



Draft Preliminary Land Capability, Salinity and Contamination Assessment - Ingleside Release Area, Ingleside NSW

For: NSW Department of Planning & Environment

OCTOBER, 2015

Project Name:	Preliminary Land Capability, Salinity and Contamination Assessment - Ingleside Release Area, Ingleside NSW
Project Number:	30011289
Report for:	NSW Department of Planning & Environment

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DRAFT	01/09/2015	Lachlan Edwards	Daniel Saunders	Daniel Saunders
DRAFT	01/10/2015	Lachlan Edwards	Daniel Saunders	Daniel Saunders

ISSUE REGISTER

Distribution List	Date Issued	Number of Copies
NSW Department of Planning & Infrastructure:	01/10/2015	1
SMEC staff:	--	--
Associates:	--	--
SMEC Project File:	01/10/2015	1

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EXECUTIVE SUMMARY

SMEC Australia Pty Ltd was engaged by NSW Department of Planning & Environment (DP&E) to prepare a Preliminary Land Capability, Salinity and Contamination Assessment for the Ingleside Release Area, Ingleside NSW.

The purpose of undertaking a Preliminary Land Capability, Salinity and Contamination Investigation is to determine any land constraints and the soil and groundwater characteristics of the site for the purposes of supporting significant urban development.

Based on the original scope of works it was planned to undertake intrusive ground investigations across the area to determine the ground conditions and allow detailed slope stability and contamination assessments to be undertaken. Subsequent constraints around site access meant that an intrusive ground investigation was not possible, therefore, SMEC has undertaken a visual Land Capability slope risk analysis of 10 previously delineated set zones within the Ingleside precinct that contain slopes that may potentially pose a risk to property.

Specifically, the Land Capability Assessment included a site inspection to identify slope characteristics, identify current and potential slope failure mechanisms to inform a slope risk assessment and categorise slope mechanisms in accordance with the Landslide Risk Management guidelines by Australian Geomechanics Society (AGS, 2007).

Based on the findings of the risk analysis in the Land Capability Assessment it has been established that the tolerable risk to future development for the identified slope failure mechanisms has not been met, as the risk for the ten sites inspected within the precinct (refer to Appendix F) is classed as moderate. Recommendations to reduce the risk to tolerable levels may include scaling the slope, installation of rock bolts and consideration of development location. These risk analyses were based on high level observations. The analysis is conservative because comprehensive and detailed geological mapping of the site was not possible. The location and proximity of any future development to an identified slope failure mechanism will potentially alter the calculated risk level. As such it should be noted that there may be other active or potential slope mechanisms that were not identified. On this basis it is recommended that for any site development, a specific slope stability assessment should be undertaken to assess the slope risk based on a detailed site inspection or investigation.

An assessment of the soil landscapes within the subject area identified that the Hawkesbury, Lambert and Oxford Falls soil landscape groups are recognised as having a higher susceptibility to erosion. The subject area is considered to present as a high erosion hazard due to the characteristics of a colluvial and erosional soil landscapes combined with high rainfall intensity which can result in high soil loss conditions. This high erosion hazard implies that significant erosion will occur during development and after land use is established, even with intensive soil conservation measures. Such erosion hazards infer that planning will need to carefully consider the balance between the probability of long term erosion damage and maintenance or repair needed to ensure the viability of the land use. Where practicable, construction programming should aim to minimise the potential for soil loss by condensing the time from the beginning of land disturbance activities to rehabilitation.

In order to determine the potential for land contamination, salinity and other environmental constraints within the subject area, a Preliminary Environmental Site Assessment with limited surface soil sampling was conducted and supported by documentation relating to the subject area to identify potential sources of contamination associated with current and historical land use.

The subject area is entirely underlain by the Hawkesbury Sandstone formation of the Wianamatta Group (*Sydney 1:100 000 Series Geological Sheet*) and comprises a variety of soil landscapes recognised under the *Soil Landscapes of the Sydney 1:100 000 Sheet*. Soil landscapes mapped within the subject area include Gymea, Oxford Falls, Hawkesbury, Somersby and Lambert.

This study indicates that the regional groundwater flow direction is expected to generally flow to the north-east in accordance with the general site topography, with localised variations in areas located nearer to water bodies and creek lines. Local groundwater can occur at depths ranging from 10-20 metres below ground level (mbgl) and regional groundwater are likely to be deeper at 100-200 mbgl. Water quality information contained within the bore logs is limited; however, information that is provided identifies salinity characteristics as good, which indicates reasonable water quality and non-saline groundwater conditions are likely. The limited soil samples collected and analysed for salinity also indicate a 'Non-saline' classification for soils.

Acid sulfate soils are not considered to present a risk within the subject area, given the mapped soils units and elevation of the subject area (ie generally >100m above sea level).

As the future land use is likely to consist of various types of residential use within some commercial/industrial use, this study has adopted the residential criteria for Health Investigation Levels (HILs). Due to site access constraints within the subject area, limited surface soil sampling was conducted at assessable locations within the subject area only. All samples were analysed for a broad suite of analytes including, Metals (8), BTEX, TPH, OCC and OPP Pesticides, PCBs and PAHs. No soil sample obtained from within the subject area exceeded the adopted site assessment criteria for contaminated land.

While no soil sample exceeded the adopted site assessment criteria, due to the limited nature of the investigation the potential remains for contamination to be present within the subject area. The sources of contamination are likely to be related to the following identified activities or Areas of Environmental Concern (AECs) within the subject area:

- The use of uncontrolled fill material and quarry activities.
- Commercial and industrial facilities.
- Small farm holdings, market gardens and nurseries.
- Hazardous materials within existing buildings and site structures.
- Septic effluent systems.
- Potential fly tipping of waste in unoccupied lands.

On-Site Effluent Assessment

SMEC undertook an On-Site Effluent Assessment for the Ingleside Release Area (2015). The assessment found that the soil landscapes within the Wirreanda Valley and Bayview Heights areas present a number of soil related environmental constraints for on-site effluent systems. Soil depths of less than 0.6 metres to bedrock may not have enough capacity to filter nutrients and pathogens. Shallow soils often have a highly variable depth, and incur a risk of effluent resurfacing near the land application area. Any decisions about the on-site management of sewage should consider these impacts. It is recommended that individual lots may be required to undertake a specific site evaluation at the development application stage which may eliminate areas not suitable for on-site sewage management.

Further investigations will be required as part of future development applications together with additional work during the construction phase. Specific investigations would include but not necessarily be limited to:

- Detailed environmental investigation (comprising subsurface sampling and laboratory testing) in the nominated AECs, primarily in those areas which lie within the proposed “development footprint”. The purpose of this work would be to quantify the level of contamination (if any) and delineate contaminated areas in order to facilitate the preparation of remediation action plans (RAP).
- Additional hazardous building material assessments should be undertaken of all buildings in the subject area that are to be demolished/renovated.
- Additional investigation should be undertaken in development areas which are to be excavated deeper than three metres or into rock at shallower depth, where direct sampling and testing of salinity has not been carried out.
- Installation of groundwater bores well in advance of construction and monitoring/sampling/analysis before, during and after construction, to monitor and assess changes in groundwater quality, electrical conductivity and level as a result of the development. The bores would be strategically located on a catchment basis near creek lines.
- Detailed geotechnical investigations on a stage-by-stage basis for determination of pavement thickness designs and lot classifications.

Overall SMEC sees no substantive reason with respect to Land Capability, Salinity and Contamination, why the subject area could not be developed from an urban development perspective subject to recommendations associated with additional investigations and implementation of appropriate mitigation measures.

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1 INTRODUCTION

SMEC Australia Pty Ltd (SMEC) was engaged by NSW Department of Planning & Environment (DP&E) to prepare a Land Capability, Salinity and Contamination Assessment for the Ingleside Release Area, Ingleside NSW. This report is a technical paper developed to inform the precinct planning process for Ingleside. The precinct planning is being developed as a partnership between the Department of Planning and Environment, Pittwater Council and Urban Growth NSW.

The Ingleside precinct occupies approximately 700 hectares within Pittwater Council Local Government Area (LGA) and is located approximately 20 km north-east of the Sydney CBD.

The location of the Ingleside precinct (subject area) is presented in Figure 1.

It is understood that the subject area will accommodate a mixture of land uses including environmental living, low and medium density dwellings (and a range of other land uses) in the future, in order to meet the strategic planning requirements of the NSW State Government.

1.1 Objectives

The key objectives of the Land Capability, Salinity and Contamination Assessment for the subject area were to:

- Identify and map soil landscapes within the subject area and the limitations of the land.
- Undertake limited salinity and contamination soil sampling and analysis.
- Assess and provide recommendations for slope stability across the precinct.
- Identify any potential areas of concern from a contamination perspective.
- Map the suitability of land for urban development.
- Provide recommendations for any additional investigations to be undertaken prior to commencing urban development in the precinct.

1.2 Scope of works

The scope of works undertaken for the Land Capability, Salinity and Contamination assessments is provided in the following sections:

1.2.1 Land Capability

Based on the original scope of works it was planned to undertake intrusive ground investigations across the area to determine the ground conditions and allow detailed slope stability assessments to be undertaken. Subsequent constraints around site access meant that an intrusive ground investigation was not possible, therefore, SMEC has undertaken a visual slope risk analysis of 10 previously delineated set zones within the Ingleside Precinct and supported by the slope risk assessment technical paper (Ingleside Precincts Slope Risk Assessment Report, SMEC 2014) located in Appendix F.

Specifically, the revised scope of works for the Land Capability assessment comprised:

- Site inspection of the ten sites to identify slope characteristics as visible from the road side or clearly identifiable public land.

- Identify current and potential slope failure mechanisms to inform a slope risk assessment.
- Categorise slope mechanisms in accordance with the Landslide Risk Management guidelines dated March 2007 by Australian Geomechanics Society (AGS, 2007).
- Conduct a risk estimation of identified slope mechanisms (i.e. comparative analysis of likelihood of a slope failure versus consequence of the failure).
- Evaluation of the estimated (assessed) risk by comparing against acceptance criteria.

1.2.2 Soil Salinity Assessment

The scope of works for the salinity assessment comprised the following:

- A review of available preliminary soil information to determine soil conditions and salinity potential within the subject area.
- Collection and laboratory analysis surface soil samples (including QAQC) from accessible locations within the subject area.
- Laboratory analysis of soil samples for Electrical Conductivity (EC), pH, sulfate and chloride.

1.2.3 Site Contamination Assessment

In order to determine the potential for land contamination and particular environmental constraints in the subject area, a Phase 1 Preliminary Environmental Site Assessment (PESA) with limited surface soil sampling was conducted.

The scope of works for the ESA comprised the following:

- Review of available documentation relating to the subject area to identify potential sources of contamination associated with current and historical land use; including:
 - Current and historical aerial photographs.
 - Soil, acid sulfate soils, geological and hydrogeological maps and information.
 - Groundwater borehole database search.
 - Environment Protection Authority (EPA) regulatory database searches.
- A detailed desktop assessment of the subject area to evaluate the risks of contamination within the subject area and identify locations where contamination may pose a potential risk to human health or the environment.
- A general site inspection of the subject area.
- Limited surface soil sampling at accessible locations within the subject area.
- Identify areas where further investigation may be required to characterise the nature and extent of any potential contamination.
- Preparation of a Draft Land Capability, Salinity and Contamination Assessment report presenting information gained during the above tasks.
- Preparation of Final Land Capability, Salinity and Contamination Assessment report including consideration of comments from relevant stakeholders.

1.3 Limitations

This report has been prepared for NSW Department of Planning and Environment. The findings of this report are based on the scope of works defined in **Section 1.2**. SMEC

performed the works in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession.

The purpose of this report is to provide a preliminary assessment of Land Capability, Salinity and Contamination characteristics of the Ingleside release area. This report does not provide a complete assessment of the defined subject area or the surrounding area.

The absence of any identified hazardous materials within the subject area should not be interpreted as a guarantee that such materials do not exist. As this is a preliminary, broad scale Land Capability assessment, it is not intended to be comprehensive.

The findings of the report are based on a review of desktop information, limited soil sampling and visual observations only and are therefore merely indicative of the environmental condition.

No warranty, expressed or implied, is made as to the information and professional advice included in this report. This document has been prepared in good faith and no responsibility can be accepted for inaccuracies contained in any information provided third parties.

The report shall only be used for the purposes stated in the signed contract and shall not be relied upon by any party other than the NSW Department of Planning and Environment for the Ingleside Release Area project.

2 LAND CAPABILITY ASSESSMENT

2.1 Site Location and Description

For the purposes of assessment and reporting, the subject area comprises the following sub-precincts:

- Wirreanda Valley
- North Ingleside
- Bayview Heights
- South Ingleside.

Collectively, the sub-precincts are generally bordered by the following:

- West - Wirrianda Creek and the Ku-ring-gai Chase National Park.
- North - Ku-ring-gai Chase National Park and the suburb of Church Point.
- East – Warriewood Escarpment, Katandra Bushland Sanctuary and the suburb of Mona Vale.
- South - Garrigal National Park and the suburb of Elanora Heights.

It is understood that the subject area adopted by DP&E for the Ingleside precinct will accommodate a mixture of land uses including environmental living, low and medium density dwellings (and a range of other land uses) in the future, in order to meet the strategic planning requirements of the NSW State Government.

2.2 Land Use

The subject area contains a number of existing land uses including recreational, private residential, commercial/industrial, schools, hobby farms and nursery related uses.

Private use of the land includes large residential blocks, commercial/industrial activities (including nursery and various commercial uses), schools, recreational camps and various other uses.

Approximately one third of the subject area is owned by the NSW State Government agencies. Key public landowners within the subject area are listed below:

- Department of Education and Communities.
- Department of Planning and Environment.
- Department of Primary Industries – Lands.
- Roads and Maritime Services.
- Sydney Water.
- Pittwater Council.

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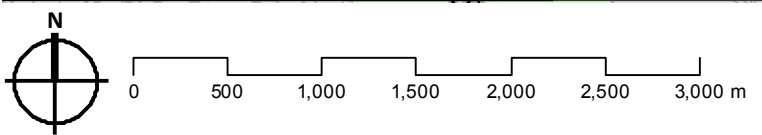
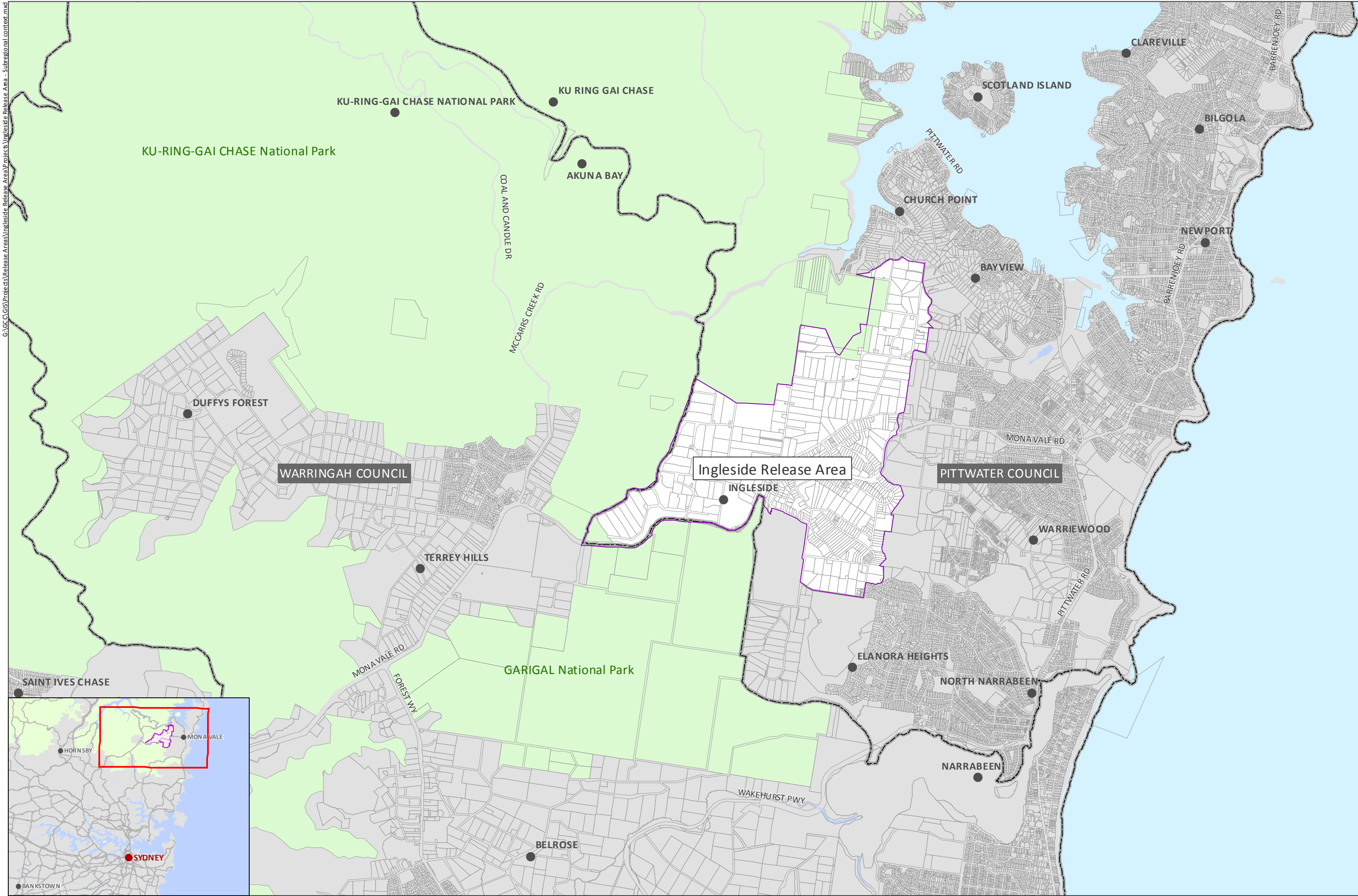


Fig. 1: Ingleside Release Area - Subregional Context

Friday 6 June 2015 © LPI Cadastre

Disclaimer: The information contained on this map is, to the best of the Government's knowledge, correct. However, no warranty or guarantee is provided by the Government and no liability is accepted for any loss or damage resulting from any person relying upon or using the information contained in the map.



2.3 Topography and Hydrology

The landscape of the subject area generally consists of relatively steep areas close to the Warriewood/Ingleside Escarpment, through to lower lying areas around the centre of the precinct (Powder Works Road, McLean Street etc.). Mona Vale Road dissects the subject area and generally follows the ridge line through the subject area. Elevations throughout the subject area generally range from a high of 200 m above sea level near the Baha'i Temple to low of 80 m above sea level in the area around Emmaus Road. In general, the subject area north of Mona Vale Road falls towards the north and north-east while the subject area south of Mona Vale Road falls towards the south-east.

Further discussion on the topography within the subject area is provided in the geotechnical / slope risk assessment report (Appendix F).

There are two creek lines located within the subject area north of Mona Vale Road. Wirreanda Creek follows the western edge of the subject area and flows to the north before discharging into McCarrs Creek, while Cicada Glen Creek flows to the north from Chiltern Road before also discharging into McCarrs Creek.

There are three creek lines located within the subject area south of Mona Vale Road. Mullet Creek (and its tributaries) flow to the south-east from King Road and Hyman Eizenberg Drive. Fern Creek and Narrabeen Creek begin at the Warriewood Escarpment and flow towards the south-east. All creek lines to the south of Mona Vale Road discharge into Narrabeen Lakes.

Figure 2, Appendix A identifies the creek lines and topography in relation to the subject area.

2.4 Soils

The subject area comprises a variety of soil landscapes recognised under the *Soil Landscapes of the Sydney 1:100 000 Sheet*. Soil landscapes mapped within the subject area include GyMEA, Oxford Falls, Hawkesbury, Somersby and Lambert.

Descriptions and characteristics of the various soil landscapes identified within the subject area are provided in Table 1 below. Figure 3, Appendix A identifies the locations of the various soil landscape groups mapped throughout the subject area.

Table 1 Soils descriptions under the Soil Landscapes of the Sydney 1:100 000 Sheet

Soil Type	Landscape	Soils
Somersby	Gently undulating to rolling rises on deeply weathered Hawkesbury Sandstone plateau. Local relief to 40 m, slopes <15%. Rock outcrop is absent. Crests are broad and convex, valleys are narrow and concave. Extensively cleared, low eucalypt open-woodland and scrubland.	Moderately deep to deep (100-300 cm) Red Earths (Gn2.14) and Yellow Earths (Gn 2.24, Gn2.21) overlying laterite gravels and clays on crests and upper slopes; Yellow Earths (Gn2.21, Gn2.24) and Earthy Sands (Uc5.11, Uc5.22) on mid slopes; Grey Earths (Gn2.81), Leached Sands (Uc2.23) and Siliceous Sands (Uc1.22) on lower slopes and drainage lines; Gleyed Podzolic Soils (Dg3.82, Dg4.51) in low lying poorly drained areas.
Oxford Falls	Hanging valleys on Hawkesbury Sandstone. Local relief <80 m, slopes <15%. Occasional broad benches and broken scarps. Valley floors are relatively wide, gently inclined and often poorly drained. Low eucalypt woodland, scrub heathland and sedgeland.	Moderately deep to deep (50 >150 cm) Earthy Sands (Ue5.23), Yellow Earths (Gn2.84, Gn2.94), Siliceous Sands (Ue 1.21) on slopes; deep (>200 cm) Leached Sands (Uc 2.12), Podzols (Uc2.32, Uc2.36) and Grey Earths (Gn2.81) on valley floors.
Hawkesbury	Lugged, rolling to very steep hills on Hawkesbury Sandstone. Local relief 40-200m, slopes >25% Rock outcrop >50%. Narrow crests and ridges, narrow incised valleys, steep sideslopes with rocky benches, broken scarps and boulders. Mostly uncleared eucalypt open-woodland (dry sclerophyll forest) and tall open-forest (wet sclerophyll forest).	Shallow (>50 cm), discontinuous Lithosols, Siliceous Sands (Ucl.21) associated with rock outcrop; Earthy Sands (Uc5.11, Uc5.23), Yellow Earths (Gn2.24) and some Yellow Podzolic Soils (Dy4.11) on inside of benches and along joints and fractures; localised Yellow and Red Podzolic Soils (Dy4.11, Dy5.21, Dr5.11, Dr5.21) associated with shale lenses; Siliceous Sands (Uc1.2) and secondary Yellow Earths (Gn2.41) along drainage lines.
Gymea	Undulating to rolling rises and low hills on Hawkesbury Sandstone. Local relief 20-80m, slopes 10-25%. Rock outcrop <25%. Broad convex crests, moderately inclined side slopes with wide benches, localised rock outcrop on low broken scarps. Extensively cleared open-forest (dry sclerophyll forest) and eucalypt woodland.	Shallow to moderately deep (30-100 cm) Yellow Earths (Gn2.24) and Earthy Sands (Uc5.11, Uc5.23) on crests and inside of benches; shallow (<20 cm) Siliceous Sands (Ucl.21) on leading edges of benches; localized Gleyed Podzolic Soils (Dg4.21) and Yellow Podzolic Soils (Dy4.11, Dy5.11, Dy5.4V) on shale lenses; shallow to moderately deep (<100 cm) Siliceous Sands (Ucl.1.2) and Leached Sands (Uc2.21) along drainage lines.
Lambert	Undulating to rolling low hills on Hawkesbury Sandstone. Local relief 20-120m, slopes <20%. Rock outcrop >50%. Broad ridges, gently to moderately inclined	Shallow (<50 cm), discontinuous Earthy Sands (Uc5.11, Uc5.22) and Yellow Earths (Gn2.2) on crests and inside of benches; shallow (<20 cm) Siliceous Sands/Lithosols (Uc1.2) on

Soil Type	Landscape	Soils
	slopes, wide rock benches with low broken scarps, small hanging valleys and areas of poor drainage. Open and closed-heathland, scrub and occasional low eucalypt open woodland.	leading edges; shallow to moderately deep (<150 cm) Leached Sands (Uc2.21), Grey Earths (Gn2.81) and Gleyed Podzolic Soils (Dg4.21) in poorly drained areas; localised Yellow Podzolic Soils (Dy4.1, Dy5.2) associated with shale lenses.

2.5 Geology

The *Sydney 1:100 000 Series Geological Sheet* indicates that the subject area is entirely underlain by the Hawkesbury Sandstone formation (mapping unit Rh) of the Wianamatta Group from the Triassic Period.

The Hawkesbury Sandstone formation typically comprises medium to coarse-grained quartz sandstone with very minor shale and laminate lenses. Figure 4, Appendix A identifies the mapped geology throughout the subject area.

2.6 Hydrogeology

SMEC completed a search of the Department of Water and Energy Online Database to identify groundwater bores within the subject area. The search indicated that there are 50 registered boreholes in the subject area.

Regional groundwater is expected to generally flow to the north-east in accordance with the general site topography with localised variations in areas located nearer to water bodies and creek lines.

Water quality information contained within the bore logs is limited; however, the information that is available identifies salinity characteristics as good to fresh which indicates reasonable water quality and non-saline groundwater conditions. This is anticipated given the geology of the subject area.

The recorded bore depths range from 5.3 mbgl in GW014179 to 210 mbgl in GW104265. Recorded historical standing water levels within the bores range from 14 mbgl in GW101503 to 105 mbgl in GW105671. The recorded bore depths and water levels indicate that there is likely more than one aquifer within the subject area.

The locations of existing groundwater boreholes within the subject area can be seen in Figure 5, Appendix A. Appendix B presents the works summary records from the groundwater database search for each groundwater bores identified within the subject area.

2.7 Slope Risk and Stability

The Land Capability assessment included a site inspection of the 10 previously delineated set zones within the Ingleside precinct (see Figure 2), that contain slopes that may potentially pose a risk to property, to identify slope characteristics, and identify current and potential slope failure mechanisms to inform a slope risk assessment and categorise slope mechanisms in accordance with the Landslide Risk Management guidelines dated March 2007 by Australian Geomechanics Society (AGS, 2007).

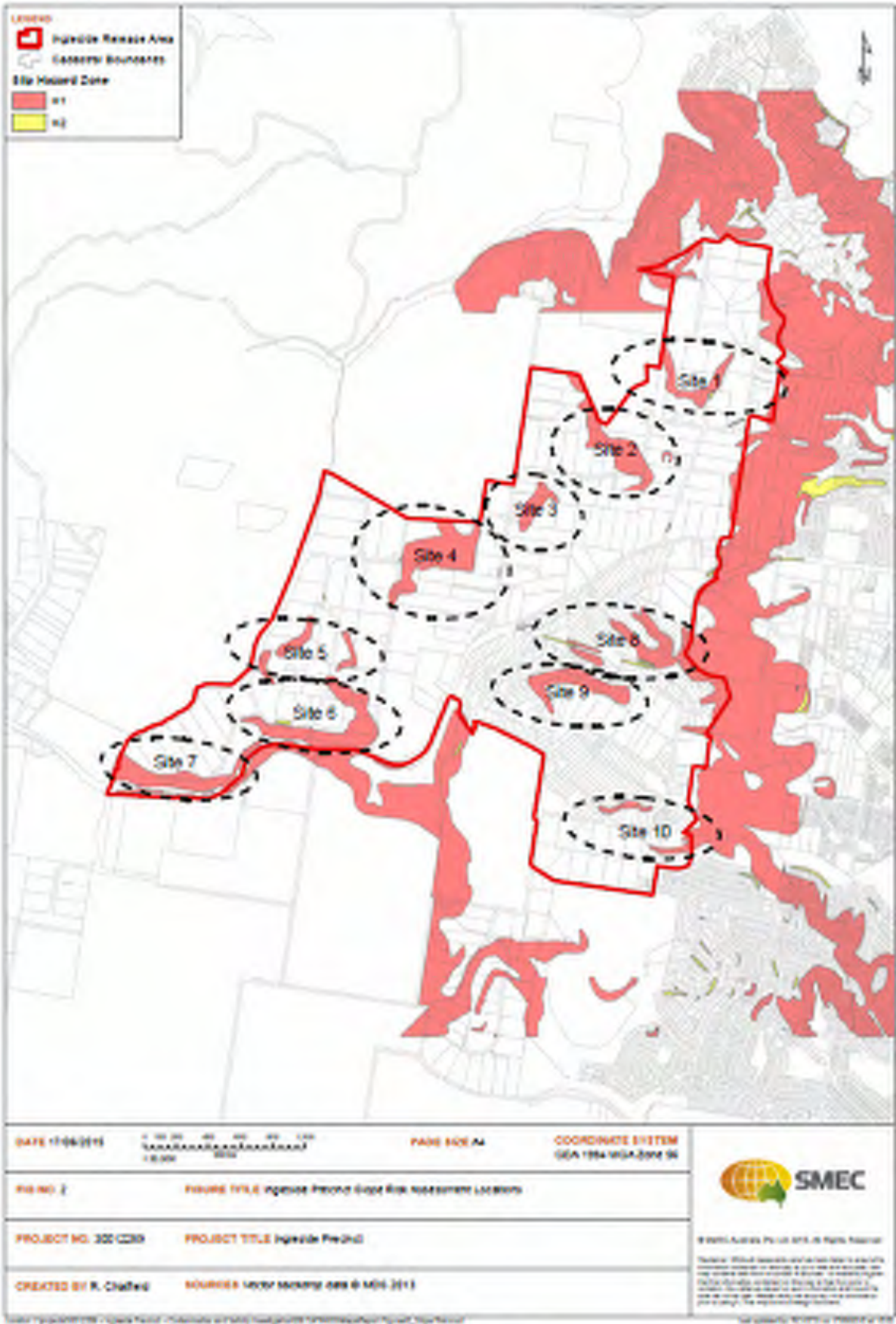


Figure 2. Site map for risk locations assessed



The methodology of assessing the risks at the site comprised the following steps:

- Site inspection involving a geological and geomorphologic appraisal
- Hazard identification
- Risk estimation.

The site inspections comprised site observations and recording of surface features including geomorphological characteristics, evident failure mechanisms, erosion and indications of slope instability.

Slope characterisation was undertaken for each precipice in order to:

- Identify whether the slope has current or potential slope instability issues
- Classify the types of slope instability, if relevant
- Assess the physical extent of the areas affected by instability being considered, including the location, areal extent and volume involved
- Assess the likely initiating event(s), the physical characteristics of the materials involved, and the failure mechanics
- Estimate the resulting anticipated travel distance and velocity of movement
- Identify if risks from a possible slope hazards to existing or future property are acceptable.

As access to private properties was not possible, SMEC has undertaken a visual slope risk analysis in line with AGS (2007) guidelines, which are included in Appendix F. These slope risk analyses involved the inspection of the slope characteristics at 10 sites (Figure 1, Appendix F). Inspections were undertaken from accessible areas, generally either from the roadside or clearly identifiable public land.

The data collected during the site visit by a senior geotechnical engineer has enabled the definition and characterisation of slope instability mechanisms at the 10 sites. Three main mechanisms were identified. These are listed below:

- Mechanism 1: Block falls up to 1 m from precipices up to 2 m in height
- Mechanism 2: Block falls up to 1 m from precipices up to 5 m in height
- Mechanism 3: Block falls up to 2 m from overhangs

SMEC considered three future uses for any land development and made assumptions with regards to the temporal probability for these uses (detailed in Appendix F Section 4.3.4). The three land uses considered are:

- Residential areas
- Roads
- Recreational areas

A risk assessment was undertaken for each of the slope instability mechanisms. For risk to property, the assessment was primarily based on a qualitative approach involving the estimation of the likelihood of a slope failure versus the consequence of the failure.

The findings of the slope risk analysis identified the risk level as 'moderate'. On this basis, the tolerable risk to property for the identified failure mechanisms has not been met. Recommendations to reduce risk to acceptable levels may include scaling the slope, installation of rock bolts and due consideration of the developments location.

Risk analyses were based on high level observations. The analyses are conservative because comprehensive and detailed geological mapping of the site was not possible. Accordingly there may be other active or potential slope mechanisms that were not identified. On this basis it is recommended that for any site development, a location-specific slope stability assessment should be undertaken to assess the slope risk based on a detailed site inspection or investigation.

2.8 Erosional and Sedimentation Characteristics

The erosion hazard is dependent on a combination of climate, landform, soil, land use and land management factors. The qualitative categories of erosion hazard are 'low', 'moderate', 'high', 'very high' and 'extreme'.

The subject area has typical geomorphic characteristics of a colluvial (loose, unconsolidated sediments) and erosional (wearing away) soil landscapes. Generally, erosional landscapes are the source of soil materials deposited in a receiving colluvial landscape. Colluvium generally accumulates as gently sloping aprons or fans, either at the base of or within gullies and hollows on hill slopes down gradient.

Soil erosion hazards refer to the susceptibility of a parcel of land to the prevailing components of erosion. The 'Soil Loss Class' is a measure of erosional hazard that underpins the erosional control aspects of the *Managing Urban Stormwater: Soils and Construction* document (Landcom, 2004) listed for each soil landscape in Table 2.

Following assignment of a soil loss class, soil erodibility is assessed. Soil erodibility is a measure of the susceptibility of individual soil particle to detach and transport by rainfall and runoff. The K-factor range for soil landscapes within the subject area is 0.025 to 0.046. In general, the Hawkesbury, Lambert and Oxford Falls soil landscape groups are recognised as having a higher susceptibility to erosion than the other soil landscapes groups within the subject area.

Rainfall erosivity is another factor determining the soil loss class. Rainfall erosivity is a measure of the ability of rainfall to cause erosion. It is the product of two components: total energy and 30 minute intensity for each storm. In NSW it varies from 750 in western parts of the state to over 10,000 in on part of the north coast. The R-factor for Ingleside is 4000. Slopes exceeding 7% are considered high erosional risk in accordance with *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004).

The annual rainfall distribution for Sydney area is seasonably variable. Given categorisation of the subject area as a high erosion risk, scheduling of construction activities during February and March (up to six months of the year in areas with higher soil loss classes) would require special measures in addition to best management practise is applied all year round.

High erosion hazard implies that significant erosion could occur during development of the particular land use and that appropriate erosion control measures would be needed to minimise long-term erosion risk. Control of short term erosion could be provided by simple soil conservation measures but long-term erosion control would involve intensive measures.

Very high erosion hazard implies that significant erosion could occur during development and after land use is established, even with intensive soil conservation measures. This category of erosion hazard infers that planning will need to carefully consider the balance between the probability of long term erosion damage and maintenance or repair needed to ensure the ongoing viability of the land use.

Where practicable, construction programming should aim to minimise the potential for soil loss by condensing the time from the beginning of land disturbance activities to rehabilitation to less than six months, subject to a detailed risk assessment. Further, on lands with a very high erosion hazard:

- (i) Attempt to confine specific land disturbance to those times of the year when the rainfall erosivity is low; or
- (ii) Show specific measures within Site Environmental Management Plans to address the high erosion hazard.

Erosion mitigation aims to reduce the severity of erosion should it occur. Erosion mitigation is a general term used to embrace all those activities, aimed at the control of soil erosion and the reduction of its impact on all forms of land use.

Table 2: Urban development limitations.

Soil Type	Limitations
Somersby	Localised permanently high water tables, areas of laterite and stony soil, very low soil fertility, highly permeable soil and slightly reactive <u>Soil Loss</u> 58 t/ha for topsoil and 162 t/ha for subsoil
Oxford Falls	Very high soil erosion hazard , perched water tables and swamps, highly permeable soil, very low to low soil fertility, localised rock outcrop. Moderately reactive <u>Soil Loss</u> 91 t/ha for topsoil and 131 t/ha for subsoil
Hawkesbury	Extreme soil erosion hazard , mass movement (rock fall) hazard, steep slopes, rock outcrop, shallow, stony, highly permeable soil, low soil fertility. Slightly reactive <u>Soil Loss</u> 109 t/ha for topsoil and 394 t/ha for subsoil
GyMEA	Localised steep slopes, high soil erosion hazard, rock outcrop, shallow highly permeable soil, very low soil fertility. Slightly reactive <u>Soil Loss</u> - 19 t/ha for topsoil and 464 t/ha for subsoil
Lambert	Very high soil erosion hazard , rock outcrop, seasonally perched water tables, shallow, highly permeable soil, very low soil fertility. Slightly reactive <u>Soil Loss</u> 17 t/ha for topsoil and 197 t/ha for subsoil

2.9 On-site Sewage Management

SMEC undertook an On-Site Effluent Assessment for the Ingleside Release Area (2015). The assessment found that the soil landscapes within the Wirreanda Valley and Bayview Heights areas present a number of soil-related environmental constraints. Soil depths of less than 0.6 metres to bedrock may not have enough capacity to filter nutrients and pathogens. Shallow soil often has a highly variable depth, and incurs a risk of effluent surfacing near the

land application area. Any decisions about the on-site management of sewage should consider these issues.

Soil landscapes in the broader subject area can be typically <0.5 metres in the Hawkesbury, Gymea and Lambert soil profile and can present wide sandstone benches on side slopes and with associated rock outcrops. These soil landscapes are characterised by low water holding capacity, low to very low cation exchange capacity (CEC), and low nutrient status. They can be seasonally waterlogged with connected seepage areas and may also seasonally feed into hillside wetlands. Soil depths to bedrock can marginally increase in the Somersby and Oxford Falls soil landscapes with ranges of 0.5–1.0 m.

It is important that on-site sewage management issues are addressed as early as possible in the planning and development process as existing and proposed on-site sewage management within the subject area has potential to impact on the natural and managed parts of the water cycle through pollution of ground and surface waters with pathogens and nutrients. Moderate soil limitations can sometimes be overcome by appropriate selection, design, and sizing of on-site systems, or by modifying the site.

Ideally, the assessment proceeds from a broad evaluation and desktop analysis to more detailed subdivision survey work. It is recommended that individual lots may be required to undertake a specific site evaluation at the development application stage which may eliminate areas not suitable for on-site sewage management.

2.10 Salinity

The *Soil Landscapes of the Sydney 1:100 000 Sheet*, (Table 4.3 Soil Limitations for Each Soil Material) identifies that there is no known occurrence of salinity within any of the soil units (Somersby, Oxford Falls, Hawkesbury, Gymea and Lambert) mapped within the subject area.

Further discussion on the salinity characteristics of the subject area is provided in Section 3 of this report.

2.11 Acid Sulfate Soil Risk

Acid sulfate soils (ASS) are acidic soil horizons (layers) resulting from the aeration of soil materials rich in iron sulfides. ASS generally occur within the following environments:

- Marine or estuarine sediments deposited during the Holocene period.
- Soils environments <5 metres above sea level.
- Marine or estuarine settings/environments.

The *Soil Landscapes of the Sydney 1:100 000 Sheet*, (Table 4.3 Soil Limitations for Each Soil Material) identifies that there is no known occurrence of ASS within any of the soil units (Somersby, Oxford Falls, Hawkesbury, Gymea and Lambert) mapped within the subject area.

Given the mapped soils units and elevation of the subject area (generally >100 m above sea level) ASS are not considered to present a risk within the subject area.

Figure 3, Appendix A identifies the areas within the vicinity of the subject area where ASS are known to occur.

3 SALINITY ASSESSMENT

In order to determine the potential for salinity within the subject area, surface soils were collected and analysed during the site inspection within the subject area. Sampling locations were identified on a subjective basis. It is noted that sampling activities were conducted prior to the revision of the subject area. As such only samples obtained from within the revised subject area are discussed in the following sections.

3.1 Assessment Criteria

Soil salinity is commonly assessed with respect to EC of a 1:5 soil:water extract (EC 1:5). This value can be converted to EC_e (electrical conductivity of a saturated extract) by multiplication by a factor dependent on soil texture ranging from 6 for shale to 17 for sand.

Hazelton and Murphy (2007) classify soil salinity on the basis of EC_e and describe the following salinity classes for assessing soil salinity:

- 'Non saline': <2 mS/cm
- 'Slightly saline': 2-4 mS/cm
- 'Moderately saline': 4-8 mS/cm
- 'Very saline': 8-16 mS/cm
- 'Highly saline': >16 mS/cm

The adopted soil salinity assessment criteria are presented in Table D3, Appendix D.

3.2 Subject area Investigation and Methodology

The principal question of the investigation is to assess the potential risks posed by soil salinity with the subject area. All sampling design plans and fieldwork were undertaken by suitably qualified, trained and experienced personnel in general accordance with the Department of Land and Water Conservation, *Site Investigations for Urban Salinity*, Sydney, 2002.

Due to constraints around site access within the subject area, limited surface soil sampling was conducted at assessable public locations within the subject area only. Samples obtained were analysed for EC, pH, sulfate and chloride.

All surface soil samples were collected using a stainless steel trowel. The sample was then transferred directly from the trowel in to laboratory supplied sample jars. New disposable nitrile gloves were worn for the collection of each sample and the trowel was decontaminated with a phosphate free detergent (Decon 90) between each sample location.

3.3 Site Assessment

Visual evidence of soil salinity was not observed throughout the subject area during the limited field investigations.

All soil samples collected and analysed were surface or near-surface soil samples obtained from approximately 0.0-0.2m.

The field texture of the soil samples collected ranged from orange brown clayey sands to dark grey silty clays.

The locations of the salinity soil samples collected within the subject area are presented in Figure 8, Appendix A.

3.4 Quality Control and Quality Assurance (QAQC)

All fieldwork was performed by suitably qualified subcontractors in accordance with SMEC's standard operating procedures.

All samples were collected directly into laboratory supplied sample jars. To avoid potential cross-contamination a clean pair of nitrile gloves was worn prior to the collection of each sample. All equipment that came into contact with multiple sample locations was decontaminated with Decon 90 and rinsed prior to use at each location.

All sample jars were filled with sample directly from a stainless steel trowel and immediately placed in an ice-filled esky to keep the samples below a temperature of approximately 4°C.

A chain of custody form was completed with the sample names, sampling date and required analyses. The Chain of Custody (COC) form and the samples were then sent in a sealed esky to the NATA accredited laboratory ALS for analysis within the prescribed analyte holding times.

Analytical methods complied with NEPM and NSW EPA requirements.

The laboratory reports and certificates and COC information are provided in Appendix E.

A total of 72 soil samples were collected from within the subject area and analysed for salinity by the primary laboratory. Two intra-laboratory blind duplicate soil samples S15/2 (S15/1) and S283 (S283/2) was also analysed ALS.

In general all Relative Percent Differences (RPD's) for replicate samples S283/2 and S15/1 were within the recognised quality control interval of $\pm 50\%$. Some exceptions were noted (moisture, sulfate, chloride), however, it is considered that the exceptions are reflective of the heterogeneous nature of the surface material sampled.

It is therefore considered that the field duplicate/laboratory QA/QC is adequate for the purposes of this investigation.

RPD results for salinity analysis are presented in Table D4, Appendix D.

3.5 Salinity Analytical Results

Laboratory EC results were converted to ECe values using a soil class factor of 8.6 (based on the average soil type encountered).

The reported EC results range from 6 $\mu\text{S}/\text{cm}$ (0.006 mS/cm) to 214 $\mu\text{S}/\text{cm}$ (0.214 mS/cm). The converted ECe results ranged from 0.1 mS/cm to 1.8 mS/cm .

Based on the assessment criteria detailed in section 5.1, the results indicate that all soil samples analysed were $< 2 \text{ mS}/\text{cm}$ and therefore can be classified as being Non-saline.

Table D3, Appendix D presents soil analytical results for salinity analysis with comparison to the adopted salinity classes presented in Section 5.1.

3.6 Discussion Of Results

Analytical results for soil samples collected and analysed for salinity from within the subject area indicate that all soil samples can be classified as being Non-saline.

The reported analytical results confirm desktop information which identified that there is no known occurrence of salinity within any of the soil units (Somersby, Oxford Falls, Hawkesbury, Gynea and Lambert) mapped within the subject area (*Soil Landscapes of the Sydney 1:100 000 Sheet*, Table 4.3 Soil Limitations for Each Soil Material).

Based on the information presented above, a salinity management plan is not considered necessary and no further assessment of soil salinity within the subject area is required.

4 CONTAMINATION ASSESSMENT

4.1 Site History Review

In order to determine the potential for land contamination and particular environmental constraints in the subject area, a Stage 1 Preliminary Environmental Site Assessment (PESA) was conducted for the subject area. This included an appraisal of the potential for site contamination that may have resulted from past and present land uses to determine Areas of Environmental Concern (AEC).

In addition to the PESA a limited surface soil sampling program was also conducted at immediately assessable locations within the subject area. It is noted that sampling activities were conducted prior to the revision of the subject area. As such only samples obtained from within the revised subject area are discussed in the following sections.

The methodology for the site history assessment of the subject area consisted of the following:

- Review of past and present aerial photographs obtained from the NSW Department of Lands. Aerial Photographs from 1930, 1947, 1965, 1978, 1991, and 2014 were reviewed to determine potential past/present contaminating activities.
- Database search of registered groundwater bores within the subject area via the NSW Natural Resource Atlas online resource.
- Identification of the subject area, including location of surrounding infrastructure, area, boundaries, and a review of the physical site setting including regional and local geology, hydrology and hydrogeology.
- Database search of EPA contaminated land record and public record for licences, applications and notices.
- Database search of EPA environment protection licences, applications, notices, audit or pollution studies and reduction programs.
- A desktop review of information relevant to the history of sites within the subject area to determine past and present land uses.
- A site inspection on 16 July 2014 by a SMEC environmental scientist to visually assess present and past potentially contaminating activities, current landforms and site condition.

Aerial imagery dated between 1930 and 2012 was reviewed to assess major changes to land use within the subject area.

Table 3 lists the historical aerial photographs that were obtained and the review observations.

Appendix C presents the aerial images summarised within Table 3.

Table 3 Summary of Historical Aerial Photograph Information

Year	Site Description and Surrounding Area	Potential (AEC)
<p>6 March 1930 Sydney Survey Run 1 - 12 B/W Scale 1:22,000</p>	<p>Minimal development appears to have occurred within the release area prior to the 1930s. The main exceptions occur within the south and south-east of the subject area where a number of roads and small farm/agricultural developments are visible.</p> <p>A parcel of cleared land (square in appearance) is visible within the north-eastern portion of the subject area. The cleared area appears to be in the general vicinity of the present day location of Bayview Heights Estate.</p>	<p>Areas developed as small farm/agricultural holdings within the South and South-eastern portion of the subject area.</p> <p>Cleared area towards north-eastern tip of the subject area.</p>
<p>Jan 1947 Broken Bay, Runs 39 and 40 B/W Scale 1:12,000</p>	<p>Other than the development of additional farm/agricultural type developments within the south and south-west of the subject area; there is little change in comparison to the 1930 image.</p> <p>The cleared area towards north-eastern tip (visible in the 1930 image) is no longer visible in the 1947 image.</p>	<p>Areas developed as small farm holdings / market gardens / nurseries within the South and South-eastern portion of the subject area.</p>
<p>23 September 1965 Cumberland Run 12E and 13E B/W Scale 1:2,200</p>	<p>The southern portion of the release area has been further developed. More lots appear to have been developed for agricultural type activities. Many of the plots (particularly within the center and south-eastern sections of the subject area) contain long rectangular greenhouse/shed type structures assumed to be related to farming or nursery operations. The golf course (Monash Country Club) has also been developed within the southern section of the release area.</p> <p>There are a few additional developed lots within the northern and central portions of the release area, that from appearance are assumed to be small farm/agricultural developments and a large area of scaring/cleared land is visible within the northern tip which is presumed to be the development of the Bayview Heights Estate.</p> <p>Some development has occurred within the north-western section of the subject area. Several roads have been developed since 1947 and there is evidence of land clearance activities, however the nature of the land use is difficult to determine.</p> <p>Construction of the Baha'i Temple is visible within the image.</p>	<p>Areas developed as small farm holdings / market gardens / nurseries within the North, Central, South and South-eastern portions of the subject area.</p>

Year	Site Description and Surrounding Area	Potential (AEC)
<p>29 March 1978 Cumberland Run 7 and 8 B/W Scale 1:16,000</p>	<p>Other than the development of some additional farming/agricultural plots and rural properties throughout the subject area; there appears to be little obvious change in comparison to the 1965 image.</p>	<p>Areas developed as small farm holdings / market gardens / nurseries, Septic effluent systems on rural properties throughout the subject area.</p>
<p>14 August 1991 Sydney Run 5 Colour Scale 1:25,000</p>	<p>Obvious changes from the 1978 image include:</p> <ul style="list-style-type: none"> - Development of light industrial activities (Sophie Ave, etc.). - Scarring/land clearance evident (potential quarry locations) east and west of Wirreanda Rd North, Bungendore St, Addison Rd, on the northern side of Powder Works Rd near Wilson Ave (present day Council works depot) and on the northern side of Lane Cove Rd at the intersection with View Rd - Construction of water tower on Wattle Rd. 	<p>Areas developed as small farm holdings / market gardens / nurseries, Septic effluent systems on rural properties throughout the subject area.</p> <p>Lots developed for light industrial activities throughout the subject area (Sophie Ave, etc.).</p> <p>Potential quarry locations and fill materials.</p>
<p>2012 Bing Maps Colour Scale Unknown</p>	<p>Other than the development of some additional rural properties throughout the release area; there appears to be little obvious major change in comparison to the 1991 image.</p>	<p>Areas developed as small farm holdings / market gardens / nurseries, Septic effluent systems on rural properties throughout the subject area.</p> <p>Lots developed for light industrial activities throughout the subject area (Sophie Ave, etc.)</p> <p>Potential quarry or former quarry locations.</p>

An online search of the EPA Contaminated Land Records Database (<http://www.epa.nsw.gov.au/prclmapp/searchregister.aspx>) was conducted on 24 June 2014. No notice records or management notices were identified for any site within the subject area. In addition, no records were held in relation to the land within a one kilometre radius of the subject area as at the search date.

An online search of the EPA Protection of the Environment Operations Act public register (<http://www.epa.nsw.gov.au/prpoeoapp>) was conducted on 24 June 2014. No environment protection licences, applications, notices, audits or pollution studies and reduction programs were identified for any site within the subject area. In addition, no environment protection licences, applications, notices, audits or pollution studies and reduction programs were identified for any site within a one kilometre radius of the subject area as at the search date.

No historical environmental reports were reviewed by SMEC in relation to the subject area for this report.

4.2 Site Inspection

A SMEC environmental scientist conducted a visual site inspection on 16 July 2014. Due to site access limitations, the site inspection consisted of observations from public roads and visual inspection to determine potential AEC and to field check desktop information.

The purpose of the visual site inspection was to gather non-invasive data to support the conceptual understanding of the spatial extent of historic and contemporary activities within the subject area.

The site inspection was undertaken to try to identify, locate and map the following surface features where they existed within the subject area:

- Disturbed ground possibly in the form of trenches or mounds.
- Illegal waste disposal, including domestic rubbish and building rubble (including asbestos fragments and sheets).
- Unnatural changes in vegetation (including evidence of cleared ground or vegetation potentially impacted by contamination).
- Potential environmental receivers.

4.3 Risk Assessment of AECs

A level of low, medium or high risk from a contamination perspective has been assigned based on qualitative judgment from observations made during the site inspection, information obtained during the desk top review and the extent of the proposed works for the proposed rezoning. Table 4 summarises the risk criteria developed to assess the AECs.

Table 4: Summary of Risk Criteria for AECs

Risk	AEC Risk Assessment Criteria
Low	Low potential of residual soil and/or groundwater contamination to exist within the extent concept proposal footprint. Low probability of engaging any potential contaminated land associated with identified AEC due to extent of proposed works.
Medium	Medium potential of residual soil and/or groundwater contamination to exist within the extent concept proposal footprint. Contaminated soil and / or groundwater associated with identified AEC may be engaged due to the extent of the proposed works.
High	High potential of some level of residual soil and/or groundwater contamination to exist within the extent concept proposal footprint. Contaminated soil and / or groundwater associated with identified AEC are likely to be engaged due to the extent of the proposed works. Further investigations recommended.

It should be noted that while the risk ranking system categorises the various AECs as ‘high’ to ‘low’ risk, this does not indicate that contamination has or has not occurred. Rather, it highlights the need that further assessment may be required. Further data would give greater confidence on these risk levels.

4.4 Potential AEC Within Subject area

Given the general history of land use within the subject area it is expected that any identified contamination would likely to be limited to relatively localised areas.

Table 5 presents the general high level AEC, potential impacts, risk rating and contaminants of concern within the subject area from a contamination perspective.

Figure 7, Appendix A identifies the AEC within the subject area from a contamination perspective.

Table 5 Potential AEC within Subject area

AEC	Potential High Level Impacts	Risk	Potential Contaminants of Concern
Uncontrolled Fill Material	Potential impacts to soil (and groundwater). The potential exists that contaminated heterogeneous fill material may have been used either within subsurface strata (i.e. used as backfill for lots to level sites) or stockpiled on lots within the subject area.	Medium	Metals (8) arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn), PAHs, Total Petroleum Hydrocarbons (TPH), Benzene, toluene, ethylbenzene and xylene (BTEX), Polycyclic Aromatic Hydrocarbons (PAHs) Polychlorinated biphenyls (PCB), Organochlorine and Organophosphorous Pesticides (OCP& OPP), and asbestos
Industrial facilities and Vehicle/Equipment Maintenance	Potential impacts to soil (and groundwater). The potential for petroleum hydrocarbon impacts exists as a result of vehicle / equipment maintenance activities being conducted within the subject area particularly on commercial / industrial lots within the subject area.	Medium	Metals – lead (Pb), solvents, Volatile Organic Hydrocarbons (VOC), PAHs, TPH, BTEX
Small farm holdings / market gardens and nurseries	Potential soil (and groundwater) impacts - The potential exists that OCC and OPP pesticides and herbicides may have been used particularly on small farm holdings / market garden and nursery lots within the subject area.	High	OCP & OPP Pesticides
Existing Buildings and Site Structures	Potential soil impacts - The potential exists that older site structures throughout the subject area may contain a variety of contaminated materials including PCBs within electrical fittings, lead based paints, Synthetic Mineral Fibers (SMF) and Asbestos based products.	High (for structures built prior to 1986)	PCBs, Lead (paint), Synthetic Mineral Fibers (SMF) and Asbestos
Septic effluent	Potential soil (and groundwater) impacts –	Medium	Fecal coliforms, Various

AEC	Potential High Level Impacts	Risk	Potential Contaminants of Concern
systems	The potential exists that Septic effluent systems will be located throughout the subject area. Potential impacts relate to fecal coliforms and the use of domestic cleaning products.		metals
Fly Tipping	Potential soil impacts - The potential exists for illegal dumping on road verges and lots throughout the subject area.	Low	Metals, PAHs, TPH, BTEX, PCB, OCP, OPP and asbestos

4.5 Potential Receptors of Concern and Pathways

Based on the information available, the potential receptors include:

- Residents (existing and future), workers and general public with the subject area.
- Transient users of areas around the subject area.
- Construction workers involved in potential redevelopment of the subject area.
- Flora and fauna in areas within and around the subject area.
- Aquatic ecosystems of Wirreanda, Cicada Glen and McCarrs Creek(s) to the north and Mullet (and its tributaries), Fern, Narrabeen Creek(s) and Narrabeen Lakes to the south-east.

Based on the information available, the potential pathways include:

- Direct contact with contaminated soil and potentially groundwater.
- Ingestion or inhalation of soils and dust.
- Inhalation of vapours from soils and potentially groundwater.

4.6 Persistence in the Environment

The potential contaminants of concern identified which have a relatively high degree of persistence in the environment are:

- Asbestos.
- Lead.
- Agricultural pesticides
- VOCs
- Some PAHs.
- Longer chain hydrocarbons (ie >C29).

4.7 Assessment Criteria

Assessment criteria for the soil analytical results are discussed below. Evaluation against assessment criteria is used to identify levels of contamination that may pose ecological or health risks to existing and future users of the site.

It is noted that a new, amended National Environment Protection (Assessment of Site Contamination) Measure (NEPM) has been approved by all Australian States and Territories. The NEPM was first published in 1999 and updated in 2013 by the National Environment Protection Council (NEPC), and provides national standards for a variety of environmental issues, including the assessment of site contamination in Schedule B(1) Guideline on Investigation Levels for Soil and Groundwater.

NEPM (2013) has undertaken the development of health-based screening levels (HSLs) for petroleum hydrocarbons to address consistent human health risk in Australian conditions. The HSLs were derived through the consideration of health effects only, with particular emphasis on the vapour exposure pathway. HSLs have been derived for petroleum hydrocarbons for different land uses, media, soil types and depths to contamination.

The management limits (MLs) for TPH fractions in soil (NEPM 2013), are more conservative than the HSLs and therefore SMEC has adopted these as screening levels for TPH fractions for this investigation.

Analytical results are also compared with the NEPM (2013) provisional phytotoxicity-based ecological investigation levels (EILs) to determine potential risks to current and future ecological receptors at the site for select analytes (As, DDT, Pb, naphthalene, Cr, Cu, Ni, Zn).

The NEPM (2013) EIL values rely on site-specific inputs and calculations, and were derived specifically for sandy loam soils or soils of a closely similar texture with a pH in the range of 6 to 8. They are intended for assessment screening purpose only.

Ecological screening levels (ESLs) are relevant in terms of petroleum impacted soils where ecological receptors are present. The ESLs presented in Table 1B(6) of the NEPM (2013) are compared against various land uses for fine or coarse soil textures.

For the purpose of this investigation TPH fractions will be compared to fine soil texture for Urban Residential/Public Open Space and Commercial/Industrial land use.

As the future land-use is likely to be predominantly various residential within some commercial/industrial, the adopted assessment criteria for assessing the soil contaminants have been sourced from:

- NEPM (2013) HILs for Residential (A, B, C) and Commercial/Industrial (HIL D) for organic and inorganic chemicals.
- NEPM (2013) ESLs and MLs for TPH.
- NEPM (2013) EILs.
- For analytes in which there are no listed criteria, the laboratory Limits of Reporting (LOR) will be taken as screening level for this investigation.
- Where more than one value is listed for any particular analyte the most conservative value has been used as a screening level.

The adopted soil assessment criteria for the site are summarised in Table D1, Appendix D.

4.8 Subject Area Investigation and Methodology

The principal question of the investigation is to assess the risks posed by potential contamination for the proposed land use of the subject area for urban development.

SMEC undertook the works in accordance with a site specific Job Safety and Environmental Analysis (JSEA) Plan. The aim of the plan was to manage the potential risks to human health and safety associated with fieldwork activities.

All fieldwork was undertaken by suitably qualified, trained and experienced personnel.

Due to limitations around site access within the subject area limited surface soil sampling was conducted at assessable locations within the subject area only. All samples obtained were analysed for a broad suit of analytes including, metals (8), BTEX, TPH, OCC and OPP pesticides, PCBs and PAHs.

The locations of the contamination soil samples collected within the subject area are presented in Figure 8, Appendix A.

All surface soil samples were collected using a stainless steel trowel. The sample was then transferred directly from the trowel in to laboratory supplied sample jars. New disposable nitrile gloves were worn for the collection of each sample and the trowel was decontaminated with Decon 90 between each sample location.

4.9 Quality Control and Quality Assurance (QAQC)

All fieldwork was performed by suitably qualified subcontractors in accordance with SMEC's standard operating procedures.

All samples were collected directly into laboratory supplied sample jars. To avoid potential cross-contamination a clean pair of nitrile gloves was worn prior to the collection of each sample. All equipment that came into contact with multiple sample locations was decontaminated with Decon 90 and rinsed prior to use at each location.

All sample jars were filled with sample directly from a stainless steel trowel and immediately placed in an ice-filled esky to keep the samples below a temperature of approximately 4°C.

A chain of custody form was completed with the sample names, sampling date and required analyses. The Chain of Custody (COC) form and the samples were then sent in a sealed esky to the NATA accredited laboratory ALS for analysis within the prescribed analyte holding times.

Analytical methods complied with NEPM and NSW EPA requirements.

The laboratory reports and certificates and Chain of Custody (COC) information are provided in Appendix E.

A total of 12 soil samples were collected from within the subject area and analysed for contaminants of concern by the primary laboratory. Two intra-laboratory blind duplicate soil samples S15/2 (S15/1) and S283 (S283/2) was also analysed ALS.

In general all Relative Percent Differences (RPD's) for replicate samples S283/2 and S15/1 were within the recognised quality control interval of $\pm 50\%$. Some exceptions were noted for some metals analytes and TPH fractions, however, it is considered that the exceptions are reflective of the heterogeneous nature of the surface material sampled.

It is therefore considered that the field duplicate/laboratory QA/QC is adequate for the purposes of this investigation.

RDP results for contamination analysis are presented in Table D2, Appendix D.

4.10 Contamination Analytical Results

All soil samples were surface soil samples obtained from approximately 0.0 -0.2m. The soil samples ranged from orange brown clayey sand to dark grey clayey silty sand. Soil analytical results obtained from the subject area were compared to the adopted site criteria.

Results indicate the following for soils respective to the criteria:

- No soil sample obtained from within the subject area exceeded the adopted site assessment criteria.

Other soil analytical results indicated that:

- Metals (8) concentrations were below the site assessment criteria for all samples analysed.
- Concentrations of PAH analytes, TPH and BTEX were generally either below their LOR or below the adopted site criteria in all samples analysed. The only exceptions were:
 - PAHs (sum of total 1.3 mg/kg), TRH C₁₀-C₄₀ (210 mg/kg) and TPH C₂₉-C₃₆ (100 mg/kg) were detected at levels either equal to or marginally above the LOR (but below site assessment criteria in sample S164. The sample was obtained from an undeveloped bush lot. The minor levels of PAH and hydrocarbons detected are probably reflective of residual oils from eucalyptus vegetation and combusted organics associated with bush fire ash likely to be in the area; and
 - OC Pesticides (DDE 0.13 mg/kg) were detected at levels marginally above the LOR (but below site assessment criteria in sample S38. It is noted sample S38 was obtained from within the vicinity of Powder Works Nursery located on Wilson Avenue.
- Remaining, OCP, OPP, PCB and phenol concentrations were below their LOR or below the adopted site criteria in all samples analysed.

Table D1, Appendix D presents soil analytical results for contamination analysis with comparison to the adopted site assessment criteria.

4.11 Summary of Contaminated Lands

Land contamination is most often the result of past land uses. It can arise from activities that took place on or adjacent to a site and be the result of improper chemical handling or disposal practices, or accidental spillages or leakages of chemicals during transport or storage. Activities not directly related to a site may also cause contamination; for example, from diffuse sources such as polluted groundwater migrating under a site or dust settling out from industrial emissions. All construction activities prior to 1986 have the potential for asbestos-containing materials (ACM) to be present.

Due to the high level nature of this investigation it is recommended that the contamination status of individual sites should be assessed as part of any future development application (DA) process. This may require further assessment of soil and groundwater conditions.

The findings of the preliminary soil contamination survey indicate soil qualities within the survey area are low risk for contamination. Localised contamination issues are likely to be associated with landfilling associated with cut and fill building pads, quarrying activities, construction equipment handling yards, and agricultural activities like nursery and market gardens where buildings are likely to contain asbestos sheeting in their construction. It is likely that underground utilities contain asbestos materials within service conduits and communications pits.

There is the potential for contaminated land to be disturbed by construction activities associated with ground engaging activities required for the proposed development of the subject area.

Potential environmental impacts associated with the proposal in relation to contaminated land management include:

- Increasing waste amounts from improper practices such as poor fill management.
- Contaminated or hazardous waste not being correctly disposed of.
- Adverse effects on human health (construction personnel, travelling public or nearby communities).
- Release of contaminants to underlying soils.
- Release of contaminants to groundwater.
- Movement of contaminated sediments into waterways.
- Adverse effects on flora and fauna.

Given the expected depth of groundwater in the vicinity of the subject area, it is considered unlikely that groundwater would be directly intercepted. During development, groundwater quality may be affected if recharge water carries pollutants generated from the proposal construction work. Sources of potential pollution could include nutrient rich water generated from nurseries, on-site sewage management systems, drainage from contaminated soil stockpiles or from spills of fuels, oil or other chemicals used in historical land uses.

5 CONCLUSIONS AND RECOMMENDATIONS

The following sections summarise the conclusions of the land capability, salinity and contamination assessment and the recommendations arising from the investigation.

5.1 Land Capability Assessment

The Land Capability Assessment included a site inspection at slope risk analysis of 10 previously delineated set zones within the Ingleside precinct to identify slope characteristics, identify current and potential slope failure mechanisms to inform a slope risk assessment and categorise slope mechanisms in accordance with the Landslide Risk Management guidelines by Australian Geomechanics Society (AGS, 2007). Appendix F outlines the risk analysis framework.

Based on the findings of the risk analysis it has been established that the tolerable risk to future development for the identified slope failure mechanisms has not been met, as the risk for the ten sites inspected within the precinct is classed as moderate. The report presenting the slope risk analysis undertaken within the precinct is contained in Appendix F. Recommendations to reduce the risk to tolerable levels may include; scaling the slope, installation of rock bolts and consideration of development location. These risk analyses were based on high level observations. The analysis is conservative because comprehensive and detailed geological mapping of the site was not possible. As such it should be noted that there may be other active or potential slope mechanisms that were not identified. The location and proximity of any future development to an identified slope failure mechanism will potentially alter the calculated risk level.

On this basis it is recommended that for any site development a specific slope stability assessment should be undertaken to assess the slope risk based on a detailed site inspection or investigation.

The subject area is considered to present as a high erosion hazard due to the typical characteristics of a colluvial and erosional soil landscapes combined with high rainfall intensity which can generate high soil loss. This high erosional hazard implies that significant erosion will occur during development and after land use is established, even with intensive soil conservation measures. Erosion hazards will need to be considered at the development application stage. Where practicable, construction programming should aim to minimise the potential for soil loss by condensing the time from the beginning of land disturbance activities to rehabilitation. This study indicates that the regional groundwater flow direction is expected to generally flow to the north-east in accordance with the general site topography with localised variations in areas located nearer to water bodies and creek lines. Local groundwater can occur at depths ranging from 10-20 m bgl and regional groundwater are likely to be deeper at 100-200 m bgl. Water quality information contained within the bore logs is limited; however, information that is provided identifies salinity characteristics as good, which indicates reasonable water quality and non-saline groundwater conditions are likely. The limited soil samples collected and analysed for salinity also indicate a 'Non-saline' classification for soils.

5.2 On-Site Sewage Assessment

SMEC undertook an On-Site Effluent Assessment for the Ingleside Release Area (2015). The assessment found that the soil landscapes within the Wirreanda Valley and Bayview Heights areas present a number of soil related environmental constraints for on-site effluent systems. Soil depths of less than 0.6 metres to bedrock may not have enough capacity to filter nutrients and pathogens. Shallow soils often have a highly variable depth, and incur a

risk of effluent resurfacing near the land application area. Any decisions about the on-site management of sewage should consider these impacts. It is recommended that individual lots may be required to undertake a specific site evaluation at the development application stage which may eliminate areas not suitable for on-site sewage management.

5.3 Salinity Assessment

With regard to the salinity investigation, the following is concluded:

- There is no known occurrence of salinity within any of the soil units (Somersby, Oxford Falls, Hawkesbury, Gymea and Lambert) mapped within the subject area.
- All soil samples obtained and analysed from the subject area were <2 mS/cm and therefore classified as being non-saline.

Based on the information presented above, a salinity management plan is not considered necessary and no further assessment of soil salinity within the subject area is required.

5.4 Contamination Assessment

With regard to the contamination investigation, the following is concluded:

- The subject area contains a number of existing land uses including recreational, private residential, commercial/industrial, schools, hobby farms and nursery related uses.
- The subject area comprises 5 soil landscapes: Gymea, Oxford Falls, Hawkesbury, Somersby, Lambert.
- There is no known occurrence of acid sulfate soils within any of the soil units (Somersby, Oxford Falls, Hawkesbury, Gymea and Lambert) mapped within the subject area. Given the mapped soils units and elevation of the subject area (generally >100m above sea level) ASS are not considered to present a risk within the subject area.
- No soil sample obtained from within the subject area exceeded the adopted site assessment criteria.
- OC pesticides (DDE 0.13 mg/kg) were detected at levels marginally above the LOR (but below site assessment criteria) in sample S38. The sample was obtained from within the vicinity of Powder Works Nursery located on Wilson Avenue.
- PAHs (sum of total 1.3 mg/kg), TRH C10-C40 (210 mg/kg) and TPH C29-C36 (100 mg/kg) were detected at levels either equal to or marginally above the LOR (but below site assessment criteria) in sample S164. The sample was obtained from an undeveloped bush lot. It is assumed that the minor levels PAH and hydrocarbons detected are probably reflective of vehicle emissions within the area.
- Potential high level AEC, from a contamination perspective, that could exist throughout the subject area include:
 - The use of uncontrolled fill material.
 - Industrial facilities and vehicle / equipment maintenance.
 - Small farm holdings / market gardens and nurseries.
 - Existing buildings and site structures.
 - Septic effluent systems.
 - Fly tipping.

- Given the general history of land use within the subject area it is expected that any identified contamination would likely to be limited to relatively localised areas.

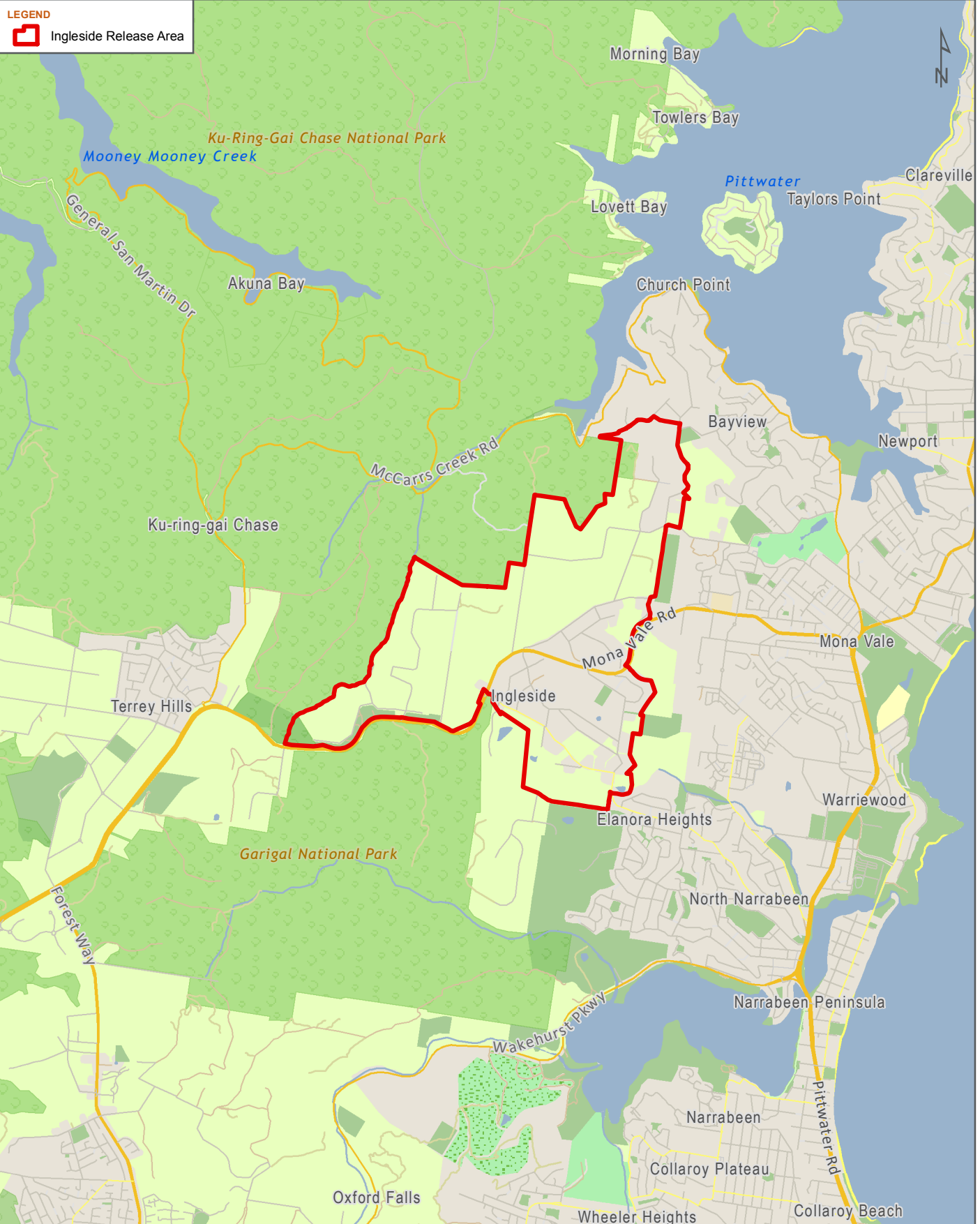
With regard to the contamination investigation, the following is recommended:


- The contamination status of each site should be further assessed as part of any future DA process. This may require further assessment of soil and groundwater conditions.
- A Remediation Action Plan should be developed to manage potential sources of contamination should they be identified during additional investigation stages.

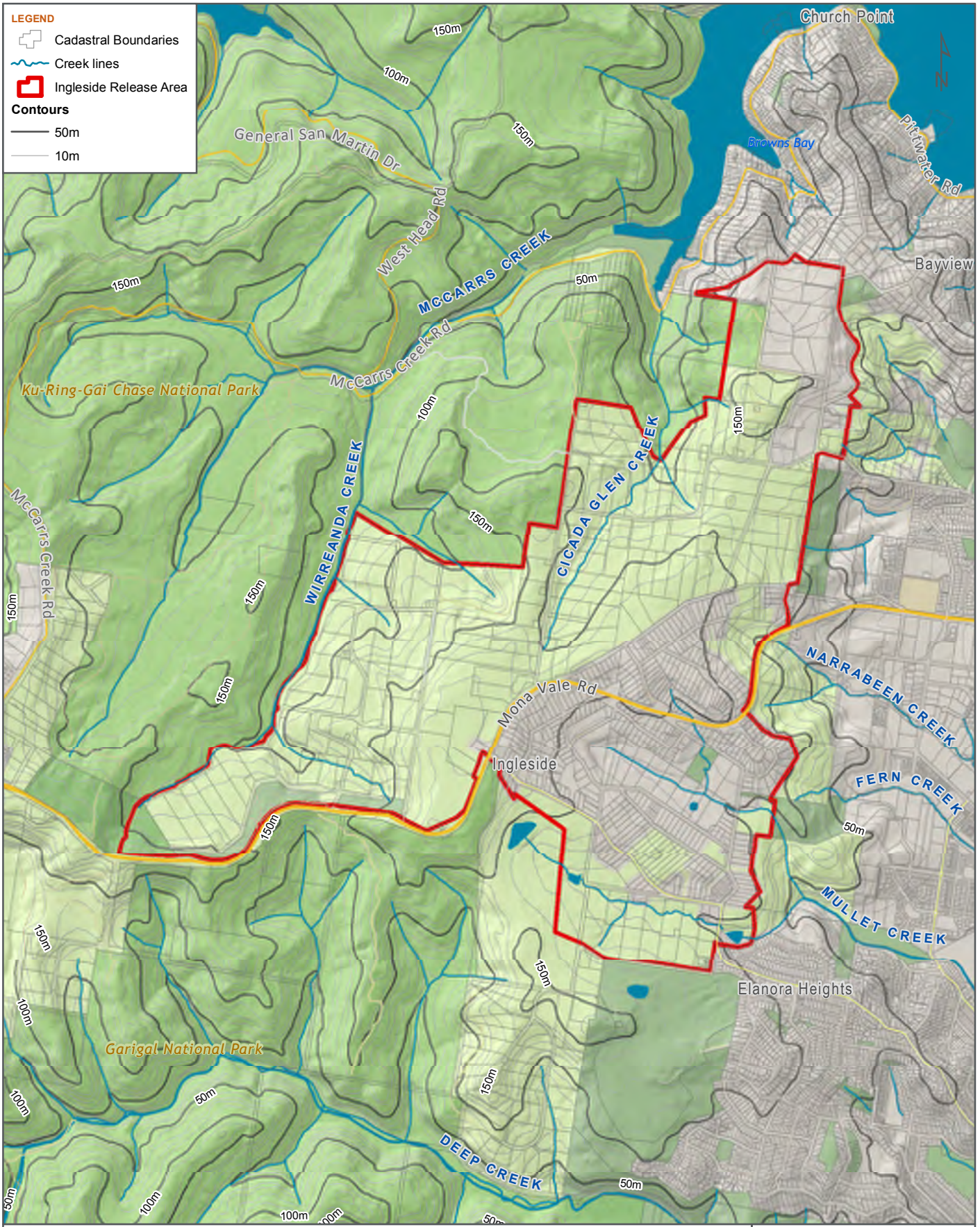
6 REFERENCES

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APPENDIX A – FIGURES



DATE 04/08/2014		PAGE SIZE A4	COORDINATE SYSTEM GDA 1994 MGA Zone 56	 © SMEC Australia Pty Ltd 2014. All Rights Reserved <small>Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, this map contains data from a number of sources - no warranty is given that the information contained on this map is free from error or omission. Any reliance placed on such information shall be at the sole risk of the user. Please verify the accuracy of all information prior to using it. This map is not a design document.</small>
FIG NO. 1	FIGURE TITLE Site location			
PROJECT NO. 30012289	PROJECT TITLE Ingleside Precinct			
CREATED BY R. Chatfield	SOURCES Vector backdrop data © MDS 2013			



LEGEND

- Cadastral Boundaries
- Creek lines
- Ingleside Release Area

Contours

- 50m
- 10m

DATE 05/08/2014 0 100 200 400 600 800 1,000 PAGE SIZE A4 COORDINATE SYSTEM
 1:30,000 Metres GDA 1994 MGA Zone 56

FIG NO. 2 FIGURE TITLE Topography and Creek lines

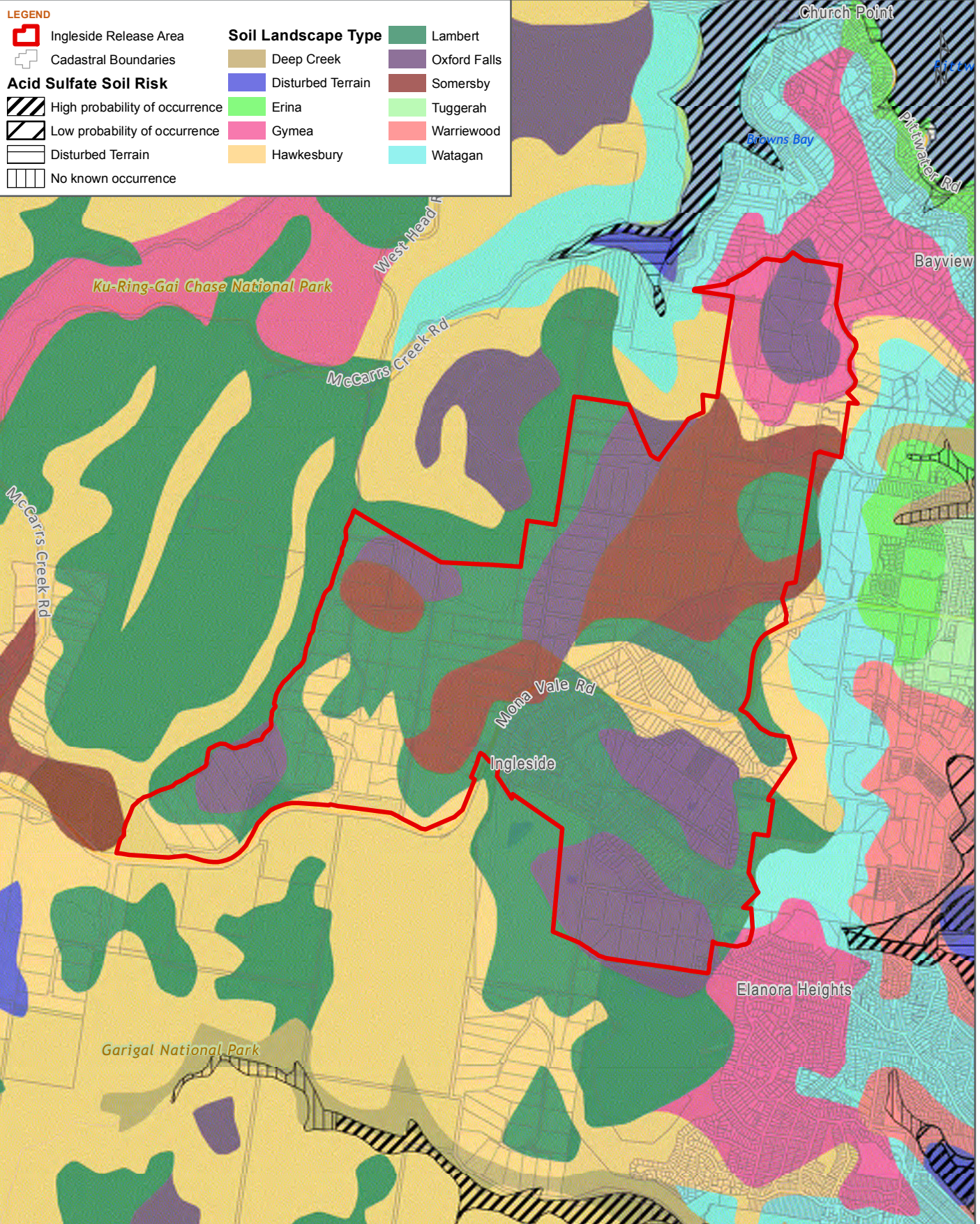
PROJECT NO. 30012289 PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield SOURCES Vector backdrop data © MDS 2013

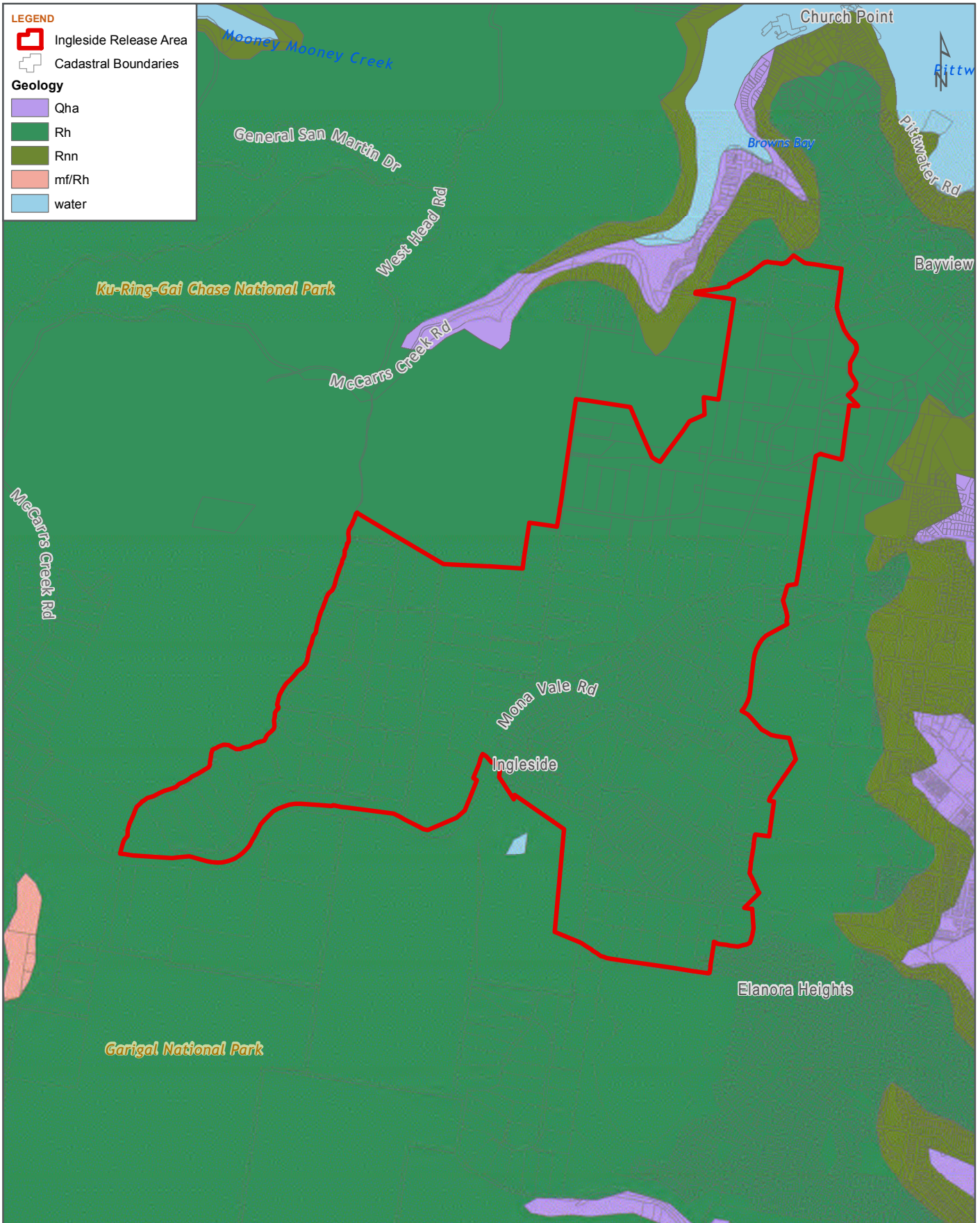



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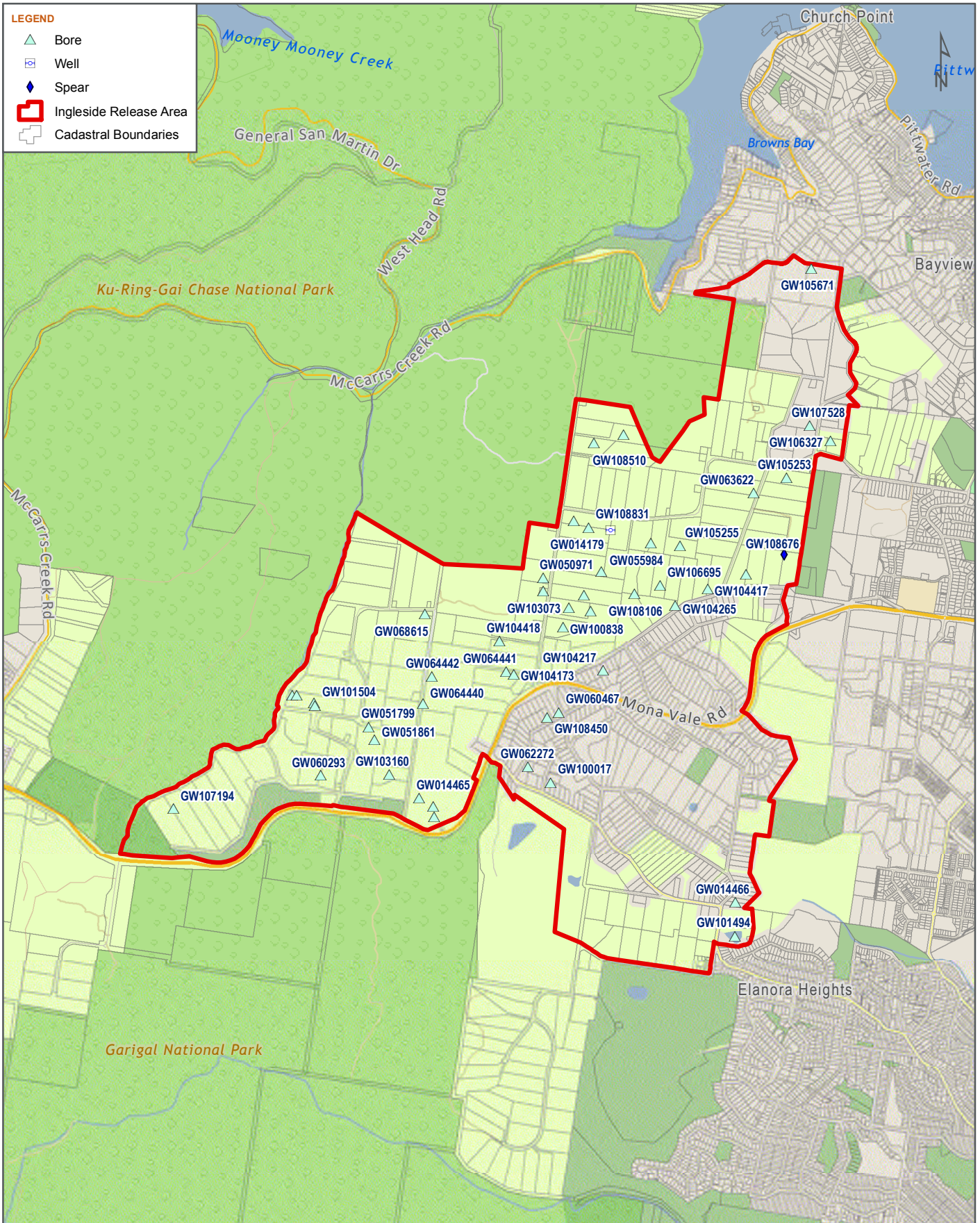
Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, this map contains data from a number of sources - no warranty is given that the information contained on this map is free from error or omission. Any reliance placed on such information shall be at the sole risk of the user. Please verify the accuracy of all information prior to using it. This map is not a design document.



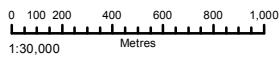
DATE 04/08/2014		PAGE SIZE A4	COORDINATE SYSTEM GDA 1994 MGA Zone 56
FIG NO. 3	FIGURE TITLE Soil Landscapes/Acid Sulfate Soil		<p>© SMEC Australia Pty Ltd 2014. All Rights Reserved</p> <p>Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, this map contains data from a number of sources - no warranty is given that the information contained on this map is free from error or omission. Any reliance placed on such information shall be at the sole risk of the user. Please verify the accuracy of all information prior to using it. This map is not a design document.</p>
PROJECT NO. 30012289	PROJECT TITLE Ingleside Precinct		
CREATED BY R. Chatfield	SOURCES Vector backdrop data © MDS 2013		



DATE 04/08/2014	0 100 200 400 600 800 1,000 1:30,000 Metres	PAGE SIZE A4	COORDINATE SYSTEM GDA 1994 MGA Zone 56
FIG NO. 4	FIGURE TITLE Geology		 <p>© SMEC Australia Pty Ltd 2014. All Rights Reserved</p> <p>Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, this map contains data from a number of sources - no warranty is given that the information contained on this map is free from error or omission. Any reliance placed on such information shall be at the sole risk of the user. Please verify the accuracy of all information prior to using it. This map is not a design document.</p>
PROJECT NO. 30012289	PROJECT TITLE Ingleside Precinct		
CREATED BY R. Chatfield	SOURCES Vector backdrop data © MDS 2013		



DATE 04/08/2014



PAGE SIZE A4

COORDINATE SYSTEM
GDA 1994 MGA Zone 56

FIG NO. 5

FIGURE TITLE Groundwater bores

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield

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LEGEND



Ingleside Release Area

Category



Stockpiles/ Quarries



Light Industrial/ Commercial



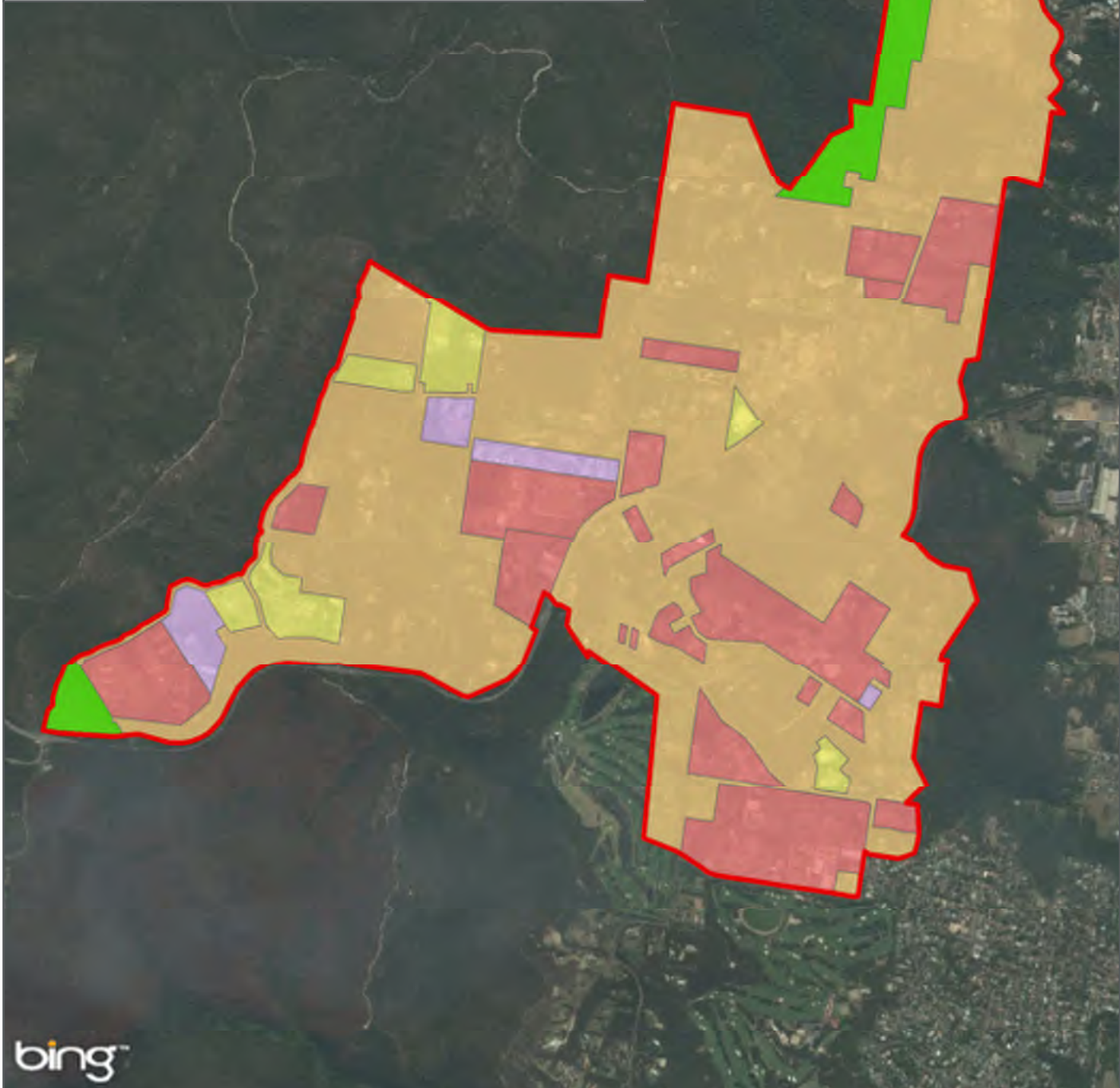
National Park



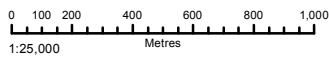
Rural / Rural Residential



Agricultural/ Market Garden/Nurseries (including historical)



DATE 21/10/2014



PAGE SIZE A4

COORDINATE SYSTEM
GDA 1994 MGA Zone 56

FIG NO. 7

FIGURE TITLE Areas of Environmental Concern (AEC)

PROPOSAL NO.

PROPOSAL TITLE Ingleside Land Capability Assessment

CREATED BY T. Rajkumar

SOURCES Vector backdrop data © MDS 2013

Bing Maps Aerial: © 2014 DigitalGlobe © 2014 GeoEye Earthstar Geographics SIO © 2014 Microsoft Corporation

Location: I:\projects\30012289 - Ingleside Precinct - Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\8_AEC.mxd



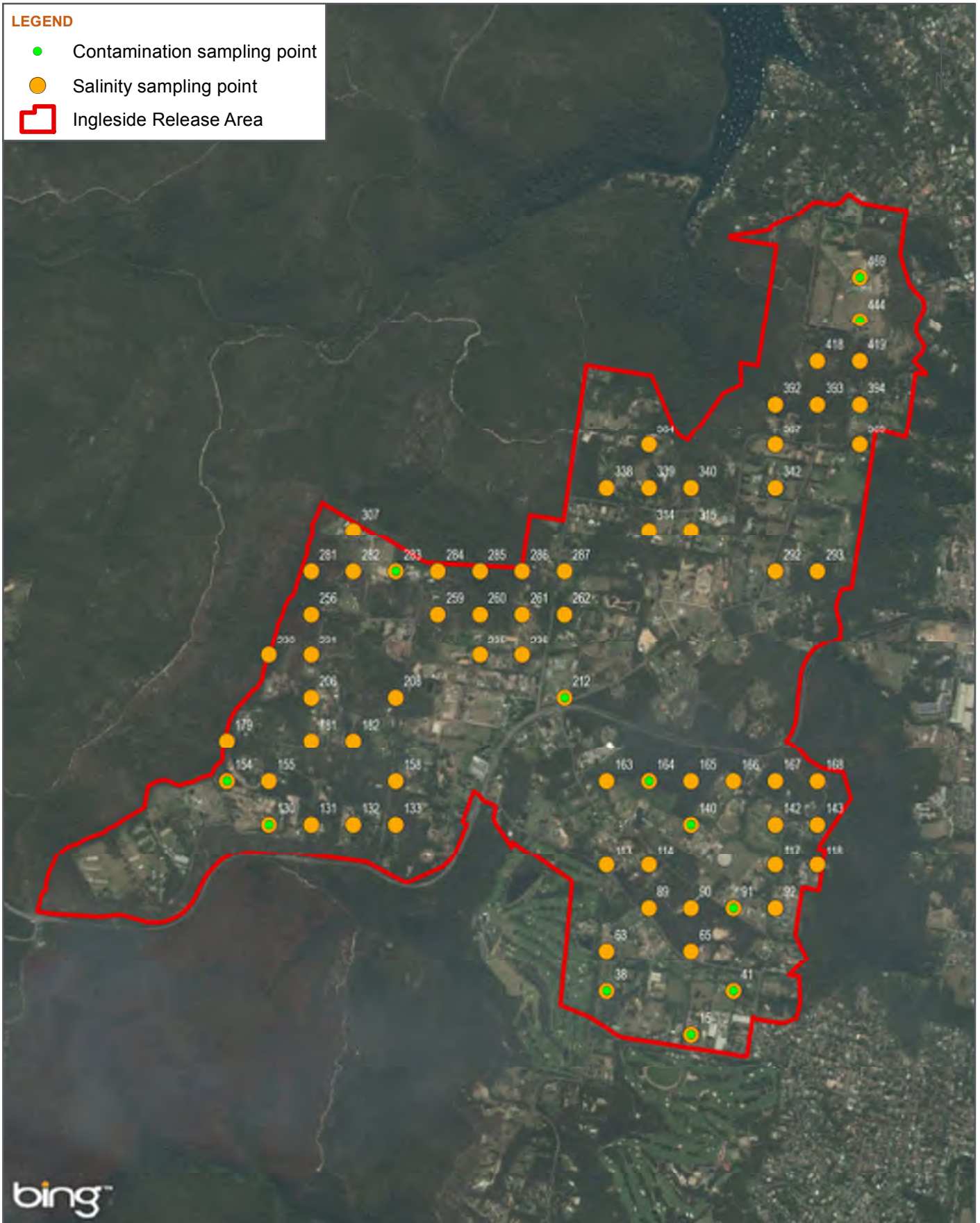
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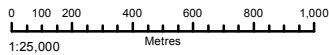
Last updated by: RC10721 on 21/10/2014 at 10:18

LEGEND

- Contamination sampling point
- Salinity sampling point
- Ingleside Release Area



DATE 20/10/2014



PAGE SIZE A4

COORDINATE SYSTEM
GDA 1994 MGA Zone 56

FIG NO. 8

FIGURE TITLE Sample location plan

PROPOSAL NO.

PROPOSAL TITLE Ingleside Land Capability Assessment

CREATED BY R. Chatfield

SOURCES Vector backdrop data © MDS 2013
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APPENDIX B – GROUNDWATER DATABASE SEARCH

NSW OFFICE OF WATER Work Summary

GW014179

Converted From HYDSYS

Licence :10BL007801

Licence Status : Active
Authorised Purpose(s)
DOMESTIC
FARMING

Intended Purpose(s)
GENERAL USE

Work Type :Well
Work Status :Supply Obtained
Construct. Method :(Unknown)
Owner Type :Private

Commenced Date : **Final Depth :** 5.30 m
Completion Date :01-Jan-1959 **Drilled Depth :** 5.30 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA :603 - SYDNEY BASIN
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
202
202

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9130-1S MONA VALE
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6272942
Easting :339549

Latitude (S) :33° 40' 17"
Longitude (E) :151° 16' 9"

GS Map :0055B3 **MGA Zone :**56

Coordinate Source :GD.,PR. MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Brick	0.00	0.20	1346			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
----------	--------	---------------	----------	------------	------------	-------------	----------------	---------------	-----------------

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.22	0.22	Loam Sandy	Loam	
0.22	5.33	5.11	Sandstone	Sandstone	

Remarks

*** End of GW014179 ***

NSW OFFICE OF WATER Work Summary

GW014464

Converted From HYDSYS

Licence :10BL009510

Licence Status :Cancelled

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

IRRIGATION

ORCHARDS (GROUNDWATER)

Work Type :Bore open thru rock

Work Status :(Unknown)

Construct. Method :Cable Tool

Owner Type :Private

Commenced Date : **Final Depth :** 33.50 m

Completion Date :01-Aug-1960 **Drilled Depth :** 33.50 m

Contractor Name :

Driller :

Assistant Driller's Name :

Property : - N/A

Standing Water Level :

GWMA :603 - SYDNEY BASIN

Salinity : (Unknown)

GW Zone : -

Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
69
7 25951

Region :10 - SYDNEY SOUTH COAST

CMA Map :9130-1S

MONA VALE

River Basin :212 - HAWKESBURY RIVER

Grid Zone :56/1

Scale :1:25,000

Area / District :

Elevation :

Northing :6271365

Latitude (S) :33° 41' 7"

Elevation Source :(Unknown)

Easting :338534

Longitude (E) :151° 15' 29"

GS Map :0055B3

MGA Zone :56

Coordinate Source :GD.,PR. MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Threaded Steel	-0.10	12.00	152			(Unknown)
1	1	Opening	Perforations		0.00	152		1	Mechanically Slotted; SL: 0mm; A: 0mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
6.00	6.00	0.00	Unconsolidated	3.00		0.03			(Unknown)
30.40	30.40	0.00	Consolidated	3.00		0.10			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	12.19	12.19	Soil Clay Water Supply	Soil	
12.19	33.52	21.33	Sandstone Water Supply	Sandstone	

Remarks

MONA VALE RD INGLESIDE

*** End of GW014464 ***

NSW OFFICE OF WATER Work Summary

GW014465

Converted From HYDSYS

Licence :10BL011016

Licence Status :Active

Authorised Purpose(s)

DOMESTIC

FARMING

Intended Purpose(s)

GENERAL USE

Work Type :Bore open thru rock

Work Status :(Unknown)

Construct. Method :Cable Tool

Owner Type :Private

Commenced Date :

Final Depth : 39.00 m

Completion Date :01-Nov-1960

Drilled Depth : 39.00 m

Contractor Name :

Driller :

Assistant Driller's Name :

Property : - N/A

Standing Water Level :

GWMA :603 - SYDNEY BASIN

Salinity :

(Unknown)

GW Zone : -

Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
69
C 25951

Region :10 - SYDNEY SOUTH COAST

CMA Map :9130-1S

MONA VALE

River Basin :212 - HAWKESBURY RIVER

Grid Zone :56/1

Scale :1:25,000

Area / District :

Elevation :

Northing :6271412

Latitude (S) :33° 41' 6"

Elevation Source :(Unknown)

Easting :338454

Longitude (E) :151° 15' 26"

GS Map :0055B3

MGA Zone :56

Coordinate Source :GD.,PR. MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Asbestos Cement	0.00	0.90	152			Cemented

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
----------	--------	---------------	----------	------------	------------	-------------	----------------	---------------	-----------------

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	30.48	30.48	Sandstone	Sandstone	
30.48	39.01	8.53	Mudstone	Mudstone	

Remarks

LOT 7 MONA VALE RD INGLESIDE

*** End of GW014465 ***

NSW OFFICE OF WATER Work Summary

GW014466

Converted From HYDSYS

Licence :10BL010502

Licence Status : Active
Authorised Purpose(s)
DOMESTIC

Intended Purpose(s)
DOMESTIC

Work Type :Bore open thru rock
Work Status :(Unknown)

Construct. Method :Cable Tool
Owner Type :Private

Commenced Date : **Final Depth :** 35.30 m
Completion Date : 01-May-1960 **Drilled Depth :** 35.40 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - GREEN ACRES
GWMA :603 - SYDNEY BASIN
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
63
PT 63

Region :10 - SYDNEY SOUTH COAST
River Basin :213 - SYDNEY COAST - GEORGES RIVER
Area / District :

CMA Map :9130-1S
Grid Zone :56/1

MONA VALE
Scale :1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6270818
Easting :340259

Latitude (S) :33° 41' 26"
Longitude (E) :151° 16' 36"

GS Map :0055B3 **MGA Zone :**56

Coordinate Source :GD.,PR. MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Asbestos Cement	0.00	1.50	152			Cemented

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
21.30	21.30	0.00	Consolidated	16.40		0.01			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.21	1.21	Soil	Soil	
1.21	35.35	34.14	Sandstone Water Supply	Sandstone	

Remarks

INGLESIDE RD NTH NARRABEEN

*** End of GW014466 ***

NSW OFFICE OF WATER Work Summary

GW047779

Converted From HYDSYS

Licence :10BL110873

Licence Status : Active
Authorised Purpose(s)
DOMESTIC
INDUSTRIAL

Intended Purpose(s)
IRRIGATION

Work Type :Bore open thru rock

Work Status :(Unknown)

Construct. Method :Rotary Air

Owner Type :Private

Commenced Date : **Final Depth :** 67.00 m

Completion Date : 01-Oct-1979 **Drilled Depth :** 67.00 m

Contractor Name :

Driller :

Assistant Driller's Name :

Property : - N/A

GWMA : -

GW Zone : -

Standing Water Level :

Salinity : 0-500 ppm

Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
169
169 752046

Region :10 - SYDNEY SOUTH COAST

River Basin :212 - HAWKESBURY RIVER

Area / District :

CMA Map :

Grid Zone :

Scale :

Elevation :

Elevation Source :(Unknown)

Northing :6271958

Easting :337854

Latitude (S) :33° 40' 48"

Longitude (E) :151° 15' 3"

GS Map :0055B3

MGA Zone :56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	P.V.C.	0.00	18.00	150			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
33.60	35.00	1.40	Consolidated	16.50		2.00			0-500 ppm

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	Soil	Soil	
1.00	9.00	8.00	Clay Soft Shale	Clay	
1.00	9.00	8.00	Sandstone	Sandstone	
9.00	33.60	24.60	Sandstone	Sandstone	
33.60	35.00	1.40	Water Supply	(Unknown)	
35.00	67.00	32.00	Sandstone	Sandstone	

Remarks

*** End of GW047779 ***

NSW OFFICE OF WATER Work Summary

GW050971

Converted From HYDSYS

Licence :10BL109711

Licence Status : Active
Authorised Purpose(s)
DOMESTIC

Intended Purpose(s)
DOMESTIC

Work Type :Bore open thru rock

Work Status :Supply Obtained

Construct. Method :Cable Tool

Owner Type :Private

Commenced Date : **Final Depth :** 17.00 m

Completion Date : 01-Apr-1979 **Drilled Depth :** 17.00 m

Contractor Name :

Driller :1435 ISELT, John Hans

Assistant Driller's Name :

Property : - N/A

GWMA : -

GW Zone : -

Standing Water Level :

Salinity : (Unknown)

Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
L8 DP30325 (87)
8 30325

Region :10 - SYDNEY SOUTH COAST

River Basin :212 - HAWKESBURY RIVER

Area / District :

CMA Map :9130-1S
Grid Zone :56/1

MONA VALE
Scale :1:25,000

Elevation :

Elevation Source :(Unknown)

Northing :6272670

Easting :339162

Latitude (S) :33° 40' 25"

Longitude (E) :151° 15' 54"

GS Map :0055B3 **MGA Zone :**56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Welded Steel	-0.20	1.40	165			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
10.90	11.00	0.10	Consolidated	5.80		0.06			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.40	0.40	Topsoil Sandy	Topsoil	
0.40	0.80	0.40	Clay Shale	Clay	
0.80	10.90	10.10	Sandstone Yellow	Sandstone	
0.80	10.90	10.10	Ironstone Bands	Ironstone	
10.90	11.00	0.10	Sandstone Yellow Open Water Supply	Sandstone	
11.00	13.60	2.60	Sandstone Yellow	Sandstone	
13.60	17.00	3.40	Sandstone Grey	Sandstone	

Remarks

*** End of GW050971 ***

NSW OFFICE OF WATER Work Summary

GW051799

Converted From HYDSYS

Licence :10BL113896

Licence Status : Active
Authorised Purpose(s) :
DOMESTIC

Intended Purpose(s) :
NOT KNOWN

Work Type :Bore
Work Status :Supply Obtained

Construct. Method :Cable Tool
Owner Type :Private

Commenced Date : **Final Depth :** 27.50 m
Completion Date : 01-Jan-1981 **Drilled Depth :** 27.50 m

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : 0-500 ppm
Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
179
179

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9130-1S
Grid Zone :56/1

MONA VALE
Scale :1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6271820
Easting :338166

Latitude (S) :33° 40' 52"
Longitude (E) :151° 15' 15"

GS Map :0055B3 **MGA Zone :**56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Welded Steel	0.30	3.00	162			Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
9.00	9.50	0.50	Consolidated						(Unknown)
11.00	11.50	0.50	Unconsolidated						(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	9.00	9.00	Sandstone Multicoloured	Sandstone	
9.00	11.00	2.00	Sandstone Water Bearing	Sandstone	
11.00	27.50	16.50	Sand Silty Water Bearing	Sand	

Remarks

*** End of GW051799 ***

NSW OFFICE OF WATER Work Summary

GW051861

Converted From HYDSYS

Licence :10BL113891

Licence Status : Active
Authorised Purpose(s)
DOMESTIC

Intended Purpose(s)
DOMESTIC

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Cable Tool

Owner Type :Private

Commenced Date : **Final Depth :** 42.00 m

Completion Date :01-Jan-1981 **Drilled Depth :** 42.00 m

Contractor Name :

Driller :

Assistant Driller's Name :

Property : - N/A

GWMA : -

GW Zone : -

Standing Water Level :

Salinity : (Unknown)

Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
L52 (179)
L52 (179)

Region :10 - SYDNEY SOUTH COAST

River Basin :212 - HAWKESBURY RIVER

Area / District :

CMA Map :9130-1S
Grid Zone :56/1

MONA VALE
Scale :1:25,000

Elevation :

Elevation Source :(Unknown)

Northing :6271745

Easting :338199

Latitude (S) :33° 40' 55"

Longitude (E) :151° 15' 16"

GS Map :0055B3

MGA Zone :56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Threaded Steel	0.30	1.00	152			Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
18.00	19.00	1.00	Unconsolidated		9.40				(Unknown)
38.00	39.00	1.00	Unconsolidated	27.50					(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	18.00	18.00	Sandstone Coloured	Sandstone	
18.00	38.00	20.00	Sand Silty Water Bearing	Sand	
38.00	40.00	2.00	Sand Water Bearing	Sand	
40.00	42.00	2.00	Sand Silty	Sand	

Remarks

*** End of GW051861 ***

NSW OFFICE OF WATER Work Summary

GW055934

Converted From HYDSYS

Licence :10BL121705

Licence Status : Active
Authorised Purpose(s)
DOMESTIC

Intended Purpose(s)
DOMESTIC

Work Type :Bore open thru rock
Work Status :(Unknown)

Construct. Method :Cable Tool
Owner Type :Private

Commenced Date : **Final Depth :** 60.00 m
Completion Date : 01-Dec-1981 **Drilled Depth :** 60.00 m

Contractor Name :
Driller :1441 BARRETT, Roy Max

Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : Good
Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
L16 (87)
L16 (P+ Port 87)

Region :10 - SYDNEY SOUTH COAST
River Basin :213 - SYDNEY COAST - GEORGES RIVER
Area / District :

CMA Map :9130-1S
Grid Zone :56/1

MONA VALE
Scale :1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6272692
Easting :340320

Latitude (S) :33° 40' 25"
Longitude (E) :151° 16' 39"

GS Map :0055B3 **MGA Zone :**56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Threaded Steel	0.00	3.00	200			Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
15.00	60.00	45.00	Consolidated		6.00	0.18			Good

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	34.00	34.00	Sandstone Water Supply	Sandstone	
0.00	34.00	34.00	Clay Seams Water Supply	Clay	
34.00	60.00	26.00	Sandstone White Water Supply	Sandstone	

Remarks

*** End of GW055934 ***

NSW OFFICE OF WATER Work Summary

GW055984

Converted From HYDSYS

Licence :10BL121849

Licence Status : Active

Authorised Purpose(s)

DOMESTIC

STOCK

Intended Purpose(s)

DOMESTIC

STOCK

Work Type :Bore

Work Status :(Unknown)

Construct. Method :Cable Tool

Owner Type :Private

Commenced Date :

Final Depth : 53.00 m

Completion Date :01-Dec-1981

Drilled Depth : 53.00 m

Contractor Name :

Driller :

Assistant Driller's Name :

Property : - N/A

GWMA : -

GW Zone : -

Standing Water Level :

Salinity :

(Unknown)

Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
203
203

Region :10 - SYDNEY SOUTH COAST

River Basin :212 - HAWKESBURY RIVER

Area / District :

CMA Map :9130-1S

Grid Zone :56/1

MONA VALE

Scale :1:25,000

Elevation :

Elevation Source :(Unknown)

Northing :6272867

Easting :339776

Latitude (S) :33° 40' 19"

Longitude (E) :151° 16' 18"

GS Map :0055B3

MGA Zone :56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	(Unknown)	-0.30	1.70	152			Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
18.00	19.00	1.00	(Unknown)						(Unknown)
26.00	27.00	1.00	(Unknown)						(Unknown)
48.00	49.00	1.00	(Unknown)						(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	16.00	16.00	Sandstone	Sandstone	
16.00	18.00	2.00	Ironstone	Ironstone	
18.00	28.00	10.00	Sandstone Shaley Water Bearing	Sandstone	
28.00	30.00	2.00	Ironstone	Ironstone	
30.00	44.00	14.00	Sand Silty	Sand	
44.00	45.00	1.00	Ironstone	Ironstone	
45.00	53.00	8.00	Sand Silty Water Bearing	Sand	

Remarks

*** End of GW055984 ***

NSW OFFICE OF WATER Work Summary

GW057745

Converted From HYDSYS

Licence :10BL123454

Licence Status :Lapsed

Authorised Purpose(s)

Intended Purpose(s)

Work Type :Bore open thru rock

Work Status :(Unknown)

DOMESTIC

IRRIGATION

IRRIGATION

STOCK

Construct. Method :Cable Tool

Owner Type :Private

Commenced Date : **Final Depth :** 150.00 m

Completion Date : 01-Sep-1982 **Drilled Depth :** 150.00 m

Contractor Name :

Driller :1435 ISELT, John Hans

Assistant Driller's Name :

Property : - N/A

Standing Water Level :

GWMA : -

Salinity : 0-500 ppm

GW Zone : -

Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
L10 DP25951 (69)
10 25951

Region :10 - SYDNEY SOUTH COAST

CMA Map :9130-1S

MONA VALE

River Basin :212 - HAWKESBURY RIVER

Grid Zone :56/1

Scale :1:25,000

Area / District :

Elevation :

Northing :6271306

Latitude (S) :33° 41' 9"

Elevation Source :(Unknown)

Eastings :338540

Longitude (E) :151° 15' 29"

GS Map :0055B3 **MGA Zone :**56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Galvanised Steel	-0.30	6.20	168			Cemented
1	1	Casing	Pressure Cemented	0.00	6.20	0			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
24.80	25.00	0.20	Consolidated	25.00		0.03			Fresh
145.10	146.00	0.90	Consolidated	32.00		0.27			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.60	0.60	Topsoil	Topsoil	
0.60	0.90	0.30	Gravel Sandy	Gravel	
0.90	12.10	11.20	Sandstone Yellow Silty	Sandstone	
12.10	13.90	1.80	Sandstone Silty	Sandstone	
13.90	24.80	10.90	Sandstone Yellow Silty	Sandstone	
24.80	25.00	0.20	Sandstone Yellow Silty Open	Sandstone	
25.00	37.10	12.10	Sandstone Red Silty	Sandstone	
37.10	49.00	11.90	Sandstone Yellow Silty	Sandstone	
49.00	52.20	3.20	Sandstone Grey	Sandstone	
52.20	135.30	83.10	Sandstone Yellow	Sandstone	
135.30	138.50	3.20	Clay Sandy	Clay	
138.50	145.10	6.60	Sandstone Yellow	Sandstone	
145.10	146.00	0.90	Sandstone Yellow Open Water Supply	Sandstone	
146.00	150.00	4.00	Sandstone	Sandstone	

Remarks

*** End of GW057745 ***

NSW OFFICE OF WATER Work Summary

GW059821

Converted From HYDSYS

Licence :10BL151475

Licence Status : Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore open thru rock

Work Status :(Unknown)

Construct. Method :Rotary

Owner Type :Private

Commenced Date :01-Feb-1993

Final Depth : 116.00 m

Completion Date :03-Feb-1993

Drilled Depth : 116.00 m

Contractor Name :INTERTECH DRILLING

Driller :1489 BARDEN, Colin Leslie

Assistant Driller's Name :

Property : - SMITH

Standing Water Level : 14.50 m

GWMA : -

Salinity : 140.00 mg/L Fresh

GW Zone : -

Yield : 1.30 L/s

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
169
169 752046

Region :10 - SYDNEY SOUTH COAST

CMA Map :9130-4S

HORNSBY

River Basin :212 - HAWKESBURY RIVER

Grid Zone :56/1

Scale :1:25,000

Area / District :

Elevation :

Northing :6272001

Latitude (S) :33° 40' 46"

Elevation Source :(Unknown)

Easting :337729

Longitude (E) :151° 14' 58"

GS Map :0055A3

MGA Zone :56

Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	42.00	116.00	152			Down Hole Hammer
1	1	Casing	PVC Class 9	-0.50	4.70	160			
1	1	Casing	Pressure Cemented Casing	0.00	4.70	0			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
83.00	107.50	24.50		14.50		1.30	116.00		140.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
42.00	60.00	18.00	SANDSTONE/GREY F.G.		
60.00	61.00	1.00	SANDSTONE/BED SHALE		
61.00	61.20	0.20	FRACTURED		
61.20	68.00	6.80	SANDSTONE GREY F.G.		
68.00	83.00	15.00	SANDSTONE GREY SMALL FRACT./BED SHALES		
83.00	107.00	24.00	SANDSTONE COURSE OPEN GRAIN W.B.		
107.00	107.50	0.50	FRACTURED W.D.		
107.50	116.00	8.50	SANDSTONE COURSE OPEN GRAIN W.B.		

Remarks

Previous Lic No: 10BL131472 due to alteration work.

*** End of GW059821 ***

NSW OFFICE OF WATER Work Summary

GW060293

Converted From HYDSYS

Licence :10BL127611

Licence Status : Cancelled

Authorised Purpose(s)

IRRIGATION

Intended Purpose(s)

IRRIGATION

Work Type :Bore open thru rock

Work Status :(Unknown)

Construct. Method :Cable Tool

Owner Type :Private

Commenced Date : **Final Depth :** 34.00 m

Completion Date : 01-Sep-1986 **Drilled Depth :** 34.00 m

Contractor Name :

Driller :1435 ISELT, John Hans

Assistant Driller's Name :

Property : - N/A

GWMA : -

GW Zone : -

Standing Water Level :

Salinity :

Fresh

Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
L2 DP52208 (139)
LT11 DP52208 PT139

Region :10 - SYDNEY SOUTH COAST

River Basin :212 - HAWKESBURY RIVER

Area / District :

CMA Map :9130-4S

Grid Zone :56/1

HORNSBY

Scale :1:25,000

Elevation :

Elevation Source :(Unknown)

Northing :6271542

Easting :337892

Latitude (S) :33° 41' 1"

Longitude (E) :151° 15' 4"

GS Map :0055B3 **MGA Zone :**56

Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Welded Steel	-0.20	4.40	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
29.20	30.30	1.10	Consolidated	18.00		1.10			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.40	1.40	Soil Sandy	Soil	
1.40	3.60	2.20	Sandstone Yellow	Sandstone	
1.40	3.60	2.20	Clay Layer	Clay	
3.60	29.20	25.60	Sandstone Grey	Sandstone	
29.20	30.30	1.10	Sandstone Grey Coarse Water Supply	Sandstone	
30.30	34.00	3.70	Sandstone Grey	Sandstone	

Remarks

*** End of GW060293 ***

NSW OFFICE OF WATER Work Summary

GW060467

Converted From HYDSYS

Licence :10BL122807

Licence Status : Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC
IRRIGATION
STOCK

IRRIGATION

Work Type :Bore open thru rock

Work Status :(Unknown)

Construct. Method :(Unknown)

Owner Type :Private

Commenced Date :

Final Depth : 130.10 m

Completion Date :01-Jan-1982

Drilled Depth : 0.00

Contractor Name :

Driller :

Assistant Driller's Name :

Property : - N/A

Standing Water Level :

GWMA : -

Salinity : (Unknown)

GW Zone : -

Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
L14 DP12115 (81)
15 12115

Region :10 - SYDNEY SOUTH COAST

CMA Map :9130-1S

MONA VALE

River Basin :213 - SYDNEY COAST - GEORGES RIVER

Grid Zone :56/1

Scale :1:25,000

Area / District :

Elevation :

Northing :6271903

Latitude (S) :33° 40' 50"

Elevation Source :(Unknown)

Easting :339251

Longitude (E) :151° 15' 57"

GS Map :0055B3

MGA Zone :56

Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing Asbestos Cement	0.00	9.10	152			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
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(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
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Remarks

*** End of GW060467 ***

NSW OFFICE OF WATER Work Summary

GW061466

Converted From HYDSYS

Licence :10BL133892

Licence Status : Active
Authorised Purpose(s)
DOMESTIC

Intended Purpose(s)
DOMESTIC

Work Type :Bore
Work Status :(Unknown)
Construct. Method :(Unknown)
Owner Type :Private

Commenced Date : **Final Depth :** 76.20 m
Completion Date : 01-Jan-1983 **Drilled Depth :** 0.00

Contractor Name :
Driller :
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : (Unknown)
Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
61
3

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9130-1S MONA VALE
Grid Zone :56/1 **Scale :**1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6272709
Easting :339495

Latitude (S) :33° 40' 24"
Longitude (E) :151° 16' 7"

GS Map :0055B3 **MGA Zone :**56

Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing P.V.C.	0.00	0.00	152			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
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(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
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Remarks

*** End of GW061466 ***

NSW OFFICE OF WATER Work Summary

GW062272

Converted From HYDSYS

Licence :10BL143759

Licence Status : Active

Authorised Purpose(s)

DOMESTIC

STOCK

Intended Purpose(s)

IRRIGATION

Work Type :Bore open thru rock

Work Status :(Unknown)

Construct. Method :(Unknown)

Owner Type :Private

Commenced Date :

Final Depth : 114.00 m

Completion Date :

Drilled Depth : 0.00

Contractor Name :

Driller :

Assistant Driller's Name :

Property : - N/A

GWMA : -

GW Zone : -

Standing Water Level :

Salinity :

(Unknown)

Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
81
PT81

Region :10 - SYDNEY SOUTH COAST

CMA Map :9130-1S

MONA VALE

River Basin :213 - SYDNEY COAST - GEORGES RIVER

Grid Zone :56/1

Scale :1:25,000

Area / District :

Elevation :

Northing :6271592

Latitude (S) :33° 41' 0"

Elevation Source :(Unknown)

Easting :339076

Longitude (E) :151° 15' 50"

GS Map :0055B3

MGA Zone :56

Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	(Unknown)	0.00	0.00	150			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
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(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
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Remarks

*** End of GW062272 ***

NSW OFFICE OF WATER Work Summary

GW063622

Converted From HYDSYS

Licence :10BL135164

Licence Status : Active
Authorised Purpose(s)
DOMESTIC

Intended Purpose(s)
DOMESTIC

Work Type :Bore
Work Status :(Unknown)
Construct. Method :Cable Tool
Owner Type :Private

Commenced Date : **Final Depth :** 46.00 m
Completion Date : 01-Sep-1986 **Drilled Depth :** 46.00 m

Contractor Name :
Driller :1435 ISELT, John Hans
Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
L2 DP30325 (87)
2 30325

Region :10 - SYDNEY SOUTH COAST
River Basin :212 - HAWKESBURY RIVER
Area / District :

CMA Map :9130-1S
Grid Zone :56/1

MONA VALE
Scale :1:25,000

Elevation :
Elevation Source :(Unknown)

Northing :6273154
Easting :340363

Latitude (S) :33° 40' 10"
Longitude (E) :151° 16' 41"

GS Map :0055B3 **MGA Zone :**56

Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Steel	-0.30	6.20	168			Cemented
1	1	Casing	Pressure Cemented Casing	0.00	6.20	168			(Unknown)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
22.30	22.60	0.30	Consolidated	20.00		0.10			Fresh
37.20	37.80	0.60	Consolidated	9.00		0.30			Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.80	0.80	Soil Sandy	Soil	
0.80	1.60	0.80	Clay Sandy Gravel	Clay	
1.60	2.90	1.30	Shale	Shale	
2.90	46.00	43.10	Sandstone Yellow	Sandstone	

Remarks

*** End of GW063622 ***

NSW OFFICE OF WATER Work Summary

GW064440

Converted From HYDSYS

Licence :10BL138571

Licence Status :Active

Authorised Purpose(s)

DOMESTIC

STOCK

Intended Purpose(s)

DOMESTIC

STOCK

Work Type :Bore

Work Status :(Unknown)

Construct. Method :Rotary Air

Owner Type :Private

Commenced Date :

Final Depth : 150.00 m

Completion Date :01-Nov-1988

Drilled Depth : 0.00

Contractor Name :

Driller :

Assistant Driller's Name :

Property : - N/A

GWMA : -

GW Zone : -

Standing Water Level :

Salinity : (Unknown)

Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
L1 DP213794 (83)
LT1 DP213794

Region :10 - SYDNEY SOUTH COAST

River Basin :212 - HAWKESBURY RIVER

Area / District :

CMA Map :9130-1S

Grid Zone :56/1

MONA VALE

Scale :1:25,000

Elevation :

Elevation Source :(Unknown)

Northing :6271952

Easting :338477

Latitude (S) :33° 40' 48"

Longitude (E) :151° 15' 27"

GS Map :0055B3

MGA Zone :56

Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	Steel	0.00	33.00	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
84.00	90.00	6.00	Consolidated			0.20			(Unknown)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments

Remarks

PUMP TEST DATA SUSPECT

*** End of GW064440 ***

NSW OFFICE OF WATER Work Summary

GW064441

Licence :10BL160105

Licence Status : Active

Authorised Purpose(s)

Intended Purpose(s)

INDUSTRIAL

INDUSTRIAL

RECREATION (GROUNDWATER)

RECREATION (GROUNDWATER)

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Down Hole Hammer

Owner Type :Private

Commenced Date :23-Aug-1990

Final Depth : 150.00 m

Completion Date :18-Sep-1990

Drilled Depth : 150.00 m

Contractor Name :INTERTECH DRILLING

Driller :1466 FERGUSON, Gary

Assistant Driller's Name :

Property : - HAMA ZKAINE

Standing Water Level : 31.90 m

GWMA : -

Salinity : Good

GW Zone : -

Yield : 1.25 L/s Cumulative

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
1//808703
1 808703

Region :10 - SYDNEY SOUTH COAST

CMA Map :

River Basin :

Grid Zone :

Area / District :

Scale :

Elevation :

Northing :6272134

Latitude (S) :33° 40' 43"

Elevation Source :

Easting :338950

Longitude (E) :151° 15' 46"

GS Map :

MGA Zone :56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	150.00	152			Down Hole Hammer
1	1	Casing	Steel	-0.50	6.50	168.3	158.7		C: .5-6.5m; Seated on Bottom

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
84.00	86.00	2.00				0.02	86.00		
120.00	150.00	30.00				1.23	150.00		

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	6.00	6.00	SANDSTONE	Sandstone	
6.00	9.00	3.00	SANDSTONE /FINE CLAY	Sandstone	
9.00	21.00	12.00	BROWN SANDSTONE,SILT AND CLAY	Sandstone	
21.00	24.00	3.00	BLACK SANDSTONE,SILT AND CLAY	Sandstone	
24.00	48.00	24.00	RED SANDSTONE,IRON AND CLAY	Sandstone	
48.00	87.00	39.00	PINK SANDSTONE, SILT AND CLAY	Sandstone	
87.00	96.00	9.00	RED SANDSTONE,IRON AND CLAY	Sandstone	
96.00	99.00	3.00	DARK GREY SHALE AND CLAY	Shale	
99.00	117.00	18.00	PALE PINK SANDSTONE AND CLAY	Sandstone	
117.00	150.00	33.00	WHITE SANDSTONE AND CLAY	Sandstone	

Remarks

PREVIOUS LIC NO: 10BL141627

*** End of GW064441 ***

NSW OFFICE OF WATER Work Summary

GW064442

Converted From HYDSYS

Licence :10BL160104

Licence Status :Active

Authorised Purpose(s)

Intended Purpose(s)

INDUSTRIAL
RECREATION (GROUNDWATER)

INDUSTRIAL
RECREATION (GROUNDWATER)

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Rotary Air

Owner Type :Private

Commenced Date : **Final Depth :** 115.00 m

Completion Date :01-Nov-1988 **Drilled Depth :** 115.00 m

Contractor Name :

Driller :

Assistant Driller's Name :

Property : - HAMA ZKAINE

GWMA : -

GW Zone : -

Standing Water Level : 45.00 m

Salinity : Good

Yield : 0.30 L/s

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
LT 1 DP 808703
1 808703

Region :10 - SYDNEY SOUTH COAST

River Basin :212 - HAWKESBURY RIVER

Area / District :

CMA Map :9130-1S
Grid Zone :56/1

MONA VALE
Scale :1:25,000

Elevation :

Elevation Source :(Unknown)

Northing :6272107

Easting :338526

Latitude (S) :33° 40' 43"

Longitude (E) :151° 15' 29"

GS Map :0055B3

MGA Zone :56

Coordinate Source :GD.,ACC.MAP

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1	1	Casing	P.V.C.	0.00	13.00	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
90.00	115.00	25.00	(Unknown)	45.00		0.30			Good

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	3.00	3.00	Gravel	Gravel	
3.00	100.00	97.00	Sandstone Water Supply	Sandstone	
100.00	115.00	15.00	Shale Water Supply	Shale	

Remarks

PREVIOUS LIC NO: 10BL138709

*** End of GW064442 ***

NSW OFFICE OF WATER Work Summary

GW068615

Licence :10BL141903

Licence Status : Active
Authorised Purpose(s)
DOMESTIC

Intended Purpose(s)

Work Type :Bore
Work Status :(Unknown)

Construct. Method :Rotary
Owner Type :

Commenced Date :10-Feb-1981 **Final Depth :** 125.00 m
Completion Date :17-Feb-1981 **Drilled Depth :** 125.00 m

Contractor Name :SLADE DRILLING
Driller : SLADE, W.E.

Assistant Driller's Name :

Property : - WILLCOCKS
GWMA : -
GW Zone : -

Standing Water Level : 15.50 m
Salinity :
Yield : 0.45 L/s

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
174/752046
174 752046

Region :10 - SYDNEY SOUTH COAST

CMA Map :
Grid Zone :

Scale :

River Basin :
Area / District :

Northing :6272464
Easting :338486

Latitude (S) :33° 40' 32"
Longitude (E) :151° 15' 28"

Elevation :
Elevation Source :

GS Map : **MGA Zone :**56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	125.00	155			Rotary
1	1	Casing	P.V.C.	0.00	12.00	155			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
5.00	6.00	1.00				0.06	9.00		
91.00	93.00	2.00				0.16	94.00		
99.00	100.00	1.00		0.00		0.08	101.00		
114.00	116.00	2.00		15.50		0.15	125.00		

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	SOIL		
2.00	27.00	25.00	SOFT MUDSTONE AND SHALE		
27.00	107.00	80.00	HARD SANDSTONE		
107.00	109.00	2.00	SHALE		
109.00	125.00	16.00	SANDSTONE		

Remarks

*** End of GW068615 ***

NSW OFFICE OF WATER Work Summary

GW100017

Licence :10BL153221

Licence Status : Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC
IRRIGATION
STOCK

DOMESTIC
IRRIGATION
STOCK

Work Type :Bore

Work Status :(Unknown)

Construct. Method :Other

Owner Type :

Commenced Date : **Final Depth :** 151.00 m

Completion Date :23-Oct-1993 **Drilled Depth :** 151.00 m

Contractor Name :INTERTECH DRILLING

Driller :1489 BARDEN, Colin Leslie

Assistant Driller's Name :

Property : - SANTA MULE

Standing Water Level :

GWMA : -

Salinity : 200.00 mg/L

GW Zone : -

Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARELLAN
NARRABEEN

Portion/Lot DP
38 12115
38 12115

Region :10 - SYDNEY SOUTH COAST

CMA Map :

River Basin :

Grid Zone :

Area / District :

Scale :

Elevation :

Northing :6271502

Latitude (S) :33° 41' 3"

Elevation Source :

Easting :339206

Longitude (E) :151° 15' 55"

GS Map :

MGA Zone :56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	6.00	203			Rotary Air
1		Hole	Hole	6.00	151.00	156			Rotary Air
1	1	Casing	Steel	-0.50	6.50				C: 0-6m; Seated on Bottom

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
12.50	13.00	0.50					6.00		150.00
60.00	80.00	20.00				0.25	6.00		200.00
99.00	104.00	5.00				0.05	6.00		200.00
139.00	150.00	11.00		62.00		0.10	6.00		

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	OVERBURDEN & FILLING		
2.00	3.50	1.50	ORANGE MED. GRAIN S.S.		
3.50	3.80	0.30	WHITE CLAY BAND		
3.80	5.00	1.20	ORANGE & WHITE MED. GRAIN S.S.		
5.00	41.00	36.00	WHITE S.S. & BED CLAY		
41.00	41.20	0.20	SMALL CAVITY		
41.20	50.00	8.80	WHITE S.S. & BED SHALE		
50.00	51.00	1.00	WHITE S.S. & BED SHALE		
51.00	51.50	0.50	SHALE BANDS		
51.50	60.00	8.50	WHITE S.S. & BED SHALE		
60.00	80.00	20.00	WHITE OPEN S.S. & WATER BEARING		
80.00	99.00	19.00	WHITE/ORANGE S.S. CLAY IN MATRIX		
99.00	99.20	0.20	SMALL CAVITY		
99.20	104.00	4.80	WHITE S.S. & BED SHALE		
104.00	112.00	8.00	WHITE GREY S.S. MED. GRAIN		
112.00	115.00	3.00	WHITE S.S. & BED SHALE		
115.00	132.00	17.00	WHITE L.G.S.S. WITH SMALL FRACTURED		
132.00	137.00	5.00	WHITE S.S. OPEN WATER BEARING		
137.00	139.00	2.00	WHITE S.S. & BED SHALE		
139.00	151.00	12.00	WHITE S.S. MED. GRAIN		
151.00	151.00	0.00	E.O.H.		

Remarks

*** End of GW100017 ***

NSW OFFICE OF WATER Work Summary

GW100648

Licence :10BL157628

Licence Status : Active
Authorised Purpose(s)
DOMESTIC

Intended Purpose(s)
DOMESTIC
STOCK

Work Type :Bore
Work Status :(Unknown)

Construct. Method :Rot. Rev. Circ. Air
Owner Type :

Commenced Date : **Final Depth :** 120.00 m
Completion Date :13-May-1996 **Drilled Depth :** 120.00 m

Contractor Name :J.H. ISELT

Driller :1435 ISELT, John Hans

Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : Fresh
Yield :

Site Details

Site Chosen By
Driller

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
2//595804
2 595804

Region :10 - SYDNEY SOUTH COAST

CMA Map :
Grid Zone :

Scale :

River Basin :
Area / District :

Northing :6273489
Easting :339622

Latitude (S) :33° 39' 59"
Longitude (E) :151° 16' 13"

Elevation :
Elevation Source :

GS Map : **MGA Zone :**56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	120.00	150			Rotary
1	1	Casing	P.V.C.	-0.30	3.00	160			C: 0-3m; Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
59.50	59.70	0.20		30.00	120.00	0.12	120.00	1.00	Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.30	0.30	Topsoil		
0.30	1.50	1.20	Sandstone Yellow		
1.50	3.50	2.00	Sandstone White		
3.50	59.50	56.00	Sandstone Yellow		
59.50	59.70	0.20	Sandstone Yellow (W.B.)		
59.70	65.00	5.30	Sandstone Yellow		
65.00	120.00	55.00	Shale		

Remarks

*** End of GW100648 ***

NSW OFFICE OF WATER Work Summary

GW100838

Licence :10BL157556

Licence Status : Active
Authorised Purpose(s)
DOMESTIC

Intended Purpose(s)
DOMESTIC
STOCK

Work Type :Bore
Work Status :(Unknown)

Construct. Method :Rotary
Owner Type :

Commenced Date : **Final Depth :** 90.50 m
Completion Date : 27-Mar-1996 **Drilled Depth :** 90.50 m

Contractor Name :INTERTECH DRILLING
Driller :1648 AULD, Richard

Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : 100.00 mg/L
Yield :

Site Details

Site Chosen By

Client Driller

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
13//803203
13 803203

Region :10 - SYDNEY SOUTH COAST

CMA Map :
Grid Zone :

Scale :

River Basin :
Area / District :

Elevation :
Elevation Source :

Northing :6272390
Easting :339276

Latitude (S) :33° 40' 35"
Longitude (E) :151° 15' 58"

GS Map : **MGA Zone :**56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	1.30	210			Rotary
1		Hole	Hole	1.30	10.80	210			Rotary
1		Hole	Hole	10.80	90.50	158			Rotary
1	1	Casing	Steel	-1.00	11.00	168.3	158.7		C: -.1-10.8m; Welded; Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
35.50	40.50	5.00				0.10	42.50	0.25	80.00
60.30	65.80	5.50				0.40	66.50	0.25	80.00
78.00	78.70	0.70				0.20	78.50	0.25	100.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.80	0.80	SANDY LOAM		
0.80	1.30	0.50	GREY CLAY		
1.30	26.50	25.20	SANDSTONE BROWN/GREY BANDS CLAY MATRIX		
26.50	27.40	0.90	GREY CLAY		
27.40	28.50	1.10	IRON STONE		
28.50	29.50	1.00	SANDSTONE, GREY, QUARTZ MATRIX		
29.50	30.00	0.50	IRONSTONE		
30.00	30.60	0.60	GREY MUDSTONE		
30.60	35.50	4.90	SANDSTONE; LT GREY, CLAY MATRIX		
35.50	40.50	5.00	SANDSTONE, BWN, QUARTZ MAT		
40.50	49.70	9.20	SANDSTONE; LT GREY, CLAY MATRIX		
49.70	51.10	1.40	IRONSTONE		
51.10	59.20	8.10	SANDSTONE; LT. GREY, COARSE GRAIN		
59.20	60.30	1.10	IRONSTONE		
60.30	65.80	5.50	SANDSTONE LT.GREY, PEBBLY QUARTZ MATRIX		
65.80	71.50	5.70	SANDSTONE LT. GREY C.G.		
71.50	71.90	0.40	GREY MUDSTONE		
71.90	78.70	6.80	SANDSTONE, LT. BWN, NARROW QUARTZ BANDS		
78.70	80.90	2.20	IRONSTONE		
80.90	82.30	1.40	SANDSTONE LT GREY, QUARTZ MATRIX		
82.30	86.40	4.10	SANDSTONE; LT GREY C.G.		
86.40	90.50	4.10	BANDED SANDSTONE - IRONSTONE, SOFT & FRACTURED		

Remarks

*** End of GW100838 ***

NSW OFFICE OF WATER Work Summary

GW101494

Licence :10BL158124

Licence Status : Cancelled

Authorised Purpose(s) :
RECREATION (GROUNDWATER)

Intended Purpose(s) :
IRRIGATION

Work Type :Bore
Work Status :(Unknown)

Construct. Method :Rotary
Owner Type :

Commenced Date : **Final Depth :** 140.00 m
Completion Date :29-Aug-1997 **Drilled Depth :** 140.00 m

Contractor Name :B.B. DRILLING

Driller :1649 BARRETT, Michael Gerard

Assistant Driller's Name :

Property : - N/A
GWMA : -
GW Zone : -

Standing Water Level :
Salinity :
Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
2//525908
2 525908

Region :10 - SYDNEY SOUTH COAST

CMA Map :
Grid Zone :

Scale :

River Basin :
Area / District :

Northing :6270626
Easting :340256

Latitude (S) :33° 41' 32"
Longitude (E) :151° 16' 35"

Elevation :
Elevation Source :

GS Map : **MGA Zone :**56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	140.00	150			Percussion
1	1	Casing	Steel	0.00	3.00	150			Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
14.90	120.00	105.10		14.90	110.00	0.20	140.00	8.00	Good

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	60.00	60.00	SANDSTONE, DARK GREY		
60.00	120.00	60.00	SANDSTONE, WHITE		
120.00	140.00	20.00	SHALE, DARK GREY		

Remarks

Form A Remarks:
COMMENT IN COMPLETION DETAILS. "OPEN HOLE"

*** End of GW101494 ***

NSW OFFICE OF WATER Work Summary

GW101503

Licence :10BL158708

Licence Status : Active
Authorised Purpose(s) :
INDUSTRIAL

Intended Purpose(s) :
INDUSTRIAL

Work Type :Bore
Work Status :Supply Obtained
Construct. Method :Cable Tool
Owner Type :Private

Commenced Date : **Final Depth :** 46.00 m
Completion Date : 08-Feb-1984 **Drilled Depth :** 46.00 m

Contractor Name : J.H. ISELT
Driller : 986 ISELT, John Hans

Assistant Driller's Name :

Property : - SMITH
GWMA : -
GW Zone : -

Standing Water Level : 14.00 m
Salinity : Fresh
Yield : 1.25 L/s

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
169 752046
169 752046

Region :10 - SYDNEY SOUTH COAST

CMA Map :
Grid Zone :

Scale :

River Basin :
Area / District :

Northing :6272001
Easting :337755

Elevation :
Elevation Source :

Latitude (S) :33° 40' 46"
Longitude (E) :151° 14' 59"

GS Map : **MGA Zone :**56

Coordinate Source :GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	46.00	152			Percussion
1	1	Casing	P.V.C.	-0.50	4.70				C: 0-4.7m; Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
12.10	12.40	0.30		8.00	16.00	0.19	16.00		Fresh
30.80	31.30	0.50		14.00	17.00	1.25	46.00		Fresh

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.10	2.10	SANDY GRAVEL	Gravel	
2.10	8.50	6.40	YELLOW SANDSTONE	Sandstone	
8.50	9.30	0.80	GREY SANDSTONE	Sandstone	
9.30	12.10	2.80	YELLOW SANDSTONE	Sandstone	
12.10	12.40	0.30	GREY SANDSTONE(OPEN AND W.B.)	Sandstone	
12.40	30.30	17.90	GREY SANDSTONE	Sandstone	
30.30	30.80	0.50	SHALE	Shale	
30.80	31.30	0.50	GREY SANDSTONE(COARSE OPEN & W.B.)	Sandstone	
31.30	36.40	5.10	GREY SANDSTONE	Sandstone	
36.40	36.70	0.30	SHALE	Shale	
36.70	46.00	9.30	GREY SANDSTONE	Sandstone	

Remarks

Form A Remarks:
13 STAGE GRUNDFOR SUBMERSIBLE 415 VOLT 3 PHASE 1 1/2 INCH DIAMETER DELIVERY PUMP

*** End of GW101503 ***

NSW OFFICE OF WATER Work Summary

GW101504

Licence :10BL158707

Licence Status : Active
Authorised Purpose(s)
INDUSTRIAL

Intended Purpose(s)
INDUSTRIAL

Work Type :Bore
Work Status :Supply Obtained
Construct. Method :Rotary
Owner Type :Private

Commenced Date : **Final Depth :** 48.00 m
Completion Date : 09-Feb-1993 **Drilled Depth :** 48.00 m

Contractor Name :INTERTECH DRILLING
Driller :1489 BARDEN, Colin Leslie

Assistant Driller's Name :

Property : - SMITH
GWMA : -
GW Zone : -

Standing Water Level :
Salinity : 180.00 mg/L
Yield : 1.60 L/s

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
LT 169 DP 752046
169 752046

Region :10 - SYDNEY SOUTH COAST

CMA Map :
Grid Zone :

Scale :

River Basin :
Area / District :

Northing :6271942
Easting :337859

Latitude (S) :33° 40' 48"
Longitude (E) :151° 15' 3"

Elevation :
Elevation Source :

GS Map : **MGA Zone :**56

Coordinate Source :GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	40.00	152			Down Hole Hammer
1	1	Casing	Steel	-0.60	9.60				C: 0-9.6m; Seated on Bottom

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
35.00	35.30	0.30		24.00		1.60	48.00		180.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	3.00	3.00	TOPSOIL AND CLAY	Topsoil	
3.00	9.00	6.00	CLAY AND SANDSTONE	Clay	
9.00	24.00	15.00	SANDSTONE,F.G.GREY, SMALL AMT CLAY	Sandstone	
24.00	36.00	12.00	SANDSTONE AND QUARTZ, LOT OF CLAY	Sandstone	
36.00	36.30	0.30	FRACTURE W.B. W.B 1.5 L/PS	Invalid Code	
36.30	48.00	11.70	SANDSTONE AND QURTZ, OPEN GRAIN	Sandstone	

Remarks

*** End of GW101504 ***

NSW OFFICE OF WATER Work Summary

GW101751

Licence :10BL158944

Licence Status : Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :(Unknown)

Construct. Method :Rotary Air

Owner Type :

Commenced Date : **Final Depth :** 132.00 m

Completion Date :01-Feb-1999 **Drilled Depth :** 132.00 m

Contractor Name :INTERTECH

Driller :1736 MILGATE, Dean John

Assistant Driller's Name :

Property : - N/A

Standing Water Level : 36.00 m

GWMA : -

Salinity : 102.00 mg/L

GW Zone : -

Yield : 1.80 L/s

Site Details

Site Chosen By

County

Parish

Portion/Lot DP

Client Driller

Form A :CUMBERLAND

NARRABEEN

1/596295

Licensed :CUMBERLAND

NARRABEEN

1 596295

Region :10 - SYDNEY SOUTH COAST

CMA Map :

River Basin :

Grid Zone :

Scale :

Area / District :

Elevation :

Northing :6272483

Latitude (S) :33° 40' 32"

Elevation Source :

Eastings :339433

Longitude (E) :151° 16' 5"

GS Map :

MGA Zone :56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.60	210			Rotary Air
1		Hole	Hole	5.60	132.00	159			Rotary Air
1	1	Casing	Steel	-0.40	5.60	168.3	158.7		C: 0-5.6m; Driven into Hole
1	1	Casing	PVC Class 9	-0.40	53.60	140			Screwed and Glued; Suspended in Clamps
1	1	Opening	Slots - Vertical	46.00	49.00	140			PVC Class 9; Sawn; SL: 100mm; A: 4mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
46.00	49.00	3.00				0.10	54.00	0.25	90.00
74.50	75.00	0.50				0.60	78.00	0.25	96.00
112.50	113.00	0.50				0.30	114.00	0.25	109.00
123.00	123.50	0.50				0.80	132.00	0.50	102.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	Fill	Fill	
2.00	6.50	4.50	Grey Sandstone M.G.	Sandstone	
6.50	7.00	0.50	Grey Clay	Clay	
7.00	18.00	11.00	Weathered Sandstone	Sandstone	
18.00	24.00	6.00	Sandstone and Quartz	Sandstone	
24.00	25.00	1.00	Grey Clay	Clay	
25.00	40.00	15.00	Grey Sandstone M.G.	Sandstone	
40.00	40.50	0.50	Grey Clay	Clay	
40.50	45.00	4.50	Grey Sandstone M.G.	Sandstone	
45.00	46.00	1.00	Grey Clay	Clay	
46.00	49.00	3.00	Sandstone and Quartz, Fractured	Sandstone	
49.00	51.00	2.00	Ironstone	Ironstone	
51.00	60.00	9.00	Sandstone and Quartz	Sandstone	
60.00	74.50	14.50	Grey Sandstone M.G.	Sandstone	
74.50	75.00	0.50	Sandstone and Quartz, Fractured	Sandstone	
75.00	90.00	15.00	White Sandstone M.G.	Sandstone	
90.00	92.00	2.00	Ironstone	Ironstone	
92.00	112.50	20.50	White Sandstone M.G.	Sandstone	
112.50	113.00	0.50	Sandstone and Quartz, Fractured	Sandstone	
113.00	123.00	10.00	White Sandstone M.G.	Sandstone	
123.00	123.50	0.50	Sandstone and Quartz, Fractured	Sandstone	
123.50	132.00	8.50	Grey Sandstone M.G.	Sandstone	

Remarks

*** End of GW101751 ***

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

NSW OFFICE OF WATER Work Summary

GW103073

Licence :10BL159597

Licence Status Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :(Unknown)

Construct. Method :Rotary Air

Owner Type :

Commenced Date : Final Depth : 150.00 m

Completion Date :29-Mar-2000 Drilled Depth : 150.00 m

Contractor Name :INTERTECH

Driller :1737 READY, Mark Edward

Assistant Driller's Name :

Property : - N/A

Standing Water Level :

GWMA : -

Salinity : 140.00 mg/L

GW Zone : -

Yield :

Site Details

Site Chosen By

County

Parish

Portion/Lot DP

Client Driller

Form A :CUMBERLAND

NARRABEEN

255//752046

Licensed :CUMBERLAND

NARRABEEN

232

Region :10 - SYDNEY SOUTH COAST

CMA Map :

River Basin :

Grid Zone :

Scale :

Area / District :

Elevation :

Northing :6272593

Latitude (S) :33° 40' 28"

Elevation Source :

Easting :339163

Longitude (E) :151° 15' 54"

GS Map :

MGA Zone :56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.60	210			Down Hole Hammer
1		Hole	Hole	5.60	150.00	158			Down Hole Hammer
1	1	Casing	Steel	-0.40	5.60	168.3	158.7		C: -.1-5.6m; Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
81.00	82.00	1.00		43.00		0.50	84.00	1.00	140.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.50	0.50	SANDY LOAM	Loam	
0.50	3.50	3.00	YELLOW SANDSTONE M.G.	Sandstone	
3.50	16.00	12.50	WHITE SANDSTONE M.G.	Sandstone	
16.00	16.20	0.20	IRONSTONE	Ironstone	
16.20	24.00	7.80	YELLOW SANDSTONE WITH IRON	Sandstone	
24.00	30.00	6.00	WHITE SANDSTONE M.G.	Sandstone	
30.00	46.00	16.00	LT GREY SANDSTONE M.G.	Sandstone	
46.00	46.50	0.50	IRONSTONE	Ironstone	
46.50	59.00	12.50	YELLOW SANDSTONE M.G.	Sandstone	
59.00	62.00	3.00	WHITE SANDSTONE M.G.	Sandstone	
62.00	73.00	11.00	LT GREY SANDSTONE M.G.	Sandstone	
73.00	73.50	0.50	IRONSTONE	Ironstone	
73.50	82.00	8.50	LT GREY SANDSTONE/QUARTZ BANDS	Sandstone	
82.00	82.30	0.30	IRONSTONE	Ironstone	
82.30	85.00	2.70	PINK TO WHITE SANDSTONE M.G.	Sandstone	
85.00	135.00	50.00	LT GREY SANDSTONE M.G.	Sandstone	
135.00	150.00	15.00	LT TO DARK GREY SANDSTONE M.G.	Sandstone	

Remarks

*** End of GW103073 ***

NSW OFFICE OF WATER Work Summary

GW103160

Licence :10BL159765

Licence Status : Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :(Unknown)

Construct. Method :Rotary Air

Owner Type :

Commenced Date : **Final Depth :** 120.50 m

Completion Date :03-Aug-2000 **Drilled Depth :** 120.50 m

Contractor Name :INTERTECH

Driller :1783 CRUMP, William

Assistant Driller's Name :

Property : - N/A

Standing Water Level :

GWMA : -

Salinity : 145.00 mg/L

GW Zone : -

Yield :

Site Details

Site Chosen By

County

Parish

Portion/Lot DP

Client Driller

Form A :CUMBERLAND

NARRABEEN

1831//812302

Licensed :CUMBERLAND

NARRABEEN

1831 812302

Region :10 - SYDNEY SOUTH COAST

CMA Map :

River Basin :

Grid Zone :

Scale :

Area / District :

Elevation :

Northing :6271548

Latitude (S) :33° 41' 1"

Elevation Source :

Eastings :338282

Longitude (E) :151° 15' 19"

GS Map : **MGA Zone :**56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	9.00	205			Rotary Air
1		Hole	Hole	9.00	11.50	210			Down Hole Hammer
1		Hole	Hole	11.50	120.50	155			Down Hole Hammer
1	1	Casing	Steel	-0.40	11.60	168.3	158.7		C: -.1-11.6m; Welded; Driven into Hole
1	1	Casing	P.V.C.	-0.40	17.50	140			Suspended in Clamps
1	1	Opening	Slots - Vertical	15.50	17.50	140			PVC Class 9; Sawn; SL: .1mm; A: 4mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
15.00	18.00	3.00				0.30	18.00	0.25	153.00
105.00	107.00	2.00				0.05	108.00	0.25	145.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	9.00	9.00	FILL	Fill	
9.00	14.00	5.00	SANDSTONE GREY	Sandstone	
14.00	15.00	1.00	SANDSTONE / CLAY	Sandstone	
15.00	18.00	3.00	SANDSTONE / QUARTZ	Sandstone	
18.00	20.00	2.00	QUARTZ	Quartz	
20.00	22.00	2.00	SANDSTONE/ QUARTZ	Sandstone	
22.00	32.00	10.00	SANDSTONE GREY	Sandstone	
32.00	38.00	6.00	SANDSTONE QUARTZ	Sandstone	
38.00	40.00	2.00	SANDSTONE GREY	Sandstone	
40.00	41.00	1.00	SANDSTONE / SHALE	Sandstone	
41.00	42.50	1.50	SANDSTONE GREY	Sandstone	
42.50	43.00	0.50	QUARTZ	Quartz	
43.00	45.00	2.00	SANDSTONE QUARTZ	Sandstone	
45.00	52.00	7.00	SANDSTONE GREY	Sandstone	
52.00	54.50	2.50	SILTSTONE FRACTURED	Siltstone	
54.50	59.00	4.50	SANDSTONE GREY AND WHITE	Sandstone	
59.00	61.00	2.00	SANDSTONE QUARTZ	Sandstone	
61.00	66.00	5.00	SANDSTONE GREY	Sandstone	
66.00	67.00	1.00	HARD SHALE	Shale	
67.00	77.00	10.00	SANDSTONE GREY	Sandstone	
77.00	78.00	1.00	SANDSTONE QUARTZ	Sandstone	
78.00	93.50	15.50	SANDSTONE GREY	Sandstone	
93.50	105.00	11.50	SANDSTONE WHITE	Sandstone	
105.00	107.00	2.00	SANDSTONE QUARTZ	Sandstone	
107.00	112.50	5.50	SANDSTONE GREY	Sandstone	
112.50	113.00	0.50	SANDSTONE QUARTZ	Sandstone	
113.00	120.50	7.50	SANDSTONE GREY	Sandstone	

Remarks

*** End of GW103160 ***

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

NSW OFFICE OF WATER Work Summary

GW103538

<p>Licence :10BL159951</p> <p>Work Type :Bore</p> <p>Work Status :(Unknown)</p> <p>Construct. Method :Rotary Air</p> <p>Owner Type :</p> <p>Commenced Date :</p> <p>Completion Date :17-Jan-2001</p> <p>Contractor Name :INTERTECH</p> <p>Driller :1737 READY, Mark Edward</p> <p>Assistant Driller's Name :</p> <p>Property : - N/A</p> <p>GWMA : -</p> <p>GW Zone : -</p>	<p>Licence Status Active</p> <p>Authorised Purpose(s) DOMESTIC STOCK</p> <p>Intended Purpose(s) DOMESTIC STOCK</p> <p>Final Depth : 132.00 m</p> <p>Drilled Depth : 132.00 m</p> <p>Standing Water Level :</p> <p>Salinity : 139.00 mg/L</p> <p>Yield :</p>
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Site Details

<p>Site Chosen By Client</p> <p>Region :10 - SYDNEY SOUTH COAST</p> <p>River Basin :</p> <p>Area / District :</p> <p>Elevation :</p> <p>Elevation Source :</p> <p>GS Map :</p>	<p>County Form A :CUMBERLAND Licensed :CUMBERLAND</p> <p>Parish NARRABEEN NARRABEEN</p> <p>CMA Map :</p> <p>Grid Zone :</p> <p>Northing :6272500 Eastings :339309</p> <p>Coordinate Source :</p>	<p>Portion/Lot DP 2//596295 2 596295</p> <p>Scale :</p> <p>Latitude (S) :33° 40' 31" Longitude (E) :151° 15' 60"</p>
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Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.60	210			Down Hole Hammer
1		Hole	Hole	5.60	132.00	156.5			Down Hole Hammer
1	1	Casing	Steel	-0.40	5.60	168.3	158.7		C: 3-5.6m; Driven into Hole
1	1	Casing	PVC Class 9	-0.40	47.60	140			Screwed and Glued; Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
54.00	55.00	1.00				0.10	60.00	25.00	150.00
88.00	89.00	1.00				0.10	90.00	25.00	150.00
112.00	113.00	1.00				0.40	114.00	25.00	140.00
115.00	117.00	2.00		32.00		0.10	120.00	50.00	139.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.50	0.50	OVERBURDEN	Overburden	
0.50	2.00	1.50	WEATHERED SANDSTONE	Sandstone	
2.00	14.00	12.00	WHITE TO PINK SANDSTONE M.G.	Sandstone	
14.00	19.00	5.00	YELLOW SANDSTONE M.G.	Sandstone	
19.00	19.20	0.20	IRONSTONE	Ironstone	
19.20	20.00	0.80	GREY SANDSTONE M.G.	Sandstone	
20.00	20.40	0.40	WHITE CLAY	Clay	
20.40	21.00	0.60	WHITE SANDSTONE M.G.	Sandstone	
21.00	21.50	0.50	WHITE CLAY	Clay	
21.50	26.00	4.50	IRONSTONE	Ironstone	
26.00	37.00	11.00	WHITE SANDSTONE M.G.	Sandstone	
37.00	37.50	0.50	IRONSTONE	Ironstone	
37.50	39.00	1.50	GREY CLAYSTONE	Clay	
39.00	57.00	18.00	WHITE SANDSTONE M.G.	Sandstone	
57.00	78.00	21.00	LT GREY SANDSTONE	Sandstone	
78.00	90.00	12.00	WHITE TO RED SANDSTONE M.G.	Sandstone	
90.00	99.00	9.00	LT GREY SANDSTONE M.G.	Sandstone	
99.00	99.20	0.20	IRONSTONE	Ironstone	
99.20	102.00	2.80	WHITE TO GREY SANDSTONE M.G.	Sandstone	
102.00	111.00	9.00	LY GREY SANDSTONE M.G.	Sandstone	
111.00	113.00	2.00	DK GREY SANDSTONE M.G.	Dacite(Tonalite)	
113.00	115.00	2.00	WHITE SANDSTONE QUARTZ	Sandstone	
115.00	115.30	0.30	IRONSTONE	Ironstone	
115.30	117.00	1.70	LT GREY SANDSTONE + QUARTZ	Sandstone	
117.00	125.00	8.00	DK GREY SANDSTONE M.G.	Dacite(Tonalite)	
125.00	132.00	7.00	LT GREY SANDSTONE M.G.	Sandstone	

Remarks

*** End of GW103538 ***

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NSW OFFICE OF WATER Work Summary

GW104173

Licence :10BL160499

Licence Status : Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :

Construct. Method :Rotary

Owner Type :

Commenced Date : **Final Depth :** 150.50 m

Completion Date :01-Mar-2002 **Drilled Depth :** 150.50 m

Contractor Name :INTERTECH DRILLING

Driller :1783 CRUMP, William

Assistant Driller's Name :

Property : - N/A

Standing Water Level :

GWMA : -

Salinity : 134.00 mg/L

GW Zone : -

Yield :

Site Details

Site Chosen By

County

Parish

Portion/Lot DP

Client

Form A :CUMBERLAND

NARRABEEN

LT D DP 33150

Licensed :CUMBERLAND

NARRABEEN

D 33150

Region :10 - SYDNEY SOUTH COAST

CMA Map :

River Basin :

Grid Zone :

Scale :

Area / District :

Elevation :

Northing :6272118

Latitude (S) :33° 40' 43"

Elevation Source :

Eastings :338993

Longitude (E) :151° 15' 47"

GS Map : **MGA Zone :**56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	210			Down Hole Hammer
1		Hole	Hole	5.50	150.50	158			Down Hole Hammer
1	1	Casing	Steel	-0.50	5.50	168.3	158.7		C: -.1-5.5m; Driven into Hole
1	1	Casing	PVC Class 9	-0.50	89.50	140	130		Screwed and Glued; Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
86.30	90.00	3.70				0.30	90.50	0.25	97.00
94.00	100.00	6.00				0.30	102.50	0.25	106.00
142.00	142.50	0.50				0.90	144.50	0.25	120.00
143.50	144.00	0.50		50.00		1.10	150.50	0.25	134.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	SAND AND ROCKS	Sand	
2.00	4.00	2.00	PINK SANDSTONE	Sandstone	
4.00	27.00	23.00	SANDSTONE LIGHT BROWN	Sandstone	
27.00	28.50	1.50	IRONSTONE AND QUARTZ	Ironstone Gravel	
28.50	30.00	1.50	CLAYSTONE DARK GREY	Claystone	
30.00	44.00	14.00	SANDSTONE LIGHT GREY	Sandstone	
44.00	44.30	0.30	CLAY, CREAM	Clay	
44.30	45.50	1.20	IRONSTONE, QUARTZ	Ironstone Gravel	
45.50	47.00	1.50	CLAYSTONE DARK GREY	Claystone	
47.00	56.50	9.50	SANDSTONE LIGHT GREY	Sandstone	
56.50	58.00	1.50	CLAY STIFF, GREY	Clay	
58.00	61.00	3.00	IRONSTONE AND QUARTZ	Ironstone Gravel	
61.00	62.00	1.00	IRONSTONE, BANDS OF CLAY	Ironstone	
62.00	85.00	23.00	SANDSTONE LIGHT GREY	Sandstone	
85.00	86.00	1.00	SANDSTONE QUARTZ	Sandstone	
86.00	86.30	0.30	IRONSTONE	Ironstone	
86.30	90.00	3.70	SANDSTONE, QUARTZ	Sandstone	
90.00	94.00	4.00	IRONSTONE, SANDSTONE	Ironstone	
94.00	100.00	6.00	SANDSTONE, QUARTZ	Sandstone	
100.00	105.50	5.50	SANDSTONE LIGHT GREY	Sandstone	
105.50	110.00	4.50	SANDSTONE D/G. FRACT.	Sandstone	
110.00	142.00	32.00	SANDSTONE GREY	Sandstone	
142.00	142.50	0.50	FINE QUARTZ	Quartz	
142.50	143.50	1.00	SANDSTONE GREY	Sandstone	
143.50	144.00	0.50	SANDSTONE QUARTZ, FRACT.	Sandstone	
144.00	150.50	6.50	SANDSTONE GREY	Sandstone	

Remarks

*** End of GW104173 ***

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

NSW OFFICE OF WATER Work Summary

GW104217

Licence :10BL160567

Licence Status : Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Rotary

Owner Type :Private

Commenced Date : **Final Depth :** 150.00 m

Completion Date :05-Mar-2002 **Drilled Depth :** 150.00 m

Contractor Name :INTERTECH DRILLING

Driller :1783 CRUMP, William

Assistant Driller's Name :

Property : - SACCO

Standing Water Level : 58.00 m

GWMA : -

Salinity : 134.00 mg/L

GW Zone : -

Yield : 0.20 L/s

Site Details

Site Chosen By

Client Driller

County

Form A :CUMBERLAND

Licensed :CUMBERLAND

Parish

NARRABEEN

NARRABEEN

Portion/Lot DP

LT 26 DP 12115

26 12115

Region :10 - SYDNEY SOUTH COAST

CMA Map :

River Basin :

Grid Zone :

Scale :

Area / District :

Elevation :

Northing :6272141

Latitude (S) :33° 40' 43"

Elevation Source :

Eastings :339505

Longitude (E) :151° 16' 7"

GS Map : **MGA Zone :**56

Coordinate Source :Map Interpretation

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	210			Down Hole Hammer
1		Hole	Hole	5.50	150.00	158			Down Hole Hammer
1	1	Casing	Steel	-0.50	5.50	168.3	158.7		C: -.1-5.5m; Driven into Hole
1	1	Casing	PVC Class 9	-0.50	89.50	140	130		Screwed and Glued; Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
60.50	61.00	0.50				0.10			120.00
94.00	101.50	7.50				0.30			128.00
116.00	117.00	1.00				0.30			134.00
132.00	133.00	1.00		58.00		0.20			134.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.50	1.50	SANDS AND LARGE ROCKS	Sandstone	
1.50	3.00	1.50	SANDSTONE RED	Sandstone	
3.00	21.00	18.00	SANDSTONE LIGHT BROWN	Sandstone	
21.00	21.50	0.50	CLAY DARK BROWN	Clay	
21.50	29.00	7.50	SANDSTONE LIGHT BROWN	Sandstone	
29.00	30.50	1.50	SHALE	Shale	
30.50	45.00	14.50	SANDSTONE LIGHT GREY	Sandstone	
45.00	45.50	0.50	SHALE	Shale	
45.50	50.00	4.50	SANDSTONE GREY	Sandstone	
50.00	55.00	5.00	IRONSTONE/QUARTZ	Ironstone	
55.00	60.50	5.50	SANDSTONE GREY	Sandstone	
60.50	61.00	0.50	QUARTZ	Invalid Code	
61.00	75.00	14.00	SANDSTONE L/G	Sandstone	
75.00	76.50	1.50	IRONSTONE	Ironstone	
76.50	79.00	2.50	SANDSTONE QUARTZ	Sandstone	
79.00	79.50	0.50	IRONSTONE FRACTURED	Ironstone Gravel	
79.50	89.00	9.50	SANDSTONE QUARTZ	Sandstone	
89.00	93.50	4.50	SANDSTONE FRACTURED	Sandstone	
93.50	94.00	0.50	CLAY/QUARTZ	Clay	
94.00	101.50	7.50	SANDSTONE/QUARTZ	Sandstone	
101.50	102.00	0.50	IRONSTONE	Ironstone	
102.00	107.00	5.00	SANDSTONE GREY	Sandstone	
107.00	107.30	0.30	CLAY	Clay	
107.30	116.00	8.70	SANDSTONE GREY	Sandstone	
116.00	117.00	1.00	SAND/QUARTZ FINE	Sand	
117.00	132.00	15.00	SANDSTONE L/G	Sandstone	
132.00	133.00	1.00	SANDSTONE QUARTZ	Sandstone	
133.00	150.00	17.00	SANDSTONE GREY	Sandstone	

Remarks

*** End of GW104217 ***

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NSW OFFICE OF WATER Work Summary

GW104265

Licence :10BL160616

Licence Status :Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Rotary

Owner Type :Private

Commenced Date : **Final Depth :** 210.00 m

Completion Date :18-Apr-2002 **Drilled Depth :** 210.00 m

Contractor Name :INTERTECH DRILLING

Driller :1783 CRUMP, William

Assistant Driller's Name :

Property : - N/A

Standing Water Level : 43.00 m

GWMA : -

Salinity : 134.00 mg/L

GW Zone : -

Yield : 0.10 L/s

Site Details

Site Chosen By

County

Parish

Portion/Lot DP

Client

Form A :CUMBERLAND

NARRABEEN

LT 71 DP 752046

Licensed :CUMBERLAND

NARRABEEN

71 752046

Region :10 - SYDNEY SOUTH COAST

CMA Map :

River Basin :

Grid Zone :

Scale :

Area / District :

Elevation :

Northing :6272512

Latitude (S) :33° 40' 31"

Elevation Source :

Easting :339916

Longitude (E) :151° 16' 23"

GS Map :

MGA Zone :56

Coordinate Source :Map Interpretation

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	210			Down Hole Hammer
1		Hole	Hole	5.50	210.00	160			Down Hole Hammer
1	1	Casing	Steel	-0.50	5.50	168.3	158.7		C: -.1-5.5m; Driven into Hole
1	1	Casing	PVC Class 9	-0.50	59.50	140	130		Screwed and Glued; Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
48.00	50.00	2.00				0.10	54.00	0.25	120.00
80.00	84.00	4.00				0.10	84.00	0.25	126.00
101.50	102.00	0.50				0.10	102.00	0.25	132.00
111.00	112.00	1.00				0.10	114.00	0.25	134.00
143.00	146.00	3.00		43.00		0.10	210.00	0.25	134.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	SAND	Sand	
1.00	8.00	7.00	SANDSTONE SOFT	Sandstone	
8.00	26.00	18.00	SANDSTONE/IRONSTONE	Sandstone	
26.00	28.00	2.00	CLAYSTONE	Claystone	
28.00	32.00	4.00	SILTSTONE	Siltstone	
32.00	37.00	5.00	SANDSTONE/IRONSTONE	Sandstone	
37.00	42.00	5.00	SANDSTONE GREY	Sandstone	
42.00	48.00	6.00	SILTSTONE	Siltstone	
48.00	50.00	2.00	IRONSTONE AND QUARTZ	Ironstone Gravel	
50.00	54.00	4.00	SANDSTONE GREY	Sand	
54.00	58.00	4.00	IRONSTONE AND QUARTZ	Ironstone Gravel	
58.00	65.00	7.00	SANDSTONE GREY	Sandstone	
65.00	80.00	15.00	SANDSTONE WITH IRONSTONE BANDS	Sandstone	
80.00	84.00	4.00	SANDSTONE/QUARTZ	Sandstone	
84.00	101.50	17.50	SANDSTONE GREY	Sandstone	
101.50	102.00	0.50	SANDSTONE/QUARTZ	Sandstone	
102.00	104.00	2.00	SANDSTONE FRACTURED	Sandstone	
104.00	111.00	7.00	SANDSTONE GREY	Sandstone	
111.00	112.00	1.00	SANDSTONE QUARTZ	Sandstone	
112.00	143.00	31.00	SANDSTONE GREY	Sandstone	
143.00	146.00	3.00	SANDSTONE DARK GREY FRACT.	Sandstone	
146.00	166.00	20.00	SANDSTONE GREY	Sandstone	
166.00	170.00	4.00	SANDSTONE DARK GREY	Sandstone	
170.00	198.00	28.00	SANDSTONE GREY	Sandstone	
198.00	202.00	4.00	SANDSTONE DARK GREY	Sandstone	
202.00	205.00	3.00	SANDSTONE DARK GREY	Sandstone	
205.00	210.00	5.00	SANDSTONE DARK GREY	Sandstone	

Remarks

*** End of GW104265 ***

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NSW OFFICE OF WATER Work Summary

GW104417

Licence :10BL160790

Licence Status :Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Rotary

Owner Type :Private

Commenced Date : **Final Depth :** 180.00 m

Completion Date :23-Aug-1982 **Drilled Depth :** 180.00 m

Contractor Name :unknown

Driller :1783 CRUMP, William

Assistant Driller's Name :

Property : - N/A

Standing Water Level : 33.00 m

GWMA : -

Salinity : 134.00 mg/L

GW Zone : -

Yield : 0.20 L/s

Site Details

Site Chosen By

County

Parish

Portion/Lot DP

Client

Form A :CUMBERLAND

NARRABEEN

LT 8 DP 30325

Licensed :CUMBERLAND

NARRABEEN

8 30325

Region :10 - SYDNEY SOUTH COAST

CMA Map :

River Basin :

Grid Zone :

Scale :

Area / District :

Elevation :

Northing :6272609

Latitude (S) :33° 40' 28"

Elevation Source :

Eastings :340101

Longitude (E) :151° 16' 31"

GS Map : **MGA Zone :**56

Coordinate Source :Map Interpretation

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	210			Down Hole Hammer
1		Hole	Hole	5.50	180.00	159			Down Hole Hammer
1	1	Casing	Steel	-0.50	5.50	168.3	158.7		C: -.1-5.5m; Driven into Hole
1	1	Casing	PVC Class 9	-0.50	47.50	140			Screwed and Glued; Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
45.00	48.00	3.00				0.10	48.00	0.25	134.00
67.00	70.00	3.00				0.20	72.00	0.25	134.00
71.50	72.50	1.00				0.30	78.00	0.25	134.00
133.00	135.00	2.00		33.00		0.20	138.00	0.25	134.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	TOPSOIL	Topsoil	
1.00	10.00	9.00	SANDSTONE LIGHT BROWN	Sandstone	
10.00	14.00	4.00	SHALE	Shale	
14.00	32.00	18.00	SANDSTONE LIGHT BROWN	Sandstone	
32.00	32.50	0.50	CLAY WHITE	Clay	
32.50	35.00	2.50	SANDSTONE WHITE	Sandstone	
35.00	35.50	0.50	CLAY	Sandstone	
35.50	39.00	3.50	SANDSTONE WHITE	Sandstone	
39.00	44.70	5.70	SANDSTONE GREY	Sandstone	
44.70	45.00	0.30	CLAY WHITE	Clay	
45.00	48.00	3.00	SANDSTONE QUARTZ	Sandstone	
48.00	67.00	19.00	SANDSTONE GREY	Sandstone	
67.00	70.00	3.00	SANDSTONE QUARTZ	Sandstone	
70.00	71.50	1.50	SANDSTONE GREY	Sandstone	
71.50	72.50	1.00	IRONSTONE QUARTZ	Ironstone Gravel	
72.50	74.00	1.50	SANDSTONE QUARTZ	Sandstone	
74.00	75.50	1.50	SANDSTONE QUARTZ FRACTURED	Sandstone	
75.50	95.00	19.50	SANDSTONE GREY	Sandstone	
95.00	95.30	0.30	CLAY WHITE	Clay	
95.30	111.00	15.70	SANDSTONE GREY	Sandstone	
111.00	112.00	1.00	SANDSTONE DARK GREY	Sandstone	
112.00	133.00	21.00	SANDSTONE GREY	Sandstone	
133.00	135.00	2.00	SANDSTONE D/G FRACTURED	Sandstone	
135.00	180.00	45.00	SANDSTONE GREY	Sandstone	

Remarks

*** End of GW104417 ***

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

NSW OFFICE OF WATER Work Summary

GW104418

Licence :10BL160792

Licence Status : Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Rotary

Owner Type :Private

Commenced Date : **Final Depth :** 180.00 m

Completion Date :21-Aug-2002 **Drilled Depth :** 180.00 m

Contractor Name :INTERTECH DRILLING

Driller :1783 CRUMP, William

Assistant Driller's Name :

Property : - N/A

Standing Water Level : 71.00 m

GWMA : -

Salinity : 134.00 mg/L

GW Zone : -

Yield : 0.30 L/s

Site Details

Site Chosen By

County

Parish

Portion/Lot DP

Client Driller

Form A :CUMBERLAND

NARRABEEN

LT B DP 403166

Licensed :CUMBERLAND

NARRABEEN

B 403166

Region :10 - SYDNEY SOUTH COAST

CMA Map :

River Basin :

Grid Zone :

Scale :

Area / District :

Elevation :

Northing :6272310

Latitude (S) :33° 40' 37"

Elevation Source :

Eastings :338914

Longitude (E) :151° 15' 44"

GS Map :

MGA Zone :56

Coordinate Source :Map Interpretation

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	210			Down Hole Hammer
1		Hole	Hole	5.50	180.00	157			Down Hole Hammer
1	1	Casing	Steel	-0.50	5.50	168.3	158.7		C: -.1-5.5m; Driven into Hole
1	1	Casing	PVC Class 9	-0.50	71.50	140			Screwed and Glued; Suspended in Clamps

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
86.50	94.00	7.50				0.25	96.00	0.25	134.00
114.00	114.50	0.50		71.00		0.05	120.00	0.25	134.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.50	0.50	TOPSOIL	Topsoil	
0.50	17.00	16.50	SANDSTONE LIGHT BROWN	Sandstone	
17.00	22.00	5.00	SANDSTONE GREY	Sandstone	
22.00	23.00	1.00	SHALE	Shale	
23.00	28.00	5.00	SANDSTONE GREY	Sandstone	
28.00	28.30	0.30	CLAY	Clay	
28.30	29.00	0.70	IRONSTONE	Ironstone	
29.00	30.00	1.00	SANDSTONE QUARTZ	Sandstone	
30.00	35.00	5.00	SANDSTONE LIGHT BROWN SOFT	Sandstone	
35.00	43.00	8.00	SANDSTONE WHITE	Sandstone	
43.00	45.00	2.00	IRONSTONE FRACTURED	Ironstone Gravel	
45.00	57.00	12.00	SANDSTONE GREY	Sandstone	
57.00	60.00	3.00	SHALE SOFT	Shale	
60.00	68.00	8.00	SANDSTONE GREY	Sandstone	
68.00	69.00	1.00	IRONSTONE	Ironstone	
69.00	86.50	17.50	SANDSTONE GREY	Sandstone	
86.50	93.00	6.50	SANDSTONE FINE QUARTZ	Sandstone	
93.00	94.00	1.00	FINE QUARTZ SOFT	Invalid Code	
94.00	98.00	4.00	SANDSTONE FINE QUARTZ	Sandstone	
98.00	114.00	16.00	SANDSTONE GREY	Sandstone	
114.00	114.50	0.50	SANDSTONE QUARTZ	Sandstone	
114.50	180.00	65.50	SANDSTONE GREY	Sandstone	

Remarks

*** End of GW104418 ***

NSW OFFICE OF WATER Work Summary

GW105253

Licence :10BL162186

Licence Status : Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Rotary Air

Owner Type :

Commenced Date : **Final Depth :** 192.50 m

Completion Date :16-Oct-2003 **Drilled Depth :** 192.50 m

Contractor Name :INTERTECH DRILLING

Driller :1489 BARDEN, Colin Leslie

Assistant Driller's Name :

Property : - MARFLEET

Standing Water Level : 87.00 m

GWMA : -

Salinity : 206.00 mg/L

GW Zone : -

Yield : 0.10 L/s

Site Details

Site Chosen By

County

Parish

Portion/Lot DP

Client Driller

Form A :CUMBERLAND

NARRABEEN

9 30325

Licensed :CUMBERLAND

NARRABEEN

9 30325

Region :10 - SYDNEY SOUTH COAST

CMA Map :9130-1S

MONA VALE

River Basin :212 - HAWKESBURY RIVER

Grid Zone :56/1

Scale :1:25,000

Area / District :

Elevation : 0.00

Northing :6273242

Latitude (S) :33° 40' 8"

Elevation Source :(Unknown)

Eastings :340553

Longitude (E) :151° 16' 49"

GS Map : **MGA Zone :**56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.60	205			Down Hole Hammer
1		Hole	Hole	5.60	102.50	159			Down Hole Hammer
1		Hole	Hole	102.50	192.50	154			Down Hole Hammer
1	1	Casing	Steel	-0.40	5.60	168.3	158.7		C: 0-5.6m; Driven into Hole
1	1	Casing	PVC Class 9	-0.40	24.00	140			Screwed and Glued; Suspended in Clamps
1	1	Opening	Slots - Diagonal	24.00	30.00	140			PVC Class 9; SL: .1mm; A: 4mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
26.50	27.50	1.00				0.20	30.50	0.25	125.00
127.00	128.00	1.00				0.10	132.50	0.25	142.00
151.00	151.30	0.30				0.10	156.50	0.25	220.00
184.50	185.50	1.00		87.00		0.10	186.50	0.50	240.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.20	0.20	TOPSOIL	Topsoil	
0.20	6.20	6.00	SANDSTONE LT GREY M/G	Sandstone	
6.20	6.50	0.30	CLAY WHITE	Clay	
6.50	24.50	18.00	SANDSTONE GREY BROWN/IRONSTONE	Sandstone	
24.50	42.50	18.00	SANDSTONE F.W.GREY BROWN M/G	Sandstone	
42.50	56.50	14.00	SANDSTONE BROWN/IRONSTONE	Sandstone	
56.50	57.50	1.00	F. SANDSTONE BROWN/IRONSTONE	Invalid Code	
57.50	127.70	70.20	SANDSTONE GREY/DARK GREY M.G	Sandstone	
127.70	128.00	0.30	F.W. SANDSTONE GREY	Invalid Code	
128.00	137.00	9.00	SANDSTONE GREY M/G	Sandstone	
137.00	147.50	10.50	SANDSTONE DARK GREY	Sandstone	
147.50	175.00	27.50	SANDSTONE GREY/DARK GREY M.G	Sandstone	
175.00	186.50	11.50	F. SANDSTONE GREY W.	Invalid Code	
186.50	188.00	1.50	SANDSTONE GREY/DARK GREY	Sandstone	
188.00	190.50	2.50	RED SHALE	Invalid Code	
190.50	192.50	2.00	SANDSTONE GREY	Sandstone	

Remarks

*** End of GW105253 ***

NSW OFFICE OF WATER Work Summary

GW105255

Licence :10BL600322

Licence Status Active
Authorised Purpose(s)
DOMESTIC
STOCK

Intended Purpose(s)
DOMESTIC
STOCK

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Rotary

Owner Type :

Commenced Date : **Final Depth** : 114.00 m
Completion Date :16-Oct-2003 **Drilled Depth** : 114.00 m

Contractor Name :ULTRA DRILLING

Driller :1423 DODD, Alan Marcus

Assistant Driller's Name :

Property : - FARAHA

GWMA : -

GW Zone : -

Standing Water Level : 44.00 m

Salinity : 96.00 mg/L

Yield : 1.00 L/s

Site Details

Site Chosen By

Client

County

Form A :CUMBERLAND

Licensed :CUMBERLAND

Parish

NARRABEEN

NARRABEEN

Portion/Lot DP

264 752046

264 752046

Region :10 - SYDNEY SOUTH COAST

River Basin :213 - SYDNEY COAST - GEORGES RIVER

Area / District :

CMA Map :9130-1S

Grid Zone :56/1

MONA VALE

Scale :1:25,000

Elevation : 0.00

Elevation Source :(Unknown)

Northing :6272855

Easting :339944

Latitude (S) :33° 40' 20"

Longitude (E) :151° 16' 25"

GS Map : **MGA Zone** :56

Coordinate Source :

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	36.00	170			Down Hole Hammer
1		Hole	Hole	36.00	114.00	130			Down Hole Hammer
1	1	Casing	Steel	0.30	2.00	160			Driven into Hole
1	1	Casing	PVC Class 9	0.30	36.00	140			Glued; Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
66.00	67.00	1.00			68.00	0.60	68.00	1.00	100.00
72.00	73.00	1.00		44.00	75.00	1.00	75.00	1.50	96.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	CLAY	Clay	
2.00	22.00	20.00	BROKEN SANDSTONE	Invalid Code	
22.00	30.00	8.00	SHALE	Shale	
30.00	76.00	46.00	WHITE SANDSTONE	Invalid Code	
76.00	83.00	7.00	SANDSTONE/SHALE	Sandstone	
83.00	114.00	31.00	WHITE SANDSTONE	Invalid Code	

Remarks

Previous Lic No:10BL162212

*** End of GW105255 ***

NSW OFFICE OF WATER Work Summary

GW105671

Licence :10BL162365

Licence Status : Active
Authorised Purpose(s)
DOMESTIC

Intended Purpose(s)
DOMESTIC

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Down Hole Hammer

Owner Type :Private

Commenced Date : **Final Depth :** 180.00 m

Completion Date :22-Oct-2003 **Drilled Depth :** 180.00 m

Contractor Name :Ultradrilling

Driller :1600 DODD, Bradley Alan

Assistant Driller's Name :

Property : - BIRD

GWMA : -

GW Zone : -

Standing Water Level : 105.00 m

Salinity : 110.00 mg/L

Yield : 105.00 L/s cumulative

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
2/618622
2 618622

Region :10 - SYDNEY SOUTH COAST

River Basin :212 - HAWKESBURY RIVER

Area / District :

CMA Map :9130-1S
Grid Zone :56/1

MONA VALE
Scale :1:25,000

Elevation : 0.00

Elevation Source :(Unknown)

Northing :6274438

Easting :340693

Latitude (S) :33° 39' 29"

Longitude (E) :151° 16' 55"

GS Map : **MGA Zone :**56

Coordinate Source :GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	72.00	174			Down Hole Hammer
1		Hole	Hole	72.00	180.00	140			Down Hole Hammer
1	1	Casing	Steel	0.30	1.00	168			Glued; Driven into Hole
1	1	Casing	PVC Class 9	0.30	72.00	140			Glued; Driven into Hole; Open End

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
162.00	163.00	1.00			164.00	0.40		1.00	110.00
174.00	175.00	1.00		105.00	180.00	0.60		2.00	110.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	soil, dirt	Soil	
1.00	3.00	2.00	clay	Clay	
3.00	66.00	63.00	sandstone, soft yellow	Sandstone	
66.00	150.00	84.00	sandstone, shale	Sandstone	
150.00	174.00	24.00	shale	Shale	
174.00	180.00	6.00	shale, red	Shale	

Remarks

updated from original form A

*** End of GW105671 ***

NSW OFFICE OF WATER Work Summary

GW106327

Licence :10BL163449

Licence Status : Active

Authorised Purpose(s)

Intended Purpose(s)

Work Type :Bore

DOMESTIC

DOMESTIC

Work Status :Supply Obtained

STOCK

STOCK

Construct. Method :Down Hole Hammer

Owner Type :Private

Commenced Date : **Final Depth :** 180.00 m

Completion Date :07-Jul-2004 **Drilled Depth :** 180.00 m

Contractor Name :INTERTECH

Driller :1783 CRUMP, William

Assistant Driller's Name :

Property : - HAUGH

Standing Water Level : 49.50 m

GWMA : -

Salinity : 198.00 mg/L

GW Zone : -

Yield : 0.40 L/s cumulative

Site Details

Site Chosen By

County

Parish

Portion/Lot DP

Client Driller

Form A :CUMBERLAND

NARRABEEN

82//875079

Licensed :CUMBERLAND

NARRABEEN

82 875079

Region :10 - SYDNEY SOUTH COAST

CMA Map :9130-1S

MONA VALE

River Basin :212 - HAWKESBURY RIVER

Grid Zone :56/1

Scale :1:25,000

Area / District :

Elevation : 0.00

Northing :6273453

Latitude (S) :33° 40' 1"

Elevation Source :(Unknown)

Eastings :340803

Longitude (E) :151° 16' 58"

GS Map : **MGA Zone :**56

Coordinate Source :GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	206			Down Hole Hammer
1		Hole	Hole	5.50	72.00	159			Down Hole Hammer
1		Hole	Hole	72.00	180.00	155			Down Hole Hammer
1	1	Casing	Steel	-0.50	5.50	168.3	158.7		Screwed and Glued; Suspended in Clamps
1	1	Casing	PVC Class 9	-0.50	11.00	140			Screwed and Glued; Driven into Hole; Open End
1	1	Opening	Slots - Diagonal	11.00	21.50	140			PVC Class 9; Sawn; SL: .1mm; A: 3mm; Screwed and Glued

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
11.30	11.50	0.20				0.10			149.00
18.30	21.10	2.80				0.10			201.00
52.00	55.00	3.00		49.50		0.01			198.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	3.00	3.00	sand, silty	Sand	
3.00	11.30	8.30	sandstone, light grey	Sandstone	
11.30	11.50	0.20	sandstone, fractured	Sandstone	
11.50	15.00	3.50	sandstone, light brown	Sandstone	
15.00	15.20	0.20	sandstone, fractured	Sandstone	
15.20	17.50	2.30	sandstone, light brown	Sandstone	
17.50	18.30	0.80	sandstone, very soft	Sandstone	
18.30	21.00	2.70	sandstone, quartz	Sandstone	
21.00	21.10	0.10	sandstone, fracture	Sandstone	
21.10	21.70	0.60	sandstone, grey	Sandstone	
21.70	22.20	0.50	clay, white	Clay	
22.20	33.00	10.80	sandstone, ironstone bands	Sandstone	
33.00	40.00	7.00	sandstone, grey	Sandstone	
40.00	40.20	0.20	clay, white	Clay	
40.20	52.00	11.80	sandstone, grey	Sandstone	
52.00	55.00	3.00	sandstone, dark grey	Sandstone	
55.00	93.50	38.50	sandstone, grey	Sandstone	
93.50	93.70	0.20	sandstone, fracture	Sandstone	
93.70	153.50	59.80	sandstone, grey	Sandstone	
153.50	159.00	5.50	silt, stone	Silt	
159.00	164.00	5.00	sandstone, grey	Sandstone	
164.00	165.50	1.50	silt, stone, grey	Silt	
165.50	178.00	12.50	silt, stone red	Silt	
178.00	180.00	2.00	silt stone, grey	Silt	

Remarks

updated from original form A

*** End of GW106327 ***

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NSW OFFICE OF WATER Work Summary

GW106695

Licence :10BL164232

Licence Status : Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Down Hole Hammer

Owner Type :Private

Commenced Date : **Final Depth :** 120.00 m

Completion Date :23-Nov-2004 **Drilled Depth :** 120.00 m

Contractor Name :INTERTECH

Driller :1783 CRUMP, William

Assistant Driller's Name :

Property : - DAWE

Standing Water Level : 38.00 m

GWMA : -

Salinity : 132.00 mg/L

GW Zone : -

Yield : 0.90 L/s cumulative

Site Details

Site Chosen By

Client Driller

County

Form A :CUMBERLAND

Licensed :CUMBERLAND

Parish

NARRABEEN

NARRABEEN

Portion/Lot DP

6//1044346

6 1044346

Region :10 - SYDNEY SOUTH COAST

CMA Map :9130-1S

MONA VALE

River Basin :213 - SYDNEY COAST - GEORGES RIVER

Grid Zone :56/1

Scale :1:25,000

Area / District :

Elevation :

Northing :6272628

Latitude (S) :33° 40' 27"

Elevation Source :

Eastings :339830

Longitude (E) :151° 16' 20"

GS Map :

MGA Zone :56

Coordinate Source :GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	208			Down Hole Hammer
1		Hole	Hole	5.50	120.00	156			Down Hole Hammer
1	1	Casing	PVC Class 9	-42.00	53.00				Screwed and Glued
1	1	Casing	Steel	-0.40	5.60	156	146.4		Driven into Hole; Open End
1	1	Casing	PVC Class 9	-0.40	30.00	140			Screwed and Glued; Suspended in Clamps
1	1	Opening	Slots - Diagonal	30.00	42.00	140			PVC Class 9; Sawn; SL: .1mm; A: 3mm; Screwed and Glued
1	1	Opening	Slots - Diagonal	53.00	59.60	140			PVC Class 9; Sawn; SL: .1mm; A: 3mm; Screwed and Glued
1		Annulus	Concrete	-0.10	5.50	208	168		

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
31.00	35.00	4.00				0.20			145.00
53.00	54.00	1.00				0.20			144.00
67.00	70.00	3.00		38.00		0.20			140.00
72.00	86.00	14.00				0.30			132.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	2.00	2.00	fill, sandstone, rocker clay	Fill	
2.00	4.00	2.00	sandstone, very soft	Sandstone	
4.00	20.00	16.00	sandstone, light brown	Sandstone	
20.00	26.00	6.00	sandstone, quartz bands	Sandstone	
26.00	27.00	1.00	clay, soft	Clay	
27.00	31.00	4.00	sandstone, light brown	Sandstone	
31.00	35.00	4.00	sandstone, quartz soft	Sandstone	
35.00	41.00	6.00	ironstone, sandstone,	Ironstone	
41.00	41.30	0.30	clay	Clay	
41.30	41.60	0.30	quartz, course	Quartz	
41.60	44.00	2.40	clay	Clay	
44.00	49.00	5.00	siltstone	Siltstone	
49.00	53.00	4.00	sandstone, grey	Sandstone	
53.00	54.00	1.00	sandstone, fractured	Sandstone	
54.00	57.00	3.00	sandstone, quartz	Sandstone	
57.00	67.00	10.00	sandstone, grey	Sandstone	
67.00	67.50	0.50	quartz, course	Quartz	
67.50	70.00	2.50	sandstone, grey	Sandstone	
70.00	72.00	2.00	ironstone	Ironstone	
72.00	86.00	14.00	sandstone, fractured quartz	Sandstone	
86.00	90.00	4.00	sandstone, grey	Sandstone	
90.00	94.00	4.00	sandstone, ironstone, fractured quartz	Sandstone	
94.00	95.00	1.00	clay, sandstone, soft	Clay	
95.00	102.00	7.00	sandstone, quartz bands	Sandstone	
102.00	120.00	18.00	sandstone, grey	Sandstone	

Remarks

updated from original form A

*** End of GW106695 ***

Warning To Clients: This raw data has been supplied to the Department of Land and Water Conservation (DLWC) by drillers, licensees and other sources. The DLWC does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

NSW OFFICE OF WATER Work Summary

GW107194

Licence :10BL163459

Licence Status : Active

Authorised Purpose(s)

DOMESTIC

STOCK

Intended Purpose(s)

DOMESTIC

STOCK

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Rotary - Percussion (Down Hole Hammer)

Owner Type :Private

Commenced Date : **Final Depth :** 192.00 m

Completion Date :28-Sep-2004 **Drilled Depth :** 192.00 m

Contractor Name :CENTRAL WEST WATER DRILLING

Driller :1812 REYNOLDS, Christopher Howard R

Assistant Driller's Name :

Property : - SWIFT

GWMA : -

GW Zone : -

Standing Water Level : 18.00 m

Salinity :

Yield : 0.40 L/s cumulative

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
137 752046
137 752046

Region :10 - SYDNEY SOUTH COAST

CMA Map :

River Basin :

Grid Zone :

Area / District :

Scale :

Elevation :

Northing :6271355

Latitude (S) :33° 41' 7"

Elevation Source :

Easting :337051

Longitude (E) :151° 14' 31"

GS Map :

MGA Zone :56

Coordinate Source :GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	192.00	200			Rotary - Percussion (Down Hole Hammer)
1	1	Casing	PVC Class 9	-0.40	192.00	164	163.8		Riveted and Glued; Driven into Hole; Open End; S: 170-192m
1	1	Opening	Slots - Vertical	0.00	0.00	164			PVC Class 9; Casing - Hand Sawn Slot; SL: 200mm; A: 2mm; Riveted and Glued

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
74.00	170.00	96.00		18.00		0.40		2.00	

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	3.00	3.00	topsoil	Topsoil	
3.00	4.00	1.00	clay, sandy	Clay	
4.00	20.00	16.00	sandstone	Sandstone	
20.00	22.00	2.00	shales, grey	Shale	
22.00	52.00	30.00	sandstone	Sandstone	
52.00	56.00	4.00	clays	Claystone	
56.00	170.00	114.00	sandstone	Sandstone	
170.00	192.00	22.00	shales, grey	Shale	

Remarks

updated from original form A

*** End of GW107194 ***

NSW OFFICE OF WATER Work Summary

GW107518

Licence :10BL164091

Licence Status : Active
Authorised Purpose(s)
DOMESTIC

Intended Purpose(s)
DOMESTIC

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :(Unknown)

Owner Type :Private

Commenced Date : **Final Depth :** 120.00 m

Completion Date : 01-Jul-2005 **Drilled Depth :** 120.00 m

Contractor Name :unknown

Driller :400 UNKNOWN, Unkown

Assistant Driller's Name :

Property : - CHOULARTON

Standing Water Level :

GWMA : -

Salinity :

GW Zone : -

Yield :

500 L/day

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
208/752046
208 752046

Region :10 - SYDNEY SOUTH COAST

CMA Map :9130-1S

MONA VALE

River Basin :213 - SYDNEY COAST - GEORGES RIVER

Grid Zone :56/1

Scale :1:25,000

Area / District :

Elevation :

Northing :6272572

Latitude (S) :33° 40' 29"

Elevation Source :

Easting :339395

Longitude (E) :151° 16' 3"

GS Map :

MGA Zone :56

Coordinate Source :GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers
H P Component Type From (m) To (m) OD (mm) ID (mm) Interval Details

(No Construction Details Found)

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
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(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
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Remarks

Type of casing PVC, diameter of casing 150mm updated from AG form

*** End of GW107518 ***

NSW OFFICE OF WATER Work Summary

GW107528

Licence :10BL165517

Licence Status :Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Down Hole Hammer

Owner Type :Private

Commenced Date : **Final Depth :** 180.30 m

Completion Date :28-Sep-2005 **Drilled Depth :** 180.30 m

Contractor Name :INTERTECH

Driller :1950 WYATT, Brett Roy

Assistant Driller's Name :

Property : - MORRIS

Standing Water Level : 83.60 m

GWMA : -

Salinity : 390.00 mg/L

GW Zone : -

Yield : 0.60 L/s cumulative

Site Details

Site Chosen By

County

Parish

Portion/Lot DP

Client

Form A :CUMBERLAND

NARRABEEN

156//752046

Licensed :CUMBERLAND

NARRABEEN

156 752046

Region :10 - SYDNEY SOUTH COAST

CMA Map :9130-1S

MONA VALE

River Basin :213 - SYDNEY COAST - GEORGES RIVER

Grid Zone :56/1

Scale :1:25,000

Area / District :

Elevation :

Northing :6273541

Latitude (S) :33° 39' 58"

Elevation Source :

Eastings :340683

Longitude (E) :151° 16' 54"

GS Map :

MGA Zone :56

Coordinate Source :GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.60	202			Down Hole Hammer
1		Hole	Hole	5.60	102.30	165			Down Hole Hammer
1		Hole	Hole	102.30	180.30	159			Down Hole Hammer
1	1	Casing	Steel	-0.20	5.80	165	155.4		Driven into Hole
1	1	Casing	PVC Class 9	-0.20	59.80	140			Screwed and Glued; Suspended in Clamps
1	1	Opening	Slots - Diagonal	17.80	23.80	140			PVC Class 9; Sawn; SL: 100mm; A: 3mm
1	1	Opening	Slots - Diagonal	29.80	41.80	140			PVC Class 9; Sawn; SL: 100mm; A: 3mm
1	1	Opening	Slots - Diagonal	47.80	53.80	140			PVC Class 9; Sawn; SL: 100mm; A: 3mm
1		Annulus	Concrete	0.00	5.80	165			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
19.80	20.30	0.50				0.08			132.00
35.70	50.90	15.20		17.00		0.13			155.00
130.50	131.20	0.70				0.10			225.00
156.00	166.00	10.00		83.60		0.30			390.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	clay, light brown	Clay	
1.00	2.00	1.00	sandstone, brown weathered	Sandstone	
2.00	2.80	0.80	sandstone & ironstone, brown, water bearing	Sandstone	
2.80	13.60	10.80	sandstone, brown	Sandstone	
13.60	14.40	0.80	shale, grey	Shale	
14.40	19.80	5.40	sandstone, brown, grey pink	Sandstone	
19.80	20.30	0.50	sandstone, pink and quartz, water bearing	Sandstone	
20.30	26.50	6.20	sandstone & ironstone, brown	Sandstone	
26.50	26.90	0.40	clay, light brown	Clay	
26.90	35.70	8.80	sandstone, grey, light brown	Sandstone	
35.70	35.80	0.10	quartz, water bearing	Quartz	
35.80	37.00	1.20	ironstone	Ironstone	
37.00	37.30	0.30	clay, light brown	Clay	
37.30	47.70	10.40	sandstone, pink, grey, brown	Sandstone	
47.70	47.90	0.20	shale, grey	Shale	
47.90	50.80	2.90	sandstone, grey	Sandstone	
50.80	50.90	0.10	sandstone, grey and quartz, water bearing	Sandstone	
50.90	63.50	12.60	sandstone, grey	Sandstone	
63.50	67.80	4.30	shale, black silty	Shale	
67.80	71.70	3.90	sandstone, light grey	Sandstone	
71.70	78.60	6.90	shale, black silty	Shale	
78.60	130.50	51.90	sandstone, grey black shale bands	Sandstone	
130.50	131.20	0.70	sandstone, grey, fractured, water bearing	Sandstone	
131.20	166.00	34.80	sandstone, grey, & grey silty shale, water bearing	Sandstone	
166.00	180.30	14.30	shale, grey silty, red silty shale	Shale	

Remarks

Form A Remarks:

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NSW OFFICE OF WATER

Work Summary

GW107528

130.5 - 131.2 very unstable - aire lifted at 132m 0.5lps updated from original form A

***** End of GW107528 *****

NSW OFFICE OF WATER Work Summary

GW108106

Licence :10BL600255

Licence Status :Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Down Hole Hammer

Owner Type :Private

Commenced Date : **Final Depth :** 180.00 m

Completion Date :15-May-2006 **Drilled Depth :** 180.00 m

Contractor Name :INTERTECH

Driller :1489 BARDEN, Colin Leslie

Assistant Driller's Name :

Property : - MEDWAY

Standing Water Level : 50.00 m

GWMA : -

Salinity :

GW Zone : -

Yield : 0.70 L/s cumulative

Site Details

Site Chosen By

County

Parish

Portion/Lot DP

Client

Form A :CUMBERLAND

NARRABEEN

8 1044346

Licensed :CUMBERLAND

NARRABEEN

8 1044346

Region :10 - SYDNEY SOUTH COAST

CMA Map :

River Basin :

Grid Zone :

Scale :

Area / District :

Elevation :

Northing :6272580

Latitude (S) :33° 40' 29"

Elevation Source :

Eastings :339684

Longitude (E) :151° 16' 14"

GS Map :

MGA Zone :56

Coordinate Source :GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.50	203			Down Hole Hammer
1		Hole	Hole	5.50	120.00	164			Down Hole Hammer
1		Hole	Hole	120.00	180.00	160			Down Hole Hammer
1	1	Casing	Steel	-0.50	5.50	168	158.4		Driven into Hole; Suspended in Clamps; Open End
1	1	Casing	PVC Class 9	-0.50	71.50	140			Screwed and Glued; Suspended in Clamps; Open End
1		Annulus	Concrete	0.00	5.50	203			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
35.00	42.00	7.00				0.01			156.00
66.00	66.30	0.30				0.49			130.00
90.50	93.00	2.50				0.10			130.00
130.00	131.50	1.50		50.00		0.10			148.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	sand, clay	Sand	
1.00	15.00	14.00	sandstone, weathered	Sandstone	
15.00	15.20	0.20	clay, grey	Clay	
15.20	28.00	12.80	sandstone, weathere d	Sandstone	
28.00	30.00	2.00	ironstone	Ironstone	
30.00	35.00	5.00	shale	Shale	
35.00	42.00	7.00	sandstone, grey quartz	Sandstone	
42.00	44.00	2.00	claym grey	Clay	
44.00	51.50	7.50	sandstone, grey	Sandstone	
51.50	66.00	14.50	sandstone, grey quartz	Sandstone	
66.00	66.30	0.30	quartz, fractured	Quartz	
66.30	88.00	21.70	sandstone, grey quartz	Sandstone	
88.00	88.50	0.50	ironstone	Ironstone	
88.50	90.50	2.00	sandstone, grey	Sandstone	
90.50	93.00	2.50	quartz	Quartz	
93.00	94.50	1.50	sandstone, grey	Sandstone	
94.50	95.00	0.50	clay, grey	Clay	
95.00	100.00	5.00	sandstone, grey	Sandstone	
100.00	103.00	3.00	sandstone, grey clay quartz	Sandstone	
103.00	104.00	1.00	sandstone, grey	Sandstone	
104.00	107.00	3.00	sandstone, grey clay	Sandstone	
107.00	122.00	15.00	sandstone, grey	Sandstone	
122.00	130.00	8.00	sandstone, grey siltstone	Sandstone	
130.00	131.50	1.50	sandstone, grey quartz	Sandstone	
131.50	158.00	26.50	sandstone, grey	Sandstone	
158.00	160.00	2.00	siltstone	Siltstone	
160.00	170.00	10.00	sandstone, grey siltstone	Sandstone	
170.00	180.00	10.00	sandstone, grey	Sandstone	

Remarks

updated from original form A

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NSW OFFICE OF WATER
Work Summary

GW108106

*** End of GW108106 ***

NSW OFFICE OF WATER Work Summary

GW108450

<p>Licence :10BL601060</p> <p>Work Type :Bore</p> <p>Work Status :Supply Obtained</p> <p>Construct. Method :Down Hole Hammer</p> <p>Owner Type :Private</p> <p>Commenced Date : Final Depth : 150.00 m</p> <p>Completion Date :19-Jan-2007 Drilled Depth : 150.00 m</p> <p>Contractor Name :INTERTECH DRILLING</p> <p>Driller :1489 BARDEN, Colin Leslie</p> <p>Assistant Driller's Name :</p> <p>Property : - SHIELDS</p> <p>GWMA : -</p> <p>GW Zone : -</p>	<p>Licence Status : Active</p> <p>Authorised Purpose(s) :</p> <p>DOMESTIC</p> <p>STOCK</p> <p>Intended Purpose(s) :</p> <p>DOMESTIC</p> <p>STOCK</p>
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Site Details

Site Chosen By	County	Parish	Portion/Lot DP
Client Driller	Form A : CUMBERLAND	NARRABEEN	86//12115
	Licensed : CUMBERLAND	NARRABEEN	86 12115
Region : 10 - SYDNEY SOUTH COAST		CMA Map : 9130-1S	MONA VALE
River Basin : 213 - SYDNEY COAST - GEORGES RIVER		Grid Zone : 56/1	Scale : 1:25,000
Area / District :			
Elevation :		Northing : 6271876	Latitude (S) : 33° 40' 51"
Elevation Source :		Eastings : 339185	Longitude (E) : 151° 15' 55"
GS Map :	MGA Zone : 56	Coordinate Source : GIS - Geographic Information System	

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	2.70	203			Down Hole Hammer
1		Hole	Hole	2.70	150.00	161			Down Hole Hammer
1	1	Casing	Steel	-0.30	2.70	168	158.4		Driven into Hole; Suspended in Clamps; Open End
1	1	Casing	PVC Class 9	-0.30	41.70	140			Screwed and Glued; Suspended in Clamps
1		Annulus	Concrete	0.00	2.70	203			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
35.50	37.00	1.50				0.02			125.00
73.00	75.00	2.00				0.10			98.00
101.00	103.00	2.00				0.23			92.00
133.00	137.00	4.00		41.30		0.20			110.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.50	0.50	Soil, sandy	Soil	
0.50	22.00	21.50	Sandstone, yellow	Sandstone	
22.00	25.00	3.00	Ironstone	Ironstone	
25.00	35.50	10.50	Sandstone, grey	Sandstone	
35.50	37.00	1.50	Sandstone-Quartz, water bearing	Sandstone	
37.00	38.00	1.00	Clay band	Clay	
38.00	49.00	11.00	Sandstone, grey	Sandstone	
49.00	63.00	14.00	Sandstone-Quartz	Sandstone	
63.00	73.00	10.00	Sandstone, grey	Sandstone	
73.00	75.00	2.00	Sandstone-Quartz, water bearing	Sandstone	
75.00	101.00	26.00	Sandstone, grey	Sandstone	
101.00	103.00	2.00	Sandstone-Quartz, water bearing	Sandstone	
103.00	116.00	13.00	Sandstone, grey	Sandstone	
116.00	117.00	1.00	Siltstone	Siltstone	
117.00	129.00	12.00	Sandstone, grey	Sandstone	
129.00	129.50	0.50	Clay	Clay	
129.50	133.00	3.50	Sandstone, grey	Sandstone	
133.00	137.00	4.00	Sandstone-Quartz, water bearing	Sandstone	
137.00	139.00	2.00	Sandstone-Siltstone	Sandstone	
139.00	148.50	9.50	Sandstone, grey	Sandstone	
148.50	149.00	0.50	Siltstone	Siltstone	
149.00	150.00	1.00	Sandstone, grey	Sandstone	

Remarks

updated from original form A

*** End of GW108450 ***

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NSW OFFICE OF WATER Work Summary

GW108510

Licence :10BL600637

Licence Status :Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Down Hole Hammer

Owner Type :Private

Commenced Date : **Final Depth :** 102.00 m

Completion Date :27-Sep-2006 **Drilled Depth :** 102.00 m

Contractor Name :INTERTECH DRILLING

Driller :1489 BARDEN, Colin Leslie

Assistant Driller's Name :

Property : - CRAIG PERKINS INVESTMENTS

Standing Water Level : 32.40 m

GWMA : -

Salinity : 125.00 mg/L

GW Zone : -

Yield : 2.40 L/s Cumulative

Site Details

Site Chosen By

Client Driller

County

Form A :CUMBERLAND

Licensed :CUMBERLAND

Parish

NARRABEEN

NARRABEEN

Portion/Lot DP

1/598867

1 598867

Region :10 - SYDNEY SOUTH COAST

CMA Map :9130-1S

MONA VALE

River Basin :212 - HAWKESBURY RIVER

Grid Zone :56/1

Scale :1:25,000

Area / District :

Elevation :

Northing :6273441

Latitude (S) :33° 40' 1"

Elevation Source :

Easting :339452

Longitude (E) :151° 16' 6"

GS Map : **MGA Zone :**56

Coordinate Source :GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	2.60	203			Down Hole Hammer
1		Hole	Hole	2.60	102.00	164			Down Hole Hammer
1	1	Casing	Steel	-0.40	2.60	168	158.4		Driven into Hole; Suspended in Clamps; Open End
1	1	Casing	PVC Class 9	-0.40	17.60	140			Screwed and Glued; Suspended in Clamps
1		Annulus	Concrete	0.00	2.60	203			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
54.00	58.00	4.00				0.20			115.00
85.50	90.00	4.50		32.40		2.20			125.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.60	0.60	Soil, sandy	Soil	
0.60	2.80	2.20	Sandstone, weathered	Sandstone	
2.80	5.40	2.60	Shale	Shale	
5.40	7.00	1.60	Sandstone, weathered	Sandstone	
7.00	8.00	1.00	Shale	Shale	
8.00	15.00	7.00	Sandstone, grey	Sandstone	
15.00	22.00	7.00	Sandstone, yellow	Sandstone	
22.00	43.00	21.00	Sandstone, grey	Sandstone	
43.00	45.00	2.00	Sandstone, grey Quartz	Sandstone	
45.00	47.00	2.00	Sandstone, grey	Sandstone	
47.00	50.00	3.00	Sandstone, grey Quartz	Sandstone	
50.00	54.00	4.00	Sandstone, grey	Sandstone	
54.00	58.00	4.00	Sandstone, grey Quartz, water bearing	Sandstone	
58.00	67.00	9.00	Sandstone, grey	Sandstone	
67.00	73.00	6.00	Sandstone, grey Quartz	Sandstone	
73.00	85.50	12.50	Sandstone, grey	Sandstone	
85.50	90.00	4.50	Quartz	Quartz	
90.00	102.00	12.00	Sandstone, grey	Sandstone	

Remarks

updated from original form A

*** End of GW108510 ***

NSW OFFICE OF WATER Work Summary

GW108676

Licence :10BL601385

Licence Status : Active
Authorised Purpose(s)
DOMESTIC

Intended Purpose(s)
DOMESTIC

Work Type :Spear

Work Status :Abandoned Bore

Construct. Method :Down Hole Hammer

Owner Type :Private

Commenced Date : **Final Depth :** 120.00 m

Completion Date : 01-Mar-2007 **Drilled Depth :** 120.00 m

Contractor Name :Highland Drilling

Driller :1771 DELAMONT, Brett

Assistant Driller's Name :

Property : - CONGAGLEN

GWMA : -

GW Zone : -

Standing Water Level :

Salinity :

Yield :

Site Details

Site Chosen By

County
Form A :CUMBERLAND
Licensed :CUMBERLAND

Parish
NARRABEEN
NARRABEEN

Portion/Lot DP
2//579095
2 579095

Region :10 - SYDNEY SOUTH COAST

River Basin :

Area / District :

Elevation :

Elevation Source :

GS Map : **MGA Zone :**56

CMA Map :

Grid Zone :

Scale :

Northing :6272803

Easting :340538

Latitude (S) :33° 40' 22"

Longitude (E) :151° 16' 48"

Coordinate Source :GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	120.00		200		Down Hole Hammer

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
----------	--------	---------------	----------	------------	------------	-------------	----------------	---------------	-----------------

(No Water Bearing Zone Details Found)

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	24.00	24.00	sandstone, pink orange	Sandstone	
24.00	72.00	48.00	sandstone, fine grey	Sandstone	
72.00	84.00	12.00	shale	Shale	
84.00	114.00	30.00	sandstone, fine grey	Sandstone	
114.00	120.00	6.00	shale	Shale	

Remarks

Abandoned bore. updated from original form A

*** End of GW108676 ***

NSW OFFICE OF WATER Work Summary

GW108708

Licence :10BL601568

Licence Status :Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Down Hole Hammer

Owner Type :Private

Commenced Date : **Final Depth :** 150.00 m

Completion Date :19-Apr-2007 **Drilled Depth :** 150.00 m

Contractor Name :INTERTECH DRILLING

Driller :1997 SHEEHY, Paul

Assistant Driller's Name :

Property : - ADDISON

Standing Water Level : 38.00 m

GWMA : -

Salinity : 270.00 mg/L

GW Zone : -

Yield : 0.85 L/s cumulative

Site Details

Site Chosen By

Client Driller

County

Form A :CUMBERLAND

Licensed :CUMBERLAND

Parish

NARRABEEN

NARRABEEN

Portion/Lot DP

1//595401

1 595401

Region :10 - SYDNEY SOUTH COAST

CMA Map :

River Basin :

Grid Zone :

Scale :

Area / District :

Elevation :

Northing :6272996

Latitude (S) :33° 40' 15"

Elevation Source :

Eastings :339338

Longitude (E) :151° 16' 1"

GS Map :

MGA Zone :56

Coordinate Source :GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.60	203			Down Hole Hammer
1		Hole	Hole	5.60	150.00	158			Down Hole Hammer
1	1	Casing	Steel	-0.40	5.60	168			Driven into Hole; Open End
1	1	Casing	PVC Class 9	-0.40	95.60	140			Screwed and Glued; Suspended in Clamps; Open End
1	1	Opening	Slots - Diagonal	72.00	90.00	140			PVC Class 9; Sawn; SL: 100mm; A: 3mm

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
37.00	42.00	5.00				0.10			121.00
73.00	76.00	3.00				0.10			150.00
108.50	112.00	3.50				0.65			270.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.20	0.20	topsoil	Topsoil	
0.20	21.00	20.80	sandstone, grey	Sandstone	
21.00	21.50	0.50	ironstone	Ironstone	
21.50	31.50	10.00	sandstone, grey	Sandstone	
31.50	34.00	2.50	sandstone, quartz	Sandstone	
34.00	37.00	3.00	sandstone, grey	Sandstone	
37.00	42.00	5.00	sandstone, quartz	Sandstone	
42.00	56.50	14.50	sandstone, grey	Sandstone	
56.50	67.00	10.50	sandstone, quartz	Sandstone	
67.00	73.00	6.00	sandstone, grey	Sandstone	
73.00	76.00	3.00	sandstone, quartz	Sandstone	
76.00	77.00	1.00	sandstone, grey	Sandstone	
77.00	78.50	1.50	siltstone, clay band	Siltstone	
78.50	85.00	6.50	sandstone, grey	Sandstone	
85.00	85.50	0.50	siltstone, clay band	Siltstone	
85.50	94.00	8.50	sandstone, quartz	Sandstone	
94.00	94.50	0.50	clay, quartz band	Clay	
94.50	98.00	3.50	sandstone, quartz	Sandstone	
98.00	108.50	10.50	sandstone, grey	Sandstone	
108.50	112.00	3.50	sandstone, quartz	Sandstone	
112.00	128.50	16.50	sandstone, grey	Sandstone	
128.50	130.00	1.50	siltstone	Siltstone	
130.00	136.00	6.00	sandstone, grey	Sandstone	
136.00	140.00	4.00	siltstone	Siltstone	
140.00	150.00	10.00	sandstone, grey	Sandstone	

Remarks

updated from original form A

*** End of GW108708 ***

NSW OFFICE OF WATER Work Summary

GW108831

Licence :10BL601319

Licence Status :Active

Authorised Purpose(s)

Intended Purpose(s)

DOMESTIC

DOMESTIC

STOCK

STOCK

Work Type :Bore

Work Status :Supply Obtained

Construct. Method :Down Hole Hammer

Owner Type :Private

Commenced Date : **Final Depth :** 180.00 m

Completion Date :17-Apr-2007 **Drilled Depth :** 180.00 m

Contractor Name :INTERTECH DRILLING

Driller :1997 SHEEHY, Paul

Assistant Driller's Name :

Property : - SCARF

Standing Water Level : 21.00 m

GWMA : -

Salinity :

GW Zone : -

Yield : 0.20 L/s cumulative

Site Details

Site Chosen By

County

Parish

Portion/Lot DP

Client Driller

Form A :CUMBERLAND

NARRABEEN

2/595401

Licensed :CUMBERLAND

NARRABEEN

2 595401

Region :10 - SYDNEY SOUTH COAST

CMA Map :

River Basin :

Grid Zone :

Scale :

Area / District :

Elevation :

Northing :6272957

Latitude (S) :33° 40' 16"

Elevation Source :

Eastings :339422

Longitude (E) :151° 16' 4"

GS Map :

MGA Zone :56

Coordinate Source :GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level;

H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity;PL-Placement of Gravel Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers

H	P	Component	Type	From (m)	To (m)	OD (mm)	ID (mm)	Interval	Details
1		Hole	Hole	0.00	5.60	203			Down Hole Hammer
1		Hole	Hole	5.60	180.00	158			Down Hole Hammer
1	1	Casing	Steel	-0.40	5.60	168			Seated on Bottom; Open End
1	1	Casing	PVC Class 9	-0.40	107.60	140			Screwed and Glued; Suspended in Clamps; Open End
1	1	Opening	Slots - Diagonal	20.00	24.00	140			PVC Class 9; Sawn; SL: 100mm; A: 3mm
1	1	Opening	Slots - Diagonal	57.00	60.00	140			PVC Class 9; Sawn; SL: 100mm; A: 3mm
1	1	Opening	Slots - Diagonal	90.00	102.00	140			PVC Class 9; Sawn; SL: 100mm; A: 3mm
1		Annulus	Concrete	0.00	5.60	203			

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
22.00	22.50	0.50				0.05			115.00
89.00	91.00	2.00				0.10			140.00
98.00	98.50	0.50				0.05			151.00

Drillers Log

From (m)	To (m)	Thickness(m)	Drillers Description	Geological Material	Comments
0.00	0.50	0.50	topsoil	Topsoil	
0.50	13.00	12.50	sandstone, yellow	Sandstone	
13.00	13.50	0.50	clay	Clay	
13.50	22.00	8.50	sandstone, yellow	Sandstone	
22.00	22.50	0.50	sandstone, quartz	Sandstone	
22.50	23.00	0.50	clay	Clay	
23.00	43.00	20.00	sandstone, yellow	Sandstone	
43.00	52.50	9.50	sandstone, quartz	Sandstone	
52.50	55.50	3.00	sandstone, grey	Sandstone	
55.50	56.50	1.00	shale, soft	Shale	
56.50	58.50	2.00	sandstone, quartz	Sandstone	
58.50	64.50	6.00	shale, clay band	Shale	
64.50	74.00	9.50	sandstone, grey	Sandstone	
74.00	77.00	3.00	shale, soft	Shale	
77.00	89.00	12.00	sandstone, grey	Sandstone	
89.00	91.00	2.00	sandstone, quartz	Sandstone	
91.00	94.00	3.00	sandstone, grey	Sandstone	
94.00	95.00	1.00	sandstone, clay band	Sandstone	
95.00	98.00	3.00	sandstone, grey	Sandstone	
98.00	98.50	0.50	sandstone, quartz	Sandstone	
98.50	100.50	2.00	sandstone, grey	Sandstone	
100.50	102.00	1.50	sandstone, clay band	Sandstone	
102.00	121.00	19.00	sandstone, grey	Sandstone	
121.00	125.00	4.00	shale	Shale	
125.00	145.00	20.00	sandstone, grey	Sandstone	
145.00	146.00	1.00	shale	Shale	
146.00	180.00	34.00	sandstone, grey	Sandstone	

Remarks

updated from original form A

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NSW OFFICE OF WATER
Work Summary

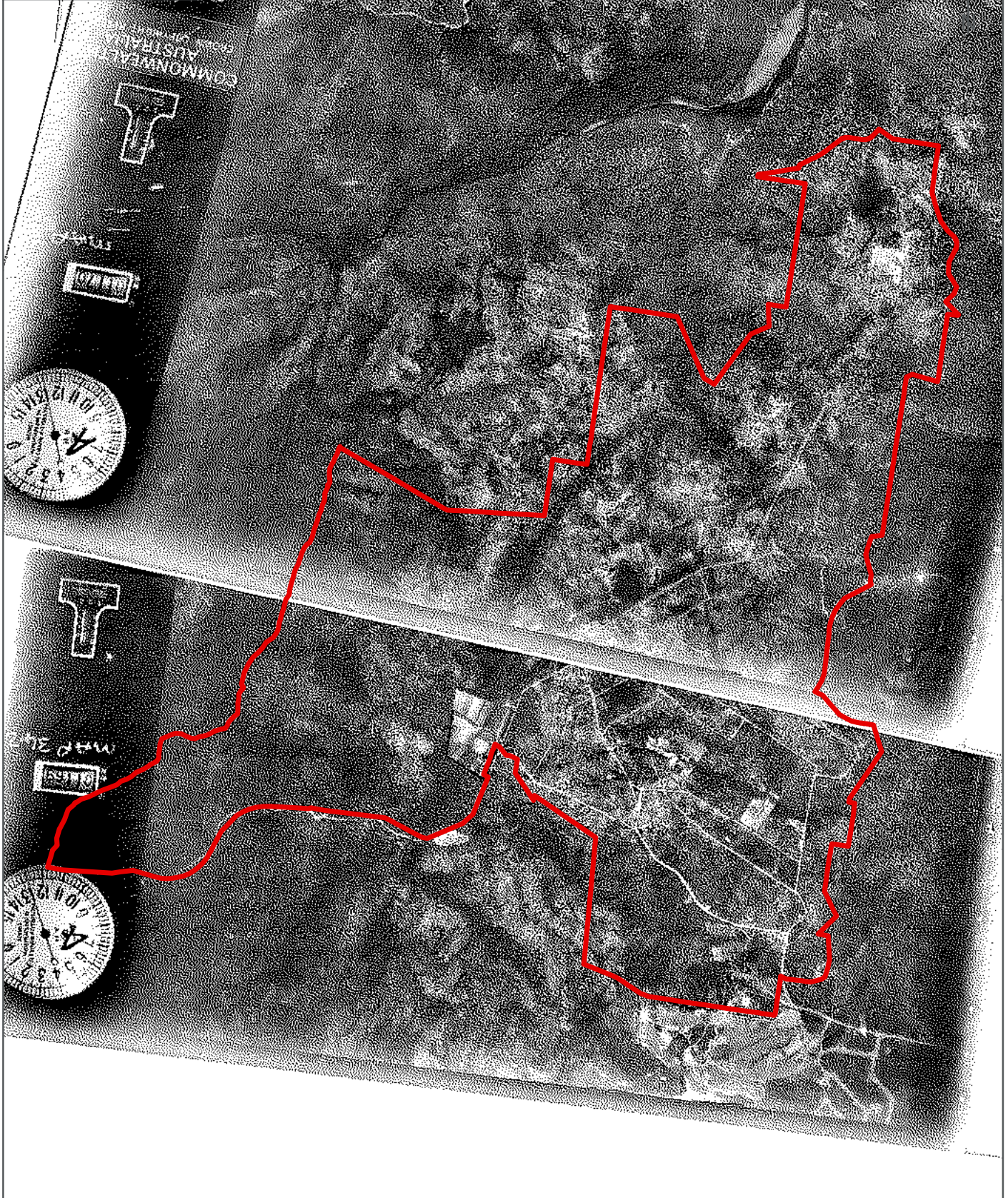
GW108831

*** End of GW108831 ***

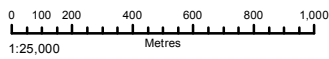
APPENDIX C – HISTORICAL AERIAL PHOTOGRAPHS

LEGEND

 Ingleside Release Area



DATE 26/08/2014



PAGE SIZE A4

COORDINATE SYSTEM
GDA 1994 MGA Zone 56

APPENDIX C

FIGURE TITLE Aerial - 1930

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct


CREATED BY R. Chatfield

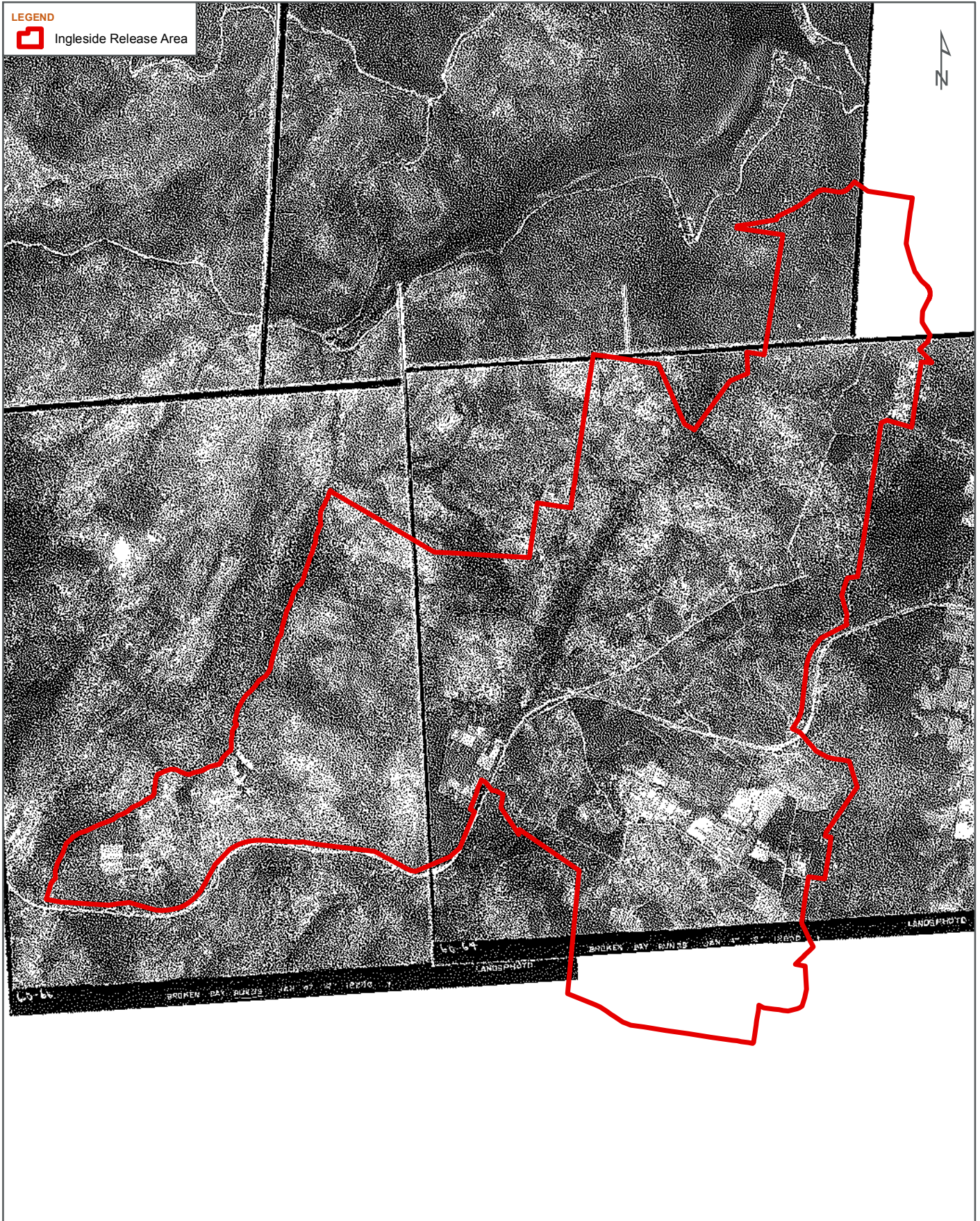
SOURCES Vector backdrop data © MDS 2013



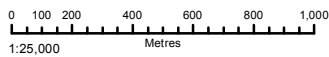
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 Ingleside Release Area



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GDA 1994 MGA Zone 56

APPENDIX C

FIGURE TITLE Aerial - 1947

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield


SOURCES Vector backdrop data © MDS 2013

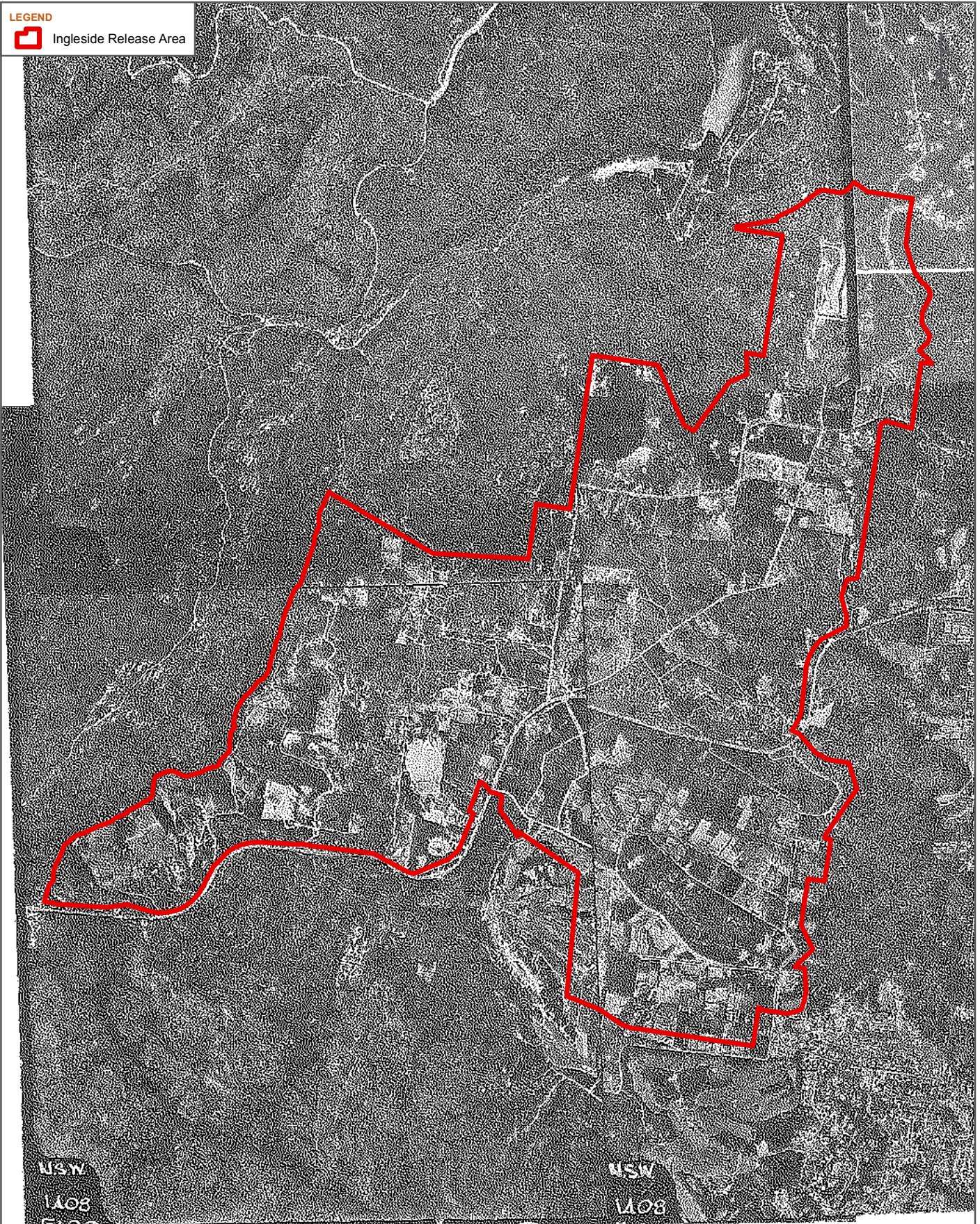


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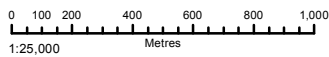
Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, this map contains data from a number of sources - no warranty is given that the information contained on this map is free from error or omission. Any reliance placed on such information shall be at the sole risk of the user. Please verify the accuracy of all information prior to using it. This map is not a design document.

LEGEND

 Ingleside Release Area



DATE 28/08/2014



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COORDINATE SYSTEM
GDA 1994 MGA Zone 56

APPENDIX C

FIGURE TITLE Aerial - 1965

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield


SOURCES Vector backdrop data © MDS 2013

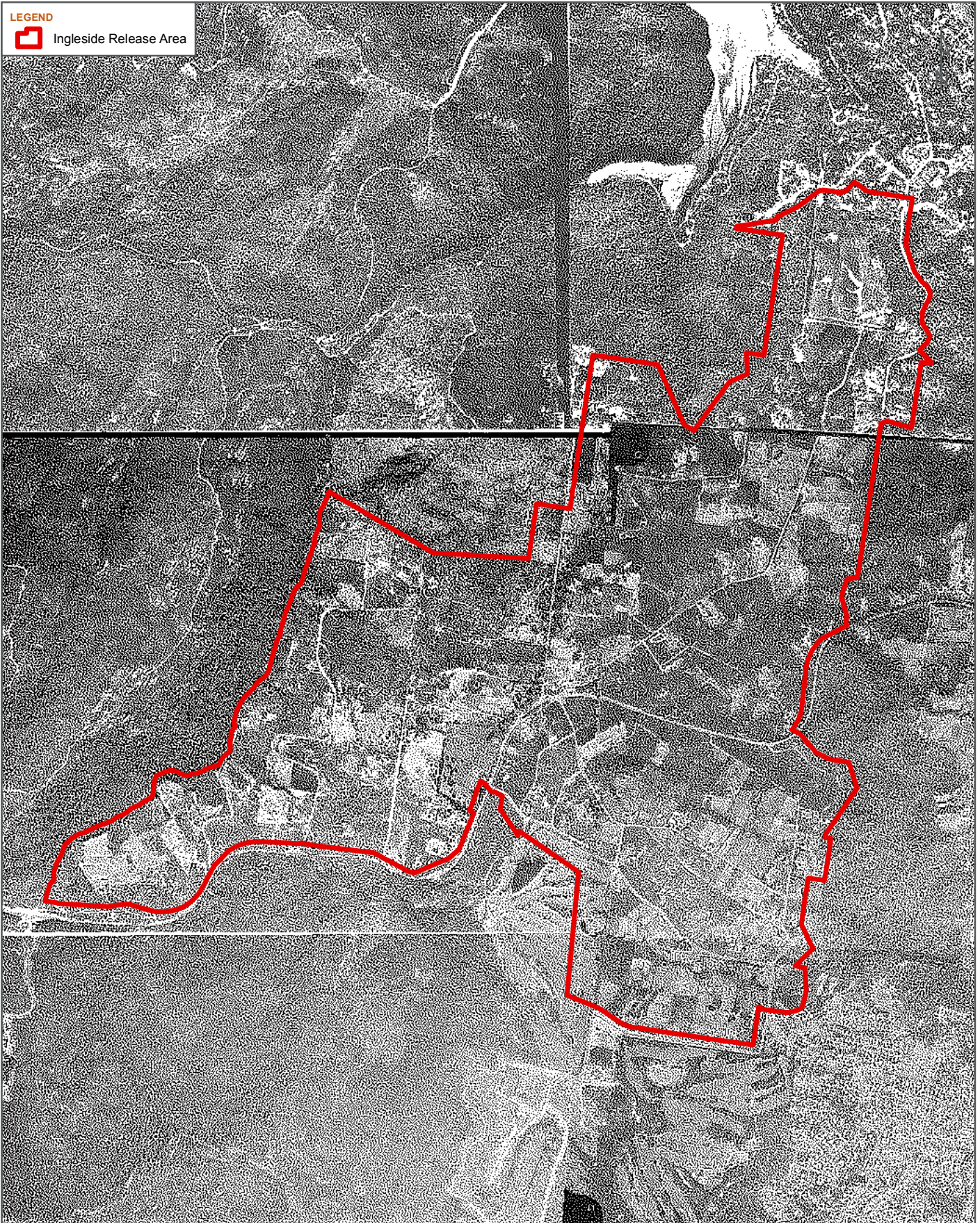


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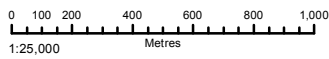
Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, this map contains data from a number of sources - no warranty is given that the information contained on this map is free from error or omission. Any reliance placed on such information shall be at the sole risk of the user. Please verify the accuracy of all information prior to using it. This map is not a design document.

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 Ingleside Release Area



DATE 28/08/2014



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COORDINATE SYSTEM
GDA 1994 MGA Zone 56

APPENDIX C

FIGURE TITLE Aerial - 1978

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield


SOURCES Vector backdrop data © MDS 2013



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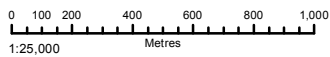
LEGEND

 Ingleside Release Area

UA 9 1025 151.45



DATE 26/08/2014



PAGE SIZE A4

COORDINATE SYSTEM
GDA 1994 MGA Zone 56

APPENDIX C

FIGURE TITLE Aerial - 1991

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield


SOURCES Vector backdrop data © MDS 2013



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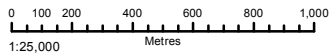
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LEGEND

 Ingleside Release Area



DATE 26/08/2014



PAGE SIZE A4

COORDINATE SYSTEM
GDA 1994 MGA Zone 56

APPENDIX C

FIGURE TITLE Aerial - 2012

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct

CREATED BY R. Chatfield

SOURCES Vector backdrop data © MDS 2013



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APPENDIX D – LABORATORY SUMMARY TABLES



Table D1 - Soil Analytical Results (Contamination)

Table with 30 columns for various pesticides and PCBs. Rows include LOR, NEPM 2013 HIL Residential A-D, Ecological Screening Level for TPH, NEPM 2013 ESLs for TPH in urban residential and public open space (fine), NEPM 2013 ESLs for TPH in commercial/industrial (fine), Management Limits for TPH Fractions in soil (NEPM 2013), Urban residential/public open space (fine), Commercial/ Industrial (fine), Ecological Investigation Levels, NEPM 1999 EIL, NEPM 2013 ACL in public open space, Average concentration, and NEPM EILs (Calculated Value ACL + Average).

Table with 30 columns for various pesticides and PCBs. Rows include field data for S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2 - Field Duplicate, S283, S283/2 - Field Duplicate, and S130.

Statistical Summary table with 30 columns for various pesticides and PCBs. Rows include Number of Results, Number of Detects, Minimum Concentration, Minimum Detect, Maximum Concentration, Maximum Detect, Average Concentration, Median Concentration, Standard Deviation, Number of Guideline Exceedances, and Number of Guideline Exceedances (Detects Only).

NEW NEPM acronyms:
ACLs = Added Contaminant Limits
ESLs = Ecological Screening Level
HSL = Health Screening Levels
EIL = Ecological Investigation Level
NL = Not Limiting
A&B = Low to high density residential
C = Residential / Open Space
D = Commercial / Industrial



Table D1 - Soil Analytical Results (Contamination)

	lenols										TRH						TPH					
	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Sum of PAH	Pyrene	C6-C10 Fraction	C6-C10 Fraction minus BTEX (F1)	>C10-C16 Fraction	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C40 Fraction (sum)	>C10-C16 Fraction minus Naphthalene (F2)	C6 - C9	C10 - C14	C15 - C28	C29-C36	>C10 - C36 (Sum of total)
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	10	10	50	100	100	50	50	10	50	100	100	50	
Health Investigation Levels (NEPM 2013)																						
NEPM 2013 HIL Residential A																						
NEPM 2013 HIL Residential B																						
NEPM 2013 HIL Residential C																						
NEPM 2013 HIL Residential D																						
Ecological Screening Level for TPH																						
NEPM 2013 ESLs for TPH in urban residential and public open space (fine)										180	120	1300	5600									
NEPM 2013 ESLs for TPH in commercial/Industrial (fine)										215	170	2500	6600									
Management Limits for TPH Fractions in soil (NEPM 2013)																						
Urban residential/public open space (fine)										800	1000	3500	10000									
Commercial/ Industrial (fine)										800	1000	5000	10000									
Ecological Investigation Levels																						
NEPM 1999 EIL																						
NEPM 2013 ACL in public open space								170														
Average concentration																						
NEPM EILs (Calculated Value ACL + Average)																						

Field ID	Sampled Date	SDG	Sample Depth	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Sum of PAH	Pyrene	C6-C10 Fraction	C6-C10 Fraction minus BTEX (F1)	>C10-C16 Fraction	>C16-C34 Fraction	>C34-C40 Fraction	>C10-C40 Fraction (sum)	>C10-C16 Fraction minus Naphthalene (F2)	C6 - C9	C10 - C14	C15 - C28	C29-C36	>C10 - C36 (Sum of total)
S154	6/3/2014	ES1405222	0-0.2	0.6	0.6	<0.5	1.3	<0.5	<0.5	<0.5	0.8	6.9	1.4	<10	<10	<50	150	130	280	<50	<10	<50	<100	130	130
S469	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S444	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S212	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S38	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S91	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S140	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S164	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	1.3	0.6	<10	<10	<50	100	110	210	<50	<10	<50	<100	100	100
S41	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S15/1	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S15/2 - Field Duplicate	6/03/2014	ES1405222	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	160	100	260	<50	<10	<50	120	110	230
S283	14/03/2014	ES1405891	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S283/2 - Field Duplicate	14/03/2014	ES1405891	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50
S130	14/03/2014	ES1405891	0-0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50

Statistical Summary																										
Number of Results	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	
Number of Detects	1	1	0	2	0	0	0	1	2	2	0	0	0	3	3	3	0	0	0	1	3	3				
Minimum Concentration	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<100	<100	<50	<50	<10	<50	<100	<100	<50	<100	<100	<50	
Minimum Detect	0.6	0.6	ND	0.7	ND	ND	ND	0.8	1.3	0.6	ND	ND	ND	100	100	210	ND	ND	ND	120	100	100				
Maximum Concentration	0.6	0.6	<0.5	1.3	<0.5	<0.5	<0.5	0.8	6.9	1.4	<10	<10	<50	160	130	280	<50	<10	<50	120	130	230				
Maximum Detect	0.6	0.6	ND	1.3	ND	ND	ND	0.8	6.9	1.4	ND	ND	ND	160	130	280	ND	ND	ND	120	130	230				
Average Concentration	0.28	0.28	0.25	0.36	0.25	0.25	0.25	0.29	0.8	0.36	5	5	25	69	64	73	25	5	25	55	64	53				
Median Concentration	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	5	5	25	50	50	25	25	5	25	50	50	25				
Standard Deviation	0.094	0.094	0	0.3	0	0	0	0.15	1.8	0.31	0	0	0	39	28	97	0	0	0	19	28	61				
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Number of Guideline Exceedances (Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

NEW NEPM acronyms:
 ACLs = Added Contaminant Limits
 ESLs = Ecological Screening Level
 HSL = Health Screening Levels
 EIL = Ecological Investigation Level
 NL = Not Limiting
 A&B = Low to high density residential
 C = Residential / Open Space
 D = Commercial / Industrial

SDG	ES1405222	ES1405222	RPD (%)	ES1405891	ES1405891	RPD (%)
Field ID	S15/1	S15/2		S283	S283/2	
Date	6/03/2014	6/03/2014		14/03/2014	14/03/2014	

Group	ChemName	Units	LOR							
BTEX	Benzene	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0	
	Ethylbenzene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Toluene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Xylene (m & p)	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Xylene (o)	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Xylene (Total)	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Napthalene	mg/kg	1	<1	<1	0	<1	<1	0	
	Sum of BTEX	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0	
	Le	Lead	mg/kg	5	15	33	75	8	<5	105
		Metals								
Metals	Arsenic	mg/kg	5	<5	<5	0	<5	<5	0	
	Cadmium	mg/kg	1	<1	<1	0	<1	<1	0	
	Chromium (III+VI)	mg/kg	2	6	9	40	<2	4	120	
	Copper	mg/kg	5	14	18	25	<5	<5	0	
	Mercury	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	
	Nickel	mg/kg	2	2	4	67	<2	<2	0	
	Zinc	mg/kg	5	62	68	9	10	<5	120	
	Organochlorine (OC) Pesticides	4,4-DDE	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
		alpha-BHC	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
		Aldrin	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
Aldrin + Dieldrin		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
beta-BHC		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
Total Chlordane (sum)		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
Chlordane (trans)		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
d-BHC		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
4,4 DDD		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
4,4 DDT		mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0	
DDT+DDE+DDD		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
Dieldrin		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
Hexachlorobenzene (HCB)		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
alpha-Endosulfan		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
cis-Chlordane		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
Endrin aldehyde		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
Endrin ketone		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
beta-Endosulfan		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
Endosulfan sulphate		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
Endrin		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
g-BHC (Lindane)		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
Heptachlor		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
Heptachlor epoxide		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
Methoxychlor		mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0	
Organophosphorous (OP) Pesticides		Dichlorvos	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
		Demeton-S-methyl	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
		Monocrotophos	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
		Dimethoate	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
		Diazinon	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
		Chlorpyrifos-methyl	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
	Parathion-methyl	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0	
	Malathion	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
	Fenthion	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
	Chlorpyrifos	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
	Parathion	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0	
	Pirimphos-ethyl	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
	Bromophos-ethyl	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
	Fenamiphos	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
	Prothiofos	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
	Ethion	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0	
Carbophenothion	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0		
Azinphos Methyl	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0		
PCB	Total Polychlorinated biphenyls	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0	
PAH/Phenols	Acenaphthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Acenaphthylene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Benz(a)anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Benzo(a) pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Benzo(a)pyrene TEQ (zero)	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Benzo(a)pyrene TEQ (half LOR)	mg/kg	0.5	0.6	0.6	0	0.6	0.6	0	
	Benzo(a)pyrene TEQ (LOR)	mg/kg	0.5	1.2	1.2	0	1.2	1.2	0	
	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Benzo(b)fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Benzo(g,h,i)perylene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Chrysene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Dibenz(a,h)anthracene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Fluorene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Naphthalene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Phenanthrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Sum of PAH	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
	Pyrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0	
TRH	C6-C10 Fraction	mg/kg	10	<10	<10	0	<10	<10	0	
	C6-C10 Fraction minus BTEX (F1)	mg/kg	10	<10	<10	0	<10	<10	0	
	>C10-C16 Fraction	mg/kg	50	<50	<50	0	<50	<50	0	
	>C16-C34 Fraction	mg/kg	100	<100	160	46	<100	<100	0	
	>C34-C40 Fraction	mg/kg	100	<100	100	67	<100	<100	0	
	>C10-C40 Fraction (sum)	mg/kg	50	<50	260	165	<50	<50	0	
	>C10-C16 Fraction minus Naphthalene (F2)	mg/kg	50	<50	<50	0	<50	<50	0	
TPH	C6 - C9	mg/kg	10	<10	<10	0	<10	<10	0	
	C10 - C14	mg/kg	50	<50	<50	0	<50	<50	0	
	C15 - C28	mg/kg	100	<100	120	82	<100	<100	0	
	C29-C36	mg/kg	100	<100	110	75	<100	<100	0	
	+C10 - C36 (Sum of total)	mg/kg	50	<50	230	161	<50	<50	0	

Note: Where RPD are above 30%, this is attributable to the heterogeneous nature of the materials sampled and not a reflection of the analytical methods used. Therefore, the results are considered to be an acceptable reflection of site conditions.



Table D3 - Soil Analytical Results (Salinity)

	Salinity							
	Electrical Conductivity @ 25°C µS/cm	Electrical Conductivity @ 25°C mS/cm	Applied soil conversion factor of 8.6 (silty clay) NA	Calculated ECe mS/cm	pH pH Unit	Moisture %	Sulfate as SO ₄ mg/kg	Chloride mg/kg
LOR	1	1	NA	1	0.1	1	10	10
Non Saline								
Slightly saline								
Moderately saline								
Very saline								
Highly saline								

Field ID	Sampled Date	SDG	Sample Depth	EC (µS/cm)	EC (mS/cm)	ECe (mS/cm)	pH	Moisture (%)	Sulfate (mg/kg)	Chloride (mg/kg)	
S212	6/03/2014	ES1405223	0-0.2	23	0.023	8.6	0.2	-	-	-	
S262	6/03/2014	ES1405223	0-0.2	16	0.016	8.6	0.1	-	-	-	
S287	6/03/2014	ES1405223	0-0.2	19	0.019	8.6	0.2	-	-	-	
S314	6/03/2014	ES1405223	0-0.2	64	0.064	8.6	0.6	-	-	-	
S338	6/03/2014	ES1405223	0-0.2	22	0.022	8.6	0.2	-	-	-	
S339	6/03/2014	ES1405223	0-0.2	19	0.019	8.6	0.2	-	-	-	
S340	6/03/2014	ES1405223	0-0.2	15	0.015	8.6	0.1	-	-	-	
S315	6/03/2014	ES1405223	0-0.2	19	0.019	8.6	0.2	-	-	-	
S364	6/03/2014	ES1405223	0-0.2	80	0.08	8.6	0.7	-	-	-	
S393	6/03/2014	ES1405223	0-0.2	23	0.023	8.6	0.2	-	-	-	
S392	6/03/2014	ES1405223	0-0.2	18	0.018	8.6	0.2	-	-	-	
S394	6/03/2014	ES1405223	0-0.2	45	0.045	8.6	0.4	-	-	-	
S369	6/03/2014	ES1405223	0-0.2	15	0.015	8.6	0.1	-	-	-	
S418	6/03/2014	ES1405223	0-0.2	28	0.028	8.6	0.2	-	-	-	
S469	6/03/2014	ES1405223	0-0.2	77	0.077	8.6	0.7	-	-	-	
S444	6/03/2014	ES1405223	0-0.2	112	0.112	8.6	1.0	-	-	-	
S419	6/03/2014	ES1405223	0-0.2	35	0.035	8.6	0.3	-	-	-	
S367	6/03/2014	ES1405223	0-0.2	17	0.017	8.6	0.1	-	-	-	
S342	6/03/2014	ES1405223	0-0.2	42	0.042	8.6	0.4	-	-	-	
S293	6/03/2014	ES1405223	0-0.2	22	0.022	8.6	0.2	-	-	-	
S292	6/03/2014	ES1405223	0-0.2	23	0.023	8.6	0.2	-	-	-	
S133	4/03/2014	ES1405223	0-0.2	64	0.064	8.6	0.6	-	-	-	
S158	4/03/2014	ES1405223	0-0.2	24	0.024	8.6	0.2	-	-	-	
S179	4/03/2014	ES1405223	0-0.2	11	0.011	8.6	0.1	-	-	-	
S154	4/03/2014	ES1405223	0-0.2	19	0.019	8.6	0.2	-	-	-	
S131	4/03/2014	ES1405223	0-0.2	15	0.015	8.6	0.1	-	-	-	
S155	4/03/2014	ES1405223	0-0.2	22	0.022	8.6	0.2	-	-	-	
S181	4/03/2014	ES1405223	0-0.2	29	0.029	8.6	0.2	-	-	-	
S206	4/03/2014	ES1405223	0-0.2	122	0.122	8.6	1.0	-	-	-	
S231	4/03/2014	ES1405223	0-0.2	33	0.033	8.6	0.3	-	-	-	
S281	4/03/2014	ES1405223	0-0.2	21	0.021	8.6	0.2	-	-	-	
S282	4/03/2014	ES1405223	0-0.2	17	0.017	8.6	0.1	-	-	-	
S307	4/03/2014	ES1405223	0-0.2	23	0.023	8.6	0.2	-	-	-	
S266	4/03/2014	ES1405223	0-0.2	17	0.017	8.6	0.1	-	-	-	
S230	4/03/2014	ES1405223	0-0.2	27	0.027	8.6	0.2	-	-	-	
S15/1	4/03/2014	ES1405223	0-0.2	80	0.08	8.6	0.7	6.9	12.7	60	20
S15/2 - Field Duplicate	4/03/2014	ES1405223	0-0.2	126	0.126	8.6	1.1	6.3	36.7	210	50
S91	6/03/2014	ES1405223	0-0.2	76	0.076	8.6	0.7	-	-	-	-
S140	6/03/2014	ES1405223	0-0.2	34	0.034	8.6	0.3	-	-	-	-
S164	6/03/2014	ES1405223	0-0.2	45	0.045	8.6	0.4	-	-	-	-
S166	6/03/2014	ES1405223	0-0.2	21	0.021	8.6	0.2	-	-	-	-
S142	6/03/2014	ES1405223	0-0.2	20	0.02	8.6	0.2	-	-	-	-
S41	6/03/2014	ES1405223	0-0.2	31	0.031	8.6	0.3	-	-	-	-
S167	6/03/2014	ES1405223	0-0.2	58	0.058	8.6	0.5	-	-	-	-
S92	6/03/2014	ES1405223	0-0.2	25	0.025	8.6	0.2	-	-	-	-
S163	6/03/2014	ES1405223	0-0.2	8	0.008	8.6	0.1	-	-	-	-
S118	6/03/2014	ES1405223	0-0.2	44	0.044	8.6	0.4	-	-	-	-
S114	6/03/2014	ES1405223	0-0.2	15	0.015	8.6	0.1	-	-	-	-
S117	6/03/2014	ES1405223	0-0.2	33	0.033	8.6	0.3	-	-	-	-
S65	6/03/2014	ES1405223	0-0.2	16	0.016	8.6	0.1	-	-	-	-
S63	6/03/2014	ES1405223	0-0.2	33	0.033	8.6	0.3	-	-	-	-
S89	6/03/2014	ES1405223	0-0.2	37	0.037	8.6	0.3	-	-	-	-
S143	6/03/2014	ES1405223	0-0.2	44	0.044	8.6	0.4	-	-	-	-
S165	6/03/2014	ES1405223	0-0.2	214	0.214	8.6	1.8	-	-	-	-
S38	6/03/2014	ES1405223	0-0.2	11	0.011	8.6	0.1	-	-	-	-
S90	6/03/2014	ES1405223	0-0.2	36	0.036	8.6	0.3	-	-	-	-
S113	6/03/2014	ES1405223	0-0.2	96	0.096	8.6	0.8	-	-	-	-
S168	6/03/2014	ES1405223	0-0.2	15	0.015	8.6	0.1	-	-	-	-
S284	14/03/2014	ES1405892	0-0.2	33	0.033	8.6	0.3	-	-	-	-
S285	14/03/2014	ES1405892	0-0.2	21	0.021	8.6	0.2	-	-	-	-
S286	14/03/2014	ES1405892	0-0.2	18	0.018	8.6	0.2	-	-	-	-
S261	14/03/2014	ES1405892	0-0.2	107	0.107	8.6	0.9	-	-	-	-
S260	14/03/2014	ES1405892	0-0.2	20	0.02	8.6	0.2	-	-	-	-
S259	14/03/2014	ES1405892	0-0.2	22	0.022	8.6	0.2	-	-	-	-
S236	14/03/2014	ES1405892	0-0.2	116	0.116	8.6	1.0	-	-	-	-
S235	14/03/2014	ES1405892	0-0.2	30	0.03	8.6	0.3	-	-	-	-
S283	14/03/2014	ES1405892	0-0.2	6	0.006	8.6	0.1	-	-	-	-
S283/2 - Field Duplicate	14/03/2014	ES1405892	0-0.2	7	0.007	8.6	0.1	-	-	-	-
S208	14/03/2014	ES1405892	0-0.2	19	0.019	8.6	0.2	-	-	-	-
S182	14/03/2014	ES1405892	0-0.2	15	0.015	8.6	0.1	-	-	-	-
S132	14/03/2014	ES1405892	0-0.2	12	0.012	8.6	0.1	-	-	-	-
S130	14/03/2014	ES1405892	0-0.2	16	0.016	8.6	0.1	-	-	-	-

Statistical Summary										
Number of Results	72	72	NA	72	2	2	2	2	2	2
Number of Detects	72	72	NA	72	2	2	2	2	2	2
Minimum Concentration	6	0.006	NA	0.0516	6.3	12.7	60	20	20	20
Minimum Detect	6	0.006	NA	0.0516	6.3	12.7	60	20	20	20
Maximum Concentration	214	0.214	NA	1.8404	6.9	36.7	210	50	50	50
Maximum Detect	214	0.214	NA	1.8404	6.9	36.7	210	50	50	50
Average Concentration	38	0.038	NA	0.33	NA	NA	NA	NA	NA	NA
Median Concentration	23	0.023	NA	0.1978	6.6	24.7	135	35	35	35
Standard Deviation	36	0.036	NA	0.31	NA	NA	NA	NA	NA	NA
Number of Guideline Exceedances	0	0	NA	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	NA	0	0	0	0	0	0	0

* Average Soil Conversion Factor 'Silty Clay' - P. A. and Murphy, B. W, 2007 (Table 5.33)

SDG	ES1405223	ES1405223	RPD (%)	ES1405892	ES1405892	RPD (%)
Field ID	S15/1	S15/2		S283	S283/2	
Date	6/03/2014	6/03/2014		14/03/2014	14/03/2014	

Group	Analyte	Units	LOR						
Salinity	Electrical Conductivity @ 25°C	µS/cm	1	80	126	0	6	7	0
	pH	pH Unit	0.1	6.9	6.3	9	--	--	--
	Moisture	%	1	12.7	36.7	97	--	--	--
	Sulfate as SO4	mg/kg	10	60	210	111	--	--	--
	Chloride	mg/kg	10	20	50	86	--	--	--

Note: Where RPD are above 30%, this is attributable to the heterogeneous nature of the materials sampled and not a reflection of the analytical methods used. Therefore, the results are considered to be an acceptable reflection of site conditions.

APPENDIX E – LABORATORY REPORTS



CHAIN OF CUSTODY

ALS Laboratory

Adelaide 21 Baring Road, Paraette SA 5096
 Ph: 08 8336 6500 E: adelaide@als.com.au
 Brisbane 32 Sirong Street, St Albans QLD 4073
 Ph: 07 3265 7222 E: southeast@als.com.au
 Gladstone 46 Cambridge Drive, Channon QLD 4680
 Ph: 07 4577 5800 E: gladstone@als.com.au

Mackay 78 Macgregor Road, Mackay QLD 4740
 Ph: 07 454 8177 E: mackay@als.com.au
 Melbourne 2-4 Wessell Road, Springvale VIC 3171
 Ph: 03 8540 5500 E: southeast.melbourne@als.com.au
 Newcastle 22 Sydney Road, Newcastle NSW 2280
 Ph: 02 8372 8725 E: newcastle@als.com.au

Newcastle 5 Princes Road, Newcastle NSW 2304
 Ph: 02 2586 9132 E: central@als.com.au
 Perth 413 Rennie Place North, Perth WA 6004
 Ph: 02 423 2820 E: perth@als.com.au
 Perth 204/100 Kingsway, Perth WA 6005
 Ph: 02 9229 1999 E: sampleperth@als.com.au

Stunter 277 Woodcock Road, Southport NSW 2314
 Ph: 02 8784 8555 E: sampleport@als.com.au
 Townsville 14-15 Dorman Court, Para. QLD 4810
 Ph: 07 4796 0690 E: townsville@als.com.au
 Wollongong 69 Koppa Street, Wollongong NSW 2500
 Ph: 02 4225 3122 E: wollongong@als.com.au

SMC ALJ

CLIENT: **SMC Retail**
 OFFICE: **14/1 Campbell St, P.O. Box 10080, Adelaide**
 PROJECT: **14/1 Campbell St, P.O. Box 10080**

PURCHASE ORDER NUMBER: **10818**

PROJECT MANAGER: **Steve**

SAMPLER: **Steve**

COC emailed to ALS7 (YES / NO) **NO** EDD FORMAT (if default):

Email Reports to (will default to PM if no other addresses are listed):

Email Invoice to (will default to PM if no other addresses are listed):

COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS:
 (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

ALS QUOTE NO.:

CONTACT PH:

RELINQUISHED BY: **JLH**

RECEIVED BY: **Keiths**

DATE/TIME: **19/3/14**

DATE/TIME: **6:30pm**

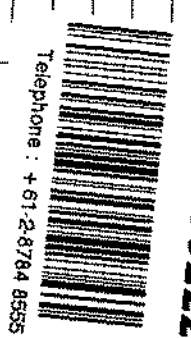
RELINQUISHED BY:

RECEIVED BY:

FOR LABORATORY USE ONLY (Circle)
 Custody Seal intact? Yes No N/A
 Free ice / frozen ice blocks present upon receipt? Yes No N/A
 Residual Sample Temperature on Receipt? Yes No N/A
 Other comment: No

ALS USE	SAMPLE DETAILS MATRIX - SOLID (S), WATER (W)	CONTAINER INFORMATION	ANALYSIS REQUIRED including SUITES (NB, Suite Codes must be listed to attract suitable prices) Where Metals are required, specify Total (unfiltered) or Dissolved (field filtered) (bottle required).	Additional Information				
LAB ID	SAMPLE ID	DATE/TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	RELINQUISHED BY:	RECEIVED BY:	DATE/TIME:
1	5154	6/3/14	S	JV HCl	21-5	JLH	Keiths	19/3/14
2	5469							
3	5490							
4	5412							
5	538							
6	541							
7	5140							
8	5168							
9	541							
10	5151							
11	5152							

Environmental Division
 Sydney
 Work Order
ES1405222



Telephone : +61-2-8784 8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; DRB = Nitric Preserved DRB; SA = Sodium Hydroxide Preserved Plastic; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved Plastic; AP = Amber Glass Unpreserved Plastic; V = VOA Va; HO Preserved; VB = VOA Va; Stadium Resilience Preserved; VS = VOA Va; Soil; Preserved; AV = Air Tight Unpreserved Vial; S3 = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Specimen Bottle; SP = Salting Preserved Plastic; F = Fomolloy's Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Plastic Bottle; ACP = Plastic Bottle; U = Unpreserved Dug.



CERTIFICATE OF ANALYSIS

Work Order : ES1405222
Client : SMEC TESTING SERVICES PTY LTD
Contact : ALL REPORTS (ENQUIRIES)
Address : P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164
E-mail : enquiries@smectesting.com.au
Telephone : ----
Facsimile : ----
Project : 19580 4030C
Order number : 10818
C-O-C number : ----
Sampler : J. KERR
Site : ----
Quote number : EN/025/13
Page : 1 of 15
Laboratory : Environmental Division Sydney
Contact : Client Services
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail : sydney@alsglobal.com
Telephone : +61-2-8784 8555
Facsimile : +61-2-8784 8500
QC Level : NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Date Samples Received : 11-MAR-2014
Issue Date : 19-MAR-2014
No. of samples received : 11
No. of samples analysed : 11

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
Analytical Results
Surrogate Control Limits



NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Table with 3 columns: Signatories, Position, Accreditation Category. Rows include Celine Conceicao (Senior Spectroscopist, Sydney Inorganics), Pabi Subba (Senior Organic Chemist, Sydney Organics), and Shobhna Chandra (Metals Coordinator, Sydney Inorganics).

Page : 2 of 15
Work Order : ES1405222
Client : SMEC TESTING SERVICES PTY LTD
Project : 19580 4030C



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **ALS is not NATA accredited for the analysis of Bifenthrin in soils when performed under ALS Method EP068D**
- **EP068: Positive results on sample #S38 confirmed by re-extraction and re-analysis.**



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S154	S469	S444	S212	S38
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405222-001	ES1405222-002	ES1405222-003	ES1405222-004	ES1405222-005
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	26.6	9.6	12.3	20.6	11.2
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	10	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	15	8	7	9	5
Copper	7440-50-8	5	mg/kg	26	22	6	18	<5
Lead	7439-92-1	5	mg/kg	36	6	6	49	<5
Nickel	7440-02-0	2	mg/kg	12	<2	3	6	<2
Zinc	7440-66-6	5	mg/kg	70	15	13	98	<5
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4,4'-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	0.13
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4,4'-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S154	S469	S444	S212	S38
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405222-001	ES1405222-002	ES1405222-003	ES1405222-004	ES1405222-005
EP068A: Organochlorine Pesticides (OC) - Continued								
4,4'-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Sum of DDD + DDE + DDT	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	0.13
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	0.8	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	1.3	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	1.4	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	0.6	<0.5	<0.5	<0.5	<0.5



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S154	S469	S444	S212	S38
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405222-001	ES1405222-002	ES1405222-003	ES1405222-004	ES1405222-005
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Chrysene	218-01-9	0.5	mg/kg	0.6	<0.5	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	0.9	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	0.7	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	0.6	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	6.9	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	0.9	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	1.2	0.6	0.6	0.6	0.6
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	1.5	1.2	1.2	1.2	1.2
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	130	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	130	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	150	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	130	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	280	<50	<50	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S154	S469	S444	S212	S38
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405222-001	ES1405222-002	ES1405222-003	ES1405222-004	ES1405222-005
EP080: BTEXN - Continued								
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	75.0	86.0	73.0	70.0	70.0
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	84.2	91.0	78.2	79.5	84.6
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	74.3	104	85.7	55.7	110
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	95.4	97.9	98.1	98.3	96.2
2-Chlorophenol-D4	93951-73-6	0.1	%	87.3	91.8	90.3	93.9	92.1
2,4,6-Tribromophenol	118-79-6	0.1	%	98.8	95.6	92.0	97.7	89.2
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	96.8	98.9	97.6	98.5	100
Anthracene-d10	1719-06-8	0.1	%	77.4	81.6	80.1	83.6	78.4
4-Terphenyl-d14	1718-51-0	0.1	%	79.4	85.7	82.4	87.4	84.5
EP080S: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	84.9	94.5	114	97.2	91.4
Toluene-D8	2037-26-5	0.1	%	77.2	87.0	89.1	91.6	84.2
4-Bromofluorobenzene	460-00-4	0.1	%	86.0	93.1	97.6	98.2	90.6



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	S91	S140	S164	S41	S15/1
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
				ES1405222-006	ES1405222-007	ES1405222-008	ES1405222-009	ES1405222-010
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	15.8	15.6	15.0	20.3	14.3
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	10	<5	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	21	14	18	6	6
Copper	7440-50-8	5	mg/kg	8	8	16	12	14
Lead	7439-92-1	5	mg/kg	16	24	35	47	15
Nickel	7440-02-0	2	mg/kg	3	<2	16	<2	2
Zinc	7440-66-6	5	mg/kg	61	73	98	50	62
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4,4'-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4,4'-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S91	S140	S164	S41	S15/1
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405222-006	ES1405222-007	ES1405222-008	ES1405222-009	ES1405222-010
EP068A: Organochlorine Pesticides (OC) - Continued								
4,4'-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Sum of DDD + DDE + DDT	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.7	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.6	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S91	S140	S164	S41	S15/1
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405222-006	ES1405222-007	ES1405222-008	ES1405222-009	ES1405222-010
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	1.3	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	0.6	0.6	0.6	0.6	0.6
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	1.2	1.2	1.2	1.2	1.2
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	<100	100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	100	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	110	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	210	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S91	S140	S164	S41	S15/1
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405222-006	ES1405222-007	ES1405222-008	ES1405222-009	ES1405222-010
EP080: BTEXN - Continued								
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	80.0	83.0	92.0	92.0	97.0
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	81.8	90.8	93.4	74.9	78.0
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	84.5	102	89.6	86.9	75.4
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	100	95.9	98.4	93.9	93.8
2-Chlorophenol-D4	93951-73-6	0.1	%	90.4	87.8	91.7	87.8	91.8
2,4,6-Tribromophenol	118-79-6	0.1	%	95.8	91.1	94.9	97.7	87.6
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	98.2	95.4	103	98.0	98.2
Anthracene-d10	1719-06-8	0.1	%	81.5	79.0	76.8	79.5	81.1
4-Terphenyl-d14	1718-51-0	0.1	%	85.5	81.1	78.5	82.1	82.9
EP080S: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	114	98.6	96.7	96.3	95.2
Toluene-D8	2037-26-5	0.1	%	95.4	94.3	90.9	94.3	89.4
4-Bromofluorobenzene	460-00-4	0.1	%	103	100	95.4	94.7	95.7



Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)

Client sample ID

S15/2	---	---	---	---
06-MAR-2014 15:00	---	---	---	---

Client sampling date / time

Compound	CAS Number	LOR	Unit	ES1405222-011	---	---	---	---
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EA055: Moisture Content

Moisture Content (dried @ 103°C)	---	1.0	%	32.2	---	---	---	---
---	-----	-----	---	-------------	-----	-----	-----	-----

EG005T: Total Metals by ICP-AES

Arsenic	7440-38-2	5	mg/kg	<5	---	---	---	---
Cadmium	7440-43-9	1	mg/kg	<1	---	---	---	---
Chromium	7440-47-3	2	mg/kg	9	---	---	---	---
Copper	7440-50-8	5	mg/kg	18	---	---	---	---
Lead	7439-92-1	5	mg/kg	33	---	---	---	---
Nickel	7440-02-0	2	mg/kg	4	---	---	---	---
Zinc	7440-66-6	5	mg/kg	68	---	---	---	---

EG035T: Total Recoverable Mercury by FIMS

Mercury	7439-97-6	0.1	mg/kg	<0.1	---	---	---	---
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EP066: Polychlorinated Biphenyls (PCB)

Total Polychlorinated biphenyls	---	0.1	mg/kg	<0.1	---	---	---	---
--	-----	-----	-------	------	-----	-----	-----	-----

EP068A: Organochlorine Pesticides (OC)

alpha-BHC	319-84-6	0.05	mg/kg	<0.05	---	---	---	---
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	---	---	---	---
beta-BHC	319-85-7	0.05	mg/kg	<0.05	---	---	---	---
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	---	---	---	---
delta-BHC	319-86-8	0.05	mg/kg	<0.05	---	---	---	---
Heptachlor	76-44-8	0.05	mg/kg	<0.05	---	---	---	---
Aldrin	309-00-2	0.05	mg/kg	<0.05	---	---	---	---
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	---	---	---	---
Total Chlordane (sum)	---	0.05	mg/kg	<0.05	---	---	---	---
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	---	---	---	---
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	---	---	---	---
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	---	---	---	---
Dieldrin	60-57-1	0.05	mg/kg	<0.05	---	---	---	---
4,4'-DDE	72-55-9	0.05	mg/kg	<0.05	---	---	---	---
Endrin	72-20-8	0.05	mg/kg	<0.05	---	---	---	---
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	---	---	---	---
4,4'-DDD	72-54-8	0.05	mg/kg	<0.05	---	---	---	---
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	---	---	---	---
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	---	---	---	---



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				S15/2	---	---	---	---
				06-MAR-2014 15:00	---	---	---	---
Client sampling date / time								
Compound	CAS Number	LOR	Unit	ES1405222-011	---	---	---	---
EP068A: Organochlorine Pesticides (OC) - Continued								
4.4'-DDT	50-29-3	0.2	mg/kg	<0.2	---	---	---	---
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	---	---	---	---
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	---	---	---	---
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	---	---	---	---
^ Sum of DDD + DDE + DDT	----	0.05	mg/kg	<0.05	---	---	---	---
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	---	---	---	---
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	---	---	---	---
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	---	---	---	---
Dimethoate	60-51-5	0.05	mg/kg	<0.05	---	---	---	---
Diazinon	333-41-5	0.05	mg/kg	<0.05	---	---	---	---
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	---	---	---	---
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	---	---	---	---
Malathion	121-75-5	0.05	mg/kg	<0.05	---	---	---	---
Fenthion	55-38-9	0.05	mg/kg	<0.05	---	---	---	---
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	---	---	---	---
Parathion	56-38-2	0.2	mg/kg	<0.2	---	---	---	---
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	---	---	---	---
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	---	---	---	---
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	---	---	---	---
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	---	---	---	---
Ethion	563-12-2	0.05	mg/kg	<0.05	---	---	---	---
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	---	---	---	---
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	---	---	---	---
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	---	---	---	---
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	---	---	---	---
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	---	---	---	---
Fluorene	86-73-7	0.5	mg/kg	<0.5	---	---	---	---
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	---	---	---	---
Anthracene	120-12-7	0.5	mg/kg	<0.5	---	---	---	---
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	---	---	---	---
Pyrene	129-00-0	0.5	mg/kg	<0.5	---	---	---	---
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	---	---	---	---



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

S15/2

Client sampling date / time

06-MAR-2014 15:00

Compound	CAS Number	LOR	Unit	ES1405222-011	---	---	---	---
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EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued

Chrysene	218-01-9	0.5	mg/kg	<0.5	---	---	---	---
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	---	---	---	---
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	---	---	---	---
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	---	---	---	---
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	---	---	---	---
Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5	---	---	---	---
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5	---	---	---	---
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	---	---	---	---
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	---	---	---	---
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	0.6	---	---	---	---
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	1.2	---	---	---	---

EP080/071: Total Petroleum Hydrocarbons

C6 - C9 Fraction	----	10	mg/kg	<10	---	---	---	---
C10 - C14 Fraction	----	50	mg/kg	<50	---	---	---	---
C15 - C28 Fraction	----	100	mg/kg	120	---	---	---	---
C29 - C36 Fraction	----	100	mg/kg	110	---	---	---	---
^ C10 - C36 Fraction (sum)	----	50	mg/kg	230	---	---	---	---

EP080/071: Total Recoverable Hydrocarbons - NEPM 2013

C6 - C10 Fraction	C6_C10	10	mg/kg	<10	---	---	---	---
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	---	---	---	---
>C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	---	---	---	---
>C16 - C34 Fraction	----	100	mg/kg	160	---	---	---	---
>C34 - C40 Fraction	----	100	mg/kg	100	---	---	---	---
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	260	---	---	---	---
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	---	---	---	---

EP080: BTEXN

Benzene	71-43-2	0.2	mg/kg	<0.2	---	---	---	---
Toluene	108-88-3	0.5	mg/kg	<0.5	---	---	---	---
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	---	---	---	---
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	---	---	---	---
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	---	---	---	---
^ Sum of BTEX	----	0.2	mg/kg	<0.2	---	---	---	---



Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)

Client sample ID

S15/2

Client sampling date / time

06-MAR-2014 15:00

Compound	CAS Number	LOR	Unit	ES1405222-011	----	----	----	----
EP080: BTEXN - Continued								
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	----	----	----	----
Naphthalene	91-20-3	1	mg/kg	<1	----	----	----	----
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	102	----	----	----	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	84.1	----	----	----	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	102	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	92.2	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%	89.2	----	----	----	----
2,4,6-Tribromophenol	118-79-6	0.1	%	96.6	----	----	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	97.6	----	----	----	----
Anthracene-d10	1719-06-8	0.1	%	80.7	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%	84.0	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	92.6	----	----	----	----
Toluene-D8	2037-26-5	0.1	%	88.0	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	91.6	----	----	----	----



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2,4,6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	72.8	133.2
Toluene-D8	2037-26-5	73.9	132.1
4-Bromofluorobenzene	460-00-4	71.6	130.0



QUALITY CONTROL REPORT

Table with 4 columns: Field, Value, Field, Value. Includes Work Order (ES1405222), Client (SMEC TESTING SERVICES PTY LTD), Laboratory (Environmental Division Sydney), and various contact and project details.

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
• Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
• Matrix Spike (MS) Report; Recovery and Acceptance Limits



NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Table with 3 columns: Signatories, Position, Accreditation Category. Lists Celine Conceicao, Pabi Subba, and Shobhna Chandra with their respective roles and accreditation categories.



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Content (QC Lot: 3335666)									
ES1405222-003	S444	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	12.3	11.6	5.6	0% - 50%
ES1405224-003	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	19.8	20.0	0.8	0% - 50%
EG005T: Total Metals by ICP-AES (QC Lot: 3341731)									
ES1405194-004	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	225	249	10.1	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	49	56	14.2	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	42	38	9.4	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	56	51	9.1	0% - 50%
		EG005T: Zinc	7440-66-6	5	mg/kg	141	165	16.0	0% - 20%
ES1405199-001	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	360	306	16.3	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	81	71	13.0	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	6	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	45	44	3.5	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	65	61	6.5	0% - 50%
		EG005T: Zinc	7440-66-6	5	mg/kg	282	302	6.8	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 3341733)									
ES1405222-004	S212	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	9	9	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	6	9	36.4	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	18	18	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	49	49	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	98	85	14.6	0% - 50%
ES1405224-003	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	25	28	11.8	0% - 50%
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3341732)									
ES1405194-004	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES1405199-001	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3341734)									
ES1405222-004	S212	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES1405224-003	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP066: Polychlorinated Biphenyls (PCB) (QC Lot: 3335080)									
ES1405222-001	S154	EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES1405222-011	S15/2	EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP068A: Organochlorine Pesticides (OC) (QC Lot: 3335079)									
ES1405222-001	S154	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4,4'-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4,4'-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4,4'-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit		
ES1405222-011	S15/2	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4,4'-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP068A: Organochlorine Pesticides (OC) (QC Lot: 3335079) - continued									
ES1405222-011	S15/2	EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4'-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4.4'-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 3335079)									
ES1405222-001	S154	EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
ES1405222-011	S15/2	EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 3335079) - continued									
ES1405222-011	S15/2	EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3335631)									
ES1405194-003	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	0.9	1.0	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	4.1	4.9	18.1	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	2.2	3.0	30.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	1.5	2.1	31.7	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	0.9	1.1	25.9	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	1.0	1.3	22.2	No Limit
		EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	0.6	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	10.6	14.0	# 27.6	0% - 20%
EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
ES1405222-003	S444	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3335631) - continued									
ES1405222-003	S444	EP075(SIM): Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3334827)									
ES1405222-001	S154	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
ES1405222-010	S15/1	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3335630)									
ES1405194-003	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	1040	1000	4.0	0% - 50%
		EP071: C29 - C36 Fraction	----	100	mg/kg	260	260	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	100	100	0.0	No Limit
ES1405222-003	S444	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QC Lot: 3334827)									
ES1405222-001	S154	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
ES1405222-010	S15/1	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QC Lot: 3335630)									
ES1405194-003	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	1110	1040	6.4	0% - 50%
		EP071: >C34 - C40 Fraction	----	100	mg/kg	150	130	18.5	No Limit
		EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	200	250	24.2	No Limit
ES1405222-003	S444	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	<50	0.0	No Limit
EP080: BTEXN (QC Lot: 3334827)									
ES1405222-001	S154	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
ES1405222-010	S15/1	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: SOIL

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
EG005T: Total Metals by ICP-AES (QCLot: 3341731)									
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	108	87	129	
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	102	80	122	
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	100	71	133	
EG005T: Copper	7440-50-8	5	mg/kg	<5	32.0 mg/kg	112	86	128	
EG005T: Lead	7439-92-1	5	mg/kg	<5	40.0 mg/kg	103	81	123	
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.0 mg/kg	108	84	130	
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	94.7	81	133	
EG005T: Total Metals by ICP-AES (QCLot: 3341733)									
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	113	87	129	
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	107	80	122	
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	102	71	133	
EG005T: Copper	7440-50-8	5	mg/kg	<5	32.0 mg/kg	111	86	128	
EG005T: Lead	7439-92-1	5	mg/kg	<5	40.0 mg/kg	108	81	123	
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.0 mg/kg	111	84	130	
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	104	81	133	
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3341732)									
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	77.9	66	112	
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3341734)									
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	76.7	66	112	
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3335080)									
EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	1 mg/kg	87.0	57.4	117	
EP068A: Organochlorine Pesticides (OC) (QCLot: 3335079)									
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	80.6	71	113	
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	93.8	66	122	
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	88.2	69	119	
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	82.6	71	115	
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	86.6	65	113	
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	87.5	68	116	
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	83.8	68	118	
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	85.5	68	116	
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	86.5	68	120	
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	76.4	69	119	
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	78.9	67	121	
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	80.8	66	118	



Sub-Matrix: SOIL

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike	Spike Recovery (%)		Recovery Limits (%)	
					Concentration	LCS	Low	High	
EP068A: Organochlorine Pesticides (OC) (QCLot: 3335079) - continued									
EP068: 4.4'-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	82.6	69	117	
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	77.4	67	123	
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	84.4	76	120	
EP068: 4.4'-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	83.8	76	120	
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	82.9	57.3	115	
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	85.2	60	124	
EP068: 4.4'-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	100	67	127	
EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	0.5 mg/kg	87.3	65	123	
EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	0.5 mg/kg	106	65	129	
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3335079)									
EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	0.5 mg/kg	75.0	56	126	
EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	86.8	64	128	
EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	0.5 mg/kg	103	54	122	
EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	0.5 mg/kg	90.4	64	124	
EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	0.5 mg/kg	75.4	73	117	
EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	0.5 mg/kg	88.4	55	119	
EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	0.5 mg/kg	87.0	69	123	
EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	0.5 mg/kg	87.2	70	120	
EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	0.5 mg/kg	81.8	71	115	
EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	0.5 mg/kg	87.1	68	114	
EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	0.5 mg/kg	87.7	68	122	
EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	0.5 mg/kg	82.1	69	115	
EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	0.5 mg/kg	85.5	68	116	
EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	0.5 mg/kg	85.4	64	120	
EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	0.5 mg/kg	82.7	68	116	
EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	0.5 mg/kg	84.0	70	118	
EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	0.5 mg/kg	84.4	67	123	
EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	0.5 mg/kg	94.0	42	126	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3335631)									
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	4 mg/kg	98.3	80	124	
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	4 mg/kg	96.2	77	123	
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	4 mg/kg	92.8	79	123	
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	4 mg/kg	107	77	123	
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	4 mg/kg	97.7	79	123	
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	4 mg/kg	96.5	79	123	
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	4 mg/kg	97.7	79	123	
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	4 mg/kg	95.8	79	125	
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	4 mg/kg	92.8	73	121	
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	4 mg/kg	94.6	81	123	



Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report				
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3335631) - continued									
EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	4 mg/kg	79.8	70	118	
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	4 mg/kg	82.8	77	123	
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	4 mg/kg	91.4	76	122	
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	4 mg/kg	80.1	71	113	
EP075(SIM): Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5	4 mg/kg	78.8	71.7	113	
EP075(SIM): Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5	4 mg/kg	77.7	72.4	114	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3334827)									
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	79.3	68.4	128	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3335630)									
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	200 mg/kg	90.7	71	131	
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	300 mg/kg	127	74	138	
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	200 mg/kg	101	64	128	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3334827)									
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	73.2	68.4	128	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3335630)									
EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	250 mg/kg	87.5	70	130	
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	350 mg/kg	121	74	138	
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	----	----	----	----	
		50	mg/kg	----	150 mg/kg	72.2	63	131	
EP080: BTEXN (QCLot: 3334827)									
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	73.1	62	116	
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	75.6	62	128	
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	70.8	58	118	
EP080: meta- & para-Xylene	108-38-3	0.5	mg/kg	<0.5	2 mg/kg	66.6	60	120	
	106-42-3								
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	72.0	60	120	
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	82.0	62	138	

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report				
				Spike Concentration	Spike Recovery(%)		Recovery Limits (%)	
					MS	Low	High	
EG005T: Total Metals by ICP-AES (QCLot: 3341731)								
ES1405194-004	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	107	70	130	
		EG005T: Cadmium	7440-43-9	50 mg/kg	97.3	70	130	



Sub-Matrix: SOIL

				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery(%) MS	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005T: Total Metals by ICP-AES (QCLot: 3341731) - continued							
ES1405194-004	Anonymous	EG005T: Chromium	7440-47-3	50 mg/kg	# Not Determined	70	130
		EG005T: Copper	7440-50-8	125 mg/kg	121	70	130
		EG005T: Lead	7439-92-1	125 mg/kg	105	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	123	70	130
		EG005T: Zinc	7440-66-6	125 mg/kg	122	70	130
EG005T: Total Metals by ICP-AES (QCLot: 3341733)							
ES1405222-004	S212	EG005T: Arsenic	7440-38-2	50 mg/kg	113	70	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	109	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	112	70	130
		EG005T: Copper	7440-50-8	125 mg/kg	113	70	130
		EG005T: Lead	7439-92-1	125 mg/kg	109	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	105	70	130
		EG005T: Zinc	7440-66-6	125 mg/kg	98.0	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3341732)							
ES1405194-004	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	99.9	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3341734)							
ES1405222-004	S212	EG035T: Mercury	7439-97-6	5 mg/kg	93.5	70	130
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3335080)							
ES1405222-001	S154	EP066: Total Polychlorinated biphenyls	----	1 mg/kg	84.0	70	130
EP068A: Organochlorine Pesticides (OC) (QCLot: 3335079)							
ES1405222-001	S154	EP068: gamma-BHC	58-89-9	0.5 mg/kg	98.2	70	130
		EP068: Heptachlor	76-44-8	0.5 mg/kg	102	70	130
		EP068: Aldrin	309-00-2	0.5 mg/kg	99.9	70	130
		EP068: Dieldrin	60-57-1	0.5 mg/kg	104	70	130
		EP068: Endrin	72-20-8	2 mg/kg	85.4	70	130
		EP068: 4,4'-DDT	50-29-3	2 mg/kg	81.3	70	130
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3335079)							
ES1405222-001	S154	EP068: Diazinon	333-41-5	0.5 mg/kg	106	70	130
		EP068: Chlorpyrifos-methyl	5598-13-0	0.5 mg/kg	74.2	70	130
		EP068: Pirimphos-ethyl	23505-41-1	0.5 mg/kg	100	70	130
		EP068: Bromophos-ethyl	4824-78-6	0.5 mg/kg	102	70	130
		EP068: Prothiofos	34643-46-4	0.5 mg/kg	75.5	70	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3335631)							
ES1405194-003	Anonymous	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	94.9	70	130
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	71.8	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3334827)							



Sub-Matrix: SOIL

					Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
					MS	MSD	Low	High	Value	Control Limit
EP080: BTEXN (QCLot: 3334827) - continued										
ES1405222-001	S154	EP080: ortho-Xylene	95-47-6	2.5 mg/kg	79.9	----	70	130	----	----
		EP080: Naphthalene	91-20-3	2.5 mg/kg	77.8	----	70	130	----	----
EP068A: Organochlorine Pesticides (OC) (QCLot: 3335079)										
ES1405222-001	S154	EP068: gamma-BHC	58-89-9	0.5 mg/kg	98.2	----	70	130	----	----
		EP068: Heptachlor	76-44-8	0.5 mg/kg	102	----	70	130	----	----
		EP068: Aldrin	309-00-2	0.5 mg/kg	99.9	----	70	130	----	----
		EP068: Dieldrin	60-57-1	0.5 mg/kg	104	----	70	130	----	----
		EP068: Endrin	72-20-8	2 mg/kg	85.4	----	70	130	----	----
		EP068: 4,4'-DDT	50-29-3	2 mg/kg	81.3	----	70	130	----	----
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3335079)										
ES1405222-001	S154	EP068: Diazinon	333-41-5	0.5 mg/kg	106	----	70	130	----	----
		EP068: Chlorpyrifos-methyl	5598-13-0	0.5 mg/kg	74.2	----	70	130	----	----
		EP068: Pirimphos-ethyl	23505-41-1	0.5 mg/kg	100	----	70	130	----	----
		EP068: Bromophos-ethyl	4824-78-6	0.5 mg/kg	102	----	70	130	----	----
		EP068: Prothiofos	34643-46-4	0.5 mg/kg	75.5	----	70	130	----	----
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3335080)										
ES1405222-001	S154	EP066: Total Polychlorinated biphenyls	----	1 mg/kg	84.0	----	70	130	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3335630)										
ES1405194-003	Anonymous	EP071: C10 - C14 Fraction	----	640 mg/kg	89.3	----	73	137	----	----
		EP071: C15 - C28 Fraction	----	3140 mg/kg	83.2	----	53	131	----	----
		EP071: C29 - C36 Fraction	----	2860 mg/kg	68.7	----	52	132	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3335630)										
ES1405194-003	Anonymous	EP071: >C10 - C16 Fraction	>C10_C16	850 mg/kg	114	----	73	137	----	----
		EP071: >C16 - C34 Fraction	----	4800 mg/kg	74.8	----	53	131	----	----
		EP071: >C34 - C40 Fraction	----	2400 mg/kg	53.6	----	52	132	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3335631)										
ES1405194-003	Anonymous	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	94.9	----	70	130	----	----
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	71.8	----	70	130	----	----
EG005T: Total Metals by ICP-AES (QCLot: 3341731)										
ES1405194-004	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	107	----	70	130	----	----
		EG005T: Cadmium	7440-43-9	50 mg/kg	97.3	----	70	130	----	----
		EG005T: Chromium	7440-47-3	50 mg/kg	# Not Determined	----	70	130	----	----
		EG005T: Copper	7440-50-8	125 mg/kg	121	----	70	130	----	----
		EG005T: Lead	7439-92-1	125 mg/kg	105	----	70	130	----	----
		EG005T: Nickel	7440-02-0	50 mg/kg	123	----	70	130	----	----
		EG005T: Zinc	7440-66-6	125 mg/kg	122	----	70	130	----	----
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3341732)										

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 Work Order : ES1405222
 Client : SMEC TESTING SERVICES PTY LTD
 Project : 19580 4030C



Sub-Matrix: SOIL

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report							
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)		
					MS	MSD	Low	High	Value	Control Limit	
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3341732) - continued											
ES1405194-004	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	99.9	----	70	130	----	----	
EG005T: Total Metals by ICP-AES (QCLot: 3341733)											
ES1405222-004	S212	EG005T: Arsenic	7440-38-2	50 mg/kg	113	----	70	130	----	----	
		EG005T: Cadmium	7440-43-9	50 mg/kg	109	----	70	130	----	----	
		EG005T: Chromium	7440-47-3	50 mg/kg	112	----	70	130	----	----	
		EG005T: Copper	7440-50-8	125 mg/kg	113	----	70	130	----	----	
		EG005T: Lead	7439-92-1	125 mg/kg	109	----	70	130	----	----	
		EG005T: Nickel	7440-02-0	50 mg/kg	105	----	70	130	----	----	
		EG005T: Zinc	7440-66-6	125 mg/kg	98.0	----	70	130	----	----	
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3341734)											
ES1405222-004	S212	EG035T: Mercury	7439-97-6	5 mg/kg	93.5	----	70	130	----	----	



Environmental

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES1405222	Page	: 1 of 7
Client	: SMEC TESTING SERVICES PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: ALL REPORTS (ENQUIRIES)	Contact	: Client Services
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580 4030C	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 11-MAR-2014
Sampler	: J. KERR	Issue Date	: 19-MAR-2014
Order number	: 10818		
Quote number	: EN/025/13	No. of samples received	: 11
		No. of samples analysed	: 11

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers



Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with recommended holding times (USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: SOIL

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content							
Soil Glass Jar - Unpreserved (EA055-103)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	06-MAR-2014	----	----	----	12-MAR-2014	20-MAR-2014	✓
EG005T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	06-MAR-2014	17-MAR-2014	02-SEP-2014	✓	17-MAR-2014	02-SEP-2014	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	06-MAR-2014	17-MAR-2014	03-APR-2014	✓	18-MAR-2014	03-APR-2014	✓
EP066: Polychlorinated Biphenyls (PCB)							
Soil Glass Jar - Unpreserved (EP066)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	06-MAR-2014	12-MAR-2014	20-MAR-2014	✓	14-MAR-2014	21-APR-2014	✓



Matrix: SOIL

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP068A: Organochlorine Pesticides (OC)							
Soil Glass Jar - Unpreserved (EP068)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	06-MAR-2014	12-MAR-2014	20-MAR-2014	✓	14-MAR-2014	21-APR-2014	✓
EP068B: Organophosphorus Pesticides (OP)							
Soil Glass Jar - Unpreserved (EP068)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	06-MAR-2014	12-MAR-2014	20-MAR-2014	✓	14-MAR-2014	21-APR-2014	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013							
Soil Glass Jar - Unpreserved (EP071)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	06-MAR-2014	13-MAR-2014	20-MAR-2014	✓	14-MAR-2014	22-APR-2014	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	06-MAR-2014	13-MAR-2014	20-MAR-2014	✓	14-MAR-2014	22-APR-2014	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)							
S154, S469, S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2	06-MAR-2014	12-MAR-2014	20-MAR-2014	✓	14-MAR-2014	20-MAR-2014	✓



Matrix: **SOIL**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EP080/071: Total Petroleum Hydrocarbons								
Soil Glass Jar - Unpreserved (EP080)								
S154, S444, S38, S140, S41, S15/2	S469, S212, S91, S164, S15/1,	06-MAR-2014	12-MAR-2014	20-MAR-2014	✓	14-MAR-2014	20-MAR-2014	✓



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: * = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaular	Actual	Expected	Evaluation	
Analytical Methods							
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	2	20	10.0	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	2	19	10.5	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	2	11	18.2	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	2	17	11.8	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	4	35	11.4	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	4	32	12.5	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	2	19	10.5	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	19	10.5	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	19	5.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	11	9.1	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	17	5.9	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	35	5.7	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	32	6.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	19	5.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	19	5.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	19	5.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	11	9.1	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	17	5.9	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	35	5.7	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	32	6.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	19	5.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	19	5.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	19	5.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	11	9.1	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	17	5.9	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	35	5.7	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	32	6.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	19	5.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	19	5.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Total Metals by ICP-AES	EG005T	SOIL	(APHA 21st ed., 3120; USEPA SW 846 - 6010) (ICPAES) Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Polychlorinated Biphenyls (PCB)	EP066	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 504)
Pesticides by GCMS	EP068	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM (2013) Schedule B(3) (Method 504,505)
TPH - Semivolatile Fraction	EP071	SOIL	(USEPA SW 846 - 8015A) Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C36. This method is compliant with NEPM (2013) Schedule B(3) (Method 506.1)
PAH/Phenols (SIM)	EP075(SIM)	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 502 and 507)
TPH Volatiles/BTEX	EP080	SOIL	(USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 501)

Preparation Methods	Method	Matrix	Method Descriptions
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	(USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids (Option A - Concentrating)	ORG17A	SOIL	In-house, Mechanical agitation (tumbler). 20g of sample, Na ₂ SO ₄ and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Tumbler Extraction of Solids (Option B - Non-concentrating)	ORG17B	SOIL	In-house, Mechanical agitation (tumbler). 10g of sample, Na ₂ SO ₄ and surrogate are extracted with 20mL 1:1 DCM/Acetone by end over end tumble. The solvent is transferred directly to a GC vial for analysis.



Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	ES1405194-003	Anonymous	Sum of polycyclic aromatic hydrocarbons	----	27.6 %	0-20%	RPD exceeds LOR based limits
Matrix Spike (MS) Recoveries							
EG005T: Total Metals by ICP-AES	ES1405194-004	Anonymous	Chromium	7440-47-3	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

- For all matrices, no Method Blank value outliers occur.
- For all matrices, no Laboratory Control outliers occur.

Regular Sample Surrogates

- For all regular sample matrices, no surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- No Quality Control Sample Frequency Outliers exist.



CHAIN OF CUSTODY
 ALS Laboratory
 please tick

CLIENT: S MEC Testing
OFFICE: Westhill Park
 10883
PROJECT: 10883
PURCHASE ORDER NUMBER:
PROJECT MANAGER: WFF
SAMPLER: J. King, SAMPLER MOBILE: 09991630

TURNAROUND REQUIREMENTS:
 (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)
 Standard TAT (List due date)
 Non-Standard or urgent TAT (List due date):

ALS QUOTE NO.:
CONTACT PH:
COE emailed to ALS? (YES / NO) EDD FOR MAT (or default)
Email Reports to (will default to PM if no other addresses are listed):
Email Invoice to (will default to PM if no other addresses are listed):

CHAIN OF CUSTODY
 AVALON 21 Bama Road, Poolara SA 5005
 Ph: 08 9359 0600 E: sales@als.com.au
 BRIDGE 93 Sharn Street, Southern ID 4033
 Ph: 07 4243 7222 E: sales@als.com.au
 GARDSTONE 46 Chalmers Rd, Dava, Okla, QLD 4680
 Ph: 07 4671 1600 E: galdstone@als.com.au
 MACKAY 79 Princes Highway, Mackay QLD 4740
 Ph: 07 4944 0777 E: mackay@als.com.au
 MELBOURNE 2-4 Waddell Road, Springvale VIC 3171
 Ph: 03 8549 9800 E: sales@als.com.au
 MURDOCH 27 Sydney Road, Murdoch NSW 2850
 Ph: 02 9372 6735 E: murdoch@als.com.au
 NEWCASTLE 15 Broughton Road, Newcastle NSW 2304
 Ph: 02 4980 9433 E: newcastle@als.com.au
 NEWRA 413 Great Place North, Newry NSW 2541
 Ph: 02 4423 2533 E: newra@als.com.au
 PERTH 101 Leed Way, Malaga WA 6093
 Ph: 08 9249 1655 E: sales@als.com.au
 STONEY 27 Woodcock Road, Stoney Creek NSW 2164
 Ph: 02 8764 8555 E: stoney@als.com.au
 SYDNEY 15-17 Deane Court, Berala QLD 4018
 Ph: 07 4788 0807 E: berala@als.com.au
 WWW.ALS.COM.AU
 Ph: 02 4295 3125 E: perth@als.com.au

FOR LABORATORY USE ONLY (Circle)
 Custody Seal Intact? Yes No
 Preserved / frozen in bottles present upon receipt? Yes No
 Random Samples Temperature on Receipt Other comment


RECEIVED BY: David
DATE/TIME: 19/3 0830

RELINQUISHED BY: David
DATE/TIME: 19/3 0830

RECEIVED BY:
DATE/TIME:

COE SEQUENCE NUMBER (Circle)
 1 2 3 4 5 6 7
 2 3 4 5 6 7

COC:
OF:

ALS USE	SAMPLE DETAILS MATRIX - SOLID (S), WATER (W)	CONTAINER INFORMATION	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).	ADDITIONAL INFORMATION
LAB ID	DATE/TIME	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	Comments on likely contaminant levels, dilutions, or samples requiring specific GC analysis etc.
1 5285	19/3/14 5	JA/TC	516	
2 5287A	19/3/14 1			
3 5301				
Environmental Division Sydney Work Order ES1405891				
 Telephone : + 61-2-6784 6555				
TOTAL				

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide/Cd Preserved; S3 = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Amber Glass Unpreserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Plastic; ST = Starch Bottle; ABB = Plastic Bag for Acid Samples only; U = Unpreserved Bag.

V = VOA Vol HCl Preserved; VB = VOA Vol Sodium Bisphthalate Preserved; VS = VOA Vol Sulfuric Preserved; AV = Airfield Unpreserved; VAI SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulfuric Preserved Plastic.



CERTIFICATE OF ANALYSIS

Work Order : ES1405891
Client : SMEC TESTING SERVICES PTY LTD
Contact : ALL REPORTS (ENQUIRIES)
Address : P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164
E-mail : enquiries@smectesting.com.au
Telephone : ----
Facsimile : ----
Project : 19580
Order number : 10833
C-O-C number : ----
Sampler : JK
Site : ----
Quote number : EN/025/13
Page : 1 of 7
Laboratory : Environmental Division Sydney
Contact : Client Services
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail : sydney@alsglobal.com
Telephone : +61-2-8784 8555
Facsimile : +61-2-8784 8500
QC Level : NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Date Samples Received : 19-MAR-2014
Issue Date : 25-MAR-2014
No. of samples received : 3
No. of samples analysed : 3

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
Analytical Results
Surrogate Control Limits



NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Table with 3 columns: Signatories, Position, Accreditation Category. Rows include Celine Conceicao (Senior Spectroscopist, Sydney Inorganics) and Pabi Subba (Senior Organic Chemist, Sydney Organics).



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **ALS is not NATA accredited for the analysis of Bifenthrin in soils when performed under ALS Method EP068D**



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S283	S283/2	S130	----	----
				14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	----	----
Compound	CAS Number	LOR	Unit	ES1405891-001	ES1405891-002	ES1405891-003	----	----
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	20.7	14.1	7.8	----	----
EG005T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	----	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	----	----
Chromium	7440-47-3	2	mg/kg	<2	4	6	----	----
Copper	7440-50-8	5	mg/kg	<5	<5	<5	----	----
Lead	7439-92-1	5	mg/kg	8	<5	10	----	----
Nickel	7440-02-0	2	mg/kg	<2	<2	<2	----	----
Zinc	7440-66-6	5	mg/kg	10	<5	<5	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
4,4'-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
4,4'-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S283	S283/2	S130	----	----
				14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	----	----
Compound	CAS Number	LOR	Unit	ES1405891-001	ES1405891-002	ES1405891-003	----	----
EP068A: Organochlorine Pesticides (OC) - Continued								
4,4'-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	<0.2	----	----
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	----	----
^ Sum of Aldrin + Dieldrin	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
^ Sum of DDD + DDE + DDT	----	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	<0.2	----	----
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	<0.2	----	----
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	<0.2	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S283	S283/2	S130	----	----
				14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	----	----
Compound	CAS Number	LOR	Unit	ES1405891-001	ES1405891-002	ES1405891-003	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	0.6	0.6	0.6	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	1.2	1.2	1.2	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	----	----
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	----	----
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	----	----
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	<50	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	----	----
>C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	<50	<50	----	----
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	----	----
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	<50	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	<50	----	----
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	----	----
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S283	S283/2	S130	----	----
				14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	----	----
Compound	CAS Number	LOR	Unit	ES1405891-001	ES1405891-002	ES1405891-003	----	----
EP080: BTEXN - Continued								
^ Total Xylenes	1330-20-7	0.5	mg/kg	<0.5	<0.5	<0.5	----	----
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	----	----
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	106	94.8	86.7	----	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.1	%	79.2	83.4	76.1	----	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.1	%	95.9	116	85.5	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	99.7	99.3	101	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%	89.6	90.5	92.8	----	----
2,4,6-Tribromophenol	118-79-6	0.1	%	83.8	81.3	82.5	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	89.6	90.5	93.1	----	----
Anthracene-d10	1719-06-8	0.1	%	78.6	78.7	81.4	----	----
4-Terphenyl-d14	1718-51-0	0.1	%	79.0	81.2	82.7	----	----
EP080S: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	92.4	106	109	----	----
Toluene-D8	2037-26-5	0.1	%	81.2	98.2	98.8	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	88.8	108	106	----	----



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2,4,6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	72.8	133.2
Toluene-D8	2037-26-5	73.9	132.1
4-Bromofluorobenzene	460-00-4	71.6	130.0



QUALITY CONTROL REPORT

Table with 4 columns: Field, Value, Field, Value. Includes Work Order (ES1405891), Client (SMEC TESTING SERVICES PTY LTD), Laboratory (Environmental Division Sydney), and various contact and project details.

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
• Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
• Matrix Spike (MS) Report; Recovery and Acceptance Limits



NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Table with 3 columns: Signatories, Position, Accreditation Category. Lists Celine Conceicao (Senior Spectroscopist) and Pabi Subba (Senior Organic Chemist).

Page : 2 of 12
Work Order : ES1405891
Client : SMEC TESTING SERVICES PTY LTD
Project : 19580



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :
Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
= Indicates failed QC



Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Content (QC Lot: 3350010)									
ES1405883-009	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	11.2	10.2	9.3	0% - 50%
ES1405938-008	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	20.3	18.7	7.9	0% - 20%
EG005T: Total Metals by ICP-AES (QC Lot: 3351439)									
ES1405739-002	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	8	7	0.0	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	8	7	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	6	5	21.4	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	15	6	83.7	No Limit
ES1405891-001	S283	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	<2	4	70.5	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	8	9	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	10	9	15.6	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 3351440)									
ES1405739-002	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES1405891-001	S283	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP066: Polychlorinated Biphenyls (PCB) (QC Lot: 3349459)									
ES1405891-001	S283	EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP068A: Organochlorine Pesticides (OC) (QC Lot: 3349458)									
ES1405891-001	S283	EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit



Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP068A: Organochlorine Pesticides (OC) (QC Lot: 3349458) - continued									
ES1405891-001	S283	EP068: 4,4'-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4,4'-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: 4,4'-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP068B: Organophosphorus Pesticides (OP) (QC Lot: 3349458)									
ES1405891-001	S283	EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3347805)									
ES1405601-001	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	1.0	0.8	18.4	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	1.2	1.1	8.9	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	1.0	0.8	20.6	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	0.6	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	0.7	0.5	20.7	No Limit
		EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	0.6	0.6	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 3347805) - continued									
ES1405601-001	Anonymous	EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	5.1	3.8	29.2	0% - 50%
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
ES1405891-003	S130	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit		
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3347806)									
ES1405601-001	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	350	310	10.2	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	220	210	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
ES1405891-003	S130	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 3347810)									
ES1405878-001	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
ES1405883-002	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QC Lot: 3347806)									
ES1405601-001	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	480	440	8.5	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	150	150	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QC Lot: 3347806) - continued									
ES1405601-001	Anonymous	EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	50	<50	0.0	No Limit
ES1405891-003	S130	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	<50	0.0	No Limit
		EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QC Lot: 3347810)							
ES1405878-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
ES1405883-002	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080: BTEXN (QC Lot: 3347810)									
ES1405878-001	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
ES1405883-002	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
EG005T: Total Metals by ICP-AES (QCLot: 3351439)									
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	112	87	129	
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	107	80	122	
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	102	71	133	
EG005T: Copper	7440-50-8	5	mg/kg	<5	32.0 mg/kg	113	86	128	
EG005T: Lead	7439-92-1	5	mg/kg	<5	40.0 mg/kg	105	81	123	
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55.0 mg/kg	110	84	130	
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	114	81	133	
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3351440)									
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	90.5	66	112	
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3349459)									
EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	1 mg/kg	82.0	57.4	117	
EP068A: Organochlorine Pesticides (OC) (QCLot: 3349458)									
EP068: alpha-BHC	319-84-6	0.05	mg/kg	<0.05	0.5 mg/kg	80.4	71	113	
EP068: Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	0.5 mg/kg	94.6	66	122	
EP068: beta-BHC	319-85-7	0.05	mg/kg	<0.05	0.5 mg/kg	101	69	119	
EP068: gamma-BHC	58-89-9	0.05	mg/kg	<0.05	0.5 mg/kg	98.7	71	115	
EP068: delta-BHC	319-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	89.2	65	113	
EP068: Heptachlor	76-44-8	0.05	mg/kg	<0.05	0.5 mg/kg	88.8	68	116	
EP068: Aldrin	309-00-2	0.05	mg/kg	<0.05	0.5 mg/kg	80.9	68	118	
EP068: Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	0.5 mg/kg	92.4	68	116	
EP068: trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	0.5 mg/kg	105	68	120	
EP068: alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	0.5 mg/kg	85.0	69	119	
EP068: cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	0.5 mg/kg	88.4	67	121	
EP068: Dieldrin	60-57-1	0.05	mg/kg	<0.05	0.5 mg/kg	89.9	66	118	
EP068: 4,4'-DDE	72-55-9	0.05	mg/kg	<0.05	0.5 mg/kg	93.1	69	117	
EP068: Endrin	72-20-8	0.05	mg/kg	<0.05	0.5 mg/kg	85.7	67	123	
EP068: beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	0.5 mg/kg	92.6	76	120	
EP068: 4,4'-DDD	72-54-8	0.05	mg/kg	<0.05	0.5 mg/kg	100	76	120	
EP068: Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	0.5 mg/kg	89.5	57.3	115	
EP068: Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	0.5 mg/kg	87.2	60	124	
EP068: 4,4'-DDT	50-29-3	0.2	mg/kg	<0.2	0.5 mg/kg	96.1	67	127	
EP068: Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	0.5 mg/kg	88.1	65	123	
EP068: Methoxychlor	72-43-5	0.2	mg/kg	<0.2	0.5 mg/kg	102	65	129	
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3349458)									



Sub-Matrix: SOIL

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report				
				Result	Spike	Spike Recovery (%)		Recovery Limits (%)	
					Concentration	LCS	Low	High	
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3349458) - continued									
EP068: Dichlorvos	62-73-7	0.05	mg/kg	<0.05	0.5 mg/kg	74.0	56	126	
EP068: Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	0.5 mg/kg	78.6	64	128	
EP068: Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	0.5 mg/kg	78.3	54	122	
EP068: Dimethoate	60-51-5	0.05	mg/kg	<0.05	0.5 mg/kg	80.9	64	124	
EP068: Diazinon	333-41-5	0.05	mg/kg	<0.05	0.5 mg/kg	86.5	73	117	
EP068: Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	0.5 mg/kg	91.6	55	119	
EP068: Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	0.5 mg/kg	89.3	69	123	
EP068: Malathion	121-75-5	0.05	mg/kg	<0.05	0.5 mg/kg	98.7	70	120	
EP068: Fenthion	55-38-9	0.05	mg/kg	<0.05	0.5 mg/kg	90.4	71	115	
EP068: Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	0.5 mg/kg	94.3	68	114	
EP068: Parathion	56-38-2	0.2	mg/kg	<0.2	0.5 mg/kg	105	68	122	
EP068: Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	0.5 mg/kg	94.9	69	115	
EP068: Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	0.5 mg/kg	97.9	68	116	
EP068: Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	0.5 mg/kg	89.7	64	120	
EP068: Prothiofos	34643-46-4	0.05	mg/kg	<0.05	0.5 mg/kg	94.5	68	116	
EP068: Ethion	563-12-2	0.05	mg/kg	<0.05	0.5 mg/kg	96.8	70	118	
EP068: Carbophenothion	786-19-6	0.05	mg/kg	<0.05	0.5 mg/kg	90.7	67	123	
EP068: Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	0.5 mg/kg	97.1	42	126	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3347805)									
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	4 mg/kg	101	80	124	
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	4 mg/kg	95.3	77	123	
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	4 mg/kg	99.0	79	123	
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	4 mg/kg	97.6	77	123	
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	4 mg/kg	103	79	123	
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	4 mg/kg	101	79	123	
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	4 mg/kg	98.5	79	123	
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	4 mg/kg	100	79	125	
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	4 mg/kg	92.0	73	121	
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	4 mg/kg	98.4	81	123	
EP075(SIM): Benzo(b)fluoranthene	205-99-2	0.5	mg/kg	<0.5	4 mg/kg	88.8	70	118	
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	4 mg/kg	101	77	123	
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	4 mg/kg	90.1	76	122	
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	4 mg/kg	83.5	71	113	
EP075(SIM): Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg	<0.5	4 mg/kg	83.5	71.7	113	
EP075(SIM): Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg	<0.5	4 mg/kg	81.4	72.4	114	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3347806)									
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	200 mg/kg	109	71	131	
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	300 mg/kg	96.0	74	138	
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	200 mg/kg	93.6	64	128	



Sub-Matrix: SOIL

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report				
					Spike Concentration	Spike Recovery (%)		Recovery Limits (%)	
						LCS	Low	High	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3347810)									
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	83.2	68.4	128	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3347806)									
EP071: >C10 - C16 Fraction	>C10_C16	50	mg/kg	<50	250 mg/kg	94.4	70	130	
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	350 mg/kg	94.7	74	138	
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	----	----	----	----	
		50	mg/kg	----	150 mg/kg	114	63	131	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3347810)									
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	80.3	68.4	128	
EP080: BTEXN (QCLot: 3347810)									
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	87.5	62	116	
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	92.2	62	128	
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	86.2	58	118	
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	83.0	60	120	
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	90.3	60	120	
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	85.5	62	138	

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: SOIL

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report				
				Spike Concentration	Spike Recovery(%)		Recovery Limits (%)	
					MS	Low	High	
EG005T: Total Metals by ICP-AES (QCLot: 3351439)								
ES1405739-002	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	107	70	130	
		EG005T: Cadmium	7440-43-9	50 mg/kg	105	70	130	
		EG005T: Chromium	7440-47-3	50 mg/kg	105	70	130	
		EG005T: Copper	7440-50-8	125 mg/kg	106	70	130	
		EG005T: Lead	7439-92-1	125 mg/kg	104	70	130	
		EG005T: Nickel	7440-02-0	50 mg/kg	97.6	70	130	
		EG005T: Zinc	7440-66-6	125 mg/kg	101	70	130	
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3351440)								
ES1405739-002	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	94.4	70	130	
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3349459)								
ES1405891-001	S283	EP066: Total Polychlorinated biphenyls	----	1 mg/kg	91.0	70	130	
EP068A: Organochlorine Pesticides (OC) (QCLot: 3349458)								
ES1405891-001	S283							



Sub-Matrix: SOIL

				Matrix Spike (MS) Report				
				Spike Concentration	Spike Recovery(%) MS	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High	
EP068A: Organochlorine Pesticides (OC) (QCLot: 3349458) - continued								
ES1405891-001	S283	EP068: gamma-BHC	58-89-9	0.5 mg/kg	96.3	70	130	
		EP068: Heptachlor	76-44-8	0.5 mg/kg	95.6	70	130	
		EP068: Aldrin	309-00-2	0.5 mg/kg	101	70	130	
		EP068: Dieldrin	60-57-1	0.5 mg/kg	109	70	130	
		EP068: Endrin	72-20-8	2 mg/kg	105	70	130	
		EP068: 4.4'-DDT	50-29-3	2 mg/kg	75.7	70	130	
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3349458)								
ES1405891-001	S283	EP068: Diazinon	333-41-5	0.5 mg/kg	103	70	130	
		EP068: Chlorpyrifos-methyl	5598-13-0	0.5 mg/kg	76.7	70	130	
		EP068: Pirimphos-ethyl	23505-41-1	0.5 mg/kg	103	70	130	
		EP068: Bromophos-ethyl	4824-78-6	0.5 mg/kg	107	70	130	
		EP068: Prothiofos	34643-46-4	0.5 mg/kg	91.4	70	130	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3347805)								
ES1405601-001	Anonymous	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	91.1	70	130	
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	84.1	70	130	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3347806)								
ES1405601-001	Anonymous	EP071: C10 - C14 Fraction	----	640 mg/kg	86.8	73	137	
		EP071: C15 - C28 Fraction	----	3140 mg/kg	80.2	53	131	
		EP071: C29 - C36 Fraction	----	2860 mg/kg	74.8	52	132	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3347810)								
ES1405878-001	Anonymous	EP080: C6 - C9 Fraction	----	32.5 mg/kg	77.3	70	130	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3347806)								
ES1405601-001	Anonymous	EP071: >C10 - C16 Fraction	>C10_C16	850 mg/kg	96.0	73	137	
		EP071: >C16 - C34 Fraction	----	4800 mg/kg	71.4	53	131	
		EP071: >C34 - C40 Fraction	----	2400 mg/kg	57.4	52	132	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3347810)								
ES1405878-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	72.5	70	130	
EP080: BTEXN (QCLot: 3347810)								
ES1405878-001	Anonymous	EP080: Benzene	71-43-2	2.5 mg/kg	73.4	70	130	
		EP080: Toluene	108-88-3	2.5 mg/kg	75.8	70	130	
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	74.0	70	130	
		EP080: meta- & para-Xylene	108-38-3	2.5 mg/kg	72.3	70	130	
			106-42-3					
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	74.8	70	130	
		EP080: Naphthalene	91-20-3	2.5 mg/kg	76.6	70	130	



The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: SOIL

					Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
					MS	MSD	Low	High	Value	Control Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 3347805)										
ES1405601-001	Anonymous	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	91.1	----	70	130	----	----
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	84.1	----	70	130	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3347806)										
ES1405601-001	Anonymous	EP071: C10 - C14 Fraction	----	640 mg/kg	86.8	----	73	137	----	----
		EP071: C15 - C28 Fraction	----	3140 mg/kg	80.2	----	53	131	----	----
		EP071: C29 - C36 Fraction	----	2860 mg/kg	74.8	----	52	132	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3347806)										
ES1405601-001	Anonymous	EP071: >C10 - C16 Fraction	>C10_C16	850 mg/kg	96.0	----	73	137	----	----
		EP071: >C16 - C34 Fraction	----	4800 mg/kg	71.4	----	53	131	----	----
		EP071: >C34 - C40 Fraction	----	2400 mg/kg	57.4	----	52	132	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3347810)										
ES1405878-001	Anonymous	EP080: C6 - C9 Fraction	----	32.5 mg/kg	77.3	----	70	130	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3347810)										
ES1405878-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	72.5	----	70	130	----	----
EP080: BTEXN (QCLot: 3347810)										
ES1405878-001	Anonymous	EP080: Benzene	71-43-2	2.5 mg/kg	73.4	----	70	130	----	----
		EP080: Toluene	108-88-3	2.5 mg/kg	75.8	----	70	130	----	----
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	74.0	----	70	130	----	----
		EP080: meta- & para-Xylene	108-38-3	2.5 mg/kg	72.3	----	70	130	----	----
			106-42-3							
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	74.8	----	70	130	----	----
		EP080: Naphthalene	91-20-3	2.5 mg/kg	76.6	----	70	130	----	----
EP068A: Organochlorine Pesticides (OC) (QCLot: 3349458)										
ES1405891-001	S283	EP068: gamma-BHC	58-89-9	0.5 mg/kg	96.3	----	70	130	----	----
		EP068: Heptachlor	76-44-8	0.5 mg/kg	95.6	----	70	130	----	----
		EP068: Aldrin	309-00-2	0.5 mg/kg	101	----	70	130	----	----
		EP068: Dieldrin	60-57-1	0.5 mg/kg	109	----	70	130	----	----
		EP068: Endrin	72-20-8	2 mg/kg	105	----	70	130	----	----
		EP068: 4,4'-DDT	50-29-3	2 mg/kg	75.7	----	70	130	----	----
EP068B: Organophosphorus Pesticides (OP) (QCLot: 3349458)										
ES1405891-001	S283	EP068: Diazinon	333-41-5	0.5 mg/kg	103	----	70	130	----	----
		EP068: Chlorpyrifos-methyl	5598-13-0	0.5 mg/kg	76.7	----	70	130	----	----
		EP068: Pirimphos-ethyl	23505-41-1	0.5 mg/kg	103	----	70	130	----	----
		EP068: Bromophos-ethyl	4824-78-6	0.5 mg/kg	107	----	70	130	----	----
		EP068: Prothiofos	34643-46-4	0.5 mg/kg	91.4	----	70	130	----	----
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3349459)										

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 Work Order : ES1405891
 Client : SMEC TESTING SERVICES PTY LTD
 Project : 19580



Sub-Matrix: SOIL

					Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike Concentration	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
					MS	MSD	Low	High	Value	Control Limit
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 3349459) - continued										
ES1405891-001	S283	EP066: Total Polychlorinated biphenyls	----	1 mg/kg	91.0	----	70	130	----	----
EG005T: Total Metals by ICP-AES (QCLot: 3351439)										
ES1405739-002	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	107	----	70	130	----	----
		EG005T: Cadmium	7440-43-9	50 mg/kg	105	----	70	130	----	----
		EG005T: Chromium	7440-47-3	50 mg/kg	105	----	70	130	----	----
		EG005T: Copper	7440-50-8	125 mg/kg	106	----	70	130	----	----
		EG005T: Lead	7439-92-1	125 mg/kg	104	----	70	130	----	----
		EG005T: Nickel	7440-02-0	50 mg/kg	97.6	----	70	130	----	----
		EG005T: Zinc	7440-66-6	125 mg/kg	101	----	70	130	----	----
EG035T: Total Recoverable Mercury by FIMS (QCLot: 3351440)										
ES1405739-002	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	94.4	----	70	130	----	----



Environmental

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES1405891	Page	: 1 of 6
Client	: SMEC TESTING SERVICES PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: ALL REPORTS (ENQUIRIES)	Contact	: Client Services
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 19-MAR-2014
C-O-C number	: ----	Issue Date	: 25-MAR-2014
Sampler	: JK	No. of samples received	: 3
Order number	: 10833	No. of samples analysed	: 3
Quote number	: EN/025/13		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers



Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with recommended holding times (USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: SOIL

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA055: Moisture Content								
Soil Glass Jar - Unpreserved (EA055-103) S283, S130	S283/2,	14-MAR-2014	----	----	----	20-MAR-2014	28-MAR-2014	✓
EG005T: Total Metals by ICP-AES								
Soil Glass Jar - Unpreserved (EG005T) S283, S130	S283/2,	14-MAR-2014	21-MAR-2014	10-SEP-2014	✓	24-MAR-2014	10-SEP-2014	✓
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved (EG035T) S283, S130	S283/2,	14-MAR-2014	21-MAR-2014	11-APR-2014	✓	24-MAR-2014	11-APR-2014	✓
EP066: Polychlorinated Biphenyls (PCB)								
Soil Glass Jar - Unpreserved (EP066) S283, S130	S283/2,	14-MAR-2014	20-MAR-2014	28-MAR-2014	✓	21-MAR-2014	29-APR-2014	✓
EP068A: Organochlorine Pesticides (OC)								
Soil Glass Jar - Unpreserved (EP068) S283, S130	S283/2,	14-MAR-2014	20-MAR-2014	28-MAR-2014	✓	21-MAR-2014	29-APR-2014	✓
EP068B: Organophosphorus Pesticides (OP)								
Soil Glass Jar - Unpreserved (EP068) S283, S130	S283/2,	14-MAR-2014	20-MAR-2014	28-MAR-2014	✓	21-MAR-2014	29-APR-2014	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013								
Soil Glass Jar - Unpreserved (EP071) S283, S130	S283/2,	14-MAR-2014	20-MAR-2014	28-MAR-2014	✓	21-MAR-2014	29-APR-2014	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved (EP075(SIM)) S283, S130	S283/2,	14-MAR-2014	20-MAR-2014	28-MAR-2014	✓	21-MAR-2014	29-APR-2014	✓



Matrix: **SOIL**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EP080: BTEXN								
Soil Glass Jar - Unpreserved (EP080) S283, S130	S283/2,	14-MAR-2014	20-MAR-2014	28-MAR-2014	✓	23-MAR-2014	28-MAR-2014	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013								
Soil Glass Jar - Unpreserved (EP080) S283, S130	S283/2,	14-MAR-2014	20-MAR-2014	28-MAR-2014	✓	23-MAR-2014	28-MAR-2014	✓



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: * = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaular	Actual	Expected	Evaluation	
Analytical Methods							
Laboratory Duplicates (DUP)							
Moisture Content	EA055-103	2	18	11.1	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (SIM)	EP075(SIM)	2	14	14.3	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	7	14.3	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	7	14.3	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	2	14	14.3	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	2	17	11.8	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	2	18	11.1	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	18	11.1	10.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	14	7.1	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	7	14.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	7	14.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	14	7.1	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	17	5.9	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	18	5.6	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	18	5.6	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	14	7.1	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	7	14.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	7	14.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	14	7.1	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	17	5.9	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	18	5.6	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	18	5.6	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	14	7.1	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	7	14.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	7	14.3	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	14	7.1	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-AES	EG005T	1	17	5.9	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	18	5.6	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	1	18	5.6	5.0	✓	NEPM 2013 Schedule B(3) and ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Total Metals by ICP-AES	EG005T	SOIL	(APHA 21st ed., 3120; USEPA SW 846 - 6010) (ICPAES) Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl ₂)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl ₂ which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
Polychlorinated Biphenyls (PCB)	EP066	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 504)
Pesticides by GCMS	EP068	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This technique is compliant with NEPM (2013) Schedule B(3) (Method 504,505)
TPH - Semivolatile Fraction	EP071	SOIL	(USEPA SW 846 - 8015A) Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C36. This method is compliant with NEPM (2013) Schedule B(3) (Method 506.1)
PAH/Phenols (SIM)	EP075(SIM)	SOIL	(USEPA SW 846 - 8270B) Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 502 and 507)
TPH Volatiles/BTEX	EP080	SOIL	(USEPA SW 846 - 8260B) Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 501)

Preparation Methods	Method	Matrix	Method Descriptions
Methanolic Extraction of Soils for Purge and Trap	* ORG16	SOIL	(USEPA SW 846 - 5030A) 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids (Option A - Concentrating)	ORG17A	SOIL	In-house, Mechanical agitation (tumbler). 20g of sample, Na ₂ SO ₄ and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Tumbler Extraction of Solids (Option B - Non-concentrating)	ORG17B	SOIL	In-house, Mechanical agitation (tumbler). 10g of sample, Na ₂ SO ₄ and surrogate are extracted with 20mL 1:1 DCM/Acetone by end over end tumble. The solvent is transferred directly to a GC vial for analysis.



Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- For all matrices, no Method Blank value outliers occur.
- For all matrices, no Duplicate outliers occur.
- For all matrices, no Laboratory Control outliers occur.
- For all matrices, no Matrix Spike outliers occur.

Regular Sample Surrogates

- For all regular sample matrices, no surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- No Quality Control Sample Frequency Outliers exist.



CHAIN OF CUSTODY

CLIENT: SMEC TESTING SERVICES
 OFFICE: 14/11 COMPASTURE PLACE
 PROJECT: 19880/10000
 ORDER NUMBER: 10920

UNACQUAY 19-48-36-31-161/161-300/ QLD 4746
 P.O. Box 489 4899 E. BRISBANE QLD 4001
 Ph: 07 294 8177
 Email: enquiries@smec.com.au

CHILLI 19-48-36-31-161/161-300/ QLD 4746
 P.O. Box 489 4899 E. BRISBANE QLD 4001
 Ph: 07 294 8177
 Email: enquiries@smec.com.au

CHILLI 19-48-36-31-161/161-300/ QLD 4746
 P.O. Box 489 4899 E. BRISBANE QLD 4001
 Ph: 07 294 8177
 Email: enquiries@smec.com.au

TURABOUND REQUIREMENTS:
 Standard TAT (List due date)
 Non Standard or urgent TAT (List due date)

19/3/14

CONTACT PH: 02 9756 2156
 CONTACT MOBILE: 02 9756 2156
 EDD FORMAT (or default):

RECEIVED BY: 10/18/14
 DATE/TIME: 6:30pm

RECEIVED BY: 11/01/14
 DATE/TIME: 6:30pm

RECEIVED BY: [blank]
 DATE/TIME: [blank]

RECEIVED BY: [blank]
 DATE/TIME: [blank]

RECEIVED BY: [blank]
 DATE/TIME: [blank]

RECEIVED BY: [blank]
 DATE/TIME: [blank]

RECEIVED BY: [blank]
 DATE/TIME: [blank]

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (codes below)	TOTAL CONTAINERS	ANALYSIS REQUIRED (including suites) (see State Codes must be listed to attract suite price) (Where Metals are required, specify Total (unfiltered) bottle required) or Dissolved (field filtered bottle required).	Additional Information
1	S212	6/3/14	S	Ter / H2O	EC		
2	S262						
3	S287						
4	S214						
5	S325						
6	S339						
7	S340						
8	S315						
9	S362						
10	S393						
11	S392						
12	S394						

Environmental Division
 Sydney
 Work Order
ES1405223



Telephone : +61-2-8784 8355

Water Container Codes: P = Unpreserved Plastic, N = Nitric Preserved Plastic, ORC = Nitric Preserved ORC, SH = Sodium Hydroxide Preserved Plastic, S = Sodium Hydroxide Preserved Plastic, AG = Amber Glass Unpreserved, AP = Amber Glass Unpreserved Plastic, A = Amber Glass Unpreserved Plastic, F = Formaldehyde Preserved Glass, Y = YOA Vial HQ Preserved, VS = YOA Vial Solid Preserved, AV = Airtight Unpreserved Vial SG = Sulphur Preserved Amber Glass, H = HCl preserved Plastic, HS = HCl preserved Specimen bottle, SP = Sodium Preserved Plastic, E = EDTA Preserved Plastic, SI = Sterile Bottle, ASS = Plastic Bag for Acid Sulphate Solids, B = Unpreserved Bag.



CHAIN OF CUSTODY

ALS Laboratory
please tick →

UNDELIVERED 21 Gemini Road, Northgate SA 5018
Ph: 08 8330 2800 E: enquiries@als.com.au
QNSW 59/60 Stirling Street, Stirling QLD 4053
Ph: 07 5533 7222 E: samples@qld.als.com.au
QLD - NORTH COAST 48 Oxenburgh Drive, Casuarina QLD 4850
Ph: 07 471 8600 E: samples@qld.als.com.au

2/3 KNOX AV 78 Henley Beach SA 5015
Ph: 07 4914 0077 E: info@als.com.au
2/4 BUNNINGS RD 24 Woodside Road, Woodside VIC 3171
Ph: 03 5503 3004 E: samples@vic.als.com.au
2/4 BUNNINGS RD 27 Sydney Road, Sydney NSW 2155
Ph: 02 6057 0530 E: info@nsw.als.com.au

CHENWOOD ST 5.6 Ross Road, Ross VIC 3094
Ph: 03 4699 3493 E: samples@vic.als.com.au
2/3 KNOX AV 78 Henley Beach SA 5015
Ph: 07 4914 0077 E: info@als.com.au
2/4 BUNNINGS RD 27 Sydney Road, Sydney NSW 2155
Ph: 02 6057 0530 E: info@nsw.als.com.au

1/3 BUNNINGS RD 27 Sydney Road, Sydney NSW 2155
Ph: 02 6057 0530 E: info@nsw.als.com.au
2/4 BUNNINGS RD 27 Sydney Road, Sydney NSW 2155
Ph: 02 6057 0530 E: info@nsw.als.com.au
2/4 BUNNINGS RD 27 Sydney Road, Sydney NSW 2155
Ph: 02 6057 0530 E: info@nsw.als.com.au

CLIENT: SMEC TESTING SERVICES
OFFICE: 141 COMPASTURE PLACE
PROJECT: 12880/40300
ORDER NUMBER: 10920
PROJECT MANAGER: VIA
SAMPLER: Jha/D.L.
CONTACT PH: 02 9756 2166
SAMPLER MOBILE: 02 9756 2166
EOD FORMAT (or default):

TURNAROUND REQUIREMENTS:
(Standard TAT may be longer for some tests e.g. Ultra Trace Organics)
ALS QUOTE NO.:
Non Standard or urgent TAT (List due date):
Standard TAT (List due date):

RELINQUISHED BY: [Signature]
DATE/TIME: 11/01/14 6:30pm
RECEIVED BY: [Signature]
DATE/TIME: 11/01/14 6:30pm

RELINQUISHED BY: [Signature]
DATE/TIME: 11/01/14 6:30pm
RECEIVED BY: [Signature]
DATE/TIME: 11/01/14 6:30pm

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ANALYSIS REQUIRED INCLUDING SUITES (NB: Suit Codes must be listed to attract suite price)
Where Metals are required, specify Total (unless noted) or Dissolved (field filtered) (where required).

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (codes below)	(refer to)	TOTAL CONTAINERS	ANALYSIS REQUIRED INCLUDING SUITES (NB: Suit Codes must be listed to attract suite price) Where Metals are required, specify Total (unless noted) or Dissolved (field filtered) (where required).	Additional Information
13	5393	6/3/14	S	Jha LTO.	EC			
14	5394							
15	5394							
16	5368							
17	5468							
18	5469							
19	5444							
20	5419							
21	5367							
22	5344							
23	5293							
24	5292							

Water Condition Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved Plastic; A = Airtight Unpreserved Plastic
 V = VOA Vol % Preserved; VP = VOA Vol % Sodium Bisulfite Preserved; VS = VOA Vol % Sulfuric Preserved; VA = Vol % Airtight Unpreserved Plastic; SV = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation Bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
 Z = Zinc Aspartate Preserved Bottle; E = EDTA Preserved Bottle; SI = Sealed Bottle; ASS = Plastic Bag for Acid Sulfate Soils; B = Unpreserved BSA.



CHAIN OF CUSTODY

ALS Laboratory
Perseus 104-3

LABORATORY 21 Roma Street, Parkville VIC 3046
Ph: 03 9347 0171 E: enquiries@emc-testing.com.au
388188AL E 33 Soroktalar Road, QLD 4039
Ph: 07 3283 7722 E: enquiries@emc-testing.com.au
257/40 STONE OF GARDENIA Drive, QLD 4049
Ph: 07 3211 5500 E: enquiries@emc-testing.com.au

QUACKENBUSH Highway Road, TASMANIA 7243
Ph: 03 6344 0171 E: enquiries@emc-testing.com
2385, BOWLING 24 Yorkhill Street, VIC 3171
Ph: 03 8561 8800 E: enquiries@emc-testing.com
241 COOPER ST, VIC 3000
Ph: 03 9247 4131 E: enquiries@emc-testing.com

CHICKENBUSH 8888, 89th Street, TX 75080
Ph: 02 4283 6242 E: enquiries@emc-testing.com
QUICKENBUSH 4033, 4033 Gony Road, NSW 1570
Ph: 02 9212 1000 E: enquiries@emc-testing.com
QUICKENBUSH 10, 10th Street, WA 6100
Ph: 08 2099 7055 E: enquiries@emc-testing.com

QUICKENBUSH 271, 271 St. George Road, NSW 1583
Ph: 02 9247 0171 E: enquiries@emc-testing.com
QUICKENBUSH 14, 14 St. George Road, NSW 1583
Ph: 02 9247 0171 E: enquiries@emc-testing.com
QUICKENBUSH 11, 11 St. George Road, NSW 1583
Ph: 02 9247 0171 E: enquiries@emc-testing.com

CLIENT: SABC TESTING SERVICES
PROJECT: 1411 COMPASTURE PLACE
PROJECT NUMBER: 19586 / 10920
PROJECT MANAGER: N/A
SAMPLER: JKL / D/L
COC emailed to ALS? NO
Email Reports to (will default to PM if no other addresses are listed): enquiries@emc-testing.com
Email invoice to (will default to PM if no other addresses are listed): accounts@emc-testing.com

TERMINAOUND REQUIREMENTS:
 Standard TAT (last due date)
 Non Standard or urgent TAT (last due date)
RELIQUISHED BY: [Signature]
DATE/TIME: 9/2/10

COC SEQUENCE NUMBER (Circle)
1 2 3 4 5 6 7
RECEIVED BY: [Signature]
DATE/TIME: 11/01/14

RECEIVED BY: [Signature]
DATE/TIME: [Blank]

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (codes below)	TOTAL CONTAINERS	ANALYSIS REQUIRED INCLUDING SUITES (NB: Suite Codes must be listed to attach suite price) where Matrix and required, specify Total (unfilled bottle required) or Disposed (ifed filtered bottle) (specify)	Additional Information
25	5133	4/3/14	S	Dr / Jce	2		
26	5158				1		
27	5172				1		
28	5154				1		
29	5131				1		
30	5155				1		
31	5181				1		
32	5106				1		
33	5131				1		
34	5181				1		
35	5182				1		
36	5307				1		

Water Contaminant Codes: P = Unpreserved Plastic, N = NGS, Preserved Plastic, OGC = Major Preserved OGC, SH = Garden Hydroxide Preserved, S = Sodium Hydroxide Preserved, AG = Amber Glass Unpreserved Plastic, AS = Amber Glass Unpreserved Plastic, AZ = Amber Glass Unpreserved Plastic, V = VOA, Vial HCl Preserved, VE = VOA, Vial Sealing, Bismuthate Preserved, VS = VOA, Vial Sealing, Bismuthate Preserved, VU = VOA, Vial Sealing, Bismuthate Preserved, VV = VOA, Vial Sealing, Bismuthate Preserved, VZ = Zinc Acetate Preserved Bottle, E = EDTA Preserved Bottle, ST = Sterile Bottle, ASS = Plastic Bag for Add. Substrate, SCS = Unpreserved Bag



CHAIN OF CUSTODY

ALS Laboratory
Please tick →

DUNDEE 21 Burnside Road, Dundee DD1 1EJ
Ph: 01307 208000 Fax: 01307 208001
DUNDEE 22 Burnside Road, Dundee DD1 1EJ
Ph: 01307 208000 Fax: 01307 208001
DUNDEE 23 Burnside Road, Dundee DD1 1EJ
Ph: 01307 208000 Fax: 01307 208001
DUNDEE 24 Burnside Road, Dundee DD1 1EJ
Ph: 01307 208000 Fax: 01307 208001

GLASGOW 21 Burnside Road, Glasgow G4 6EJ
Ph: 0141 208000 Fax: 0141 208001
GLASGOW 22 Burnside Road, Glasgow G4 6EJ
Ph: 0141 208000 Fax: 0141 208001
GLASGOW 23 Burnside Road, Glasgow G4 6EJ
Ph: 0141 208000 Fax: 0141 208001
GLASGOW 24 Burnside Road, Glasgow G4 6EJ
Ph: 0141 208000 Fax: 0141 208001

GLASGOW 25 Burnside Road, Glasgow G4 6EJ
Ph: 0141 208000 Fax: 0141 208001
GLASGOW 26 Burnside Road, Glasgow G4 6EJ
Ph: 0141 208000 Fax: 0141 208001
GLASGOW 27 Burnside Road, Glasgow G4 6EJ
Ph: 0141 208000 Fax: 0141 208001
GLASGOW 28 Burnside Road, Glasgow G4 6EJ
Ph: 0141 208000 Fax: 0141 208001

GLASGOW 29 Burnside Road, Glasgow G4 6EJ
Ph: 0141 208000 Fax: 0141 208001
GLASGOW 30 Burnside Road, Glasgow G4 6EJ
Ph: 0141 208000 Fax: 0141 208001
GLASGOW 31 Burnside Road, Glasgow G4 6EJ
Ph: 0141 208000 Fax: 0141 208001
GLASGOW 32 Burnside Road, Glasgow G4 6EJ
Ph: 0141 208000 Fax: 0141 208001

CLIENT: SMEC TESTING SERVICES
OFFICE: 14th FLOOR PASTURE PLAZA
PROJECT: 10580/40300
ORDER NUMBER: 10920
PROJECT MANAGER: NA
SAMPLER: Jk/D.L.
COC emailed to ALS? NO
Email Reports to (with default to PM if no other addresses are listed): smc@smc-testing.com.au
Email Invoicing to (will default to PM if no other addresses are listed): accounts@smc-testing.com.au

TURNAROUND REQUIREMENTS:
Standard TAT may be longer for some tests e.g. Urine Toxic Screens
ALS QUOTE NO.:
CONTACT PH: 02 9756 2166
SAMPLER MOBILE: 02 9756 2166
EOD FORMAT (for default):
REQUISITIONED BY: [Signature]
DATE/TIME: 19/3/14
RECEIVED BY: [Signature]
DATE/TIME: 11/03/14

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (codes below)	(refer to)	TOTAL CONTAINERS	ANALYSIS REQUIRED including SUITES (i.e. Suite Codes must be listed to attract slice prices) when Matrix and method, specify total (unfilled) and/or (required) or Disposed (field favour bottles required)	Additional Information
37	5256		S	Jk/IR		EC		
38	5230					HO		
39	5151					SOB		
40	5151A					10		

Water Condenser Codes: Z = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide Preserved Plastic; S = Sodium Hydroxide Preserved Plastic; AS = Antiseptic Glass Unpreserved; AP = Antiseptic Unpreserved Plastic
V = VOA Vial SO Preserved; VB = VOA Vial Sodium Bisphosphate Preserved; VS = VOA Vial Sulphur Preserved; AV = Air/vial Unpreserved Vial; SS = Sulphur Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Eppendorf Bottle; SP = Sulphur Preserved Plastic; F = Formaldehyde Preserved Glass
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; SI = Sterile Bottle; ASS = Plastic Bag for Ash Sulphate Soils; B = Unpreserved Box



CHAIN OF CUSTODY

ALS Laboratory:
please tick -

CLIENT: Spec Test Services

OFFICE: 19/1 Coopers Pl, W.P.

PROJECT: 19/14580/4030C

PURCHASE ORDER NUMBER: 10910

PROJECT MANAGER: WJF

SAMPLER: JK DL

SAMPLER MOBILE:

COG emailed to ALS? (YES / NO) YES **EDD FORMAT (or default):**

Email Reports to (will default to PM if no other addresses are listed):

Email Invoice to (will default to PM if no other addresses are listed):

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS:
(Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

ALS QUOTE NO.:

RELINQUISHED BY: 956168

RECEIVED BY: 10/13/14

DATE/TIME: 6:30pm

RELINQUISHED BY:

RECEIVED BY:

DATE/TIME:

FOR LABORATORY USE ONLY (Circle)

Custody: Scan intact? Yes No N/A

Facility: Freezer (ice chips) Yes No N/A

Present upon receipt? Yes No N/A

Random Sample (temperature, receipt, Other, comment):

AGENCY CONTACT LIST:

- AFB AFB 21 Burns Road Rockdale SA 5095
Ph: 08 8351 6690 E: aablab@afbsa.gov.au
- BARRISMAN 22 Spring Street, Adelaide SA 5000
Ph: 08 8247 7272 E: scott.barrisman@afbsa.gov.au
- GARDNER 48 Colquhoun Drive, Glenelg SA 5015
Ph: 08 827 3800 E: gscott@afbsa.gov.au
- MACKAY 78 Lobley Road, Hackney QLD 4740
Ph: 07 4944 8177 E: mackay@afbsa.gov.au
- NEWBOURNE 2-4 Wexford Road, Strathmore VIC 3117
Ph: 03 8549 9600 E: samples.melbourne@afbsa.gov.au
- HUNTER 27 Sydney Road, Mudgee NSW 2850
Ph: 02 6822 8735 E: mudgee@afbsa.gov.au
- NEWCASTLE 5 Breganz Road, Newcastle NSW 2304
Ph: 02 4995 9435 E: samples.newcastle@afbsa.gov.au
- ROYBA 413 Green Place, North Sydney NSW 2060
Ph: 02 423 5053 E: newcastle@afbsa.gov.au
- PERTH 10 King Way, Perth WA 6000
Ph: 08 9248 7255 E: perth@afbsa.gov.au
- SYDNEY 277 Wagon Road, Smithfield NSW 2154
Ph: 02 8764 6555 E: samples.sydney@afbsa.gov.au
- TOWERSVILLE 14415 Osborn Court, Scottsdale CO 8019
Ph: 07 4756 0600 E: kowman@afbsa.gov.au
- WOLLONGONG 88 Roper Street, Wollongong NSW 2500
Ph: 02 425 3152 E: wollongong@afbsa.gov.au

COG	COG SEQUENCE NUMBER (Circle)	OF:	RECEIVED BY:	DATE/TIME:	RELINQUISHED BY:	DATE/TIME:	RECEIVED BY:	DATE/TIME:
1	2	1	10/13/14					
2	3	2						
3	4	3						
4	5	4						
5	6	5						
6	7	6						
7	8	7						

ALS USE	MATRIX - SOLID (S), WATER (W)	SAMPLE ID	DATE/TIME	MATRIX	CONTAINER INFORMATION	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	ANALYSIS REQUIRED including SUITES (NB: Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered) or Dissolved (filtered) bottle required.	Additional Information
Y1		591	6/1/14	S		JK DL	1		Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
Y2		5140					1		
Y3		5169					1		
Y4		5168					1		
Y5		5164					1		
Y6		541					1		
Y7		5167					1		
Y8		592					1		
Y9		5163					1		
TOTAL								ec.	

Water Container Codes: P = Unpreserved Plastic; N = Nalc Preserved Plastic; ORC = Nalc Preserved ORC; SH = Sodium Hydroxide Preserved Plastic; AC = Amber Glass Unpreserved; AP = Airtight Unpreserved Plastic; V = VOA Vial HCl Preserved; VA = VOA Vial Sodium Bisulfate Preserved; VS = VOA Vial Sulfuric Preserved; NV = Airtight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Specialisation Bottle; SP = Sulfuric Preserved Plastic; F = Formic Acid Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Rubber; ST = Stalk Station; ABO = Burette; B = Acid Burette Station; P = Unpreserved Bq.



CHAIN OF CUSTODY

ALS Laboratory

entironmental please tick

ALS Laboratory
 4885 Rte 21, Burton, Road, Poola SA 5005
 Ph: 08 8351 0883 E: als@alsenviro.com
 BRISBANE 32 Spring Street, Sturt SA 5033
 Ph: 08 8351 7222 E: samples@alsenviro.com
 MELBOURNE 48 Glenmore Rd, Glenmore SA 5080
 Ph: 08 8351 7500 E: press@alsenviro.com

TURNAROUND REQUIREMENTS:
 (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

Standard TAT (List due date):
 Non Standard or urgent TAT (List due date):

ADRIAN 78 Highway Road, Heston QLD 4170
 Ph: 07 4544 8177 E: mick@alsenviro.com
 MELBOURNE 2-4 Vespa Road, Springvale VIC 3171
 Ph: 03 8848 5000 E: samples.melbourne@alsenviro.com
 MILDURA 27 Sydney Road, Mildura VIC 3490
 Ph: 02 6372 8755 E: milder@alsenviro.com

NEWCASTLE 5 Breugnot Road, Warbrook NSW 2204
 Ph: 02 4928 9435 E: samples.newcastle@alsenviro.com
 NORFOLK 413 River Place, North Haven NSW 2541
 Ph: 02 4253 2388 E: north@alsenviro.com
 PERTH 10 Paul Way, Perth WA 6200
 Ph: 08 9265 7855 E: samples.perth@alsenviro.com

SYDNEY 27 Woodcock Road, Springfield NSW 2166
 Ph: 02 8786 5555 E: samples.sydney@alsenviro.com
 TOWNSVILLE 14-15 Deana Court, Townsville QLD 4810
 Ph: 07 4756 6000 E: towsville@alsenviro.com
 WOLLONGONG 90 Kery Street, Wollongong NSW 2500
 Ph: 02 4223 3125 E: wollongong@alsenviro.com

CLIENT: **DMC Testing Services**

OFFICE: **VIA Campbell Rd, W.P.**

PROJECT: **19580/40306**

PURCHASE ORDER NUMBER: **10920**

PROJECT MANAGER: **VA**

SAMPLER: **DA/D.C**

SAMPLER MOBILE:

COC emailed to ALS? (YES / NO) EDD FORMAT (or default):

Email Reports to (will default to PM if no other addresses are listed):

Email Invoice to (will default to PM if no other addresses are listed):

COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE: _____

MATRIX - SOLID (S), WATER (W): _____

CONTAINER INFORMATION:

ANALYSIS REQUIRED including SITES (NA, Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered) or Dissolved (filtered) (filtered bottle required):

Additional Information

LAB ID: _____

SAMPLE ID: _____

DATE/TIME: _____

MATRIX: _____

TYPE & PRESERVATIVE (refer to codes below)

TOTAL CONTAINERS

RECEIVED BY: _____ DATE/TIME: _____

REINQUISHED BY: _____ DATE/TIME: _____

RECEIVED BY: _____ DATE/TIME: _____

LAB ID	SAMPLE ID	DATE/TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	RECEIVED BY:	DATE/TIME:	REINQUISHED BY:	DATE/TIME:	RECEIVED BY:	DATE/TIME:
S0	5118	6/1/16	S	DA/D.C	EC						
S1	5114										
S2	5117										
S3	565										
S4	563										
S5	589										
S6	5143										
S7	5165										
S8	538										
S9	590										
60	513										
61	5168										
TOTAL											

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved Plastic; AP = Airtight Unpreserved Plastic; V = VOA Vial (HCl Preserved); V9 = VOA Vial Sodium Bisulfate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airtight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Farnaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Silver Bottle; ASD = Plastic; DAG = Amber Glass; SPS = Special Preserved Bag.

CHAIN OF CUSTODY

ALS LABORATORY
 21 Spence Road, Pootung SA 5045
 Ph: 08 8269 0650 E: als@alslaboratory.com.au

ALS LABORATORY
 21 Spence Road, Pootung SA 5045
 Ph: 08 8269 0650 E: als@alslaboratory.com.au

ALS LABORATORY
 21 Spence Road, Pootung SA 5045
 Ph: 08 8269 0650 E: als@alslaboratory.com.au

ALS LABORATORY
 21 Spence Road, Pootung SA 5045
 Ph: 08 8269 0650 E: als@alslaboratory.com.au

CLIENT: SIMEC TESTING SERVICES

OFFICE: 14/1 COMPASTURE PLACE

PROJECT: 1980/4000

ORDER NUMBER: 10920

PROJECT MANAGER: N/A

SAMPLER: J.K. / D.L.

COC emailed to ALS: NO

Contact PH: 02 9758 2166

SAMPLER MOBILE: 02 9758 2166

EDD FORMAT (pr default):

TURNAROUND REQUIREMENTS:

Standard TAT (Last due date):

Non Standard or urgent TAT (List due date):

ALS QUOTE NO.:

ANALYSIS REQUIRED INCLUDING SUITES (NB. Suite Codes must be listed to attract suite price)

Where Metals are required, specify Total (further bottles required) or Dissolved (field filtered bottle required).

ANALYSIS REQUIRED INCLUDING SUITES (NB. Suite Codes must be listed to attract suite price)

Where Metals are required, specify Total (further bottles required) or Dissolved (field filtered bottle required).

CONTAINER INFORMATION

(refer to)

TOTAL CONTAINERS

TYPE & PRESERVATIVE codes below

RECEIVED BY:

DATE/TIME:

RECEIVED BY:

DATE/TIME:

RELINQUISHED BY:

DATE/TIME:

RELINQUISHED BY:

DATE/TIME:

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE codes below	TOTAL CONTAINERS	ANALYSIS REQUIRED INCLUDING SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (further bottles required) or Dissolved (field filtered bottle required).	Additional Information
1	5212	6/3/18	J	Jar Ho	1	EC	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
2	5262				1		
3	5287				1		
4	5314				1		
5	5335				1		
6	5339				1		
7	5340				1		
8	5315				1		
9	5369				1		
10	5393				1		
11	5392				1		
12	5394				1		
TOTAL							

Environmental Division
 Sydney
 Work Order
ES1405223



Telephone : +61-2-6784 8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; CRC = Nitric Preserved DRC; SH = Sodium Hydroxide Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Air Tight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bicarbonate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Air Tight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; (IS = HCl Preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.



CHAIN OF CUSTODY

DADELAIDE 21 Evans Road Pootah SA 5545
 Ph: 08 8352 9200 E: enquiries@smcfast.com

DEERBANK 32 Owens Street Brisbane QLD 4003
 Ph: 07 3243 7777 E: enquiries@smcfast.com

GLADSTONE 48 Parklands Drive Chilton QLD 4500
 Ph: 07 7471 0000 E: enquiries@smcfast.com

GRACELAY 78 Shuter Road Manly QLD 4170
 Ph: 07 4344 0777 E: enquiries@smcfast.com

IMELBOURNE 3-4 Wharf Road Southport QLD 4217
 Ph: 07 5549 5000 E: enquiries@smcfast.com

MAJUGEE 27 Shuter Road Manly NSW 2200
 Ph: 02 6372 6126 E: enquiries@smcfast.com

CHERRYVALES 111 Rees Drive Warrumbidgee NSW 2544
 Ph: 02 6958 3433 E: enquiries@smcfast.com

MANLYVALES 4/15 Cross Place North Manly NSW 2251
 Ph: 02 4233 2065 E: enquiries@smcfast.com

WESTRICH 10-14 St Johns Road Manly NSW 2200
 Ph: 02 6372 6126 E: enquiries@smcfast.com

WENTWORTHY 271-289 Woodcock Drive Smithfield NSW 2164
 Ph: 02 4764 8155 E: enquiries@smcfast.com

WENTWORTHY 44-45 Cross Street Smithfield QLD 4113
 Ph: 07 4736 0900 E: enquiries@smcfast.com

WENTWORTHY 29 Henry Street The Entrance NSW 2250
 Ph: 02 4223 3129 E: enquiries@smcfast.com

CLIENT: SMEC TESTING SERVICES

OFFICE: 14/1 COMPASTURE PLACE

PROJECT: 19880/40300

ORDER NUMBER: 10920

PROJECT MANAGER: N/A

SAMPLER: Jw/D.L.

COC emailed to ALS? NO

Enroll Reports to (will default to PM if no other address is listed): enquiries@smcfasting.com.au

Enroll Invoice to (will default to PM if no other address is listed): accounts@smcfasting.com.au

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

TURNAROUND REQUIREMENTS:

Standard TAT (list due date):

Non Standard or urgent TAT (list due date):

(Ultra Trace Organics)

ALS QUOTE NO.:

CONTACT PH: 02 9759 2166

SAMPLER MOB. E: 02 9756 2166

EDD FORMAT (or default):

LABORATORY USE ONLY

FOR ANALYSIS USE ONLY (COC)

COG: 1 0 3 4 5 6 7

OF: 1 2 3 4 5 6 7

RECEIVED BY: *Hulsh*

DATE/TIME: 11/01/14

RELINQUISHED BY: *6:30pm*

DATE/TIME:

ANALYSIS REQUIRED INCLUDING SUITES (NB. Suite Codes must be listed to attract extra price)

Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE codes below	TOTAL CONTAINERS (refer to codes below)	ANALYSIS REQUIRED INCLUDING SUITES (NB. Suite Codes must be listed to attract extra price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).	Additional Information
13	5393 <i>Sump #10</i>	6/3/14	J		FC		
14	5394 <i>#10</i>						
15	5394 <i>#11</i>						
16	5368 <i>#12</i>						
17	5468						
18	5469						
19	5444						
20	5419						
21	5367						
22	5341						
23	5293						
24	5292						

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; DRG = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide/Cd Preserved; AG = Amber Glass Unpreserved Plastic; AP = Air-tight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulphuric Preserved; AV = Air-tight Unpreserved Vial; BG = Sulphuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Plastic; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.



CHAIN OF CUSTODY

ALS Laboratory
 19580/10920

CLIENT: SMCC TESTING SERVICES
 OFFICE: 14/1 COPPASTURE PLACE
 PROJECT: 19580/10920

ORDER NUMBER:
 PROJECT MANAGER: N/A
 SAMPLER: Jde/D.L

CONTACT PH: 02 9755 2166
 SAMPLER MOBILE: 02 9755 2166
 EDD FORMAT (for default):

RELINQUISHED BY:
 DATE/TIME:
 RECEIVED BY:
 DATE/TIME:

RELINQUISHED BY:
 DATE/TIME:
 RECEIVED BY:
 DATE/TIME:

RELINQUISHED BY:
 DATE/TIME:
 RECEIVED BY:
 DATE/TIME:

RELINQUISHED BY:
 DATE/TIME:
 RECEIVED BY:
 DATE/TIME:

RELINQUISHED BY:
 DATE/TIME:
 RECEIVED BY:
 DATE/TIME:

COG SEQUENCE NUMBER (Circle)
 COG: 1 2 3 4 5 6 7
 OF: 1 2 3 4 5 6 7

ANALYSIS REQUIRED INCLUDING SITES (NR, Subo Codes must be listed to effect suite price)
 Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE codes below	TOTAL CONTAINERS (refer to)	ADDITIONAL INFORMATION
25	J135	4/3/19	J	Var / Jce	03	
26	J158				1	
27	J179				1	
28	J154				1	
29	J131				1	
30	J155				1	
31	J181				1	
32	J206				1	
33	J231				1	
34	J281				1	
35	J282				1	
36	J307				1	

Water Container Codes: P = Unpreserved Plastic; N = Milk Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide/Cd Preserved; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Sulphate Preserved; VS = VOA Vial Sodium Sulphate Preserved; AV = VOA Vial Airfreight Preserved; AV = VOA Vial Airfreight Unpreserved; Vial SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Plastic; SP = Sulfuric Preserved Plastic; R = Fumarsulphate Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Boils; B = Unpreserved Bag.



CHAIN OF CUSTODY

ALS Laboratory
please tick →

CHADWICKS 111 Bunka Road, Newcastle SA 5006
Ph: 08 9390 9800
CER 99 LAKE 32 Inyang Street, Stirling GLD 4053
Ph: 07 5537 7222
CJGL 4581 TINGE 46 Balcarras Road, Drive Chilton QLD 4040
Ph: 07 7471 5200

UNACON 78-90 Great Road, Mackay QLD 4740
Ph: 07 4644 0177
CINELCOURSE 2-a Wormal Road, Spillways VIC 3171
Ph: 03 8543 5800
CANTON 46/47 Sydney Road, Melbourne VIC 3048
Ph: 02 6770 0725

CHRYSLER 11 Rose Glen Road, Warrackbeee NSW 2364
Ph: 02 4988 8435
CHICKISA 413 Cheyney Place, North Narrabri NSW 2387
Ph: 02 4720 2903
CANTON 46/47 Sydney Road, Melbourne VIC 3048
Ph: 02 6770 0725

LABORATORY 277-289 Woodroffe Road, Enfield NSW 2164
Ph: 02 4784 8556
UTURNVILLE 14-15 Duff Street, Uturnville QLD 4018
Ph: 07 4726 0506

CLIENT: SMEC TESTING SERVICES

OFFICE: 14/3 COMPASTURE PLACE

PROJECT: 19580/4030C

ORDER NUMBER: 10970

PROJECT MANAGER: N/A

SAMPLER: Jh/D.L.

COC emailed to ALS? NO

Email Reports to (will default to PM if no other addresses are listed): enquiries@smectesting.com.au

Email Invoice to (will default to PM if no other addresses are listed): accounts@smectesting.com.au

TURNAROUND REQUIREMENTS:

Standard TAT may be longer for some tests e.g. Ultra Trace Organics

ALS QUOTE NO.:

CONTACT PH: 02 9756 2166

SAMPLER MOBILE: 02 9756 2166

EDD FORMAT (or default):

Standard TAT (List due date):

Non Standard or urgent TAT (List due date):

19/3/14

COC SEQUENCE NUMBER (Circle)

1 2 3 4 5 6 7

RECEIVED BY: [Signature]

DATE/TIME: 11/03/14

RELINQUISHED BY: [Signature]

DATE/TIME: 11/03/14

RECEIVED BY: [Signature]

DATE/TIME: 11/03/14

FOR LABORATORY USE ONLY (COC)

ANALYSIS REQUIRED INCLUDING SUITES (RI, Suite Codes must be listed to attract suite price)

Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

LAB ID

SAMPLE ID

DATE / TIME

MATRIX

TYPE & PRESERVATIVE codes below

TOTAL CONTAINERS (refer to codes below)

ANALYSIS REQUIRED INCLUDING SUITES (RI, Suite Codes must be listed to attract suite price)

Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

Additional Information

Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.

LAB ID

SAMPLE ID

DATE / TIME

MATRIX

TYPE & PRESERVATIVE codes below

TOTAL CONTAINERS (refer to codes below)

ANALYSIS REQUIRED INCLUDING SUITES (RI, Suite Codes must be listed to attract suite price)

Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

Additional Information

Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.

LAB ID

SAMPLE ID

DATE / TIME

MATRIX

TYPE & PRESERVATIVE codes below

TOTAL CONTAINERS (refer to codes below)

ANALYSIS REQUIRED INCLUDING SUITES (RI, Suite Codes must be listed to attract suite price)

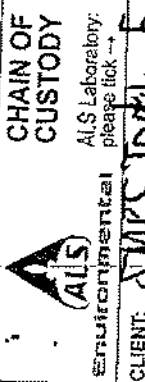
Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

Additional Information

Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE codes below	TOTAL CONTAINERS (refer to codes below)	ANALYSIS REQUIRED INCLUDING SUITES (RI, Suite Codes must be listed to attract suite price)	Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).	Additional Information
37	5256		S	Jar / Ice	10	Fe		
38	5230				1			
39	5051				1			
40	5152				1			
					TOTAL			

Water Container Codes: P = Unpreserved Plastic; ORC = Nitric Preserved Plastic; ORC = Nitric Preserved Plastic; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Aqueous Unpreserved Plastic; V = VOA Vial HCl Preserved; VS = VOA Vial Sodium Bisphthalate Preserved; VS = VOA Vial Sodium Bisphthalate Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; AS = HCl Preserved Plastic; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Aspartate Preserved Bottles; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Solids; G = Unpreserved Bag.



CHAIN OF CUSTODY

AL-S Laboratory
please tick →

CLIENT: JMC Tech Services
19/05/14
10910

OFFICE: 19/05/14
PROJECT: 19500/4030C
PURCHASE ORDER NUMBER: 10910
PROJECT MANAGER: WA
SAMPLER: JMC/DL

TURNAROUND REQUIREMENTS:
(Standard TAT may be longer for some tests e.g. Ultra Trace Organics)
 Standard TAT (List due date):
 Non Standard or urgent TAT (List due date):

ALS QUOTE NO.:
CONTACT PH: 9862166
SAMPLER MOBILE:

COC emailed to ALS? (YES / NO) EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed):
Email Invoice to (will default to PM if no other addresses are listed):

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No
Pres Job / Frozen Ice Bricks present upon receipt? Yes No
Random Sample Temporal (in/on Recept) Other comment:

RECEIVED BY: DATE/TIME:
RELINQUISHED BY: DATE/TIME:
RECEIVED BY: DATE/TIME:
RELINQUISHED BY: DATE/TIME:

ANALYSIS REQUIRED INCLUDING SUITES (NB. Suite Codes must be listed to extract suite price) Where initials are required, specify total (unfiltered bottle required) or Dissolved (field filtered bottle required).

CONTAINER INFORMATION
TYPE & PRESERVATIVE (refer to codes below)
MATRIX

DATE/TIME
6/2/14 5:10 PM

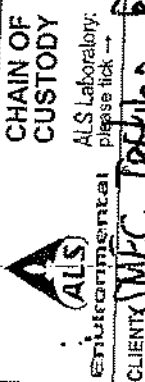
SAMPLE ID
41 591
42 5140
43 5169
44 5165
45 5142
46 591
47 5167
48 591
49 5163

LAB ID

CONTAINERS TOTAL
EC

ADDITIONAL INFORMATION
Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cr Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Amber Glass Preserved Plastic; V = VOA Vial (IC) Preserved; VR = VOA Vial Sodium Bicarbonate Preserved; VS = VOA Vial Sulphur Preserved; AV = Airtight Unpreserved Vial; SG = Stilltop Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Specimen Bottle; SP = Stilltop Preserved Plastic; F = Farnaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Stilltop Bottle; AED = Plastic Bag - Acid sulphuric acid; U = Unpreserved Bag.



CHAIN OF CUSTODY

ALS Laboratory
 please tick →

CLIENT: MEC Petting Service
OFFICE: 18/1 Campbell Pt, W.P.
PROJECT: 19580/90309

TURNAROUND REQUIREMENTS:
 (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

ALS QUOTE NO.:

CONTACT PH: 97562166

PURCHASE ORDER NUMBER: 10920

PROJECT MANAGER: V/A

SAMPLER: Jde/D.L SAMPLER MOBILE:

FOR LABORATORY USE ONLY (Circle):
 Custody Seal intact: Yes No
 Freezers/Freezer bags present upon receipt: Yes No
 Random Sample Temperature on Receipt: Yes No
 Other comment:

RECEIVED BY: DATE/TIME:

RELINQUISHED BY: DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required):

CONTAINER INFORMATION

TYPE & PRESERVATIVE (refer to codes below)

TOTAL CONTAINERS

ADDITIONAL INFORMATION:

Comments on likely contaminant levels, dilutions or samples requiring specific QC analysis etc.

WATER CONTAINER CODES: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved Plastic; V = VOA Vial (HCl Preserved); VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulphuric Preserved; AV = Airtight Unpreserved Amber Glass; H = HCl Preserved Amber Glass; HS = HCl Preserved Speciation bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Stabils; Bather; ABO = Plastic Bag for Acid sample collection; P = Unpreserved bag.

RECEIVED BY: DATE/TIME:

RELINQUISHED BY: DATE/TIME:

COCC: 1 2 3 4 5 6 7

OF: 1 2 3 4 5 6 7

STANDARD TAT (List due date):

Non Standard or urgent TAT (List due date): 17/2/10

NEWCASTLE: Progress from Warabook, NSW 2304
 Ph: 02 4968 9400 E: samples@progressnsw.com

NEWCASTLE: 4713 Ocean Place North Street, NSW 2341
 Ph: 02 4423 2063 E: newcas@alsau.com

PERTH: 10 Lind Ave, Malpas WA 6093
 Ph: 08 9279 7555 E: samples.perth@alsnsw.com

MACKAY: 78 Murray Road Mackay QLD 4740
 Ph: 07 4944 0177 E: mackay@alsqld.com

MELBOURNE: 2-4 Wsland Road Springvale VIC 3171
 Ph: 03 8549 6600 E: samples.melb@alsvic.com.au

WAGGA: 27 Sydney Road Wagga NSW 2650
 Ph: 02 6372 8738 E: mackay@alsnsw.com

WAGGA: 21 Bump Road Wagga NSW 2650
 Ph: 08 5359 0680 E: adelaide@alsnsw.com

BUSBY: 42 Strand Street, Stafford QLD 4053
 Ph: 07 3243 7222 E: busby@alsnsw.com

GLASSBORO: 48 Colson Road, Drive Clifton QLD 4880
 Ph: 07 4571 5800 E: glassboro@alsqld.com

STONEY: 277 Woodford Road, Smithfield NSW 2164
 Ph: 02 8764 8553 E: samples.stoney@alsnsw.com

TOWNSVILLE: 74-78 Diana Court Bole QLD 4810
 Ph: 07 4796 0060 E: townsville@alsnsw.com

WOLLONGONG: 99 Kenny Street Wollongong NSW 2500
 Ph: 02 4253 3125 E: wollongong@alsnsw.com

190314

CHAIN OF CUSTODY
 ALS LABORATORY
 PH: 07 4377 6774 FAX
 PH: 07 4377 6774
 PH: 07 4377 6774
 PH: 07 4377 6774

TURNAROUND SERVICES
 Standard TAT (List due date):
 Non Standard or urgent TAT (List due date):

CLIENT: SMEC TESTING SERVICES
 OFFICE: 141 COMCASTURE PLACE
 PROJECT: 1980/4000
 ORDER NUMBER: 10920
 PROJECT MANAGER: WA
 SAMPLER: J.L. D.L.

CONTACT PH: 07 9788 2166
SAMPLER MOBILE: 02 9788 2166
EDD FORMAT (for default):

RECEIVED BY: [Signature]
DATE/TIME: 11/02/14
RELINQUISHED BY: [Signature]
DATE/TIME: 6:30pm

ANALYSIS REQUIRED INCLUDING SURTES (NB. Surtes Codes must be listed to attract surtes prices)
 Where Metals are required, specify Total (unfiltered bottles required) or Dissolved (field filtered bottle required).

CONTAINER INFORMATION

SAMPLE DETAILS
 WATER/SOLID/WATER (W)

LAB ID
 1 5212
 2 5262
 3 5287
 4 5314
 5 5338
 6 5339
 7 5340
 8 5315
 9 5368
 10 5393
 11 5392
 12 5394

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE codes below	TOTAL CONTAINERS (refer to)	ANALYSIS REQUIRED INCLUDING SURTES (NB. Surtes Codes must be listed to attract surtes prices)	Additional Information
1	5212	6/3/14	J	Jar / J10	1	EC	Comments on likely contaminant levels, duplicates, or samples requiring specific QC analysis etc.
2	5262				1		
3	5287				1		
4	5314				1		
5	5338				1		
6	5339				1		
7	5340				1		
8	5315				1		
9	5368				1		
10	5393				1		
11	5392				1		
12	5394				1		

Environmental Division
Sydney
Work Order
ES1405223

Telephone: + 61-2-8784 8565

WATER/SOLID/WATER (W)

WATER CONTAINER CODES: P = Unpreserved Plastic; K = Micro Preserved Plastic; DRG = Nitric Preserved DRG; SH = Sodium Hydroxide/CO2 Preserved; S = Sodium Hydroxide Preserved Plastic; AC = Amber Glass Unpreserved; AP = Acidified Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulfate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airtight Unpreserved Vial; EB = Subbase Preserved Amber Glass; H = HCl Preserved Plastic; H8 = HCl Preserved Plastic; SP = Subbase Preserved Plastic; F = Formablenite Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Substrate; B = Unpreserved Bag



CHAIN OF CUSTODY

ALS Laboratory
 1950/40300
 10920

CLIENT: SMEC TESTING SERVICES

OFFICE: 141 COMPASTORE FLAGE

PROJECT: 1950/40300

ORDER NUMBER: 10920

PROJECT MANAGER: N/A

SAMPLER: Jhu/D.L.

COC emailed to ALS? NO

CONTACT PH: 02 9756 2166

SAMPLER MOBILE: 02 9756 2166

EDD FORMAT (or default):

TURNAROUND REQUIREMENTS: Standard TAT (List due date); Non Standard or urgent TAT (List due date)

ALS QUOTE NO:

RECEIVED BY: [Signature]

DATE/TIME: 11/01/14 6:20pm

RELINQUISHED BY: [Signature]

DATE/TIME: 11/01/14 6:20pm

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE codes below)	TOTAL CONTAINERS (refer to)	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify 'total' (unfiltered bottle required) or 'Dissolved' (field filtered bottle required).	Additional Information
15	S393	6/3/14	S	Jar 1/10	1		
16	S394				1		
17	S369				1		
18	S418				1		
19	S444				1		
20	S419				1		
21	S367				1		
22	S341				1		
23	S293				1		
24	S291				1		
TOTAL							

Water: Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Air-tight Unpreserved Plastic; Y = VOA Via HCl Preserved; VB = VOA Via Sulfuric Preserved; AV = Air-tight Unpreserved Vial SS = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation bottle; SF = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulfate Solids; B = Unpreserved Bag.



CHAIN OF CUSTODY

CHAMBERS ROAD LABORATORY
 141 COMPASTURE PLACE
 MELBOURNE VIC 3067
 PH: 03 9585 2222
 FAX: 03 9585 2221
 EMAIL: enquiries@smec.com.au

CHAMBERS ROAD LABORATORY
 141 COMPASTURE PLACE
 MELBOURNE VIC 3067
 PH: 03 9585 2222
 FAX: 03 9585 2221
 EMAIL: enquiries@smec.com.au

CHAMBERS ROAD LABORATORY
 141 COMPASTURE PLACE
 MELBOURNE VIC 3067
 PH: 03 9585 2222
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 EMAIL: enquiries@smec.com.au

CHAMBERS ROAD LABORATORY
 141 COMPASTURE PLACE
 MELBOURNE VIC 3067
 PH: 03 9585 2222
 FAX: 03 9585 2221
 EMAIL: enquiries@smec.com.au

CLIENT: SMEC TESTING SERVICES
OFFICE: 141 COMPASTURE PLACE
PROJECT: 19580 / 40300
ORDER NUMBER: 10920
PROJECT MANAGER: N/A
SAMPLER: JTB/DL
CONTACT PH: 029758 2166
SAMPLER MOBILE: 02 9755 2166
EDD FORMAT (or default):
RECEIVED BY: [Signature]
DATE/TIME: 11/03/14 6:30pm
RELINQUISHED BY: [Signature]
DATE/TIME: 11/03/14 6:30pm

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE codes below	TOTAL CONTAINERS	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to avoid suite price) Where Metals are required, specify total (unfiltered) or dissolved (final filtered) bottle (required)	Additional Information
25	5131	4/3/14	J	Var / Jce	1	EC	
26	5158				1		
29	5179				1		
28	5154				1		
29	5131				1		
30	5155				1		
31	5181				1		
32	5206				1		
33	5231				1		
34	5281				1		
35	5282				1		
36	5307				1		
TOTAL:							

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airflight Unpreserved Plastic; V = VOA Vial HCl Preserved; VS = VOA Vial Sodium Bisulfate Preserved; V6 = VOA Vial Sulfuric Preserved; AV = Airflight Unpreserved Vial SSC = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; MS = HCl Preserved Plastic; SP = Sulfuric Preserved Plastic; F = Formalehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; U = Unpreserved Bag.



CHAIN OF CUSTODY

ALS Laboratory
please tick →

DAVIDSON 71 Ropes Road, Perth WA 6150
Ph: 08 9430 1555
GARRIBONE 27 Strand Street, Perth WA 6150
Ph: 08 9430 1555
DUNEDIN 27 Strand Street, Perth WA 6150
Ph: 08 9430 1555

UNIONWAY 20, 10th Floor, Perth WA 6150
Ph: 08 9430 1555
DUNEDIN 27 Strand Street, Perth WA 6150
Ph: 08 9430 1555

CHANDLER 11, Rose Court Road, Perth WA 6150
Ph: 08 9430 1555
DUNEDIN 27 Strand Street, Perth WA 6150
Ph: 08 9430 1555

STURLEY 271-281 Woodvale Road, Perth WA 6150
Ph: 08 9430 1555
DUNEDIN 27 Strand Street, Perth WA 6150
Ph: 08 9430 1555

CLIENT: SMEC TESTING SERVICES

OFFICE: 14TH COMPASTURE PLACE
PROJECT: 19580/4000C

ORDER NUMBER: 10920

PROJECT MANAGER: N/A

SAMPLER: Jh/DL

CONTACT PH: 02 8756 2166

SAMPLER MOBILE: 02 8756 2166

EDD FORMAT (or default):

Email Reports to (will default to PM if no other addresses are listed): enquiries@smectesting.com.au

Email Invoice to (will default to PM if no other addresses are listed): account@smectesting.com.au

TURNAROUND REQUIREMENTS:

Standard TAT may be longer for some tests e.g. Ultra Trace Elements

ALS QUOTE NO.:

STANDARD TAT (List due date):

Non Standard or urgent TAT (List due date):

RECEIVED BY:

DATE/TIME: 19/3/16

COC SEQUENCE NUMBER (Circle): 7

OF: 1 2 3

RELINQUISHED BY:

DATE/TIME: 11/03/14

COC SEQUENCE NUMBER (Circle): 7

OF: 1 2 3

RECEIVED BY:

DATE/TIME:

COC SEQUENCE NUMBER (Circle): 7

OF: 1 2 3

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ANALYSIS REQUIRED INCLUDING SUITES (M, S, etc. Codes must be listed to affect suite prices)

Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

CONTAINER INFORMATION:

LAB ID

SAMPLE ID

DATE / TIME

MATRIX

TYPE & PRESERVATIVE codes below)

TOTAL CONTAINERS (refer to)

Additional Information

37 5256

38 5230

39 5151

40 5152

S

Jar / Jar

Fe

PK

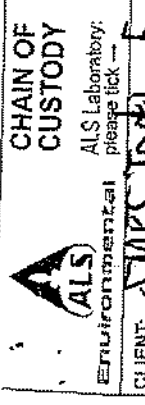
log

10

Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.

TOTAL

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; CRC = Nitric Preserved CRC; SH = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airtight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulfate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airtight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Speciation Bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.



CHAIN OF CUSTODY
ALS Laboratory
please tick -

AGELAISE 21 Burma Road, Rozelle SA 5155
Ph: 08 8359 6800 E: adelaide@als.com.au
 BRISBANE 20 Sherd Street, Stuffed QLD 4063
Ph: 07 3247 7222 E: brisbane@als.com.au
 MELBOURNE 16 Glenamoth, Parkville VIC 3046
Ph: 03 9374 5800 E: melbourne@als.com.au

MANKAY 78 Hickory Road, Mackay QLD 4740
Ph: 07 4944 0177 E: mackay@als.com.au
 MELBOURNE 2-4 Westgate Road, Springvale VIC 3171
Ph: 03 8549 0900 E: melbourne@als.com.au
 MURFEE 27 Sydney Road, Maribee NSW 2353
Ph: 02 6522 0735 E: murree@als.com.au

SYDNEY 277 Phillip Park Road, Westmead NSW 2164
Ph: 02 4631 6555 E: sydney@als.com.au
 TONYPARK 14-15 Deane Court, Bialla QLD 4819
Ph: 07 4750 0600 E: tonypark@als.com.au
 WOLLONGONG 99 Kenny Street, Wollongong NSW 2500
Ph: 02 4225 3125 E: wollongong@als.com.au

CLIENT: **SPEC TESTS SERVICES**
OFFICE: **10/1 Campbell Pl. W.A.**
PROJECT: **19500/4030C**

PURCHASE ORDER NUMBER: **10910**
PROJECT MANAGER: **UJA**
SAMPLER: **JAC/DL**

TURNAROUND REQUIREMENTS:
(Standard TAT may be longer for some tests e.g. Ultra Trace Organics)
 Standard TAT (List due date):
 Non Standard or urgent TAT (List due date):

CONTACT PH: **9362168**
SAMPLER MOBILE:
COC emailed to ALS? (YES / NO) **EDD FORMAT (or default):**
Email Reports to (will default to PM if no other addresses are listed):
Email Invoice to (will default to PM if no other addresses are listed):

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No
Freezer/Frozen Ice bricks present upon receipt? Yes No
Random Samples taken upon Receipt? Yes No
Other comment: _____

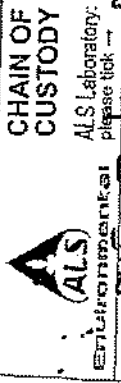
RECEIVED BY: _____ DATE/TIME: _____
RELINQUISHED BY: **John** DATE/TIME: **11/03/14 6:30pm**

RECEIVED BY: _____ DATE/TIME: _____
RELINQUISHED BY: _____ DATE/TIME: _____

COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE ID	MATRIX - SOLID (S), WATER (W)	DATE/TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	ANALYSIS REQUIRED INCLUDING SUITES (NS. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Disolved (field filtered bottle required).	ADDITIONAL INFORMATION
41	591		6/3/14	S	JAC/DL	1	EC	
42	5140					1		
43	5169					1		
44	5166					1		
45	5144					1		
46	541					1		
47	5167					1		
48	594					1		
49	5163					1		
						TOTAL		

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Amber Glass Unpreserved Plastic; V = VOA Via HCl Preserved; VB = VOA Via Sodium Disulfate Preserved; VS = VOA Via Sulfate Preserved; AV = Airfreight Unpreserved Vial; SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formic Acid Preserved Glass; Z = Zinc Preserved Plastic; ACC = Acid Preserved Plastic; U = Unpreserved bag.



CHAIN OF CUSTODY

ABELLA 21999a Road Plover CA 95055
 Ph: 07 6336 0650 E: abella@als.com.au
 3155 WARE ST SHAND STREET SAFFORD QLD 4655
 Ph: 07 3243 7222 E: samp@als.com.au
 96 ASTORIE AVE COLUMBIA DRUG CHAIN QLD 4980
 Ph: 07 2971 9500 E: gies@als.com.au

MANGARY 73 Haining Road Mackay QLD 4740
 Ph: 07 4944 0177 E: mangary@als.com.au
 MELBOURNE 2-4 Winstall Road Springvale VIC 3171
 Ph: 03 8549 9530 E: samp@als.com.au
 MURDOCH 27 Sanger Road Murdoch NSW 2850
 Ph: 02 6372 8755 E: murdoch@als.com.au

NEWCASTLE 5 Regentum Place Warabrook NSW 2304
 Ph: 02 4993 9235 E: samp@als.com.au
 NORRICH 473 Great Place North Norwich NSW 2541
 Ph: 02 4423 2053 E: norwich@als.com.au
 PERTH 10 Hwy New Australia WA 6000
 Ph: 08 9209 7650 E: samp@als.com.au

STONEY 277 New York Road Stoney Creek NSW 2164
 Ph: 02 8784 8555 E: stoney@als.com.au
 TOWNVILLE 14-15 Deane Court Tully QLD 4818
 Ph: 07 4780 6600 E: townville@als.com.au
 WELLINGTON 89 Kerry Street Wellington NSW 2200
 Ph: 02 425 3175 E: wellington@als.com.au

CLIENT: **JMEC Petrol Services**

OFFICE: **14/1 Compton Pl, W.P.**

PROJECT: **19580/40309**

PURCHASE ORDER NUMBER: **10920**

PROJECT MANAGER: **D.A.**

SAMPLER: **J.L. / D.L.**

TURNAROUND REQUIREMENTS:
 (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

ALS QUOTE NO.:

CONTACT PH: **97562166**

RECEIVED BY: **[Signature]**

DATE/TIME: **17/3/19**

COC emailed to ALS? (YES / NO)

EDD FORMAT (or default):

RECEIVED BY: **[Signature]**

DATE/TIME: **11/3/19**

RECEIVED BY: **[Signature]**

DATE/TIME: **17/3/19**

Email Reports to (will default to PM if no other addresses are listed):

Email Invoice to (will default to PM if no other addresses are listed):

RECEIVED BY: **[Signature]**

DATE/TIME: **11/3/19**

RECEIVED BY: **[Signature]**

DATE/TIME: **17/3/19**

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

FOR LABORATORY USE ONLY (Circle)

Custody Seal Intact? Yes No

Freezer/ frozen ice blocks present upon receipt? Yes No

Random Sample Temperature on Receipt? Yes No

Other comment: **[Signature]**

COC SEQUENCE NUMBER (Circle)

COCC: 1 2 3 4 5 6 7

OF: 1 2 3 4 5 6 7

RECEIVED BY: **[Signature]**

DATE/TIME: **17/3/19**

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to extract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

CONTAINER INFORMATION

TYPE & PRESERVATIVE (refer to codes below)

TOTAL CONTAINERS

Additional Information

LAB ID

MATRIX

DATE/TIME

SAMPLE ID

Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.

50 518

5

6/3/19

516

51 514

52 517

53 565

54 563

55 589

56 513

57 515

58 508

59 590

60 513

61 518

TOTAL

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Clod Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Dichloride Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SB = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; SF = Sulfuric Preserved Plastic; B = Unpreserved bag.



CERTIFICATE OF ANALYSIS

Table with 2 columns: Field Name and Value. Fields include Work Order (ES1405223), Client (SMEC TESTING SERVICES PTY LTD), Laboratory (Environmental Division Sydney), and various contact and project details.

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
Analytical Results



NATA Accredited Laboratory 825
Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Table with 3 columns: Signatories, Position, Accreditation Category. Rows include Ankit Joshi (Inorganic Chemist) and Shobhna Chandra (Metals Coordinator).

Page : 2 of 14
Work Order : ES1405223
Client : SMEC TESTING SERVICES PTY LTD
Project : 19580 40300



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				S212	S262	S287	S314	S338
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
				ES1405223-001	ES1405223-002	ES1405223-003	ES1405223-004	ES1405223-005
Compound	CAS Number	LOR	Unit					
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	23	16	19	64	22

Client sampling date / time



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				S339	S340	S315	S364	S393
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-006	ES1405223-007	ES1405223-008	ES1405223-009	ES1405223-010
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	19	15	19	80	23

Client sampling date / time



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				S392	S394	S369	S418	S469
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-011	ES1405223-012	ES1405223-016	ES1405223-017	ES1405223-018
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	18	45	15	28	77

Client sampling date / time



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				S444	S419	S367	S342	S293
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-019	ES1405223-020	ES1405223-021	ES1405223-022	ES1405223-023
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	112	35	17	42	22

Client sampling date / time



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				S292	S133	S158	S179	S154
				06-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-024	ES1405223-025	ES1405223-026	ES1405223-027	ES1405223-028
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	23	64	24	11	19

Client sampling date / time



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				S131	S155	S181	S206	S231
				04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-029	ES1405223-030	ES1405223-031	ES1405223-032	ES1405223-033
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	15	22	29	122	33

Client sampling date / time



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				S281	S282	S307	S256	S230
				04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00	04-MAR-2014 15:00
				ES1405223-034	ES1405223-035	ES1405223-036	ES1405223-037	ES1405223-038
Compound	CAS Number	LOR	Unit					
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	21	17	23	17	27

Client sampling date / time

Compound CAS Number LOR Unit

EA010: Conductivity

Electrical Conductivity @ 25°C

1

µS/cm

21

17

23

17

27



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

Client sampling date / time

				S15/1	S15/2	S91	S140	S164
				04-MAR-2014 15:00	04-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-039	ES1405223-040	ES1405223-041	ES1405223-042	ES1405223-043
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.9	6.3	----	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	80	126	76	34	45
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1.0	%	12.7	36.7	----	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	60	210	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	20	50	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				S166	S142	S41	S167	S92
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-044	ES1405223-045	ES1405223-046	ES1405223-047	ES1405223-048
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	21	20	31	58	25

Client sampling date / time



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				S163	S118	S114	S117	S65
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405223-049	ES1405223-050	ES1405223-051	ES1405223-052	ES1405223-053
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	8	44	15	33	16

Client sampling date / time



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				S63	S89	S143	S165	S38
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00
				ES1405223-054	ES1405223-055	ES1405223-056	ES1405223-057	ES1405223-058
				33	37	44	214	11

Client sampling date / time

Compound	CAS Number	LOR	Unit
EA010: Conductivity			
Electrical Conductivity @ 25°C	----	1	µS/cm

EA010: Conductivity

Electrical Conductivity @ 25°C

1

µS/cm

33

37

44

214

11



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				S90	S113	S168	----	----
				06-MAR-2014 15:00	06-MAR-2014 15:00	06-MAR-2014 15:00	----	----
Compound	CAS Number	LOR	Unit	ES1405223-059	ES1405223-060	ES1405223-061	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	36	96	15	----	----



QUALITY CONTROL REPORT

Table with 4 columns: Field, Value, Field, Value. Includes Work Order (ES1405223), Client (SMEC TESTING SERVICES PTY LTD), Laboratory (Environmental Division Sydney), and various contact and project details.

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
• Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
• Matrix Spike (MS) Report; Recovery and Acceptance Limits



NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Table with 3 columns: Signatories, Position, Accreditation Category. Lists Ankit Joshi (Inorganic Chemist) and Shobhna Chandra (Metals Coordinator) under Sydney Inorganics.

Page : 2 of 4
Work Order : ES1405223
Client : SMEC TESTING SERVICES PTY LTD
Project : 19580 40300



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC



Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA002 : pH (Soils) (QC Lot: 3334853)									
ES1405172-004	Anonymous	EA002: pH Value	----	0.1	pH Unit	4.3	4.2	0.0	0% - 20%
ES1405240-001	Anonymous	EA002: pH Value	----	0.1	pH Unit	6.3	6.3	0.0	0% - 20%
EA010: Conductivity (QC Lot: 3334845)									
ES1405223-001	S212	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	23	19	18.3	0% - 20%
ES1405223-011	S392	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	18	18	0.0	0% - 50%
EA010: Conductivity (QC Lot: 3334846)									
ES1405223-024	S292	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	23	23	0.0	0% - 20%
ES1405223-034	S281	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	21	21	0.0	0% - 20%
EA010: Conductivity (QC Lot: 3334847)									
ES1405223-046	S41	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	31	30	0.0	0% - 20%
ES1405223-056	S143	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	44	44	0.0	0% - 20%
EA010: Conductivity (QC Lot: 3334849)									
ES1405032-001	Anonymous	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	504	533	5.6	0% - 20%
ES1405172-004	Anonymous	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	34	36	7.1	0% - 20%
EA055: Moisture Content (QC Lot: 3336930)									
ES1405067-034	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	19.6	20.1	2.4	0% - 20%
ES1405194-006	Anonymous	EA055-103: Moisture Content (dried @ 103°C)	----	1.0	%	9.0	8.2	9.3	No Limit
ED040S: Soluble Major Anions (QC Lot: 3334852)									
ES1405172-004	Anonymous	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	50	40	0.0	0% - 20%
ED045G: Chloride by Discrete Analyser (QC Lot: 3334851)									
ES1405072-001	Anonymous	ED045G: Chloride	16887-00-6	10	mg/kg	25200	25300	0.5	0% - 20%



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: SOIL

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
Method: Compound	CAS Number	LOR	Unit	Result	Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
EA010: Conductivity (QCLot: 3334845)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	99.6	70	130
EA010: Conductivity (QCLot: 3334846)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	97.9	70	130
EA010: Conductivity (QCLot: 3334847)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	96.6	70	130
EA010: Conductivity (QCLot: 3334849)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	99.6	70	130
ED040S: Soluble Major Anions (QCLot: 3334852)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	750 mg/kg	103	84	112
ED045G: Chloride by Discrete Analyser (QCLot: 3334851)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	5000 mg/kg	99.0	79	125

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: SOIL

				Matrix Spike (MS) Report			
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike Concentration	Spike Recovery (%) MS	Recovery Limits (%) Low High	
ED045G: Chloride by Discrete Analyser (QCLot: 3334851)							
ES1405072-001	Anonymous	ED045G: Chloride	16887-00-6	1250 mg/kg	# Not Determined	70	130

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: SOIL

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike Concentration	Spike Recovery (%) MS MSD		Recovery Limits (%) Low High		RPDs (%) Value Control Limit	
ED045G: Chloride by Discrete Analyser (QCLot: 3334851)										
ES1405072-001	Anonymous	ED045G: Chloride	16887-00-6	1250 mg/kg	# Not Determined	----	70	130	----	----



INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES1405223	Page	: 1 of 7
Client	: SMEC TESTING SERVICES PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: SMEC TESTING ALL RESULTS	Contact	: Client Services
Address	:	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580 40300	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 11-MAR-2014
C-O-C number	: ----	Issue Date	: 19-MAR-2014
Sampler	: JK/DL	No. of samples received	: 58
Order number	: 10920	No. of samples analysed	: 58
Quote number	: EN/025/13		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers



Matrix: **SOIL**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis				
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation		
EA010: Conductivity - Continued									
S212, S287, S338, S340, S364, S392, S369, S469, S419, S342, S292, S140, S166, S41, S92, S118, S117, S63, S143, S38, S113,	S262, S314, S339, S315, S393, S394, S418, S444, S367, S293, S91, S164, S142, S167, S163, S114, S65, S89, S165, S90, S168	06-MAR-2014	12-MAR-2014	13-MAR-2014	✓	13-MAR-2014	09-APR-2014	✓	
EA055: Moisture Content									
Soil Glass Jar - Unpreserved (EA055-103) S15/1,	S15/2	04-MAR-2014	----	----	----	13-MAR-2014	18-MAR-2014	✓	
ED040S : Soluble Sulfate by ICPAES									
Soil Glass Jar - Unpreserved (ED040S) S15/1,	S15/2	04-MAR-2014	12-MAR-2014	01-APR-2014	✓	12-MAR-2014	09-APR-2014	✓	
ED045G: Chloride Discrete analyser									
Soil Glass Jar - Unpreserved (ED045G) S15/1,	S15/2	04-MAR-2014	12-MAR-2014	01-APR-2014	✓	12-MAR-2014	09-APR-2014	✓	



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Reaular	Actual	Expected	Evaluation	
Analytical Methods							
Laboratory Duplicates (DUP)							
Chloride Soluble By Discrete Analyser	ED045G	1	6	16.7	10.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	8	69	11.6	10.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	1	10	10.0	10.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Moisture Content	EA055-103	2	20	10.0	10.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	2	12	16.7	10.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Chloride Soluble By Discrete Analyser	ED045G	2	6	33.3	10.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	4	69	5.8	5.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	1	10	10.0	5.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chloride Soluble By Discrete Analyser	ED045G	1	6	16.7	5.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	4	69	5.8	5.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	1	10	10.0	5.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Chloride Soluble By Discrete Analyser	ED045G	1	6	16.7	5.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
pH (1:5)	EA002	SOIL	(APHA 21st ed., 4500H+) pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3) (Method 103)
Electrical Conductivity (1:5)	EA010	SOIL	(APHA 21st ed., 2510) Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3) (Method 104)
Moisture Content	EA055-103	SOIL	A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Major Anions - Soluble	ED040S	SOIL	In-house. Soluble Anions are determined off a 1:5 soil / water extract by ICPAES.
Chloride Soluble By Discrete Analyser	ED045G	SOIL	APHA 21st edition 4500-Cl- E. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride. In the presence of ferric ions the liberated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm. Analysis is performed on a 1:5 soil / water leachate.
<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.



Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
ED045G: Chloride by Discrete Analyser	ES1405072-001	Anonymous	Chloride	16887-00-6	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

- For all matrices, no Method Blank value outliers occur.
- For all matrices, no Duplicate outliers occur.
- For all matrices, no Laboratory Control outliers occur.

Regular Sample Surrogates

- For all regular sample matrices, no surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis			
	Container / Client Sample ID(s)	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA002 : pH (Soils)							
Soil Glass Jar - Unpreserved							
S15/1,	S15/2	12-MAR-2014	11-MAR-2014	1	----	----	----
EA010: Conductivity							
Soil Glass Jar - Unpreserved							
S15/1,	S15/2	12-MAR-2014	11-MAR-2014	1	----	----	----
Soil Glass Jar - Unpreserved							
S133,	S158,	12-MAR-2014	11-MAR-2014	1	----	----	----
S179,	S154,						
S131,	S155,						
S181,	S206,						
S231,	S281,						
S282,	S307,						
S256,	S230						



Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**
-



CHAIN OF CUSTODY

ADELAIDE 21, Burnside Reef Precinct SA 5085
 Ph: 08 8355 0830 E: adelaide@als.com.au
 BRISBANE 99, Stone Street QLD 4003
 Ph: 07 3223 7222 E: brisbane@als.com.au
 BUNBURY 66, Park Street VIC 3400
 Ph: 07 4571 8300 E: bunbury@als.com.au

MAREEWAY 70, Highway Road Maree QLD 4240
 Ph: 07 4644 0177 E: maree@als.com.au
 MELBOURNE 2-4, Wormal Road Springvale VIC 3171
 Ph: 03 8540 8600 E: samples@melbourne.als.com.au
 MURFREES 27, Sydney Road Murfrees NSW 2850
 Ph: 02 6572 8735 E: murfrees@als.com.au

NEWCASTLE 3, Reservoir Road Newcastle NSW 2304
 Ph: 02 4988 9439 E: samples@newcastle.als.com.au
 ROARAH 4/13, Geary Place North Ryde NSW 2114
 Ph: 02 4423 2083 E: newcastle@als.com.au
 PERTH 10, Red Valley Terrace WA 6006
 Ph: 08 9209 7635 E: samples@perth.als.com.au

SYDNEY 271, Wronson Road Sydney NSW 2164
 Ph: 02 8784 8555 E: samples@sydney.als.com.au
 TOWNSVILLE 14-15, Uthera Court Bakers QLD 4818
 Ph: 07 4786 0600 E: samples@townsville.als.com.au
 WELLSBROOK 59, Army Street Wollongong NSW 2520
 Ph: 02 4225 5125 E: perth@black.als.com.au

CLIENT: **SMC Jethly**
 OFFICE: **Veterin Park**

TURNAROUND REQUIREMENTS:
 (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

Standard TAT (List due date):
 Non Standard or urgent TAT (List due date):

FOR LABORATORY USE ONLY (Circle)

PROJECT: **19580**
 PURCHASE ORDER NUMBER: **10881**
 PROJECT MANAGER: **VJA**

ALSO QUOTE NO.:
 CONTACT PH: **97502186**

COC SEQUENCE NUMBER (Circle)
 COC: **2**
 OF: **7**

Custody Seal Intact? Yes No
 Freezer (Frozen ice bricks present) Yes No
 Random Sample Temperature (on Receipt) Yes No
 Other comment:

SAMPLER: **JMC**
 COC emailed to ALS? (YES / NO) YES / NO
 Email Reports to (will default to PM if no other addresses are listed):
 Email Invoice to (will default to PM if no other addresses are listed):

RELINQUISHED BY: **[Signature]**
 DATE/TIME: **14/3**

RELINQUISHED BY: **[Signature]**
 DATE/TIME: **14/3**

RECEIVED BY:
 DATE/TIME:

COMMENTS / SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE ID	MATRIX - SOLID (S), WATER (W)	DATE/TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	ANALYSIS REQUIRED including SUITES (NB, Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).	Additional Information
1	2808		08/3/14	S	For H2O	23		
2	285							
3	286							
4	261							
5	260							
6	259							
7	236							
8	235							
9	234							
10	258							
11	282/2							
12	208							
TOTAL:								

Environmental Division
 Sydney
 Work Order
ES1405892



Telephone : +61-2-8784 8555

Water Container Codes: P = Unpreserved Plastic; M = Nitro Preserved Plastic; ORC = Nitro Preserved ORC; SH = Sodium Hydroxide Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airtight Unpreserved Plastic; V = VOA Vial HCl Preserved; VA = VOA Vial Sodium Bisphthalate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airtight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Specialized Bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; P = Unpreserved bag.

ALS
CHAIN OF CUSTODY
 ALS Laboratory:
 please tick -

CLIENT: *JMC Trading, PO Box 19580*

OFFICE: *Westhill Rd.*

PROJECT: *19580*

PURCHASE ORDER NUMBER: *10801*

PROJECT MANAGER: *M/A*

SAMPLER: *Jh*

SAMPLER MOBILE: *0800179*

CONTACT PH: *0778216*

ALS QUOTE NO.:

TURNAROUND REQUIREMENTS:
 (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)

Adelaide 21 Barma Road, Poreba SA 5095
 Ph: 07 2259 0800 E: adelaide@als.com.au

Brisbane 93 Shind Street, St Johns QLD 4053
 Ph: 07 3241 7222 E: brisbane@als.com.au

Gladstone 46 Colquhoun Drive, Gladstone QLD 4680
 Ph: 07 4971 5800 E: gladstone@als.com.au

Mackay 78 Harbour Road, Mackay QLD 4740
 Ph: 07 4944 9177 E: mackay@als.com.au

Melbourne 2-4 Westall Road, Springvale VIC 3171
 Ph: 03 8549 9500 E: melbourne@als.com.au

Perth 27 Sydney Road, Mullewa WA 6809
 Ph: 02 8374 8735 E: mullewa@als.com.au

Newcastle 15 Progress Road, Warabrook NSW 2304
 Ph: 02 4938 9403 E: newcastle@als.com.au

Sydney 4713 Green Paces North, Sydney NSW 2041
 Ph: 02 4423 2853 E: newcastle@als.com.au

Perth 20 Wood Way, Malaga WA 6009
 Ph: 08 9203 7600 E: samples@als.com.au

Sydney 277 Wycherly Road, St John's Park NSW 2164
 Ph: 02 8724 0555 E: samples@als.com.au

Toowoomba 11-15 Deanna Court, Toowoomba QLD 4370
 Ph: 07 4786 0009 E: toowoomba@als.com.au

Wollongong 93 Woy Woy Road, Woy Woy NSW 2550
 Ph: 02 4225 3125 E: wollongong@als.com.au

FOR LABORATORY USE ONLY - (Circle)

Custody Seal Intact: YES NO

Freeze/Freeze-Thaw Incubation: YES NO

Random Sample Temperature on Receipt: YES NO

Other comment:

RECEIVED BY: *Du-1* **DATE/TIME:** *19/3 0830*

RELINQUISHED BY: *Jh* **DATE/TIME:** *19/3 0830*

COC SEQUENCE NUMBER (Circle):
 1 2 3 4 5 6 7

COC: *1* **OF:** *2*

ANALYSIS REQUIRED INCLUDING SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

LAB ID	SAMPLE ID	DATE/TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	ANALYSIS REQUIRED INCLUDING SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).	ADDITIONAL INFORMATION
13	102	14/3/14	S	JA/JA	1		
14	132	14/3/14	S	JA/JA	1		
15	130	14/3/14	S	JA/JA	1		
TOTAL							

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airflight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Disulphate Preserved; VS = VOA Vial Sulphate Preserved; AV = Airflight Unpreserved Vial; SG = Sulphate Preserved Amber Glass; H = HCl Preserved Plastic; HS = HCl Preserved Spexation bottle; SP = Spexation Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; ST = Double Better; ABB = Double Bag for Acid Sulphate Oxide; D = Unpreserved bag.



CERTIFICATE OF ANALYSIS

Table with 2 columns: Field Name and Value. Fields include Work Order (ES1405892), Client (SMEC TESTING SERVICES PTY LTD), Contact (ALL REPORTS (ENQUIRIES)), Address (P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164), E-mail (enquiries@smectesting.com.au), Telephone, Facsimile, Project (19580), Order number (10841), C-O-C number, Sampler (JK), Site, Quote number (EN/025/13), Page (1 of 5), Laboratory (Environmental Division Sydney), Contact (Client Services), Address (277-289 Woodpark Road Smithfield NSW Australia 2164), E-mail (sydney@alsglobal.com), Telephone (+61-2-8784 8555), Facsimile (+61-2-8784 8500), QC Level (NEPM 2013 Schedule B(3) and ALS QCS3 requirement), Date Samples Received (19-MAR-2014), Issue Date (24-MAR-2014), No. of samples received (14), No. of samples analysed (14).

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
Analytical Results



NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Table with 3 columns: Signatories, Position, Accreditation Category. Row 1: Ankit Joshi, Inorganic Chemist, Sydney Inorganics

Page : 2 of 5
Work Order : ES1405892
Client : SMEC TESTING SERVICES PTY LTD
Project : 19580



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

	S284	285	286	261	260			
Client sampling date / time	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00			
Compound	ES1405892-001	ES1405892-002	ES1405892-003	ES1405892-004	ES1405892-005			
CAS Number								
LOR								
Unit								
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	33	21	18	107	20



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

				259	236	235	283	283/2
				14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00
Compound	CAS Number	LOR	Unit	ES1405892-006	ES1405892-007	ES1405892-008	ES1405892-010	ES1405892-011
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	22	116	30	6	7

Client sampling date / time



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)

Client sample ID

208	182	132	130	----
------------	------------	------------	------------	------

Client sampling date / time

14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	14-MAR-2014 15:00	----
-------------------	-------------------	-------------------	-------------------	------

Compound	CAS Number	LOR	Unit					
				ES1405892-012	ES1405892-013	ES1405892-014	ES1405892-015	----

EA010: Conductivity

Electrical Conductivity @ 25°C								
	----	1	µS/cm	19	15	12	16	----



QUALITY CONTROL REPORT

Table with 4 columns: Field, Value, Field, Value. Includes Work Order (ES1405892), Client (SMEC TESTING SERVICES PTY LTD), Laboratory (Environmental Division Sydney), Project (19580), and Quote number (EN/025/13).

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
• Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
• Matrix Spike (MS) Report; Recovery and Acceptance Limits



NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Table with 3 columns: Signatories, Position, Accreditation Category. Row 1: Ankit Joshi, Inorganic Chemist, Sydney Inorganics



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC



Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA010: Conductivity (QC Lot: 3351327)									
ES1405892-001	S284	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	33	33	0.0	0% - 20%
ES1405892-012	208	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	19	20	5.4	0% - 20%



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: SOIL

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
Method: Compound	CAS Number	LOR	Unit	Result	Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low High	
EA010: Conductivity (QCLot: 3351327)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	101	70	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) Results are required to be reported.**

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**



Environmental

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: ES1405892	Page	: 1 of 5
Client	: SMEC TESTING SERVICES PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: ALL REPORTS (ENQUIRIES)	Contact	: Client Services
Address	: P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: enquiries@smectesting.com.au	E-mail	: sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 19580	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----	Date Samples Received	: 19-MAR-2014
C-O-C number	: ----	Issue Date	: 24-MAR-2014
Sampler	: JK	No. of samples received	: 14
Order number	: 10841	No. of samples analysed	: 14
Quote number	: EN/025/13		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers



Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with recommended holding times (USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: * = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis			
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA010: Conductivity								
Soil Glass Jar - Unpreserved (EA010)								
S284,	285,	14-MAR-2014	21-MAR-2014	21-MAR-2014	✓	21-MAR-2014	18-APR-2014	✓
286,	261,							
260,	259,							
236,	235,							
283,	283/2,							
208,	182,							
132,	130							



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(when) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Regular	Actual	Expected	Evaluation	
Analytical Methods							
Laboratory Duplicates (DUP)							
Electrical Conductivity (1:5)	EA010	2	14	14.3	10.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Electrical Conductivity (1:5)	EA010	1	14	7.1	5.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Electrical Conductivity (1:5)	EA010	1	14	7.1	5.0	✔	NEPM 2013 Schedule B(3) and ALS QCS3 requirement



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Electrical Conductivity (1:5)	EA010	SOIL	(APHA 21st ed., 2510) Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (2013) Schedule B(3) (Method 104)

<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.



Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- For all matrices, no Method Blank value outliers occur.
- For all matrices, no Duplicate outliers occur.
- For all matrices, no Laboratory Control outliers occur.
- For all matrices, no Matrix Spike outliers occur.

Regular Sample Surrogates

- For all regular sample matrices, no surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- No Quality Control Sample Frequency Outliers exist.

APPENDIX F – GEOTECHNICAL REPORT



Ingleside Precinct

Slope Risk Assessment Report

Prepared for: Department of Planning and
Environment
Date: 1 September, 2015



DOCUMENT CONTROL

Title	Ingleside Precinct Slope Risk Assessment Report		
Prepared for	Department of Planning and Environment		
Project Ref	30012289		
	Name	Position	Date
Originator	Ben Morris	Senior Geotechnical Engineer	15/08/2014
Review	Simon Baldock	Senior Engineering Geologist	
Approval	Daniel Saunders	Project Manager Senior Environmental Scientist	

Details of Revisions

Rev	Date	Description	WVR Number
DRAFT	15/08/2014	Draft Report	
FINAL	01/09/2015	Final Report	001

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

EXECUTIVE SUMMARY

Ingleside Release Area (Ingleside Precinct) is located within the Pittwater Local Government Area and is approximately 700 hectares in size.

The Minister for Planning and Pittwater Council have agreed to undertake a Precinct Planning Process for the Ingleside Precinct to confirm development potential and to establish planning controls to enable development consistent with that potential.

As part of this process the Department of Planning and Environment wish to identify areas where slopes pose a risk to future development within the Ingleside Precinct.

SMEC has undertaken an inspection of the site where current and potential failure mechanisms were identified. A slope risk analysis of the failure mechanisms has been carried out in line with Australian Geomechanics Society method “*A National Landslide Risk Management Guideline for Australia (2007)*”.

Previous work undertaken had delineated set zones within the Ingleside Precinct that contain slopes that may potentially pose a risk to future development; these can be grouped into ten sites.

Three main slope instability mechanisms were identified. A risk analysis was undertaken for each of the slope instability mechanisms based on three future land uses. The risk analysis framework can be found in Appendix C.

For the risk to property, the analysis was primarily based on a qualitative approach involving the estimation of the likelihood of a slope failure versus the consequence of the failure. SMEC also undertook an estimation of the risk to life in accordance with the AGS (2007). This approach is primarily based on a quantitative approach.

Based on the findings of the risk analysis it has been established that the tolerable risk to future development for the identified slope failure mechanisms has not been met, as the risk for the ten sites inspected within the precinct is classed as moderate.

The assessed risk for loss of life considering the assumed temporal probabilities are within an acceptable risk level for all three conceptualised mechanisms.

The risk levels determined should be considered where the instability mechanisms are present where development occurs within the subject area and implementation of treatment options should be considered as part of any application.

Recommendations to reduce the risk to tolerable levels may include; scaling the slope, installation of rock bolts and consideration of development location.

These risk analyses were based on high level observations. The analysis is conservative because comprehensive and detailed geological mapping of the site was not possible. As such it should be noted that there may be other active or potential slope mechanisms that were not identified. On this basis it is recommended that for any site development a specific slope stability assessment should be undertaken to assess the slope risk based on a detailed site inspection or investigation. For any development that is undertaken on slopes it is recommended that the advice presented in Appendix B “Examples of good and poor hillside construction” is followed.

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1. INTRODUCTION

1.1 Project Background

Ingleside Release Area (Ingleside Precinct) is located within the Pittwater Local Government Area and is approximately 700 hectares in size.

The majority of the Ingleside precinct is zoned RU2 Rural Landscape under the Pittwater LEP 2014. A mix of public and private land ownership exists in the Precinct. Approximately one third of the area is in State Government ownership.

The Minister for Planning and Pittwater Council have agreed to undertake a Precinct Planning Process for the Ingleside Precinct to confirm development potential and to establish planning controls to enable development consistent with that potential.

As part of this planning process a land capability, salinity and contamination assessment is required. As part of the land capability assessment slope stability assessments across the site are required; identifying areas which are, or are likely to be, prone to stability problems.

This report details the findings of SMEC's slope stability assessments undertaken for the Ingleside Precinct.

1.2 Scope of Works

Based on the original scope of works it was planned to undertake intrusive ground investigations across the area to determine the ground conditions and allow detailed slope stability assessments to be undertaken. Subsequent issues with gaining access to private property has meant that an intrusive ground investigation was not possible, therefore, SMEC have undertaken a visual slope risk analysis.

Previous work undertaken had delineated set zones within the Ingleside Precinct that contain slopes that may potentially pose a risk to property. These can be grouped into ten sites as shown on Figure 1.

The scope of work was to undertake an inspection of the ten sites to identify current and potential failure mechanisms; to inform a slope risk assessment of the categorised slope mechanisms in accordance with the Landslide Risk Management guidelines dated March 2007 by Australian Geomechanics Society (AGS, 2007).

Specifically, this role included:

- Site inspection of the slope characteristics as visible from the road side or clearly identifiable public land;
- Risk estimation (comparative analysis of likelihood of a slope failure versus consequence of the failure).
- Evaluation of the estimated (assessed) risk by comparing against acceptance criteria.

2. SITE DESCRIPTION AND GEOLOGY

2.1 Site Description

The Ingleside Precinct area is bounded by Gilwinga Drive to the north, Minkara Road and Ingleside Road to the east, Wilga Street to the south and Wirreanda Road to the west. The area is intersected in an east-west direction by Mona Vale Road.

The topography of the area consists of undulating hillsides with some steepened precipices and valleys that make up the upper reaches of the Pittwater Plateau. Based on site observations undertaken during a site visit on 6th August 2014 and GIS extracted information (Figure 3) much of the area comprises of slopes with a slope angle of less than 20°. There are some isolated areas where slopes have an angle of up to 30° and a very minor component with slope angles between 30° and 40°. A few vertical precipices were observed, up to 5m in height, some containing overhangs.

Land use across the site comprised urban sized residential blocks; large rural residential blocks; rural acreages with farming; light industrial blocks; quarries and Crown Land.

Table 1 below provides a summary of the topography, land use, and identified slope characteristics within each of the ten previously identified sites.

Appendix A presents a plan with comments and collation of photographs for each of the ten sites.

Table 1 – Summary of Site Characteristics

Site	Land Use	Topography and Slope Characteristics
1	Undeveloped land	Undulating terrain with precipices along the eastern and southern extents (Walter Road and Cicada Glen Road). Sandstone precipices up to 5m high with minor overhangs.
2	Undeveloped land and large rural residential blocks	Gently dipping valley (up to 30°) north of Cicada Glen Road between residential blocks. Some sandstone precipices up to 2m high.
3	Large rural residential blocks	Private property frontage restricted visibility of slope characteristics, however, it is considered to be similar to Site 2 above.
4	Large rural residential blocks, open farming areas	Gently graded slopes (up to 20°) and some minor sandstone precipices up to 2m in height adjacent to Addison Road.
5 and 6	Undeveloped land, large rural residential blocks, commercial blocks, quarry	Slopes up to 30° with sandstone precipices up to 3m in height between Mona Vale Road and Wirreanda Road, loose sandstone blocks up to 1.5m in size on upper slope adjacent to Mona Vale Road (remnants of cutting Mona Vale Road).
7	Undeveloped land	Gently graded slope from Mona Vale Road to Wirreanda Road in the order of 15°, sandstone precipices up to 2m high.

8	Undeveloped land and urban size residential blocks	Generally undulating slopes 15° to 35°, sandstone precipices up to 4m in height adjacent to Mona Vale Road, with overhangs .
9	Light industrial blocks	Unable to access or view portions of land likley to contain slopes. Considered to be similar to Site 7 above.
10	Large rural residential blocks, open farming areas	Gently graded land sloping at an angle of up to 10° towards creek crossing Powder Works Road.

2.2 Regional Geology and Material Description

The 1:250,000 Geological Series map S1 56-5 for Sydney indicates that the Pittwater Plateau is underlain by near-horizontally bedded sequence of sedimentary rocks of Triassic Age. The ridges, which make up the majority of the Ingleside Precinct are formed by Hawkesbury Sandstone, medium to coarse grained quartzose sandstone, very minor shale and laminite lenses, reasonably distinct bedding and well developed, typically widely spaced near-vertical joints. The slopes surrounding the plateau are underlain by an interbedded sequence of laminite, siltstone, shale and sandstone of the Narrabeen Formation. On the slopes these rocks are overlain by talus which has fallen from the sandstone uphill and by clayey colluvium derived by the weathering process of the sandstone and siltstone rock units. (MacGregor et al, 2007)

An extract of the geological map for the area is presented as Figure 2.

3. INSPECTION AND RISK ASSESSMENT METHODOLOGY

3.1 General

The Australian Geomechanics Society sub-committee first developed and published, 'Landslide Risk Assessment Procedures' in Australian Geomechanics, Volume 35, Number 1 dated March 2000. The intention of this system of slope risk classification was to establish terminology, define the general framework, provide guidance on risk analysis methods and provide sufficient information on tolerable and acceptable risks for loss of life.

Since then, several published papers have progressed the understanding of the landslide risk framework for these assessments and the procedures have subsequently been adjusted. The updated benchmark guidelines on Landslide Risk Management (LRM) are presented in the Australian Geomechanics publication, Volume 42, Number 1, dated March 2007. This issue presents a series of LRM guidelines and further understanding on the application of the risk assessments for the recommended use by all practitioners nationwide.

This investigation was undertaken in accordance with the LRM guidelines dated March 2007.

The methodology of assessing the risks at the site comprised the following steps:

- Site inspection involving a geological and geomorphologic appraisal;
- Hazard identification; and
- Risk Estimation.

3.2 Site Inspection

The site inspection involved a walkover of the ten respective sites within the Ingleside Precinct that have been previously identified as containing slopes which may potentially pose a risk to future development. The site visit was undertaken on 6th August 2014 by a senior geotechnical engineer and included a walkover survey of the areas by accessing clearly identifiable public land and road reserves. Many of the sites were entirely bounded by private property and therefore identifiable slope features was restricted to that visible from the road.

The site inspections comprised site observations and recording of surface features including geomorphological characteristics, evident failure mechanisms, erosion and indications of slope instability.

Slope characterisation was undertaken for each precipice in order to:

- identify if the slope has current or potential slope instability issues;
- classify the types of slope instability, if applicable;
- assess the physical extent of the areas affected by instability being considered, including the location, areal extent and volume involved;
- assess the likely initiating event(s), the physical characteristics of the materials involved, and the failure mechanics;
- estimate the resulting anticipated travel distance and velocity of movement; and

- identify if risk from a possible slope hazards to existing or future property are acceptable.

3.3 Hazard Identification

A landslide is defined as “the movement of a mass of rock, debris or earth down a slope”. Apart from ground subsidence and collapse, this definition is open to the movement of material types including rock, earth and debris downslope. The causes of landslides can be complex. However, two common factors include the occurrence of a failure of part of the soil or rock material on a slope and the resulting movement is driven by gravity. The actual motion of a landslide is subdivided into the five kinematically distinctive types of material movement including fall, topple, slide, spread, and flow. Table 2 shows the major types of landslides (AGS, 2007).

Table 2 – Major Types of Landslides

Type of Movement	Type of Material		
	Bedrock	Engineering Soils	
		Predominantly Coarse	Predominantly Fine
Falls	Rock fall	Debris fall	Earth fall
Topples	Rock topple	Debris topple	Earth topple
Rotational slide	Rock slide	Debris slide	Earth slide
Translational slide			Earth spread
Lateral spread	Rock spread	Debris spread	Earth flow
Flows	Rock flow (deep creep)	Debris flow (soil creep)	Earth flow (soil creep)
Complex	Combination of two or more principle types of movement		

The more common landslides occurring along plateaus and the surrounding slopes include falling or toppling rocks and rotational earth or debris slides.

Rock falls generally result from the under-cutting of the precipice by erosional processes, including scour from surface flows and direct rainfall. Rock topple mechanisms occur in a similar fashion to rock falls, however, the inherent jointing structure within the bedrock and root jacking may be additional factors for the instability of a precipice.

Rotational landslides typically develop in moderate to steep slopes where earth or debris becomes inundated by water and downward movement occurs. They are semi-circular in shape and exhibit a back tilted upper section and a disrupted toe section. Translational slides are similar to rotational slides but may feature downward movement of weak material along a more competent planar surface.

The frequency of landslides is generally complex and typically dependent on the inter-relationship between the factors influencing the stability of the slope. Some of the common factors affecting the stability of slopes within plateau landscapes include land development, vegetation removal and changes in drainage. Some of the potential failure triggers that may affect the stability of slopes include:

- undercutting of erosion;
- prolonged rainfall with water percolating into rock mass defects causing washout of fines and reduction of rock mass strength;
- earthquakes.

One or a combination of these conditions could result in a landslide failure event

3.4 Risk Estimation

A risk assessment was undertaken for each of the categorised slope hazards. The risk assessment and management process adopted for this study in general complies with AGS (2007a). Definition of the terms used in this report with respect to the slope risk assessment and management is as per AGS (2007b).

3.4.1 Risk to Property

For risk to property, the assessment was primarily based on a qualitative approach. The assessment process for each hazard involved the following:

- Risk estimation (comparative analysis of likelihood of a slope failure versus consequence of the failure).
- Evaluation of the estimated (assessed) risk by comparing against acceptance criteria.

Risk management and control strategies are recommended where the estimated risk is beyond the acceptable/tolerable limit.

The qualitative terminology for use in assessing risk to property is presented in Appendix C.

3.4.2 Risk to Life

In accordance with the AGS 2007c Landslide Risk Management Guidelines for loss of life, the risk assessment was primarily based on a quantitative approach. The individual risk for loss of life can be calculated from:

$$R(\text{LoL}) = P(\text{H}) \times P(\text{S:H}) \times P(\text{T:S}) \times V(\text{D:T})$$

Where:

- R (LoL) is the risk (annual probability of loss of life (death) of an individual).
- P (H) is the annual probability of the landslide.
- P (S:H) is the probability of spatial impact of the landslide impacting a building (location) taking into account the travel distance and travel direction of a given event.

- P (T:S) is the temporal spatial probability (e.g. of the building or location being occupied by the individual) given the spatial impact and allowing for the possibility of evacuation given there is warning of the landslide occurrence.
- V (D:T) is the vulnerability of the individual (probability of loss of life of the individual given the impact).

Risk management and control strategies are recommended where the estimated risk is beyond the acceptable/tolerable limit.

4. RISK ASSESSMENT

4.1 General

The benchmark guidelines on Landslide Risk Management (LRM) are presented in the Australian Geomechanics publication, Volume 42, Number 1, dated March 2007. As noted in Section 3.1, this document presents a series of LRM guidelines and further understanding on the application of the risk assessments recommended for use by all practitioners nationwide. This investigation was undertaken in accordance with the LRM guidelines dated March 2007.

4.2 Risk Acceptance Criteria

The risk acceptance criteria consider the occurrence of the potential hazards identified and evaluate the risks against a Tolerable Risk Criteria.

The AGS 2007 guidelines indicate that the regulator, with assistance from the practitioner where required, is the appropriate authority to set the standards for tolerable risks relating to perceived safety in relation to other risks and government policy. The importance of the implementation of levels of the tolerable risk should not be understated due to the wide ranging implications, both in terms of the relative risks or safety to the community and the potential economic impact on the community.

For property loss, the tolerable risk criterion may be determined by the importance level of infrastructure. The importance level is directly related to societal requirements during or immediately after extreme events. The AGS provided recommendation for tolerable risk level to property is the "low" risk level. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required. Otherwise the "very low" risk level is acceptable.

For tolerable risk related to loss of life, the following risk levels are as recommended by AGS. For the purpose of this risk assessment the site may be broadly defined as a new development. The AGS risk threshold provided in Table 3 for new developments suggests the 'Tolerable Loss of Life for the person most at risk' is 1×10^{-5} per annum.

Table 3 – AGS Suggested Tolerable Risk (AGS, 2007).

Situation	Suggested tolerable loss of life risk for the person most at risk
Existing Slope (1) / Existing Development (2)	1×10^{-4} /annum or 0.01%
New Constructed Slope (3) / New Development (4) / Existing Landslide (5)	1×10^{-5} /annum or 0.001%

Notes:

1. "Existing Slopes" in this context are slopes that are not part of a recognisable landslide and have demonstrated non-failure performance over at least several seasons or events of extended adverse weather, usually being a period of at least 10 to 20 years.
2. "Existing Development" includes existing structures, and slopes that have been modified by cut and fill, that are not located on or part of a recognisable landslide and have demonstrated non-failure

performance over at least several seasons or events of extended adverse weather, usually being a period of at least 10 to 20 years.

3. “New Constructed Slope” includes any change to existing slopes by cut or fill or changes to existing slopes by new stabilisation works (including replacement of existing retaining walls or replacement of existing stabilisation measures, such as rock bolts or catch fences).

4. “New Development” includes any new structure or change to an existing slope or structure. Where changes to an existing structure or slope result in any cut or fill of less than 1.0m vertical height from the toe to the crest and this change does not increase the risk, then the Existing Slope / Existing Structure criterion may be adopted. Where changes to an existing structure do not increase the building footprint or do not result in an overall change in footing loads, then the Existing Development criterion may be adopted.

5. “Existing Landslides” have been considered likely to require remedial works and hence would become a New Constructed Slope and acquire the lower risk. Even where remedial works are not required per se, it would be a reasonable expectation of the public for a known landslide to be assessed against the lower risk category as a matter of “public safety”.

4.3 Risk Assessments

As noted in Section 3.2, these risk assessments were based on high level observations made during a limited site visit by a senior geotechnical engineer. The assessments are conservative because comprehensive and detailed geological mapping of the site was not possible under the prescribed scope of work and the limitations of being able to access all areas of the sites. Any future detailed evaluations of particular sites may change the quantification of the hazard risk.

The data collected for this report has enabled the definition and characterisation of slope instability hazards.

4.3.1 Hazard Mechanisms

Photographs showing various site locations where representative slope mechanisms were identified are provided in Appendix A.

During the site inspection the following slope failure mechanisms were identified and conceptualised. For each of these failure mechanisms a risk assessment was carried out.

4.3.1.1 Mechanism 1 (M1): Block Falls up to 1m from Precipices up to 2m in Height

Mobilisation of block falls to 1m are considered to arise from the precipices with jointed sandstone units up to 2m in height and influenced by exposure conditions to wind and rain.

4.3.1.2 Mechanism 2 (M2): Block Falls up to 1m from Precipices up to 5m in Height

Mobilisation of block falls to 1m are considered to arise from the precipices with jointed sandstone units up to 5m in height and influenced by exposure conditions to wind and rain.

4.3.1.3 Mechanism 3 (M3): Block Falls up to 2m from Overhangs

Mobilisation of block falls from overhangs are considered to arise from the precipices with major overhangs and influenced by exposure to wind and rain.

4.3.2 Understanding Failure Modes and Triggering Factors

In view of the site observations, measurements and experience, a conceptual understanding of the failure mechanisms and contributing factors was developed to comprehend its vulnerability and associated risks. The main points describing this phenomenon and triggering factors are summarised below;

- The slopes are directly exposed to weathering processes, wind, rain and atmospheric exposure. This causes the rock mass and joints in the rock to be weakened and blocks are loosened.
- The largely absent sub-vertical joint sets lead to the mechanisms being more stable than would be in a highly fractures and frequently jointed rock mass.

4.3.3 Assets at Risk

As this risk assessment is a high level assessment for future development it is considered that the assets at risk would be newly constructed dwellings or other buildings, roads or areas of congregation of persons such as parks and other recreation areas.

4.3.4 Temporal Probability

The following assumptions have been made with respect to temporal probability. Alteration of these assumptions will inevitably alter the magnitude of risk.

Table 4 – Adopted Temporal Probability

Aspect of Assessment	Assumed Temporal Probability P(T:S)
Residential Areas	It is assumed that people would be present below the slope within residential areas on an average of 30mins/day. This would include being in an area of vulnerability to the mechanism and may include being inside the dwelling.
Roads	For the suburban roads it is assumed that the temporary probability would be 0.001*.
Recreational Areas	It is assumed that people would be present below the slope within recreational areas on an average of 30mins/day.

Notes: *Allocation of temporal probability is based on the Temporal Probability Rating Definitions adopted by RMS for Slope Risk Analysis, Table 11 RMS Guide to Slope Risk Analysis Version 4 (RMS 2011).

With regards to the above temporal probabilities, common usage has been assumed. Allowance for more frequent presence for specific situations, such as persons seeking refuge in adverse weather conditions, has not been considered and therefore re-assessment of the specific land use at the slope is to be undertaken prior to application of these probabilities.

4.3.5 Assessed Risk

Table 5 and 6 below show the assessed risk to property and the risk of loss of life associated with conceptualised failure mechanisms.

Table 5 – Summary of Risk Assessment – Risk to Property

		M1: Block Falls (1.0m) from Precipices up to 2m in Height	M2: Block Falls (1.0m) from Precipices up to 5m in Height	M3: Block Falls (up to 2m) from Overhangs
Probability P(H)	Descriptor	Likely	Possible	Possible
	Level	B	C	C
	Rate	0.01	0.001	0.001
Consequence to Building	Level	Minor	Minor	Medium
	Descriptor	4	4	3
Risk To Property		Moderate	Moderate	Moderate

Table 6 – Summary of Risk Assessment - Level of Risk for Loss of Life

		M1: Block Falls (1.0m) from Precipices up to 2m in Height	M2: Block Falls (1.0m) from Precipices up to 5m in Height	M3: Block Falls (up to 2m) from Overhangs
Probability P(H)		0.01	0.001	0.001
Probability of Spatial Impact (P_{S:H})		0.02 (1.0m block on 50m long section of slope)	0.02 (1.0m block on 50m long section of slope)	0.04 (2.0m length failure over 25m section of slope)
Vulnerability of an Individual (P_{D:T})		1.0 (person killed) 0.1 (person injured)		
Probability of Temporal Impact (P_{T:S})	Residential Areas	0.021		
	Roads	0.001		
	Recreational Areas	0.021		
Risk (loss of life)	Residential Areas	Death 4.2x10 ⁻⁶ Injury 4.2x10 ⁻⁷	Death 4.2x10 ⁻⁷ Injury 4.2x10 ⁻⁸	Death 8.4x10 ⁻⁷ Injury 8.4x10 ⁻⁸
	Roads	Death 2.0x10 ⁻⁷ Injury 2.0x10 ⁻⁸	Death 2.0x10 ⁻⁸ Injury 2.0x10 ⁻⁹	Death 4.0x10 ⁻⁸ Injury 4.0x10 ⁻⁹
	Recreational Areas	Death 4.2x10 ⁻⁶ Injury 4.2x10 ⁻⁷	Death 4.2x10 ⁻⁷ Injury 4.2x10 ⁻⁸	Death 8.4x10 ⁻⁷ Injury 8.4x10 ⁻⁸

According to the AGS suggested tolerable levels for loss of property for the above conceptualised mechanisms do not yield acceptable levels. Noted implications in the AGS guideline is that for risk to loss of property of "moderate" levels "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."

Based on the AGS suggested tolerable levels for loss of life outlined in Table 3 and considering the assumed temporal probability an acceptable risk level is obtained for all conceptualised mechanisms.

5. DISCUSSION AND RECOMMENDATIONS

As previously stated the original scope of works allowed for intrusive ground investigations to be undertaken across the Ingleside Precinct to determine ground conditions for slope stability assessments.

As access to private property was not possible, SMEC, have undertaken a visual slope risk analysis in line with AGS (2007) guidelines. These slope risk analysis involved the inspection of the slope characteristics at ten sites from accessible areas, generally either from the roadside or clearly identifiable public land.

The data collected during the site visit by a senior geotechnical engineer has enabled the definition and characterisation of slope instability mechanisms at the ten sites. Three main mechanisms were identified. These are listed below:

- Mechanism 1: Block Falls up to 1m from precipices up to 2m in Height
- Mechanism 2: Block Falls up to 1m from precipices up to 5m in Height
- Mechanism 3: Block Falls up to 2m from overhangs

SMEC considered three future uses for any land development and made assumptions with regards to the temporal probability for these uses (detailed in Section 4.3.4). The three land uses considered are:

- Residential Areas
- Roads
- Recreational Areas

A risk assessment was undertaken for each of the slope instability mechanisms. For risk to property, the assessment was primarily based on a qualitative approach involving the estimation of the likelihood of a slope failure versus the consequence of the failure.

In addition to the risk to property SMEC also undertook an estimation of the risk to life in accordance with the AGS (2007). This approach is primarily based on a quantitative approach.

Based on the findings of the risk assessment, as presented in Section 4.3.5, it has been established that the tolerable risk to future development for the identified failure mechanisms has not been met as the risk is classed as moderate.

It is noted that in the AGS guidelines that for risk to loss of property of "moderate" levels "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."

The assessed risk for loss of life considering the assumed temporal probabilities are within an acceptable risk level for all three conceptualised mechanisms.

The risk levels determined should be considered where the instability mechanisms are present within the subject area and implementation of treatment options should be considered as part of any application.

A summary of stabilisation recommendations for reducing the risk levels is presented in Table 7 below.

Table 7 – Summary of Stabilisation Recommendations

Recommendation	Description
Scaling	Removal of rock blocks/mass can be coupled with site earthworks process
Rock Bolts	Rock bolts are frequently used for stabilisation applications of potentially unstable rock blocks due to their relative low cost and fast installation process
Appropriateness of Building	Location of proposed buildings, and suitability of building to withstand a dislodged block may be considered to accept a high level of risk or to derive a tolerable risk level

As noted in Section 3.2, these risk assessments were based on high level observations made during a limited site visit by a senior geotechnical engineer. The assessments are conservative because comprehensive and detailed geological mapping of the site was not possible under the prescribed scope of work and the limitations of being able to access all areas of the sites.

It should be noted that due to the high level nature of the site inspection there may be other active or potential slope mechanisms that were not identified and conceptualised. Any future detailed evaluations of particular sites may change the quantification of the hazard risk.

On this basis it is recommended that for any site development a specific slope stability assessment should be undertaken to assess the slope risk based on a detailed site inspection or investigation. For any development that is undertaken on slopes it is recommended that the advice presented in Appendix B “Examples of good and poor hillside construction” is followed.

6. CONCLUSIONS

SMEC have undertaken a site visit and a subsequent slope risk analysis in line with AGS (2007) guidelines for ten sites within the Ingleside Precinct.

Three main slope instability mechanisms were identified. A risk analysis was undertaken for each of the slope instability mechanisms based on three future land uses.

For the risk to property, the analysis was primarily based on a qualitative approach involving the estimation of the likelihood of a slope failure versus the consequence of the failure. SMEC also undertook an estimation of the risk to life in accordance with the AGS (2007). This approach is primarily based on a quantitative approach.

Based on the findings of the risk analysis it has been established that the tolerable risk to property for the identified failure mechanisms has not been met, as the risk is classed as moderate.

The assessed risk for loss of life considering the assumed temporal probabilities are within an acceptable risk level for all three conceptualised mechanisms.

AGS guidelines state that for risk to loss of property "moderate" levels "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."

The risk levels determined should be considered where the instability mechanisms are present where development occurs within the subject area and implementation of treatment options should be considered as part of any future application. Recommendations to reduce the risk to tolerable levels may include; scaling the slope, installation of rock bolts and consideration of development location.

These risk analyses were based on high level observations. The analysis is conservative because comprehensive and detailed geological mapping of the site was not possible. As such it should be noted that there may be other active or potential slope mechanisms that were not identified. In addition no details on proposed future development were available. The location and proximity of any future development to an identified slope failure mechanism will potentially alter the calculated risk level.



On this basis it is recommended that for any site development a specific slope stability assessment should be undertaken to assess the slope risk based on a detailed site inspection or investigation. For any development that is undertaken on slopes it is recommended that the advice presented in Appendix B "Examples of good and poor hillside construction" is followed.

REFERENCES



- AGS (2007a). "Guideline for landslide susceptibility, hazard and risk zoning for land use planning", Australian Geomechanics, Vol 42, No. 1, March 2007.
- AGS (2007b). "Commentary on guideline for landslide susceptibility, hazard and risk zoning for land use planning", Australian Geomechanics, Vol 42, No. 1, March 2007.
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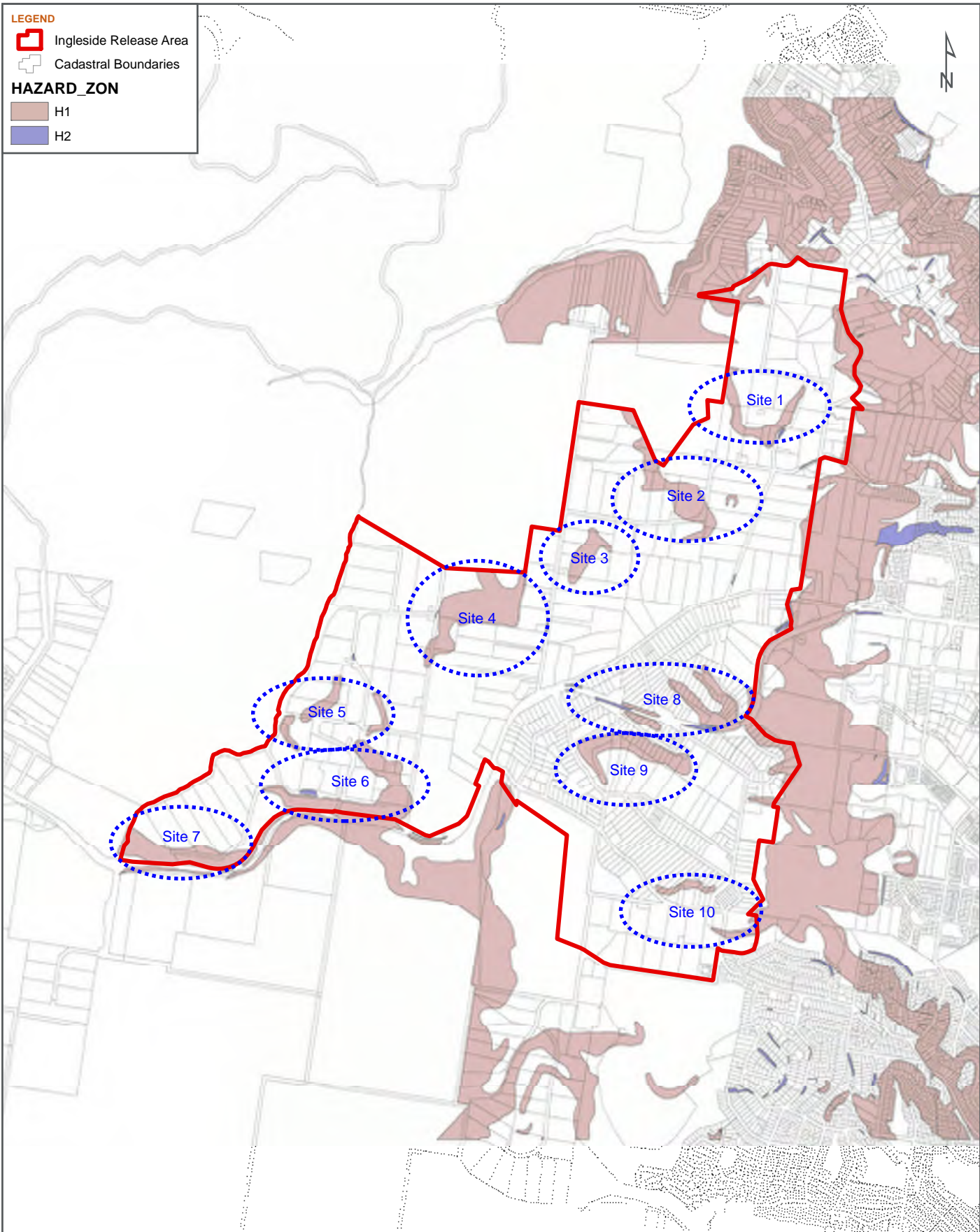
FIGURES

LEGEND

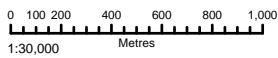
-  Ingleside Release Area
-  Cadastral Boundaries

HAZARD_ZON

-  H1
-  H2



DATE



PAGE SIZE A4

COORDINATE SYSTEM
GDA 1994 MGA Zone 56

FIG NO. 1

FIGURE TITLE Ingleside Precinct Site Locations

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct Slope Risk Assessments

CREATED BY R. Chatfield

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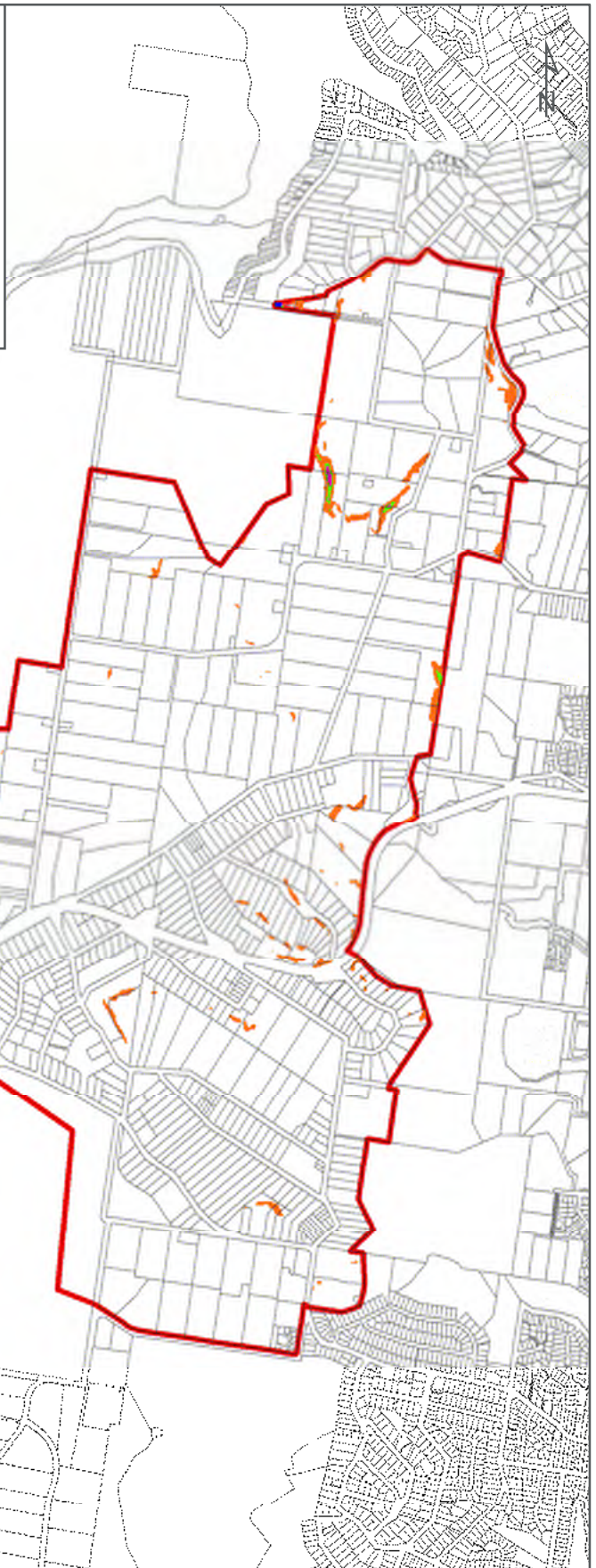
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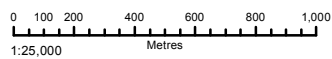
 Cadastral Boundaries  Ingleside Release Area

Slope (deg)

-  0 - 20
-  20 - 30
-  30 - 35
-  35 - 40
-  40 - 45



DATE 31/07/2014



PAGE SIZE A4

COORDINATE SYSTEM
GDA 1994 MGA Zone 56

FIG NO. 3

FIGURE TITLE Ingleside Precinct Terrain Map

PROJECT NO. 30012289

PROJECT TITLE Ingleside Precinct Slope Risk Assessments

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APPENDIX A: PHOTOGRAPHS AND NOTES



Figure 1: Site 1

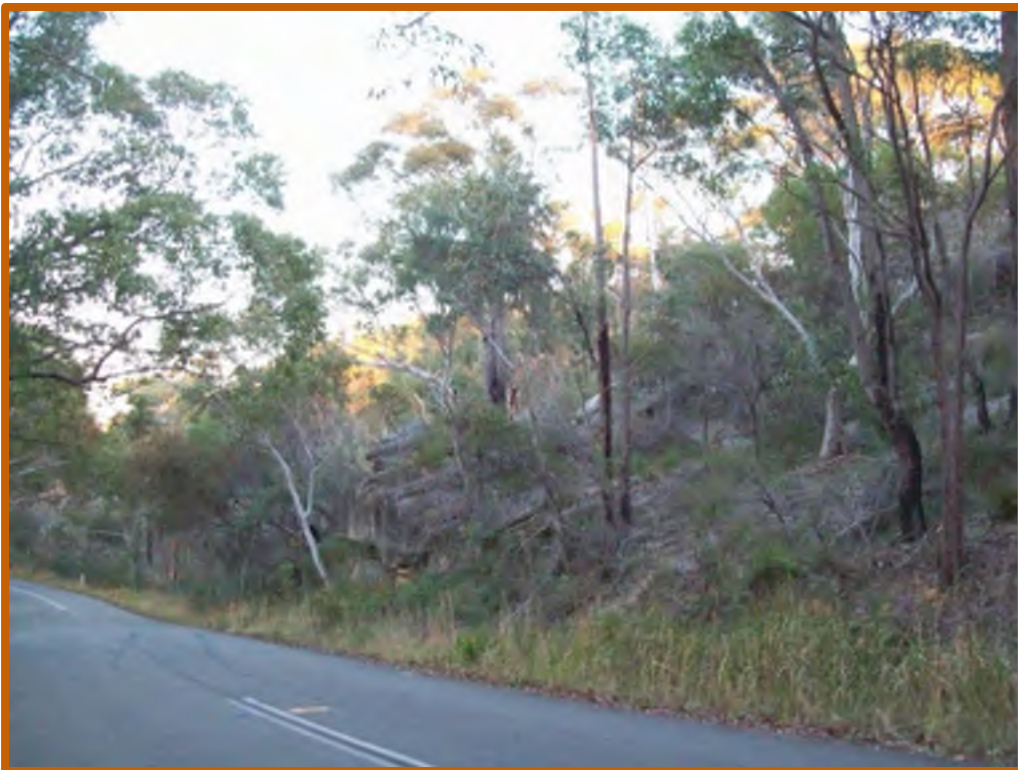


Figure 2: Site 1



Figure 3: Site 1



Figure 4: Site 1



Figure 5: Site 2



Figure 6: Site 2



Figure 7: Site 2



Figure 8: Site 2



Figure 9: Site 2



Figure 10: Site 3



Figure 11: Site 3



Figure 12: Site 4



Figure 13: Site 4



Figure 14: Site 4



Figure 15: Site 6



Figure 16: Site 6



Figure 17: Site 6



Figure 18: Site 6



Figure 19: Site 6



Figure 20: Site 6

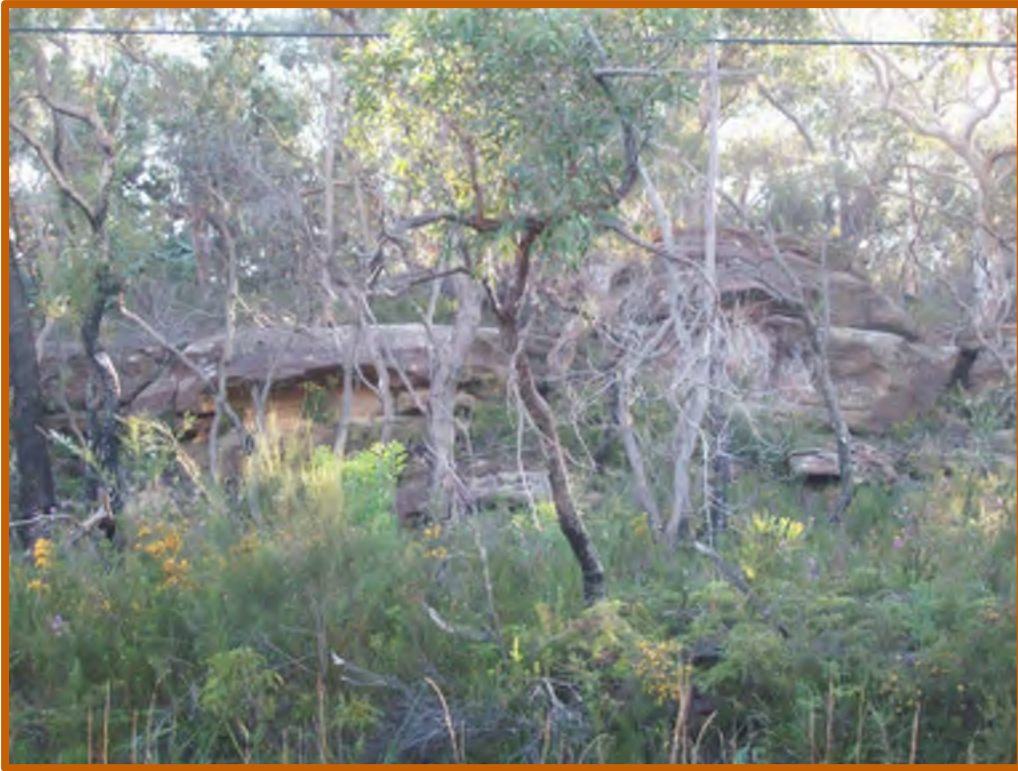


Figure 21: Site 6



Figure 22: Site 7



Figure 23: Site 7



Figure 24: Site 8



Figure 25: Site 8



Figure 26: Site 8



Figure 27: Site 8



Figure 28: Site 8







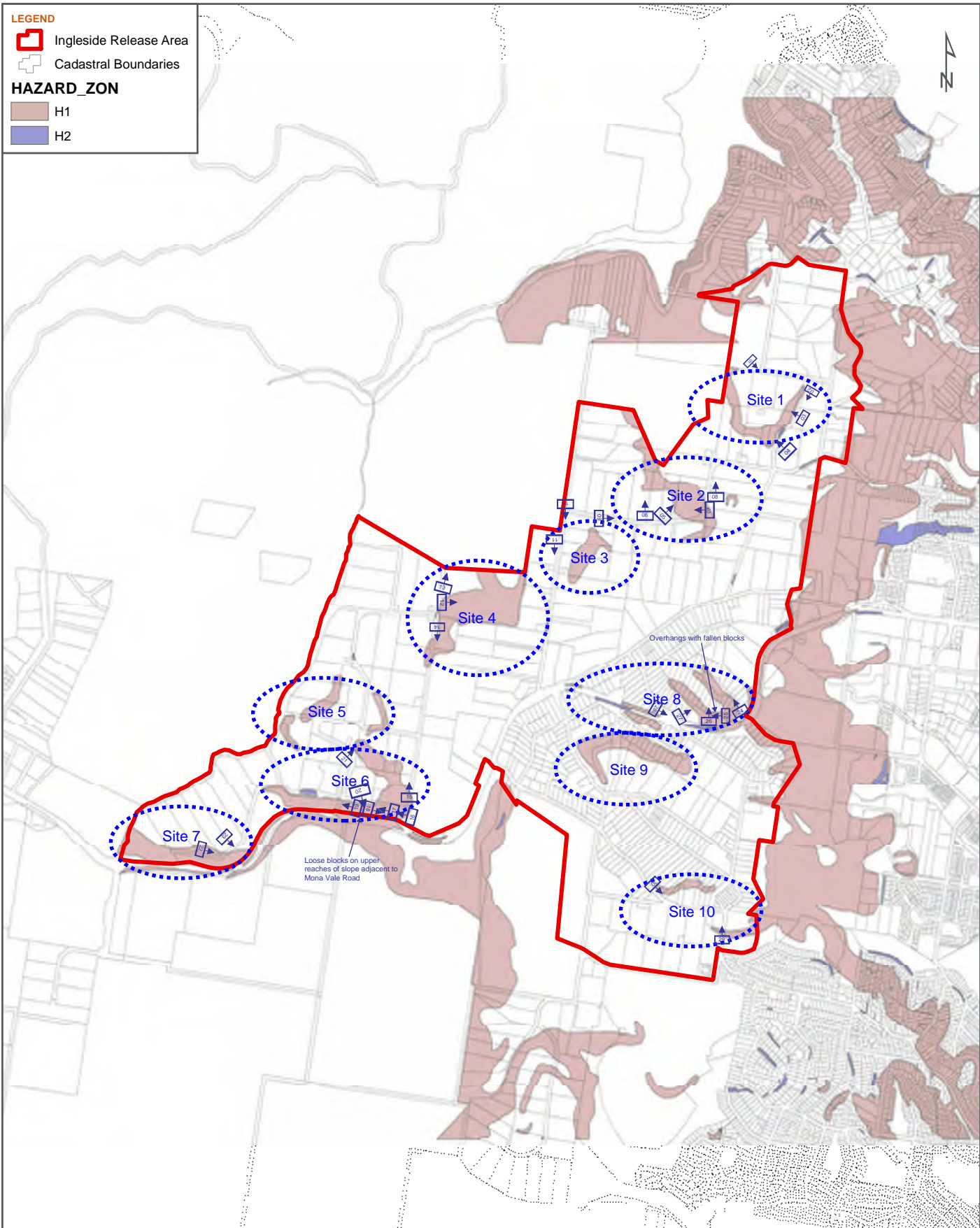
Figure 29: Site 10

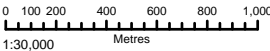


Figure 30: Site 10

LEGEND

-  Ingleside Release Area
-  Cadastral Boundaries
- HAZARD_ZON**
-  H1
-  H2



DATE		PAGE SIZE A4	COORDINATE SYSTEM GDA 1994 MGA Zone 56
FIG NO. 2	FIGURE TITLE Ingleside Release Area Geology		
PROPOSAL NO.	PROPOSAL TITLE Ingleside Land Capability Assessment		
CREATED BY R. Chatfield	SOURCES Vector backdrop data © MDS 2013		

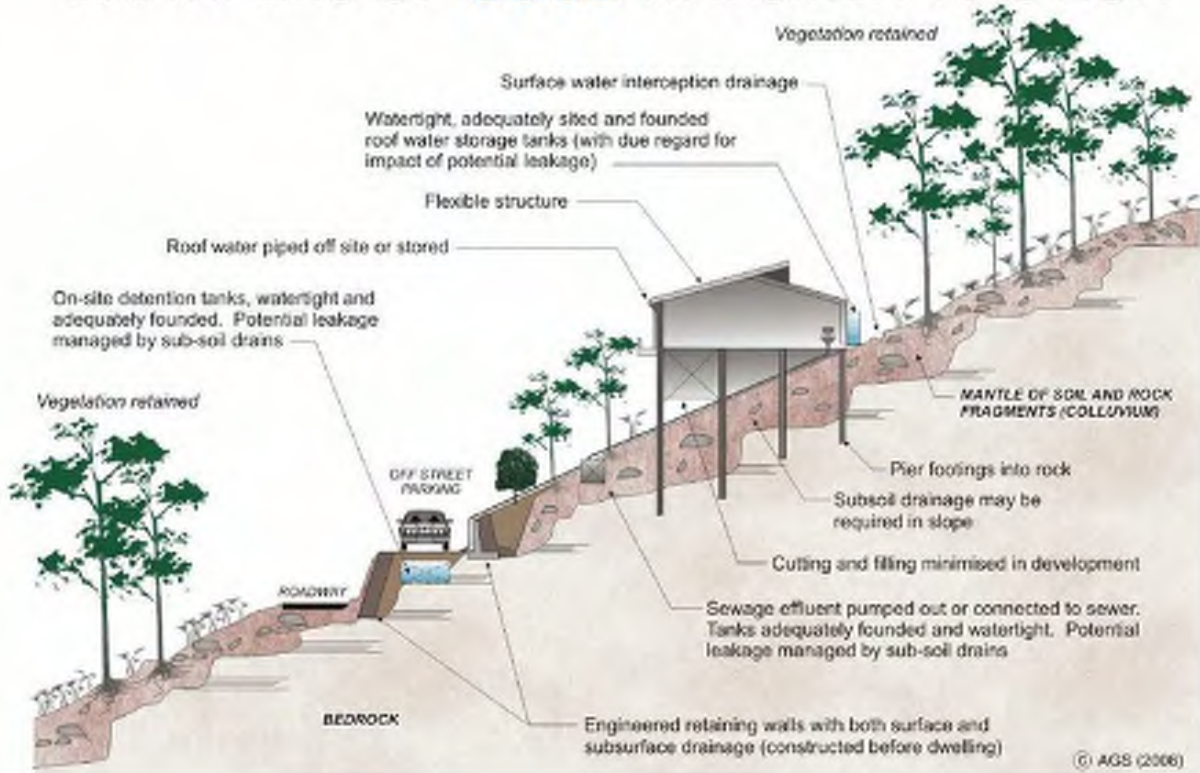


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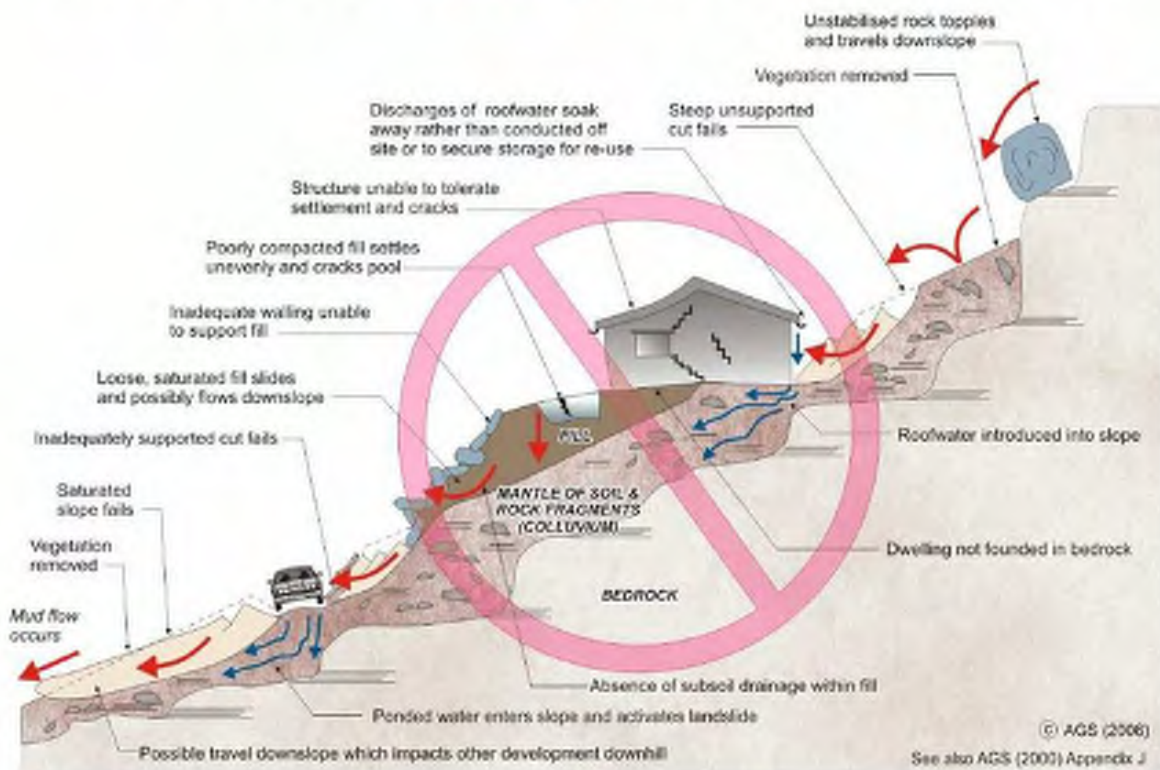
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APPENDIX B: EXAMPLES OF HILLSIDE PRACTICE

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE



APPENDIX C: RISK TO PROPERTY TERMINOLOGY

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007
APPENDIX C: 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	5x10 ⁻²	10 years	20 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10 ⁻²		100 years		The event will probably occur under adverse conditions over the design life.	LIKELY	B
10 ⁻³	5x10 ⁻³	1000 years	200 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10 ⁻⁴	5x10 ⁻⁴	10,000 years	2000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10 ⁻⁵	5x10 ⁻⁵	100,000 years	20,000 years	The event is conceivable but only under exceptional circumstances over the design life.	RARE	E
10 ⁻⁶	5x10 ⁻⁶	1,000,000 years	200,000 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%		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%	40%	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%	10%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	MINOR	4
0.5%	1%	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*

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: – 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) For 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.