailed geotechnical investigation.

If any of the above ground portions of the proposed buildings extend outside the footprint of the proposed basements, these must be supported by suspended slabs on footings founded within bedrock below a 45° line inclined up at from the base of the adjacent excavation.

All piles/footings should be drilled/excavated, cleaned out, inspected and poured with minimal delay.

For other proposed structures, specific advice on footings for these would be provided as part of a future geotechnical investigation. However, we expect that the majority of these buildings will need to be uniformly supported by footings founded in the underlying bedrock, due to the moderate slopes in some areas, and the possibility that bedrock might be encountered within any excavations. In some cases, it may be feasible to uniformly found on the clays, with the Site Classification to AS2870-2011 'Residential slabs and footings' to be confirmed as part of the geotechnical investigation.

8.6 Earthworks

The proposed development will require construction of new access roads, as well as possible upgrading of existing roads. We have not been provided with the proposed surface levels.

Initially, all grass, vegetation, trees (and their root balls), topsoil, root affected soils and any deleterious fill should be fully stripped from the proposed development footprint. Stripped topsoil and root affected soils should be stockpiled separately as they are generally considered unsuitable for reuse as engineered fill. They may however be reused for landscaping purposes, subject to approval from an environmental consultant.

Care must be taken during the earthworks, not to undermine or remove support from the site boundaries, and in particular the toe of the fill embankment which supports the Illawarra Highway. If excavation will be required in these areas, detailed geotechnical advice should be sought.

Following stripping and any excavation down to design subgrade levels, the subgrade should be proof rolled with a large smooth drum roller of at least 12 tonnes deadweight, under the direction of an experienced geotechnical engineer for the detection of any 'unstable' subgrade areas. Subgrade heaving during proof rolling may occur in areas where the subgrade has become 'saturated' and/or where under-compacted

existing fill exists. Small areas can typically be improved by locally removing the heaving material to a stable base and replacing with engineered fill. If the area is deep, then a 'bridging' layer may be more economical. Options and detailed design of subgrade improvement works must be provided by the geotechnical engineer following the proof rolling inspection.

Following preparation of the subgrade and where ground surface levels are to be raised, engineered fill will be required. All engineered fill will need to be placed in loose layers and compacted in accordance with an appropriate specification, which would be provided as part of the geotechnical investigation. All engineered fill will need to be supported by engineer design retaining walls or graded to a suitable permanent batter slope.

9 GENERAL COMMENTS

It is possible that the subsurface soil, rock or groundwater conditions encountered during construction may be found to be different (or may be interpreted to be different) from those inferred from our surface observations in preparing this report. Also, we have not had the opportunity to observe surface run-off patterns during heavy rainfall and cannot comment directly on this aspect. If conditions appear to be at variance or cause concern for any reason, then we recommend that you immediately contact this office.

This report provides preliminary advice on geotechnical aspects for the proposed civil and structural design and a detailed geotechnical investigation must be carried out prior to preparing any Contract Documents and Specifications.

A waste classification is required for any soil and/or bedrock excavated from the site prior to offsite disposal. Subject to the appropriate testing, material can be classified as Virgin Excavated Natural Material (VENM), Excavated Natural Material (ENM), General Solid, Restricted Solid or Hazardous Waste. Analysis can take up to seven to ten working days to complete, therefore, an adequate allowance should be included in the construction program unless testing is completed prior to construction. If contamination is encountered, then substantial further testing (and associated delays) could be expected. We strongly recommend that this requirement is addressed prior to the commencement of excavation on site.

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. If there is any change in the proposed development described in this report then all recommendations should be reviewed. Copyright in this report is the property of JK Geotechnics. We have used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report. The report shall not be reproduced except in full.

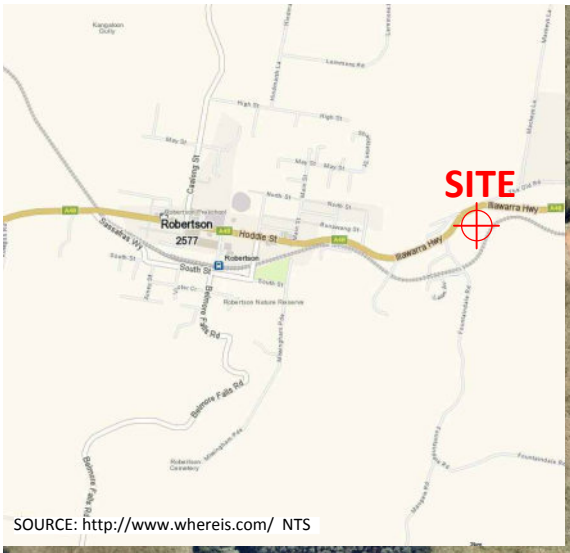
TABLE A
SUMMARY OF RISK ASSESSMENT TO PROPERTY

POTENTIAL LANDSLIDE HAZARD	A: Instability of the hillside slope and fill batter slopes to 28° (including near surface and deep-seated landslides)	B: Instability of the hillside slope (slow creep movement)	C: Instability of existing and proposed retaining walls	D: Instability of the Illawarra Highway fill embankment	E: Breach of the existing dam	F: Instability of the concrete wall supporting the pond	G: Instability of permanent batter slopes
Assessed Likelihood	Rare	Barely Credible	Existing Walls: Likely Proposed Walls: Rare	Unlikely	Existing condition: Likely Following Redevelopment: Rare	Unlikely	Barely Credible
Assessed Consequences	Insignificant to Medium	Minor to Medium	Existing Walls: Minor Proposed Walls: Minor to Medium	Minor to Medium	Existing condition: Insignificant Following Redevelopment: Minor	Insignificant to Minor	Insignificant to Minor
Risk	Very Low to Low	Very Low	Existing Walls: Moderate Proposed Walls: Very Low to Low	Low	Existing: Low Following Redevelopment: Very Low	Very Low to Low	Very Low
Comments	No obvious signs of any near surface or deep-seated instability. No obvious signs of fill batter slope instability. Ground surface slopes are generally gently to moderately sloping, with bedrock expected at moderate depth. .	No obvious signs of creep movements observed, such as leaning tree trunks. Bedrock expected at shallow to moderate depth.	Existing walls are generally in poor condition. Assumes the retaining walls will be engineer designed in accordance with the advice from the geotechnical engineer and well constructed.	No obvious signs of fill batter slope instability observed, though our observations were largely limited by dense vegetation.	The dam is currently in poor condition, including evidence of seepage through the embankment and foundation material. The assessed likelihood following rehabilitation of the dam (comprising either a properly designed engineered embankment, or the lining the dam) will reduce to Rare. A spillway to be installed.	No obvious signs of instability observed, however, the wall must be checked as part of the geotechnical investigation. A spillway to be installed.	Assumes the batter slopes will be constructed and graded in accordance with advice from the geotechnical engineer.

TABLE B
SUMMARY OF RISK ASSESSMENT TO LIFE AFTER REDEVELOPMENT

POTENTIAL LANDSLIDE HAZARD	A: Instability of the hillside slope and fill batter slopes to 28° (including near surface and deep-seated landslides)		B: Instability of the hillside slope (slow creep movement)	C: Instability of proposed retaining walls, including basement walls.	D: Instability of the Illawarra Highway fill embankment	E: Breach of the dam	F: Instability of the concrete wall supporting the pond	G: Instability of permanent batter slopes
	Slopes less than 20°	Slopes more than 20°						
Assessed Likelihood	Barely Credible	Rare	Barely Credible	Barely Credible	Unlikely	: Barely Credible (Assumes the dam is rehabilitated or lined, as per Section 8.1)	Unlikely	Barely Credible
Indicative Annual Probability	10^{-6}	10^{-5}	10^{-6}	10^{-6}	10^{-4}	10^{-6}	10^{-4}	10^{-6}
Persons at Risk	Person anywhere on site			Person in buildings or along the crest or toe of any retaining walls	Persons along the proposed western access road or new footpath along crest	Person in a villa in the eastern portion of the site	Person on footbridge	Person along the crest or toe of a permanent batter slope
Number of Persons Considered	1							
Duration of Use of Area Affected (Temporal Probability)	Say 20 hours per day (0.83)	Say 0.5 hour per day (0.02)	Say 20 hours per day (0.83)	Say 8 hours per day (0.33)	Say 2 hours per day (0.08)	Say 20 hours per day (0.83)	Say ¼ hour per day (0.01)	Say 2 hours per day (0.08)
Probability of Not Evacuating Area	0.1 Prior warning likely		0.001 Slow creep movement	0.1 Prior warning likely	0.5 Prior warning likely, however, vegetation cover may limit such warnings	0.9 Failure expected to be rapid and unlikely to evacuate villa quickly	0.9 Failure expected to be rapid	0.1 Prior warning likely
Spatial Probability	0.05	0.5	0.05	0.1	0.1	0.5	1	0.1
Vulnerability to Life if Failure Occurs Whilst Person Present	0.9 May be buried if slump volume is large		0 Inconceivable that death would occur from a creep slide	0.9 May be buried if the retaining wall is higher than 2m.	0.5 Could be buried depending on size of the slump	0.2 The villa could collapse and we have adopted a probability of 0.2 that collapse could occur	0.1 Unlikely to drown as water expected to flow below footbridge	0.1 Unlikely to be buried
Risk for Person Most at Risk	3.7×10^{-9}	9.0×10^{-9}	0	3.0×10^{-9}	2.0×10^{-7}	7.5×10^{-8}	9.0×10^{-8}	8×10^{-11}

From a summation of the individual risks above, the assessed total risk for the person most at risk is about 3.8×10^{-7}



SOURCE: http://www.whereis.com/ NTS

IMAGE SOURCE: http://maps.au.nearmap.com.22.Oct. 2019

0 40 80 120 160 200

SCALE 1:4000 @A4 m

This plan should be read in conjunction with the JK Geotechnics report.

Title: **SITE LOCATION PLAN**

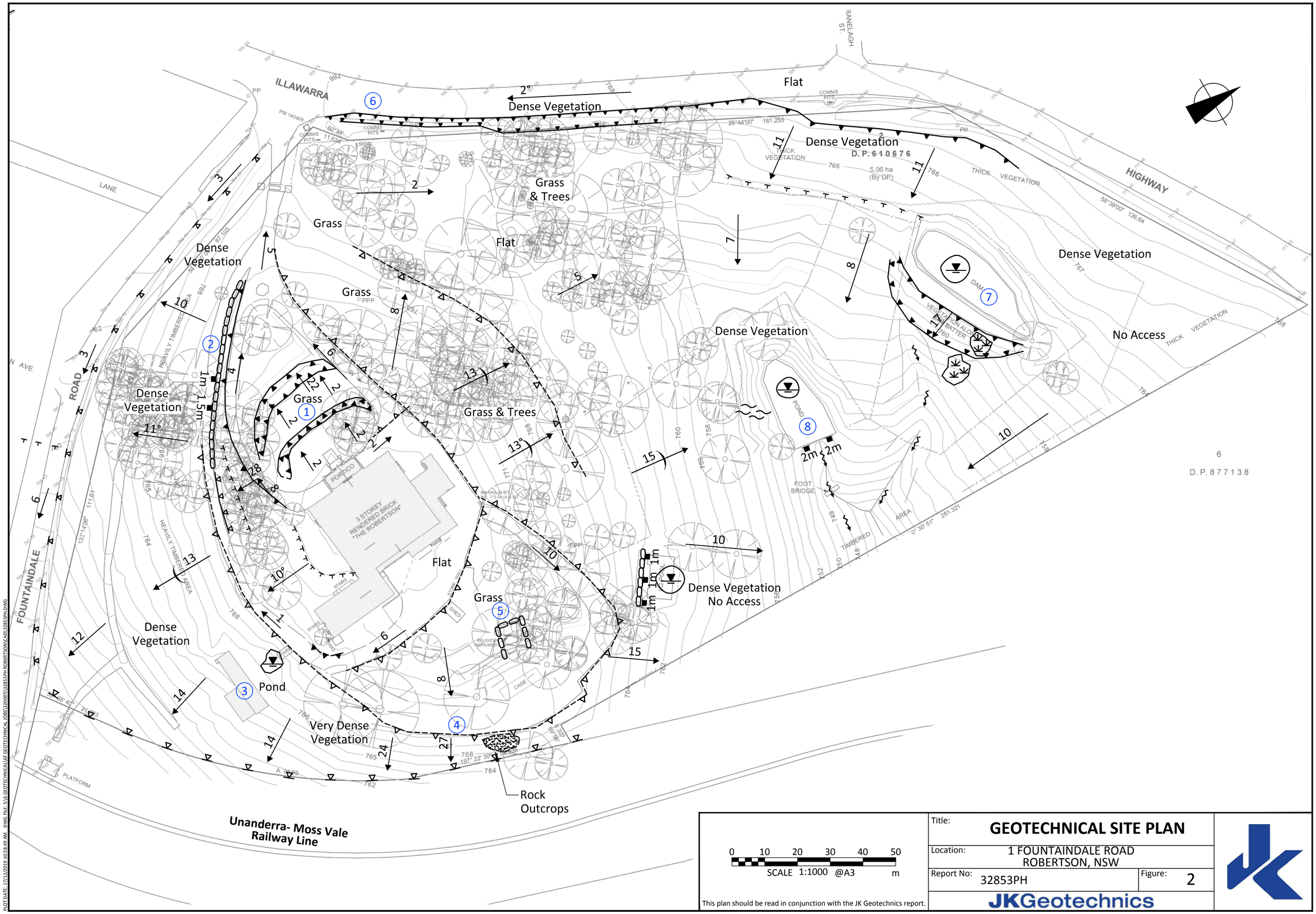
Location: 1 FOUNTAINDALE ROAD
ROBERTSON, NSW

Report No: 32853PH

Figure: 1

JKGeotechnics

PLOT DATE: 17/12/2019 10:58:37 AM DWG FILE: S:\6 GEOTECHNICAL\6F GEOTECHNICAL JOBS\32000'S\32853 PH ROBERTSON\CAD\32853PH.DWG



Title:	GEOTECHNICAL SITE PLAN
Location:	1 FOUNTAINDALE ROAD ROBERTSON, NSW
Report No:	32853PH
Figure:	2

0 10 20 30 40 50 m
SCALE 1:1000 @A3

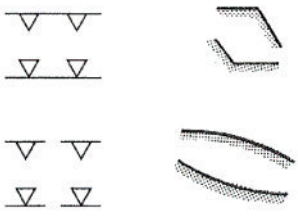
This plan should be read in conjunction with the JK Geotechnics report.

JKGeotechnics

PLOT DATE: 17/12/2019 10:58:49 AM DWG FILE: S:\G GEOTECHNICAL\GF GEOTECHNICAL JOBS\32000'S\32853PH ROBERTSON\CAD\32853PH.DWG

TOPOGRAPHY

Symbol *Ground Profile*



convex
concave
} well defined or angular break of slope

convex
concave
} poorly defined or smooth change of slope

breaks of slope
changes of slope
} convex and concave too close together to allow the use of separate symbols

sharp
rounded
} ridge crest

3 Cliff or escarpment or sharp break 40° or more (estimated height in metres)

15 Uniform Slope
10 Concave Slope
8 Convex Slope
} Slope direction and angle (Degrees)

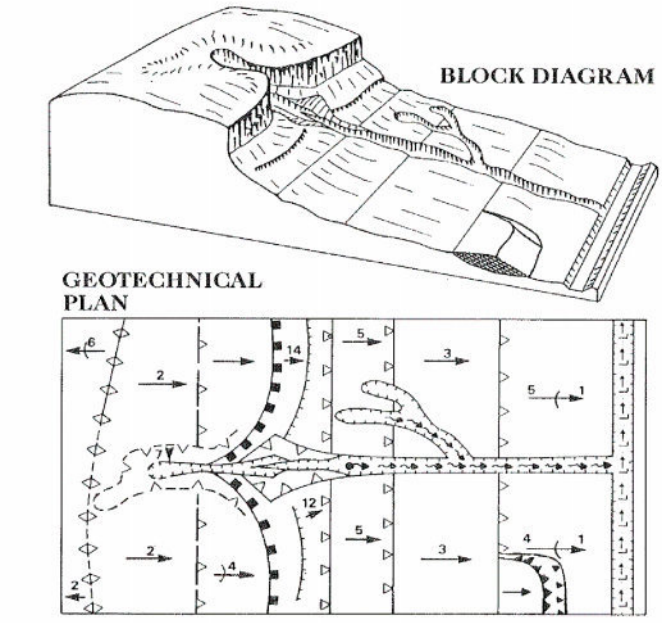
Top
Bottom
} Cut or fill slope, arrows pointing down slope

Hummocky or irregular ground

OTHER FEATURES

Boulder
Seepage/spring
Swallow hole for runoff
Natural water course
Open drain, unlined
Open drain, lined
Fenceline
Property boundary
Dry Stone Wall
J 200 J Major joint in rock face (opening in millimetres)
– T – T – 10 Tension crack (opening in millimetres)
Masonry or concrete wall
Ponding water
Boggy or swampy area

EXAMPLE OF USE OF TOPOGRAPHIC SYMBOLS:



(After Gardiner, V & Dackombe, R. V. (1983), Geomorphological Field Manual; George Allen & Unwin).

Title:	**GEOTECHNICAL MAPPING SYMBOLS**	
Location:	1 FOUNTAINDALE ROAD ROBERTSON, NSW	
Report No: 32853PH		Figure: 3

This plan should be read in conjunction with the JK Geotechnics report.

JKGeotechnics

APPENDIX A

LANDSLIDE RISK MANAGEMENT TERMINOLOGY

LANDSLIDE RISK MANAGEMENT

Definition of Terms and Landslide Risk

Risk Terminology	Description
Acceptable Risk	A risk for which, for the purposes of life or work, we are prepared to accept as it is with no regard to its management. Society does not generally consider expenditure in further reducing such risks justifiable.
Annual Exceedance Probability (AEP)	The estimated probability that an event of specified magnitude will be exceeded in any year.
Consequence	The outcomes or potential outcomes arising from the occurrence of a landslide expressed qualitatively or quantitatively, in terms of loss, disadvantage or gain, damage, injury or loss of life.
Elements at Risk	The population, buildings and engineering works, economic activities, public services utilities, infrastructure and environmental features in the area potentially affected by landslides.
Frequency	A measure of likelihood expressed as the number of occurrences of an event in a given time. See also 'Likelihood' and 'Probability'.
Hazard	A condition with the potential for causing an undesirable consequence (the landslide). The description of landslide hazard should include the location, volume (or area), classification and velocity of the potential landslides and any resultant detached material, and the likelihood of their occurrence within a given period of time.
Individual Risk to Life	The risk of fatality or injury to any identifiable (named) individual who lives within the zone impacted by the landslide; or who follows a particular pattern of life that might subject him or her to the consequences of the landslide.
Landslide Activity	The stage of development of a landslide; pre failure when the slope is strained throughout but is essentially intact; failure characterised by the formation of a continuous surface of rupture; post failure which includes movement from just after failure to when it essentially stops; and reactivation when the slope slides along one or several pre-existing surfaces of rupture. Reactivation may be occasional (eg. seasonal) or continuous (in which case the slide is 'active').
Landslide Intensity	A set of spatially distributed parameters related to the destructive power of a landslide. The parameters may be described quantitatively or qualitatively and may include maximum movement velocity, total displacement, differential displacement, depth of the moving mass, peak discharge per unit width, or kinetic energy per unit area.
Landslide Risk	The AGS Australian GeoGuide LR7 (AGS, 2007e) should be referred to for an explanation of Landslide Risk.
Landslide Susceptibility	The classification, and volume (or area) of landslides which exist or potentially may occur in an area or may travel or retrogress onto it. Susceptibility may also include a description of the velocity and intensity of the existing or potential landsliding.
Likelihood	Used as a qualitative description of probability or frequency.
Probability	A measure of the degree of certainty. This measure has a value between zero (impossibility) and 1.0 (certainty). It is an estimate of the likelihood of the magnitude of the uncertain quantity, or the likelihood of the occurrence of the uncertain future event. These are two main interpretations: (i) Statistical – frequency or fraction – The outcome of a repetitive experiment of some kind like flipping coins. It includes also the idea of population variability. Such a number is called an 'objective' or relative frequentist probability because it exists in the real world and is in principle measurable by doing the experiment.

Risk Terminology	Description
Probability *(continued)*	(ii) Subjective probability (degree of belief) – Quantified measure of belief, judgment, or confidence in the likelihood of an outcome, obtained by considering all available information honestly, fairly, and with a minimum of bias. Subjective probability is affected by the state of understanding of a process, judgment regarding an evaluation, or the quality and quantity of information. It may change over time as the state of knowledge changes.
Qualitative Risk Analysis	An analysis which uses word form, descriptive or numeric rating scales to describe the magnitude of potential consequences and the likelihood that those consequences will occur.
Quantitative Risk Analysis	An analysis based on numerical values of the probability, vulnerability and consequences and resulting in a numerical value of the risk.
Risk	A measure of the probability and severity of an adverse effect to health, property or the environment. Risk is often estimated by the product of probability x consequences. However, a more general interpretation of risk involves a comparison of the probability and consequences in a non-product form.
Risk Analysis	The use of available information to estimate the risk to individual, population, property, or the environment, from hazards. Risk analyses generally contain the following steps: scope definition, hazard identification and risk estimation.
Risk Assessment	The process of risk analysis and risk evaluation.
Risk Control or Risk Treatment	The process of decision-making for managing risk and the implementation or enforcement of risk mitigation measures and the re-evaluation of its effectiveness from time to time, using the results of risk assessment as one input.
Risk Estimation	The process used to produce a measure of the level of health, property or environmental risks being analysed. Risk estimation contains the following steps: frequency analysis, consequence analysis and their integration.
Risk Evaluation	The stage at which values and judgments enter the decision process, explicitly or implicitly, by including consideration of the importance of the estimated risks and the associated social, environmental and economic consequences, in order to identify a range of alternatives for managing the risks.
Risk Management	The complete process of risk assessment and risk control (or risk treatment).
Societal Risk	The risk of multiple fatalities or injuries in society as a whole: one where society would have to carry the burden of a landslide causing a number of deaths, injuries, financial, environmental and other losses.
Susceptibility	See 'Landslide Susceptibility'.
Temporal Spatial Probability	The probability that the element at risk is in the area affected by the landsliding, at the time of the landslide.
Tolerable Risk	A risk within a range that society can live with so as to secure certain net benefits. It is a range of risk regarded as non-negligible and needing to be kept under review and reduced further if possible.
Vulnerability	The degree of loss to a given element or set of elements within the area affected by the landslide hazard. It is expressed on a scale of 0 (no loss) to 1 (total loss). For property, the loss will be the value of the damage relative to the value of the property; for persons, it will be the probability that a particular life (the element at risk) will be lost, given the person(s) is affected by the landslide.

NOTE: Reference should be made to Figure A1 which shows the inter-relationship of many of these terms and the relevant portion of Landslide Risk Management.

Reference should also be made to the paper referenced below for Landslide Terminology and more detailed discussion of the above terminology.

This appendix is an extract from PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT as presented in Australian Geomechanics, Vol 42, No 1, March 2007, which discusses the matter more fully.

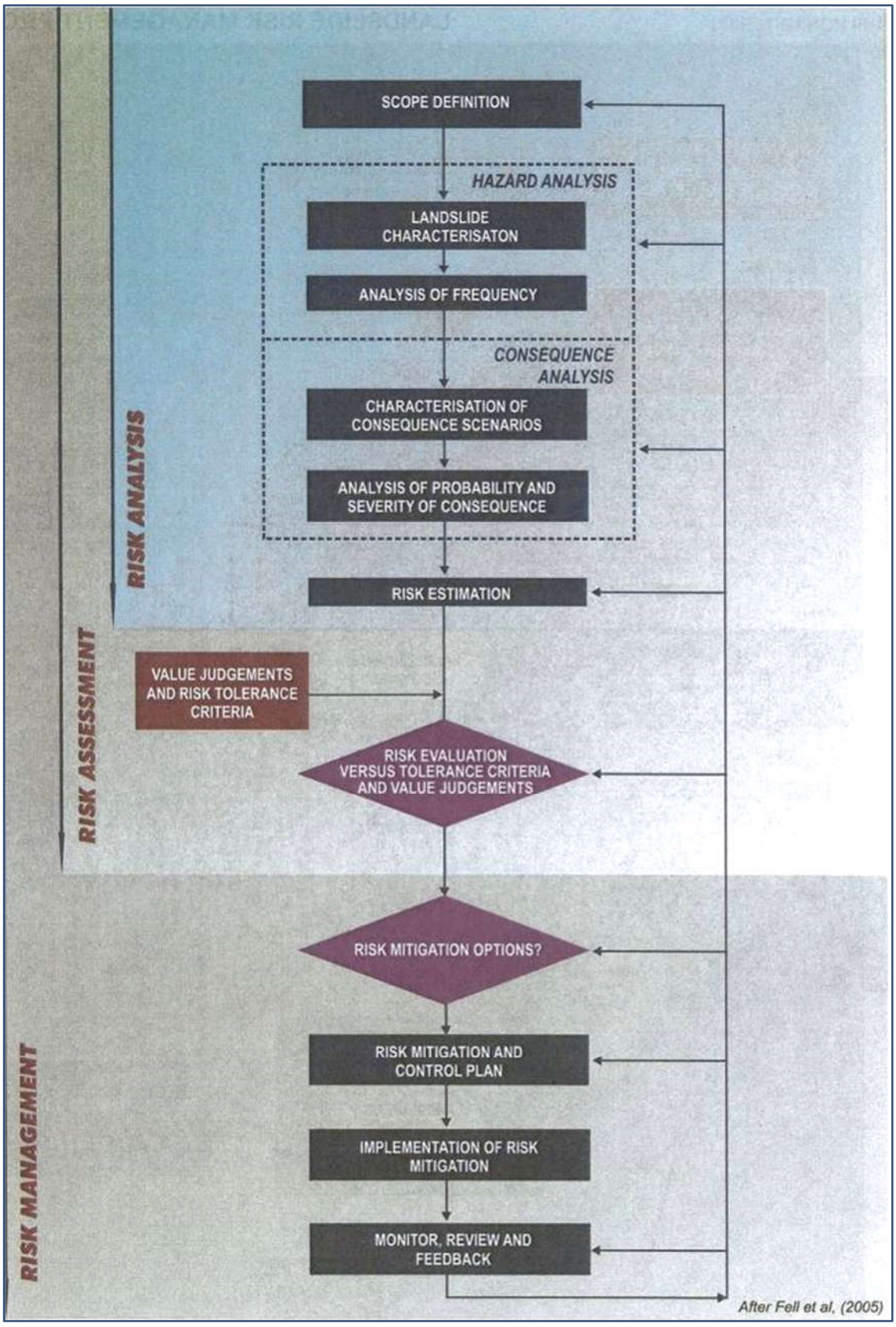


FIGURE A1: Flowchart for Landslide Risk Management.

This figure is an extract from GUIDELINE FOR LANDSLIDE SUSCEPTIBILITY, HAZARD AND RISK ZONING FOR LAND USE PLANNING, as presented in Australian Geomechanics Vol 42, No 1, March 2007, which discusses the matter more fully.

TABLE A1: LANDSLIDE RISK ASSESSMENT
QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

QUALITATIVE MEASURES OF LIKELIHOOD

Approximate Annual Probability		Implied Indicative Landslide Recurrence Interval		Description	Descriptor	Level
Indicative Value	Notional Boundary					
10^{-1}	5×10^{-2}	10 years	20 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}	5×10^{-3}	100 years	200 years	The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	5×10^{-4}	1000 years	2000 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}	5×10^{-5}	10,000 years	20,000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	5×10^{-2}	100,000 years	200,000 years	The event is conceivable but only under exceptional circumstances over the design life.	RARE	E
10^{-6}		1,000,000 years		The event is inconceivable or fanciful over the design life.	BARELY CREDIBLE	F

Note: (1) The table should be used from left to right; use Approximate Annual Probability or Description to assign Descriptor, not *vice versa*.

QUALITATIVE MEASURES OF CONSEQUENCES TO PROPERTY

Approximate cost of Damage		Description	Descriptor	Level
Indicative Value	Notional Boundary			
200%	100%	Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequence damage.	CATASTROPHIC	1
60%	40%	Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequence damage.	MAJOR	2
20%	10%	Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequence damage.	MEDIUM	3
5%	1%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	MINOR	4
0.5%		Little damage. (Note for high probability event (Almost Certain), this category may be subdivided at a notional boundary of 0.1%. See Risk Matrix.)	INSIGNIFICANT	5

Notes: (2) The Approximate Cost of Damage is expressed as a percentage of market value, being the cost of the improved value of the unaffected property which includes the land plus the unaffected structures.

(3) The Approximate Cost is to be an estimate of the direct cost of the damage, such as the cost of reinstatement of the damaged portion of the property (land plus structures), stabilisation works required to render the site to tolerable risk level for the landslide which has occurred and professional design fees, and consequential costs such as legal fees, temporary accommodation. It does not include additional stabilisation works to address other landslides which may affect the property.

(4) The table should be used from left to right; use Approximate Cost of Damage or Description to assign Descriptor, not vice versa.

Extract from PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT as presented in Australian Geomechanics, Vol 42, No 1, March 2007, which discusses the matter more fully.

TABLE A1: LANDSLIDE RISK ASSESSMENT
QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY (continued)

QUALITATIVE RISK ANALYSIS MATRIX – LEVEL OF RISK TO PROPERTY

LIKELIHOOD		CONSEQUENCES TO PROPERTY (With Indicative Approximate Cost of Damage)				
	Indicative Value of Approximate Annual Probability	1: CATASTROPHIC 200%	2: MAJOR 60%	3: MEDIUM 20%	4: MINOR 5%	5: INSIGNIFICANT 0.5%
A – ALMOST CERTAIN	10^{-1}	VH	VH	VH	H	M or **L** (5)
B - LIKELY	10^{-2}	VH	VH	H	M	**L**
C - POSSIBLE	10^{-3}	VH	H	M	M	**VL**
D - UNLIKELY	10^{-4}	H	M	**L**	**L**	**VL**
E - RARE	10^{-5}	M	**L**	**L**	**VL**	**VL**
F - BARELY CREDIBLE	10^{-6}	**L**	**VL**	**VL**	**VL**	**VL**

Notes: (5) Cell A5 may be subdivided such that a consequence of less than 0.1% is Low Risk.
(6) When considering a risk assessment it must be clearly stated whether it is for existing conditions or with risk control measures which may not be implemented at the current time.

RISK LEVEL IMPLICATIONS

Risk Level		Example Implications (7)
VH	VERY HIGH RISK	Unacceptable without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low; may be too expensive and not practical. Work likely to cost more than value of the property.
H	HIGH RISK	Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to Low. Work would cost a substantial sum in relation to the value of the property.
M	MODERATE RISK	May be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable.
L	LOW RISK	Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.
VL	VERY LOW RISK	Acceptable. Manage by normal slope maintenance procedures.

Note: (7) The implications for a particular situation are to be determined by all parties to the risk assessment and may depend on the nature of the property at risk; these are only given as a general guide.

Extract from PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT as presented in Australian Geomechanics, Vol 42, No 1, March 2007, which discusses the matter more fully.

AUSTRALIAN GEOGUIDE LR2 (LANDSLIDES)

What is a Landslide?

Any movement of a mass of rock, debris, or earth, down a slope, constitutes a "landslide". Landslides take many forms, some of which are illustrated. More information can be obtained from Geoscience Australia, or by visiting its Australian landslide Database at www.ga.gov.au/urban/factsheets/landslide.jsp. Aspects of the impact of landslides on buildings are dealt with in the book "Guideline Document Landslide Hazards" published by the Australian Building Codes Board and referenced in the Building Code of Australia. This document can be purchased over the internet at the Australian Building Codes Board's website www.abcb.gov.au.

Landslides vary in size. They can be small and localised or very large, sometimes extending for kilometres and involving millions of tonnes of soil or rock. It is important to realise that even a 1 cubic metre boulder of soil, or rock, weighs at least 2 tonnes. If it falls, or slides, it is large enough to kill a person, crush a car, or cause serious structural damage to a house. The material in a landslide may travel downhill well beyond the point where the failure first occurred, leaving destruction in its wake. It may also leave an unstable slope in the ground behind it, which has the potential to fall again, causing the landslide to extend (regress) uphill, or expand sideways. For all these reasons, both "potential" and "actual" landslides must be taken very seriously. The present a real threat to life and property and require proper management.

Identification of landslide risk is a complex task and must be undertaken by a geotechnical practitioner (GeoGuide LR1) with specialist experience in slope stability assessment and slope stabilisation.

What Causes a Landslide?

Landslides occur as a result of local geological and groundwater conditions, but can be exacerbated by inappropriate development (GeoGuide LR8), exceptional weather, earthquakes and other factors. Some slopes and cliffs never seem to change, but are actually on the verge of failing. Others, often moderate slopes (Table 1), move continuously, but so slowly that it is not apparent to a casual observer. In both cases, small changes in conditions can trigger a landslide with series consequences. Wetting up of the ground (which may involve a rise in groundwater table) is the single most important cause of landslides (GeoGuide LR5). This is why they often occur during, or soon after, heavy rain. Inappropriate development often results in small scale landslides which are very expensive in human terms because of the proximity of housing and people.

Does a Landslide Affect You?

Any slope, cliff, cutting, or fill embankment may be a hazard which has the potential to impact on people, property, roads and services. Some tell-tale signs that might indicate that a landslide is occurring are listed below:

- Open cracks, or steps, along contours
- Groundwater seepage, or springs
- Bulging in the lower part of the slope
- Hummocky ground
- trees leaning down slope, or with exposed roots
- debris/fallen rocks at the foot of a cliff
- tilted power poles, or fences
- cracked or distorted structures

These indications of instability may be seen on almost any slope and are not necessarily confined to the steeper ones (Table 1). Advice should be sought from a geotechnical practitioner if any of them are observed. Landslides do not respect property boundaries. As mentioned above they can "run-out" from above, "regress" from below, or expand sideways, so a landslide hazard affecting your property may actually exist on someone else's land.

Local councils are usually aware of slope instability problems within their jurisdiction and often have specific development and maintenance requirements. **Your local council is the first place to make enquiries if you are responsible for any sort of development or own or occupy property on or near sloping land or a cliff.**

TABLE 1 – Slope Descriptions

Appearance	Slope Angle	Maximum Gradient	Slope Characteristics
Gentle	0° - 10°	1 on 6	Easy walking.
Moderate	10° - 18°	1 on 3	Walkable. Can drive and manoeuvre a car on driveway.
Steep	18° - 27°	1 on 2	Walkable with effort. Possible to drive straight up or down roughened concrete driveway, but cannot practically manoeuvre a car.
Very Steep	27° - 45°	1 on 1	Can only climb slope by clutching at vegetation, rocks, etc.
Extreme	45° - 64°	1 on 0.5	Need rope access to climb slope.
Cliff	64° - 84°	1 on 0.1	Appears vertical. Can abseil down.
Vertical or Overhang	84° - 90±°	Infinite	Appears to overhang. Abseiler likely to lose contact with the face.

Some typical landslides which could affect residential housing are illustrated below:

Rotational or circular slip failures (Figure 1) - can occur on moderate to very steep soil and weathered rock slopes (Table 1). The sliding surface of the moving mass tends to be deep seated. Tension cracks may open at the top of the slope and bulging may occur at the toe. The ground may move in discrete "steps" separated by long periods without movement. More rapid movement may occur after heavy rain.

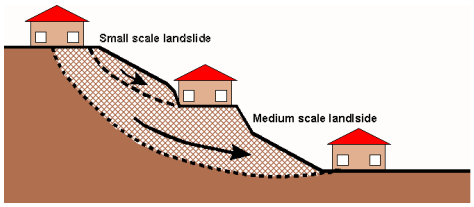


Figure 1

Translational slip failures (Figure 2) - tend to occur on moderate to very steep slopes (Table 1) where soil, or weak rock, overlies stronger strata. The sliding mass is often relatively shallow. It can move, or deform slowly (creep) over long periods of time. Extensive linear cracks and hummocks sometimes form along the contours. The sliding mass may accelerate after heavy rain.

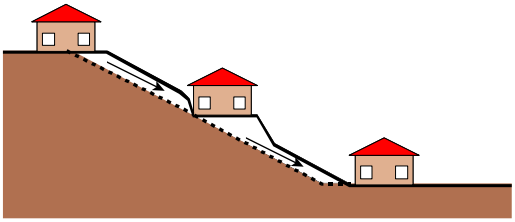


Figure 2

Wedge failures (Figure 3) - normally only occur on extreme slopes, or cliffs (Table 1), where discontinuities in the rock are inclined steeply downwards out of the face.

Rock falls (Figure 3) - tend to occur from cliffs and overhangs (Table 1).

Cliffs may remain, apparently unchanged, for hundreds of years. Collections of boulders at the foot of a cliff may indicate that rock falls are ongoing. Wedge failures and rock falls do not "creep". Familiarity with a particular local situation can instil a false sense of security since failure, when it occurs, is usually sudden and catastrophic.

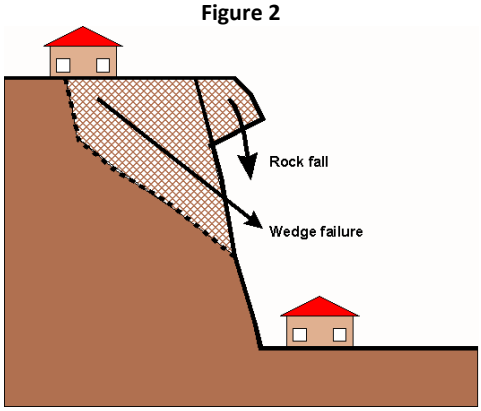


Figure 3

Debris flows and mud slides (Figure 4) - may occur in the foothills of ranges, where erosion has formed valleys which slope down to the plains below. The valley bottoms are often lined with loose eroded material (debris) which can "flow" if it becomes saturated during and after heavy rain. Debris flows are likely to occur with little warning; they travel a long way and often involve large volumes of soil. The consequences can be devastating.

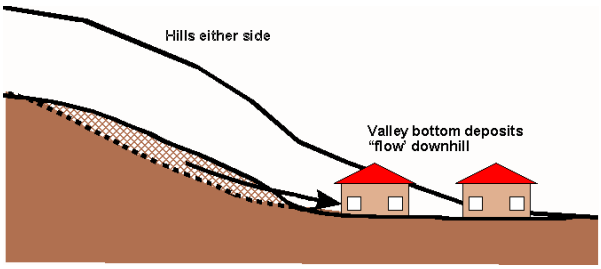


Figure 4

More information relevant to your particular situation may be found in other Australian GeoGuides:

- GeoGuide LR1 - Introduction
- GeoGuide LR3 - Soil Slopes
- GeoGuide LR4 - Rock Slopes
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
- GeoGuide LR8 - Hillside Construction
- GeoGuide LR9 - Effluent & Surface Water Disposal
- GeoGuide LR10 - Coastal Landslides
- GeoGuide LR11 - Record Keeping

The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to help you understand why slopes and retaining structures can be a hazard and what can be done with appropriate professional advice and local council approval (if required) to remove, reduce, or minimise the risk they represent. The GeoGuides have been prepared by the Australian Geomechanics Society, a specialist technical society within Engineers Australia, the national peak body for all engineering disciplines in Australia, whose members are professional geotechnical engineers and engineering geologists with a particular interest in ground engineering. The GeoGuides have been funded under the Australian governments' National Disaster Mitigation Program.

AUSTRALIAN GEOGUIDE LR7 (LANDSLIDE RISK)

Concept of Risk

Risk is a familiar term, but what does it really mean? It can be defined as *"a measure of the probability and severity of an adverse effect to health, property, or the environment."* This definition may seem a bit complicated. In relation to landslides, geotechnical practitioners (see GeoGuide LR1) are required to assess risk in terms of the likelihood that a particular landslide will occur and the possible consequences. This is called landslide risk assessment. The consequences of a landslide are many and varied, but our concerns normally focus on loss of, or damage to, property and loss of life.

Landslide Risk Assessment

Some local councils in Australia are aware of the potential for landslides within their jurisdiction and have responded by designating specific "landslide hazard zones". Development in these areas is normally covered by special regulations. If you are contemplating building, or buying an existing house, particularly in a hilly area, or near cliffs, then go first for information to your local council.

Landslide risk assessment must be undertaken by a geotechnical practitioner. It may involve visual inspection, geological mapping, geotechnical investigation and monitoring to identify:

- potential landslides (there may be more than one that could impact on your site);
- the likelihood that they will occur;
- the damage that could result;
- the cost of disruption and repairs; and
- the extent to which lives could be lost.

Risk assessment is a predictive exercise, but since the ground and the processes involved are complex, prediction tends to lack precision. If you commission a landslide risk assessment for a particular site you should expect to receive a report prepared in accordance with current professional guidelines and in a form that is acceptable to your local council, or planning authority.

Risk to Property

Table 1 indicates the terms used to describe risk to property. Each risk level depends on an assessment of how likely a landslide is to occur and its consequences in dollar terms. "Likelihood" is the chance of it happening in any one year, as indicated in Table 2. "Consequences" are related to the cost of the repairs and temporary loss of use if the landslide occurs. These two factors are combined by the geotechnical practitioner to determine the Qualitative Risk.

TABLE 2 – LIKELIHOOD

Likelihood	Annual Probability
Almost Certain	1:10
Likely	1:100
Possible	1:1,000
Unlikely	1:10,000
Rare	1:100,000
Barely credible	1:1,000,000

The terms "unacceptable", "may be tolerable" etc. in Table 1 indicate how most people react to an assessed risk level. However, some people will always be more prepared, or better able, to tolerate a higher risk level than others.

Some local councils and planning authorities stipulate a maximum tolerable risk level of risk to property for developments within their jurisdictions. In these situations the risk must be assessed by a geotechnical practitioner. If stabilisation works are needed to meet the stipulated requirements these will normally have to be carried out as part of the development, or consent will be withheld.

TABLE 1 – RISK TO PROPERTY

Qualitative Risk		Significance - Geotechnical engineering requirements
Very high	VH	**Unacceptable** without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low. May be too expensive and not practical. Work likely to cost more than the value of the property.
High	H	**Unacceptable** without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to acceptable level. Work would cost a substantial sum in relation to the value of the property.
Moderate	M	**May be tolerated** in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as possible.
Low	L	**Usually acceptable** to regulators. Where treatment has been needed to reduce the risk to this level, ongoing maintenance is required.
Very Low	VL	**Acceptable**. Manage by normal slope maintenance procedures.

Risk to Life

Most of us have some difficulty grappling with the concept of risk and deciding whether, or not, we are prepared to accept it. However, without doing any sort of analysis, or commissioning a report from an "expert", we all take risks every day. One of them is the risk of being killed in an accident. This is worth thinking about, because it tells us a lot about ourselves and can help to put an assessed risk into a meaningful context. By identifying activities that we either are, or are not, prepared to engage in, we can get some indication of the maximum level of risk that we are prepared to take. This knowledge can help us to decide whether we really are able to accept a particular risk, or to tolerate a particular likelihood of loss, or damage, to our property (Table 2).

In Table 3, data from NSW for the years 1998 to 2002, and other sources, is presented. A risk of 1 in 100,000 means that, in any one year, 1 person is killed for every 100,000 people undertaking that particular activity. The NSW data assumes that the whole population undertakes the activity. That is, we are all at risk of being killed in a fire, or of choking on our food, but it is reasonable to assume that only people who go deep sea fishing run a risk of being killed while doing it.

It can be seen that the risks of dying as a result of falling, using a motor vehicle, or engaging in water-related activities (including bathing) are all greater than 1:100,000 and yet few people actively avoid situations where these risks are present. Some people are averse to flying and yet it represents a lower risk than choking to death on food. The data also indicate that, even when the risk of dying as a consequence of a particular event is very small, it could still happen to any one of us today. If this were not so, there would be no risk at all and clearly that is not the case.

In NSW, the planning authorities consider that 1:1,000,000 is the maximum tolerable risk for domestic housing built near an obvious hazard, such as a chemical factory. Although not specifically considered in the NSW guidelines there is little difference between the hazard presented by a neighbouring factory and a landslide: both have the capacity to destroy life and property and both are always present.

TABLE 3 – RISK TO LIFE

Risk (deaths per participant per year)	**Activity/Event Leading to Death** (NSW data unless noted)
1:1,000	Deep sea fishing (UK)
1:1,000 to 1:10,000	Motor cycling, horse riding, ultra-light flying (Canada)
1:23,000	Motor vehicle use
1:30,000	Fall
1:70,000	Drowning
1:180,000	Fire/burn
1:660,000	Choking on food
1:1,000,000	Scheduled airlines (Canada)
1:2,300,000	Train travel
1:32,000,000	Lightning strike

More information relevant to your particular situation may be found in other Australian GeoGuides:

- GeoGuide LR1 - Introduction
- GeoGuide LR3 - Soil Slopes
- GeoGuide LR4 - Rock Slopes
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
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APPENDIX B

SOME GUIDELINES

FOR

HILLSIDE CONSTRUCTION

SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

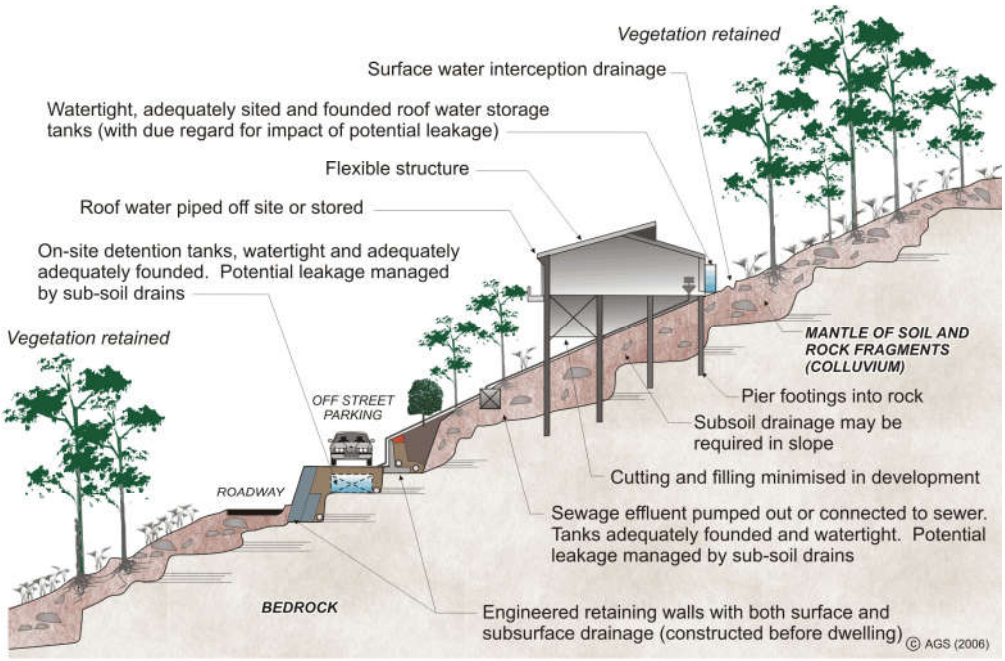
	GOOD ENGINEERING PRACTICE	POOR ENGINEERING PRACTICE
ADVICE		
GEOTECHNICAL ASSESSMENT	Obtain advice from a qualified, experienced geotechnical consultant at early stage of planning and before site works.	Prepare detailed plan and start site works before geotechnical advice.
PLANNING		
SITE PLANNING	Having obtained geotechnical advice, plan the development with the risk arising from the identified hazards and consequences in mind.	Plan development without regard for the Risk.
DESIGN AND CONSTRUCTION		
HOUSE DESIGN	Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.	Floor plans which require extensive cutting and filling. Movement intolerant structures.
SITE CLEARING	Retain natural vegetation wherever practicable.	Indiscriminately clear the site.
ACCESS & DRIVEWAYS	Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.	Excavate and fill for site access before geotechnical advice.
EARTHWORKS	Retain natural contours wherever possible.	Indiscriminant bulk earthworks.
CUTS	Minimise depth. Support with engineered retaining walls or batter to appropriate slope. Provide drainage measures and erosion control.	Large scale cuts and benching. Unsupported cuts. Ignore drainage requirements.
FILLS	Minimise height. Strip vegetation and topsoil and key into natural slopes prior to filling. Use clean fill materials and compact to engineering standards. Batter to appropriate slope or support with engineered retaining wall. Provide surface drainage and appropriate subsurface drainage.	Loose or poorly compacted fill, which if it fails, may flow a considerable distance (including onto properties below). Block natural drainage lines. Fill over existing vegetation and topsoil. Include stumps, trees, vegetation, topsoil, boulders, building rubble etc. in fill.
ROCK OUTCROPS & BOULDERS	Remove or stabilise boulders which may have unacceptable risk. Support rock faces where necessary.	Disturb or undercut detached blocks or boulders.
RETAINING WALLS	Engineer design to resist applied soil and water forces. Found on bedrock where practicable. Provide subsurface drainage within wall backfill and surface drainage on slope above. Construct wall as soon as possible after cut/fill operation.	Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork. Lack of subsurface drains and weepholes.
FOOTINGS	Found within bedrock where practicable. Use rows of piers or strip footings oriented up and down slope. Design for lateral creep pressures if necessary. Backfill footing excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulders or undercut cliffs.
SWIMMING POOLS	Engineer designed. Support on piers to rock where practicable. Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.	
DRAINAGE		
SURFACE	Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. Provide generous falls to prevent blockage by siltation and incorporate silt traps. Line to minimise infiltration and make flexible where possible. Special structures to dissipate energy at changes of slope and/or direction.	Discharge at top of fills and cuts. Allow water to pond bench areas.
SUBSURFACE	Provide filter around subsurface drain. Provide drain behind retaining walls. Use flexible pipelines with access for maintenance. Prevent inflow of surface water.	Discharge of roof run-off into absorption trenches.
SEPTIC & SULLAGE	Usually requires pump-out or mains sewer systems; absorption trenches may be possible in some areas if risk is acceptable. Storage tanks should be water-tight and adequately founded.	Discharge sullage directly onto and into slopes. Use of absorption trenches without consideration of landslide risk.
EROSION CONTROL & LANDSCAPING	Control erosion as this may lead to instability. Revegetate cleared area.	Failure to observe earthworks and drainage recommendations when landscaping.
DRAWINGS AND SITE VISITS DURING CONSTRUCTION		
DRAWINGS	Building Application drawings should be viewed by a geotechnical consultant.	
SITE VISITS	Site visits by consultant may be appropriate during construction.	
INSPECTION AND MAINTENANCE BY OWNER		
OWNER'S RESPONSIBILITY	Clean drainage systems; repair broken joints in drains and leaks in supply pipes. Where structural distress is evident seek advice. If seepage observed, determine cause or seek advice on consequences.	

This table is extracted from PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT as presented in *Australian Geomechanics*, Vol 42, No 1, March 2007 which discusses the matter more fully.

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

Sensible development practices are required when building on hillsides, particularly if the hillside has more than a low risk of instability (GeoGuide LR7). Only building techniques intended to maintain, or reduce, the overall level of landslide risk should be considered. Examples of good hillside construction practice are illustrated below.

EXAMPLES FOR **GOOD** HILLSIDE CONSTRUCTION PRACTICE



WHY ARE THESE PRACTICES GOOD?

Roadways and parking areas - are paved and incorporate kerbs which prevent water discharging straight into the hillside (GeoGuide LR5).

Cuttings - are supported by retaining walls (GeoGuide LR6).

Retaining walls - are engineer designed to withstand the lateral earth pressures and surcharges expected, and include drains to prevent water pressures developing in the backfill. Where the ground slopes steeply down towards the high side of a retaining wall, the disturbing force (see GeoGuide LR6) can be two or more times that due to level ground. Retaining walls must be designed taking these forces into account.

Sewage - whether treated or not is either taken away in pipes or contained in properly founded tanks so it cannot soak into the ground.

Surface water - from roofs and other hard surfaces is piped away to a suitable discharge point rather than being allowed to infiltrate into the ground. Preferably, the discharge point will be in a natural creek where ground water exits, rather than enters, the ground. Shallow, lined, drains on the surface can fulfill the same purpose (GeoGuide LR5).

Surface loads - are minimised. No fill embankments have been built. The house is a lightweight structure. Foundation loads have been taken down below the level at which a landslide is likely to occur and, preferably, to rock. This sort of construction is probably not applicable to soil slopes (GeoGuide LR3). If you are uncertain whether your site has rock near the surface, or is essentially a soil slope, you should engage a geotechnical practitioner to find out.

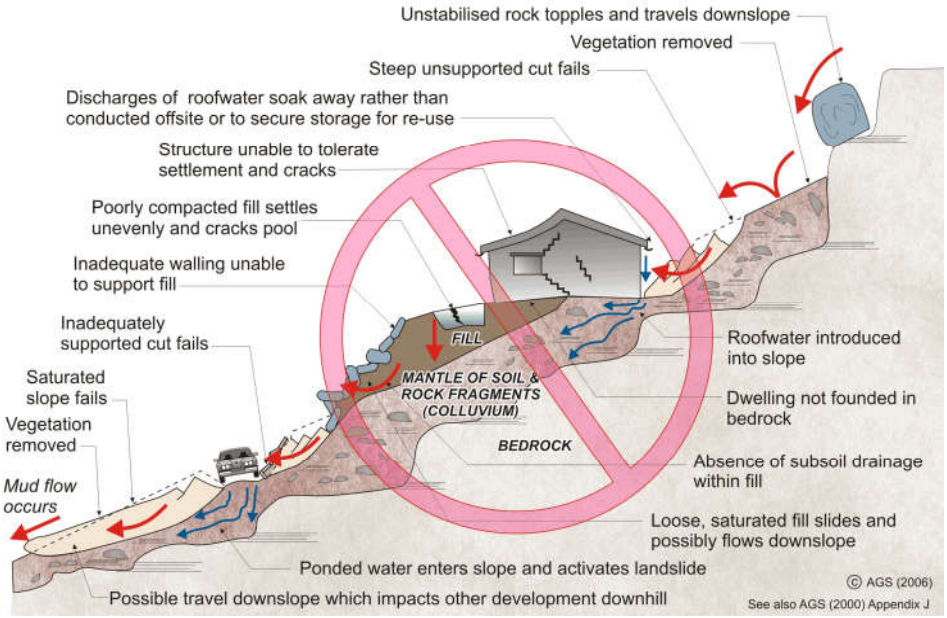
Flexible structures - have been used because they can tolerate a certain amount of movement with minimal signs of distress and maintain their functionality.

Vegetation clearance - on soil slopes has been kept to a reasonable minimum. Trees, and to a lesser extent smaller vegetation, take large quantities of water out of the ground every day. This lowers the ground water table, which in turn helps to maintain the stability of the slope. Large scale clearing can result in a rise in water table with a consequent increase in the likelihood of a landslide (GeoGuide LR5). An exception may have to be made to this rule on steep rock slopes where trees have little effect on the water table, but their roots pose a landslide hazard by dislodging boulders.

Possible effects of ignoring good construction practices are illustrated on page 2. Unfortunately, these poor construction practices are not as unusual as you might think and are often chosen because, on the face of it, they will save the developer, or owner, money. You should not lose sight of the fact that the cost and anguish associated with any one of the disasters illustrated, is likely to more than wipe out any apparent savings at the outset.

ADOPT GOOD PRACTICE ON HILLSIDE SITES

EXAMPLES FOR **POOR** HILLSIDE CONSTRUCTION PRACTICE



WHY ARE THESE PRACTICES POOR?

Roadways and parking areas - are unsurfaced and lack proper table drains (gutters) causing surface water to pond and soaks into the ground.

Cut and fill - has been used to balance earthworks quantities and level the site leaving unstable cut faces and added large surface loads to the ground. Failure to compact the fill properly has led to settlement, which will probably continue for several years after completion. The house and pool have been built on the fill and have settled with it and cracked. Leakage from the cracked pool and the applied surface loads from the fill have combined to cause landslides.

Retaining walls - have been avoided, to minimise cost, and hand placed rock walls used instead. Without applying engineering design principles, the walls have failed to provide the required support to the ground and have failed, creating a very dangerous situation.

A heavy, rigid, house - has been built on shallow, conventional, footings. Not only has the brickwork cracked because of the resulting ground movements, but it has also become involved in a man-made landslide.

Soak-away drainage - has been used for sewage and surface water run-off from roofs and pavements. This water soaks into the ground and raises the water table (GeoGuide LR5). Subsoil drains that run along the contours should be avoided for the same reason. If felt necessary, subsoil drains should run steeply downhill in a chevron, or herringbone, pattern. This may conflict with the requirements for effluent and surface water disposal (GeoGuide LR9) and if so, you will need to seek professional advice.

Rock debris - from landslides higher up on the slope seems likely to pass through the site. Such locations are often referred to by geotechnical practitioners as "debris flow paths". Rock is normally even denser than ordinary fill, so even quite modest boulders are likely to weigh many tonnes and do a lot of damage once they start to roll. Boulders have been known to travel hundreds of metres downhill leaving behind a trail of destruction.

Vegetation - has been completely cleared, leading to a possible rise in the water table and increased landslide risk (GeoGuide LR5).

DON'T CUT CORNERS ON HILLSIDE SITES - OBTAIN ADVICE FROM A GEOTECHNICAL PRACTITIONER

More information relevant to your particular situation may be found in other Australian GeoGuides:

- GeoGuide LR1 - Introduction
- GeoGuide LR3 - Soil Slopes
- GeoGuide LR4 - Rock Slopes
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
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APPENDIX C

19 December 2019
Ref: E32853Blet

Australian Executive Apartments Pty Ltd
c/- X.Pace Design Group
Unit 201, 50 Marshall Street
Surry Hills, NSW 2010

Attention: Mr Ignacio Pistone

REVIEW OF ENVIRONMENTAL SENSITIVE AREAS, WATERWAYS AND DRINKING WATER CATCHMENT
PROPOSED REDEVELOPMENT OF ROBERTSON HOTEL
1 FOUNTAINDALE ROAD, ROBERTSON, NSW

1 INTRODUCTION

Australian Executive Apartments Pty Ltd ('the client') commissioned JK Environments (JKE) as part of the scope of works outlined by JK Geotechnics in the proposal (Ref: P49746PH Rev1, dated 2 July 2019) to undertake a review of environmental sensitive areas including waterways and drinking water catchments associated with the proposed redevelopment of the Robertson Hotel at 1 Fountaindale Road, Robertson, NSW.

This review does not form an environmental impact statement (EIS) or review of environmental factors (REF). The review was undertaken to meet with the requirements outlined by Wingecarribee Council as part of the determination of the development application for the site.

The site is identified as Lot 2 in DP610676. The site location is shown on JK Figure 1 attached. This letter forms an appendix to the JK geotechnical investigation report (Ref: 32853PHprt) and should be read in conjunction with the recommendations presented in the geotechnical report.

The information presented in this letter has been sourced from various publicly available data sources as outlined in the Lotsearch Pty Ltd report attached in the appendices. An independent verification of the data is outside the scope of this review.

1.1 Proposed Development Details

Based on a review of the provided information, we understand that the proposed development will include the following:

- A new five-storey hotel extension on the northern and eastern sides of the existing hotel. The existing hotel will remain and is to be refurbished. The lowest basement level (Level 2) will be at RL768.08m, requiring excavation to a maximum depth of approximately 7m below existing surface levels;

- A three-storey community leisure and health centre, incorporating an indoor pool, to the north-east of the existing hotel. The lowest level (Level 1) will be at RL761.50m. A tunnel and lift are proposed on the southern side of the centre to provide access into the hotel extension, requiring excavation to a maximum depth of approximately 6m below existing surface levels. Due to the sloping site, the lower eastern side of the centre will be above the existing surface levels;
- A loading dock on the eastern side of the existing hotel;
- Eight eco cabins on the north-eastern side of the hotel extension, suspended above existing surface levels;
- Nine eco cabins on the western side of the site, which will have floor levels at, or above, existing surface levels;
- Three villas with courtyards at the north-eastern corner of the site with floor levels between approximately 2m and 4.5m above existing surface levels;
- A reception venue towards the northern corner of the site;
- A bus/coach parking area at the southern corner of the site, off Fountaindale Road, requiring excavation to an assumed maximum depth of approximately 4m below exiting surface levels;
- Several new internal roads and 'eco walk' tracks connecting the proposed buildings. On-grade car parking areas are also proposed near the main entrance into the site off Illawarra Highway. The proposed surface levels of these are not shown, but we assume that due to the sloping site, cut-to-fill earthworks to maximum depths/heights of approximately 2m may be required; and
- The existing dam and pond over the northern portion of the site are to remain.

2 SITE IDENTIFICATION

Table 2-1: Site Identification

Site Address:	1 Fountaindale Road, Robertson, NSW
Lot & Deposited Plan:	Lot 2 DP610676
Current Land Use:	Commercial (Hotel)
Proposed Land Use:	Commercial (extensions to Hotel)
Local Government Authority:	Wingecarribee
Current Zoning:	E3 – Environmental Management
Site Area (m^2):	51,346m^2
RL (AHD in m) (approx.):	750 - 770m
Geographical Location (decimal degrees) (approx.):	Latitude: -34.589218021 Longitude: 150.6106152
Site Location Plan:	Figure 1

3 REVIEW OF ENVIRONMENTAL SENSITIVE AREAS

A review of relevant information from the Lotsearch report is summarised in the table below.

Table 3-1: Review of Environmental Sensitive Issues

Review of NSW EPA data bases on contaminated land:	No notices or records were available for the site. The properties adjacent to the site did not have any notices of records under the EPA databases.
Site Information from Aerial Photos and Business Directory:	The site was occupied by the existing building 'Ranelagh House' since at least 1949. It is unsure when the commercial activities associated with the hotel commenced. No businesses were registered at the site between 1950 and 1991.
Waterways:	There are no major water bodies, watercourse or water pipelines recorded in the immediate vicinity of the site. A few small dams and associated gullies and creeks were scattered to the north and south of the site.
State Forests, National Parks and Wildlife Reserves:	Not recorded within the buffer area of approximately 1,000m of the site. Robertson Nature Reserve is located beyond 1,000m to the west of the site.
Hydrogeology & Groundwater:	The hydrogeology of the site is described as porous, extensive aquifers of low to moderate productivity. The site is not located in any groundwater management zones. A review of the groundwater bores registered with the NSW Dept of Primary Industries indicates the presence of 16 registered bores in the buffer of 2,000m. There were three bores registered for domestic use within 500m of the site. The standing water levels (SWL) in these bores ranged from approximately 7m to 16m below ground level.
Drinking Water Catchments:	Tanks or water catchment areas were not identified within the buffer area of approximately 1,000m of the site. Two tanks point or above ground tanks were noted in the search area. The closest one was approximately 142m to the north of the site and was listed as 'operational'. The tank is located beyond Illawarra Highway on a rural property.
Acid Sulfate Soils (ASS):	The site is not located in an ASS risk area mapped under the Local Environmental Plan (LEP) 2010. The site is not mapped as having ASS risk under the Atlas of Australian Acid Sulfate Soils.
Dryland Salinity:	Not recorded within the buffer area of approximately 1,000m of the site.
State Environmental Planning:	The site is zoned as E3 – Environmental Management under the LEP 2010. The existing building on site 'Ranelagh House' is listed as a heritage item under the LEP 2010.
Natural Hazards:	The site is located in a Category 1 bush fire prone area. No other hazardous were recorded within the buffer area of approximately 1,000m of the site.

Ecological Constrains:	The site contains the Robertson Basalt Rainforest and is recorded on the SEPP44. The site is listed as having a low potential for groundwater dependent ecosystems (GDE) associated with the deeply dissected sandstone plateaus. The site is also listed as having inflow dependent ecosystems (IDE) categories 1 to 3 associated with the deeply dissected sandstone plateaus.

4 CONCLUSIONS

A review of the above information has identified ecological constrains at the site associated with the presence of GDE and IDE. The proposed development includes expansions to the existing hotel including excavations to approximately 7m below the existing site surface. The development has the potential to impact the ecological receptors identified at the site. A detailed ecological assessment should be undertaken by an experienced arborist/ecologist to assess the impacts and provide recommendations to minimise/manage any adverse impacts.

5 LIMITATIONS

The report limitations are outlined below:

- JKE accepts no responsibility for any unidentified issues at the site. Any unexpected problems/subsurface features that may be encountered during development works should be inspected by an environmental consultant as soon as possible;
- This document has been prepared based on site conditions which existed at the time of the investigation; scope of work and limitation outlined in the JKG proposal; and terms of contract between JKG and the client (as applicable);
- The investigation and preparation of this document have been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria;
- Where information has been provided by third parties, JKE has not undertaken any verification process, except where specifically stated in the report;
- JKE accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- JKE have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or landuse. JKE should be contacted immediately in such circumstances;
- This document has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose;
- Copyright in this document is the property of JKE. JKE has used a degree of care, skill and diligence normally exercised by consulting professionals in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report;

- If the client, or any person, provides a copy of this document to any third party, such third party must not rely on this report except with the express written consent of JKE; and
- Any third party who seeks to rely on this document without the express written consent of JKE does so entirely at their own risk and to the fullest extent permitted by law, JKE accepts no liability whatsoever, in respect of any loss or damage suffered by any such third party.

If you have any questions concerning the contents of this letter please do not hesitate to contact us.

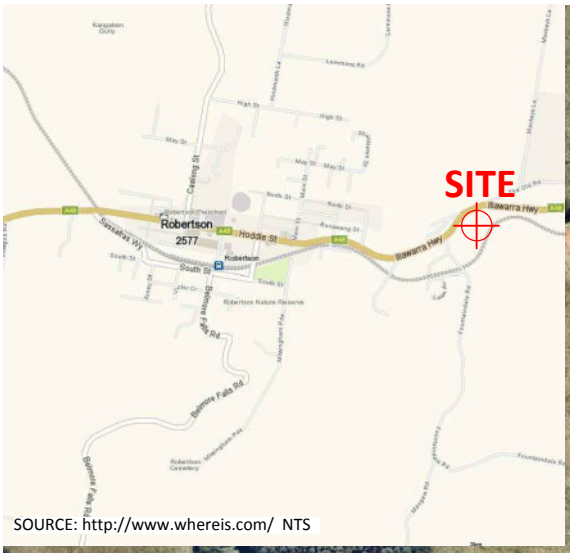
Kind Regards

Vittal Boggaram
Principal Associate Environmental Scientist

Appendices:

Appendix A: Report Figures
Appendix B: Lotsearch Enviro Report

Appendix A: Report Figures



SOURCE: http://www.whereis.com/ NTS

IMAGE SOURCE: http://maps.au.nearmap.com.22.Oct. 2019

0 40 80 120 160 200

SCALE 1:4000 @A4 m

This plan should be read in conjunction with the JK Geotechnics report.

Title: **SITE LOCATION PLAN**

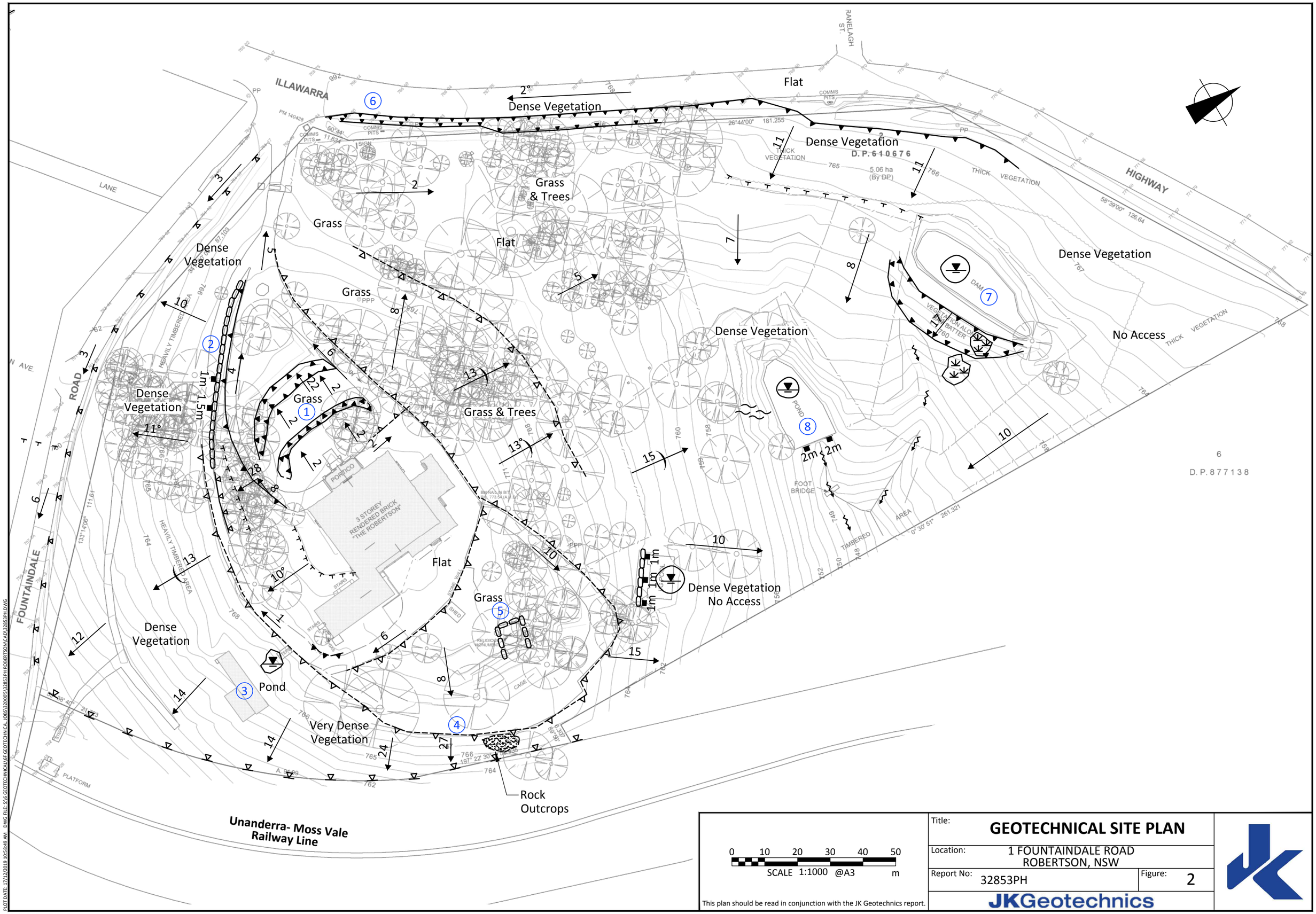
Location: 1 FOUNTAINDALE ROAD
ROBERTSON, NSW

Report No: 32853PH

Figure: 1

JKGeotechnics

PLOT DATE: 17/12/2019 10:58:37 AM DWG FILE: S:\6 GEOTECHNICAL\6F GEOTECHNICAL JOBS\32000'S\32853 PH ROBERTSON\CAD\32853PH.DWG



Title:	GEOTECHNICAL SITE PLAN
Location:	1 FOUNTAINDALE ROAD ROBERTSON, NSW
Report No:	32853PH
Figure:	2

0 10 20 30 40 50 m
SCALE 1:1000 @A3

This plan should be read in conjunction with the JK Geotechnics report.

JKGeotechnics

PLOT DATE: 17/12/2019 10:58:49 AM DWG FILE: S:\G GEOTECHNICAL\GF GEOTECHNICAL JOBS\32000'S\32853PH ROBERTSON\CAD\32853PH.DWG

Appendix B: Lotsearch Enviro Report

LOTSEARCH

LOTSEARCH ENVIRO PROFESSIONAL

Date: 05 Dec 2019 10:19:52

Reference: LS010087 EP

Address: 1 Fountaindale Road, Robertson, NSW 2577

Dataset Listing

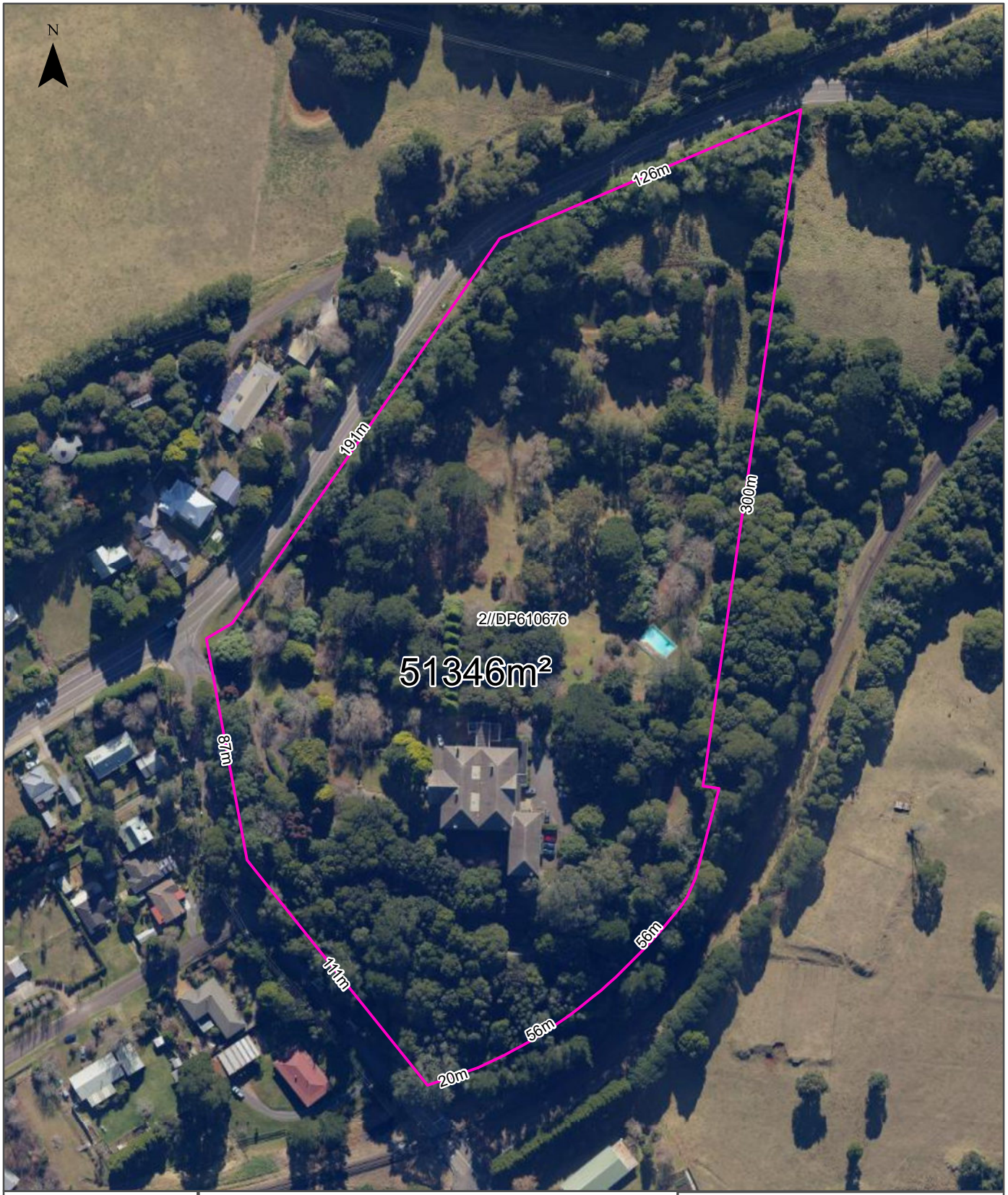
Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Cadastre Boundaries	NSW Department of Finance, Services & Innovation	11/11/2019	11/11/2019	Quarterly	-	-	-	-
Topographic Data	NSW Department of Finance, Services & Innovation	25/06/2019	25/06/2019	As required	-	-	-	-
List of NSW contaminated sites notified to EPA	Environment Protection Authority	19/11/2019	18/11/2019	Monthly	1000	0	0	0
Contaminated Land Records of Notice	Environment Protection Authority	13/11/2019	13/11/2019	Monthly	1000	0	0	0
Former Gasworks	Environment Protection Authority	03/12/2019	11/10/2017	Monthly	1000	0	0	0
National Waste Management Facilities Database	Geoscience Australia	05/11/2019	07/03/2017	Quarterly	1000	0	0	0
EPA PFAS Investigation Program	Environment Protection Authority	04/11/2019	04/11/2019	Monthly	2000	0	0	0
Defence PFAS Investigation & Management Program	Department of Defence	04/11/2019	04/11/2019	Monthly	2000	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	04/11/2019	04/11/2019	Monthly	2000	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	04/11/2019	04/11/2019	Monthly	2000	0	0	0
EPA Other Sites with Contamination Issues	Environment Protection Authority	13/12/2018	13/12/2018	Annually	1000	0	0	0
Licensed Activities under the POEO Act 1997	Environment Protection Authority	25/11/2019	25/11/2019	Monthly	1000	0	1	1
Delicensed POEO Activities still regulated by the EPA	Environment Protection Authority	25/11/2019	25/11/2019	Monthly	1000	0	0	0
Former POEO Licensed Activities now revoked or surrendered	Environment Protection Authority	25/11/2019	25/11/2019	Monthly	1000	0	3	3
UPSS Environmentally Sensitive Zones	Environment Protection Authority	14/04/2015	12/01/2010	As required	1000	1	1	1
UBD Business Directories 1950 - 1991 (Premise & Intersection Matches)	Hardie Grant			Not required	150	0	0	0
UBD Business Directories 1950 - 1991 (Road & Area Matches)	Hardie Grant			Not required	150	-	16	16
UBD Business Directory Drycleaners & Motor Garages/Service Stations (Premise & Intersection Matches)	Hardie Grant			Not required	500	0	0	0
UBD Business Directory Drycleaners & Motor Garages/Service Stations (Road & Area Matches)	Hardie Grant			Not required	500	-	0	0
Points of Interest	NSW Department of Finance, Services & Innovation	12/07/2019	12/07/2019	Quarterly	1000	1	1	9
Tanks (Areas)	NSW Department of Finance, Services & Innovation	12/07/2019	12/07/2019	Quarterly	1000	0	0	0
Tanks (Points)	NSW Department of Finance, Services & Innovation	12/07/2019	12/07/2019	Quarterly	1000	0	0	2
Major Easements	NSW Department of Finance, Services & Innovation	12/07/2019	12/07/2019	Quarterly	1000	0	0	6
State Forest	NSW Department of Finance, Services & Innovation	18/01/2018	18/01/2018	As required	1000	0	0	0
NSW National Parks and Wildlife Service Reserves	NSW Office of Environment & Heritage	16/01/2019	14/11/2018	Annually	1000	0	0	0
Hydrogeology Map of Australia	Commonwealth of Australia (Geoscience Australia)	08/10/2014	17/03/2000	As required	1000	1	1	1
Botany Groundwater Management Zones	NSW Department of Primary Industries	15/03/2018	01/10/2005	As required	1000	0	0	0
Groundwater Boreholes	NSW Dept. of Primary Industries - Water NSW; Commonwealth of Australia (Bureau of Meteorology)	24/07/2018	23/07/2018	Annually	2000	0	0	16
Geological Units 1:250,000	NSW Dept. of Industry, Resources & Energy	20/08/2014		None planned	1000	1	-	2

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Geological Structures 1:250,000	NSW Dept. of Industry, Resources & Energy	20/08/2014		None planned	1000	0	-	0
Naturally Occurring Asbestos Potential	NSW Dept. of Industry, Resources & Energy	04/12/2015	24/09/2015	Unknown	1000	0	0	0
Soil Landscapes	NSW Office of Environment & Heritage	12/08/2014		None planned	1000	1	-	2
Atlas of Australian Soils	ABARES	19/05/2017	17/02/2011	As required	1000	1	1	2
Environmental Planning Instrument Acid Sulfate Soils	NSW Department of Planning and Environment	28/11/2019	11/10/2019	Weekly	500	0	-	-
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000	1	1	2
Dryland Salinity - National Assessment	National Land and Water Resources Audit	18/07/2014	12/05/2013	None planned	1000	0	0	0
Dryland Salinity Potential of Western Sydney	NSW Office of Environment & Heritage	12/05/2017	01/01/2002	None planned	1000	-	-	-
Mining Subsidence Districts	NSW Department of Finance, Services & Innovation	12/07/2019	12/07/2019	Quarterly	1000	0	0	0
Environmental Planning Instrument SEPP State Significant Precincts	NSW Department of Planning and Environment	28/11/2019	07/12/2018	Weekly	1000	0	0	0
Environmental Planning Instrument Land Zoning	NSW Department of Planning and Environment	28/11/2019	22/11/2019	Weekly	1000	1	7	23
Commonwealth Heritage List	Australian Government Department of the Environment and Energy - Heritage Branch	16/01/2019	31/07/2018	Unknown	1000	0	0	0
National Heritage List	Australian Government Department of the Environment and Energy - Heritage Branch	16/01/2019	28/09/2018	Unknown	1000	0	0	0
State Heritage Register - Curtilages	NSW Office of Environment & Heritage	08/11/2019	09/11/2018	Quarterly	1000	0	0	0
Environmental Planning Instrument Heritage	NSW Department of Planning and Environment	28/11/2019	22/11/2019	Weekly	1000	2	2	2
Bush Fire Prone Land	NSW Rural Fire Service	28/08/2019	03/06/2019	Quarterly	1000	2	2	2
Vegetation Mapping Wingecarribee	NSW Office of Environment & Heritage	06/09/2016	04/08/2011	Unknown	1000	1	3	36
Ramsar Wetlands of Australia	Commonwealth of Australia Department of the Environment	08/10/2014	24/06/2011	As required	1000	0	0	0
Groundwater Dependent Ecosystems	Bureau of Meteorology	14/08/2017	15/05/2017	Unknown	1000	1	2	2
Inflow Dependent Ecosystems Likelihood	Bureau of Meteorology	14/08/2017	15/05/2017	Unknown	1000	3	4	9
NSW BioNet Species Sightings	NSW Office of Environment & Heritage	05/12/2019	05/12/2019	Weekly	10000	-	-	-

Site Diagram

1 Fountaindale Road, Robertson, NSW 2577



Legend

- Site Boundary
- Internal Parcel Boundaries

Total Area:	51346m^2
Total Perimeter:	959m

Scale: 0 25 50 100 Meters

Data Sources: Aerial Imagery: © NSW Department Finance, Services & Innovation 2019

Disclaimers:

Measurements are approximate only and may have been simplified or smaller lengths removed for readability.

Parcels that make up a small percentage of the total site area have not been labelled for increased legibility.

Coordinate System: GDA 1994 MGA Zone 56

Date: 05 December 2019

Contaminated Land & Waste Management Facilities

1 Fountaindale Road, Robertson, NSW 2577

List of NSW contaminated sites notified to EPA

Records from the NSW EPA Contaminated Land list within the dataset buffer:

Map Id	Site	Address	Suburb	Activity	Management Class	Status	Location Confidence	Dist (m)	Direction
N/A	No records in buffer								

The values within the EPA site management class in the table above, are given more detailed explanations in the table below:

EPA site management class	Explanation
Contamination being managed via the planning process (EP&A Act)	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. The contamination of this site is managed by the consent authority under the Environmental Planning and Assessment Act 1979 (EP&A Act) planning approval process, with EPA involvement as necessary to ensure significant contamination is adequately addressed. The consent authority is typically a local council or the Department of Planning and Environment.
Contamination currently regulated under CLM Act	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the Contaminated Land Management Act 1997 (CLM Act). Management of the contamination is regulated by the EPA under the CLM Act. Regulatory notices are available on the EPA's Contaminated Land Public Record of Notices.
Contamination currently regulated under POEO Act	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. Management of the contamination is regulated under the Protection of the Environment Operations Act 1997 (POEO Act). The EPA's regulatory actions under the POEO Act are available on the POEO public register.
Contamination formerly regulated under the CLM Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation under the Contaminated Land Management Act 1997 (CLM Act). The contamination was addressed under the CLM Act.
Contamination formerly regulated under the POEO Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed under the Protection of the Environment Operations Act 1997 (POEO Act).
Contamination was addressed via the planning process (EP&A Act)	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed by the appropriate consent authority via the planning process under the Environmental Planning and Assessment Act 1979 (EP&A Act).
Ongoing maintenance required to manage residual contamination (CLM Act)	The EPA has determined that ongoing maintenance, under the Contaminated Land Management Act 1997 (CLM Act), is required to manage the residual contamination. Regulatory notices under the CLM Act are available on the EPA's Contaminated Land Public Record of Notices.
Regulation being finalised	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the Contaminated Land Management Act 1997. A regulatory approach is being finalised.
Regulation under the CLM Act not required	The EPA has completed an assessment of the contamination and decided that regulation under the Contaminated Land Management Act 1997 is not required.
Under assessment	The contamination is being assessed by the EPA to determine whether regulation is required. The EPA may require further information to complete the assessment. For example, the completion of management actions regulated under the planning process or Protection of the Environment Operations Act 1997. Alternatively, the EPA may require information via a notice issued under s77 of the Contaminated Land Management Act 1997 or issue a Preliminary Investigation Order.

NSW EPA Contaminated Land List Data Source: Environment Protection Authority

Contaminated Land & Waste Management Facilities

1 Fountaindale Road, Robertson, NSW 2577

Contaminated Land: Records of Notice

Record of Notices within the dataset buffer:

Map Id	Name	Address	Suburb	Notices	Area No	Location Confidence	Distance	Direction
N/A	No records in buffer							

Contaminated Land Records of Notice Data Source: Environment Protection Authority

Former Gasworks

Former Gasworks within the dataset buffer:

Map Id	Location	Council	Further Info	Location Confidence	Distance	Direction
N/A	No records in buffer					

Former Gasworks Data Source: Environment Protection Authority

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site Id	Owner	Name	Address	Suburb	Class	Landfill	Reprocess	Transfer	Comments	Loc Conf	Dist (m)	Direction
N/A	No records in buffer											

Waste Management Facilities Data Source: Geoscience Australia

PFAS Investigation Programs

1 Fountaindale Road, Robertson, NSW 2577

EPA PFAS Investigation Program

Sites that are part of the EPA PFAS investigation program, within the dataset buffer:

Id	Site	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

EPA PFAS Investigation Program: Environment Protection Authority

Defence PFAS Investigation & Management Program

Sites being investigated or managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Dist	Dir
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites

1 Fountaindale Road, Robertson, NSW 2577

Defence 3 Year Regional Contamination Investigation Program

Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

EPA Other Sites with Contamination Issues

1 Fountaindale Road, Robertson, NSW 2577

EPA Other Sites with Contamination Issues

This dataset contains other sites identified on the EPA website as having contamination issues. This dataset currently includes:

- James Hardie asbestos manufacturing and waste disposal sites
- Radiological investigation sites in Hunter's Hill
- Pasminco Lead Abatement Strategy Area

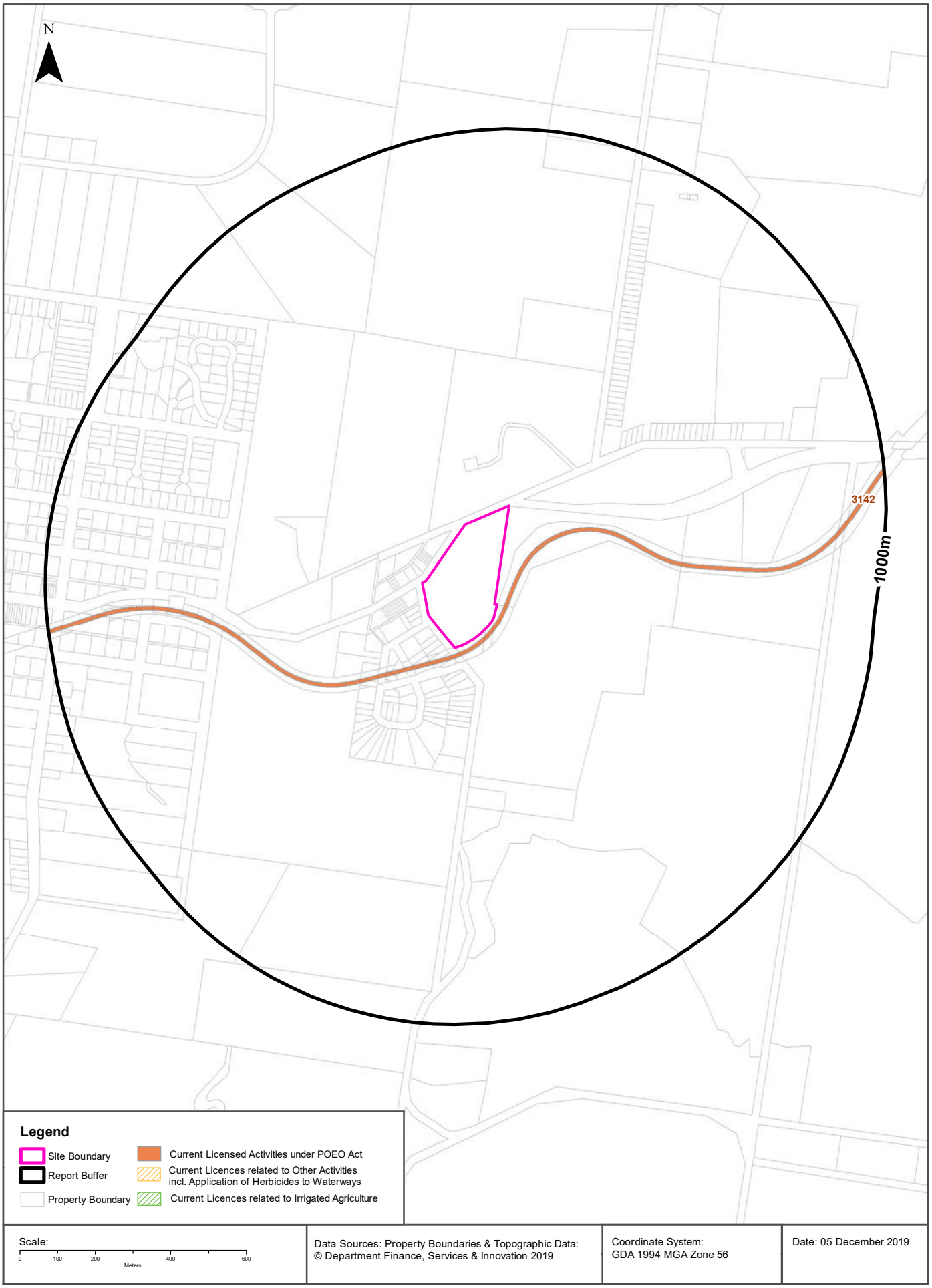
Sites within the dataset buffer:

Site Id	Site Name	Site Address	Dataset	Comments	Location Confidence	Distance	Direction
N/A	No records in buffer						

EPA Other Sites with Contamination Issues: Environment Protection Authority

Current EPA Licensed Activities

1 Fountaindale Road, Robertson, NSW 2577



EPA Activities

1 Fountaindale Road, Robertson, NSW 2577

Licensed Activities under the POEO Act 1997

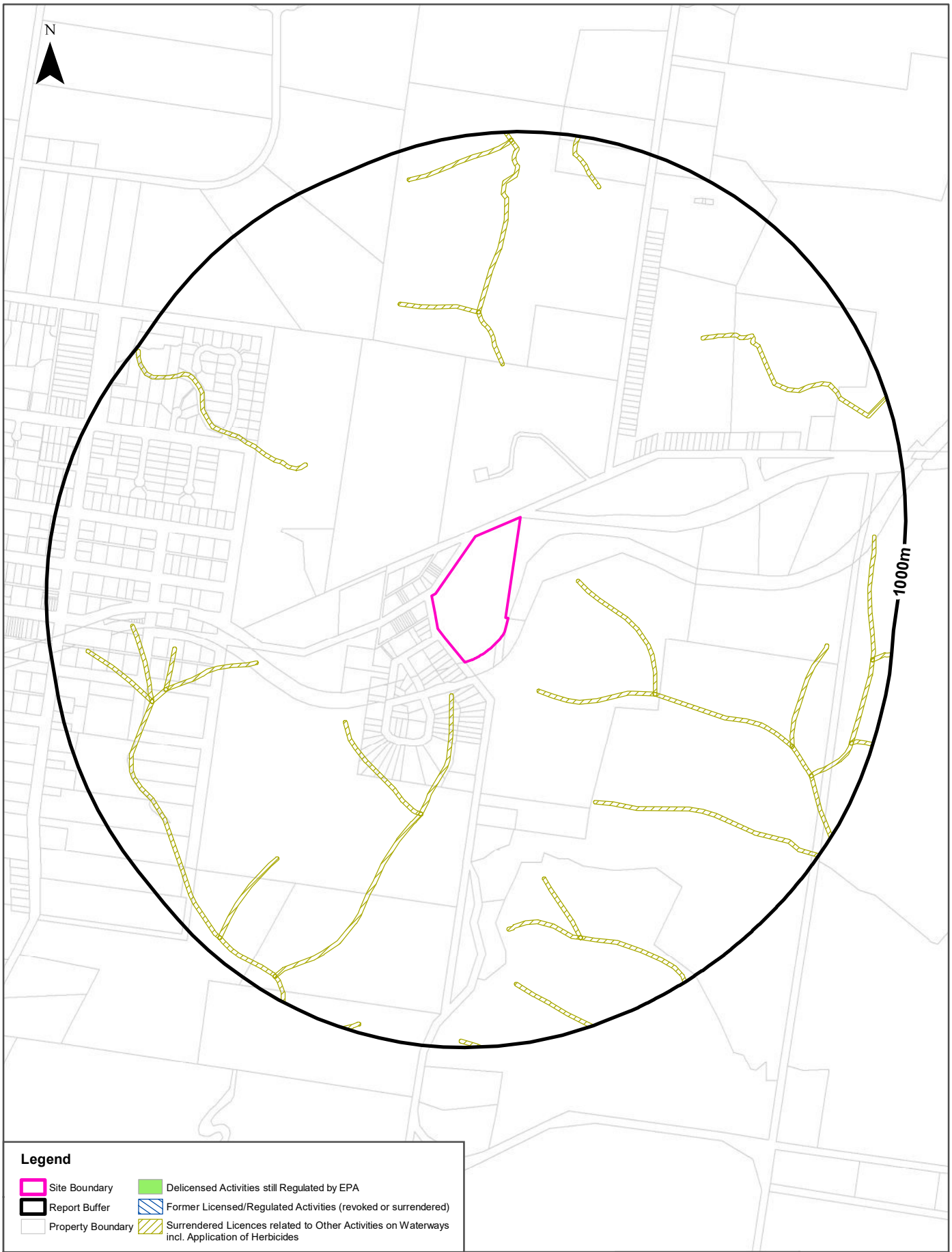
Licensed activities under the Protection of the Environment Operations Act 1997, within the dataset buffer:

EPL	Organisation	Name	Address	Suburb	Activity	Loc Conf	Distance	Direction
3142	AUSTRALIAN RAIL TRACK CORPORATION LIMITED		Australian Rail Track Corporation (ARTC) network as defined by the ARTC Network Deeds within NSW., SYDNEY, NSW 2001		Railway systems activities	Network of Features	9m	South East

POEO Licence Data Source: Environment Protection Authority

Delicensed & Former Licensed EPA Activities

1 Fountaindale Road, Robertson, NSW 2577



EPA Activities

1 Fountaindale Road, Robertson, NSW 2577

Delicensed Activities still regulated by the EPA

Delicensed activities still regulated by the EPA, within the dataset buffer:

Licence No	Organisation	Name	Address	Suburb	Activity	Loc Conf	Distance	Direction
N/A	No records in buffer							

Delicensed Activities Data Source: Environment Protection Authority

Former Licensed Activities under the POEO Act 1997, now revoked or surrendered

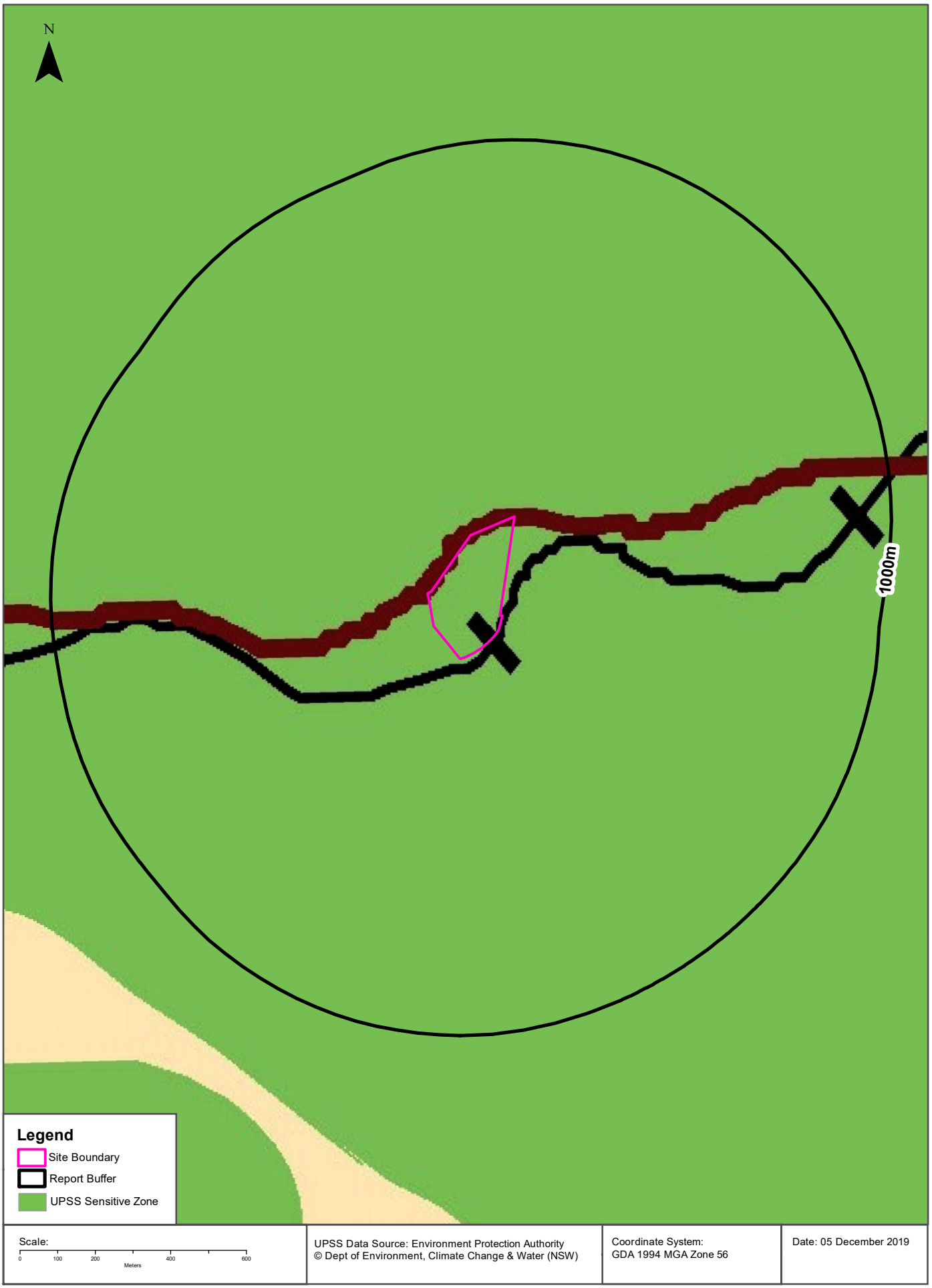
Former Licensed activities under the Protection of the Environment Operations Act 1997, now revoked or surrendered, within the dataset buffer:

Licence No	Organisation	Location	Status	Issued Date	Activity	Loc Conf	Distance	Direction
4653	LUHRMANN ENVIRONMENT MANAGEMENT PTY LTD	WATERWAYS THROUGHOUT NSW	Surrendered	06/09/2000	Other Activities / Non Scheduled Activity - Application of Herbicides	Network of Features	87m	-
4838	Robert Orchard	Various Waterways throughout New South Wales - SYDNEY NSW 2000	Surrendered	07/09/2000	Other Activities / Non Scheduled Activity - Application of Herbicides	Network of Features	87m	-
6630	SYDNEY WEED & PEST MANAGEMENT PTY LTD	WATERWAYS THROUGHOUT NSW - PROSPECT, NSW, 2148	Surrendered	09/11/2000	Other Activities / Non Scheduled Activity - Application of Herbicides	Network of Features	87m	-

Former Licensed Activities Data Source: Environment Protection Authority

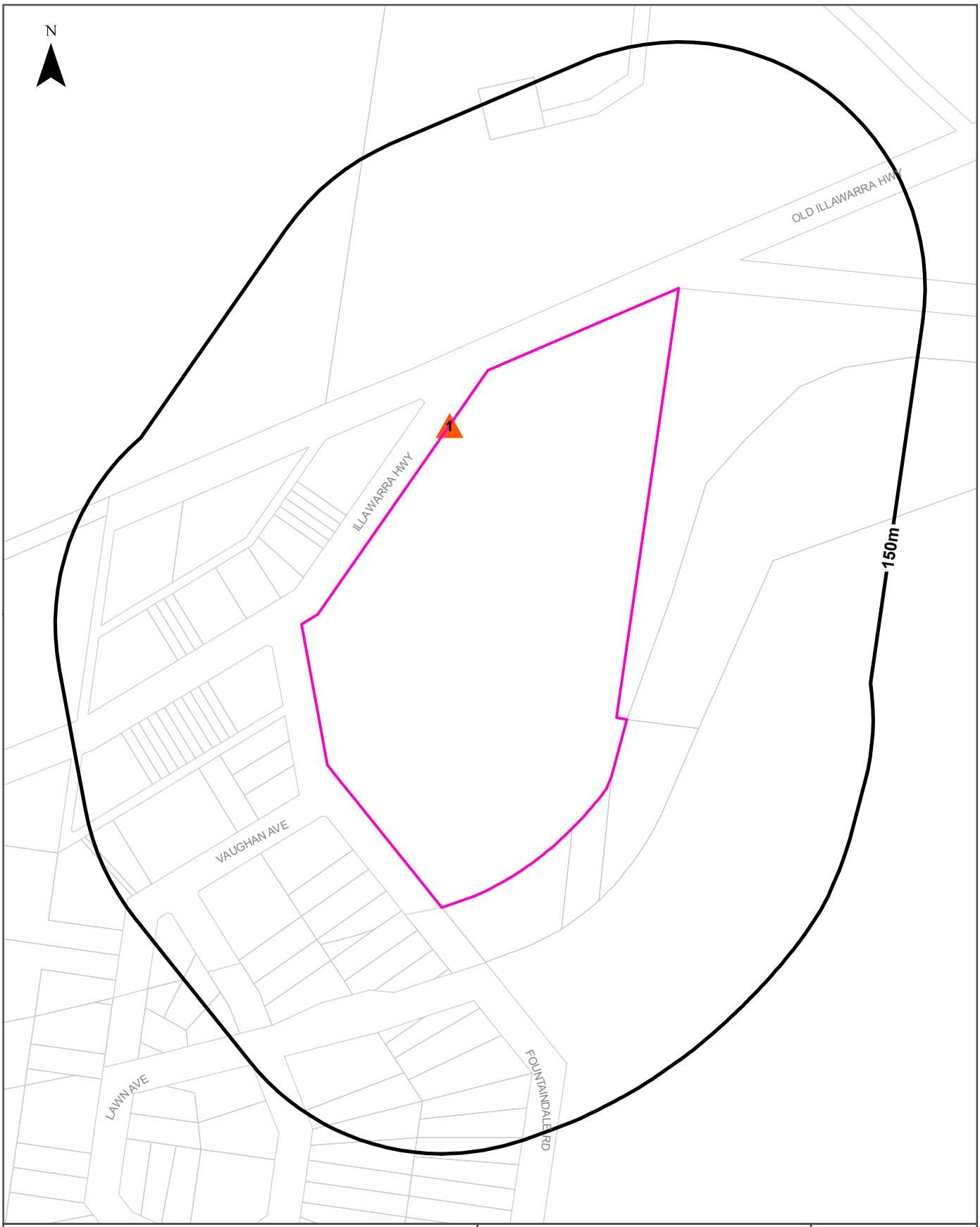
UPSS Sensitive Zones

1 Fountaindale Road, Robertson, NSW 2577



Historical Business Directories 1950-1991

1 Fountaindale Road, Robertson, NSW 2577



Legend

- Site Boundary
- Buffer 150m
- Property Boundary
- Business directory records mapped to a specific premise
- Business directory records mapped to a road intersection
- Business directory records mapped to a road corridor
- Business directory records mapped to a general area

Scale: 0 40 80 120 160 Meters

Coordinate System: GDA 1994 MGA Zone 56

Date: 05 December 2019

Historical Business Directories

1 Fountaindale Road, Robertson, NSW 2577

Business Directory Records 1950-1991
Premise or Road Intersection Matches

Universal Business Directory records from years 1982, 1970, 1961 & 1950, mapped to a premise or road intersection within the dataset buffer:

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Property Boundary or Road Intersection	Direction
	No records in buffer						

Business Directory Records 1950-1991
Road or Area Matches

Universal Business Directory records from years 1982, 1970, 1961 & 1950, mapped to a road or an area, within the dataset buffer. Records are mapped to the road when a building number is not supplied, cannot be found, or the road has been renumbered since the directory was published:

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
1	NOT LISTED	Cayford, D., Mtr.Gar., Hoddle St., Robertson	138304	1982	Road Match	0m
	NOT LISTED	Commercial Banking Co. of Sydney Ltd., Hoddle St., Robertson	138306	1982	Road Match	0m
	NOT LISTED	County Inn Hotel, Hoddle St., Robertson	138307	1982	Road Match	0m
	NOT LISTED	James, Henry Development Corp. Pty. Ltd., Bldr., Illawarra Hway., Robertson	138308	1982	Road Match	0m
	NOT LISTED	Mauger, A., Carrier, Hoddle St., Robertson	138309	1982	Road Match	0m
	NOT LISTED	Maugher, J. C. & Son, Stk. 6 Stn. Agent, Hoddle St., Robertson	138310	1982	Road Match	0m
	NOT LISTED	Murray Motors, Hoddle St., Robertson	138312	1982	Road Match	0m
	NOT LISTED	Police Station, Hoddle St., Robertson	138313	1982	Road Match	0m
	NOT LISTED	Post Office, Hoddle St., Robertson	138314	1982	Road Match	0m
	NOT LISTED	Quartermaine, B. & M., Grcr., Hoddle St., Robertson	138315	1982	Road Match	0m
	NOT LISTED	Robertson Motor Service Garage, Hoddle St., Robertson	138316	1982	Road Match	0m
	NOT LISTED	Robertson Red Soil Potatoes. Prdce. Mercht., Hoddle St., Robertson	138317	1982	Road Match	0m
	NOT LISTED	Waters, N. & H., Genl.Store, Hoddle St., Robertson	138319	1982	Road Match	0m
	NOT LISTED	Waters. N. N., Carrier Hoddle St., Robertson	138320	1982	Road Match	0m
	NOT LISTED	Wilson, J. l., Btchr., Hoddle St., Robertson	138322	1982	Road Match	0m
	NOT LISTED	Wilson, M. A., Baker Illawarra Highway., Robertson	138323	1982	Road Match	0m

Historical Business Directories

1 Fountaindale Road, Robertson, NSW 2577

Dry Cleaners, Motor Garages & Service Stations Premise or Road Intersection Matches

Dry Cleaners, Motor Garages & Service Stations from UBD Business Directories, mapped to a premise or road intersection, within the dataset buffer.

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Property Boundary or Road Intersection	Direction
	No records in buffer						

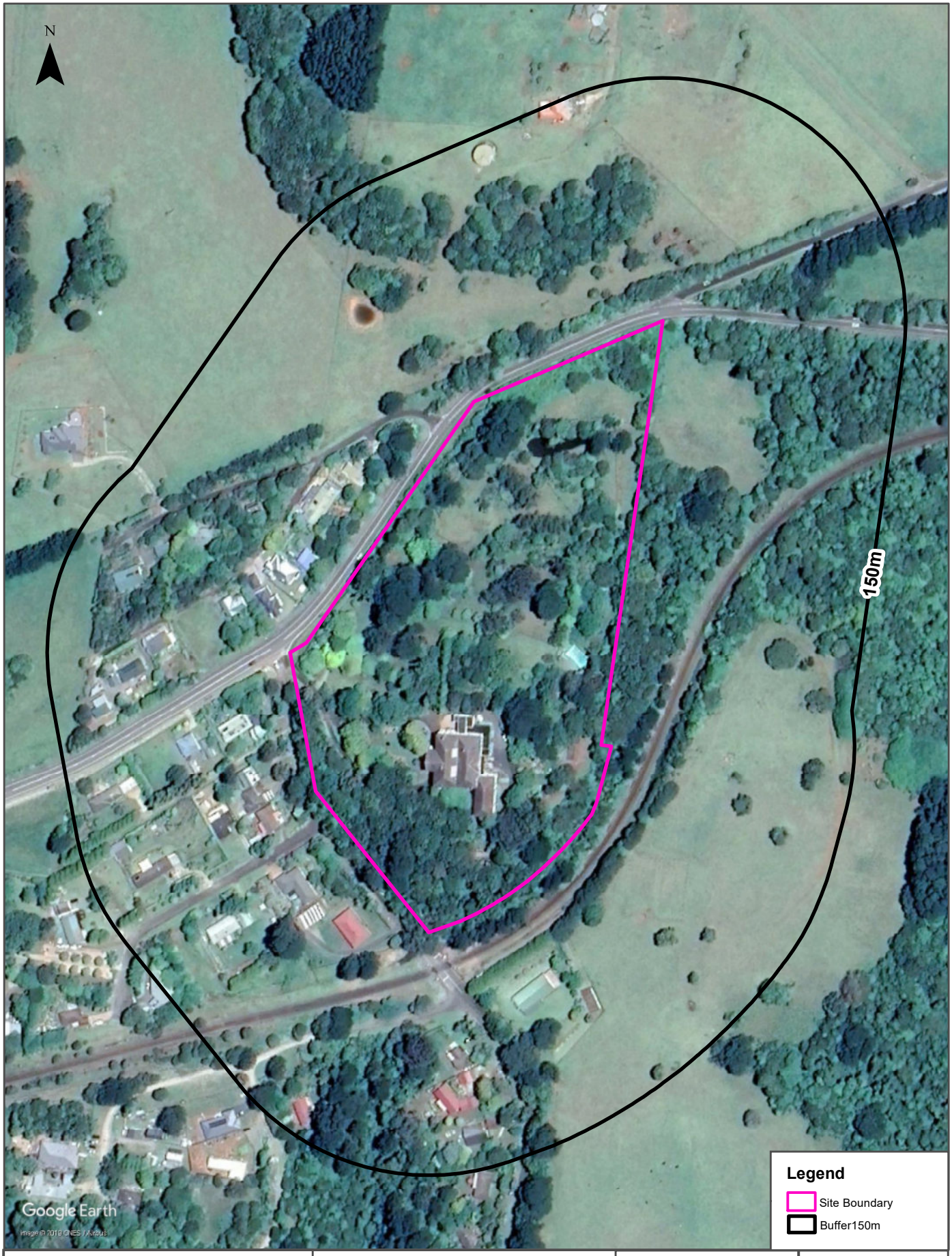
Dry Cleaners, Motor Garages & Service Stations Road or Area Matches

Dry Cleaners, Motor Garages & Service Stations from UBD Business Directories, mapped to a road or an area, within the dataset buffer. Records are mapped to the road when a building number is not supplied, cannot be found, or the road has been renumbered since the directory was published.

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
	No records in buffer					

Aerial Imagery 2018

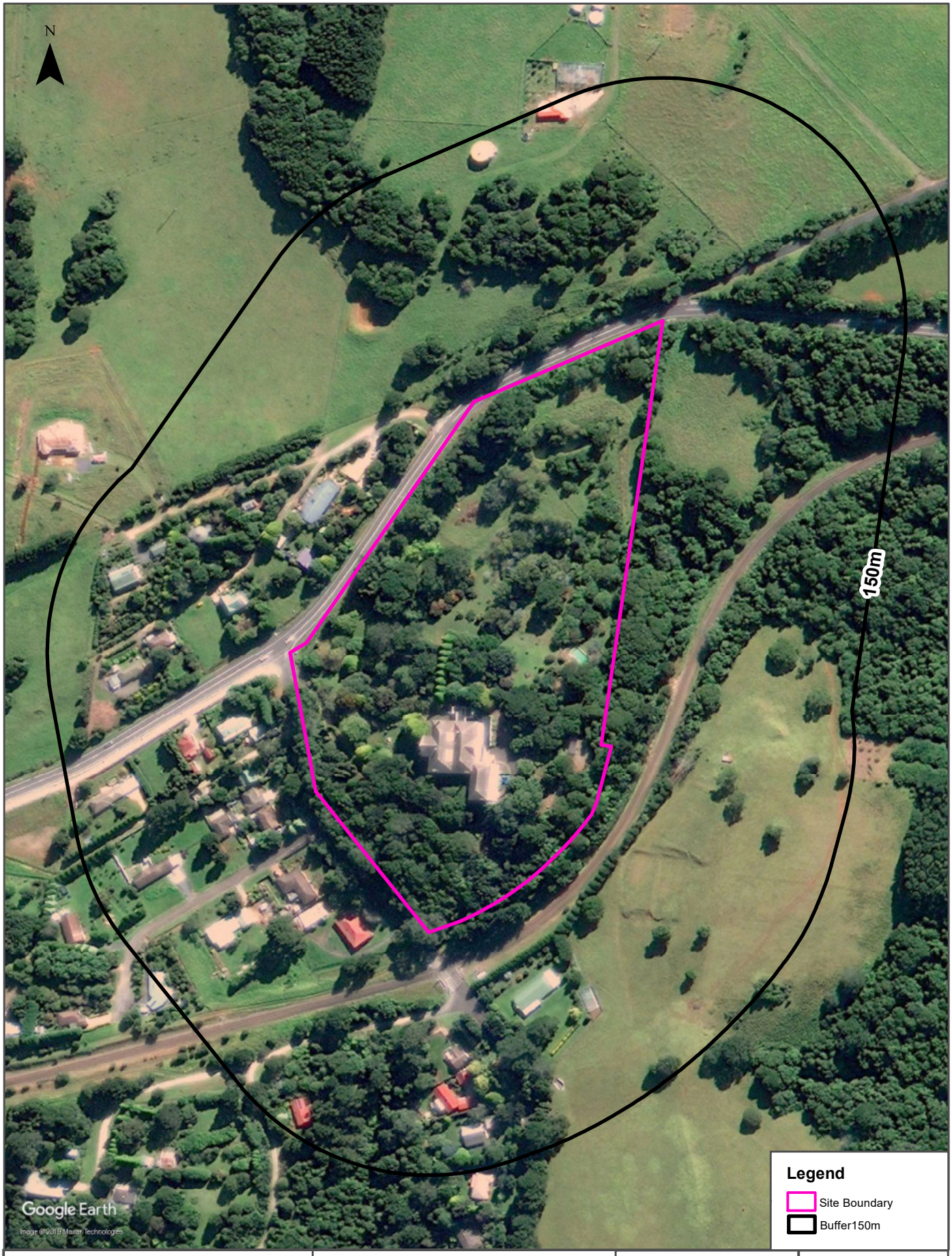
1 Fountaindale Road, Robertson, NSW 2577



Scale: 0 30 60 Meters 90 120	Data Source Aerial Imagery: © 2019 Google Inc, used with permission. Google and the Google logo are registered trademarks of Google Inc.	Coordinate System: GDA 1994 MGA Zone 56	Date: 03 December 2019

Aerial Imagery 2010

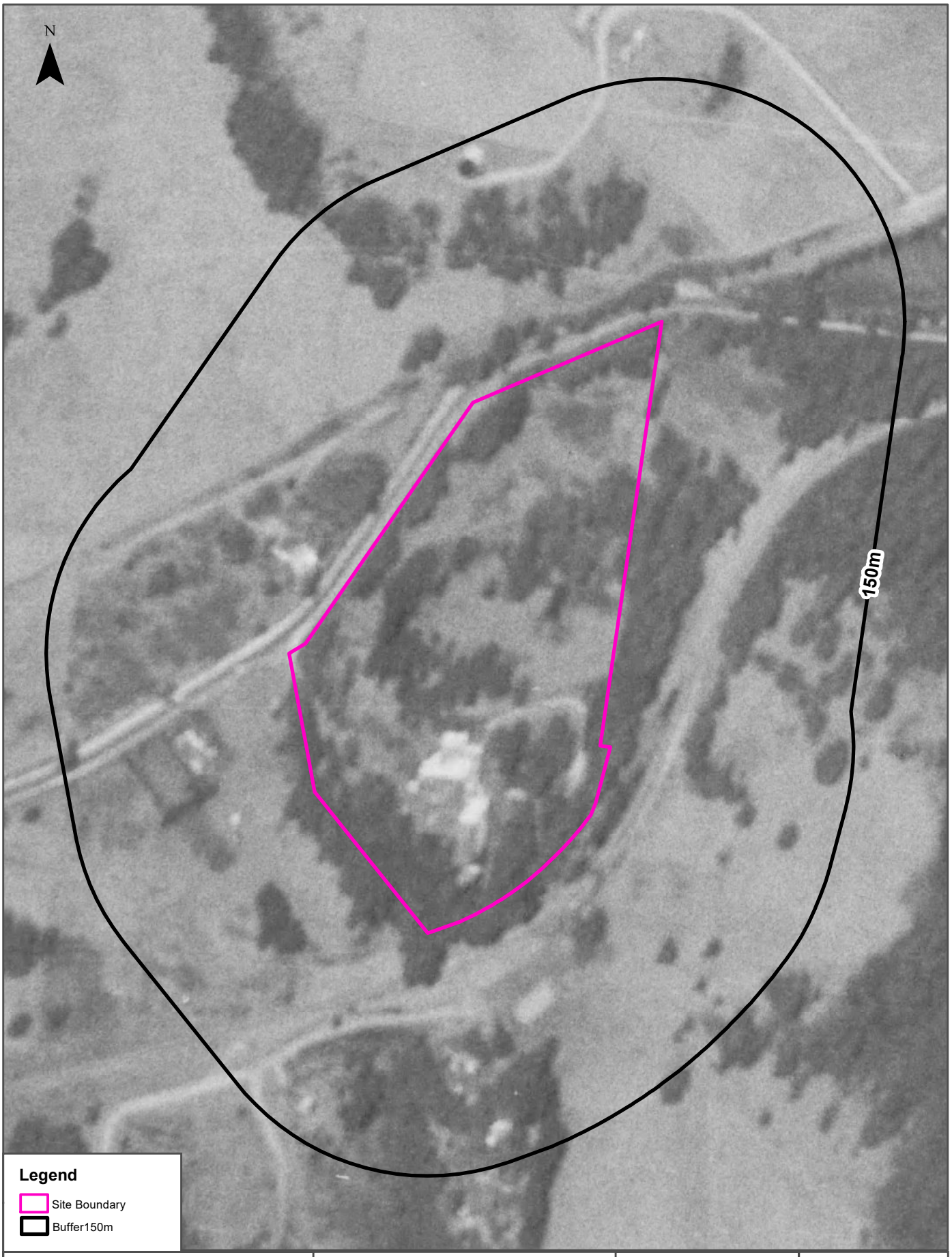
1 Fountaindale Road, Robertson, NSW 2577



Scale: 0 30 60 90 120 Meters	Data Source Aerial Imagery: © 2019 Google Inc, used with permission. Google and the Google logo are registered trademarks of Google Inc.	Coordinate System: GDA 1994 MGA Zone 56	Date: 03 December 2019

Aerial Imagery 1980

1 Fountaindale Road, Robertson, NSW 2577

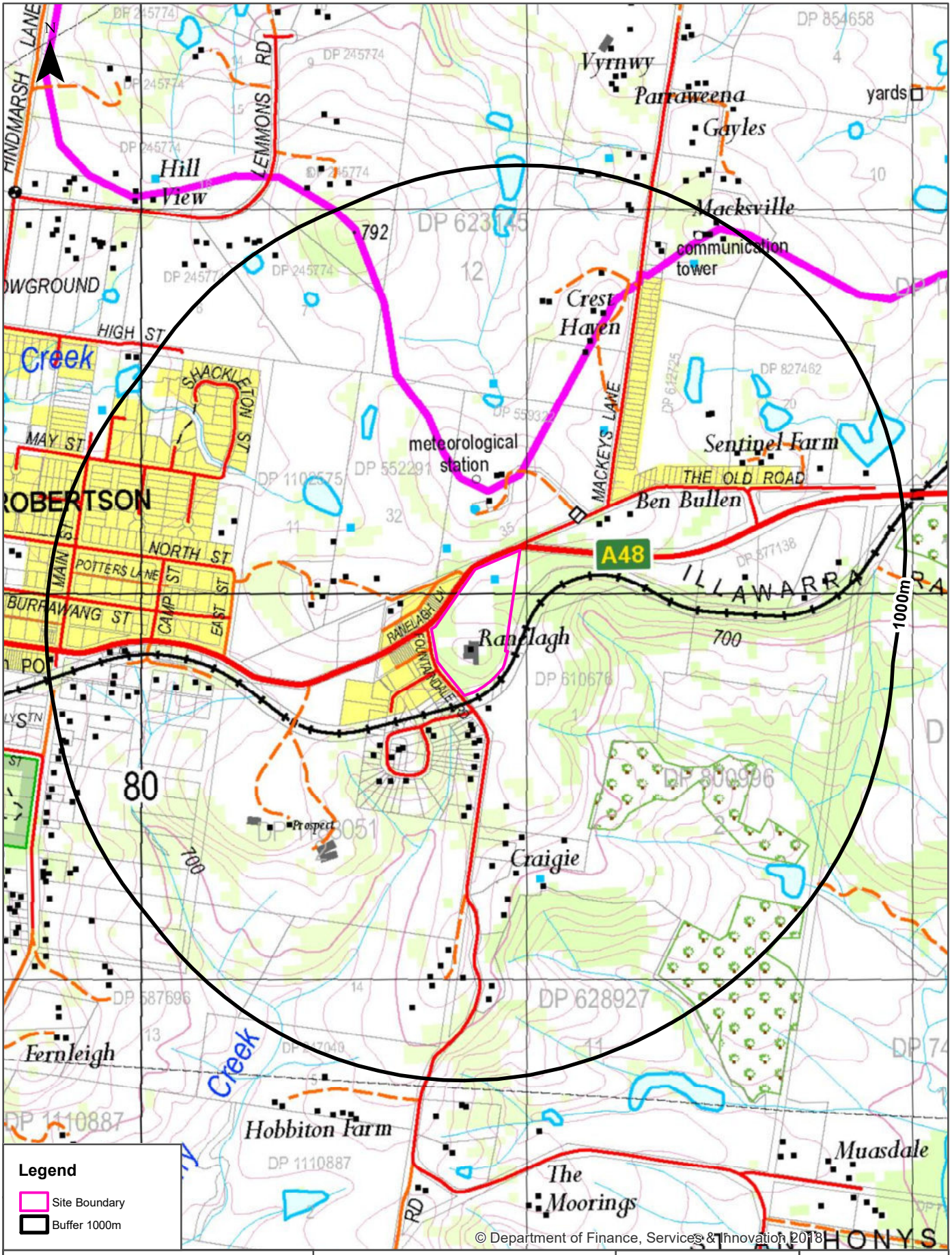


Aerial Imagery 1949

1 Fountaindale Road, Robertson, NSW 2577

Topographic Map 2015

1 Fountaindale Road, Robertson, NSW 2577



Scale:	Data Sources: Topographic Map Data © NSW Land and Property Information	Coordinate System: GDA 1994 MGA Zone 56	Date: 05 December 2019

Historical Map 1998

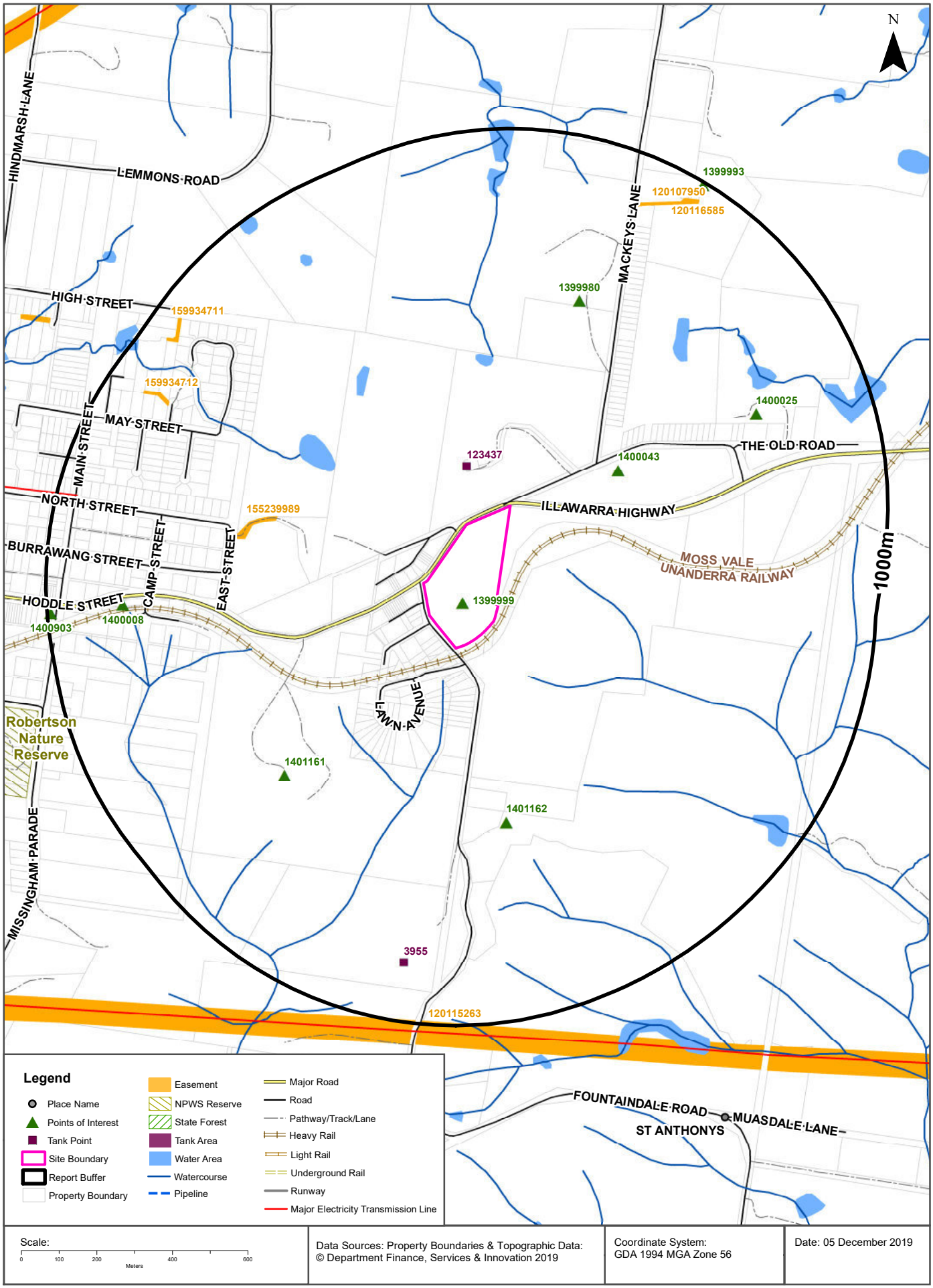
1 Fountaindale Road, Robertson, NSW 2577

Historical Map c.1932

1 Fountaindale Road, Robertson, NSW 2577

Topographic Features

1 Fountaindale Road, Robertson, NSW 2577



Topographic Features

1 Fountaindale Road, Robertson, NSW 2577

Points of Interest

What Points of Interest exist within the dataset buffer?

Map Id	Feature Type	Label	Distance	Direction
1399999	Homestead	RANELAGH	0m	Onsite
1400043	Homestead	BEN BULLEN	300m	North East
1401162	Homestead	CRAIGIE	480m	South
1401161	Homestead	PROSPECT	564m	South West
1399980	Homestead	CREST HAVEN	573m	North
1400025	Homestead	SENTINEL FARM	695m	North East
1400008	Tourist Information Centre	ROBERTSON VISITOR CENTRE	798m	West
1400903	Post Office	ROBERTSON POST OFFICE	990m	West
1399993	Homestead	MACKSVILLE	991m	North East

Topographic Features

1 Fountaindale Road, Robertson, NSW 2577

Tanks (Areas)

What are the Tank Areas located within the dataset buffer?
Note. The large majority of tank features provided by LPI are derived from aerial imagery & are therefore primarily above ground tanks.

Map Id	Tank Type	Status	Name	Feature Currency	Distance	Direction
	No records in buffer					

Tanks (Points)

What are the Tank Points located within the dataset buffer?
Note. The large majority of tank features provided by LPI are derived from aerial imagery & are therefore primarily above ground tanks.

Map Id	Tank Type	Status	Name	Feature Currency	Distance	Direction
123437	Water	Operational		01/12/2013	142m	North
3955	Tank-RuralWater	Feature on Previous LPI Tank Point Supply		11/01/2005	843m	South

Major Easements

What Major Easements exist within the dataset buffer?
Note. Easements provided by LPI are not at the detail of local governments. They are limited to major easements such as Right of Carriageway, Electrical Lines (66kVa etc.), Easement to drain water & Significant subterranean pipelines (gas, water etc.).

Map Id	Easement Class	Easement Type	Easement Width	Distance	Direction
155239989	Primary	Right of way	variable	426m	West
159934712	Primary	Right of way	Variable	824m	North West
120107950	Primary	Undefined		865m	North East
159934711	Primary	Right of way	Variable	904m	North West
120116585	Primary	Undefined		925m	North East
120115263	Primary	Undefined		992m	South

Topographic Features

1 Fountaindale Road, Robertson, NSW 2577

State Forest

What State Forest exist within the dataset buffer?

State Forest Number	State Forest Name	Distance	Direction
N/A	No records in buffer		

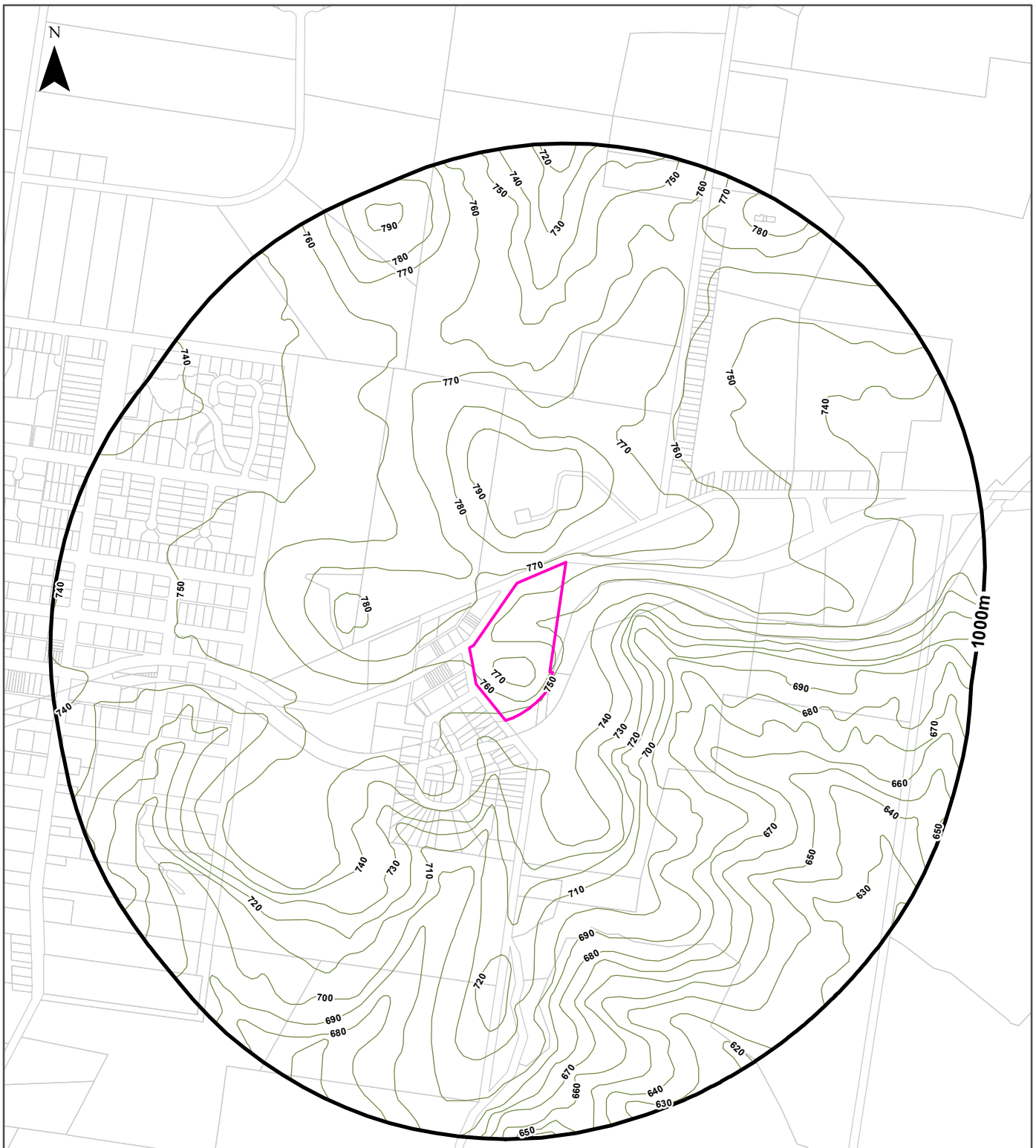
National Parks and Wildlife Service Reserves

What NPWS Reserves exist within the dataset buffer?

Reserve Number	Reserve Type	Reserve Name	Gazetted Date	Distance	Direction
N/A	No records in buffer				

Elevation Contours (m AHD)

1 Fountaindale Road, Robertson, NSW 2577



Hydrogeology & Groundwater

1 Fountaindale Road, Robertson, NSW 2577

Hydrogeology

Description of aquifers on-site:

Description
Porous, extensive aquifers of low to moderate productivity

Description of aquifers within the dataset buffer:

Description
Porous, extensive aquifers of low to moderate productivity

Hydrogeology Map of Australia : Commonwealth of Australia (Geoscience Australia)

Botany Groundwater Management Zones

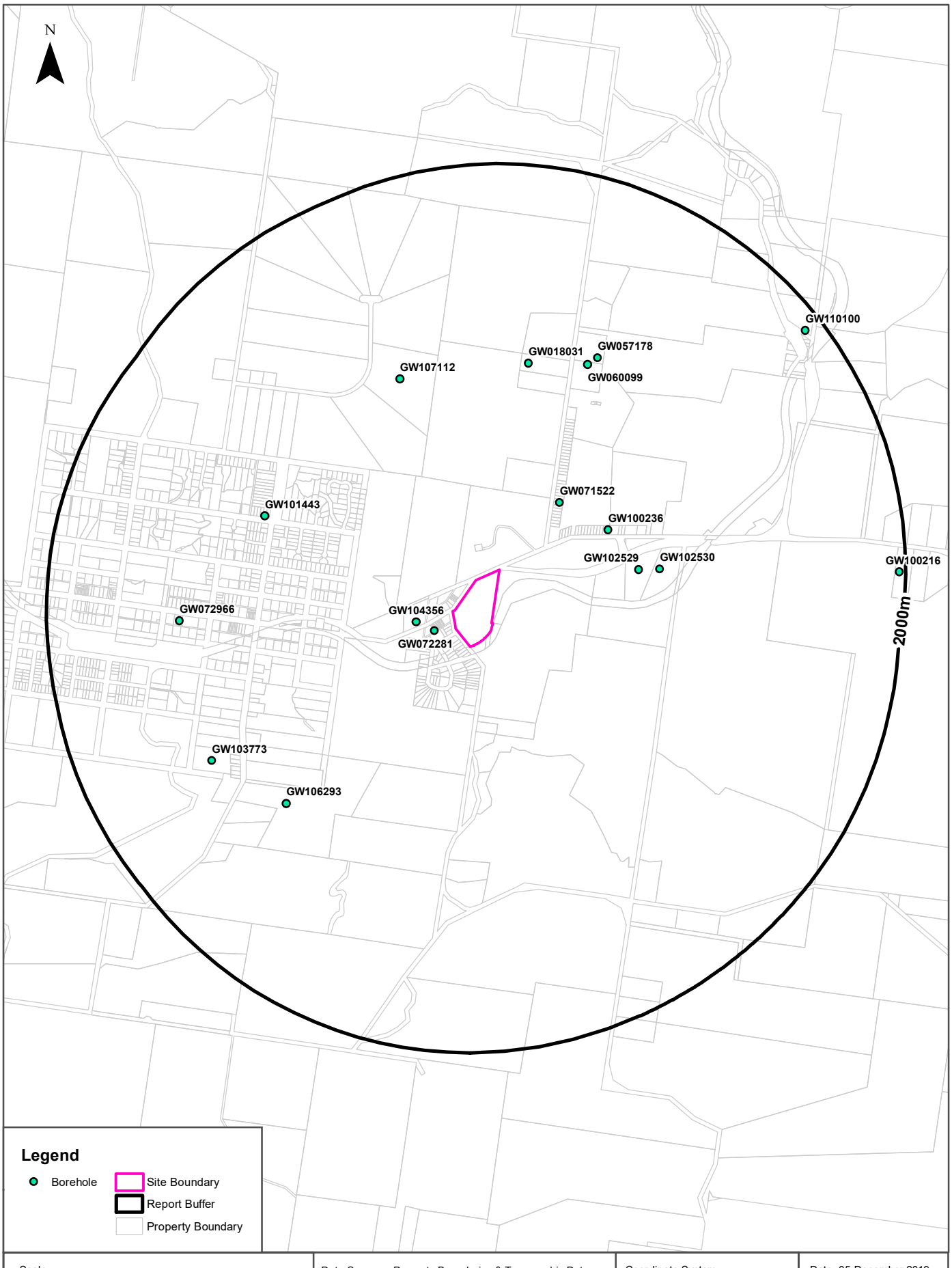
Groundwater management zones relating to the Botany Sand Beds aquifer within the dataset buffer:

Management Zone No.	Restriction	Distance	Direction
N/A	No records in buffer		

Botany Groundwater Management Zones Data Source : NSW Department of Primary Industries

Groundwater Boreholes

1 Fountaindale Road, Robertson, NSW 2577



Hydrogeology & Groundwater

1 Fountaindale Road, Robertson, NSW 2577

Groundwater Boreholes

Boreholes within the dataset buffer:

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m)	Yield (L/s)	Elev (AHD)	Dist	Dir
GW072281		Bore	Private		Domestic		17/01/1995	18.00	18.00					104m	South West
GW104356	10BL160113, 10WA106316	Bore	Private	Domestic	Domestic		15/08/2001	108.00	108.00	Good	16.00	0.025		186m	West
GW071522	10BL150182, 10WA106092	Bore	Private	Domestic, Stock	Domestic, Stock		29/05/1992	12.00	12.00	Good	7.00	0.300	159.00	444m	North East
GW100236	10BL152606, 10WA106105	Bore	Private	Domestic	Domestic		01/09/1993	12.00	12.00	95	5.00	0.900		572m	North East
GW102529	10BL159192, 10WA106278	Bore		Domestic, Stock	Domestic, Stock		19/05/1999	30.00	30.00					688m	East
GW102530	10BL158896, 10WA106263	Bore		Domestic, Stock	Domestic, Stock		25/03/1999	36.00	36.00	300				790m	East
GW018031	10BL010138, 10BL602995, 10WA111511	Excavation	Private	Domestic, Stock	Domestic, Stock		01/01/1939	1.50	1.50	0-500 ppm	1.00	5.000		1027m	North
GW101443	10BL158187, 10WA110437	Bore	Private	Domestic	Domestic			140.00	150.00	Good	50.00	1.500		1037m	North West
GW107112	10BL163024, 10WA111104	Bore	Private	Domestic, Stock	Domestic, Stock		11/06/2005	210.00	210.00	35	14.10	1.180		1057m	North
GW060099	10BL130942	Bore	Private	Domestic, Irrigation	Irrigation		01/03/1984	54.90	54.90					1101m	North East
GW057178	10BL124586, 10WA109865	Bore open thru rock	Private	Domestic, Stock	Domestic, Stock		01/11/1982	53.60	53.60	Good				1151m	North East
GW106293	10BL162235, 10WA106384	Bore	Private	Domestic, Stock	Domestic, Stock		28/07/2004	120.00	120.00	Fresh	70.00	2.750		1190m	South West
GW072966		Bore	Private		Domestic		22/03/1995	18.00	18.00	Good				1343m	West
GW103773	10BL156599, 10WA106171	Bore		Domestic	Domestic		17/05/1995	140.00	140.00	Fair				1364m	South West
GW110100	10BL600107, 10WA106478	Bore	Private	Domestic, Stock	Domestic, Stock		15/03/2006	24.00	24.00		3.00	2.000		1913m	North East
GW100216	10BL152349, 10WA106101	Bore	Private	Domestic	Domestic		18/05/1993	42.00	42.00	Good	9.30	1.200		1970m	East

Hydrogeology & Groundwater

1 Fountaindale Road, Robertson, NSW 2577

Driller's Logs

Drill log data relevant to the boreholes within the dataset buffer:

Groundwater No	Drillers Log	Distance	Direction
GW072281	0.40m-8.00m Brown Clay 8.00m-8.50m Brown Soft Basalt 8.50m-18.00m Black Basalt	104m	South West
GW104356	0.00m-1.00m RED SOIL 1.00m-3.00m BASALT HARD 3.00m-7.00m BASALT WEATHERED 7.00m-18.00m BASALT GREEN SOFT 18.00m-36.00m CLAY BROWN 36.00m-48.00m BASALT 48.00m-63.00m BROWN ASH 63.00m-101.00m BASALT 101.00m-108.00m SOFT GRANITE	186m	West
GW071522	0.00m-6.00m soil & clay 6.00m-12.00m gravel	444m	North East
GW100236	0.00m-0.80m SOIL 0.80m-12.00m BASALT/SOIL	572m	North East
GW102529	0.00m-1.00m SOIL RED 1.00m-5.00m CLAY ORANGE 5.00m-6.00m CLAY ORANGE/BASALT BOULDERS 6.00m-30.00m BASALT	688m	East
GW102530	0.00m-2.00m SOIL RED 2.00m-11.00m CLAY 11.00m-22.00m BASALT BOULDERS (VERY BROKEN) 22.00m-36.00m BASALT,SOLID ROCK,STILL FRACTURED	790m	East
GW101443	0.00m-1.00m RED SOIL 1.00m-54.00m BASALT 54.00m-122.00m SANDSTONE	1037m	North West
GW107112	0.00m-0.50m topsoil 0.50m-6.00m basalt, clay 6.00m-18.00m basalt, decomposed bouders 18.00m-69.00m basalt 69.00m-71.00m clay, yellow orange 71.00m-144.00m shale 144.00m-210.00m sandstone, grey	1057m	North
GW060099	0.00m-0.30m Topsoil 0.30m-1.80m Boulders Basaltic 1.80m-9.10m Basalt Broken 9.10m-54.90m Basalt	1101m	North East
GW057178	0.00m-0.60m Topsoil 0.60m-5.50m Clay 5.50m-7.00m Basalt Clay 7.00m-53.60m Basalt Water Supply	1151m	North East
GW106293	0.00m-18.00m soil, red sticky clay 18.00m-26.00m basalt, red weathered 26.00m-84.00m sandstone, yellow, grey, orange, interbeded 84.00m-90.00m siltstone 90.00m-120.00m sandstone, white medium to coarse	1190m	South West
GW072966	1.00m-7.00m Decomposed Basalt	1343m	West
GW103773	0.00m-2.00m SOIL AND CLAY 2.00m-18.00m BASALT 18.00m-96.00m SHALE 96.00m-140.00m SANDSTONE	1364m	South West
GW110100	0.00m-3.00m CLAY 3.00m-5.00m GREY SHALE 5.00m-24.00m BASALT	1913m	North East

Groundwater No	Drillers Log	Distance	Direction
GW100216	0.00m-1.00m SOILS & CLAY 1.00m-4.00m BROKEN BASALT 4.00m-8.00m BASALT 8.00m-13.00m GRAVELS & SAND 13.00m-42.00m BASALT	1970m	East

Geology 1:250,000

1 Fountaindale Road, Robertson, NSW 2577

Geology

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Geological Units

What are the Geological Units onsite?

Symbol	Description	Unit Name	Group	Sub Group	Age	Dom Lith	Map Sheet	Dataset
T-Rb	Alkaline olivine basalt and basanite	Robertson Basalt			Cainozoic			1:250,000

What are the Geological Units within the dataset buffer?

Symbol	Description	Unit Name	Group	Sub Group	Age	Dom Lith	Map Sheet	Dataset
Rw	Mid grey and dark grey mudrocks and interbedded lithic sandstone	undifferentiated	Wianamatta Group		Mesozoic			1:250,000
T-Rb	Alkaline olivine basalt and basanite	Robertson Basalt			Cainozoic			1:250,000

Geological Structures

What are the Geological Structures onsite?

Feature	Name	Description	Map Sheet	Dataset
No features				1:250,000

What are the Geological Structures within the dataset buffer?

Feature	Name	Description	Map Sheet	Dataset
No features				1:250,000

Geological Data Source : NSW Department of Industry, Resources & Energy

Naturally Occurring Asbestos Potential

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Naturally Occurring Asbestos Potential

Naturally Occurring Asbestos Potential within the dataset buffer:

Potential	Sym	Strat Name	Group	Formation	Scale	Min Age	Max Age	Rock Type	Dom Lith	Description	Dist	Dir
No records in buffer												

Mining Subsidence District Data Source: © State of New South Wales through NSW Department of Industry, Resources & Energy

Soil Landscapes

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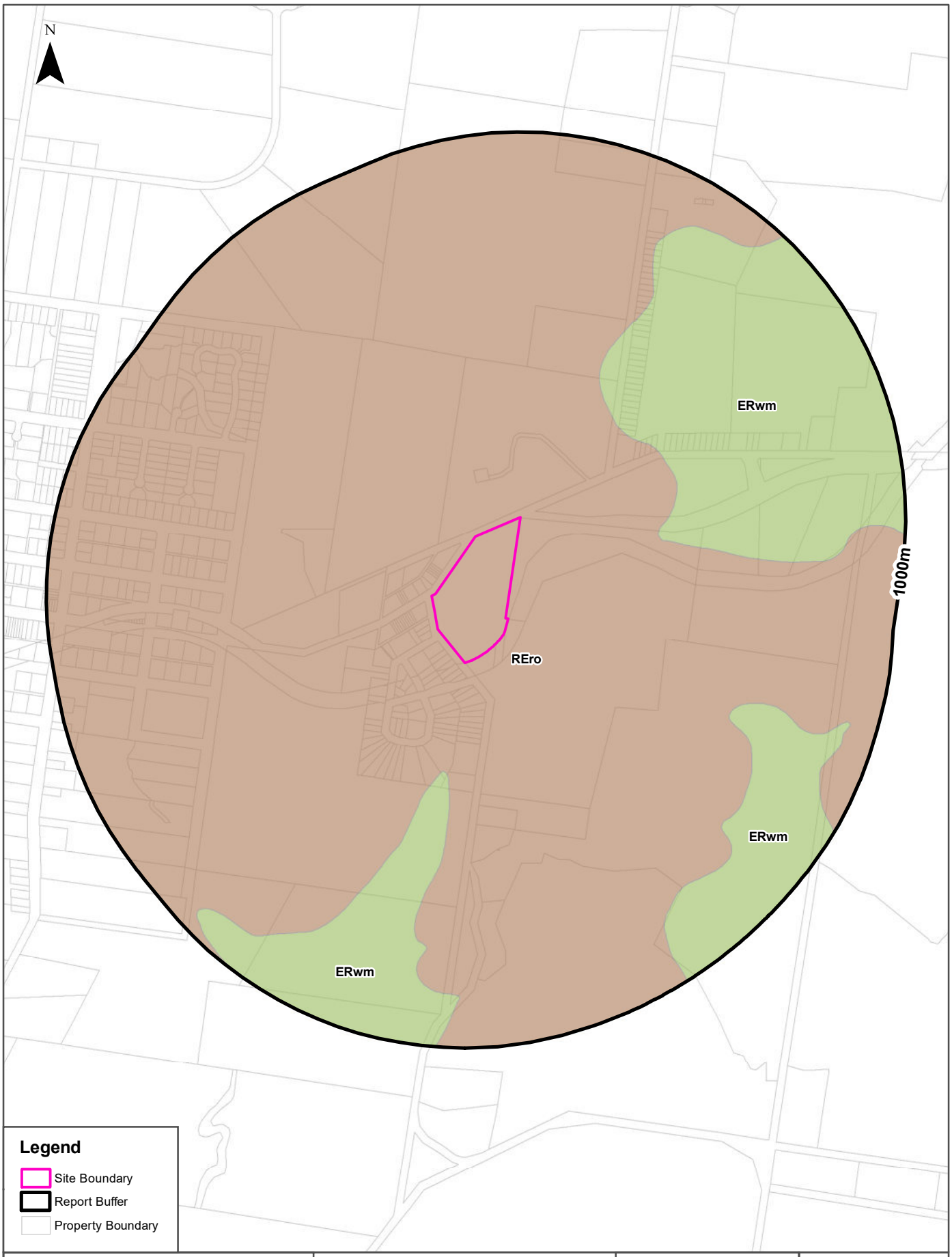

Soils

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Soil Landscapes

What are the onsite Soil Landscapes?

Soil Code	Name	Group	Process	Map Sheet	Scale
REro	ROBERTSON		RESIDUAL	Kiama	1:100,000

What are the Soil Landscapes within the dataset buffer?

Soil Code	Name	Group	Process	Map Sheet	Scale
ERwm	WILDES MEADOW		EROSIONAL	Kiama	1:100,000
REro	ROBERTSON		RESIDUAL	Kiama	1:100,000

Atlas of Australian Soils

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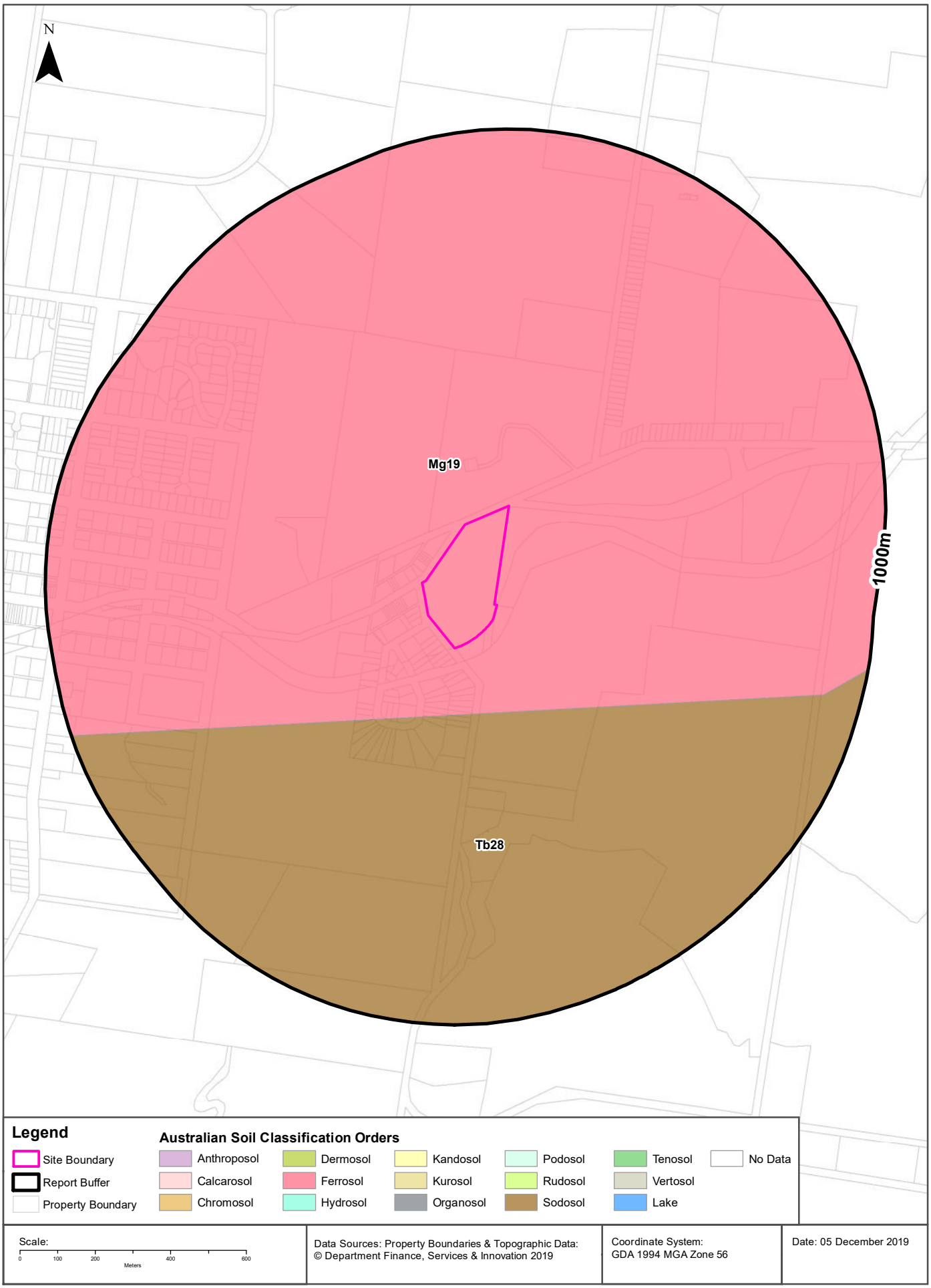

Soils

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Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

Map Unit Code	Soil Order	Map Unit Description	Distance
Mg19	Ferrosol	Gently rolling to rounded hilly country occasionally with some steep slopes dissected remnants of the old basaltic plateau: chief soils are red friable porous earths (Gn4.11). Associated are small areas of various soils, including (Um6.21) on the steeper slopes. As mapped, areas of units Tb28, Gd3, and Mb2 are included.	0m
Tb28	Sodosol	Flat to undulating with low rises, knolls and ridges, swampy depressions, and valleys: chief soils are hard acidic yellow mottled soils (Dy3.41) with more or less regular occurrences of red earths (Gn2.14) on low rises, and various undescribed soils probably occurring in specific topographic situations. As mapped, islands of the soils of unit Gd3 and some areas of soils, especially the yellow earths, of unit Mb2 are included. Compare units Tb29 and Mu5.	177m

Acid Sulfate Soils

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Environmental Planning Instrument - Acid Sulfate Soils

What is the on-site Acid Sulfate Soil Plan Class that presents the largest environmental risk?

Soil Class	Description	EPI Name
N/A		

If the on-site Soil Class is 5, what other soil classes exist within 500m?

Soil Class	Description	EPI Name	Distance	Direction
N/A				

Atlas of Australian Acid Sulfate Soils

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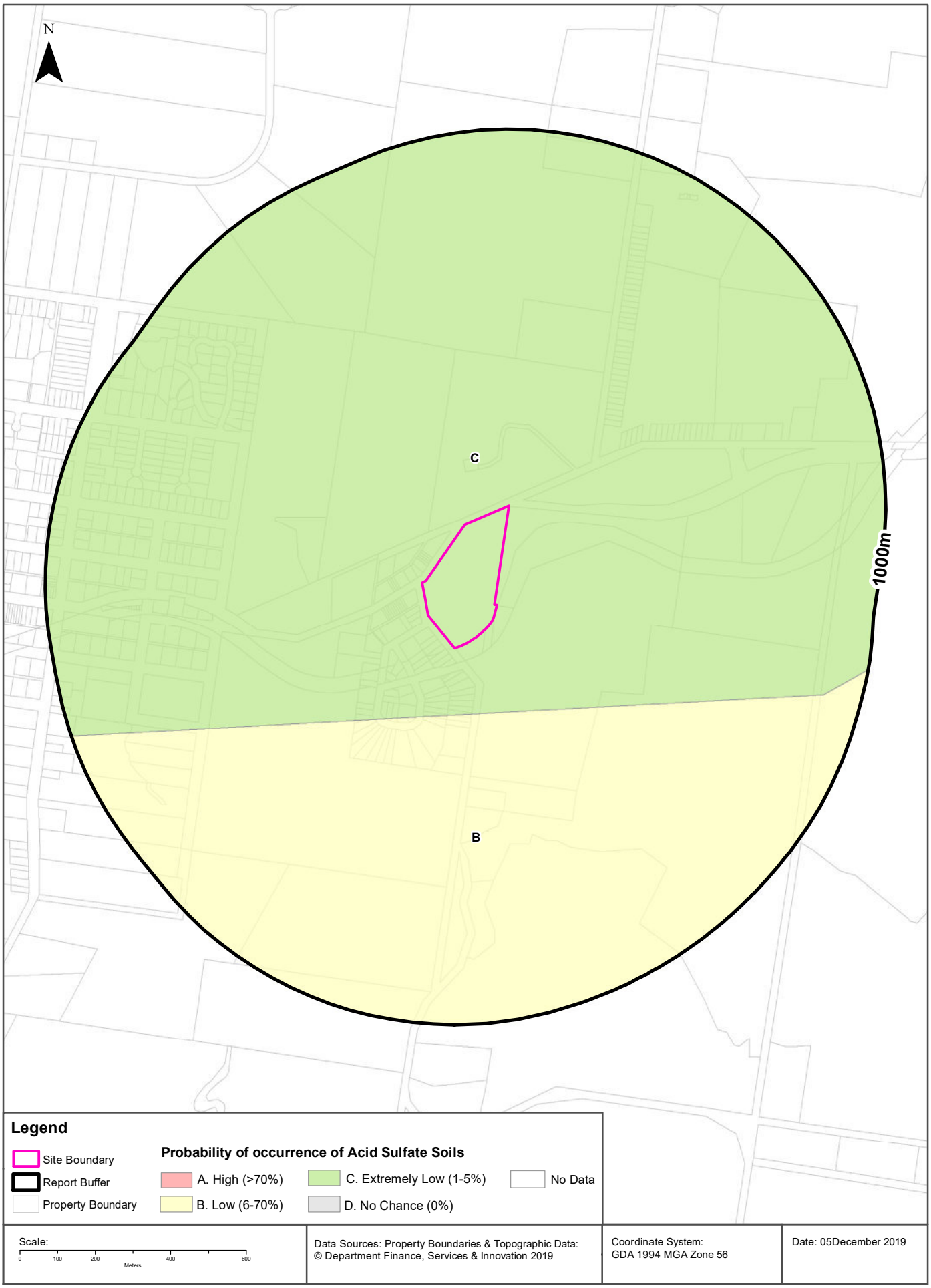

Acid Sulfate Soils

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Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m
B	Low Probability of occurrence. 6-70% chance of occurrence.	177m

Dryland Salinity

1 Fountaindale Road, Robertson, NSW 2577

Dryland Salinity - National Assessment

Is there Dryland Salinity - National Assessment data onsite?

No

Is there Dryland Salinity - National Assessment data within the dataset buffer?

No

What Dryland Salinity assessments are given?

Assessment 2000	Assessment 2020	Assessment 2050	Distance	Direction
N/A	N/A	N/A	N/A	N/A

Dryland Salinity Data Source : National Land and Water Resources Audit
The Commonwealth and all suppliers of source data used to derive the maps of "Australia, Forecast Areas Containing Land of High Hazard or Risk of Dryland Salinity from 2000 to 2050" do not warrant the accuracy or completeness of information in this product. Any person using or relying upon such information does so on the basis that the Commonwealth and data suppliers shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information. Any persons using this information do so at their own risk.
In many cases where a high risk is indicated, less than 100% of the area will have a high hazard or risk.

Dryland Salinity Potential of Western Sydney

Dryland Salinity Potential of Western Sydney within the dataset buffer?

Feature Id	Classification	Description	Distance	Direction
N/A	Outside Data Coverage			

Dryland Salinity Potential of Western Sydney Data Source : NSW Office of Environment and Heritage

Mining Subsidence Districts

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Mining Subsidence Districts

Mining Subsidence Districts within the dataset buffer:

District	Distance	Direction
There are no Mining Subsidence Districts within the report buffer		

State Environmental Planning Policy

1 Fountaindale Road, Robertson, NSW 2577

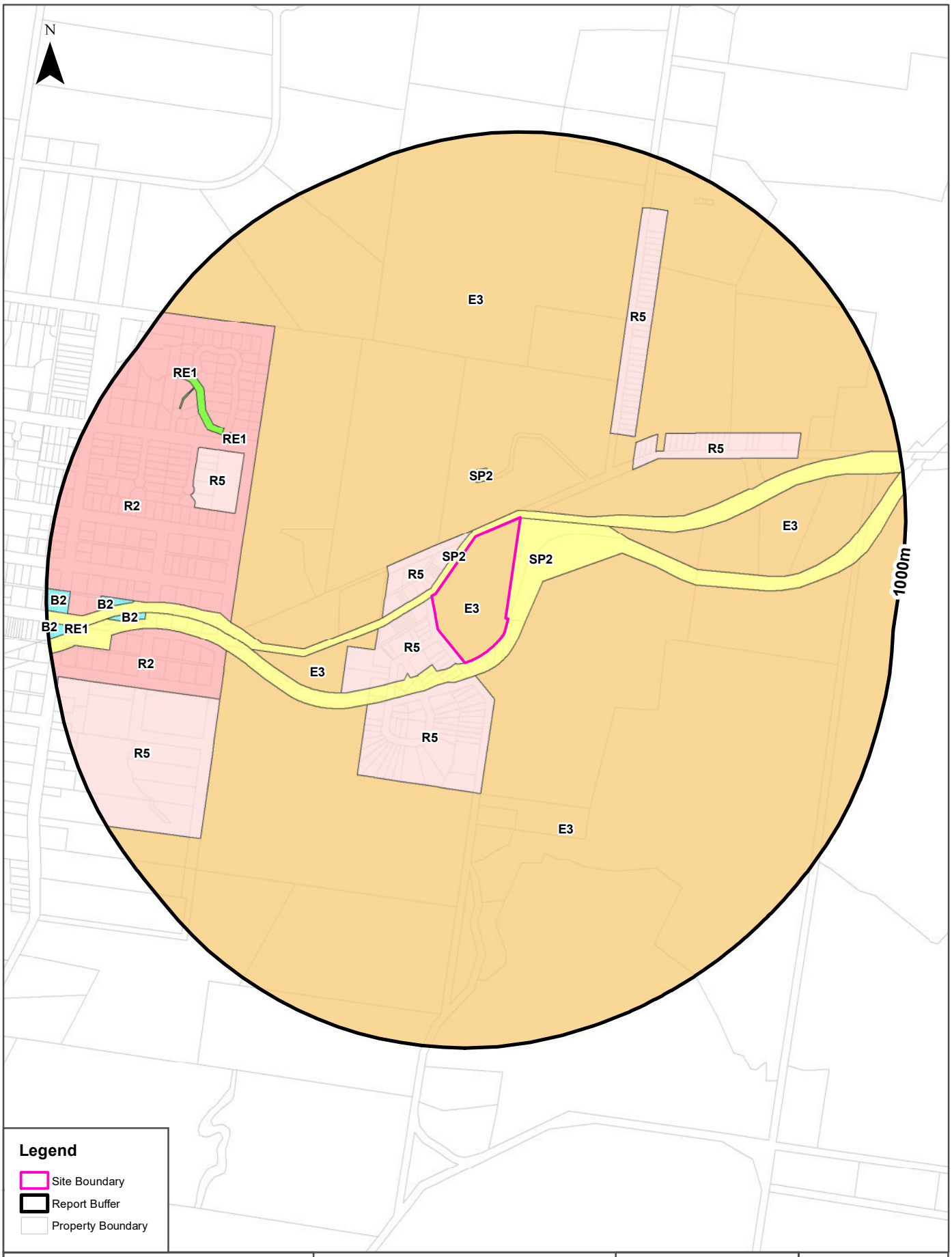
State Significant Precincts

What SEPP State Significant Precincts exist within the dataset buffer?

Map Id	Precinct	EPI Name	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
N/A	No Records in Buffer							

EPI Planning Zones

1 Fountaindale Road, Robertson, NSW 2577



Environmental Planning Instrument

1 Fountaindale Road, Robertson, NSW 2577

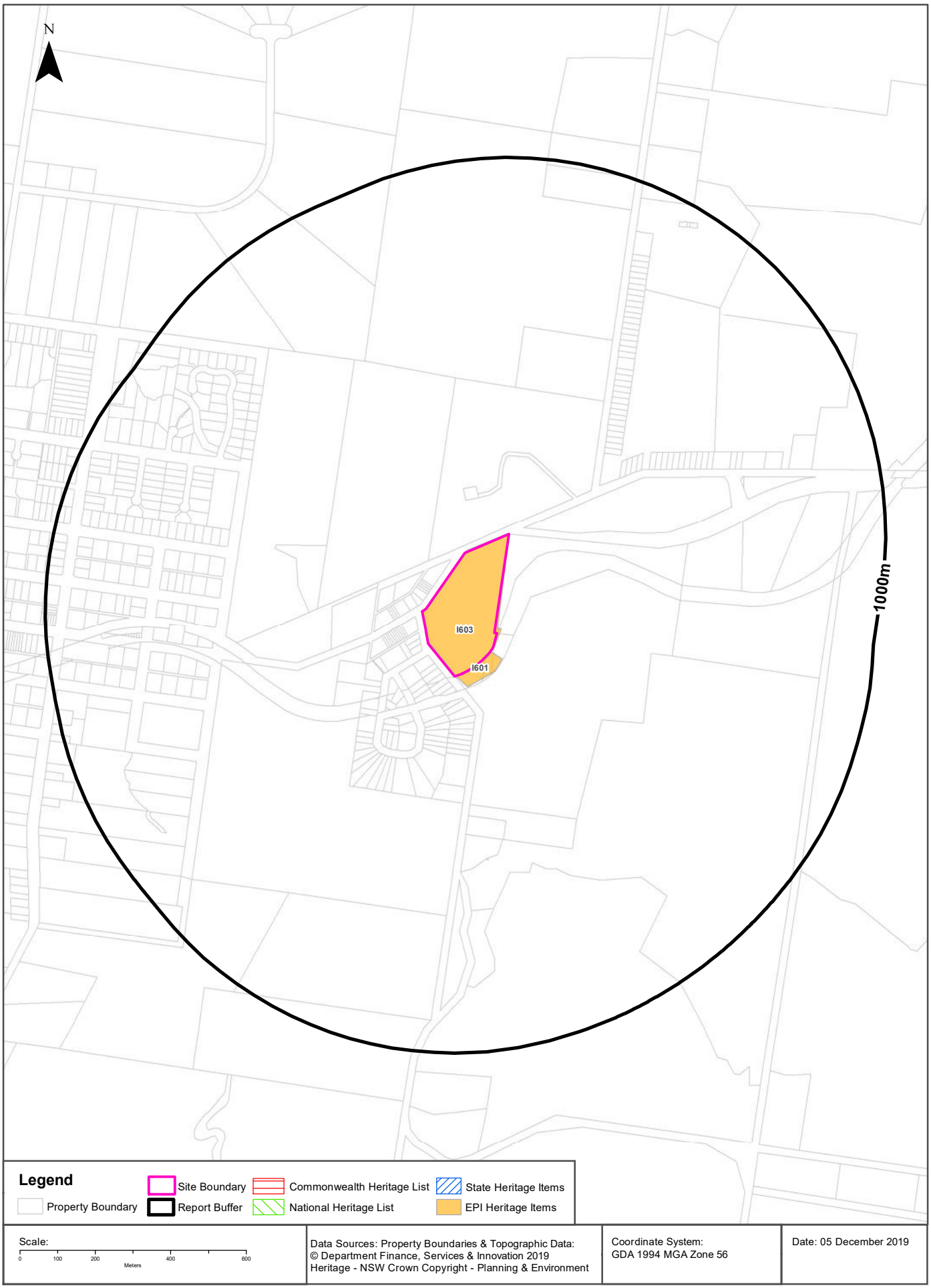
Land Zoning

What EPI Land Zones exist within the dataset buffer?

Zone	Description	Purpose	EPI Name	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
E3	Environmental Management		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		0m	Onsite
R5	Large Lot Residential		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		0m	South West
SP2	Infrastructure	Infrastructure	Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		0m	North East
R5	Large Lot Residential		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		17m	West
E3	Environmental Management		Wingecarribee Local Environmental Plan 2010	06/09/2019	06/09/2019	06/09/2019	Amendment No 50	19m	North West
E3	Environmental Management		Wingecarribee Local Environmental Plan 2010	05/04/2019	05/04/2019	06/09/2019	Amendment No 48	37m	West
R5	Large Lot Residential		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		40m	South
SP2	Infrastructure	Water Supply System	Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		122m	North
E3	Environmental Management		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		153m	South West
E3	Environmental Management		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		230m	East
R5	Large Lot Residential		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		316m	North East
R5	Large Lot Residential		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		318m	North East
R2	Low Density Residential		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		507m	West
R2	Low Density Residential		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		550m	West
R5	Large Lot Residential		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		555m	North West
R5	Large Lot Residential		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		595m	South West
RE1	Public Recreation		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		627m	North West
RE1	Public Recreation		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		686m	North West
B2	Local Centre		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		743m	West
B2	Local Centre		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		772m	West
RE1	Public Recreation		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		910m	West
B2	Local Centre		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		938m	West
B2	Local Centre		Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	06/09/2019		953m	West

Heritage Items

1 Fountaindale Road, Robertson, NSW 2577



Heritage

1 Fountaindale Road, Robertson, NSW 2577

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch

National Heritage List

What are the National Heritage List Items located within the dataset buffer?
Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch

State Heritage Register - Curtilages

What are the State Heritage Register Items located within the dataset buffer?

Map Id	Name	Address	LGA	Listing Date	Listing No	Plan No	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: NSW Crown Copyright - Office of Environment & Heritage

Environmental Planning Instrument - Heritage

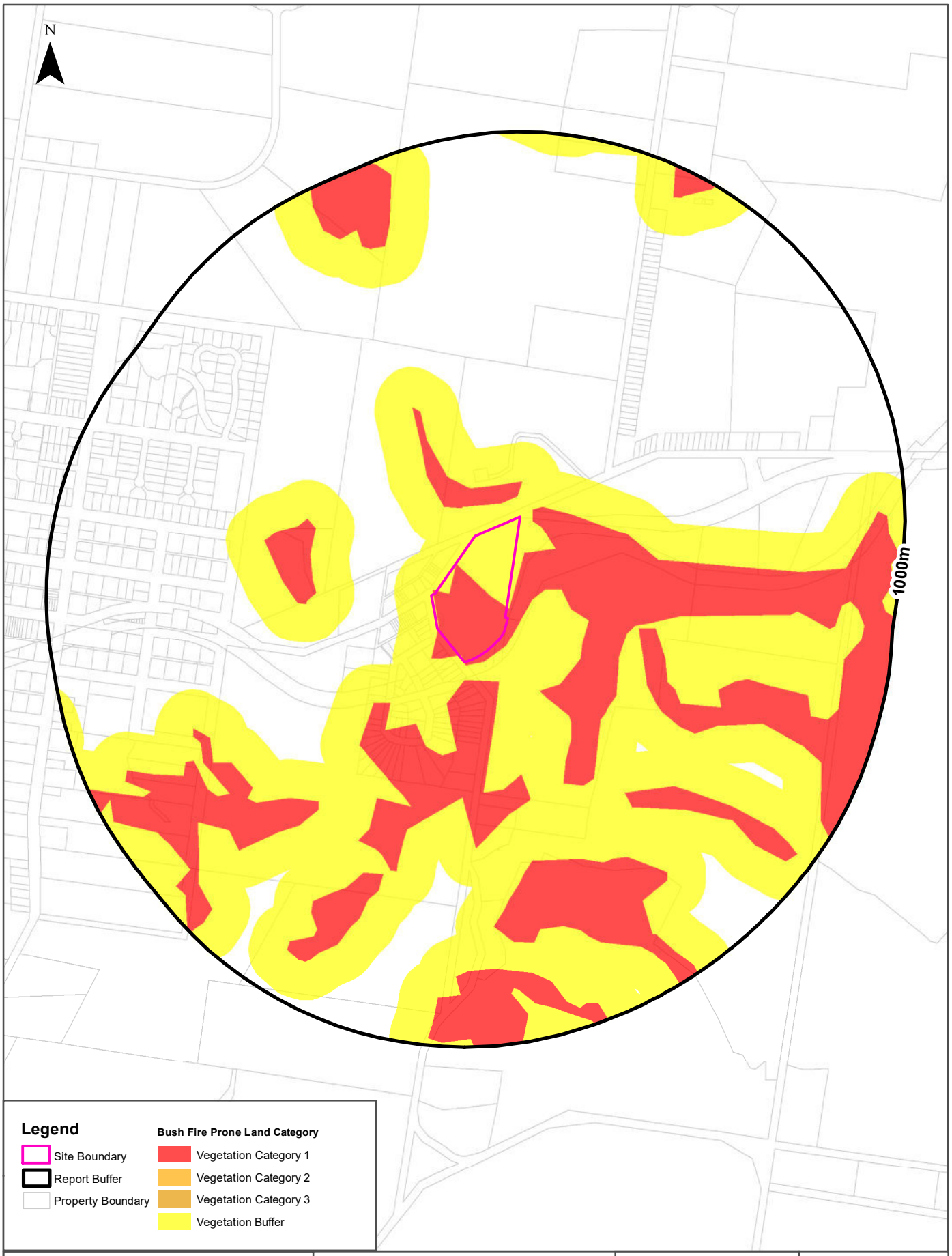
What are the EPI Heritage Items located within the dataset buffer?

Map Id	Name	Classification	Significance	EPI Name	Published Date	Commenced Date	Currency Date	Distance	Direction
I601	Ranelagh House guest house, grounds and railway si	Item - General	Local	Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	15/06/2018	0m	Onsite
I603	Ranelagh House guest house, grounds and railway si	Item - General	Local	Wingecarribee Local Environmental Plan 2010	16/06/2010	16/06/2010	15/06/2018	0m	Onsite

Heritage Data Source: NSW Crown Copyright - Planning & Environment

Natural Hazards - Bush Fire Prone Land

1 Fountaindale Road, Robertson, NSW 2577



Data Sources: Bush Fire Prone Land: © NSW Rural Fire Service 2019. Property Boundaries: © Department Finance, Services & Innovation 2019

Coordinate System: GDA 1994 MGA Zone 56

Date: 05 December 2019

Natural Hazards

1 Fountaindale Road, Robertson, NSW 2577

Bush Fire Prone Land

What are the nearest Bush Fire Prone Land Categories that exist within the dataset buffer?

Bush Fire Prone Land Category	Distance	Direction
Vegetation Buffer	0m	Onsite
Vegetation Category 1	0m	Onsite

Ecological Constraints - Vegetation & Ramsar Wetlands

1 Fountaindale Road, Robertson, NSW 2577

Ecological Constraints

1 Fountaindale Road, Robertson, NSW 2577

Vegetation Mapping- Wingecarribee

What Vegetation exists within the dataset buffer?

Id	Map Unit	SEPP44 Tree	Distance	Direction
6883	Robertson Basalt Rainforest	Recorded	0m	Onsite
6995	Robertson Basalt Rainforest	Recorded	46m	North
7030	Robertson Basalt Rainforest	Recorded	53m	South
6988	Robertson Basalt Rainforest	Recorded	274m	South
9182	Southern Highlands Shale Woodland	Not Recorded	299m	South
6875	Robertson Basalt Rainforest	Recorded	308m	West
9296	Southern Highlands Shale Woodland	Not Recorded	455m	South
11065	Weeds/exotics/pine plantations	Not Recorded	487m	North
9224	Southern Highlands Shale Woodland	Not Recorded	499m	South
9226	Southern Highlands Shale Woodland	Not Recorded	505m	South
6954	Robertson Basalt Rainforest	Recorded	508m	South East
10681	Regenerating Vegetation	Not Recorded	519m	North
6920	Robertson Basalt Rainforest	Recorded	532m	South West
6955	Robertson Basalt Rainforest	Recorded	548m	South
7799	Southern Highlands Shale Woodland	Not Recorded	596m	South West
6916	Robertson Basalt Rainforest	Recorded	597m	South West
8986	Southern Highlands Shale Woodland	Not Recorded	624m	South East
7849	Southern Highlands Shale Woodland	Not Recorded	745m	South East
7007	Robertson Basalt Rainforest	Recorded	780m	North
10680	Regenerating Vegetation	Not Recorded	786m	North East
7014	Robertson Basalt Rainforest	Recorded	803m	South
10673	Regenerating Vegetation	Not Recorded	809m	North
11148	Water	Not Recorded	835m	North
10678	Regenerating Vegetation	Not Recorded	853m	North East
8511	Southern Highlands Shale Woodland	Not Recorded	863m	North East
6957	Robertson Basalt Rainforest	Recorded	872m	North East
7768	Southern Highlands Shale Woodland	Not Recorded	876m	South
8516	Southern Highlands Shale Woodland	Not Recorded	881m	North East
8842	Southern Highlands Shale Woodland	Not Recorded	907m	East

7803	Southern Highlands Shale Woodland	Not Recorded	909m	South East
7009	Robertson Basalt Rainforest	Recorded	923m	North East
7841	Southern Highlands Shale Woodland	Not Recorded	928m	South West
7769	Southern Highlands Shale Woodland	Not Recorded	930m	South East
11144	Water	Not Recorded	939m	North
10677	Regenerating Vegetation	Not Recorded	962m	North East
10997	Weeds/exotics/pine plantations	Not Recorded	963m	North West

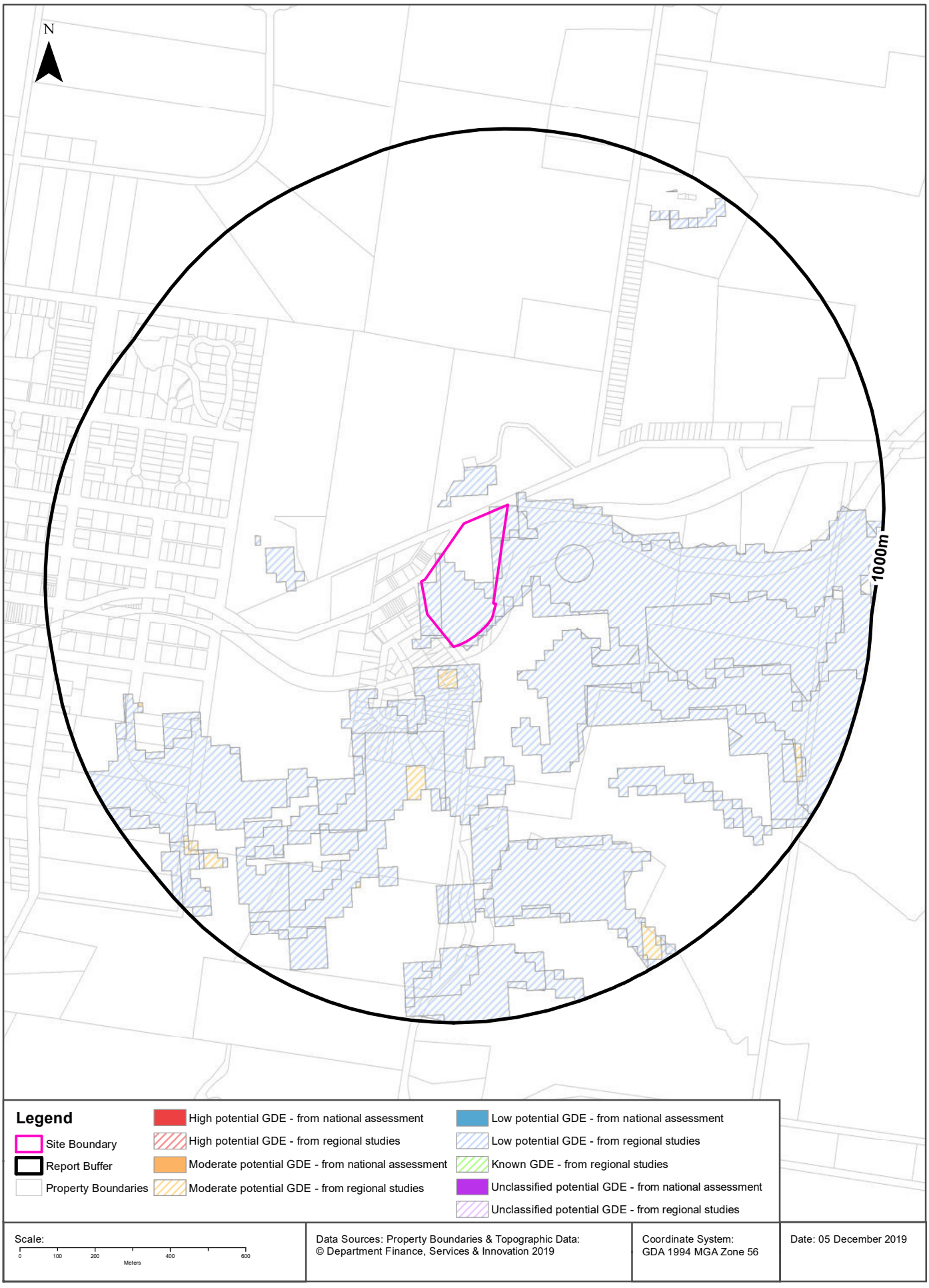
Ramsar Wetlands

What Ramsar Wetland areas exist within the dataset buffer?

Map Id	Ramsar Name	Wetland Name	Designation Date	Source	Distance	Direction
N/A	No records in buffer					

Ecological Constraints - Groundwater Dependent Ecosystems Atlas

1 Fountaindale Road, Robertson, NSW 2577



Ecological Constraints

1 Fountaindale Road, Robertson, NSW 2577

Groundwater Dependent Ecosystems Atlas

Type	GDE Potential	Geomorphology	Ecosystem Type	Aquifer Geology	Distance
Terrestrial	Low potential GDE - from regional studies	Deeply dissected sandstone plateaus.	Vegetation		0m
Terrestrial	Moderate potential GDE - from regional studies	Deeply dissected sandstone plateaus.	Vegetation		59m

Ecological Constraints - Inflow Dependent Ecosystems Likelihood

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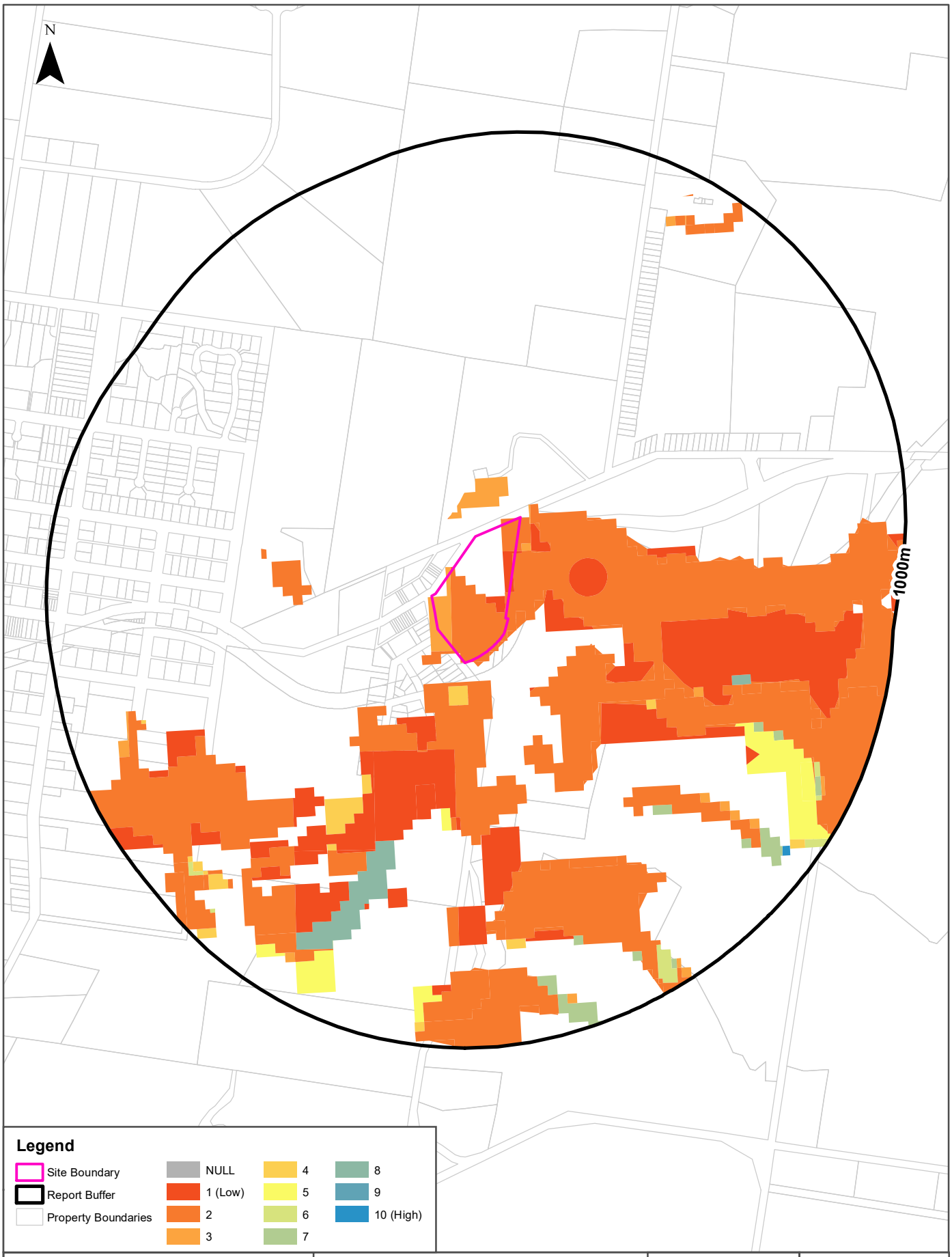

Ecological Constraints

1 Fountaindale Road, Robertson, NSW 2577

Inflow Dependent Ecosystems Likelihood

Type	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Distance
Terrestrial	1	Deeply dissected sandstone plateaus.	Vegetation		0m
Terrestrial	2	Deeply dissected sandstone plateaus.	Vegetation		0m
Terrestrial	3	Deeply dissected sandstone plateaus.	Vegetation		0m
Terrestrial	4	Deeply dissected sandstone plateaus.	Vegetation		59m
Terrestrial	5	High hill chains of granite, sandstone and greywacke, moderately dissected, some fault lines.	Vegetation		378m
Terrestrial	8	Deeply dissected sandstone plateaus.	Vegetation		495m
Terrestrial	7	Deeply dissected sandstone plateaus.	Vegetation		584m
Terrestrial	6	Deeply dissected sandstone plateaus.	Vegetation		867m
Terrestrial	10	Deeply dissected sandstone plateaus.	Vegetation		907m

Ecological Constraints

1 Fountaindale Road, Robertson, NSW 2577

NSW BioNet Atlas

Species on the NSW BioNet Atlas that have a NSW or federal conservation status, a NSW sensitivity status, or are listed under a migratory species agreement, and are within 10km of the site?

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Amphibia	Heleioporus australiacus	Giant Burrowing Frog	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Amphibia	Litoria littlejohni	Littlejohn's Tree Frog	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Amphibia	Mixophyes balbus	Stuttering Frog	Endangered	Category 2	Vulnerable	
Animalia	Amphibia	Pseudophryne australis	Red-crowned Toadlet	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Artamus cyanopterus cyanopterus	Dusky Woodswallow	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Botaurus poiciloptilus	Australasian Bittern	Endangered	Not Sensitive	Endangered	
Animalia	Aves	Callocephalon fimbriatum	Gang-gang Cockatoo	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Calyptorhynchus lathami	Glossy Black-Cockatoo	Vulnerable	Category 2	Not Listed	
Animalia	Aves	Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Daphoenositta chrysoptera	Varied Sittella	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Dasyornis brachypterus	Eastern Bristlebird	Endangered	Category 2	Endangered	
Animalia	Aves	Hieraaetus morphnoides	Little Eagle	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Lathamus discolor	Swift Parrot	Endangered	Category 3	Critically Endangered	
Animalia	Aves	Neophema pulchella	Turquoise Parrot	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Ninox strenua	Powerful Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Pachycephala olivacea	Olive Whistler	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Petroica boodang	Scarlet Robin	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Petroica phoenicea	Flame Robin	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Pezoporus wallicus wallicus	Eastern Ground Parrot	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Plegadis falcinellus	Glossy Ibis	Not Listed	Not Sensitive	Not Listed	CAMBA
Animalia	Aves	Tyto novaehollandiae	Masked Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Tyto tenebricosa	Sooty Owl	Vulnerable	Category 3	Not Listed	
Animalia	Insecta	Petalura gigantea	Giant Dragonfly	Endangered	Not Sensitive	Not Listed	
Animalia	Mammalia	Cercartetus nanus	Eastern Pygmy-possum	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable	Not Sensitive	Endangered	

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Mammalia	Falsistrellus tasmaniensis	Eastern False Pipistrelle	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	Endangered	Not Sensitive	Endangered	
Animalia	Mammalia	Miniopterus australis	Little Bent-winged Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Miniopterus orianae oceanensis	Large Bent-winged Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Petauroides volans	Greater Glider	Not Listed	Not Sensitive	Vulnerable	
Animalia	Mammalia	Petaurus norfolcensis	Squirrel Glider	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Phascolarctos cinereus	Koala	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Potorous tridactylus	Long-nosed Potoroo	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Pseudomys novaehollandiae	New Holland Mouse	Not Listed	Not Sensitive	Vulnerable	
Animalia	Mammalia	Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Scoteanax rueppellii	Greater Broad-nosed Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Reptilia	Aprasia parapulchella	Pink-tailed Legless Lizard	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Amperea xiphoclada var. pedicellata		Presumed Extinct	Not Sensitive	Extinct	
Plantae	Flora	Boronia deanei	Deane's Boronia	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Daphnandra johnsonii	Illawarra Socketwood	Endangered	Not Sensitive	Endangered	
Plantae	Flora	Eucalyptus macarthurii	Paddys River Box, Camden Woollybutt	Endangered	Not Sensitive	Endangered	
Plantae	Flora	Gentiana wingecarribiensis	Wingecarribee Gentian	Critically Endangered	Category 3	Endangered	
Plantae	Flora	Grevillea rivularis	Carrington Falls Grevillea	Critically Endangered	Not Sensitive	Endangered	
Plantae	Flora	Irenepharsus trypherus	Illawarra Irene	Endangered	Not Sensitive	Endangered	
Plantae	Flora	Lysimachia vulgaris var. davurica	Yellow Loosestrife	Endangered	Category 3	Not Listed	
Plantae	Flora	Persicaria elatior	Tall Knotweed	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Persoonia glaucescens	Mittagong Geebung	Endangered	Not Sensitive	Vulnerable	
Plantae	Flora	Pomaderris walshii	Carrington Falls Pomaderris	Critically Endangered	Category 2	Not Listed	
Plantae	Flora	Prasophyllum fuscum	Slaty Leek Orchid	Critically Endangered	Category 2	Vulnerable	
Plantae	Flora	Pterostylis pulchella	Waterfall Greenhood	Vulnerable	Category 2	Vulnerable	
Plantae	Flora	Pultenaea aristata	Prickly Bush-pea	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Rhodamnia rubescens	Scrub Turpentine	Critically Endangered	Not Sensitive	Not Listed	
Plantae	Flora	Solanum celatum		Endangered	Not Sensitive	Not Listed	
Plantae	Flora	Thelymitra kangaloonica	Kangaloon Sun Orchid	Critically Endangered	Category 2	Critically Endangered	
Plantae	Flora	Xerochrysum palustre	Swamp Everlasting	Not Listed	Not Sensitive	Vulnerable	

Data does not include NSW category 1 sensitive species.

Data obtained 05/11/2019

Location Confidences

Where Lotsearch has had to georeference features from supplied addresses, a location confidence has been assigned to the data record. This indicates a confidence to the positional accuracy of the feature. Where applicable, a code is given under the field heading “LC” or “LocConf”. These codes lookup to the following location confidences:

LC Code	Location Confidence
Premise match	Georeferenced to the site location / premise or part of site
General area or suburb match	Georeferenced with the confidence of the general/approximate area
Road match	Georeferenced to the road or rail
Road intersection	Georeferenced to the road intersection
Feature is a buffered point	Feature is a buffered point
Land adjacent to geocoded site	Land adjacent to Georeferenced Site
Network of features	Georeferenced to a network of features

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APPENDIX D

The Robertson Hotel

01

THICK VEGETATION
VILLAS WITH COURTYARD
FOOT BRIDGE
ECO WALK
PROTECTED ZONE
COMMUNITY LEISURE AND HEALTH CENTRE
ECO CABINS
NEW HOTEL WING
EXISTING HOTEL
LOADING DOCK
ARTIST IN RESIDENCE
BUS DROP OFF STOP
BUGGY PARKING
REFURBISHED HERITAGE RAIL PLATFORM
BUS/COACH PARKING
SERVICES ACCESS
OUTDOOR FUNCTION AREA
THICK VEGETATION
VILLAS WITH COURTYARD
NEW PUBLIC FOOTPATH
RECEPTION SMALL VENUE FIRE REFUGE
ADJUSTED BOUNDARY POSITION
ECOCABINS
OUTDOOR FUNCTION AREA 2
TIMBER FENCE
PETTING ZOO
PERFORMANCE AMPITHEATRE
ON GROUND OVERFLOW PARKING
OUTDOOR FUNCTION 3 [POTENTIAL OVERFLOW PARKING]
1.8m SANDSTONE WALL
SIGNAGE
PETTING ZOO
THICK VEGETATION
PEDESTRIAN GATE
TIMBER FENCE
SIGNAGE

CENTRAL FACILITIES_LEGEND

- (A) - PLAZZA
- (B) - RECEPTION
- (C) - CENTRAL GARDEN
- (D) - GARDEN RESTAURANT
- (E) - GALLERY / MUSEUM
- (F) - CAFE

ROADS AND PATHS_LEGEND

- PERVIOUS: PEDESTRIAN FOOTPATH & BIKES
- PERVIOUS: PEDESTRIAN FOOTPATH, BIKES & BUGGYS
- SEALED ROAD ASPHALT
- SEALED STONE [CAFE, GALLERY/MUSEUM & GARDEN RESTAURANT AREA]
- SEALED COBBLESTONE [PLAZZA]

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MASTER PLAN

1:500 @ A1

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