

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

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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 programing 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 subprecincts:

- 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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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.

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 (Uc1.21) 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) Silkeous Sands (Uc1.1.2) 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

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

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 are 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 programing 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 Soil Loss 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 Soil Loss 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 Soil Loss 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 <u>no known occurrence</u> 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 ECe (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 ECe 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 μ S/cm (0.006 mS/cm) to 214 μ S/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 mS/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, Gymea 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 activates 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.

Year	Site Description and Surrounding Area	Potential (AEC)
6 March1930 Sydney Survey Run 1 - 12 B/W Scale 1:22,000	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. 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.	Areas developed as small farm/agricultural holdings within the South and South-eastern portion of the subject area. Cleared area towards north-eastern tip of the subject area.
Jan 1947 Broken Bay, Runs 39 and 40 B/W Scale 1:12,000	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. The cleared area towards north-eastern tip (visible in the 1930 image) is no longer visible in the 1947 image.	Areas developed as small farm holdings / market gardens / nurseries within the South and South- eastern portion of the subject area.
23 September 1965 Cumberland Run 12E and 13E B/W Scale 1:2,200	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. 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	Areas developed as small farm holdings / market gardens / nurseries within the North, Central, South and South-eastern portions of the subject area.
	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.	
	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.	
	Construction of the Baha'i Temple is visible within the image.	

Table 3 Summary of Historical Aerial Photograph Information

Year	Site Description and Surrounding Area	Potential (AEC)
29 March 1978 Cumberland Run 7 and 8 B/W Scale 1:16,000	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.	Areas developed as small farm holdings / market gardens / nurseries, Septic effluent systems on rural properties throughout the subject area.
14 August 1991 Sydney Run 5 Colour Scale 1:25,000	 Obvious changes from the 1978 image include: 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. 	Areas developed as small farm holdings / market gardens / nurseries, Septic effluent systems on rural properties throughout the subject area. Lots developed for light industrial activates throughout the subject area (Sophie Ave, etc.). Potential quarry locations and fill materials.
2012 Bing Maps Colour Scale Unknown	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.	Areas developed as small farm holdings / market gardens / nurseries, Septic effluent systems on rural properties throughout the subject area. Lots developed for light industrial activates throughout the subject area (Sophie Ave, etc.) Potential quarry or former quarry locations.

An online search of the EPA Contaminated Land Records Database (http://www.epa.nsw.gov.au/prcImapp/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 are	a
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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/Equip ment 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 at 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 caries 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 programing 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 mgbl 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.

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.

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APPENDIX A – FIGURES



Location: I:\projects\30012289 – Ingleside Precinct – Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\1_Site_location.mxd

Last updated by: RC10721 on 4/08/2014 at 12:55



Location: I:\projects\30012289 – Ingleside Precinct – Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\2_Topography_Creek_lines.mxd

Last updated by: RC10721 on 5/08/2014 at 15:01



Location: I:\projects\30012289 – Ingleside Precinct – Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\3_Soil Landscapes_Acid Sulfate Soil.mxd

Last updated by: RC10721 on 4/08/2014 at 12:32



Location: I:\projects\30012289 - Ingleside Precinct - Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\4_Geology.mxd

Last updated by: RC10721 on 4/08/2014 at 11:52



Location: I:\projects\30012289 - Ingleside Precinct - Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\5_Bores.mxd

Last updated by: RC10721 on 4/08/2014 at 14:17



CREATED BY T. Rajkumar

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LEGEND

• Contamination sampling point



DATE 20/10/2014	0 100 200 400 600 800 1.000 1:25,000 Metres	PAGE SIZE A4	COORDINATE SYSTEM GDA 1994 MGA Zone 56	(Anna)
FIG NO. 8	SMEC			
PROPOSAL NO. PROPOSAL TITLE Ingleside Land Capability Assessment				© SMEC Australia Pty Ltd 2014. All Rights Reserved Disclarine: While all reasonable care has been taken to ensure the information and a nonetable for the set of a nonetable that
CREATED BY R. Chatfield SOURCES Vector backdrop data © MDS 2013 © 2014 DigitalGlobe © 2014 GeoEye Earthstar Geographics SIO © 2014 Microsoft Corporation			Incometor Contention on this map is up to use any occurring the given 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.	

Location: I:\projects\30012289 – Ingleside Precinct – Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\9_Samples.mxd

Last updated by: RC10721 on 20/10/2014 at 14:05

APPENDIX B – GROUNDWATER DATABASE SEARCH

GW014179

Licence :10BL007801 Work Type :Well Work Status :Supply Obtained Construct. Method :(Unknown) Owner Type :Private			Licence Status Active Authorised Purpose(s) DOMESTIC FARMING	Intended Purpose(s) GENERAL USE
Commenced Date : Completion Date :01-Jan-1959	Final Depth : Drilled Depth :	5.30 m 5.30 m		
Contractor Name : Driller : Assistant Driller's Name :				
Property: - N/A GWMA:603 - SYDNEY BASIN GW Zone: -			Standing Water Level : Salinity : Yield :	(Unknown)
Site Details				
Site Chosen By	Co Form A :CU Licensed :CU	ounty JMBERLAND JMBERLAND	Parish NARRABEEN NARRABEEN	Portion/Lot DP 202 202
Region :10 - SYDNEY River Basin :212 - HAWKE Area / District :	SOUTH COAST SBURY RIVER		CMA Map : 9130-1S Grid Zone : 56/1	MONA VALE 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 M	GA Zone :56		Coordinate Source :GD.,PR. MA	AP
Construction Negative depths indicate H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter	Above Ground Level; er;C-Cemented;SL-Slot Length;A-A m (m) To (m) OD (mm) H	perture;GS-Grain Siz	e;Q-Quantity;PL-Placement of Gravel Pack; tails	PC-Pressure Cemented;S-Sump;CE-Centralisers

 If 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

(No Water Bearing Zone Details Found)

S.W.L. (m) D.D.L. (m)

Drillers Log

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

Geological Material Loam Sandstone Comments

Salinity (mg/L)

Yield (L/s) Hole Depth (m) Duration (hr)

Remarks

*** End of GW014179 ***

Converted From HYDSYS

Converted From HYDSYS

GW014464			Converted From HYDSYS
Licence :10BL009510 Work Type :Bore open thru rock Work Status :(Unknown) Construct. Method :Cable Tool Owner Type :Private		Licence Status Cancelled Authorised Purpose(s) DOMESTIC ORCHARDS (GROUNDWAT	Intended Purpose(s) IRRIGATION ER)
Commenced Date :Final DepCompletion Date :01-Aug-1960Drilled Dep	th: 33.50 m th: 33.50 m		
Contractor Name : Driller : Assistant Driller's Name :			
Property: - N/A GWMA:603 - SYDNEY BASIN GW Zone: -		Standing Water Level : Salinity : Yield :	(Unknown)
Site Details			
Site Chosen By Fo	County orm A :CUMBERLAND censed :CUMBERLAND	Parish NARRABEEN NARRABEEN	Portion/Lot DP 69 7 25951
Region :10 - SYDNEY SOUTH COAST River Basin :212 - HAWKESBURY RIVER Area / District :	Γ	CMA Map : 9130-1S Grid Zone : 56/1	MONA VALE Scale :1:25,000
Elevation : Elevation Source :(Unknown)		Northing : 6271365 Easting : 338534	Latitude (S) :33° 41' 7" Longitude (E) :151° 15' 29"
GS Map : 0055B3 MGA Zone : 56		Coordinate Source :GD.,PR. MA	Р
Negative depths indicate Above Ground Level Megative depths indicate Above Ground Level H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Sk H P Component Type From (m) To (m) O 1 1 Casing Threaded Steel -0.10 12.00 1 1 Opening Perforations 0.00 Water Bearing Zones From (m) To (m) Thickness (m) WBZ Type 6.00 6.00 0.00 Unconsolidated 30.40 30.40 0.00 Consolidated 0.00 10.00 12.19 Trime (m) To (m) Thickness (m) WBZ Type 6.00 6.00 0.00 Unconsolidated Drillers Log From (m) To (m) Thickness(m) Drillers Description 0.00 12.19 12.19 21.33 Sandstone Water Supply 12.19 33.52 21.33 Sandstone Water Supply	; bt Length;A-Aperture;GS-Grain Siz D (mm) ID (mm) Interval Def 152 (U: 152 1 Me S.W.L. (m 3.00 3.00	re;Q-Quantity;PL-Placement of Gravel Pack;F tails nknown) chanically Slotted; SL: 0mm; A 0 D.D.L.(m) Yield (L/s) 0 0.03 0 0.10 Geological Material Soil Sandstone	rC-Pressure Cemented;S-Sump;CE-Centralisers : Onun Hole Depth (m) Duration (hr) Salinity (mg/L) (Unknown) (Unknown) Comments

Remarks

MONA VALE RD INGLESIDE

*** End of GW014464 ***

GW014465

Licence :10BL011016 Work Type :Bore open thru rock Work Status :(Unknown) Construct. Method :Cable Tool Owner Type :Private			Licence Status Active Authorised Purpose(s) DOMESTIC FARMING	Intended Purpose(s) GENERAL USE
Commenced Date : Completion Date :01-Nov-1960	Final Depth : Drilled Depth :	39.00 m 39.00 m		
Contractor Name : Driller : Assistant Driller's Name :				
Property: - N/A GWMA :603 - SYDNEY B GW Zone : -	ASIN		Standing Water Level : Salinity : Yield :	(Unknown)
Site Details				
Site Chosen By	C Form A :C Licensed :C	County CUMBERLAND CUMBERLAND	Parish NARRABEEN NARRABEEN	Portion/Lot DP 69 C 25951
Region :10 - SYDNEY SO River Basin :212 - HAWKESB Area / District :	UTH COAST URY RIVER		CMA Map : 9130-18 Grid Zone : 56/1	MONA VALE Scale :1:25,000
Elevation : Elevation Source :(Unknown)			Northing : 6271412 Easting : 338454	Latitude (S) :33° 41' 6" Longitude (E) :151° 15' 26"
GS Map : 0055B3 MGA	Zone :56		Coordinate Source :GD.,PR. MA	AP

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

(No Water Bearing Zone Details Found)

S.W.L. (m) D.D.L. (m)

Drillers Log

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

Geological Material Sandstone Mudstone

Yield (L/s)

Comments

Hole Depth (m) Duration (hr)

Salinity (mg/L)

Remarks

LOT 7 MONA VALE RD INGLESIDE

*** End of GW014465 ***

Converted From HYDSYS

<u>GW014466</u>

Converted From HYDSYS

0111100		
Licence :10BL010502 Work Type :Bore open thru rock Work Status :(Unknown) Construct. Method :Cable Tool Owner Type :Private	Licence Status Active Authorised Purpose(s) DOMESTIC	Intended Purpose(s) DOMESTIC
Commenced Date :Final Depth :35.30Completion Date :01-May-1960Drilled Depth :35.40	m m	
Contractor Name : Driller : Assistant Driller's Name :		
Property: - GREEN ACRES GWMA :603 - SYDNEY BASIN GW Zone: -	Standing Water Level : Salinity : Yield :	(Unknown)
Site Details		
Site Chosen By County Form A :CUMBERLA Licensed :CUMBERLA	Parish ND NARRABEEN ND 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. MA	Р
Hole: Prom (m) To (m) OD (mm) ID (mm) Interval 1 1 Casing Asbestos Cement 0.00 1.50 152	ain Size;Q-Quantity;PL-Placement of Gravel Pack;P al Details Cemented	C-Pressure Cemented;S-Sump;CE-Centralisers
Water Bearing Zones From (m) To (m) Thickness (m) WBZ Type S.W. 21.30 21.30 0.00 Consolidated S.W.	L. (m) D.D.L. (m) Yield (L/s) 16.40 0.01	Hole Depth (m) Duration (hr) Salinity (mg/L) (Unknown)
Drillers Log From (m) To (m) Thickness(m Drillers Description 0.00 1.21 1.29 Soil 1.21 35.35 34.14 Sandstone Water Supply	Geological Material Soil Sandstone	Comments

Remarks

INGLESIDE RD NTH NARRABEEN

*** End of GW014466 ***

GW047779

Longitude (E) :151° 15' 3"

Licence :10BL110873 Work Type :Bore open thru rock Work Status :(Unknown) Construct. Method :Rotary Air Owner Type :Private			Licence Status Active Authorised Purpose(s) DOMESTIC INDUSTRIAL	Intended Purpose(s) IRRIGATION
Commenced Date : Completion Date :01-Oct-1979	Final Depth : Drilled Depth :	67.00 m 67.00 m		
Contractor Name : Driller : Assistant Driller's Name :				
Property : - N/A GWMA : - GW Zone : -			Standing Water Level : Salinity : Yield :	0-500 ppm
Site Details				
Site Chosen By	C Form A :C Licensed :C	County CUMBERLAND CUMBERLAND	Parish NARRABEEN NARRABEEN	Portion/Lot DP 169 169 752046
Region :10 - SYDNEY SC River Basin :212 - HAWKESB Area / District :	OUTH COAST URY RIVER		CMA Map : Grid Zone :	Scale :
Elevation :			Northing :6271958	Latitude (S) : 33° 40' 48"

Easting :337854

Coordinate Source :

Elevation : Elevation Source :(Unknown)

GS Map :0055B3 MGA Zone :56

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) 33.60		To (m) Thickness (m) WBZ Type 35.00 1.40 Consolidated	S.W.L. (m) 16.50	D.D.L. (m)	Yield (L/s) 2.00	Hole Depth (m) Duration	n (hr) Salinity (mg/L) 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 ***

GW050971

Converted From HYDSYS

011000711							
Licence :10BL109711			Licence Status Active Authorised Purpose(s) DOMESTIC		Intended Purpose(s) DOMESTIC		-)
Work Type :Bore open thru Work Status :Supply Obtain Construct. Method :Cable Tool Owner Type :Private	ıru rock ined						s)
Commenced Date : Completion Date :01-Apr-1979	Final Depth : Drilled Depth :	17.00 m 17.00 m					
Contractor Name : Driller :1435 Assistant Driller's Name :	ISELT, John Hans						
Property: - N/A GWMA: - GW Zone: -			Standing Wate	r Level : Salinity : Yield :		(Unknown)	
Site Details							
Site Chosen By	C Form A :C Licensed :C	bunty UMBERLAND UMBERLAND	Pari NAF NAF	is h RRABEEN RRABEEN	Portion/ L8 DP30 8 30325	Lot DP 0325 (87)	
Region :10 - SYDNE River Basin :212 - HAW Area / District :	EY SOUTH COAST KESBURY RIVER		CMA M Grid Zo	Iap : 9130-1S one :56/1	MONA VALE Scale :1:25,0	00	
Elevation : Elevation Source :(Unknown)			North East	ing :6272670 ing :339162	Latit Longit	ude (S) :33° 4 ude (E) :151°	0' 25" 15' 54"
GS Map : 0055B3	MGA Zone :56	(Coordinate Sou	rce :			
Construction Negative depths indi H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Dia Diameter;ID-Inside Dia H P Component Type 1 1 Casing Welded Steel	Tot Tot Op Tot Tot <thtot< th=""> Tot <thtot< th=""> <thtot< th=""> <thtot< th=""></thtot<></thtot<></thtot<></thtot<>	Aperture;GS-Grain Siz ID (mm) Interval Det Dr:	e;Q-Quantity;PL-Plac ails iven into Hole	ement of Gravel Pack;P	C-Pressure Cemented;S	-Sump;CE-Central	isers
Water Bearing Zones From (m) To (m) Thickness (m) 10.90 11.00 0.10	WBZ Type Consolidated	S.W.L. (m 5.80) D.D.L. (m)	Yield (L/s) 0.06	Hole Depth (m)	Duration (hr)	Salinity (mg/L) (Unknown)
Drillers Log From (m) To (m) Thickness(m) Drillers D 0.00 0.40 0.40 Topsoil Sa 0.40 0.80 0.40 Clay Shale 0.80 10.90 10.10 Sandstone 0.80 10.90 10.10 Isandstone 10.90 11.00 0.10 Sandstone 13.60 17.00 3.40 Sandstone	es cription hdy Yellow Bands Yellow Open Water Supply Yellow Grey			Geological Material Topsoil Clay Sandstone Ironstone Sandstone Sandstone Sandstone	Commen	ts	

Remarks

*** End of GW050971 ***

GW051700

Converted From HYDSYS

GW051799						converteeu	TIOM HIDDID
Licence :10BL113896		Licence Status Active		Into	ndad Durnasa		
Work Type :Bore Work Status :Supply Obtained Construct. Method :Cable Tool Owner Type :Private			DOMESTIC	rpose(s)	NOT	Γ KNOWN	(8)
Commenced Date : Completion Date :01-Jan-1981	Final Depth : Drilled Depth :	27.50 m 27.50 m					
Contractor Name : Driller : Assistant Driller's Name :							
Property: - N/A GWMA: - GW Zone: -			Standing Water Sa	Level : alinity : Yield :		0-500 ppm	
Site Details							
Site Chosen By	C Form A :C Licensed :C	County CUMBERLAND CUMBERLAND	Paris NARI NARI	h RABEEN RABEEN	Portion 179 179	/Lot DP	
Region :10 - SYDNEY River Basin :212 - HAWKE Area / District :	SOUTH COAST SBURY RIVER		CMA Ma Grid Zor	np :9130-18 ne :56/1	MONA VALE Scale :1:25,0	E 000	
Elevation : Elevation Source :(Unknown)			Northin Eastin	ng :6271820 ng :338166	Lati Longi	itude (S) :33° 4 tude (E) :151°	.0' 52" 15' 15"
GS Map : 0055B3 M	GA Zone :56		Coordinate Sour	ce :			
Construction Negative depths indicate H-Hole:P-Pipe:OD-Outside Diameter:ID-Inside Diameter Diameter:ID-Inside Diameter H P Component Type From 1 1 Casing Welded Steel From	Above Ground Level; xr;C-Cemented;SL-Slot Length;A- m (m) To (m) OD (mm) 0.30 3.00 162	Aperture;GS-Grain Siz ID (mm) Interval De Su	e;Q-Quantity;PL-Placer tails spended in Clamp	nent of Gravel Pack;P	C-Pressure Cemented	S-Sump;CE-Central	lisers
Water Bearing Zones							
From (m) To (m) Thickness (m) WB2 9.00 9.50 0.50 Con 11.00 11.50 0.50 Unc	Z Type solidated onsolidated	S.W.L. (m	a) D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L) (Unknown) (Unknown)
Drillers Log							
From (m) To (m) Thickness(m) Drillers Description 0.00 9.00 9.00 Sandstone Multi 9.00 11.00 2.00 Sandstone Watter 11.00 27.50 16.50 Sand Sitty	ption icoloured er Bearing er Bearing		G S S S	eological Material andstone andstone and	Comme	ents	

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

Remarks

*** End of GW051799 ***

GW051861

Converted From HYDSYS

Licence :10BL11389	1		Licence Status Active	T. (
Work Type :Bore Work Status :Supply Obta Construct. Method :Cable Tool Owner Type :Private	ined		Authorised Purpose(s) DOMESTIC	DOMESTIC	æ(s)
Commenced Date : Completion Date :01-Jan-1981	Final Depth : Drilled Depth :	42.00 m 42.00 m			
Contractor Name : Driller : Assistant Driller's Name :					
Property : - N/A GWMA : - GW Zone : -			Standing Water Level : Salinity : Yield :	(Unknown)	
Site Details					
Site Chosen By		County	Parish	Portion/Lot DP	
	Form License	A :CUMBERLAND d :CUMBERLAND	NARRABEEN NARRABEEN	L52 (179) L52 (179)	
Region :10 - SYD River Basin :212 - HA Area / District :	NEY SOUTH COAST WKESBURY RIVER		CMA Map : 9130-1S Grid Zone : 56/1	MONA VALE Scale :1:25,000	
Elevation :			Northing :6271745	Latitude (S) :33°	40' 55"
Elevation Source :(Unknown)			Easting :338199	Longitude (E) :151	° 15' 16"
GS Map :0055B3	MGA Zone :56		Coordinate Source :		
Magative depths H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside I H P Component Type 1 1 Casing Threaded Steel	indicate Above Ground Level; Diameter;C-Cemented;SL-Slot Leng From (m) To (m) OD (mm 0.30 1.00 15	sth;A-Aperture;GS-Grain Siz a) ID (mm) Interval Det 2 Sus	e;Q-Quantity;PL-Placement of Gravel Pa tails spended in Clamps	ack;PC-Pressure Cemented;S-Sump;CE-Cent	ralisers
From (m) To (m) Thickness (n 18.00 19.00 1.0 38.00 39.00 1.0	n) WBZ Type 00 Unconsolidated 00 Unconsolidated	S.W.L. (m 9.4(27.5(a) D.D.L. (m) Yield (L	/s) Hole Depth (m) Duration (hr)	Salinity (mg/L) (Unknown) (Unknown)
Drillers Log From (m) To (m) Thickness(m Drillers	s Description		Geological Mater	ial Comments	

From (m) 0.00 18.00 38.00 40.00
 To (m)
 Thickness(m)
 Drillers
 Description

 18.00
 18.00
 Sandstone
 Coloured

 38.00
 20.00
 Sand Silty
 Water Bearing

 40.00
 2.00
 Sand Water Bearing

 42.00
 2.00
 Sand Silty

Remarks

*** End of GW051861 ***

Sandstone Sand Sand Sand

GW055934

Converted From HYDSYS

31100000							
Licence :10BL121705			Licence Status	Active	Inter	dad Dumaaa	
Work Type :Bore open thru Work Status :(Unknown) Construct. Method :Cable Tool Owner Type :Private	rock		Authorised Purp DOMESTIC	pose(s)	DOM	IESTIC	8)
Commenced Date : Completion Date :01-Dec-1981	Final Depth : Drilled Depth :	60.00 m 60.00 m					
Contractor Name : Driller :1441 Assistant Driller's Name :	BARRETT, Roy Max						
Property : - N/A GWMA : - GW Zone : -		S	tanding Water L Sali Y	evel : inity : /ield :		Good	
Site Details							
Site Chosen By	Co Form A :CU Licensed :CI	ounty JMBERLAND JMBERLAND	Parish NARRA NARRA	ABEEN ABEEN	Portion/ L16 (87) L16 (P+	Lot DP	
Region : 10 - SYDN River Basin : 213 - SYDN Area / District :	EY SOUTH COAST EY COAST - GEORGES RI	VER	CMA Map Grid Zone	:9130-1S :56/1	MONA VALE Scale :1:25,0	00	
Elevation : Elevation Source :(Unknown)			Northing Easting	:6272692 :340320	Latit Longit	ude (S) :33° 4 ude (E) :151°	0' 25" 16' 39"
GS Map :0055B3	MGA Zone :56	C	oordinate Source	:			
Construction Negative depths indi H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Dia H H P Component Type 1 1 Casing Threaded Steel	cate Above Ground Level; meter;C-Cemented;SL-Slot Length;A-A From (m) To (m) OD (mm) II 0.00 3.00 200	Aperture;GS-Grain Size; D (mm) Interval Detai Susp	Q-Quantity;PL-Placeme ls wended in Clamps	nt of Gravel Pack;F	PC-Pressure Cemented;S	-Sump;CE-Centra	isers
Water Bearing Zones From (m) To (m) Thickness (m) 15.00 60.00 45.00	WBZ Type Consolidated	S.W.L. (m) 6.00	D.D.L. (m)	Yield (L/s) 0.18	Hole Depth (m)	Duration (hr)	Salinity (mg/L) Good
Drillers Log							
From (m) To (m) Thickness(m) Drillers Do 0.00 34.00 34.00 Sandstone 0.00 34.00 34.00 Clay Seam 34.00 60.00 26.00 Sandstone	escription Water Supply s Water Supply White Water Supply		Geo San Clay San	logical Material Idstone y Idstone	Commen	ts	

Remarks

*** End of GW055934 ***

GW055984

Licence :10BL121849			Licence Status Active	Intended Purnose(s)
Work Type :Bore			DOMESTIC	DOMESTIC
Work Status :(Unknown)			STOCK	STOCK
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			Standing Water Level :	
GWMA : -			Salinity :	(Unknown)
GW Zone : -			Yield :	. ,
Site Details				

Site Details

Site Chosen E	3y		Form A Licensed	County CUMBERLAND CUMBERLAND	Parish NARR NARR	ABEEN ABEEN	Portion 203 203	/Lot DP	
Riv Area /	Region :10 - er Basin :212 - / District :	SYDNEY SOUTH HAWKESBURY	I COAST 7 RIVER		CMA Map Grid Zone	:9130-1S :56/1	MONA VALE Scale :1:25,	E 000	
E Elevation	Clevation : n Source :(Unkno	own)			Northing Easting	:6272867 :339776	Lat Longi	itude (S) :33° 4 tude (E) :151°	40' 19" 16' 18"
	GS Map :0055B	3 MGA Zoi	ne :56		Coordinate Source	:			
Constru H-Hole;P-Pipe;OD H P Compone 1 1 Casing	Negative O-Outside Diameter;ID- ent Type (Unknown)	depths indicate Above G Inside Diameter;C-Ceme From (m) -0.30	round Level; ented;SL-Slot Length; To (m) OD (mm) 1.70 152	A-Aperture;GS-Grain Siz ID (mm) Interval Det Su	e;Q-Quantity;PL-Placeme tails spended in Clamps	nt of Gravel Pack;F	PC-Pressure Cemented	;S-Sump;CE-Centra	lisers
Water Be	earing Zone	S sness (m) WBZ Type		S.W.L. (m) D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
26.00 48.00	27.00 49.00	1.00 (Unknown) 1.00 (Unknown) 1.00 (Unknown)							(Unknown) (Unknown) (Unknown)

Drillers Log

	- ° O		
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 ***

Converted From HYDSYS

GW057745				Convertee	d From HYDSYS
Licence :10BL123454]	Licence Status Lapsed	Intended Purpo	se(s)
Work Type :Bore open thru rock Work Status :(Unknown) Construct. Method :Cable Tool Owner Type :Private]	DOMESTIC IRRIGATION STOCK	IRRIGATION	SC(3)
Commenced Date : Completion Date :01-Sep-1982	Final Depth : Drilled Depth :	150.00 m 150.00 m			
Contractor Name : Driller :1435 ISE Assistant Driller's Name :	ELT, John Hans				
Property : - N/A GWMA : - GW Zone : -		St	anding Water Level : Salinity : Yield :	0-500 ppm	
Site Details					
Site Chosen By	Form A : Licensed :	County CUMBERLAND CUMBERLAND	Parish NARRABEEN NARRABEEN	Portion/Lot DP L10 DP25951 (69) 10 25951	
Region : 10 - SYDNEY SC River Basin : 212 - HAWKESB Area / District :	OUTH COAST URY RIVER		CMA Map : 9130-1 Grid Zone : 56/1	S MONA VALE Scale :1:25,000	
Elevation : Elevation Source :(Unknown)			Northing :627130 Easting :338540	D6 Latitude (S) :33° D Longitude (E) :15	° 41' 9" 1° 15' 29"
GS Map :0055B3 MGA	Zone : 56	Со	ordinate Source :		
Property Property Provided Hamilton Construction Negative depths indicate Ab H-Hole; P-Pipe; OD-Outside Diameter; ID-Inside Diamet	ove Ground Level; -Cemented;SL-Slot Length; m) To (m) OD (mm) 30 6.20 168 00 6.20 0	A-Aperture;GS-Grain Size;Q ID (mm) Interval Details Cemer (Unkr	-Quantity;PL-Placement of Grave s ited iown)	el Pack;PC-Pressure Cemented;S-Sump;CE-Cen	tralisers
From (m) To (m) Thickness (m) WBZ T 24.80 25.00 0.20 Consol 145.10 146.00 0.90 Consol	ype Lidated Lidated	S.W.L. (m) 25.00 32.00	D.D.L. (m) Yield	d (L/s) Hole Depth (m) Duration (hr) 0.03 0.27	Salinity (mg/L) Fresh Fresh
Drillers Log					
From (m) To (m) Thickness(m) Drillers Description 0.00 0.60 0.60 To (m) Thickness(m) Drillers Description 0.60 0.90 0.30 Gravel Sandy Operation Operation The constraint of the constra	on Silty Silty Open Y Silty Silty		Geological Ma Topsoil Gravel Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Clay Sandstone Clay Sandstone Sandstone Sandstone Sandstone	tterial Comments	

Remarks

*** End of GW057745 ***

Converted From HYDSYS

Licence :10BL151475			Licence Status	Active	Inton	dad Purnosa(2)
Work Type :Bore open the Work Status :(Unknown) Construct. Method :Rotary Owner Type :Private	u rock		DOMESTIC STOCK	(pose(s)	DOM	iestic CK	5)
Commenced Date :01-Feb-1993 Completion Date :03-Feb-1993	Final Depth : Drilled Depth :	116.00 m 116.00 m					
Contractor Name :INTERTECH Driller :1489 Assistant Driller's Name :	I DRILLING BARDEN, Colin Leslie						
Property : - SMITH GWMA : - GW Zone : -			Standing Water Sa	Level : linity : Yield :	14.50 m 140.00 mg/L 1.30 L/s	Fresh	
Site Details							
Site Chosen By	C Form A :C Licensed :C	ounty UMBERLAND UMBERLAND	Parisl NARF NARF	1 RABEEN RABEEN	Portion / 169 169 7520	Lot DP 046	
Region :10 - SYDM River Basin :212 - HAW Area / District :	IEY SOUTH COAST VKESBURY RIVER		CMA Ma Grid Zon	p :9130-4S e :56/1	HORNSBY Scale :1:25,00	00	
Elevation : Elevation Source :(Unknown)			Northin Eastin	g :6272001 g :337729	Latit Longit	ude (S) :33° 40 ude (E) :151° 1)' 46" 14' 58"
GS Map :0055A3	MGA Zone :56	(Coordinate Sourc	e :GD.,ACC.MA	AP		
Construction Negative depths in H-Hole:P-Pipe;OD-Outside Diameter;ID-Inside D H P Component Type 1 Hole 1 Casing PVC Class 9 1 Casing Pressure Cemented	dicate Above Ground Level; iameter;C-Cemented;SL-Slot Length;A From (m) To (m) OD (mm) II 42.00 116.00 152 -0.50 4.70 160 0.00 4.70 0	Aperture;GS-Grain Size D (mm) Interval Deta Dow (Un	:Q-Quantity;PL-Placen ails n Hole Hammer uknown)	nent of Gravel Pack;Po	C-Pressure Cemented;S	-Sump;CE-Centrali	sers
Water Bearing Zones							
From (m) To (m) Thickness (m) 83.00 107.50 24.50) WBZ Type	S.W.L. (m) 14.50	D.D.L. (m)	Yield (L/s) 1.30	Hole Depth (m) 116.00	Duration (hr)	Salinity (mg/L) 140.00
Barbon To (m) Thickness(m Drillers 42.00 60.00 18.00 SANDS' 60.00 61.00 10.00 SANDS' 61.00 61.20 0.20 FRACTU 61.20 68.00 6.80 SANDS' 68.00 83.00 15.00 SANDS' 83.00 107.00 24.00 SANDS' 107.00 107.50 0.50 FRACTU 107.50 116.00 8.50 SANDS'	Description ONE/GREY F.G. ONE/BED SHALE JRED ONE GREY F.G. ONE GREY SMALL FRACT/BED SH ONE COURSE OPEN GRAIN W.B. JRED W.D. ONE COURSE OPEN GRAIN W.B.	ALES	G	eological Material	Commen	ts	

Remarks

Previous Lic No: 10BL131472 due to alteration work.

*** End of GW059821 ***

GW060293

Converted From HYDSYS

0110002/0							
Licence :10BL127611			Licence Stat	us Cancelled	T /	1.15	
Work Type :Bore open thru Work Status :(Unknown) Construct. Method :Cable Tool Owner Type :Private	ı rock		Authorised I IRRIGATION	Purpose(s) N	Inte IRR	nded Purpose IGATION	(5)
Commenced Date : Completion Date :01-Sep-1986	Final Depth : Drilled Depth :	34.00 m 34.00 m					
Contractor Name : Driller :1435 Assistant Driller's Name :	ISELT, John Hans						
Property : - N/A GWMA : - GW Zone : -			Standing Wate	er Level : Salinity : Yield :		Fresh	
Site Details							
Site Chosen By	Form A Licensed	County CUMBERLAND CUMBERLAND	Par NA NA	ish RRABEEN RRABEEN	Portion L2 DP5 LT11 D	/ Lot DP 2208 (139) P52208 PT139	
Region :10 - SYDN River Basin :212 - HAW Area / District :	EY SOUTH COAST KESBURY RIVER		CMA N Grid Z	/ap :9130-4S one :56/1	HORNSBY Scale :1:25,0	000	
Elevation : Elevation Source :(Unknown)			North East	ting :6271542 ting :337892	Lati Longi	itude (S) :33° 4 tude (E) :151°	1' 1" 15' 4"
GS Map :0055B3	MGA Zone :56		Coordinate Sou	Irce :GD.,ACC.M	AP		
Construction Negative depths ind H-Hole:P-Pipe;OD-Outside Diameter;ID-Inside Diameter;ID-	icate Above Ground Level; uneter;C-Cemented;SL-Slot Length From (m) To (m) OD (mm) -0.20 4.40 168	h;A-Aperture;GS-Grain Siz ID (mm) Interval De Dr	ze;Q-Quantity;PL-Plac tails iven into Hole	cement of Gravel Pack;F	C-Pressure Cemented	S-Sump;CE-Centra	lisers
From (m) To (m) Thickness (m) 29.20 30.30 1.10	WBZ Type Consolidated	S.W.L. (n 18.0	n) D.D.L. (m)	Yield (L /s) 1.10	Hole Depth (m)	Duration (hr)	Salinity (mg/L) Fresh
Drillers Log From (m) To (m) Thickness(m Drillers D) 0.00 1.40 3.60 2.20 1.40 3.60 2.20 Clay Laye 3.60 29.20 25.60 Sandstone 29.20 30.30 1.10 Sandstone 30.30 34.00 3.70 Sandstone	escription / Yellow r Grey Grey Coarse Water Supply Grey			Geological Material Soil Sandstone Clay Sandstone Sandstone Sandstone	Comme	ents	

Remarks

*** End of GW060293 ***

GW060467				Converted F	rom HYDSYS
Licence :10BL122807 Work Type :Bore open thru rock Work Status :(Unknown) Construct. Method :(Unknown) Owner Type :Private			Licence Status Active Authorised Purpose(s) DOMESTIC IRRIGATION STOCK	Intended Purpose(s) IRRIGATION	
Commenced Date :JCompletion Date :01-Jan-1982Dr	Final Depth : 1 illed Depth :	30.10 m 0.00			
Contractor Name : Driller : Assistant Driller's Name :					
Property : - N/A GWMA : - GW Zone : -			Standing Water Level : Salinity : Yield :	(Unknown)	
Site Details					
Site Chosen By	County Form A :CUMB Licensed :CUMB	/ ERLAND ERLAND	Parish NARRABEEN NARRABEEN	Portion/Lot DP L14 DP12115 (81) 15 12115	
Region :10 - SYDNEY SOUT River Basin :213 - SYDNEY COA Area / District :	Ή COAST ST - GEORGES RIVER		CMA Map : 9130-18 Grid Zone : 56/1	MONA VALE Scale :1:25,000	
Elevation : Elevation Source :(Unknown)			Northing : 6271903 Easting : 339251	Latitude (S) :3 3° 40' Longitude (E) :1 51° 15	50" 5' 57"
GS Map :0055B3 MGA Zo	one :56	(Coordinate Source :GD.,ACC.M	/IAP	
Negative depths indicate Above of Construction H-Hole:P-Pipe:OD-Outside Diameter;ID-Inside Diameter;C-Cen H P From (m) 1 1 Casing Asbestos Cement 0.00 Water Bearing Zones Construction	Ground Level; nented;SL-Slot Length;A-Apertur To (m) OD (mm) ID (mm 9.10 152	e;GS-Grain Siza) Interval Det Dri	e;Q-Quantity;PL-Placement of Gravel Pack ails Iven into Hole	PC-Pressure Cemented;S-Sump;CE-Centralise	15
From (m) To (m) Thickness (m) WBZ Type	(No Water Be	S.W.L.(m) earing Zo) D.D.L.(m) Yield(L/s) one Details Found)	Hole Depth (m) Duration (hr)	Salinity (mg/L)
N 111 - X					
Drillers Log From (m) To (m) Thickness(m Drillers Description			Geological Material	Comments	

From (m) To (m) Thickness(m Drillers Description

Remarks

*** End of GW060467 ***

GW061466

Converted From HYDSYS

0///01400					
Licence :10BL133892			Licence Status Active	Intended Purnose	(s)
Work Type :Bore Work Status :(Unknown) Construct. Method :(Unknown) Owner Type :Private			DOMESTIC	DOMESTIC	
Commenced Date : Completion Date :01-Jan-1983	Final Depth : Drilled Depth :	76.20 m 0.00			
Contractor Name : Driller : Assistant Driller's Name :					
Property : - N/A GWMA : - GW Zone : -			Standing Water Level : Salinity : Yield :	(Unknown)	
Site Details					
Site Chosen By	C Form A :C Licensed :C	ounty UMBERLAND UMBERLAND	Parish NARRABEEN NARRABEEN	Portion/Lot DP 61 3	
Region :10 - SYDN River Basin :212 - HAV Area / District :	VEY SOUTH COAST VKESBURY RIVER		CMA Map : 9130-15 Grid Zone : 56/1	S MONA VALE Scale :1:25,000	
Elevation : Elevation Source :(Unknown)			Northing :627270 Easting :339495	9 Latitude (S) : 33° 4 Longitude (E) : 151°	0' 24" 16' 7"
GS Map :0055B3	MGA Zone :56	(Coordinate Source :GD.,AC	CC.MAP	
Construction Negative depths in H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside D H H P Component Type 1 1 Casing P.V.C.	dicate Above Ground Level; iameter;C-Cemented;SL-Slot Length;A- From (m) To (m) OD (mm) I 0.00 0.00 152	Aperture;GS-Grain Size D (mm) Interval Det (Ur	e;Q-Quantity;PL-Placement of Gravel ails aknown)	Pack;PC-Pressure Cemented;S-Sump;CE-Centra	isers
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 Wate	r Bearing Zo	one Details Found)		
Drillers Log From (m) To (m) Thickness(m Drillers)	Description		Geological Mat	terial Comments	

Remarks

*** End of GW061466 ***

Licence :10BL143759 Licence Status Active Authorised Purpose(s) Intended Purpose(s) DOMESTIC IRRIGATION Work Type :Bore open thru rock Work Status :(Unknown) STOCK 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 **Standing Water Level :** GWMA: -(Unknown) Salinity : GW Zone : -Yield : Site Details Site Chosen By Parish Portion/Lot DP County Form A :CUMBERLAND NARRABEEN 81 Licensed :CUMBERLAND NARRABEEN **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

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 1.50 (Unknown)

Water Bearing Zones

To (m) Thickness (m) WBZ Type From (m)

(No Water Bearing Zone Details Found)

D.D.L. (m)

S.W.L. (m)

Coordinate Source :GD., ACC. MAP

Yield (L/s)

Geological Material

Hole Depth (m) Duration (hr)

Comments

Salinity (mg/L)

Drillers Log

To (m) Thickness(m Drillers Description From (m)

Remarks

*** End of GW062272 ***

Converted From HYDSYS

GW063622

Converted From HYDSYS

Licence :10DL155104			Licence Status Active		
Work Type :Bore Work Status :(Unknown) Construct. Method :Cable Tool Owner Type :Private			Authorised Purpose(s) DOMESTIC	Intended Purpose(s) DOMESTIC	
Commenced Date : Completion Date :01-Sep-1986	Final Depth : Drilled Depth :	46.00 m 46.00 m			
Contractor Name : Driller :1435 Assistant Driller's Name :	ISELT, John Hans				
Property : - N/A GWMA : - GW Zone : -		Si	tanding Water Level : Salinity : Yield :	Fresh	
Site Details					
Site Chosen By	Form A Licensed	County CUMBERLAND CUMBERLAND	Parish NARRABEEN NARRABEEN	Portion/Lot DP L2 DP30325 (87) 2 30325	
Region : 10 - SYDNE River Basin : 212 - HAWI Area / District :	EY SOUTH COAST KESBURY RIVER		CMA Map : 9130-1S Grid Zone : 56/1	MONA VALE Scale :1:25,000	
Region :10 - SYDN River Basin :212 - HAW Area / District : Elevation : Elevation Source :(Unknown)	EY SOUTH COAST KESBURY RIVER		CMA Map :9130-15 Grid Zone :56/1 Northing :6273154 Easting :340363	MONA VALE Scale :1:25,000 Latitude (S) :33° 40' 10" Longitude (E) :151° 16' 41"	
Region :10 - SYDNF River Basin :212 - HAW Area / District : Elevation : Elevation Source :(Unknown) GS Map :0055B3	EY SOUTH COAST KESBURY RIVER MGA Zone :56	Co	CMA Map :9130-15 Grid Zone :56/1 Northing :6273154 Easting :340363 Dordinate Source :GD.,ACC.	MONA VALE Scale :1:25,000 Latitude (S) :33° 40' 10" Longitude (E) :151° 16' 41" MAP	
Region :10 - SYDNI River Basin :212 - HAW: Area / District : Elevation : Elevation Source :(Unknown) GS Map :0055B3 Construction I-Hole:P-Pipe;OD-Outside Diameter;ID-Inside Diam H P Component Type 1 Casing Steel 1 Casing Pressure Cemented Casing Water Regaring Tomes	MGA Zone :56 cate Above Ground Level; meter;C-Cemented;SL-Slot Length; From (m) To (m) OD (mm) -0.30 6.20 168 0.00 6.20 168	Co A-Aperture;GS-Grain Size;Q ID (mm) Interval Detail Cemer (Unki	CMA Map :9130-1S Grid Zone :56/1 Northing :6273154 Easting :340363 Dordinate Source :GD.,ACC.: P-Quantity;PL-Placement of Gravel Pac Inted nown)	MONA VALE Scale :1:25,000 Latitude (S) :33° 40' 10" Longitude (E) :151° 16' 41" MAP k;PC-Pressure Cemented;S-Sump;CE-Centralisers	
Region :10 - SYDN River Basin :212 - HAW Area / District : Elevation : Elevation Source :(Unknown) GS Map :0055B3 Construction Negative depths indi H-Hole:P-Pipe;OD-Outside Diameter;ID-Inside Diam H P Component Type 1 1 Casing Steel 1 1 Casing Steel 1 1 Casing Pressure Cemented Casing Water Bearing Zones From (m) To (m) Thickness (m) V 22.30 22.60 0.30 (A SOUTH COAST KESBURY RIVER MGA Zone :56 cate Above Ground Level; meter;C-Cemented;SL-Slot Length; From (m) To (m) OD (mm) -0.30 6.20 168 0.00 6.20 168 WBZ Type Consolidated Consolidated	Co A-Aperture;GS-Grain Size;Q ID (mm) Interval Detail Cemer (Unkr S.W.L. (m) 20.00 9.00	CMA Map :9130-1S Grid Zone :56/1 Northing :6273154 Easting :340363 Dordinate Source :GD.,ACC. 2-Quantity:PL-Placement of Gravel Pac s nted nown) D.D.L. (m) Yield (L/s 0.11 0.30	MONA VALE Scale :1:25,000 Latitude (S) :33° 40' 10" Longitude (E) :151° 16' 41" MAP k;PC-Pressure Cemented;S-Sump;CE-Centralisers	ty (mg/I Fres Fres
Region :10 - SYDNE River Basin :212 - HAW: Area / District : Elevation : Elevation Source :(Unknown) GS Map :0055B3 Construction 1-Hole:P-Pipe:OD-Outside Diameter;ID-Inside Diameter;ID	MGA Zone :56 cate Above Ground Level; meter;C-Cemented;SL-Slot Length; From (m) To (m) OD (mm) -0.30 6.20 168 0.00 6.20 168 0.00 6.20 168 WBZ Type Consolidated Consolidated	Co A-Aperture;GS-Grain Size;Q ID (mm) Interval Detail Cemer (Unkr S.W.L. (m) 20.00 9.00	CMA Map :9130-1S Grid Zone :56/1 Northing :6273154 Easting :340363 Dordinate Source :GD.,ACC. Q-Quantity:PL-Placement of Gravel Pace is nted nown) D.D.L. (m) Yield (L/s 0.11 0.30	MONA VALE Scale :1:25,000 Latitude (S) :33° 40' 10" Longitude (E) :151° 16' 41" MAP k;PC-Pressure Cemented;S-Sump;CE-Centralisers	ty (mg/J Fres Fres

Remarks

*** End of GW063622 ***

GW064440

Licence :10BL138571 Work Type :Bore Work Status :(Unknown) Construct. Method :Rotary Air Owner Type :Private			Licence Status Active Authorised Purpose(s) DOMESTIC STOCK	Intended Purpose(s) DOMESTIC STOCK
Commenced Date : Completion Date :01-Nov-1988 Contractor Name : Driller : Assistant Driller': Name :	Final Depth : Drilled Depth :	150.00 m 0.00		
Property: - N/A GWMA: - GW Zone: -			Standing Water Level : Salinity : Yield :	(Unknown)
Site Details				
Site Chosen By	Con Form A :CU	unty MBERLAND	Parish NARRABEEN	Portion/Lot DP L1 DP213794 (83)

	Form A :C Licensed :C	UMBERLAND UMBERLAND	NARRABI NARRABI	EEN EEN	L1 DP2 LT1 DF	13794 (83) 213794	
Region : 10 - SYDN River Basin : 212 - HAW Area / District :		CMA Map :91 Grid Zone :56	30-1S 5/1	MONA VALE Scale :1:25,000			
Elevation : Elevation Source :(Unknown)			Northing :62 Easting :33	271952 88477	Lati Longi	itude (S) :33° 4 tude (E) :151°	0' 48" 15' 27"
GS Map : 0055B3	MGA Zone :56	Coor	dinate Source :G	D.,ACC.MA	ΔP		
Construction Negative depths ind	licate Above Ground Level;						
H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Dia H P Component Type 1 1 Casing Steel	ameter;C-Cemented;SL-Slot Length;A- From (m) To (m) OD (mm) I 0.00 33.00 168	Aperture;GS-Grain Size;Q-Q D (mm) Interval Details Driven	uantity;PL-Placement of	Gravel Pack;P0	C-Pressure Cemented	S-Sump;CE-Centra;	lisers
From (m) To (m) Thickness (m) 84.00 90.00 6.00	WBZ Type Consolidated	S.W.L. (m)	D.D.L. (m)	Yield (L/s) 0.20	Hole Depth (m)	Duration (hr)	Salinity (mg/L) (Unknown)
Drillers Log From (m) To (m) Thickness(m Drillers D	tescription		Geologia	cal Material	Comme	ents	

Remarks

PUMP TEST DATA SUSPECT

*** End of GW064440 ***

Converted From HYDSYS

GW064441

Licence :10BL16010: Work Type :Bore Work Status :Supply Obta Construct. Method :Down Hole : Owner Type :Private	5 ined Hammer		Licence Status Active Authorised Purpose(s) INDUSTRIAL RECREATION (GROUN	DWATER)	Intended Purpose INDUSTRIAL RECREATION (C	e(s) ROUNDWATER)
Commenced Date :23-Aug-199 Completion Date :18-Sep-1990	0 Final Depth : D Drilled Depth :	150.00 m 150.00 m				
Contractor Name :INTERTEC Driller :1466 Assistant Driller's Name :	H DRILLING FERGUSON, Gary					
Property : - HAMA GWMA : - GW Zone : -	ZKAINE	S	tanding Water Level : Salinity : Yield :	31.90 n 1.25 L	Good /s Cumulative	
Site Details						
Site Chosen By	Form A : Licensed :	County CUMBERLAND CUMBERLAND	Parish NARRABEEN NARRABEEN	Pc 1// 1 3	rtion/Lot DP 808703 808703	
Region : 10 - SYD River Basin : Area / District :	NEY SOUTH COAST		CMA Map : Grid Zone :	Scale :		
Elevation : Elevation Source :			Northing :627213 Easting :338950	34) I	Latitude (S) : 33° Longitude (E) :151°	40' 43" ' 15' 46"
GS Map :	MGA Zone :56	C	oordinate Source :			
Negative depths H-Hole:P-Pipe;OD-Outside Diameter;ID-Inside I H P Component Type 1 Hole Hole 1 1 Casing 1 1 Casing	indicate Above Ground Level; Diameter;C-Cemented;SL-Slot Length;A From (m) To (m) OD (mm) 0.00 150.00 152 -0.50 6.50 168.3	A-Aperture;GS-Grain Size; ID (mm) Interval Detai Down 158.7 C:	Q-Quantity:PL-Placement of Grave Is Hole Hammer 5-6.5m; Seated on Botto	el Pack;PC-Pressure Cea	nented;S-Sump;CE-Centr	alisers
From (m) To (m) Thickness (m) 84.00 86.00 2.0 120.00 150.00 30.0	n) WBZ Type 0 00	S.W.L. (m)	D.D.L. (m) Yield	l (L/s) Hole Dept 0.02 8 1.23 150	n (m) Duration (hr) 5.00 0.00	Salinity (mg/L)
Brom (m) To (m) Thickness(m) Drillers 0.00 6.00 6.00 SANDS 6.00 9.00 3.00 SANDS 9.00 21.00 12.00 BROW 21.00 24.00 3.00 BLACK 24.00 48.00 24.00 RED SA 48.00 96.00 9.00 RED SA 96.00 99.00 3.00 DLACK 99.00 117.00 18.00 PALE F 117.00 150.00 33.00 WHITE	S Description TONE STONE /FINE CLAY N SANDSTONE,SILT AND CLAY (SANDSTONE,SILT AND CLAY ANDSTONE,IRON AND CLAY ANDSTONE, IRON AND CLAY GREY SHALE AND CLAY YINK SANDSTONE AND CLAY SANDSTONE AND CLAY		Geological Ma Sandstone Sandstone Sandstone Sandstone Sandstone Shale Sandstone Shale	sterial (Comments	

Remarks

PREVIOUS LIC NO: 10BL141627

*** End of GW064441 ***

GW064442

Converted From HYDSYS

Licence :10BL160104	Licence Sta	tus Active	Intended Durnese(s)	
Work Type :Bore Work Status :Supply Obtained Construct. Method :Rotary Air Owner Type :Private	INDUSTRIA RECREATION	AL ON (GROUNDWATER)	INDUSTRIAL RECREATION (GRO	JNDWATER)
Commenced Date :Final Depth :Completion Date :01-Nov-1988Drilled Depth :	115.00 m 115.00 m			
Contractor Name : Driller : Assistant Driller's Name :				
Property: - HAMAZKAINE GWMA: - GW Zone: -	Standing Wa	ter Level : 45.00 Salinity : 90.30 Yield : 0.30	m Good L/s	
Site Details				
Site Chosen By Cou Form A :CUN Licensed :CUN	nty Pa MBERLAND NA MBERLAND NA	rish ARRABEEN ARRABEEN	Portion/Lot DP LT 1 DP 808703 1 808703	
Region :10 - SYDNEY SOUTH COAST River Basin :212 - HAWKESBURY RIVER Area / District :	CMA Grid Z	Map :9130-1S MON/A Zone :56/1 Scal	A VALE e :1:25,000	
Elevation : Elevation Source :(Unknown)	Nort Ea	hing :6272107 sting :338526	Latitude (S) :33° 40' 4 Longitude (E) :151° 15'	3" 29"
GS Map : 0055B3 MGA Zone : 56	Coordinate So	urce :GD.,ACC.MAP		
Negative depths indicate Above Ground Level; H-Hole:P-Pipe:OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Apper H Promonent Type From (m) To (m) OD (mm) ID (m) 1 1 Casing P.V.C. 0.00 13.00 168	rture;GS-Grain Size;Q-Quantity;PL-Pl mm) Interval Details Driven into Hol	acement of Gravel Pack;PC-Pressure	Cemented;S-Sump;CE-Centralisers	
Water Bearing ZonesFrom (m)To (m)Thickness (m)WBZ Type90.00115.0025.00 (Unknown)	S.W.L. (m) D.D.L. (m) 45.00	Yield (L/s) Hole Do	epth (m) Duration (hr) S	Salinity (mg/L) Good
Drillers Log From (m) To (m) Thickness(m) Drillers Description 0.00 3.00 3.00 Gravel 3.00 100.00 97.00 Sandstone Water Supply 100.00 115.00 15.00 Shale Water Supply		Geological Material Gravel Sandstone Shale	Comments	

Remarks

PREVIOUS LIC NO: 10BL138709

*** End of GW064442 ***

GW068615

Licence :10Bl Work Type :Bore Work Status :(Unk Construct. Method :Rota	L141903 mown) ry			Licence Status Active Authorised Purpose(s) DOMESTIC		Active rpose(s)	Intended Purpose(s)		
Owner Type :	5								
Commenced Date :10-F Completion Date :17-F	eb-1981 eb-1981	Final Depth Drilled Depth	n: 1 n: 1	25.00 m 25.00 m					
Contractor Name :SLA Driller : Assistant Driller's Name :	DE DRILLING SLA	DE, W.E.							
Property : -	WILLCOCKS			St	anding Water	Level :	15.50 m		
GWMA : - GW Zone : -					Salinity : Yield :		0.45 L/s		
Site Details									
Site Chosen By		For Lice	County rm A :CUMBI nsed :CUMBI	ERLAND ERLAND	Paris NAR NAR	h RABEEN RABEEN	Portion 174//75 174 752	h/Lot DP 2046 2046	
Region : 10 River Basin : Area / District :	- SYDNEY SO	UTH COAST			CMA Ma Grid Zoi	np : ne :	Scale :		
Elevation : Elevation Source :					Northiı Eastiı	ng :6272464 ng :338486	Lati Longi	itude (S) :33° 4 itude (E) :151°	40' 32" 15' 28"
GS Map :	MGA	Zone :56		Со	ordinate Sour	ce :			
Construction Negati	ve depths indicate Abo	ve Ground Level;							
H-Hole;P-Pipe;OD-Outside Diameter; H P Component Type 1 Hole Hole 1 1 Casing P.V.C.	ID-Inside Diameter;C-0 From (m 0.0 0.0	Cemented;SL-Slot) To (m) OD 0 125.00 0 12.00	Length;A-Aperture (mm) ID (mm) 155 155	GS-Grain Size;Q Interval Details Rotar Drive	-Quantity;PL-Places Y en into Hole	ment of Gravel Pack;PC	C-Pressure Cemented	;S-Sump;CE-Centra	lisers
Water Bearing Zon	ies								
From (m) To (m) The form 5.00 6.00 91.00 93.00 99.00 100.00	ickness (m) WBZ Ty 1.00 2.00 1.00	ре		S.W.L. (m)	D.D.L. (m)	Yield (L/s) 0.06 0.16 0.08	Hole Depth (m) 9.00 94.00 101.00	Duration (hr)	Salinity (mg/L)
114.00 116.00	2.00			15.50		0.15	125.00		
Drillers Log									
From (m) To (m) Thickness(2.00 0.00 2.00 2.7.0 2.00 27.00 25.0 27.00 107.00 80.0 107.00 109.00 2.6 109.00 125.00 16.0	m Drillers Description 0 SOIL 00 SOFT MUDSTONE 00 HARD SANDSTON 00 SHALE 00 SANDSTONE	n 2 AND SHALE NE			G	eological Material	Commo	ents	

Remarks

*** End of GW068615 ***

GW100017

Li Work Work S Construct. M Owner	Licence :10BL153221 Work Type :Bore Work Status :(Unknown) Construct. Method :Other Owner Type :			Licence Status Active Authorised Purpose(s) DOMESTIC IRRIGATION STOCK		Intended Purpose(s) DOMESTIC IRRIGATION STOCK			
Commenced Completion	Date : Date :23-Oct	-1993 I	Final Depth : Drilled Depth :	151.00 m 151.00 m					
Contractor D D Assistant Driller's	Name :INTER)riller :1489 Name :	TECH DRILLI BAR	NG DEN, Colin Les	lie					
Pro GV GW	perty: - SA WMA: - Zone: -	ANTA MULE			Standing Water Sa	Level : alinity : Yield :	200.00 mg/L		
Site Details	1								
Site Chosen By			Form License	County A :CUMBERLAND cd :CUMBERLAND	Paris NAR NAR	h ELLAN RABEEN	Portion 38 1211 38 1211	/ Lot DP 5 5	
R River Area / Di	egion :10 - Basin : istrict :	SYDNEY SOU	TH COAST		CMA Ma Grid Zoi	ap : ne :	Scale :		
Elev Elevation S	vation : ource :				Northin Eastin	ng :6271502 ng :339206	Lati Longi	tude (S) :33° 4 tude (E) :151°	11' 3" 15' 55"
Construct H-Hole:P-Pipe;OD-Ou H P Component 1 Hole 1 1 Losing S	Negative of tside Diameter;ID- Type Hole Steel	lepths indicate Abov Inside Diameter;C-C From (m) 0.00 6.00 -0.50	e Ground Level; emented;SL-Slot Len To (m) OD (mr 6.00 20 151.00 15 6.50	gth;A-Aperture;GS-Grain S n) ID (mm) Interval I 3 R 6 R C	ize;Q-Quantity;PL-Placer Details otary Air otary Air : O-6m; Seated on	ment of Gravel Pack;F	C-Pressure Cemented	S-Sump;CE-Centra	lisers
Water Bear From (m) 12.50 60.00 99.00 139.00	ring Zone To (m) Thick 13.00 80.00 104.00 150.00	S ness (m) WBZ Typ 0.50 20.00 5.00 11.00	e	S.W.L. (m) D.D.L. (m)	Yield (L/s) 0.25 0.05 0.10	Hole Depth (m) 6.00 6.00 6.00 6.00	Duration (hr)	Salinity (mg/L) 150.00 200.00 200.00
Drillers Log From (m) To (0.00 2 2.00 3 3.50 3 3.80 5 5.00 41 41.00 41 41.00 51 51.00 51 51.50 60 60.00 80 80.00 99 99.20 104 104.00 115 115.00 132 132.00 137 137.00 139 139.00 151 151.00 151	g Thickness(m) .00 2.00 (.50 1.50 (.60 1.20 (.00 36.00 (.00 36.00 (.00 36.00 (.00 36.00 (.00 36.00 (.00 8.80 (.00 8.00 (.00 8.00 (.00 20.00 (.00 20.00 (.00 20.00 (.00 3.00 (.00 5.00 (.00 5.00 (.00 5.00 (.00 5.00 (.00 1.00 (.00 1.00 (.00 1.00 (.00 1.00 (Drillers Description VERBURDEN & F JRANGE MED. GR WHTE CLAY BAN WANGE & WHITE VHITE S.S. & BED WHITE GREY S.S. 1 VHITE S.S. & BED WHITE G.S.S. WI VHITE S.S. & BED WHITE S.S. & BED VHITE S.S. & BED VHITE S.S. & BED VHITE S.S. & BED VHITE S.S. MED. C O.H.	ILLING AIN S.S. D SMED. GRAIN S.S. CLAY SHALE SHALE SHALE & WATER BEARING SHALE TH SMALL FRACTU WATER BEARING SHALE SHALE SHALE SHALE SHALE SHALE SHALE	X JRED	G	cological Material	Commo	nts	
Remarks									

*** End of GW100017 ***

GW100648

Licence :10BL157628 Work Type :Bore Work Status :(Unknown) Construct. Method :Rot. Rev. Circ. Owner Type :	ce :10BL157628 pe :Bore us :(Unknown) od :Rot. Rev. Circ. Air pe :		Licence Status Active Authorised Purpose(s) DOMESTIC	Intended Purpose(s) DOMESTIC STOCK		
Commenced Date : Completion Date :13-May-1996	Final Depth : Drilled Depth :	120.00 m 120.00 m				
Contractor Name :J.H. ISELT Driller :1435 Assistant Driller's Name :	ISELT, John Hans					
Property : - N/A GWMA : - GW Zone : -		S	tanding Water Level : Salinity : Yield :	Fresh		
Site Details						
Site Chosen By Driller	Form A Licensed	County CUMBERLAND CUMBERLAND	Parish NARRABEEN NARRABEEN	Portion/Lot DP 2//595804 2 595804		
Region : 10 - SYDN River Basin : Area / District :	EY SOUTH COAST		CMA Map : Grid Zone :	Scale :		
Elevation : Elevation Source :			Northing :6273489 Easting :339622	Latitude (S) :33° 39' 59" Longitude (E) :151° 16' 13"		
GS Map :	MGA Zone :56	C	oordinate Source :			
Property Negative depths indition H-Hole:P-Pipe;OD-Outside Diameter;ID-Inside Dia H P Component Type 1 Hole 1 Hole 1 Statistical Property	icate Above Ground Level; meter;C-Cemented;SL-Slot Length; From (m) To (m) OD (mm) 0.00 120.00 150 -0.30 3.00 160	A-Aperture;GS-Grain Size; ID (mm) Interval Detai Rota C: 0	Q-Quantity;PL-Placement of Gravel Pack;I Is Iry)-3m; Driven into Hole	PC-Pressure Cemented;S-Sump;CE-Centralisers		
From (m) To (m) Thickness (m) 59.50 59.70 0.20	WBZ Type	S.W.L. (m) 30.00	D.D.L. (m) 120.00 Yield (L/s) 0.12	Hole Depth (m) Duration (hr) Salinity (mg/L) 120.00 1.00 Fresh		
Drillers Log From (m) To (m) Thickness(m Drillers Drilers Drilers Drillers Drillers Drillers Drillers Drillers Driler	escription Yellow White Yellow Yellow (W.B.) Yellow		Geological Material	Comments		

Remarks

*** End of GW100648 ***

GW100838

Licence :10 Work Type :B Work Status :(U Construct. Method :R Owner Type :)BL157556 pre Jnknown) ptary					L A D	icence Status uthorised Pur OMESTIC	Active pose(s)	Int DO STO	ended Purpose MESTIC DCK	(5)
Commenced Date : Completion Date :27	7-Mar-1996	Final Dep Drilled Dep	oth : oth :	90 90	0.50 n 0.50 n	1 1					
Contractor Name :IN Driller :16 Assistant Driller's Name :	TERTECH DRII	LLING ULD, Richard									
Property : GWMA : GW Zone :	- N/A -					Sta	nding Water I Sal Y	Level : linity : Yield :	100.00 mg/L		
Site Details											
Site Chosen By Client Dril	ler	F Li	C orm A :C censed :C	County CUMBEI CUMBEI	RLAN RLAN	D D	Parish NARR NARR	ABEEN ABEEN	Portion 13//803 13 8032	n/Lot DP 3203 203	
Region :10 River Basin : Area / District :) - SYDNEY S	OUTH COAS	Т				CMA Map Grid Zone): e:	Scale :		
Elevation : Elevation Source :							Northing Easting	g :6272390 g :339276	Lat Long	itude (S) :33° 4 itude (E) :151°	40' 35" 15' 58"
GS Map :	MG	A Zone : 56				Coo	rdinate Source	e :			
Construction Herois Construction H-Hole;P-Pipe;OD-Outside Diame H P Component Type 1 Hole 1 Hole 1 Hole 1 Hole 1 Hole 1 I Casing Steel Image: Construction of the text of t	ter;ID-Inside Diameter; From 1 0 1 0 10 -1 0 0 10 -1 0 0 10 -1 0 0 10 -1 0 0 10 -1 0 0 10 -1 0 0 0 0	C-Cemented;SL-SI (m) To (m) C 00 1.30 .30 10.80 .80 90.50 .00 11.00 Type	ot Length;A D (mm) 210 210 158 168.3	-Aperture;C ID (mm) I 158.7	GS-Grain nterval S.W.L	Size;Q- Details Rotary Rotary C::	Quantity;PL-Placeme , , , -10.8m; Weldee D.D.L. (m)	ent of Gravel Pack;P d; Driven into Yield (L/s) 0.10	C-Pressure Cemented Hole Hole Depth (m) 42.50	;S-Sump;CE-Centra Duration (hr) 0.25	lisers Salinity (mg/L) 80.00
60.3065.8078.0078.70	5.50 0.70							0.40 0.20	66.50 78.50	0.25 0.25	80.00 100.00
Drillers Log From (m) To (m) Thickne 0.00 0.80 1.30 1.30 26.50 27.40 26.50 27.40 28.50 29.50 30.00 30.60 30.60 35.50 40.50 49.70 49.70 59.20 65.80 71.50 71.50 71.50 71.90 71.90 71.90 78.70 80.90 80.90 82.30 82.30 86.40 90.50 50.50	 And Constant State St	tion ROWN/GREY BA GREY, QUARTZ M DNE LT GREY, CLAY M BWN, QUARTZ M LT GREY, CLAY M LT. GREY, COARS T. GREY, COARS DNE LT. BWN, NARRO T. GREY, QUART T. GREY, QUART T. GREY, C.G. DSTONE - IRONST	NDS CLAY IATRIX AT MATRIX SE GRAIN Y QUARTZ I W QUARTZ Z MATRIX FONE, SOFT	MATRIX MATRIX Z BANDS F & FRACT	TURED		Geo	ological Material	Comm	ents	

Remarks

*** End of GW100838 ***

GW101494

Licence :10BL158124			Licence Status Cancelled	Intended Dunness	
Work Type :Bore Work Status :(Unknown) Construct. Method :Rotary Owner Type :			RECREATION (GROUNDWA	ATER) IRRIGATION	(8)
Commenced Date : Completion Date :29-Aug-1997	Final Depth : Drilled Depth :	140.00 m 140.00 m			
Contractor Name :B.B. DRILLING Driller :1649 Assistant Driller's Name :	BARRETT, Michael Go	erard			
Property : - N/A GWMA : - GW Zone : -		S	tanding Water Level : Salinity : Yield :		
Site Details					
Site Chosen By	Form A Licensed	County :CUMBERLAND :CUMBERLAND	Parish NARRABEEN NARRABEEN	Portion/Lot DP 2//525908 2 525908	
Region : 10 - SYDNE [*] River Basin : Area / District :	Y SOUTH COAST		CMA Map : Grid Zone :	Scale :	
Elevation : Elevation Source :			Northing :6270626 Easting :340256	Latitude (S) :33° 4 Longitude (E) :151°	41' 32" ' 16' 35"
GS Map : M	AGA Zone :56	Co	oordinate Source :		
Construction Negative depths indicative H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diam	tte Above Ground Level; eter;C-Cemented;SL-Slot Length rom (m) To (m) OD (mm) 0.00 140.00 150 0.00 3.00 150	A-Aperture;GS-Grain Size;(ID (mm) Interval Detail Perc Susp	Q-Quantity;PL-Placement of Gravel Pack; s ussion ended in Clamps	PC-Pressure Cemented;S-Sump;CE-Centra	ılisers
From (m) To (m) Thickness (m) W 14.90 120.00 105.10	BZ Type	S.W.L. (m) 14.90	D.D.L. (m) 110.00 Yield (L/s) 0.20	Hole Depth (m) Duration (hr) 140.00 8.00	Salinity (mg/L) Good
Drillers Log From (m) To (m) Thickness(m Drillers Des 0.00 60.00 60.00 SANDSTON 60.00 120.00 60.00 SANDSTON 120.00 140.00 20.00 SHALE, DA	cription IE, DARK GREY IE, WHITE RK GREY		Geological Material	Comments	

Remarks

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

*** End of GW101494 ***
GW101503

Licence :10BL158708			Licence Statu Authorised P	is Active	Intended Purpose(s)		
Work Type :Bore Work Status :Supply Obtain Construct. Method :Cable Tool Owner Type :Private	ied		INDUSTRIA		IND	USTRIAL	(5)
Commenced Date : Completion Date :08-Feb-1984	Final Depth : Drilled Depth :	46.00 m 46.00 m					
Contractor Name :J.H. ISELT Driller :986 Assistant Driller's Name :	ISELT, John Hans						
Property: - SMITH GWMA: - GW Zone: -			Standing Wate	er Level : Salinity : Yield :	14.00 m 1.25 L/s	Fresh	
Site Details							
Site Chosen By	Form A Licensed	County CUMBERLAND CUMBERLAND	Par i NAI NAI	ish RRABEEN RRABEEN	Portion 169 752 169 752	/ Lot DP 2046 2046	
Region : 10 - SYDN River Basin : Area / District :	EY SOUTH COAST		CMA M Grid Zo	Iap : one :	Scale :		
Elevation : Elevation Source :			North East	ing :6272001 ing :337755	Lati Longi	tude (S) :33° 4 tude (E) :151°	0' 46" 14' 59"
GS Map :	MGA Zone :56		Coordinate Sou	rce :GIS - Geograj	phic Information	System	
Negative depths ind H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Dia H P Component Type 1 Hole Hole 1 Casing P.V.C.	licate Above Ground Level; ameter;C-Cemented;SL-Slot Leng From (m) To (m) OD (mm 0.00 46.00 152 -0.50 4.70	th;A-Aperture;GS-Grain Siz) ID (mm) Interval De Pe C:	re;Q-Quantity;PL-Plac tails rcussion 0-4.7m; Driver	ement of Gravel Pack;PG	C-Pressure Cemented;	S-Sump;CE-Centra	isers
Water Rearing Zones		-					
From (m) To (m) Thickness (m) 12.10 12.40 0.30 30.80 31.30 0.50	WBZ Type	S.W.L. (m 8.0 14.0	D.D.L. (m) 0 16.00 0 17.00	Yield (L/s) 0.19 1.25	Hole Depth (m) 16.00 46.00	Duration (hr)	Salinity (mg/L) Fresh Fresh
Drillers Log From (m) To (m) Thickness(m) Drillers D 0.00 2.10 2.10 SANDY C 2.10 8.50 6.40 YELLOW 8.50 9.30 12.10 2.80 YELLOW 12.10 12.40 0.30 GREY SA 30.30 30.80 0.50 SHALE 30.30 30.80 0.50 SHALE 30.40 5.10 GREY SA 31.30 36.40 5.10 GREY SA 36.70 46.00 9.30 GREY SA	Description GRAVEL SANDSTONE SANDSTONE SANDSTONE NDSTONE(OPEN AND W.B.) NDSTONE NDSTONE NDSTONE NDSTONE NDSTONE	V.B.		Geological Material Gravel Sandstone Sandstone Sandstone Sandstone Shale Sandstone Sandstone Shale Sandstone Shale Sandstone	Comme	nts	

Remarks

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

*** End of GW101503 ***

GW101504

Licence :10BL158707			Licence Statu	is Active	Intended Purpose(s)			
Work Type :Bore Work Status :Supply Obtained Construct. Method :Rotary Owner Type :Private	d		INDUSTRIA	L	IND	USTRIAL	3)	
Commenced Date : Completion Date :09-Feb-1993	Final Depth : Drilled Depth :	48.00 m 48.00 m						
Contractor Name :INTERTECH D Driller :1489 Assistant Driller's Name :	RILLING BARDEN, Colin Leslie							
Property : - SMITH GWMA : - GW Zone : -		S	Standing Wate	er Level : Salinity : Yield :	180.00 mg/L 1.60 L/s			
Site Details								
Site Chosen By	Co Form A :CU Licensed :CU	unty JMBERLAND JMBERLAND	Par NAI NAI	ish RRABEEN RRABEEN	Portion LT 169 169 752	/ Lot DP DP 752046 046		
Region : 10 - SYDNE River Basin : Area / District :	Y SOUTH COAST		CMA M Grid Z	fap : one :	Scale :			
Elevation : Elevation Source :			North East	ing :6271942 ing :337859	Lati Longi	tude (S) :33° 4 tude (E) :151°	0' 48" 15' 3"	
GS Map :	MGA Zone :56	С	oordinate Sou	rce :GIS - Geogra	phic Information	System		
Construction Negative depths indic H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diam Diameter;ID-Inside Diameter;I	ate Above Ground Level; eter;C-Cemented;SL-Slot Length;A-A rom (m) To (m) DD (mm) ID 0.00 40.00 152 -0.60 9.60	perture;GS-Grain Size; (mm) Interval Deta Dowr C: (Q-Quantity;PL-Plac ils h Hole Hammer D-9.6m; Seated	cement of Gravel Pack;P d on Bottom	C-Pressure Cemented;	S-Sump;CE-Central	isers	
Water Bearing ZonesFrom (m)To (m)Thickness (m)W35.0035.300.30	/BZ Type	S.W.L. (m) 24.00	D.D.L. (m)	Yield (L/s) 1.60	Hole Depth (m) 48.00	Duration (hr)	Salinity (mg/L) 180.00	
Drillers Log From (m) To (m) Thickness(m Drillers Des 0.00 3.00 3.00 TOPSOIL A 3.00 9.00 6.00 CLAY AND 9.00 24.00 15.00 SANDSTON 24.00 36.00 12.00 SANDSTON 36.00 36.30 0.30 FRACTURE 36.30 48.00 11.70 SANDSTON	cription ND CLAY SANDSTONE &F.G.GREY, SMALL AMT CLAY WE AND QUARTZ, LOT OF CLAY & W.B U.5 L/PS & AND OURTZ, OPEN GRAIN			Geological Material Topsoil Clay Sandstone Sandstone Invalid Code Sandstone	Comme	nts		

Remarks

*** End of GW101504 ***

GW101751

	Licence :10BL158944			Licence Status Active	Intended Purpose(s)	
W Wo Construct Ow	ork Type :Bore rk Status :(Unknown) t. Method :Rotary Air ner Type :			DOMESTIC STOCK	DOMESTIC STOCK	
Commer Comple	nced Date : tion Date :01-Feb-1999	Final Depth : Drilled Depth :	132.00 m 132.00 m			
Contract Assistant Dril	tor Name :INTERTECH Driller :1736 ler's Name :	MILGATE, Dean Jo	hn			
(Property : - N/A GWMA : - GW Zone : -			Standing Water Level : Salinity : Yield :	36.00 m 102.00 mg/L 1.80 L/s	
Site Deta	nils					
Site Chosen Client	By Driller	Form Licens	County A :CUMBERLAND ed :CUMBERLAND	Parish NARRABEEN NARRABEEN	Portion/Lot DP 1//596295 1 596295	
Ri [.] Area	Region :10 - SYDN ver Basin : / District :	EY SOUTH COAST		CMA Map : Grid Zone :	Scale :	
] Elevatio	Elevation : on Source :			Northing :6272483 Easting :339433	Latitude (S) :33° 40' 32" Longitude (E) :151° 16' 5"	
	GS Map :	MGA Zone :56		Coordinate Source :		
H-Hole;P-Pipe;Ol H P Composed H Hole Hole Hole Cosing Construction Hole Hole Cosing Construction Hole Composed Hole Hole Hole Hole Hole Hole Hole Hole	UCLUDI D-Outside Diameter;ID-Inside Dia nent Type Hole Hole g Steel g PVC Class 9 ng Slots - Vertical	To (m) To (m) OD (m) 0.00 5.60 2 5.60 132.00 1 -0.40 5.60 16 -0.40 53.60 1 46.00 49.00 1	ngth;A-Aperture;GS-Grain Si m) ID (mm) Interval D 10 Rc 59 Rc .3 158.7 C 40 Sc 40 Sc 40 Pc	ze;Q-Quantity;PL-Placement of Gravel I etails btary Air btary Air : 0-5.6m; Driven into Hole rrewed and Glued; Suspended /C Class 9; Sawn; SL: 100mm;	Pack;PC-Pressure Cemented;S-Sump;CE-Centralisers in Clamps A: 4mm	
Water B	earing Zones					
From (m) 46.00 74.50 112.50 123.00	To (m) Thickness (m) 49.00 3.00 75.00 0.50 113.00 0.50 123.50 0.50	WBZ Type	S.W.L. (1	n) D.D.L. (m) Yield () 0. 0. 0. 0. 0.	L/s) Hole Depth (m) Duration (hr) Salin 10 54.00 0.25 60 78.00 0.25 30 114.00 0.25 80 132.00 0.50	ity (mg/L) 90.00 96.00 109.00 102.00
Drillers 1 From (m) 0.00 2.00 6.50 7.00	Log To (m) Thickness(m Drillers D 2.00 2.00 Fill 6.50 4.50 Grey Sand 7.00 0.50 Grey Clay	escription Istone M.G.		Geological Mate Fill Sandstone Clay	rial Comments	

Remarks

*** End of GW101751 ***

GW103073

	Licence :10BL15959	7		Licence Statu	s Active	Intended	Purnoso(s)
W Wa Construc Ow	Vork Type :Bore ork Status :(Unknown) t. Method :Rotary Air wner Type :			DOMESTIC STOCK	in pose(s)	DOMESTI STOCK	C
Commer Comple	nced Date : etion Date :29-Mar-200	Final Depth : 00 Drilled Depth :	150.00 m 150.00 m				
Contrac Assistant Dril	tor Name :INTERTEC Driller :1737 ller's Name :	CH READY, Mark Edward					
,	Property : - N/A GWMA : - GW Zone : -			Standing Wate S	r Level : Salinity : Yield :	140.00 mg/L	
Site Deta	ails						
Site Chosen Client	By Driller	Form A : Licensed :	County CUMBERLAND CUMBERLAND	Pari NAF NAF	sh RRABEEN RRABEEN	Portion/Lot E 255//752046 232	0P
Ri Area	Region :10 - SYD iver Basin : i / District :	DNEY SOUTH COAST		CMA M Grid Zo	ap : one :	Scale :	
Elevatio	Elevation : on Source :			Northi Easti	ing :6272593 ing :339163	Latitude (Longitude ()	S) :33° 40' 28" E) :151° 15' 54"
	GS Map :	MGA Zone :56		Coordinate Sou	rce :		
Constru H-Hole;P-Pipe;O H P Compo H Hole 1 Hole 1 1 Casin Water B From (m) 81.00	Negative depths PD-Outside Diameter;ID-Inside ment Type Hole g Steel Pearing Zones To (m) Thickness (82.00 1.	indicate Above Ground Level; Diameter;C-Cemented;SL-Slot Length;A From (m) To (m) OD (mm) 0.00 5.60 210 5.60 150.00 158 -0.40 5.60 168.3 m) WBZ Type 00	A-Aperture;GS-Grain Siz ID (mm) Interval Der Dov 158.7 C: S.W.L. (m 43.01	e:Q-Quantity;PL-Place ails wn Hole Hammer wn Hole Hammer 1-5.6m; Driv) D.D.L.(m)	ement of Gravel Pack;P en into Hole Yield (L/s) 0.50	C-Pressure Cemented;S-Sump Hole Depth (m) Durati 84.00	CE-Centralisers n (hr) Salinity (mg/L) 1.00 140.00
Drillers From (m) 0.00 0.50 3.50 16.00 16.20 24.00 30.00 46.50 59.00 62.00 73.00 73.50 82.00 82.30 85.00 135.00	Log To (m) Thickness(m Driller 0.50 0.50 SAND 3.50 3.00 YELL 16.00 12.50 WHT 16.20 0.20 IRONS 24.00 7.80 YELL 30.00 6.00 WHT 46.00 16.00 LT GR 46.50 0.50 IRONS 59.00 12.50 YELL 62.00 3.00 WHT 73.00 11.00 LT GR 73.50 0.50 IRONS 82.00 8.50 LT GR 82.30 0.30 IRONS 82.00 2.70 PINKT 135.00 50.00 LT GR	s Description Y LOAM DW SANDSTONE M.G. E SANDSTONE M.G. STONE DW SANDSTONE WITH IRON E SANDSTONE M.G. EY SANDSTONE M.G. EY SANDSTONE M.G. EY SANDSTONE M.G. EY SANDSTONE M.G. TONE EY SANDSTONE M.G. TONE EY SANDSTONE/QUARTZ BANDS STONE TO WHITE SANDSTONE M.G. EY SANDSTONE M.G. DARK GREY SANDSTONE M.G.			Geological Material Loam Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Ironstone Sandstone Ironstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone	Comments	

Remarks

*** End of GW103073 ***

GW103160

Licen Work Tyj Work State Construct. Metho Owner Tyj	ce :10BL159765 pe :Bore us :(Unknown) pd :Rotary Air pe :			Licence Stat Authorised I DOMESTIC STOCK	us Active Purpose(s)	Intended Purpose(s) DOMESTIC STOCK		
Commenced Da Completion Da	te : te : 03-Aug-2000	Final Depth Drilled Depth	120.50 m 120.50 m					
Contractor Nan Drill Assistant Driller's Nar	ne :INTERTECH er :1783 ne :	CRUMP, William						
Proper GWM GW Zor	ty: - N/A [A: - ne: -			Standing Wat	er Level : Salinity : Yield :	145.00 mg/L		
Site Details								
Site Chosen By Client	Driller	Forn Licen	County n A :CUMBERLAND sed :CUMBERLAND	Pa i NA NA	rish RRABEEN RRABEEN	Portion/Lot DP 1831//812302 1831 812302		
Regio River Bas Area / Distri	on :10 - SYDNE in : ct :	EY SOUTH COAST		CMA N Grid Z	Map : Cone :	Scale :		
Elevatio Elevation Sour	on : ce :			Nortl Eas	hing :6271548 ting :338282	Latitude (S) :33° 4 Longitude (E) :1 51°	41' 1" 15' 19"	
GS Ma	ap :	MGA Zone :56		Coordinate Sou	urce :			
H-Hole;P-Pipe;OD-Outside H P Component Type 1 Hole Hole 1 Hole Hole 1 Hole Hole 1 1 Casing Stee 1 1 Casing P.V. 1 1 Opening Slot Water Rearis	Diameter;ID-Inside Dian Diameter;ID-Inside Dian C. S Vertical	meter;C-Cemented;SL-Slot L From (m) To (m) OD (r 0.00 9.00 9.00 11.50 11.50 120.50 -0.40 11.60 16 -0.40 17.50 15.50 17.50	ength;A-Aperture;GS-Grain Si mm) ID (mm) Interval D 205 Re 210 D 155 D 8.3 158.7 C 140 Si 140 P	ize;Q-Quantity;PL-Pla etails otary Air own Hole Hammer own Hole Hammer :1-11.6m; We uspended in Cla VC Class 9; Saw	cement of Gravel Pack;P lded; Driven intc mps n; SL: .lmm; A: 4	C-Pressure Cemented;S-Sump;CE-Centra > Hole Hmm	lisers	
From (m) T 15.00 1 105.00 10	g Zones fo (m) Thickness (m) V .8.00 3.00 07.00 2.00	WBZ Type	S.W.L. (1	m) D.D.L. (m)	Yield (L/s) 0.30 0.05	Hole Depth (m) Duration (hr) 18.00 0.25 108.00 0.25	Salinity (mg/L) 153.00 145.00	
Drillers Log From (m) To (m) 0.00 9.00 14.00 15.00 15.00 18.00 20.00 22.00 22.00 32.00 38.00 40.00 41.00 41.00 42.00 32.00 38.00 40.00 41.00 42.50 43.00 45.00 52.00 54.50 59.00 61.00 66.00 67.00 77.00 78.00 93.50 105.00 105.00 107.00 113.00 113.00	Thickness(m Drillers De 9.00 FILL 5.00 SANDSTO 1.00 SANDSTO 2.00 SANDSTO 2.00 SANDSTO 2.00 SANDSTO 6.00 SANDSTO 6.00 SANDSTO 1.00 SANDSTO 1.00 SANDSTO 1.00 SANDSTO 1.50 SANDSTO 2.00 SANDSTO 1.00 SANDSTO 2.00 SANDSTO 2.00 SANDSTO	escription NE GREY NE / CLAY NE / CLAY NE / QUARTZ NE QUARTZ NE QUARTZ NE GREY NE GREY NE GREY NE QUARTZ NE GREY NE QUARTZ NE GREY NE QUARTZ NE GREY NE QUARTZ NE GREY NE QUARTZ NE GREY NE QUARTZ NE QUARTZ			Geological Material Fill Sandstone Sandstone Ouartz Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Quartz Sandstone Quartz Sandstone	Comments		

Remarks

*** End of GW103160 ***

GW103538

Licence :10BL159951 Work Type :Bore Work Status :(Unknown) Construct. Method :Rotary Air Owner Type : Commenced Date : Final Depth :							L A D S	icence Stat uthorised I OMESTIC TOCK	us Active Purpose(s)	Inte DO STO	e nded Purpose MESTIC DCK	(s)	
Commen Complet	ced Date : tion Date :1	7-Jan-2001	D	Final De rilled De	pth : pth :	132 132	2.00 m 2.00 m						
Contract Assistant Drill	or Name :I Driller :1 er's Name :	NTERTECH 737	REAI	OY, Mark	c Edward								
l G	Property : GWMA : GW Zone :	- N/A -						Sta	nding Wat	er Level : Salinity : Yield :	139.00 mg/L		
<u>Site Deta</u>	ils												
Site Chosen I Client	By			I	Form A : Jicensed :	County CUMBER CUMBER	RLANE RLANE)	Pa ı NA NA	rish .RRABEEN .RRABEEN	Portion 2//5962 2 59629	n/Lot DP 195 95	
Riv Area	Region :1 /er Basin : / District :	0 - SYDNI	EY SOU	ГН СОА	ST				CMA M Grid Z	Map : Zone :	Scale :		
F Elevation	Elevation : n Source :								North Eas	hing :6272500 ting :339309	Lat Longi	itude (S) :33° 4 itude (E) :151°	40' 31" ' 15' 60"
Constru H-Hole;P-Pipe;OD H P Compon 1 Hole 1 Hole 1 1 Casing 1 1 Casing	D-Outside Diam ent Type Hole Hole Steel PVC Class	egative depths ind eter;ID-Inside Dia 35 9	icate Above meter;C-Ce From (m) 0.00 5.60 -0.40 -0.40	Ground Ley mented;SL-: To (m) 5.60 132.00 5.60 47.60	vel; Slot Length; OD (mm) 210 156.5 168.3 140	A-Aperture;G ID (mm) Ir 158.7	S-Grain S nterval I I I C S	Size;Q-C Details Down H Down H C: 3-5 Screwe	Quantity;PL-Pla Hole Hammer Hole Hammer 5.6m; Drive Ed and Glue	ccement of Gravel Pack;P n into Hole d; Suspended in C	C-Pressure Cemented	;S-Sump;CE-Centra	lisers
Water Be From (m) 54.00 88.00 112.00 115.00	Earing 2 To (m 55.00 89.00 113.00 117.00	Thickness (m) 1.00 1.00 1.00 2.00	WBZ Type	:			S.W.L.	(m) 00	D.D.L. (m)	Yield (L/s) 0.10 0.10 0.40 0.10	Hole Depth (m) 60.00 90.00 114.00 120.00	Duration (hr) 25.00 25.00 25.00 50.00	Salinity (mg/L) 150.00 150.00 140.00 139.00
Drillers 1 From (m) 0.00 0.50 2.00 14.00 19.00 19.20 20.00 20.40 21.50 26.00 37.00 37.50 39.00 57.00 99.00 99.00 99.20 102.00 111.00 115.30 117.00 125.00	Log Thickr To (m) Thickr 0.50 2.00 14.00 19.00 19.20 20.00 20.40 21.00 21.50 26.00 37.00 37.50 39.00 57.00 78.00 99.00 99.20 102.00 111.00 115.00 115.00 115.00 125.00 132.00	Instant Image Stress 0.50 OVERBUI 1.50 WEATHE 12.00 WHITE T 5.00 YELLOW 0.20 IRONSTO 0.80 GREY SA 0.40 WHITE C 0.60 WHITE S. 0.50 IRONSTO 1.60 WHITE S. 0.50 IRONSTO 1.50 GREY CL 18.00 WHITE S. 21.00 UHITE T 9.00 LT GREY 0.20 IRONSTO 2.00 WHITE S. 2.00 ULT GREY 2.00 UKONSTO 2.00 UKONSTO 2.00 UKONSTO 2.00 UKORSTO 2.00 UK GREY 2.00 UK GREY	escription RDEN RED SANC D PINK SA SANDSTONE LAY NE ANDSTONE LAY NE ANDSTONI NE ANDSTONI SANDSTON NE SANDSTO SANDSTO SANDSTO SANDSTO SANDSTO SANDSTO SANDSTO SANDSTO SANDSTO	ISTONE NDSTONE INE M.G. E M.G. E M.G. E M.G. E M.G. INE M.G. INE M.G. INE M.G. INE M.G. INE M.G. INE M.G. INE M.G. INE M.G.	М.G. м.G. : M.G. RTZ					Geological Material Overburden Sandstone Sandstone Sandstone Clay Ironstone Sandstone Clay Ironstone Sandstone Ironstone Clay Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Dacite(Tonalite) Sandstone Dacite(Tonalite) Sandstone Dacite(Tonalite) Sandstone	Comm	ents	

Remarks

*** End of GW103538 ***

GW104173

Licence :10BL160499 Work Type :Bore Work Status : Construct. Method :Rotary Owner Type : Commenced Date : Fin								Licence Stat Authorised I DOMESTIC STOCK	us Active Purpose(s)	Inte DOI STC	e nded Purpose MESTIC OCK	(8)
Commen Comple	nced Date : tion Date :0	1-Mar-2002	F Dri	inal Dep lled Dep	oth : oth :	150 150	0.50 m 0.50 m					
Contract Assistant Dril	tor Name :II Driller :1 ler's Name :	NTERTECH 1 783	DRILLIN CRUM	G P, Willia	ım							
(Property : GWMA : GW Zone :	- N/A -					S	Standing Wat	er Level : Salinity : Yield :	134.00 mg/L		
Site Deta	ils											
Site Chosen	Ву			F Li	orm A : censed :	County CUMBER CUMBER	LAND LAND	Pa NA NA	rish JRRABEEN JRRABEEN	Portion LT D D D 3315	/Lot DP PP 33150 0	
Riv Area	Region :1 ver Basin : / District :	0 - SYDNI	EY SOUTI	H COAS	Т			CMA I Grid Z	Map : Zone :	Scale :		
l Elevatio	Elevation : on Source :							Nortl Eas	hing :6272118 sting :338993	Lat Longi	itude (S) :33° 4 tude (E) :151°	40' 43" 15' 47"
H-Hole;P-Pipe;OI H P Comport Hole Hole Hole Casing Casing	D-Outside Diam nent Type Hole Hole g Steel g PVC Clas	eter;ID-Inside Dia	meter;C-Cem From (m) 0.00 5.50 -0.50 -0.50	ented;SL-S To (m) (5.50 150.50 5.50 89.50	lot Length; DD (mm) 210 158 168.3 140	A-Aperture;G ID (mm) Ir 158.7 130	S-Grain Size; nterval Deta Dowr Dowr C: - Scre	Q-Quantity;PL-Pk ils 1 Hole Hammer 1 Hole Hammer 1-5.5m; Dri ewed and Glue	acement of Gravel Pack;P	C-Pressure Cemented	;S-Sump;CE-Centra	lisers
Water B From (m) 86.30 94.00 142.00 143.50	Caring Z To (m) 90.00 100.00 142.50 144.00	ONES Thickness (m) 3.70 6.00 0.50 0.50	WBZ Type				S.W.L. (m) 50.00	D.D.L. (m)	Yield (L/s) 0.30 0.30 0.90 1.10	Hole Depth (m) 90.50 102.50 144.50 150.50	Duration (hr) 0.25 0.25 0.25 0.25 0.25	Salinity (mg/L) 97.00 106.00 120.00 134.00
Drillers 7 From (m) 0.00 2.00 4.00 27.00 28.50 30.00 44.30 44.30 45.50 47.00 56.50 58.00 61.00 62.00 85.00 86.30 86.30 86.30 90.00 94.00 105.50 110.00 142.50 143.50 144.00	Log To (m) Thickn 2.00 27.00 28.50 30.00 44.00 44.30 44.30 44.30 44.30 45.50 47.00 56.50 58.00 61.00 62.00 86.30 90.00 94.00 100.00 105.50 110.00 110.00 1142.50 144.50 144.00 150.50	ess(m Drillers D 2.00 SAND AN 2.00 PINK SAN 2.00 PINK SAN 2.00 SANDSTC 1.50 CLAYSTC 1.50 SANDSTC 3.70 SANDSTC 4.50 SANDSTC 3.50 SANDSTC	escription D ROCKS DISTONE DISTONE INE LIGHT F NE AND QU NE LIGHT C EAM NE, QUART NE QUART NE AND QU NE, BANDS NE LIGHT C NE, BANDS NE LIGHT C NE, QUART NE, QUART NE, QUART NE D/G, FR. NE GREY INE GREY INE GREY INE GREY INE GREY	BROWN ARTZ REY JREY Z REY ARTZ OF CLAY REY Z TZ ONE Z REY ACT. Z, FRACT.					Geological Material Sand Sandstone Sandstone Claystone Gravel Claystone Sandstone Clay Ironstone Gravel Claystone Sandstone Clay Ironstone Gravel Ironstone Sandstone	Comm	ents	

Remarks

*** End of GW104173 ***

GW104217

Licence :10BL160567 Work Type :Bore Work Status :Supply Obtained Construct. Method :Rotary Owner Type :Private			Licence Stat Authorised I DOMESTIC STOCK	us Active Purpose(s)	Intended Purpose DOMESTIC STOCK	2(\$)
Commenced Date : Completion Date :05-Mar-2002	Final Depth : Drilled Depth :	150.00 m 150.00 m				
Contractor Name :INTERTECH DI Driller :1783 Assistant Driller's Name :	RILLING CRUMP, William					
Property : - SACCO GWMA : - GW Zone : -			Standing Wat	er Level : Salinity : Yield :	58.00 m 134.00 mg/L 0.20 L/s	
Site Details						
Site Chosen By Client Driller	Form A : Licensed :	County CUMBERLAND CUMBERLAND	Pa i NA NA	rish RRABEEN RRABEEN	Portion/Lot DP LT 26 DP 12115 26 12115	
Region : 10 - SYDNEY River Basin : Area / District :	SOUTH COAST		CMA M Grid Z	Map : Zone :	Scale :	
Elevation : Elevation Source :			North Eas	hing :6272141 ting :339505	Latitude (S) :33° Longitude (E) :151	40' 43" ° 16' 7"
GS Map : M	IGA Zone :56		Coordinate Sou	urce :Map Interpret	ation	
H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diame H P Component Type Fr Hole Hole Hole Hole Casing Steel 1 Casing PVC Class 9 Water Bearing Zones	ter;C-Cemented;SL-Slot Length; om (m) To (m) OD (mm) 0.00 5.50 210 5.50 150.00 158 -0.50 5.50 168.3 -0.50 89.50 140	A-Aperture;GS-Grain Siz ID (mm) Interval De Do Do 158.7 C: 130 Sc	e:Q-Quantity;PL-Pla tails wn Hole Hammer wn Hole Hammer 1-5.5m; Dri rewed and Glue	cement of Gravel Pack;Pd ven into Hole d; Suspended in C	C-Pressure Cemented;S-Sump;CE-Centr lamps	alisers
From (m) To (m) Thickness (m) WI 60.50 61.00 0.50 94.00 101.50 7.50 116.00 117.00 1.00 132.00 133.00 1.00	ЗZ Туре	S.W.L. (n 58.0	n) D.D.L. (m)	Yield (L/s) 0.10 0.30 0.30 0.20	Hole Depth (m) Duration (hr)	Salinity (mg/L) 120.00 128.00 134.00 134.00
Drillers Log						
From (m) 16 (m) Indextessifi Drillers Desc 0.00 1.50 1.50 SANDS AND 1.50 3.00 1.50 SANDSTONI 3.00 21.00 18.00 SANDSTONI 21.00 21.50 0.50 CLAY DARK 21.50 29.00 7.50 SANDSTONI 29.00 30.50 1.50 SHALE 30.50 45.00 14.50 SANDSTONI 45.50 50.00 45.00 SANDSTONI 45.50 50.00 45.00 IA.50 50.00 55.00 5.00 RONSTONE 50.00 55.00 5.00 RONSTONE 50.00 55.00 5.00 RONSTONE 61.00 75.00 1.400 SANDSTONI 75.00 76.50 1.50 IRONSTONE 70.50 79.00 2.50 SANDSTONI 79.00 75.00 1.50 IRONSTONE 79.50 90.0 9.50 ANDSTONI	IIPUION LARGE ROCKS E RED E LIGHT BROWN E LIGHT BROWN E LIGHT GREY GREY OUJARTZ GREY E UARTZ E QUARTZ E FRACTURED E QUARTZ E GREY E GREY			Veological Material Sandstone Sandstone Clay Sandstone Shale Sandstone Shale Sandstone Ironstone Ironstone Ironstone Sandstone Ironstone Gravel Sandstone Ironstone Gravel Sandstone Clay Sandstone Ironstone Sandstone Clay Sandstone	Comments	

Remarks

*** End of GW104217 ***

GW104265

516 otained		Licence Stat Authorised 1 DOMESTIC STOCK	tus Active Purpose(s)	Intended Purpose(s) DOMESTIC STOCK		
Final Depth : 002 Drilled Depth :	210.00 m 210.00 m					
CH DRILLING CRUMP, William						
		Standing Wat	er Level : Salinity : Yield :	43.00 m 134.00 mg/L 0.10 L/s		
Form . License	County A :CUMBERLAND d :CUMBERLAND	Pa NA NA	rish IRRABEEN IRRABEEN	Portion LT 71 I 71 7520	/Lot DP DP 752046)46	
DNEY SOUTH COAST		CMA I Grid Z	Map : Zone :	Scale :		
		Nortl Eas	hing :6272512 sting :339916	Lati Longi	itude (S) :33° 4 tude (E) :151°	0' 31" 16' 23"
MGA Zone :56		Coordinate So	urce :Map Interpret	tation		
de Diameter;C-Cemented;SL-Slot Leng From (m) To (m) OD (mm 0.00 5.50 21 5.50 210.00 16 -0.50 5.50 168. -0.50 59.50 14	th;A-Aperture;GS-Grain Siz) ID (mm) Interval De 0 Do 0 Do 3 158.7 C: 0 130 Sc	e:Q-Quantity;PL-P& tails wn Hole Hammer wn Hole Hammer 1-5.5m; Dri rewed and Glue	acement of Gravel Pack;P	C-Pressure Cemented	;S-Sump;CE-Centra	isers
s (m) WBZ Type .00 .50 .50 .00 .00	S.W.L. (n 43.0	a) D.D.L. (m)	Yield (L/s) 0.10 0.10 0.10 0.10 0.10	Hole Depth (m) 54.00 84.00 102.00 114.00 210.00	Duration (hr) 0.25 0.25 0.25 0.25 0.25 0.25	Salinity (mg/L) 120.00 126.00 132.00 134.00 134.00
				_		
ers Description D DSTONE SOFT DSTONE/IRONSTONE YSTONE STONE STONE STONE STONE AND QUARTZ SSTONE AND QUARTZ SSTONE GREY DSTONE GREY DSTONE GREY DSTONE GREY DSTONE QUARTZ DSTONE QUARTZ DSTONE QUARTZ DSTONE QREY DSTONE QREY DSTONE QREY DSTONE QREY DSTONE QREY DSTONE QREY DSTONE GREY DSTONE GREY DSTONE GREY DSTONE GREY DSTONE DARK GREY FRACT. DSTONE DARK GREY DSTONE DARK GREY DSTONE DARK GREY DSTONE DARK GREY DSTONE DARK GREY DSTONE DARK GREY	95		Geological Material Sand Sand Sandstone Claystone Siltstone Sandstone Sandstone Sandstone Sandstone Gravel Sand Ironstone Gravel Sandstone	Comme	ents	
	16 tained Time Server	16 tained Term Depth : 210.00 m 20 Drilled Depth : 210.00 m CH DRILLING CRUMP, William CRUMP, William CRUMP, William CRUMP, William MGA Zone : 56 s indicate Above Ground Level; e Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Siz From (m) To (m) To (m) D (mm) Interval De 0.00 5.50 210 Do 5.50 210.00 160 Do 0.00 5.50 140 130 Se (m) WBZ Type S.W.L. (m 00 .00 5.50 140 130 Se (m) WBZ Type S.W.L. (m 00 .00 43.0 CRUMP SITUE STONE RONSTONE STONE SOFT STONE GREY STONE DARK GREY STONE DARK GREY STONE DARK GREY STONE DARK GREY	16 Licence Stat Authorised DOMESTIC STOCK tained STOCK 02 Drilled Depth : 210.00 m 02 Drilled Depth : 210.00 m CH DRILLING CRUMP, William Standing Wat Standing County Pa Form A :CUMBERLAND NA Licensed :CUMBERLAND NA Licensed :CUMBERLAND NA DNEY SOUTH COAST CMGA Zone :56 Coordinate So Sindicate Above Ground Level: e Dimeter:-Cemented:SL-Stot Length, A-Aperture:(GS-Grain Size-Q-Quantity:PL-PH From (m) To (m) Of (mm) D (mm) D Interval Detais North Eas 0.00 5.50 140 130 Screwed and Glue (m) WBZ Type SW.L (m) D.D.L. (m) 00 .00 5.50 140 130 Screwed and Glue (m) WBZ Type SW.L (m) D.D.L (m) 00 .00 53:00 43.00 43.00 STONE GREY STONE GREY STONE GREY STONE GREY STONE GREY STONE GREY STONE GREY STONE GREY STONE GREY STONE GREY STONE GREY STONE GREY STONE GREY STONE CALVERD STONE GREY STONE GREY <td>16 Licence Status Active Authorised Purpose(s) DOMESTIC tained STOCK 02 Final Depth 210.00 m 03 D'Filled Depth 210.00 m 04 D'Filled Depth 210.00 m 05 D'Filled Depth 210.00 m 06 CRUMP, William Standing Water Level : Salinity : Yield : Statuting Water Level : Salinity : Yield : Domestion of the status Active Mage Salinity : Yield : Domestion of the status Active Mage Salinity : Yield : Domestion of the status Active Mage Salinity : Yield : Domestion of the status Active Mage Salinity : Yield : Domestion of the status Active Mage Salinity : Grid Zone : Domestion of the status Active Appendic Color of the status Active Active Salinity : Pon (m 7 e(m 00 Domestic Domestic Hammer -0.50 5.50 210 Down: Hole Hammer -0.50 Down: Hole Hammer -0.50 Down: Hole Hammer -0.50 0.10 00 0.10 Down: Hole Hammer -0.50 0.10 0.10 01 130 Sterewed and Glued : Status Active Salistone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone San</td> <td>16 Licence Status Active Authorised Purpose(s) Inte DOMESTIC 10 STOCK STOCK 10 Final Depth : 210.00 m 10 Drilled Depth : 210.00 m 10 Drilled Depth : 210.00 m 11 CRUMP, William Standing Water Level : 43.00 m 12 Crump, William Standing Water Level : 43.00 m 13 CRUMP, William Standing Water Level : 43.00 m 14 County Parish Portion 15 Form A :CUMBERLAND NARRABEEN 17.711 16 Licensed :CUMBERLAND NARRABEEN 17.7320 DNEY SOUTH COAST Coordinate Source Map Interpretation Ideate Alowe Ground Level : Stating :33916 Longi 16 Ideater Alowe Ground Level : 0.00 1/20 Down Note Hammer 10.00 1/20 Down Note Hammer 1.00 100 Interval Details Down Note Hammer 10.00 1/20 Beetprint 1.00 100 Down Note Hammer 10.00 1/20 Beetprint 10.00 1/20 Beetprint 1.00 100 100 Down Note Hammer 10.00 1/20 Beetprint 10.00 1/20 Beetprint 1.00 100 100 Down Note</td> <td>Indicate Licence Status Active Authorised Purpose(s) DOMESTIC. Intended Purpose DOMESTIC. 02 Final Depth :: 210.00 m 03 Drilled Depth :: 210.00 m 04 Standing Water Level :: 43.00 m 05 Salinity :: 134.00 mgL 06 County Parish Form A: CUMBERLAND NARRABEEN 07 County Parish Form A: CUMBERLAND NARRABEEN 08 County County Parish Form A: CUMBERLAND NARRABEEN 09 County Control (Cumberland) NARRABEEN 117 71 DP 752046 DNEY SOUTH COAST CMA Map :: Scale : Control (Cumberland) Northing :6272512 Latitude (S) :33° 4 Longitude (E) :151° MGA Zone :56 Coordinate Source : Map Interpretation Iongitude (E) :151° MGA Zone :56 Coordinate Source : Map Interpretation Iongitude (E) :22.00 10:00 5:03 120 Domi Iotal Hamme Iongitude (E) :22.00 10:00 5:03 130 Berewel and Glued ? Supported in Clumps 10:00 5:03 120 Domi Iotal Hamme 10:00 5:03 120 Domi Iotal Hamme 10:00 5:03 120 Domi Iotal Hamme 10:00</td>	16 Licence Status Active Authorised Purpose(s) DOMESTIC tained STOCK 02 Final Depth 210.00 m 03 D'Filled Depth 210.00 m 04 D'Filled Depth 210.00 m 05 D'Filled Depth 210.00 m 06 CRUMP, William Standing Water Level : Salinity : Yield : Statuting Water Level : Salinity : Yield : Domestion of the status Active Mage Salinity : Yield : Domestion of the status Active Mage Salinity : Yield : Domestion of the status Active Mage Salinity : Yield : Domestion of the status Active Mage Salinity : Yield : Domestion of the status Active Mage Salinity : Grid Zone : Domestion of the status Active Appendic Color of the status Active Active Salinity : Pon (m 7 e(m 00 Domestic Domestic Hammer -0.50 5.50 210 Down: Hole Hammer -0.50 Down: Hole Hammer -0.50 Down: Hole Hammer -0.50 0.10 00 0.10 Down: Hole Hammer -0.50 0.10 0.10 01 130 Sterewed and Glued : Status Active Salistone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone San	16 Licence Status Active Authorised Purpose(s) Inte DOMESTIC 10 STOCK STOCK 10 Final Depth : 210.00 m 10 Drilled Depth : 210.00 m 10 Drilled Depth : 210.00 m 11 CRUMP, William Standing Water Level : 43.00 m 12 Crump, William Standing Water Level : 43.00 m 13 CRUMP, William Standing Water Level : 43.00 m 14 County Parish Portion 15 Form A :CUMBERLAND NARRABEEN 17.711 16 Licensed :CUMBERLAND NARRABEEN 17.7320 DNEY SOUTH COAST Coordinate Source Map Interpretation Ideate Alowe Ground Level : Stating :33916 Longi 16 Ideater Alowe Ground Level : 0.00 1/20 Down Note Hammer 10.00 1/20 Down Note Hammer 1.00 100 Interval Details Down Note Hammer 10.00 1/20 Beetprint 1.00 100 Down Note Hammer 10.00 1/20 Beetprint 10.00 1/20 Beetprint 1.00 100 100 Down Note Hammer 10.00 1/20 Beetprint 10.00 1/20 Beetprint 1.00 100 100 Down Note	Indicate Licence Status Active Authorised Purpose(s) DOMESTIC. Intended Purpose DOMESTIC. 02 Final Depth :: 210.00 m 03 Drilled Depth :: 210.00 m 04 Standing Water Level :: 43.00 m 05 Salinity :: 134.00 mgL 06 County Parish Form A: CUMBERLAND NARRABEEN 07 County Parish Form A: CUMBERLAND NARRABEEN 08 County County Parish Form A: CUMBERLAND NARRABEEN 09 County Control (Cumberland) NARRABEEN 117 71 DP 752046 DNEY SOUTH COAST CMA Map :: Scale : Control (Cumberland) Northing :6272512 Latitude (S) :33° 4 Longitude (E) :151° MGA Zone :56 Coordinate Source : Map Interpretation Iongitude (E) :151° MGA Zone :56 Coordinate Source : Map Interpretation Iongitude (E) :22.00 10:00 5:03 120 Domi Iotal Hamme Iongitude (E) :22.00 10:00 5:03 130 Berewel and Glued ? Supported in Clumps 10:00 5:03 120 Domi Iotal Hamme 10:00 5:03 120 Domi Iotal Hamme 10:00 5:03 120 Domi Iotal Hamme 10:00

Remarks

*** End of GW104265 ***

GW104417

Licence :10BL160790 Work Type :Bore Work Status :Supply Obtained Construct. Method :Rotary Owner Type :Private Commenced Date : Final Depth : 180.00							Licence Stat Authorised I DOMESTIC STOCK	tus Active Purpose(s)	Inte DO STO	ended Purpose MESTIC DCK	(8)	
Commer Comple	nced Date : etion Date :23-A	Aug-1982	D	Final D rilled I	Depth : Depth :	180. 180.	.00 m .00 m					
Contrac Assistant Dril	tor Name :unk Driller :178 ller's Name :	nown 3	CRUN	MP, Wi	lliam							
	Property : - GWMA : - GW Zone : -	N/A					S	Standing Wat	ter Level : Salinity : Yield :	33.00 m 134.00 mg/L 0.20 L/s		
Site Detc	ails											
Site Chosen Client	By				Form A Licensed	County CUMBER	LAND LAND	Pa NA NA	rish ARRABEEN ARRABEEN	Portion LT 8 D 8 3032	n/Lot DP P 30325 5	
Ri Area	Region : 10 ver Basin : / District :	- SYDNEY	Y SOU	ГН СО	AST			CMA I Grid Z	Map : Zone :	Scale :		
Elevatio	Elevation : on Source :							Nortl Eas	hing :6272609 sting :340101	Lat Long	itude (S) :33° 4 itude (E) :151°	40' 28" 16' 31"
	GS Map :	N	1GA Z	one :56	i		C	Coordinate So	urce :Map Interpre	tation		
Constru H-Hole;P-Pipe;O H P Compoo H Hole Hole 1 Hole 1 Casing Casing Kater B From (m) 45.00 67.00 71.60	D-Outside Diameter nent Type Hole Hole g Steel g PVC Class earing Zoi To (m) Tt 48.00 70.00	(ID-Inside Diamo Fr DES hickness (m) W 3.00 3.00 1.00	eter;C-Ce: rom (m) 0.00 5.50 -0.50 -0.50 BZ Type	mented;SI To (m) 5.50 180.00 5.50 47.50	L-Slot Length OD (mm) 210 159 168.3 140	a;A-Aperture;GS ID (mm) In 158.7	S-Grain Size: terval Deta Down C: Scro S.W.L. (m)	Q-Quantity;PL-Pla ils n Hole Hammer n Hole Hammer 1-5.5m; Dri ewed and Glue D.D.L. (m)	acement of Gravel Pack;F .ven into Hole d; Suspended in (Yield (L/s) 0.10 0.20 0.20	C-Pressure Cemented Clamps Hole Depth (m) 48.00 72.00 72.00	t;S-Sump;CE-Centra Duration (hr) 0.25 0.25 0.25	lisers Salinity (mg/L) 134.00 134.00
71.50 133.00	72.50 135.00	1.00 2.00					33.00		0.30	78.00 138.00	0.25	134.00 134.00
Drillers 2 From (m) 0.00 1.00 1.00 14.00 32.50 35.50 35.50 35.00 44.70 45.00 44.70 45.00 70.00 71.50 72.50 74.00 75.50 95.30 111.00 112.00 133.00 135.00	$\begin{array}{c} Log \\ \hline {\bf To} ({\bf m}) \ \ {\rm Thickness} \\ 1.00 \ \ 1. \\ 10.00 \ \ 9. \\ 14.00 \ \ 4. \\ 32.00 \ \ 18. \\ 32.50 \ \ 0. \\ 35.00 \ \ 2. \\ 35.50 \ \ 0. \\ 35.00 \ \ 2. \\ 35.50 \ \ 0. \\ 35.00 \ \ 3. \\ 44.70 \ \ 5. \\ 45.00 \ \ 0. \\ 48.00 \ \ 3. \\ 44.70 \ \ 5. \\ 45.00 \ \ 0. \\ 19. \\ 70.00 \ \ 3. \\ 71.50 \ \ 1. \\ 72.50 \ \ 1. \\ 74.00 \ \ 1. \\ 75.50 \ \ 1. \\ 95.00 \ \ 19. \\ 95.00 \ \ 19. \\ 95.00 \ \ 19. \\ 95.00 \ \ 19. \\ 95.00 \ \ 19. \\ 95.00 \ \ 19. \\ 110.00 \ \ 15. \\ 112.00 \ \ 1. \\ 133.00 \ \ 2. \\ 180.00 \ \ 45. \end{array}$	(*************************************	E LIGHT E LIGHT E WHITT E WHITT E GREY E QUAR E GREY E QUAR E GREY E QUAR E QUAR E GREY E QUAR E GREY E DARK E GREY E D/G FF E GREY	BROWN BROWN 3 3 TZ TZ TZ TZ TZ FRAC GREY RACTURI	TURED				Geological Material Topsoil Sandstone Shale Sandstone Clay Sandstone Sandstone Sandstone Clay Sandstone Clay Sandstone Sandstone Sandstone Ironstone Gravel Sandstone Sandstone Clay Sandstone	Comm	ents	

Remarks

*** End of GW104417 ***

GW104418

Licen Work Tyj Work Stat Construct. Metho Owner Tyj	ce :10BL160792 pe :Bore us :Supply Obtaine od :Rotary pe :Private	d		Licence Stat Authorised I DOMESTIC STOCK	us Active Purpose(s)	Inte DOI STC	ended Purpose MESTIC OCK	(s)
Commenced Da Completion Da	n te : 1 te : 21-Aug-2002	Final Depth Drilled Depth	: 180.00 m : 180.00 m					
Contractor Nan Drill Assistant Driller's Nar	ne :INTERTECH E er :1783 me :	DRILLING CRUMP, William						
Proper GWM GW Zoi	rty: - N/A IA: - ne: -			Standing Wat	er Level : Salinity : Yield :	71.00 m 134.00 mg/L 0.30 L/s		
<u>Site Details</u> Site Chosen By			County	Pai	rish	Portior	/Lot DP	
Client	Driller	For Lice	m A :CUMBERLAND nsed :CUMBERLAND	NA	RRABEEN RRABEEN	LT B D B 4031	P 403166 66	
Regio River Bas Area / Distri	on:10 - SYDNE in: ict:	Y SOUTH COAST		CMA M Grid Z	Map : Cone :	Scale :		
Elevatio Elevation Sour	on : ce :			Nortl Eas	hing :6272310 ting :338914	Lat Longi	itude (S) :33° 4 itude (E) :151°	0' 37" 15' 44"
Construction H-Hole:P-Pipe;OD-Outside H P Component Type Hole Hole Hole Hole 1 1 Casing Stee 1 1 Casing PVC	Negative depths indic Diameter;ID-Inside Diam e F 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	ate Above Ground Level; heter;C-Cemented;SL-Slot I From (m) To (m) OD (0.00 5.50 5.50 180.00 -0.50 5.50 16	Length;A-Aperture;GS-Grain Si mm) ID (mm) Interval D 210 D 157 D 58.3 158.7 C 140 So	ze;Q-Quantity;PL-Pla etails own Hole Hammer own Hole Hammer :1-5.5m; Dri crewed and Glue	cement of Gravel Pack;P ven into Hole d; Suspended in C	C-Pressure Cemented	;S-Sump;CE-Centra	lisers
From (m) T 86.50 9 114.00 11	g Zones Fo (m) Thickness (m) V 94.00 7.50 14.50 0.50	VBZ Type	S.W.L. (1	n) D.D.L. (m)	Yield (L/s) 0.25 0.05	Hole Depth (m) 96.00 120.00	Duration (hr) 0.25 0.25	Salinity (mg/L) 134.00 134.00
From (m) To (m) from (m) To (m) 0.00 0.50 0.50 17.00 22.00 23.00 23.00 23.00 28.00 28.30 28.30 28.30 28.30 35.00 35.00 35.00 35.00 45.00 45.00 57.00 60.00 68.00 68.00 68.00 65.50 93.00 93.00 94.00 98.00 114.00 114.50 180.00	Thickness(m Drillers De: 0.50 TOPSOIL 16.50 SANDSTOI 5.00 SANDSTOI 0.00 SHALE 5.00 SANDSTOI 0.30 CLAY 0.70 IRONSTON 1.00 SANDSTOI 2.00 IRONSTON 12.00 SANDSTOI 3.00 SANDSTOI 1.00 IRONSTON 11.00 IRONSTON 11.00 IRONSTON 11.00 SANDSTOI 6.50 SANDSTOI 0.00 SANDSTOI 0.00 SANDSTOI 0.00 SANDSTOI 0.05 SANDSTOI 0.05 SANDSTOI 0.50 SANDSTOI 0.50 SANDSTOI 0.50 SANDSTOI 0.50 SANDSTOI 0.50 SANDSTOI	scription NE LIGHT BROWN NE GREY NE GREY NE QUARTZ NE LIGHT BROWN SOFT NE QUARTZ NE LIGHT BROWN SOFT NE GREY NE GREY NE GREY NE GREY NE FINE QUARTZ NE FINE QUARTZ NE FINE QUARTZ NE FINE QUARTZ NE GREY NE QUARTZ NE QUARTZ NE QUARTZ NE QUARTZ NE QUARTZ NE QUARTZ			Geological Material Topsoil Sandstone Shale Sandstone Clay Ironstone Sandstone Sandstone Sandstone Sandstone Ironstone Gravel Sandstone Shale Sandstone Ironstone Sandstone Ironstone Sandstone Irvalid Code Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone	Comm	ents	

Remarks

*** End of GW104418 ***

GW105253

Licence :10BL162186 Work Type :Bore Work Status :Supply Obtained Construct. Method :Rotary Air Owner Type :						Licence Stat Authorised DOMESTIC STOCK	tus Active Purpose(s)	Inte DO STO	ended Purpose MESTIC DCK	(s)		
Commer Comple	nced Date : etion Date :16	5-Oct-2003	D	Final De rilled De	pth: pth:	19 19	2.50 m 2.50 m					
Contrac Assistant Dril	tor Name :IN Driller :14 ller's Name :	TERTECH	DRILLIN BARI	IG DEN, Col	in Leslie	:						
ſ	Property : GWMA : GW Zone :	- MARFLE - -	EET					Standing Wat	ter Level : Salinity : Yield :	87.00 m 206.00 mg/L 0.10 L/s		
Site Deta	ails											
Site Chosen Client	By Drill	er] L	Form A icensed	County CUMBE	RLAND RLAND	Pa NA NA	rish ARRABEEN ARRABEEN	Portion 9 3032: 9 3032:	n/Lot DP 5 5	
Ri Area	Region :10 iver Basin :21 / District :) - SYDN 2 - HAW	EY SOU KESBUF	TH COAS RY RIVE	ST R			CMA I Grid Z	Map :9130-1S Zone :56/1	MONA VALI Scale :1:25,	E 000	
Elevatio	Elevation : on Source :(U	(Inknown)	0.00					Nort Eas	hing :6273242 sting :340553	Lat Long	itude (S) :33° 4 itude (E) :151°	40' 8" 16' 49"
	GS Map :		MGA Z	one :56			(Coordinate So	urce :			
Constru H-Hole;P-Pipe;O H P Compose 1 Hole 1 Hole 1 Hole 1 1 Casing 1 1 Casing 1 1 Openin	DD-Outside Diame nent Type Hole Hole Hole g Steel g PVC Class ng Slots - I	ter;ID-Inside Dia 9 9 Jiagonal	ameter;C-Ce From (m) 0.00 5.60 102.50 -0.40 -0.40 24.00	mented;SL-3 To (m) 5.60 102.50 192.50 5.60 24.00 30.00	Slot Length OD (mm) 205 159 154 168.3 140 140	;A-Aperture; ID (mm) 1 158.7	GS-Grain Size Interval Det Dov Dov C: Scr PVC	c;Q-Quantity;PL-Pk ails nn Hole Hammer nn Hole Hammer nn Hole Hammer 0-5.6m; Drive rewed and Glue 2 Class 9; SL:	acement of Gravel Pack;P 	C-Pressure Cemented	l;S-Sump;CE-Centra	lisers
Water B From (m) 26.50 127.00 151.00 184.50	<i>earing</i> Z To (m) 27.50 128.00 151.30 185.50	DNES Thickness (m) 1.00 1.00 0.30 1.00	WBZ Type				S.W.L. (m) 87.00) D.D.L. (m)	Yield (L/s) 0.20 0.10 0.10 0.10	Hole Depth (m) 30.50 132.50 156.50 186.50	Duration (hr) 0.25 0.25 0.25 0.50	Salinity (mg/L) 125.00 142.00 220.00 240.00
Drillers	Log											
From (m) 0.00 0.20 6.20 6.50 24.50 57.50 127.70 128.00 137.00 147.50 175.00 186.50 188.00 190.50	Composition Thicknee 0.20 6.20 6.50 24.50 42.50 56.50 57.50 127.70 128.00 137.00 137.00 147.50 147.50 188.00 188.00 190.50 192.50 125.00	ss(m Drillers D 0.2) TOPSOIL 0.30 CLAY WI 8.00 SANDST 8.00 SANDST 4.00 SANDST 1.00 F. SANDS 0.20 SANDST 0.30 F.W. SAN 9.00 SANDST 0.50 SANDST 1.50 F. SANDS 1.50 SANDST 2.50 RED SHA 2.00 SANDST 0.51 SANDST 2.50 RED SHA 2.00 SANDST	escription ONE LT GR HITE DNE GREY DNE F.W.G DNE BRC DNE GREY DNE GREY DNE GREY DNE GREY LE DNE GREY	EY M/G BROWN/IF REY BROW WN/IRONST WN/IRONST WN/IRONST WN/IRONST WN/IRONST MAG GREY DARK GRI DARK GRI DARK GRI	CONSTONE IN M/G DNE STONE EY M/G EY M/G EY M/G	3			Geological Material Topsoil Sandstone Clay Sandstone Sandstone Invalid Code Sandstone Invalid Code Sandstone Sandstone Sandstone Invalid Code Sandstone Invalid Code Sandstone Invalid Code Sandstone Invalid Code Sandstone	Comm	ents	

Remarks

*** End of GW105253 ***

GW105255

Licence :10BL600322 Work Type :Bore Work Status :Supply Obtain Construct. Method :Rotary Owner Type :	ned		Licence Statu Authorised Pu DOMESTIC STOCK	s Active arpose(s)	Inte DON STO	nded Purpose MESTIC ICK	(s)
Commenced Date : Completion Date :16-Oct-2003	Final Depth : Drilled Depth :	114.00 m 114.00 m					
Contractor Name :ULTRA DRII Driller :1423 Assistant Driller's Name :	LING DODD, Alan Marcus						
Property : - FARAH GWMA : - GW Zone : -			Standing Water S	r Level : alinity : Yield :	44.00 m 96.00 mg/L 1.00 L/s		
Site Details							
Site Chosen By Client	Form A Licensed	County :CUMBERLAND :CUMBERLAND	Pari s NAR NAR	sh RABEEN RABEEN	Portion 264 752 264 752	/ Lot DP 046 046	
Region : 10 - SYDN River Basin : 213 - SYDI Area / District :	EY SOUTH COAST NEY COAST - GEORGES	RIVER	CMA M Grid Zo	ap :9130-1S ne :56/1	MONA VALE Scale :1:25,0	000	
Elevation : (Elevation Source :(Unknown)).00		Northi Easti	ng :6272855 ng :339944	Lati Longi	tude (S) : 33° 4 tude (E) : 151°	0' 20" 16' 25"
GS Map :	MGA Zone :56		Coordinate Sour	ce :			
Hender Negative depths inc Herder Negative depths inc Herder Display the second	ticate Above Ground Level; ameter;C-Cemented;SL-Slot Length From (m) To (m) OD (mm) 0.00 36.00 170 36.00 114.00 130 0.30 2.00 160 0.30 36.00 140	;A-Aperture;GS-Grain Siz ID (mm) Interval De Do Do Dr Gl	e:Q-Quantity;PL-Place tails wn Hole Hammer wn Hole Hammer iven into Hole ued; Driven into	ement of Gravel Pack;Po	C-Pressure Cemented;	S-Sump;CE-Centra	lisers
Water Bearing Zones From (m) To (m) Thickness (m) 66.00 67.00 1.00 72.00 73.00 1.00	WBZ Type	S.W.L. (m	D.D.L. (m) 68.00 0 75.00	Yield (L/s) 0.60 1.00	Hole Depth (m) 68.00 75.00	Duration (hr) 1.00 1.50	Salinity (mg/L) 100.00 96.00
Drillers Log From (m) To (m) Thickness(m Drillers E 0.00 2.00 2.00 CLAY 2.00 22.00 20.00 BROKEN 22.00 30.00 8.00 SHALE 30.00 76.00 46.00 WHITE S 83.00 114.00 31.00 WHITE S	Description SANDSTONE ANDSTONE ONE/SHALE ANDSTONE			Geological Material Clay nvalid Code Shale nvalid Code Sandstone nvalid Code	Comme	nts	

Remarks

Previous Lic No:10BL162212

*** End of GW105255 ***

GW105671

Licence :10BL162365 Work Type :Bore Work Status :Supply Obtain Construct. Method :Down Hole Ha Owner Type :Private	ed ımmer		Licence Statu Authorised P DOMESTIC	s Active urpose(s)	Inte DOI	nded Purpose MESTIC	(s)
Commenced Date : Completion Date :22-Oct-2003	Final Depth : Drilled Depth :	180.00 m 180.00 m					
Contractor Name :Ultradrilling Driller :1600 Assistant Driller's Name :	DODD, Bradley Alan						
Property: - BIRD GWMA: - GW Zone: -			Standing Water S	r Level : Salinity : Yield :	105.00 m 110.00 mg/L 105.00 L/s	cumulative	
Site Details							
Site Chosen By	Form A Licensed	County CUMBERLAND CUMBERLAND	Pari NAR NAR	sh RRABEEN RRABEEN	Portion 2//6186 2 61862	/Lot DP 22 22	
Region : 10 - SYDN River Basin : 212 - HAW Area / District :	EY SOUTH COAST KESBURY RIVER		CMA M Grid Zo	ap :9130-1S one :56/1	MONA VALE Scale :1:25,0	E 000	
Elevation : 0 Elevation Source :(Unknown)	.00		Northi Easti	ng :6274438 ng :340693	Lati Longi	itude (S) :33° 3 tude (E) :151°	9' 29" 16' 55"
GS Map :	MGA Zone :56	(Coordinate Sou	r ce : GIS - Geogra _l	phic Information	system	
Property Negative depths ind H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;ID-Ins	icate Above Ground Level; meter;C-Cemented;SL-Slot Length From (m) To (m) OD (mm) 0.00 72.00 174 72.00 180.00 140 0.30 1.00 168 0.30 72.00 140	A-Aperture;GS-Grain Sizz ID (mm) Interval Det Dov Glu Glu	e;Q-Quantity;PL-Place ails wn Hole Hammer wn Hole Hammer ied; Driven into ied; Driven into	ement of Gravel Pack;PG o Hole o Hole; Open End	C-Pressure Cemented	S-Sump;CE-Central	isers
From (m) To (m) Thickness (m) 162.00 163.00 1.00 174.00 175.00 1.00	WBZ Type	S.W.L. (m)	D.D.L. (m) 164.00 180.00	Yield (L/s) 0.40 0.60	Hole Depth (m)	Duration (hr) 1.00 2.00	Salinity (mg/L) 110.00 110.00
Drillers Log From (m) To (m) Thickness(m) Drillers D 0.00 1.00 1.00 soil, dirt 1.00 3.00 66.00 63.00 sandstone, 66.00 150.00 84.00 sandstone, 150.00 174.00 24.00 shale 174.00 180.00 6.00 shale, red	escription soft yellow shale			Geological Material Soil Clay Sandstone Sandstone Shale Shale	Commo	ents	

Remarks

updated from original form A

*** End of GW105671 ***

GW106327

Licence :10BL163449 Work Type :Bore Work Status :Supply Obtai Construct. Method :Down Hole F Owner Type :Private	ined Hammer		Licence Statu Authorised P DOMESTIC STOCK	ıs Active turpose(s)	Intended Purpose DOMESTIC STOCK	(s)
Commenced Date : Completion Date :07-Jul-2004	Final Depth : Drilled Depth :	180.00 m 180.00 m				
Contractor Name :INTERTECH Driller :1783 Assistant Driller's Name :	I CRUMP, William					
Property : - HAUGH GWMA : - GW Zone : -	I		Standing Wate	er Level : Salinity : Yield :	49.50 m 198.00 mg/L 0.40 L/s cumualtive	
Site Details						
Site Chosen By Client Driller	Form A : Licensed :	County CUMBERLAND CUMBERLAND	Pari NAF NAF	ish RRABEEN RRABEEN	Portion/Lot DP 82//875079 82 875079	
Region : 10 - SYDI River Basin : 212 - HAV Area / District :	NEY SOUTH COAST WKESBURY RIVER		CMA M Grid Zo	Iap : 9130-1S one :56/1	MONA VALE Scale :1:25,000	
Elevation : Elevation Source :(Unknown)	0.00		North East	ing :6273453 ing :340803	Latitude (S) :33° 4 Longitude (E) :151°	0' 1" 16' 58"
GS Map :	MGA Zone :56		Coordinate Sou	rce :GIS - Geogra	phic Information System	
H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside D H P Component Type 1 Hole Hole 1 Hole Hole 1 Hole Hole 1 I Casing Steel 1 1 Casing PVC Class 9 1 1 Opening Slots - Diagonal	Diameter;C-Cemented;SL-Slot Lengt;A From (m) To (m) OD (mm) 0.00 5.50 206 5.50 72.00 159 72.00 180.00 155 -0.50 5.50 168.3 -0.50 11.00 140 11.00 21.50 140	A-Aperture;GS-Grain Siz ID (mm) Interval De Do Do 158.7 Sc Sc PV	te:Q-Quantity;PL-Plac tails wn Hole Hammer wn Hole Hammer wn Hole Hammer rewed and Glued rewed and Glued C Class 9; Sawn	ement of Gravel Pack;P l; Suspended in C l; Driven into Ho l; SL: .1mm; A: 3	C-Pressure Cemented;S-Sump;CE-Centra :lamps .le; Open End mm; Screwed and Glued	lisers
Water Bearing Zones From (m) To (m) Thickness (m) 11.30 11.50 0.2 18.30 21.10 2.8 52.00 55.00 3.0	a) WBZ Type	S.W.L. (m 49.5	n) D.D.L. (m)	Yield (L/s) 0.10 0.10 0.01	Hole Depth (m) Duration (hr)	Salinity (mg/L) 149.00 201.00 198.00
Drillers Log From (m) To (m) Thickness(m) Drillers 0.00 3.00 3.00 sand, sill 3.00 11.30 8.30 sandston 11.30 11.50 0.20 sandston 11.50 15.00 3.50 sandston 15.00 15.20 0.20 sandston 15.20 17.50 2.30 sandston 12.00 21.10 0.10 sandston 21.10 21.10 0.10 sandston 21.10 21.70 2.60 clay 33.00 40.00 7.00 sandston 33.00 40.00 0.20 clay 40.20 52.00 11.80 sandston 55.00 93.50 38.50 sandston 55.00 93.70 0.20 sandston 51.50 93.50 38.50 sandston 51.50 159.00 5.50 sint, ston 153.50 159.00	Description y e, light grey e, fractured e, fractured e, light brown e, very soft e, ugat brown e, very soft e, quartz e, qracture e, grey tite te te e, grey e, dark grey e, grey e, grey e, grey e, grey e, grey e, grey e e, grey e e, grey e e, grey e e, grey e e, grey e red b, grey			Geological Material Sand Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Clay Sandstone Sandstone Clay Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Sandstone Silt Silt Silt	Comments	

Remarks

updated from original form A

*** End of GW106327 ***

GW106695

Li Work Work S Construct. M Owner	icence :10BL164232 Type :Bore Status :Supply Obtain iethod :Down Hole H Type :Private	ned Iammer		Licence Statu Authorised P DOMESTIC STOCK	s Active urpose(s)	Intended Purpose DOMESTIC STOCK	s)
Commenced Completion	Date : Date :23-Nov-2004	Final Depth Drilled Depth	: 120.00 m : 120.00 m				
Contractor E Assistant Driller's	Name :INTERTECH Driller :1783 5 Name :	CRUMP, William					
Pro GV GW	pperty : - DAWE WMA : - Zone : -			Standing Wate	r Level : Salinity : Yield :	38.00 m 132.00 mg/L 0.90 L/s cumulative	
Site Details	5						
Site Chosen By Client	Driller	For Lice	County m A :CUMBERLAND nsed :CUMBERLAND	Pari NAF NAF	sh RRABEEN RRABEEN	Portion/Lot DP 6//1044346 6 1044346	
R River Area / D	tegion :10 - SYDN Basin :213 - SYD istrict :	IEY SOUTH COAST NEY COAST - GEOR	GES RIVER	CMA M Grid Zo	ap :9130-15 one :56/1	MONA VALE Scale :1:25,000	
Elev Elevation S	vation : ource :			Northi Easti	ing :6272628 ing :339830	Latitude (S) :33° 4 Longitude (E) :151°	0' 27" 16' 20"
Construct H-Hole:P-Pipe;OD-Ou H P Component 1 Hole 1 Hole 1 1 Casing 1 1 Casing 1 1 Casing 1 1 Opening 1 1 Opening 1 Annulus	toon Regard depuis in ttside Diameter;ID-Inside D Type Hole Hole PVC Class 9 Sloel PVC Class 9 Slots - Diagonal Slots - Diagonal Concrete	iameter;C-Cemented;SL-Slot From (m) To (m) 0.00 5.50 5.50 120.00 -42.00 53.00 -0.40 5.60 -0.40 30.00 30.00 42.00 53.00 59.60 -0.10 5.50	Length;A-Aperture;GS-Grain S 208 D 156 D 156 146.4 D 140 S 140 P 140 P 208 168	ize;Q-Quantity;PL-Place etails own Hole Hammer own Hole Hammer crewed and Glued riven into Hole; crewed and Glued VC Class 9; Sawn VC Class 9; Sawn	Open End ; Suspended in (; SL: .1mm; A: 1 ; SL: .1mm; A: 1	C-Pressure Cemented;S-Sump;CE-Central Clamps Smm; Screwed and Glued Smm; Screwed and Glued	isers
Water Bean From (m) 31.00 53.00 67.00 72.00 Drillorg Lo	ring Zones To (m) Thickness (m) 35.00 4.00 54.00 1.00 70.00 3.00 86.00 14.00) WBZ Type	S.W.L. (38.	m) D.D.L. (m)	Yield (L/s) 0.20 0.20 0.20 0.30	Hole Depth (m) Duration (hr)	Salinity (mg/L) 145.00 144.00 140.00 132.00
$\begin{array}{c c} From (m) & To \\ 0.00 & 2 \\ 2.00 & 4 \\ 4.00 & 26 \\ 20.00 & 26 \\ 26.00 & 27 \\ 27.00 & 33 \\ 31.00 & 35 \\ 35.00 & 41 \\ 41.00 & 41 \\ 41.30 & 41 \\ 41.30 & 41 \\ 41.60 & 44 \\ 44.00 & 49 \\ 49.00 & 55 \\ 55.00 & 55 \\ 57.00 & 67 \\ 67.00 & 67 \\ 67.00 & 67 \\ 67.00 & 67 \\ 70.00 & 77 \\ 72.00 & 86 \\ 86.00 & 90 \\ 99.00 & 94 \\ 94.00 & 95 \\ 95.00 & 102 \\ 102.00 & 120 \\ \end{array}$	★ (m) Thickness(m Drillers 1) 2.00 2.00 fill, sands 0.00 2.00 sandstom 0.00 16.00 sandstom 0.00 16.00 sandstom 0.00 1.00 clay, soft 0.00 4.00 sandstom 0.00 4.00 sandstom 0.00 4.00 sandstom 0.00 6.00 ironstome 0.00 2.40 clay 0.00 5.00 guartz, ct 0.00 3.00 sandstom 0.00 3.00 sandstom 0.01 1.00 sandstom 0.02 2.50 gaadstom 0.01 0.00 sandstom 0.02 2.50 sandstom 0.01 4.00 sandstom 0.02 2.00 ironstone 0.00 1.00 clay, sandstom 0.00 1.00 sandstom 0.00 <t< td=""><td>Description stone, rocker clay 2, very soft 2, light brown 2, quartz bands 2, light brown 2, quartz soft 3, sandstone, 2, grey 4, fractured 2, grey 4, fractured 4, quartz 5, grey 9, fractured quartz 4, grey 9, grey 9, fractured quartz 5, grey 9, ironstone, fractured quartz Istone, soft 2, quartz bands 3, grey</td><td></td><td></td><td>Geological Material Fill Sandstone Sandstone Clay Sandstone Sandstone Sandstone Sandstone Clay Quartz Clay Siltstone Sandstone</td><td>Comments</td><td></td></t<>	Description stone, rocker clay 2, very soft 2, light brown 2, quartz bands 2, light brown 2, quartz soft 3, sandstone, 2, grey 4, fractured 2, grey 4, fractured 4, quartz 5, grey 9, fractured quartz 4, grey 9, grey 9, fractured quartz 5, grey 9, ironstone, fractured quartz Istone, soft 2, quartz bands 3, grey			Geological Material Fill Sandstone Sandstone Clay Sandstone Sandstone Sandstone Sandstone Clay Quartz Clay Siltstone Sandstone	Comments	

Remarks

updated from original form A

*** End of GW106695 ***

GW107194

Licence :10BL163459 Work Type :Bore Work Status :Supply Obtain Construct. Method :Rotary - Percu Owner Type :Private	ed ssion (Down Hole Hammer)		Licence Status Activ Authorised Purpose DOMESTIC STOCK	′e (s)	Intended Purpose DOMESTIC STOCK	(8)
Commenced Date : Completion Date :28-Sep-2004	Final Depth : Drilled Depth :	192.00 m 192.00 m				
Contractor Name :CENTRAL W Driller :1812 Assistant Driller's Name :	EST WATER DRILLING REYNOLDS, Christopher	Howard R				
Property : - SWIFT GWMA : - GW Zone : -			Standing Water Level Salinity Yield	18.00 1. 0.40	m L/s cumulative	
Site Details						
Site Chosen By	C Form A :C Licensed :C	ounty UMBERLAND UMBERLAND	Parish NARRABE NARRABE	EN 1 EN	Portion/Lot DP 137 752046 137 752046	
Region : 10 - SYDN River Basin : Area / District :	EY SOUTH COAST		CMA Map : Grid Zone :	Scale):	
Elevation : Elevation Source :			Northing :627 Easting :337	71355 7051	Latitude (S) : 33° 4 Longitude (E) : 151°	1' 7" 14' 31"
GS Map :	MGA Zone :56	(Coordinate Source :GI	S - Geographic Info	rmation System	
Construction Negative depths ind H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter	icate Above Ground Level; imeter;C-Cemented;SL-Slot Length;A- From (m) To (m) OD (mm) I 0.00 192.00 200 -0.40 192.00 164 0.00 0.00 164	Aperture;GS-Grain Sizz D (mm) Interval Det Rot 163.8 Riv PVG	e;Q-Quantity;PL-Placement of (ails cary – Percussion (Dov veted and Glued; Drive C Class 9; Casing – He	Gravel Pack;PC-Pressure C vn Hole Hammer) en into Hole; Open and Sawn Slot; SL:	Cemented;S-Sump;CE-Central End; S: 170~192m 200mm; A: 2mm; Rive	lisers ted and Glued
From (m) To (m) Thickness (m) 74.00 170.00 96.00	WBZ Type	S.W.L. (m 18.00) D.D.L. (m)	Yield (L/s) Hole Dep 0.40	pth (m) Duration (hr) 2.00	Salinity (mg/L)
Drillers Log From (m) To (m) Thickness(m) Drillers D 0.00 3.00 3.00 tospsoil 3.00 4.00 1.00 clay, sandy 4.00 20.00 16.00 sandstome 20.00 22.00 2.00 shales, gre 22.00 52.00 30.00 clays 56.00 170.00 114.00 sandstome 170.00 192.00 22.00 shales, gre	escription y y		Geologica Topsoil Clay Sandstor Shale Sandstor Clayston Sandstor Shale	Il Material ne e ne	Comments	

Remarks

updated from original form A

*** End of GW107194 ***

GW107518

Licence :10BL164091 Work Type :Bore Work Status :Supply Obtained Construct. Method :(Unknown) Owner Type :Private	Licence :10BL164091 Work Type :Bore Work Status :Supply Obtained onstruct. Method :(Unknown) Owner Type :Private		Licence Status Active Authorised Purpose(s) DOMESTIC			Intended Purpose(s) DOMESTIC		
Commenced Date : Completion Date :01-Jul-2005	Final Depth : Drilled Depth :	120.00 m 120.00 m						
Contractor Name :unknown Driller :400 Assistant Driller's Name :	UNKNOWN, Unkown							
Property: - CHOULAR' GWMA: - GW Zone: -	ΓΟΝ	\$	Standing Water Le Salin Yi	vel : iity : eld :		500 L/day		
Site Details								
Site Chosen By	Cou Form A :CU Licensed :CU	inty MBERLAND MBERLAND	Parish NARRA NARRA	BEEN BEEN	Portion 208//752 208 752	'Lot DP 2046 046		
Region : 10 - SYDNEY River Basin : 213 - SYDNE Area / District :	SOUTH COAST Y COAST - GEORGES RIV	ER	CMA Map : Grid Zone :	9130-1S 56/1	MONA VALE Scale :1:25,0	00		
Elevation : Elevation Source :			Northing : Easting :	6272572 339395	Lati Longit	tude (S) :33° 40 tude (E) :151° 1)' 29" 16' 3"	
GS Map : M	GA Zone : 56	C	coordinate Source :	GIS - Geogra	phic Information	System		
Construction Negative depths indicate H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diamet Free H P Component Type	e Above Ground Level; er;C-Cemented;SL-Slot Length;A-Ap m (m) To (m) OD (mm) ID	erture;GS-Grain Size (mm) Interval Deta	;Q-Quantity;PL-Placement ils	of Gravel Pack;P	C-Pressure Cemented;	S-Sump;CE-Centrali	sers	
	(No Co.	nstruction	Details Found)				
Water Bearing Zones From (m) To (m) Thickness (m) WB	Z Type (No Water	S.W.L.(m) Bearing Zo	D.D.L.(m) ne Details For	Yield (L/s) und)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)	
Drillers Log From (m) To (m) ^{Thickness(m} Drillers Descr	iption		Geolo	gical Material	Comme	ats		

Remarks

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

*** End of GW107518 ***

GW107528

l Wor Work Construct. N Owne	Licence :10BL16 *k Type :Bore \$ Status :Supply (Method :Down H er Type :Private	5517 Obtained Iole Hammer				Licence Stat Authorised DOMESTIC STOCK	tus Active Purpose(s)	Inten DOM STOC	i ded Purpose (; IESTIC CK	s)
Commence Completio	ed Date : on Date :28-Sep-	2005	Final Dep Drilled Dep	th : th :	180.30 m 180.30 m	L L				
Contractor Assistant Driller	r Name :INTERT Driller :1950 r's Name :	TECH W	YATT, Brett I	Roy						
Pr (GV	roperty : - MC GWMA : - W Zone : -	ORRIS				Standing Wat	ter Level : Salinity : Yield :	83.60 m 390.00 mg/L 0.60 L/s	cumulative	
Site Detai	ls									
Site Chosen By Client	y		Fo) orm A :(censed :(C ounty CUMBERLAN CUMBERLAN	Pa D NA D NA	rish Arrabeen Arrabeen	Portion/ 156//752 156 7520	Lot DP 046)46	
Rive Area / J	Region :10 - 5 r Basin :213 - District :	SYDNEY SO SYDNEY C	OUTH COAS OAST - GEC	Г DRGES F	RIVER	CMA Grid Z	Map :9130-1S Zone :56/1	MONA VALE Scale :1:25,00	00	
Elevation	evation : Source :					Nort Eas	hing :6273541 sting :340683	Latit Longiti	ude (S) :33° 39 ude (E) :151°	9' 58" 16' 54"
G	S Map :	MGA	Zone : 56			Coordinate So	urce :GIS - Geogr	aphic Information	System	
HINDLA THEOREM	nt Type Hole Hole Steel PVC Class 9 Slots - Diagon Slots - Diagon Slots - Diagon Concrete Tring Zones To (m) Thickm	From (0. 102. -0. -0. al 17. al 29. al 47. 0. Seess (m) WBZ T	To (m) O 00 5.60 50 102.30 30 180.30 20 5.80 20 59.80 30 23.80 30 41.80 30 53.80 20 5.80	D (mm) 202 165 159 165 140 140 140 140 140	ID (mm) Interval	Details Down Hole Hammer Down Hole Hammer Down Hole Hammer Driven into Hole Screwed and Glue PVC Class 9; Sav PVC Class 9; Sav PVC Class 9; Sav	c c c d; Suspended in wn; SL: 100mm; A: wn; SL: 100mm; A: Yield (L/s)	Clamps 3mm 3mm 3mm Hole Depth (m)	Duration (hr)	Salinity (mg/L)
19.80 35.70 130.50 156.00	20.30 50.90 131.20 166.00	0.50 15.20 0.70 10.00			17	2.00	0.08 0.13 0.10 0.30			132.00 155.00 225.00 390.00
Drillers L From (m) T 0.00 1.00 2.00 2.80 13.60 14.40 19.80 20.30 26.50 26.90 35.70 35.80 37.00 37.30 37.30 37.30 37.30 37.30 50.80 50.90 63.550 67.80 71.70 78.60 1 131.20 1 166.00 1	OG (m) Thickness(m D 1.00 1.00 cl 2.00 1.00 sa 2.80 0.80 sa 13.60 10.80 sa 14.40 0.80 sf 19.80 5.40 sa 26.50 6.20 sa 26.50 6.20 sa 26.50 0.40 cl 35.70 8.80 sa 35.80 0.10 qi 37.30 0.30 cl 47.70 10.40 sa 47.70 10.40 sa 47.70 0.20 sf 50.80 2.90 sa 50.90 sa 50.90 sa 50.90 sa 50.90 sa 50.90 sa 50.90 sa 50.90 sa 50.90 sa 50.90 sa 51.260 sa 6.20 sa 7.20 sa 6.20 sa 7.20 sa 6.20 sa 7.20 sa	rillers Descripti ay, light brown ndstone, brown ale, grey ndstone, brown, ndstone, brown, ndstone, brown, ndstone, grey, light brown ndstone, grey, light brown ndstone, grey ndstone, grey ndstone, grey ndstone, grey ale, black silty ndstone, grey, fin alostone, grey, fin alostone, grey, fin alostone, grey, fin alostone, grey, fin alostone, grey, fin distone, grey, fin di	yn veathered one, brown, water grey pink d quartz, water bes one, brown g ey, brown d quartz, water bes ey ck shale bands cctured, water bea grey silty shale, w	bearing aring aring ring vater bearin	g		Geological Material Clay Sandstone Sandstone Shale Sandstone Sandstone Clay Sandstone Quartz Ironstone Clay Sandstone Shale Sandstone Shale Sandstone Shale Sandstone Shale Sandstone Shale Sandstone Shale Sandstone Shale Sandstone Shale Sandstone Shale Sandstone Shale Sandstone Shale Sandstone Shale Sandstone Shale	Commen	ts	

Remarks

Form A Remarks:

GW107528

130.5 - 131.2 very unstable - aire lifted at 132m 0.51ps updated from original form A $$\ast\!\!\ast\!\!\ast\!\!\ast\!\!$ End of GW107528 $\ast\!\!\ast\!\!\ast\!\!\ast\!\!$

GW108106

Wor Worl Construct. Own	Licence :10BL600255 rk Type :Bore k Status :Supply Obtain Method :Down Hole Ha er Type :Private	ed ammer			Licence Stat Authorised I DOMESTIC STOCK	us Active Purpose(s)	Intended Purpose DOMESTIC STOCK	(s)
Commenc Completi	ed Date : on Date :15-May-2006	Final Dep Drilled Dep	th: 180.4 th: 180.4	00 m 00 m				
Contracto Assistant Drille	or Name :INTERTECH Driller :1489 r's Name :	BARDEN, Colin	n Leslie					
P G	Property : - MEDWA GWMA : - W Zone : -	Y		SI	tanding Wat	er Level : Salinity : Yield :	50.00 m 0.70 L/s cumulative	
<u>Site Detai</u>	ils							
Site Chosen B Client	y	F	County orm A :CUMBERI censed :CUMBERI	LAND LAND	Pa NA NA	ish RRABEEN RRABEEN	Portion/Lot DP 8 1044346 8 1044346	
Rive Area /	Region :10 - SYDN er Basin : District :	EY SOUTH COAS	Т		CMA N Grid Z	/Iap : one :	Scale :	
El Elevation	levation : Source :				North Eas	ning :6272580 ting :339684	Latitude (S) :33° 4 Longitude (E) :151°	40' 29" 16' 14"
(GS Map :	MGA Zone :56		Co	oordinate Sou	arce :GIS - Geogra	phic Information System	
H-Hole:P-Pipe:0D- H P Compone 1 Hole 1 Hole 1 Hole 1 Casing 1 Casing 1 Annulus Water Bed From (m)	Ction of the second sec	Immeter;C-Cemented;SL-Sk From (m) To (m) O 0.00 5.50 120.00 120.00 180.00 -0.50 5.50 -0.50 5.50 1.50 0.00 0.00 5.50 5.50 0.00 5.50 0.00 5.50 71.50 0.00 5.50	ot Length;A-Aperture;GS D (mm) D (mm) Int 203 164 160 168 158.4 140 203	-Grain Size;Q erval Detail Down Down Drive Scree S.W.L. (m)	2-Quantity:PL-Pla is Hole Hammer Hole Hammer Hole Hammer en into Hole wed and Glue D.D.L. (m)	cement of Gravel Pack;P ; Suspended in Cl d; Suspended in C Yield (L/s)	C-Pressure Cemented;S-Sump;CE-Centra amps; Open End 'lamps; Open End Hoke Depth (m) Duration (hr)	lisers Salinity (mg/L)
35.00	42.00 7.00 66.30 0.30					0.01 0.49 0.10	• • • • • •	156.00 130.00
130.00	131.50 2.50 1.50			50.00		0.10		148.00
Drillers L From (m) 1 0.00 1.00 15.00 15.20 28.00 30.00 35.00 35.00 42.00 44.00 44.00 66.30 66.00 66.30 90.50 93.00 94.50 95.00 100.00 103.00 103.00 131.50 158.00 158.00 160.00 170.00	Ogg Thickness(m) Drillers E 1.00 1.00 sand, clay 15.00 14.00 sandstone 15.00 14.00 sandstone 15.20 0.20 clay, grey 28.00 12.80 sandstone 30.00 2.00 ionstone 35.00 5.00 shale 42.00 7.00 sandstone 66.30 0.20 claym gre 51.50 7.50 sandstone 66.30 0.30 <quartz, fra<="" td=""> sandstone 66.30 0.50 isandstone 90.50 2.00 sandstone 90.50 2.00 sandstone 90.50 0.50 clay, grey 100.00 5.00 sandstone 95.00 0.50 clay, grey 103.00 3.00 sandstone 103.00 3.00 sandstone 131.50 1.50 sandstone 131.50 1.50 sandstone <td>escription weathered weathere d grey quartz y grey quartz ctured grey quartz grey quartz grey grey grey grey grey grey grey grey</td><td></td><td></td><td></td><td>Geological Material Sand Sandstone Clay Sandstone Ironstone Shale Sandstone Clay Sandstone Quartz Sandstone Quartz Sandstone Quartz Sandstone Clay Sandstone Clay Sandstone Sand</td><td>Comments</td><td></td></quartz,>	escription weathered weathere d grey quartz y grey quartz ctured grey quartz grey quartz grey grey grey grey grey grey grey grey				Geological Material Sand Sandstone Clay Sandstone Ironstone Shale Sandstone Clay Sandstone Quartz Sandstone Quartz Sandstone Quartz Sandstone Clay Sandstone Clay Sandstone Sand	Comments	

Remarks

updated from original form A

GW108106

*** End of GW108106 ***

GW108450

Licence :10BL601060 Work Type :Bore Work Status :Supply Obtained Construct. Method :Down Hole Hammer Owner Type :Private		Licence Status Active Authorised Purpose(s) DOMESTIC STOCK	Intended Purpose(s) DOMESTIC STOCK
Commenced Date : Completion Date :19-Jan-2007	Final Depth : 150.00 m Drilled Depth : 150.00 m		
Contractor Name :INTERTECH DRILL Driller :1489 BAI Assistant Driller's Name :	.ING RDEN, Colin Leslie		
Property : - SHIELDS GWMA : - GW Zone : -		Standing Water Level : Salinity : Yield :	41.30 m 110.00 mg/L 0.55 L/s Cumulative
Site Details			
Site Chosen By Client Driller	County Form A :CUMBERLAND Licensed :CUMBERLAND	Parish NARRABEEN NARRABEEN	Portion/Lot DP 86//12115 86 12115
Region :10 - SYDNEY SO River Basin :213 - SYDNEY CO Area / District :	UTH COAST OAST - GEORGES RIVER	CMA Map : 9130-1S Grid Zone : 56/1	MONA VALE Scale :1:25,000
Elevation : Elevation Source :		Northing :6271876 Easting :339185	Latitude (S) :33° 40' 51" Longitude (E) :151° 15' 55"
GS Map : MGA	Zone :5 6	Coordinate Source :GIS - Geogra	phic Information System
H-Hole:P-Pipe:OD-Outside Diameter;ID-Inside Diameter;C- H P Component Type From (m Hole Hole 0.0 Hole Hole 2.7 1 1 Casing Steel -0.3 1 2 Casing PVC Class 9 -0.3 Annulus Concrete 0.0	Cemented;SL-Slot Length;A-Aperture;GS-Grain Siz n) To (m) OD (mm) ID (mm) Interval De 0 2.70 203 Do' Do' 0 0 0 150.00 161 Do' 0 0 150.00 161 Do' 0 0 41.70 140 Sc: 0 2.70 203 Sc: 0 2.70 203 Sc: 0 1.70 1.40 Sc: 0 1.70 2.03 Sc: 0 1.70 2.70 2.03 Sc: 0 1.70 1.40 Sc: 0 2.70 2.03 Sc: 0 1.70 1.40 Sc:	re:Q-Quantity;PL-Placement of Gravel Pack;F tails wn Hole Hammer wn Hole Hammer iven into Hole; Suspended in C rewed and Glued; Suspended in C	C-Pressure Cemented;S-Sump;CE-Centralisers Lamps; Open End Lamps
From (m) To (m) Thickness (m) WBZ Ty 35.50 37.00 1.50 73.00 75.00 2.00 101.00 103.00 2.00 133.00 137.00 4.00	pe S.W.L. (m 41.3	a) D.D.L. (m) Yield (L/s) 0.02 0.10 0.23 0 0.20	Hole Depth (m) Duration (hr) Salinity (mg/L) 125.00 98.00 92.00 110.00
Broillers Log From (m) To (m) Thickness(m) Drillers Description 0.00 0.50 0.50 Soil, sandy 0.50 22.00 21.50 Sandstone, yellow 22.00 25.00 3.50 Inostone 25.00 35.50 10.50 Sandstone, grey 35.50 37.00 1.50 Sandstone, grey 38.00 49.00 11.00 Sandstone, grey 49.00 63.00 14.00 Sandstone, grey 75.00 101.00 Sandstone, grey 103.00 73.00 2.00 75.00 101.00 Sandstone, grey 103.00 1.00 Sandstone, grey 103.00 116.00 13.00 Sandstone, grey 116.00 13.00 Sandstone, grey 117.00 129.00 12.00 Sandstone, grey 129.00 129.50 0.50 Clay 129.00 129.50 0.50 Clay 133.00 37.00 4.00 Sandstone, grey 133.00 137	n water bearing water bearing water bearing	Geological Material Soil Sandstone Ironstone Sandstone Clay Sandstone	Comments

Remarks

updated from original form A

*** End of GW108450 ***

GW108510

Wo Woi Construct Own	Licence :101 ork Type :Bor rk Status :Sup . Method :Do ner Type :Pri	BL600637 re oply Obtained wn Hole Ham vate	mer					Licence Stat Authorised I DOMESTIC STOCK	us Active Purpose(s)	Inte DON STO	nded Purpose MESTIC OCK	(s)
Commen Complet	ced Date : tion Date :27-	Sep-2006	F Dri	`inal Deptl illed Deptl	h: h:	10 10	2.00 m 2.00 m					
Contract Assistant Drill	or Name :IN Driller :148 er's Name :	FERTECH DI 39	RILLIN(BARD	G EN, Colin	Leslie							
] (Property : - GWMA : - GW Zone : -	CRAIG PER	RKINS I	NVESTM	ENTS			Standing Wat	er Level : Salinity : Yield :	32.40 m 125.00 mg/L 2.40 L/s	Cumulative	
<u>Site Deta</u>	vils											
Site Chosen I Client	By Drille	r		Fo Lice	rm A :(ensed :(County CUMBE CUMBE	RLAND RLAND	Pa i NA NA	ish RRABEEN RRABEEN	Portion 1//5988 1 59886	/ Lot DP 67 67	
Riv Area	Region : 10 ver Basin :212 / District :	- SYDNEY 2 - HAWKI	SOUT ESBUR	H COAST Y RIVER				CMA M Grid Z	Map :9130-1S Sone :56/1	MONA VALE Scale :1:25,0	2 000	
H Elevatio	Elevation : n Source :							Nortl Eas	ning :6273441 ting :339452	Lati Longi	tude (S) :33° 4 tude (E) :151°	40' 1" 16' 6"
	GS Map :	N	IGA Zo	ne : 56				Coordinate Sou	urce :GIS - Geogra	phic Information	System	
Constru	ection Nega	tive depths indicat	e Above C	Ground Level;								
H-Hole;P-Pipe;OI H P Compon	D-Outside Diamete ent Type	r;ID-Inside Diame Fr	ter;C-Cem om (m)	ented;SL-Slot To (m) OD	Length;A	A-Aperture; ID (mm)	GS-Grain Siz Interval De	e;Q-Quantity;PL-Pla tails	cement of Gravel Pack;P	C-Pressure Cemented;	S-Sump;CE-Centra	lisers
1 Hole 1 Hole 1 1 Casing 1 1 Casing 1 Annulu	Hole Hole Steel PVC Class S Concrete	9	0.00 2.60 -0.40 -0.40 0.00	2.60 102.00 2.60 17.60 2.60	203 164 168 140 203	158.4	Do Do Dr Sc	wn Hole Hammer wn Hole Hammer iven into Hole rewed and Glue	; Suspended in Cl d; Suspended in C	amps; Open End lamps		
Water Be	earing Zo	nes										
From (m) 54.00 85.50	To (m) 7 58.00 90.00	Thickness (m) WI 4.00 4.50	BZ Type				S.W.L. (m 32.4	a) D.D.L. (m)	Yield (L/s) 0.20 2.20	Hole Depth (m)	Duration (hr)	Salinity (mg/L) 115.00 125.00
Drillers I	Log											
From (m) 0.00 0.60 2.80 5.40 7.00 8.00 45.00 43.00 45.00 45.00 58.00 58.00 58.00 58.00 67.00 73.00 85.50 90.00	To (m) Thickness 0.60 0 2.80 2 5.40 2 7.00 1 8.00 1 15.00 7 22.00 7 43.00 2 47.00 2 54.00 4 67.00 2 73.00 6 85.50 12 90.00 4 102.00 12	s(m Drillers Desc 6.60 Soil, sandy 2.20 Sandstone, we 6.60 Shale 6.60 Sandstone, gr 0.00 Sandstone, gr 0.50 Sandstone, gr 0.50 Quarts, 250 Q	ription eathered eathered ey ey ey Quartz ey ey Quartz ey ey Quartz ey ey Quartz ey ey ey	water bearing					Geological Material Soil Sandstone Shale Sandstone Shale Sandstone	Comme	nts	

Remarks

updated from original form A

*** End of GW108510 ***

GW108676

Licence :10BL601385 Work Type :Spear Work Status :Abandoned B Construct. Method :Down Hole H Owner Type :Private	ore Iammer	I A I	icence Status Active authorised Purpose(s) OOMESTIC	Intended Purpose(s) DOMESTIC	
Commenced Date : Completion Date :01-Mar-2007	Final Depth : Drilled Depth :	120.00 m 120.00 m			
Contractor Name :Highland Dri Driller :1771 Assistant Driller's Name :	lling DELAMONT, Brett				
Property : - CONGA GWMA : - GW Zone : -	GLEN	Sta	anding Water Level : Salinity : Yield :		
Site Details					
Site Chosen By	Form A : Licensed :	County CUMBERLAND CUMBERLAND	Parish NARRABEEN NARRABEEN	Portion/Lot DP 2//579095 2 579095	
Region : 10 - SYDN River Basin : Area / District :	EY SOUTH COAST		CMA Map : Grid Zone :	Scale :	
Elevation : Elevation Source :			Northing :6272803 Easting :340538	Latitude (S) :33° 40' 22' Longitude (E) :151° 16' 43	" 8"
GS Map :	MGA Zone :56	Coo	ordinate Source :GIS - Geogr	aphic Information System	
Construction Negative depths in H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside D H H P Component Type 1 Hole Hole	dicate Above Ground Level; iameter;C-Cemented;SL-Slot Length;/ From (m) To (m) OD (mm) 0.00 120.00 200	A-Aperture;GS-Grain Size;Q- ID (mm) Interval Details Down	Quantity;PL-Placement of Gravel Pack; Hole Hammer	PC-Pressure Cemented;S-Sump;CE-Centralisers	
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) Sal	linity (mg/L)
	(No Wat	er Bearing Zone	e Details Found)	• • • • • • • • • •	
Drillers Log From (m) To (m) Thickness(m Drillers) 0.00 24.00 24.00 24.00 72.00 48.00 72.00 84.00 12.00 84.00 114.00 30.00 114.00 120.00 6.00	Description 2, pink orange 2, fine grey 2, fine grey		Geological Material Sandstone Sandstone Shale Sandstone Shale	Comments	

Remarks

Abandoned bore. updated from original form A

*** End of GW108676 ***

GW108708

Licence :10BL601568 Work Type :Bore Work Status :Supply Obtained Construct. Method :Down Hole Hammer		Licence Status Active Authorised Purpose(s) DOMESTIC STOCK	Intended Purpose (s DOMESTIC STOCK	;)
Owner Type :Private Commenced Date : Final Depth : Completion Date :19-Apr-2007 Drilled Depth :	150.00 m 150.00 m			
Contractor Name :INTERTECH DRILLING Driller :1997 SHEEHY, Paul Assistant Driller's Name :				
Property : - ADDISON GWMA : - GW Zone : -		Standing Water Level : Salinity : Yield :	38.00 m 270.00 mg/L 0.85 L/s cumulative	
Site Details				
Site Chosen By Client Driller Form A Licensee	County CUMBERLAND CUMBERLAND	Parish NARRABEEN NARRABEEN	Portion/Lot DP 1//595401 1 595401	
Region :10 - SYDNEY SOUTH COAST River Basin : Area / District :		CMA Map : Grid Zone :	Scale :	
Elevation : Elevation Source :		Northing :6272996 Easting :339338	Latitude (S) :33° 40 Longitude (E) :151° 1	0' 15" 6' 1"
GS Map : MGA Zone : 56		Coordinate Source :GIS - Geogr	aphic Information System	
Construction Tright of optimal matter to be defauld betwy H-Hole;P-Pipe;OD-Outside Diameter;ID-Inside Diameter;C-Cemented;SL-Slot Leng H P Component Type From (m) To (m) OD (mm) H Hole 0.00 5.60 203 1 Hole Hole 5.60 150.00 158 1 1 Casing Steel -0.40 5.60 164 1 Casing PVC Class 9 -0.40 95.60 144 Water Bearing Zones From (m) To (m) Thickness (m) WBZ Type 37.00 42.00 5.00 73.00 76.00 3.00 XBZ Type 37.00 3.00 XBZ Type	th;A-Aperture;GS-Grain Si ID (mm) Interval De D D D D D D D D	ze;Q-Quantity;PL-Placement of Gravel Pack stails worn Hole Hammer iven into Hole; Open End rrewed and Glued; Suspended in CC Class 9; Sawn; SL: 100mm; A: n) D.D.L.(m) Yield (L/s) 0.10 0.10	PC-Pressure Cemented;S-Sump;CE-Centrali Clamps; Open End 3mm Hole Depth (m) Duration (hr)	sers Salinity (mg/L) 121.00 150.00
108.50 112.00 3.50		0.65		270.00
Dritliers Log From (m) To (m) Thickness(m Drillers Description 0.00 0.20 0.20 topsoil 0.20 21.00 20.80 sandstone, grey 21.00 21.50 31.50 10.00 sandstone, grey 31.50 34.00 2.50 sandstone, quartz 34.00 37.00 30.00 sandstone, quartz 42.00 56.50 14.50 sandstone, quartz 42.00 56.50 14.50 sandstone, grey 56.50 67.00 10.00 sandstone, grey 76.00 73.00 6.00 sandstone, grey 76.00 75.00 3.00 sandstone, grey 76.00 75.00 1.50 siltstone, clay band 78.50 1.50 siltstone, clay band 78.50 9.50 sandstone, grey 78.50 0.50 sandstone, quartz 94.00 94.50 98.00 94.50 98.00 3.50 sandstone, quartz 98.00 10.50 sandstone, grey 112.00 128.50 16.50 sandstone, quartz 98.00 105.50 sandstone, quart		Geological Material Topsoil Sandstone Ironstone Sandstone	Comments	

Remarks

updated from original form A

*** End of GW108708 ***

GW108831

Wo Woi Construct Ow	Licence : fork Type : rk Status : t. Method : rer Type :	10BL601319 Bore Supply Obtair Down Hole H Private	ned ammer				Licence Stat Authorised DOMESTIC STOCK	tus Active Purpose(s)	Inte DOI STC	e nded Purpose MESTIC OCK	(s)
Commen Complet	nced Date : tion Date :	17-Apr-2007] Di	Final Dept rilled Dept	h : h :	180.00 m 180.00 m					
Contract Assistant Drill	tor Name : Driller : ler's Name :	NTERTECH 1997	DRILLIN SHEE	IG HY, Paul							
Property : - SCARF GWMA : - GW Zone : -							Standing Wat	ter Level : Salinity : Yield :	21.00 m 0.20 L/s	cumulative	
Site Deta	ails										
Site Chosen I Client	By Dr	iller		Fo Lic) orm A :(ensed :(C ounty CUMBERLAND CUMBERLAND	Pa NA NA	rish ARRABEEN ARRABEEN	Portion 2//5954 2 59540	n/Lot DP 01)1	
Riv Area	Region : ver Basin : / District :	10 - SYDN	EY SOUT	TH COAST			CMA I Grid Z	Map : Zone :	Scale :		
I Elevatio	Elevation : on Source :						Nort Eas	hing :6272957 sting :339422	Lati Longi	itude (S) :33° 4 tude (E) :151°	0' 16" 16' 4"
	GS Map :		MGA Z	one :56			Coordinate So	urce :GIS - Geogr	aphic Information	n System	
H-Hole:P-Pipe;OI H P Compon 1 Hole 1 Hole 1 Casing 1 Casing 1 Openin 1 Openin 1 Openin 1 Openin 1 Annulu	D-Outside Dian ment Type Hole Hole g Steel g PVC Cla ng Slots - ng Slots - ng Slots - ns Concret	eter;ID-Inside Di Diagonal Diagonal Diagonal e	ameter;C-Cen From (m) 0.00 5.60 -0.40 -0.40 20.00 57.00 90.00 0.00	nented;SL-Slo To (m) OI 5.60 180.00 5.60 107.60 24.00 60.00 102.00 5.60	t Length;A D (mm) 203 158 168 140 140 140 140 203	A-Aperture;GS-Grain S ID (mm) Interval E S S S P P P	Size:Q-Quantity:PL-Pk betails bown Hole Hammer eated on Bottom crewed and Glue VC Class 9; Saw VC Class 9; Saw	acement of Gravel Pack; ; ; open End ed; Suspended in m; SL: 100mm; A: m; SL: 100mm; A: m; SL: 100mm; A:	PC-Pressure Cemented Clamps; Open End 3mm 3mm 3mm	;S-Sump;CE-Centra	lisers
Water Be From (m) 22.00 89.00 98.00	earing 2 To (m 22.5 91.0 98.5	CONES a) Thickness (m) 0 0.50 0 2.00 0 0.50	WBZ Type			S.W.L. ((m) D.D.L. (m)	Yield (L/s) 0.05 0.10 0.05	Hole Depth (m)	Duration (hr)	Salinity (mg/L) 115.00 140.00 151.00
From (m) 0.00 0.50 13.00 22.00 22.50 23.00 43.00 55.50 56.50 58.50 64.50 74.00 77.00 89.00 91.00 94.00 98.00 98.00 98.00 100.50 100.50 102.00 125.00 145.00 146.00	LOG To (m) Thick 0,50 13,00 13,50 22,00 22,50 23,00 43,00 52,50 55,50 56,50 58,50 64,50 74,00 77,00 89,00 94,00 94,00 95,00 98,50 102,00 121,00 122,00 121,00 121,00 121,00 145,00 146,00 180,00	ness(m Drillers I 0.50 topsoil 12.50 sandstone 0.50 clay 8.50 sandstone 0.50 clay 20.00 sandstone 3.00 sandstone 1.00 shale, soft 2.00 sandstone 3.00 shale, clay 9.50 sandstone 3.00 shale, clay 9.50 sandstone 3.00 sandstone 3.00 sandstone 3.00 sandstone 3.00 sandstone 3.00 sandstone 3.00 sandstone 3.00 sandstone 1.50 sandstone	Pescription , yellow , quartz , yellow , quartz , grey , grey , quartz , grey					Geological Material Topsoil Sandstone Clay Sandstone Sandstone Sandstone Sandstone Sandstone Shale Sandstone Shale Sandstone Shale Sandstone	Comme	ents	

Remarks

updated from original form A

GW108831

*** End of GW108831 ***

APPENDIX C – HISTORICAL AERIAL PHOTOGRAPHS

LEGEND Ingleside Release Area			
	And		
DATE 26/08/2014 0 100 200 400 600 800 1,000 1:25,000 Metres Metres PAGE SIZE A4 COORDINATE SYSTEM GDA 1994 MGA Zone 56			
APPENDIX C FIGURE TITLE Aerial - 1930	SMEC		
PROJECT NO. 30012289 PROJECT TITLE Ingleside Precinct	© SMEC Australia Pty Ltd 2014. All Rights Reserved Disclaimer. While all reasonable care has been taken to ensure the information contained on this main is us to draw and any care the		
CREATED BY R. Chatfield SOURCES Vector backdrop data © MDS 2013	 information contained on this map is up to date and accurate, this map contained state from a number of sources - no warrantly is given that the information contained on this map is free from error or ormission. Any reliance placed on such information shall be at the sole risk of the user. Heast verify the accuracy of al information prior to using it. This map is not a design focument. 		

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Last updated by: RC10721 on 26/08/2014 at 14:52



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Last updated by: RC10721 on 28/08/2014 at 9:34



Location: I:\projects\30012289 – Ingleside Precinct – Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\D_1978.mxd

Last updated by: RC10721 on 28/08/2014 at 10:14



Location: I:\projects\30012289 – Ingleside Precinct – Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\E_1991.mxd

Last updated by: RC10721 on 26/08/2014 at 14:57



Location: I:\projects\30012289 – Ingleside Precinct – Contamination and Salinity Investigation\008 DATA\GIS\Maps\Report Figures\F_2012.mxd

Last updated by: RC10721 on 26/08/2014 at 14:58


	<u> </u>			вт	EX				Lead				Metals											
	3enzene	Ethylbenzene	Coluene	(ylene (m & p)	(ylene (o)	(ylene (Total)	lapthalene	Sum of BTEX	-ead	Arsenic	Cadmium	Chromium (III+VI)	Copper	Mercury	lickel	linc	,4-DDE	alpha-BHC	Aldrin	Adrin + Dieldrin	beta-BHC	fotal Chlordane (sum)	Chlordane (trans)	łBHC
	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	mg/kg	mg/kg
LOR	0.2	0.5	0.5	0.5	0.5	0.5	1	0.2	5	5	1	2	5	0.1	2	5	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Health Investigation Levels (NEPM 2013)	'																					<u> </u>		
NEPM 2013 HIL Residential A									300	100	20		6000	40	400	7400				6		50		
NEPM 2013 HIL Residential B									1200	500	150		30000	120	1200	60000				10		90		
NEPM 2013 HIL Residential C									600	300	90		17000	80	1200	30000				10		70		
NEPM 2013 HIL Residential D									1500	3000	900		240000	730	6000	400000				45		530		
Ecological Screening Level for TPH																						<u> </u>		
NEPM 2013 ESLs for TPH in urban residential and public open space (fine)	65	125	105			45																		
NEPM 2013 ESLs for TPH in commercial/Industrial (fine)	95	185	135			95																		
Management Limits for TPH Fractions in soil (NEPM 2013)																						<u> </u>		
Urban residential/public open space (fine)																								
Commercial/ Industrial (fine)																								
Ecological Investigation Levels																								
NEPM 1999 EIL									600	20	3		100	1	60	200								
NEPM 2013 ACL in public open space									1100	100		190	230		30	280								
Average concentration									21			9	11		3.8	45								
NEPM EILs (Calculated Value ACL + Average)									1121			199	241		34	325								
Field ID Sampled Date SDG Sample Denth																								

Field_ID	Sampled_Date	SDG	Sample_Depth																								
S154	6/3/20114	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	36	<5	<1	15	26	<0.1	12	70	<0.05	< 0.05	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05
S469	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	6	<5	<1	8	22	<0.1	<2	15	<0.05	<0.05	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05
S444	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	6	10	<1	7	6	<0.1	3	13	<0.05	<0.05	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05
S212	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	49	<5	<1	9	18	<0.1	6	98	< 0.05	<0.05	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05
S38	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	<5	<5	<1	5	<5	<0.1	<2	<5	0.13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S91	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	16	10	<1	21	8	<0.1	3	61	<0.05	< 0.05	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05
S140	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	24	<5	<1	14	8	0.1	<2	73	<0.05	< 0.05	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05
S164	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	35	<5	<1	18	16	<0.1	16	98	<0.05	< 0.05	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05
S41	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	47	<5	<1	6	12	<0.1	<2	50	<0.05	< 0.05	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05
S15/1	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	15	<5	<1	6	14	<0.1	2	62	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
S15/2 - Field Duplicate	6/03/2014	ES1405222	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	33	<5	<1	9	18	<0.1	4	68	<0.05	< 0.05	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05
S283	14/03/2014	ES1405891	0-0.2	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	8	<5	<1	<2	<5	<0.1	<2	10	<0.05	<0.05	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05
S283/2 - Field Duplicate	14/03/2014	ES1405891	0-0.2	< 0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	<5	<5	<1	4	<5	<0.1	<2	<5	<0.05	<0.05	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05
S130	14/03/2014	ES1405891	0-0.2	< 0.2	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	<1	< 0.2	10	<5	<1	6	<5	<0.1	<2	<5	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

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	Т
Number of Detects	0	0	0	0	0	0	0	0	12	2	0	13	10	1	7	11	1	0	0	0	0	0	0	0	Т
Minimum Concentration	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	<5	<5	<1	<2	<5	<0.1	<2	<5	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	<0.05	< 0.05	۰T
Minimum Detect	ND	ND	ND	ND	ND	ND	ND	ND	6	10	ND	4	6	0.1	2	10	0.13	ND	ND	ND	ND	ND	ND	ND	Т
Maximum Concentration	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.2	49	10	<1	21	26	0.1	16	98	0.13	< 0.05	<0.05	< 0.05	<0.05	< 0.05	<0.05	< 0.05	<i>,</i> [
Maximum Detect	ND	ND	ND	ND	ND	ND	ND	ND	49	10	ND	21	26	0.1	16	98	0.13	ND	ND	ND	ND	ND	ND	ND	Т
Average Concentration	0.1	0.25	0.25	0.25	0.25	0.25	0.5	0.1	21	3.6	0.5	9.2	11	0.054	3.8	45	0.033	0.025	0.025	0.025	0.025	0.025	0.025	0.025	·Τ
Median Concentration	0.1	0.25	0.25	0.25	0.25	0.25	0.5	0.1	15.5	2.5	0.5	7.5	10	0.05	1.5	55.5	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	۰T
Standard Deviation	0	0	0	0	0	0	0	0	16	2.7	0	5.7	7.9	0.013	4.6	36	0.028	0	0	0	0	0	0	0	Т
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	6	0	0	4	7	0	4	8	0	0	0	0	0	0	0	0	Т
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	6	0	0	4	7	0	4	8	0	0	0	0	0	0	0	0	T
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)

		Organoo	chlorine	(OC) Pe	sticides	3				
4.4 DDD	4.4 DDT	Organoo DDL+DDD DDL+DDD	Dieldrin	Hexachlorobenzene (HCB) 0	appha-Endosufan	cis-Chlordane	Endrin aldehyde	Endrin ketone	oeta-Endosulfan	Endosulfan sulphate
na/ka	ma/ka	ma/ka	ma/ka	ma/ka	ma/ka	ma/ka	ma/ka	ma/ka	ma/ka	ma/ka
0.05	0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
5.55	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		240								
		600								
		400								
		3600								
	180									
	100									
<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	< 0.05	< 0.05
<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	< 0.05	<0.05
<0.05	<0.2	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
< 0.05	<0.2	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05
< 0.05	<0.2	0.13	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
< 0.05	< 0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	< 0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	<0.2	< 0.05	< 0.05	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	<0.2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
<0.05	<0.2	<0.05	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
14	14	14	14	14	14	14	14	14	14	14
0	0	1	0	0	0	0	0	0	0	0
<0.05	<0.2	<0.05	< 0.05	<0.05	< 0.05	< 0.05	<0.05	< 0.05	< 0.05	< 0.05
ND	ND	0.13	ND	ND	ND	ND	ND	ND	ND	ND
<0.05	<0.2	0.13	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	< 0.05	<0.05
ND	ND	0.13	ND	ND	ND	ND	ND	ND	ND	ND
0.025	0.1	0.033	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
0.025	0.1	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
0	0	0.028	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
v	v	0	v	0	0	v	0	v	v	0



	_													Org	ganophosp	ohorou	s (OP)	Pesticid	es							PCB										PAH/Ph
				mg/kg	by Game)	u by/68	by/00/Heptachlor epoxide	⊠y/ð Methoxychlor	by/Mc beneton-S-methyl	Monocrotophos	Dimethoate	Diazinon Wã/kā	a by∫d by	barathion-methyl	Malathion Mathion	/g//g/	Chlorpyrifos	Parathion Mol/Parathion	mg/kg	Bromophos-ethyl	Ballenamiphos	Prothiofos Walyba	mg/kg n	by/b0 by/b0	Mzinphos Methyl	build Total Polychlorinated biphenyls	Mg/kg	ay@a	Anthracene	ଞ୍ଚ ଜିକ୍ଷ മନ୍ଧ	mg/kg	jenzo(a)pyrene TEQ (zero) bγ	jenzo(a)pyrene TEQ (half LOR) bγ	≅ Senzo(a)pyrene TEQ (LOR) Sg	∭w∭ Benzo(k)fluoranthene	banzo(b)fluoranthene
LOR				0.05	0.05	0.05	0.05	0.2	0.05 0.05	0.2	0.05	0.05	0.05	0.2	0.05 (0.05	0.05	0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Health Investigation Leve	IS (NEPM 2013)			10		6		300																											+	
NEPM 2013 HIL Residentia	al B			20		10		500																												
NEPM 2013 HIL Residentia	al C			20		10		400																												
NEPM 2013 HIL Residentia	al D vol for TDU			100		50	2	2500		-																									4	4
NEPM 2013 ESLs for TPH	in urban residential and public	c open space (fine)																													0.7					
NEPM 2013 ESLs for TPH	in commercial/Industrial (fine))																													1.4					
Management Limits for TF	PH Fractions in soil (NEPM	2013)						_																												
Commercial/Industrial (fine	en space (nne)																																			
Ecological Investigation L	Levels																																			
NEPM 1999 EIL																																				
NEPM 2013 ACL in public of	open space							_																												
NEPM EILs (Calculated Va	lue ACL + Average)																																			
																																				<i>p</i>
Field_ID	Sampled_Date	SDG	Sample_Depth	<0.05	<0.05		0.05	-0.2	~0.05	<02	<0.05	<0.05	<0.05	<0.2	<0.05	0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	<01	<0.5	<0.5	<0.5	0.6	07	0.0	12	15		
S469	6/03/2014	ES1405222	0-0.2	<0.05	<0.05	<0.05 <	0.05	<0.2	<0.05 <0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05 <	:0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05 <	:0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.0	<0.5	<0.5
S444	6/03/2014	ES1405222	0-0.2	< 0.05	<0.05	<0.05 <	:0.05	<0.2	<0.05 <0.05	<0.2	<0.05	<0.05	< 0.05	<0.2	<0.05 <	:0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05 <	<0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S212	6/03/2014	ES1405222	0-0.2	<0.05	<0.05	<0.05 <	0.05	< 0.2	<0.05 <0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05 <	0.05	< 0.05	<0.2	<0.05	<0.05	<0.05	<0.05	< 0.05 <	0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
<u>530</u> S91	6/03/2014	ES1405222 ES1405222	0-0.2	<0.05	<0.05	<0.05 <	0.05	<0.2	<0.05 <0.05	<0.2	< 0.05	<0.05	<0.05	<0.2	<0.05 <	0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05 <	0.05	<0.05	<0.1	<0.5	< 0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S140	6/03/2014	ES1405222	0-0.2	< 0.05	<0.05	<0.05 <	0.05	<0.2	<0.05 <0.05	<0.2	<0.05	<0.05	< 0.05	<0.2	<0.05 <	0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05 <	:0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S164	6/03/2014	ES1405222	0-0.2	< 0.05	< 0.05	< 0.05 <	0.05	< 0.2	<0.05 <0.05	<0.2	< 0.05	< 0.05	< 0.05	<0.2	<0.05 <	:0.05	< 0.05	<0.2	<0.05	< 0.05	< 0.05	< 0.05	< 0.05 <	:0.05	< 0.05	<0.1	<0.5	< 0.5	< 0.5	< 0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S41 S15/1	6/03/2014	ES1405222 ES1405222	0-0.2	<0.05	<0.05	<0.05 <	0.05	<0.2	<0.05 <0.05 <0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05 <	0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05 <	0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S15/2 - Field Duplicate	6/03/2014	ES1405222	0-0.2	< 0.05	< 0.05	<0.05 <	0.05	<0.2	<0.05 <0.05	<0.2	< 0.05	< 0.05	< 0.05	<0.2	<0.05 <	0.05	<0.05	<0.2	< 0.05	< 0.05	<0.05	< 0.05	< 0.05 <	:0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	< 0.5	0.6	1.2	<0.5	<0.5
S283	14/03/2014	ES1405891	0-0.2	< 0.05	< 0.05	< 0.05 <	:0.05	<0.2	<0.05 <0.05	<0.2	< 0.05	<0.05	<0.05	<0.2	<0.05 <	:0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05 <	:0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
S283/2 - Field Duplicate	14/03/2014	ES1405891	0-0.2	<0.05	<0.05	<0.05 <	0.05	<0.2	<0.05 <0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05 <	0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05 <	0.05	<0.05	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
13 130	14/03/2014	E31403691	0-0.2	1 40.00	1 40.00	1 40.00		10.2	10.00 1 10.00	40.Z	10.00	40.00	40.00	10.2	1 40.00 1 4	.0.00	40.00	10.2	10.00	10.00	10.00	10.00	10.00		20.00		40.0	20.0	40.0	10.0	40.0		0.0	1.2		10.0
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	14	14	14	14	14	14	14	14	14
Number of Detects				0	0	0	0	0		0	0	0	0	0	0	0.05	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	14	14	- 0	1
Minimum Detect				ND	ND	ND	ND	ND	ND ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.6	0.7	0.9	0.6	1.2	ND	0.9
Maximum Concentration				< 0.05	< 0.05	<0.05 <	0.05	<0.2	<0.05 <0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05 <	:0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05 <	:0.05	<0.05	<0.1	<0.5	<0.5	<0.5	0.6	0.7	0.9	1.2	1.5	<0.5	0.9
Maximum Detect				ND	ND	ND	ND	ND	ND ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND 0.005	ND	ND	ND	ND	ND	ND	0.6	0.7	0.9	1.2	1.5	ND	0.9
Average Concentration				0.025	0.025	0.025 0	0.025	0.1	0.025 0.025	0.1	0.025	0.025	0.025	0.1	0.025 0	0.025	0.025	0.1	0.025	0.025	0.025	0.025	0.025 0	0.025	0.025	0.05	0.25	0.25	0.25	0.28	0.28	0.3	0.64	1.2	0.25	0.3
Standard Deviation				0.025	0.023	0.025 0	020	0	0 0.025	0.1	0.025	0.025	0.025	0.1	0.025 0	023	0.025	0.1	0.025	0.025	0.025	0.025	0.025 0	020	0.025	0.05	0.25	0.25	0.25	0.25	0.25	0.25	0.0	0.08	0.25	0.25
Number of Guideline Excee	edances			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	0	0	0	0	0	0	0	0	0
Number of Guideline Excee	edances(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	0	0	0	0	0	0	0	0	0

20114 ES1405222	0-0.2	< 0.05	< 0.05	< 0.05	< 0.05	<0.2	< 0.05	< 0.05	<0.2	<0.05	< 0.05	< 0.05	<0.2	<0.05	<0.05	<0.05	<0.2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0
2014 ES1405222	0-0.2	< 0.05	< 0.05	< 0.05	< 0.05	<0.2	< 0.05	< 0.05	<0.2	<0.05	< 0.05	< 0.05	<0.2	<0.05	<0.05	<0.05	<0.2	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0
2014 ES1405222	0-0.2	< 0.05	< 0.05	< 0.05	< 0.05	<0.2	< 0.05	< 0.05	<0.2	<0.05	< 0.05	< 0.05	<0.2	<0.05	<0.05	<0.05	<0.2	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0
2014 ES1405222	0-0.2	< 0.05	< 0.05	< 0.05	< 0.05	<0.2	< 0.05	< 0.05	<0.2	<0.05	< 0.05	< 0.05	<0.2	<0.05	<0.05	<0.05	<0.2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0
2014 ES1405222	0-0.2	< 0.05	<0.05	<0.05	<0.05	<0.2	<0.05	< 0.05	<0.2	<0.05	< 0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	<0.1	<0
2014 ES1405222	0-0.2	< 0.05	<0.05	<0.05	<0.05	<0.2	<0.05	< 0.05	<0.2	<0.05	< 0.05	< 0.05	<0.2	<0.05	<0.05	<0.05	<0.2	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0
2014 ES1405222	0-0.2	< 0.05	<0.05	<0.05	<0.05	<0.2	<0.05	< 0.05	<0.2	<0.05	<0.05	< 0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	<0.1	<0
2014 ES1405222	0-0.2	< 0.05	< 0.05	< 0.05	< 0.05	<0.2	< 0.05	< 0.05	<0.2	<0.05	< 0.05	< 0.05	<0.2	<0.05	<0.05	<0.05	<0.2	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0
2014 ES1405222	0-0.2	< 0.05	< 0.05	< 0.05	< 0.05	<0.2	< 0.05	< 0.05	<0.2	<0.05	< 0.05	< 0.05	<0.2	<0.05	<0.05	<0.05	<0.2	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0
2014 ES1405222	0-0.2	< 0.05	<0.05	<0.05	<0.05	<0.2	<0.05	< 0.05	<0.2	<0.05	< 0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	<0.1	<0
2014 ES1405222	0-0.2	< 0.05	<0.05	<0.05	<0.05	<0.2	<0.05	< 0.05	<0.2	<0.05	< 0.05	< 0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0
3/2014 ES1405891	0-0.2	< 0.05	<0.05	<0.05	<0.05	<0.2	<0.05	< 0.05	<0.2	<0.05	<0.05	< 0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0
3/2014 ES1405891	0-0.2	< 0.05	< 0.05	< 0.05	< 0.05	<0.2	< 0.05	< 0.05	<0.2	< 0.05	< 0.05	< 0.05	<0.2	<0.05	<0.05	<0.05	<0.2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0
3/2014 ES1405891	0-0.2	< 0.05	<0.05	<0.05	<0.05	<0.2	<0.05	< 0.05	<0.2	<0.05	< 0.05	< 0.05	<0.2	< 0.05	< 0.05	<0.05	<0.2	< 0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0
	20114 ES1405222 3/2014 ES1405821 3/2014 ES1405821 3/2014 ES1405891 3/2014 ES1405891 3/2014 ES1405891	20114 ES1405222 0-0.2 3/2014 ES1405822 0-0.2 3/2014 ES1405891 0-0.2 3/2014 ES1405891 0-0.2 3/2014 ES1405891 0-0.2 3/2014 ES1405891 0-0.2	20114 ES1405222 0-0.2 <0.05	20114 ES1405222 0-0.2 <0.05 <0.05 3/2014 ES1405222 0-0.2 <0.05	20114 ES1405222 0-0.2 <0.05 <0.05 3/2014 ES1405222 0-0.2 <0.05	20114 ES1405222 0-0.2 <0.05 <0.05 <0.05 <0.05 3/2014 ES1405222 0-0.2 <0.05	20114 ES1405222 0-0.2 <0.05 <0.05 <0.05 <0.05 <0.05 <0.02 3/2014 ES1405222 0-0.2 <0.05	20114 ES1405222 0-0.2 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 <0.05 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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	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
Minimum Concentration	< 0.05	<0.05	< 0.05	<0.05	<0.2	<0.05	< 0.05	<0.2	< 0.05	< 0.05	< 0.05	<0.2	< 0.05	< 0.05	< 0.05	<0.2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.1	<0.
Minimum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NE
Maximum Concentration	< 0.05	<0.05	<0.05	< 0.05	<0.2	<0.05	< 0.05	<0.2	< 0.05	< 0.05	< 0.05	<0.2	< 0.05	<0.05	<0.05	<0.2	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	<0.1	<0.
Maximum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NE
Average Concentration	0.025	0.025	0.025	0.025	0.1	0.025	0.025	0.1	0.025	0.025	0.025	0.1	0.025	0.025	0.025	0.1	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.05	0.2
Median Concentration	0.025	0.025	0.025	0.025	0.1	0.025	0.025	0.1	0.025	0.025	0.025	0.1	0.025	0.025	0.025	0.1	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.05	0.2
Standard Deviation	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	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																									

Table D1 - Soil Analytical Results (Contamination)



	enols													TRH						TPH		
	a berzo(g,h,i)perylene	Chrysene	g bibenz(a,h)anthracene	Agg Fluoranthene	Eluorene Mä/Kä	∭ bay bay bay bay bay bay bay bay bay bay	Maphthalene bay@a	Phenanthrene W/ba	HPH of BAH	Priene Mg/kg	න්ති කිරී C6-C10 Fraction	ଞ୍ଚ ସିସ୍ଥି C6-C10 Fraction minus BTEX (F1)	agest section by the	agkorsteen by C16-C34 Fraction	a ∭asc34-C40 Fraction bay	මූ ක්රි⇒C10-C40 Fraction (sum)	⊒ ຊື່ອັ⊳c10-C16 Fraction minus Naphthalene (F2) ຜິງ	co - so mg/kg	54/6m bay/s	by/6m by/6m	c29-c36	a a/ja ba/j ba/j
LOR	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
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	1																					
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																						
S154	6/3/20114	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 Decoding	1 44	44					44			1 44 1											4.4	4.4
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
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
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
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
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)



	SIVIEC		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						
	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
Ĕ	Xylene (m & p)	mg/kg	0.5	<0.5	< 0.5	0	<0.5	<0.5	0
'n	Xylene (o) Xylene (Total)	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Napthalene	ma/ka	1	<1	<1	0	<1	<1	0
	Sum of BTEX	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
Lei	Lead	mg/kg	5	15	33	75	8	<5	105
	Arsenic	mg/kg	5	<5	<5	0	<5	<5	0
	Cadmium	mg/kg	1	<1	<1	0	<1	<1	0
als	Chromium (III+VI)	mg/kg	2	6	9	40	<2	4	120
Met	Copper	mg/kg	5	14	18	25	<5	<5	0
	Nickel	ma/ka	2	2	4	67	<2	<2	0
	Zinc	mg/kg	5	62	68	9	10	<5	120
	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
	Total Chlordane (sum)	ma/ka	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
des	d-BHC	mg/kg	0.05	< 0.05	<0.05	0	< 0.05	<0.05	0
stici	4.4 DDD	mg/kg	0.05	<0.05	< 0.05	0	<0.05	<0.05	0
Peé		mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
ŝ		mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
)) e(Hexachlorobenzene (HCB)	mg/kg mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
lorir	appha-Endosulfan	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
ch	cis-Chlordane	mg/kg	0.05	< 0.05	< 0.05	0	< 0.05	<0.05	0
Janc	Endrin aldehyde	mg/kg	0.05	<0.05	< 0.05	0	<0.05	<0.05	0
ō	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
	Endosuliari supriate	mg/kg 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
	Dichlorvos	mg/kg	0.05	< 0.05	< 0.05	0	<0.05	<0.05	0
	Demeton-S-methyl Monocratophon	mg/kg	0.05	<0.05	< 0.05	0	<0.05	<0.05	0
s	Dimethoate	mg/kg mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
cide	Diazinon	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
esti	Chlorpyrifos-methyl	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
е (с	Parathion-methyl	mg/kg	0.2	<0.2	<0.2	0	<0.2	<0.2	0
Ō	Malathion	mg/kg	0.05	< 0.05	<0.05	0	<0.05	<0.05	0
sno	Fenthion	mg/kg	0.05	<0.05	< 0.05	0	<0.05	<0.05	0
hor	Parathion	mg/kg mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
dso	Pirimphos-ethyl	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
hqo	Bromophos-ethyl	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
gan	Fenamiphos	mg/kg	0.05	<0.05	<0.05	0	<0.05	<0.05	0
ō	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
m	Azinprios Metry	шу/ку	0.05	<0.05	<0.05	0	<0.05	<0.05	0
PC	Total Polychlorinated biphenyls	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0
	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 Benz(a)anthracena	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/ka	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
5	Benzo(a)pyrene TEQ (LOR)	mg/kg	0.5	1.2	1.2	0	1.2	1.2	0
slon	Benzo(k)fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
Phe	Benzo(b)fluoranthene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
AH/.	Denzo(g,n,i)perylene Chrysene	mg/kg	0.5 0.5	<0.5	<0.5	0	<0.5	<0.5	0
à	Dibenz(a,h)anthracene	ma/ka	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Fluoranthene	mg/ka	0.5	<0.5	<0.5	0	<0.5	<0.5	Ő
	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
	Prenanthrene	mg/kg	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	Pyrene	ma/ka	0.5	<0.5	<0.5	0	<0.5	<0.5	0
	C6-C10 Fraction	mg/ka	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
Ц	>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-C16 Fraction (sum)	mg/kg	50	<50	260	165	<50	<50	0
	C6 - C9	ma/ka	10	<00	<10	0	<00	<00	0
	C10 - C14	mg/ka	50	<50	<50	0	<50	<50	0
Ŧ	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.



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				μS/cm	mS/cm	NA	mS/cm	pH Unit	~	mg/kg	mg/kg
LOR				1	1	NA	1	0.1	1	10	10
Slightly saline							2 - 4				
Moderately saline							4 - 8				
Very saline Highly saline							8 - 16				
S212	6/03/2014	SDG 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				
S338	6/03/2014	ES1405223 ES1405223	0-0.2	22	0.064	8.6	0.6	-	-		-
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 S364	6/03/2014	ES1405223 ES1405223	0-0.2	80	0.019	8.6	0.2	-		-	-
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				
S369	6/03/2014	ES1405223 ES1405223	0-0.2	45	0.045	8.6	0.4	-			-
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				
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 S293	6/03/2014	ES1405223 ES1405223	0-0.2	42	0.042	8.6	0.4	-			-
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 S179	4/03/2014	ES1405223 ES1405223	0-0.2	24	0.024	8.6	0.2	-	-	-	-
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				
S181	4/03/2014	ES1405223 ES1405223	0-0.2	22	0.022	8.6	0.2				
S206	4/03/2014	ES1405223	0-0.2	122	0.122	8.6	1.0				
S231 S281	4/03/2014	ES1405223 ES1405223	0-0.2	21	0.033	8.6	0.3				
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				
S256 S230	4/03/2014	ES1405223 ES1405223	0-0.2	27	0.017	8.6	0.1				
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 S91	4/03/2014	ES1405223 ES1405223	0-0.2	126	0.126	8.6 8.6	1.1	6.3	36.7	210	- 50
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 S142	6/03/2014	ES1405223 ES1405223	0-0.2	21	0.021	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	-	-	-	-
\$163	6/03/2014	ES1405223 ES1405223	0-0.2	8	0.025	8.6	0.2	-		-	-
S118	6/03/2014	ES1405223	0-0.2	44	0.044	8.6	0.4	-	-	-	-
S114 S117	6/03/2014	ES1405223	0-0.2	15	0.015	8.6	0.1	-	-	-	-
S65	6/03/2014	ES1405223	0-0.2	16	0.035	8.6	0.5	-	-	-	-
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	-	-	-	-
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 S113	6/03/2014	ES1405223 ES1405223	0-0.2	96	0.036	8.6	0.3	-		-	-
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				
286	14/03/2014	ES1405892	0-0.2	18	0.021	8.6	0.2	-	-	-	-
261	14/03/2014	ES1405892	0-0.2	107	0.107	8.6	0.9	-	-	-	-
250	14/03/2014	ES1405892	0-0.2	20	0.02	8.6 8.6	0.2		-		
236	14/03/2014	ES1405892	0-0.2	116	0.116	8.6	1.0	-	-	-	-
235	14/03/2014	ES1405892	0-0.2	30	0.03	8.6	0.3	-	-	-	-
283/2 - Field Duplicate	14/03/2014	ES1405892	0-0.2	7	0.006	0.0 8.6	0.1				\vdash
208	14/03/2014	ES1405892	0-0.2	19	0.019	8.6	0.2	-	-	-	-
182	14/03/2014	ES1405892	0-0.2	15	0.015	8.6	0.1	-	-	-	-
130	14/03/2014	ES1405892	0-0.2	16	0.012	8.6	0.1	-	-	-	-
Statistical Summer											
Number of Results				72	72	NA	72	2	2	2	2
Number of Detects				72	72	NA	72	2	2	2	2
Minimum Concentration				6	0.006	NA NA	0.0516	6.3	12.7	60 60	20
Maximum Concentration				214	0.214	NA	1.8404	6.9	36.7	210	50
Maximum Detect				214	0.214	NA	1.8404	6.9	36.7	210	50
Median Concentration				23	0.036	NA	0.33	6.6	24.7	135	35
Standard Deviation	dances			36	0.036	NA	0.31	NA	NA	NA	NA
Number of Guideline Excee	edances(Detects Only)		0	0	NA	0	0	0	0	0

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



			SDG	ES1405223	ES1405223	000	ES1405892	ES1405892	000
			Field ID	S15/1	S15/2	(%)	S283	S283/2	(%)
			Date	6/03/2014	6/03/2014	(70)	14/03/2014	14/03/2014	(70)
-									
Group	Analyte	Units	LOR						
	Electrical Conductivity @ 25°C	µS/cm	1	80	126	0	6	7	0
Ę	рН	pH Unit	0.1	6.9	6.3	9			-
li	Moisture	%	1	12.7	36.7	97			
Sa	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.

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APPENDIX E – LABORATORY REPORTS
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	USE	MATRIX - SOLID (S	ETAILS 5), WATER (W)	CONTAINER INFORMATION	ANALYSIS REQUIRED incluc	Ing SUITES (NB. Suite Codes must be listed to attract suite price) Who xial (unfiltered bottle remainent) or Olsenhaaf (fisher manual bottle)	ere Additional Information
	LABID	SAMPLE ID	DATE/TIME	TYPE & PRESERVATIVE (refer to codes below)	TOTAL DINTAINERS		Comments on likely contaminant lavels, diutions, or samples
		5174			c. J		elc.
	N	5469		. JE /20.			
	ω	2445				Sydney	
	4-	5,212				Work Order	
	γ	365	· ·	*		ES1405000	
	.6	54					
	2	<u>~</u> {¢					
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	2	Surli					
		1	-				
				A State of the second			
	Water Contain	rer Godres: P = Linpreserved Plastic: N = Ni	inc Preservad Plastic: ORC = Mit	in Preserved ORC: SH = Socium Hydroiddalod Preserved	S & System Huterouties Browners Director of a statement		
	F = Formaldelt	y <u>te Preserveu, vo - vvA versoonum essip</u> y <u>te Preservet Glass; Z = Zinc Acetate Pres</u> c	htva Proserved; VS = VOA Vial Sc rved Bottle: E = EDTA Preserved	לאלג'ב Preserved: AV = Africetytt Unpreserved Vial SG = Stat Rollow: SY = Stovin Ballow: ASB = Pr4. Say to a low outp	inc Preserved Ambor Glass, H = HCJ preserved Plastic 	nass Umprakanned; AP - Aufleight Unpresenred Plasik; 2; HS = HC) proserved Speciation bollle; SP = Sutturk Preserved Plasic;	· · · · · · · · · · · · · · · · · · ·
		موجوع الحالي ومحمد المحمد معامل ولي المحمد الم	سيعيد المركزية فتحري المحارين وتركز كمعالا يبعد مراكز بالاسا والمستليدة	والمترفية والمعرفية والمسارية والمستعلم والمستعمل	24		
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	CERI	FIFICATE OF ANALYSIS	
Work Order	ES1405222	Page	: 1 of 15
Client	: SMEC TESTING SERVICES PTY LTD	Laboratory	: Environmental Division Sydney
Contact	: ALL REPORTS (ENQUIRIES)	Contact	: Client Services
Address	: P O BOX 6989	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
	WETHERILL PARK 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
Order number	: 10818		
C-O-C number	:	Date Samples Received	: 11-MAR-2014
Sampler	: J. KERR	Issue Date	: 19-MAR-2014
Site	:		
		No. of samples received	: 11
Quote number	: EN/025/13	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	Signatories This document has been electronically carried out in compliance with procedures spe	ndicated below. Electronic signing has been	
NAIA	ISO/IEC 17025.	Signatories	Position	Accreditation Category
		Celine Conceicao Pabi Subba Shobhna Chandra	Senior Spectroscopist Senior Organic Chemist Metals Coordinator	Sydney Inorganics Sydney Organics Sydney Inorganics

Address 277-289 Woodpark Road Smithfield NSW Australia 2164 PHONE +61-2-8784 8555 Facsimile +61-2-8784 8500 Environmental Division Sydney ABN 84 009 936 029 Part of the ALS Group An ALS Limited Company



www.alsglobal.com

RIGHT SOLUTIONS RIGHT PARTNER



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: Pozitive results on sample #S38 confirmed by re-extraction and re-analysis.

Page : 3 of 15 Work Order : ES1405222 Client : SMEC TESTING SERVICES PTY LTD Project : 19580 4030C



Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	S154	S469	S444	S212	S38
	Cli	ient samplii	ng date / time	06-MAR-2014 15:00				
Compound	CAS Number	LOR	Unit	ES1405222-001	ES1405222-002	ES1405222-003	ES1405222-004	ES1405222-005
EA055: Moisture Content	one number							
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 Fl	IMS							
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

Page: 4 of 15Work Order: ES1405222Client: SMEC TESTING SERVICES PTY LTDProject: 19580 4030C



Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	S154	S469	S444	S212	S38
	Cli	ient sampli	ng date / time	06-MAR-2014 15:00				
Compound	CAS Number	LOR	Unit	ES1405222-001	ES1405222-002	ES1405222-003	ES1405222-004	ES1405222-005
EP068A: Organochloring Posticides	(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 Pestici	des (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

Page : 5 of 15 Work Order : ES1405222 Client : SMEC TESTING SERVICES PTY LTD Project : 19580 4030C



Sub-Matrix: SOIL (Matrix: SOIL)	Clie	ent sample ID	S154	S469	S444	S212	S38
c	lient sampli	na date / time	06-MAR-2014 15:00				
		Unit	ES1405222-001	ES1405222-002	ES1405222-003	ES1405222-004	ES1405222-005
Combound CAS Number	LOR	Unit					
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Con	tinued		••				
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
A Benzo(a)pyrene TEQ (zero)	0.5	mg/kg	0.9	<0.5	<0.5	<0.5	<0.5
A Benzo(a)pyrene TEQ (half LOR)	0.5	mg/kg	1.2	0.6	0.6	0.6	0.6
A 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 20	13						
C6 - C10 Fraction C6_C10	10	mg/kg	<10	<10	<10	<10	<10
C6 - C10 Fraction minus BTEX C6_C10-BTEX (F1)	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
Benzene 71 42 2	02	ma/ka	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene 108.82.3	0.5	ma/ka	<0.5	<0.5	<0.5	<0.5	<0.5
Fthylbenzene 100-80-3	0.5	ma/ka	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xviene 100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xvlene 05 47 6	0.5	ma/ka	<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

Page : 6 of 15 Work Order : ES1405222 Client : SMEC TESTING SERVICES PTY LTD Project : 19580 4030C



Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	S154	S469	S444	S212	S38
	Cli	ent sampli	ng date / time	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 Surrog	ate							
Dibromo-DDE	21655-73-2	0.1	%	84.2	91.0	78.2	79.5	84.6
EP068T: Organophosphorus Pesticide Su	rrogate							
DEF	78-48-8	0.1	%	74.3	104	85.7	55.7	110
EP075(SIM)S: Phenolic Compound Surrog	ates							
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

Page : 7 of 15 Work Order : ES1405222 Client : SMEC TESTING SERVICES PTY LTD Project : 19580 4030C



Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	S91	S140	S164	S41	S15/1
	Cli	ent samplii	ng date / time	06-MAR-2014 15:00				
Compound	CAS Number	LOR	Unit	ES1405222-006	ES1405222-007	ES1405222-008	ES1405222-009	ES1405222-010
EA055: Moisture Content	one number							
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 F	IMS							
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

Page : 8 of 15 Work Order : ES1405222 Client : SMEC TESTING SERVICES PTY LTD Project : 19580 4030C



Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	S91	S140	S164	S41	S15/1
	CI	ient sampli	ng date / time	06-MAR-2014 15:00				
Compound	CAS Number	I OR	Unit	ES1405222-006	ES1405222-007	ES1405222-008	ES1405222-009	ES1405222-010
EP068A: Organochloring Posticida	(OC) Continued	2011	UTIN					
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 Pesti	cides (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 Aromati	ic 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

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Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	S91	S140	S164	S41	S15/1
	Cl	ient sampli	na date / time	06-MAR-2014 15:00				
2 mm mm d	040 March 44	LOP	Unit	ES1405222-006	ES1405222-007	ES1405222-008	ES1405222-009	ES1405222-010
	CAS Number	LOK	Onn					
EP075(SIM)B: Polynuclear Aromatic H	ydrocarbons - Con	linued		-0.5	-0.5	-0.5	-0.5	-0.5
	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
A Benzo(a)pyrene TEQ (zero)		0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
A 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 Hydrocarl	oons							
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 Hydroca	arbons - NEPM 201	3						
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

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Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	S91	S140	S164	S41	S15/1
	Cli	ent sampli	ng date / time	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 Sur	rogate							
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 Sur	rrogates							
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



Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	S15/2	 	
	Cli	ent samplii	na date / time	06-MAR-2014 15:00	 	
O	04044		Unit	ES1405222-011	 	
	CAS Number	LOK	Onn			
EA055: Moisture Content		10	%	32.2	 	
		1.0	70	52.2		
Arconic	7440.00.0	5	ma/ka	<5		
Cadmium	7440-38-2	1	mg/kg	<1	 	
Chromium	7440-43-9	2	mg/kg	0	 	
Copper	7440-47-3	5	mg/kg	18	 	
	7440-30-8	5	mg/kg	33	 	
Nickel	7439-92-1	2	mg/kg	4	 	
Zinc	7440-02-0	5	mg/kg	68	 	
	7440-00-0		ingrig			
And the second s	7/30.07.6	0.1	ma/ka	<0.1	 	
	7439-97-0	0.1	mg/kg			
Total Polychlorinated biphonyls (PCB)		0.1	ma/ka	<0.1	 	
ED000A. Organization Destisides (OO)		0.1	inging			
alpha-BHC	319-84-6	0.05	ma/ka	<0.05	 	
Hexachlorobenzene (HCB)	118-74-1	0.05	ma/ka	<0.05	 	
beta-BHC	319-85-7	0.05	ma/ka	<0.05	 	
gamma-BHC	58-89-9	0.05	ma/ka	<0.05	 	
delta-BHC	319-86-8	0.05	ma/ka	<0.05	 	
Heptachlor	76-44-8	0.05	ma/ka	<0.05	 	
Aldrin	309-00-2	0.05	ma/ka	<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	 	
			5 5		 	

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Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	S15/2	 	
	Cl	ient sampli	ng date / time	06-MAR-2014 15:00	 	
Compound	CAS Number	I OR	l Init	ES1405222-011	 	
ED068A: Organachlaring Bastisidas		LOIN	Offic			
4.4'-DDT	5 (OC) - Continued	0.2	ma/ka	<0.2	 	
Endrin ketone	53494-70-5	0.05	ma/ka	<0.05	 	
Methoxychlor	72-43-5	0.2	ma/ka	<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 Pestic	ides (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	 	

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Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	S15/2	 	
	Cl	ient sampli	na date / time	06-MAR-2014 15:00	 	
Common and	CAC Alumbar	LOR	Unit	ES1405222-011	 	
		LOIN	Onn			
Chrysene	varocarbons - Cont	inued	malka	<0 E		
	218-01-9	0.5	mg/kg	<0.5	 	
Benzo(b)fluorantnene	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 Hydrocart	ons					
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 Hydroca	arbons - NEPM 201	3				
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	 	



Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	S15/2				
	Cli	ient sampli	ng 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 Surrog	ate							
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 Surrog	ates							
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				

ALS

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

Work Order	: ES1405222	Page	: 1 of 14
Client Contact Address	 SMEC TESTING SERVICES PTY LTD ALL REPORTS (ENQUIRIES) P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164 	Laboratory Contact Address	: Environmental Division Sydney : Client Services : 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail Telephone Facsimile	: enquiries@smectesting.com.au : :	E-mail Telephone Facsimile	: sydney@alsglobal.com : +61-2-8784 8555 : +61-2-8784 8500
Project Site	: 19580 4030C :	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
C-O-C number Sampler Order number	: : J. KERR : 10818	Date Samples Received Issue Date	: 11-MAR-2014 : 19-MAR-2014
Quote number	: EN/025/13	No. of samples received No. of samples analysed	: 11 : 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 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 Signatories

Laboratory 825 This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out ir compliance with procedures specified in 21 CFR Part 11.

Accredited for	Signatories	Position	Accreditation Category
compliance with	Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
ISU/IEC 17025.	Pabi Subba	Senior Organic Chemist	Sydney Organics
	Shobhna Chandra	Metals Coordinator	Sydney Inorganics

Address 277-289 Woodpark Road Smithfield NSW Australia 2164 | PHONE +61-2-8784 8555 | Facsimile +61-2-8784 8500 Environmental Division Sydney ABN 84 009 936 029 Part of the ALS Group An ALS Limited Company



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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 Co	ntent (QC Lot: 333566	6)							
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 Metal	Is by ICP-AES (QC Lo	t: 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 Metal	Is by ICP-AES (QC Lo	t: 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 Reco	overable Mercury by F	IMS (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

Page	: 4 of 14
Work Order	: ES1405222
Client	: SMEC TESTING SERVICES PTY LTD
Project	: 19580 4030C



Sub-Matrix: SOIL	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 Rec	overable 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: Polychloring	ated Binhenvis (PCB) (QC	Lot: 3335080)			0.0				
ES1405222-001	S154	EP066: Total Polychlorinated hinhonyls		0.1	ma/ka	<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: Organochi	orine Pesticides (OC) (OC	L ot: 3335079)		0.1	mg/kg	-0.1	-0.1	0.0	
ES1405222-001	S154		319-84-6	0.05	ma/ka	<0.05	<0.05	0.0	No Limit
101403222-001	0104		118 74 1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
			310-85-7	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
			58-89-9	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
			310-86-8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: delta-BHC	76 44 8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
			300 00 2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: Aldrin	1024 57 3	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
			5102 7 4 2	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: trans-Chiordane	050.08.8	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: alpha-Endosultan	5102 71 0	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
		EP068: cis-Chiordane	60.57.1	0.05	mg/kg	<0.05	<0.05	0.0	No Limit
			72 55 0	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 LIMIL
			72-20-0	0.05	mg/kg	<0.05	<0.05	0.0	NO LIMIL
		EP068: beta-Endosultan	33213-05-9	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
504405000.044	0.15/0	EP068: Methoxychlor	/2-43-5	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
ES1405222-011	\$15/2	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

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



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: Organochlo	orine 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: Organopho	sphorus Pesticides (Ol	P) (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

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



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: Organopho	osphorus Pesticides (O	P) (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: Polyn	uclear Aromatic Hydro	carbons (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		0.5	mg/kg	10.6	14.0	# 27.6	0% - 20%		
		hydrocarbons									
		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: Polynu	clear Aromatic Hydrocarbo	ns (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		0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		hydrocarbons							
		EP075(SIM): Benzo(a)pyrene TEQ (zero)		0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP080/071: Total Pet	roleum 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 Pet	roleum 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 Rec	overable Hydrocarbons - N	EPM 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 Rec	overable Hydrocarbons - N	EPM 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 I	_ot: 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	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			106-42-3						
		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	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			106-42-3						
		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 Blank (MB)	Laboratory Control Spike (LCS) Report			
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	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 (QCLo	ot: 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 (QCL	ot: 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: 33	35080)							
EP066: Total Polychlorinated biphenyls		0.1	mg/kg	<0.1	1 mg/kg	87.0	57.4	117
EP068A: Organochlorine Pesticides (OC) (QCLot: 3	335079)							
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

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Sub-Matrix: SOIL			Method Blank (MB)	Laboratory Control Spike (LCS) Report				
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP068A: Organochlorine Pesticides (OC) (QC	CLot: 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 Hydroca	rbons (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

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Sub-Matrix: SOIL				Method Blank (MB)		Laboratory Control Spike (LCS) Report			
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High	
EP075(SIM)B: Polynuclear Aromatic Hydrocar	bons (QCLot: 3335631) - co	ntinued							
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(Q	CLot: 3334827)								
EP080: C6 - C9 Fraction		10	mg/kg	<10	26 mg/kg	79.3	68.4	128	
EP080/071: Total Petroleum Hydrocarbons(Q	CLot: 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: 333482	27)							
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: 333563	30)							
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	Sub-Matrix: SOIL			Matrix Spike (MS) Report				
				Spike	SpikeRecovery(%)	Recovery Li	mits (%)	
Laboratory sample ID	Client sample ID	Method: Compound CAS N	Number	Concentration	MS	Low	High	
EG005T: Total Meta	als by ICP-AES (QCLot: 3341731)							
ES1405194-004	Anonymous	EG005T: Arsenic 7440-3	-38-2	50 mg/kg	107	70	130	
		EG005T: Cadmium 7440-4	-43-9	50 mg/kg	97.3	70	130	



Sub-Matrix: SOIL						Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery L	imits (%)		
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High		
EG005T: Total Met	als 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 Met	als 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 Red	coverable Mercury by FIMS (QCLot: 3341732)								
ES1405194-004	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	99.9	70	130		
EG035T: Total Red	coverable Mercury by FIMS (QCLot: 3341734)								
ES1405222-004	S212	EG035T: Mercury	7439-97-6	5 mg/kg	93.5	70	130		
EP066: Polychlorir	nated Biphenyls (PCB) (QCLot: 3335080)								
ES1405222-001	S154	EP066: Total Polychlorinated biphenyls		1 mg/kg	84.0	70	130		
EP068A: Organoch	nlorine 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: Organopl	nosphorus 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: Poly	nuclear 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		
FP080/071: Total P	Petroleum Hydrocarbons (OCI ot: 3334827)								

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Sub-Matrix: SOIL	b-Matrix: SOIL			Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery L	imits (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP080/071: Total P	etroleum Hydrocarbons (QCLot: 3334827) - continued						
ES1405222-001	S154	EP080: C6 - C9 Fraction		32.5 mg/kg	80.5	70	130
EP080/071: Total P	etroleum 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 R	ecoverable Hydrocarbons - NEPM 2013 (QCLot: 333482	7)					
ES1405222-001	S154	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	75.0	70	130
EP080/071: Total R	ecoverable Hydrocarbons - NEPM 2013 (QCLot: 333563	0)					
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
EP080: BTEXN (Q	CLot: 3334827)						
ES1405222-001	S154	EP080: Benzene	71-43-2	2.5 mg/kg	72.3	70	130
		EP080: Toluene	108-88-3	2.5 mg/kg	78.5	70	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	78.3	70	130
		EP080: meta- & para-Xylene	108-38-3	2.5 mg/kg	74.2	70	130
			106-42-3				
		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

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							
				Spike	Spike Rec	overy (%)	Recovery	Limits (%)	RPDs	s (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit	
EP080/071: Total Petroleum Hydrocarbons (QCLot: 3334827)											
ES1405222-001	S154	EP080: C6 - C9 Fraction		32.5 mg/kg	80.5		70	130			
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 (QCLot: 3334827)											
ES1405222-001	S154	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	75.0		70	130			
EP080: BTEXN (QCLot: 3334827)											
ES1405222-001	S154	EP080: Benzene	71-43-2	2.5 mg/kg	72.3		70	130			
		EP080: Toluene	108-88-3	2.5 mg/kg	78.5		70	130			
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	78.3		70	130			
		EP080: meta- & para-Xylene	108-38-3	2.5 mg/kg	74.2		70	130			
			106-42-3								

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Sub-Matrix: SOIL				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPL	Ds (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EP080: BTEXN (Q	CLot: 3334827) - continuec	1								
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: Organoch	lorine Pesticides (OC) (QC	CLot: 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: Organoph	nosphorus 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: Polvchlorin	ated Biphenvls (PCB) (QC	:Lot: 3335080)								
ES1405222-001	S154	EP066: Total Polychlorinated biphenyls		1 mg/kg	84.0		70	130		
EP080/071: Total P	etroleum Hvdrocarbons (C	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 R	ecoverable Hvdrocarbons	- 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: Polv	nuclear Aromatic Hvdroca	rbons (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 Met	als by ICP-AES (QCLot: 33	41731)								
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		70	130		
				0 0	Determined					
		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 Reg	overable Mercury by EIMS	(OCI ot: 3341732)								
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Sub-Matrix: SOIL					Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report					
				Spike	Spike Red	overy (%)	Recovery	Limits (%)	RPD	s (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EG035T: Total Rec	overable Mercury by FIMS (QCLot: 33417	/32) - continued								
ES1405194-004	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	99.9		70	130		
EG005T: Total Meta	Is 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 Rec	overable Mercury by FIMS (QCLot: 33417									
ES1405222-004	S212	EG035T: Mercury	7439-97-6	5 mg/kg	93.5		70	130		



	INTERPRETIVE QUALITY CONTROL REPORT									
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Client	: SMEC TESTING SERVICES PTY LTD	Laboratory	: Environmental Division Sydney							
Contact	: ALL REPORTS (ENQUIRIES)	Contact	: Client Services							
Address	: P O BOX 6989	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164							
	WETHERILL PARK 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									
		No. of samples received	: 11							
Quote number	: EN/025/13	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

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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 ; 🗸 = Withii	n holding time.
Method Sample Date Extract			traction / Preparation			Analysis		
Container / Client Sample	e ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Conte	ent							
Soil Glass Jar - Unprese	erved (EA055-103)							
S154,	S469,	06-MAR-2014				12-MAR-2014	20-MAR-2014	✓
S444,	S212,							
S38,	S91,							
S140,	S164,							
S41,	S15/1,							
S15/2								
EG005T: Total Metals b	by ICP-AES							
Soil Glass Jar - Unprese	erved (EG005T)							
S154,	S469,	06-MAR-2014	17-MAR-2014	02-SEP-2014	1	17-MAR-2014	02-SEP-2014	✓
S444,	S212,							
S38,	S91,							
S140,	S164,							
S41,	S15/1,							
S15/2								
EG035T: Total Recover	rable Mercury by FIMS							
Soil Glass Jar - Unprese	erved (EG035T)							
S154,	S469,	06-MAR-2014	17-MAR-2014	03-APR-2014	1	18-MAR-2014	03-APR-2014	✓
S444,	S212,							
S38,	S91,							
S140,	S164,							
S41,	S15/1,							
S15/2								
EP066: Polychlorinated	l Biphenyls (PCB)							
Soil Glass Jar - Unprese	erved (EP066)							
S154,	S469,	06-MAR-2014	12-MAR-2014	20-MAR-2014	~	14-MAR-2014	21-APR-2014	✓
S444,	S212,							
S38,	S91,							
S140,	S164,							
S41,	S15/1,							
S15/2								



Matrix: SOIL					Evaluation	× = Holding time	breach ; ✓ = Within	n holding time.
Method	Sample Date	Ex	traction / Preparation	Analysis				
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP068A: Organochlorine Pes	sticides (OC)							
Soil Glass Jar - Unpreserved	(EP068)							
S154,	S469,	06-MAR-2014	12-MAR-2014	20-MAR-2014	1	14-MAR-2014	21-APR-2014	 ✓
S444,	S212,							
S38,	S91,							
S140,	S164,							
S41,	S15/1,							
S15/2								
EP068B: Organophosphorus	s Pesticides (OP)						1	
Soil Glass Jar - Unpreserved	(EP068)							
S154,	S469,	06-MAR-2014	12-MAR-2014	20-MAR-2014	1	14-MAR-2014	21-APR-2014	\checkmark
S444,	S212,							
S38.	S91.							
S140	S164							
S41	S15/1							
S15/2								
EP080/071: Total Recoverabl	le Hydrocarbons - NEPM 2013							
Soil Glass Jar - Unpreserved	(EP071)							
S154	S469	06-MAR-2014	13-MAR-2014	20-MAR-2014	1	14-MAR-2014	22-APR-2014	1
S444	S212				-			•
S38	S01							
530, 5140	S91, 6164							
3140,	S104,							
541,	515/1,							
515/2								
EP075(SIM)B: Polynuclear A	romatic Hydrocarbons					1		
Soli Glass Jai - Onpreserved	(EF075(SIM)) S460	06-MAR-2014	13-MAR-2014	20-MAR-2014		14-MAR-2014	22-APR-2014	
S104,	5400, 5212	•••••••••••••••••••••••••••••••••••••••		20	· ·			¥
0444, 020	5212,							
538,	S91,							
S140,	S164,							
S41,	S15/1,							
S15/2								
EP080: BTEXN						1	1	
Soil Glass Jar - Unpreserved	(EP080)	00 MAD 0044	42 MAD 2044	20 MAD 2014		14 MAD 2014	20 MAD 2014	
5154,	S469,	06-MAR-2014	12-WAR-2014	20-IVIAR-2014	~	14-MAR-2014	20-IVIAR-2014	✓
5444,	S212,							
S38,	S91,							
S140,	S164,							
S41,	S15/1,							
S15/2								

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Client	: SMEC TESTING SERVICES PTY LTD
Project	19580 4030C



Matrix: SOIL Evaluation: \mathbf{x} = Holding time breach ; \mathbf{v} = Within holding time. Method Extraction / Preparation Analysis Sample Date Container / Client Sample ID(s) Due for analysis Date extracted Due for extraction Evaluation Date analysed Evaluation EP080/071: Total Petroleum Hydrocarbons Soil Glass Jar - Unpreserved (EP080) S154, S469, 06-MAR-2014 12-MAR-2014 20-MAR-2014 1 14-MAR-2014 20-MAR-2014 \checkmark S444, S212, S38, S91, S140, S164, S41, S15/1, S15/2



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	n: × = Quality Co	ntrol frequency r	not within specification ; \checkmark = Quality Control frequency within specification.					
Quality Control Sample Type		Co	ount		Rate (%)		Quality Control Specification					
Analvtical Methods	Method	QC	Reaular	Actual	Expected	Evaluation						
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	1	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 (SnCl2)(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 SnCl2 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, Na2SO4 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, Na2SO4 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		27.6 %	0-20%	RPD exceeds LOR based limits
			hydrocarbons				
Matrix Spike (MS) Recoveries							
EG005T: Total Metals by ICP-AES	ES1405194-004	Anonymous	Chromium	7440-47-3	Not		MS recovery not determined,
					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.

Indie II/ Wooder hau Saitheid KW 2164 Projet II/ Wooder hau Saitheid KW 2164 Invisiti 514-15 Desce fan Saitheid KW 2164 Willie 14-15 Desce fan Saitheid KW 2164 Willie 24-15 Desce fan Saitheid KW 2164 Millie 24-15 Desce fan Saitheid KW 2164	(story Seatinaci' ver No.	DATE/TIME:	bolls required). Comments on likely contaminant feetings peoline CC analysis of			
Image: Contract of the second management of the second management of the second second second management of the second second second second management second	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Televine Sulfres (NB: Sulle Codes must be feterd to etree	ify Total (unfiltered bollte required) or Dissolved (field filtered)	Environmental Division Sydney Work Order ES1405891	Telephone : + 51-2-6704 8555	ther Glass Unpreserved, AP - Arteologik Unpreserved Plastic. Plastic, HS = HCi preserved Speciation bplic, SP = Sulktic Preserved P
A VICO AND	275516 COC: 2755166 OF: LINQUISHED BY: RECEIVE	19 ADON AMALYSIS REQUIRED IN	TOTAL CONTRINERS DIFTER			TOTAL TOTALA
ADBLADE 21 Burne Free Tear Free Tear 26 005 Ph. 60 4359 6300 E antest regard rear an 5055 Ph. 60 4359 6300 E antest seatured on 4033 Ph. 72 743 722 E Samples Information Ph. 72 743 722 E Samples Information Ph. 72 743 771 E Samples Information Ph. 72 743 771 E Samples Information Ph. 72 743 771 2010 E E Could Rear Samples TURNAROUND RECUIREMENTS: (Standard TAT may be longer for Softendard TAT may be longer for an anter Softendard TAT may be longer for a softendard for a softendard tot and a softendard for a softendard tot and a softendard for a softendard fo	ALS GUOTE NO.: ALS GUOTE NO.: CONTACT PH: CONTACT PH:	e listed): SAL: CONTAINER(INPORM)	TYPE & PRESERVATIVE (refer to codes below)	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		PAC = Marte Preserved ORO; SN = Soddan Hydrawde/Cd P DA Val Satluni: Preserved; AV = Akthelyn; Unyreserved Val. Pacanood Bardioi; ST = 2004b, ADO = Primte D., A
ALS LADOR CUSTODY ALS LADORADY METERA MEC TRUTIN	ORDER NUMBER: CSPO ANAGER: CSPO ANAGER: CV/H, J (Cuv, sampler MOE Ito ALS? (YES / NO) EDD FORMA	e to (will default to PM if no other addressos ar sPECIAL HANDLING/STORAGE OR DISPO SAMPLE DETAILS MATRIX - SOLID (S), WÄTER (W)	SAMPLE ID DATE/TIME	1)/SH1 / 1021		odes: P = Unpresorvec Plastic, N = Nitho Preserved Plastic; I reserved VB = NoV Vail Socium Bis Aphala Preserved VB = V reserved dasss. Z = Zipo Apalaja Preserved Sotis: E = FOTA F
	PROJECT PURCHASE PROJECT M SAMPLER: COC ornalled Email Report	Email Invoic COMMENTS	LABID	- ~~		Water Container C V = VOA Vat HOLP F = FocmeXetydot



CERTIFICATE OF ANALYSIS									
Work Order	ES1405891	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	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164						
	WETHERILL PARK 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						
Order number	: 10833								
C-O-C number	:	Date Samples Received	: 19-MAR-2014						
Sampler	: JK	Issue Date	: 25-MAR-2014						
Site	:								
		No. of samples received	: 3						
Quote number	: EN/025/13	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	Signatories This document has been electronically carried out in compliance with procedures spe	signed by the authorized signatories in cified in 21 CFR Part 11.	ndicated below. Electronic signing has been
MAIA	ISO/IEC 17025.	Signatories	Position	Accreditation Category
		Celine Conceicao Pabi Subba	Senior Spectroscopist Senior Organic Chemist	Sydney Inorganics Sydney Inorganics Sydney Organics

Address 277-289 Woodpark Road Smithfield NSW Australia 2164 PHONE +61-2-8784 8555 Facsimile +61-2-8784 8500 Environmental Division Sydney ABN 84 009 936 029 Part of the ALS Group An ALS Limited Company



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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



Sub-Matrix: SOIL (Matrix: SOIL)	fatrix: SOIL (Matrix: SOIL)		ent sample ID	S283	S283/2	S130			
	Cli	ient sampliı	ng date / time	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	i i								
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 FI	мѕ								
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			

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Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	S283	S283/2	S130	
	Cl	ient sampli	ng date / time	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 Pestici	des (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	

Page : 5 of 7 Work Order : ES1405891 Client : SMEC TESTING SERVICES PTY LTD Project : 19580



Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	S283	S283/2	S130	 		
	Cl	ient sampli	ng date / time	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 H	vdrocarbons - Cont	inued							
Chrvsene	218-01-9	0.5	ma/ka	<0.5	<0.5	<0.5	 		
Benzo(b)fluoranthene	205-99-2	0.5	ma/ka	<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	 		
A Benzo(a)pyrene TEQ (zero)		0.5	mg/kg	<0.5	<0.5	<0.5	 		
A 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 Hydrocarb	oons								
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 Hydroca	arbons - NEPM 201	3							
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	 		



Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	S283	S283/2	S130			
	Cli	ent sampli	ng date / time	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 Surrog	ate								
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 Surrog	ates								
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

Work Order	: ES1405891	Page	: 1 of 12
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Project Site	: 19580 :	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
C-O-C number Sampler Order number	: : JK : 10833	Date Samples Received Issue Date	: 19-MAR-2014 : 25-MAR-2014
Quote number	: EN/025/13	No. of samples received No. of samples analysed	: 3 : 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 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 Signatories

Laboratory 825 This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out ir compliance with procedures specified in 21 CFR Part 11.

Accredited for	Signatories	Position	Accreditation Category	
compliance with ISO/IEC 17025.	Celine Conceicao Pabi Subba	Senior Spectroscopist Senior Organic Chemist	Sydney Inorganics Sydney Inorganics Sydney Organics	

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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 Co	ntent (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 Metal	s by ICP-AES (QC Lot: 335	1439)							
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 Reco	verable 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: Polychlorina	ted Biphenyls (PCB) (QC L	ot: 3349459)							
ES1405891-001	S283	EP066: Total Polychlorinated biphenyls		0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EP068A: Organochlo	orine Pesticides (OC) (QC L	.ot: 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

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Sub-Matrix: SOIL	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: Organochi	orine 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: Organoph	osphorus Pesticides (C	DP) (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: Polyr	uclear Aromatic Hydro	ocarbons (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	

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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: Polynu	clear Aromatic Hydrocarbo	ons (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		0.5	mg/kg	5.1	3.8	29.2	0% - 50%	
		hydrocarbons							
		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		0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		hydrocarbons							
		EP075(SIM): Benzo(a)pyrene TEQ (zero)		0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP080/071: Total Pet	roleum 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 Pet	roleum Hydrocarbon <u>s</u> (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 Rec	overable Hydrocarbons - N	EPM 2013 (QC Lot: 3347806)							
ES1405601-001	Anonymous	EP071: >C16 - C34 Eraction		100	ma/ka	480	440	8.5	No Limit
		EP071: >C34 - C40 Fraction		100	mg/ka	150	150	0.0	No Limit
ES1405678-001 ES1405883-002 EP080/071: Total Rec ES1405601-001	Anonymous coverable Hydrocarbons - N Anonymous	EPU80: C6 - C9 Fraction EP080: C6 - C9 Fraction EPM 2013 (QC Lot: 3347806) EP071: >C16 - C34 Fraction EP071: >C34 - C40 Fraction	 	10 10 100 100	mg/kg mg/kg mg/kg	<10 <10 480 150	<10 <10 440 150	0.0 0.0 8.5 0.0	No Limit No Limit No Limit No Limit

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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 Re	coverable Hydrocarbor	ns - 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 Re	coverable Hydrocarbor	ns - 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	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			106-42-3						
		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	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
			106-42-3						
		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 Blank (MB)	Laboratory Control Spike (LCS) Report						
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)			
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High			
EG005T: Total Metals by ICP-AES (QCLot: 335143	9)										
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) (QCI	Lot: 3349458)										

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Client	: SMEC TESTING SERVICES PTY LTD
Project	: 19580



Sub-Matrix: SOIL				Method Blank (MB)	Laboratory Control Spike (LCS) Report				
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High	
EP068B: Organophosphorus Pesticides (OP) (QCL	.ot: 3349458) - continue	d							
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 Blank (MB)	Laboratory Control Spike (LCS) Report					
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)		
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High		
EP080/071: Total Petroleum Hydrocarbons (QC	Lot: 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 - N	IEPM 2013 (QCLot: 334781	10)								
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	0.5	mg/kg	<0.5	2 mg/kg	83.0	60	120		
	106-42-3									
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	Jb-Matrix: SOIL				Matrix Spike (MS) Report				
					SpikeRecovery(%)	Recovery Li	mits (%)		
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High		
EG005T: Total Meta	ils 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 Rec	overable Mercury by FIMS (QCLot: 3351440)								
ES1405739-002	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	94.4	70	130		
EP066: Polychlorin	ated Biphenyls (PCB) (QCLot: 3349459)								
ES1405891-001	S283	EP066: Total Polychlorinated biphenyls		1 mg/kg	91.0	70	130		
EP068A: Organoch	lorine Pesticides (OC) (QCLot: 3349458)								
ES1405891-001	S283								



Sub-Matrix: SOIL				Matrix Spike (MS) Report				
				Spike	SpikeRecovery(%)	Recovery L	imits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High	
EP068A: Organocl	nlorine Pesticides (OC) (QCLot: 3349458) - cont	inued						
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: Organop	nosphorus 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: Poly	nuclear Aromatic Hydrocarbons (QCLot: 33478	05)						
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 P	etroleum 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 P	etroleum Hydrocarbons (QCLot: 3347810)							
ES1405878-001	Anonymous	EP080: C6 - C9 Fraction		32.5 mg/kg	77.3	70	130	
EP080/071: Total F	ecoverable 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 F	ecoverable Hydrocarbons - NEPM 2013 (QCLot	: 3347810)						
ES1405878-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	72.5	70	130	
EP080: BTEXN (Q	CLot: 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: Nanhthalene	91-20-3	2.5 ma/ka	76.6	70	130	

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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 (I	rt					
				Spike	Spike Re	covery (%)	Recovery	Limits (%)	RP	Ds (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EP075(SIM)B: Poly	nuclear Aromatic Hydrocarbo	ons (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 P	etroleum Hydrocarbons (QC	Lot: 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 R	ecoverable Hydrocarbons - N	IEPM 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 P	etroleum Hvdrocarbons (QC	Lot: 3347810)								
ES1405878-001	Anonymous	EP080: C6 - C9 Fraction		32.5 mg/kg	77.3		70	130		
EP080/071: Total R	ecoverable Hydrocarbons - N	IEPM 2013 (QCLot: 3347810)								
ES1405878-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	72.5		70	130		
FP080 BTEXN (QC	CL ot: 3347810)									
ES1405878-001	Anonymous	EP080: Benzene	71-43-2	2.5 ma/ka	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	0.0						
		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: Organoch	lorine Pesticides (OC) (QCL	ot: 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: Organoph	osphorus Pesticides (OP) (C	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: Polychlorin	ated Biphenvls (PCB)_(QCLc	ot: 3349459)								

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Client	: SMEC TESTING SERVICES PTY LTD
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Sub-Matrix: SOIL	ub-Matrix: SOIL				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	pike Spike Recovery (%)		Recovery Limits (%)		RPDs (%)		
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit	
EP066: Polychlorin	ated Biphenyls (PCB) (QCLot: 3349459)	- continued									
ES1405891-001	S283	EP066: Total Polychlorinated biphenyls		1 mg/kg	91.0		70	130			
EG005T: Total Meta	ls 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 Rec	overable Mercury by FIMS(QCLot: 33514	40)									
ES1405739-002	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	94.4		70	130			



	INTERPRETIVI	<u>E QUALITY CONTROL I</u>	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	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
	WETHERILL PARK 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	:		
C-O-C number	:	Date Samples Received	: 19-MAR-2014
Sampler	: JK	Issue Date	: 25-MAR-2014
Order number	: 10833		
		No. of samples received	: 3
Quote number	: EN/025/13	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 Interpretive Quality Control Report contains the following information:

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

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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	n holding time.
Method		Sample Date	Ex	traction / Preparation			Analysis	
Container / Client Sample ID(s)			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	1	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	1	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	1	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 - NE	EPM 2013							
Soil Glass Jar - Unpreserved (EP071) S283, S130	S283/2,	14-MAR-2014	20-MAR-2014	28-MAR-2014	4	21-MAR-2014	29-APR-2014	~
EP075(SIM)B: Polynuclear Aromatic Hydrocarbor	ns							
Soil Glass Jar - Unpreserved (EP075(SIM)) S283, S130	S283/2,	14-MAR-2014	20-MAR-2014	28-MAR-2014	1	21-MAR-2014	29-APR-2014	~

Page	: 3 of 6
Work Order	: ES1405891
Client	: SMEC TESTING SERVICES PTY LTD
Project	19580

Matrix: SOIL



Evaluation: \star = Holding time breach ; \checkmark = Within holding time.

Method		Sample Date	Ex	traction / Preparation			Analysis	
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080: BTEXN								
Soil Glass Jar - Unpreserved (EP080)								
S283,	S283/2,	14-MAR-2014	20-MAR-2014	28-MAR-2014	~	23-MAR-2014	28-MAR-2014	✓
S130								
EP080/071: Total Recoverable Hydrocarbons - NEPM 201	3							
Soil Glass Jar - Unpreserved (EP080)								
S283,	S283/2,	14-MAR-2014	20-MAR-2014	28-MAR-2014	~	23-MAR-2014	28-MAR-2014	✓
S130								



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	n: 🗴 = Quality Co	ntrol frequency r	not within specification ; \checkmark = Quality Control frequency within specification.
Quality Control Sample Type		Co	ount		Rate (%)		Quality Control Specification
Analvtical Methods	Method	OC	Reaular	Actual	Expected	Evaluation	
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	1	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	1	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 (SnCl2)(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 SnCl2 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, Na2SO4 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, Na2SO4 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.

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J.Z.S.Y.D.R.Y. 277-2913 Woodpark Fond Steerbeau 1587-2754 Per 2018/1944 (2014) Annolessayo Strenghangkana Leon T.Y.Y.M.S.W.L.J. 44 (5.D.Sanda Deni J.S.M. 1841) 2017 A. 2018 Strengt S	OPAUSE ONLY (CITUE) - CARACTER - C					DATECTME			ite price) srec bolite Additional information	Comments on likely cortaminant levels. Unitions, or samplos requiring spacific QO ensigns one.				· · · · ·			· · · · · · · · · · · · · · · · · · ·			
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	CERT	IFICATE OF ANALYSIS	
Work Order	ES1405223	Page	: 1 of 14
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
Order number	: 10920		
C-O-C number	:	Date Samples Received	: 11-MAR-2014
Sampler	: JK/DL	Issue Date	: 19-MAR-2014
Site	:		
		No. of samples received	: 58
Quote number	: EN/025/13	No. of samples analysed	: 58

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	Signatories This document has been electronically carried out in compliance with procedures spe	signed by the authorized signatories i	indicated below. Electronic signing has been
MAIA	ISO/IEC 17025.	Signatories	Position	Accreditation Category
		Ankit Joshi Shobhna Chandra	Inorganic Chemist Metals Coordinator	Sydney Inorganics Sydney Inorganics Sydney Inorganics

Address 277-289 Woodpark Road Smithfield NSW Australia 2164 PHONE +61-2-8784 8555 Facsimile +61-2-8784 8500 Environmental Division Sydney ABN 84 009 936 029 Part of the ALS Group An ALS Limited Company



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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



Sub-Matrix: SOIL (Matrix: SOIL)		Cli	ent sample ID	S212	S262	S287	S314	S338
	CI	ient sampli	ng date / time	06-MAR-2014 15:00				
Compound	CAS Number	LOR	Unit	ES1405223-001	ES1405223-002	ES1405223-003	ES1405223-004	ES1405223-005
EA010: Conductivity								
Electrical Conductivity @ 25°C		1	µS/cm	23	16	19	64	22



Sub-Matrix: SOIL (Matrix: SOIL)		Cli	ent sample ID	S339	S340	S315	S364	S393
	CI	ient sampli	ng date / time	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



Sub-Matrix: SOIL (Matrix: SOIL)		Cli	ent sample ID	S392	S394	S369	S418	S469
	Cl	ient sampli	ng date / time	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



Sub-Matrix: SOIL (Matrix: SOIL)		Cli	ent sample ID	S444	S419	S367	S342	S293
	Cl	ient sampli	ng date / time	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



Sub-Matrix: SOIL (Matrix: SOIL)		Cli	ent sample ID	S292	S133	S158	S179	S154
	Cl	lient sampli	ng date / time	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



Sub-Matrix: SOIL (Matrix: SOIL)		Cli	ent sample ID	S131	S155	S181	S206	S231
	Cl	ient sampli	ng date / time	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



Sub-Matrix: SOIL (Matrix: SOIL)	Client sample ID		S281	S282	S307	S256	S230	
	CI	ient sampli	ng date / time	04-MAR-2014 15:00				
Compound	CAS Number	LOR	Unit	ES1405223-034	ES1405223-035	ES1405223-036	ES1405223-037	ES1405223-038
EA010: Conductivity								
Electrical Conductivity @ 25°C		1	µS/cm	21	17	23	17	27



Sub-Matrix: SOIL (Matrix: SOIL)	Client sample ID		S15/1	S15/2	S91	S140	S164	
	Cl	ient sampli	ng date / time	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			



Sub-Matrix: SOIL (Matrix: SOIL)	Client sample ID		S166	S142	S41	S167	S92	
	CI	ient sampli	ng date / time	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



Sub-Matrix: SOIL (Matrix: SOIL)	Client sample ID		S163	S118	S114	S117	S65	
	Client sampling date / time		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



Sub-Matrix: SOIL (Matrix: SOIL)	Client sample ID		S63	S89	S143	S165	S38	
	Cl	ient sampli	ng date / time	06-MAR-2014 15:00				
Compound	CAS Number	LOR	Unit	ES1405223-054	ES1405223-055	ES1405223-056	ES1405223-057	ES1405223-058
EA010: Conductivity								
Electrical Conductivity @ 25°C		1	µS/cm	33	37	44	214	11



Sub-Matrix: SOIL (Matrix: SOIL)	Client sample ID		S90	S113	S168	 	
	Ci	lient sampli	ing date / time	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

Work Order	ES1405223	Page	: 1 of 4
Client Contact Address	SMEC TESTING SERVICES PTY LTD SMEC TESTING ALL RESULTS	Laboratory Contact Address	: Environmental Division Sydney : Client Services : 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail Telephone Facsimile	: enquiries@smectesting.com.au : :	E-mail Telephone Facsimile	: sydney@alsglobal.com : +61-2-8784 8555 : +61-2-8784 8500
Project	: 19580 40300	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site C-O-C number Sampler Order number	: : : JK/DL : 10920	Date Samples Received Issue Date	: 11-MAR-2014 : 19-MAR-2014
Quote number	: EN/025/13	No. of samples received No. of samples analysed	: 58 : 58

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 Signatories

Laboratory 825 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.

Accredited for	Signatories	Position	Accreditation Category
compliance with ISO/IEC 17025.			Sydney Inorganics
	Ankit Joshi	Inorganic Chemist	Sydney Inorganics
	Shobhna Chandra	Metals Coordinator	Sydney Inorganics

Address 277-289 Woodpark Road Smithfield NSW Australia 2164 PHONE +61-2-8784 8555 Facsimile +61-2-8784 8500 Environmental Division Sydney ABN 84 009 936 029 Part of the ALS Group An ALS Limited Company



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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 D	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) (C	C 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 Con	tent (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 Maj	or Anions (QC Lot: 3334852	2)							
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)	Laboratory Control Spike (LCS) Report				
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	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					
				Spike	SpikeRecovery(%)	Recovery L	imits (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED045G: Chloride b	by Discrete Analyser (QCLot: 3334851)						
ES1405072-001	Anonymous	ED045G: Chloride	16887-00-6	1250 mg/kg	# Not	70	130
					Determined		

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 (I	MS) and Matrix Spi	ke Duplicate	(MSD) Repo	rt	
				Spike	Spike Re	covery (%)	Recovery	Limits (%)	RPD)s (%)
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
ED045G: Chloride b	y Discrete Analyser (QCLot: 3334851)									
ES1405072-001	Anonymous	ED045G: Chloride	16887-00-6	1250 mg/kg	# Not		70	130		
					Determined					
					Determined					



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	:		
C-O-C number	:	Date Samples Received	: 11-MAR-2014
Sampler	: JK/DL	Issue Date	: 19-MAR-2014
Order number	: 10920		
		No. of samples received	: 58
Quote number	: EN/025/13	No. of samples analysed	: 58

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

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Analysis Holding Time Compliance

Matrix: SOIL

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 <u>VOC in soils</u> 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.

Evaluation: * = Holding time breach ; \checkmark = Within holding time.

							,	0
Method		Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA002 : pH (Soils)								
Soil Glass Jar - Unpreserved (EA002)								
S15/1,	S15/2	04-MAR-2014	12-MAR-2014	11-MAR-2014	*	12-MAR-2014	12-MAR-2014	✓
EA010: Conductivity								
Soil Glass Jar - Unpreserved (EA010)								
S15/1,	S15/2	04-MAR-2014	12-MAR-2014	11-MAR-2014	*	12-MAR-2014	09-APR-2014	✓
Soil Glass Jar - Unpreserved (EA010)								
S133,	S158,	04-MAR-2014	12-MAR-2014	11-MAR-2014	*	13-MAR-2014	09-APR-2014	✓
S179,	S154,							
S131,	S155,							
S181,	S206,							
S231,	S281,							
S282,	S307,							
S256,	S230							
Soil Glass Jar - Unpreserved (EA010)								
Page	: 3 of 7							
------------	---------------------------------							
Work Order	: ES1405223							
Client	: SMEC TESTING SERVICES PTY LTD							
Project	19580 40300							



Matrix: SOIL					Evaluation:	Holding time	breach ; 🗸 = Withir	n holding time.
Method		Sample Date	Ex	traction / Preparation			Analysis	
Container / Client Sample ID(s)			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010: Conductivity - Continued								
S212,	S262,	06-MAR-2014	12-MAR-2014	13-MAR-2014	1	13-MAR-2014	09-APR-2014	✓
S287,	S314,							
S338,	S339,							
S340,	S315,							
S364,	S393,							
S392,	S394,							
S369,	S418,							
S469,	S444,							
S419,	S367,							
S342,	S293,							
S292,	S91,							
S140,	S164,							
S166,	S142,							
S41,	S167,							
S92,	S163,							
S118,	S114,							
S117,	S65,							
S63,	S89,							
S143,	S165,							
S38,	S90,							
S113,	S168							
EA055: Moisture Content								
Soil Glass Jar - Unpreserved (EA0	55-103)							
S15/1,	S15/2	04-MAR-2014				13-MAR-2014	18-MAR-2014	✓
ED040S : Soluble Sulfate by ICPA	ES							
Soil Glass Jar - Unpreserved (ED04	40S)							
S15/1,	S15/2	04-MAR-2014	12-MAR-2014	01-APR-2014		12-MAR-2014	09-APR-2014	✓
ED045G: Chloride Discrete analys	ser							
Soil Glass Jar - Unpreserved (ED04	45G)							
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 Co	ntrol frequency n	ot within specification ; \checkmark = Quality Control frequency within specification.
Quality Control Sample Type		С	ount		Rate (%)		Quality Control Specification
Analytical Methods	Method	QC	Reaular	Actual	Expected	Evaluation	
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
рН (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.

Analytical Methods	Method	Matrix	Method Descriptions
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-CI- 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 librated
			thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm. Analysis is performed on a 1:5
			soil / water leachate.
Preparation Methods	Method	Matrix	Method Descriptions
	Metrioù	Maurix	Method Descriptions
1:5 solid / water leach for soluble	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
analytes			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		MS recovery not determined,
					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		Ex	traction / Preparation		Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Days	Date analysed	Due for analysis	Days	
				overdue			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.

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MACKAY 78 Hartber Raid Medicy 010 4760 Image 100 1000 Image 1000	ATE/TIME: DATE/TIME: ATE/TIME: AT	ANALYSIS REQUIRED INCLU MOLES are moreed, specify the C. C. C		TOTAL Preserved: S = Sodium Apritoxida Preserved Plastic; AG = Ambar Preserved: S = Sublucto Preserved Ander Glass; H = HC) preserved Plast And aprime event; C - Universerved Dag.
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CHAIN OF CUSTODY ALS ALS Laboratory: ALS Laboratory: Labor	ed to ALS? (YES / NO) EDD FORMAT i orts to (will default to PM if no other addresses are los to (will default to PM if no other addresses are i S/ SPECIAL HANDLING/STORAGE OR DISPOSA	SAMPLE DETAILS MATRIX - SOLID (S), WATER (W) S SAMPLE ID DATE/ TIME	162 16/3/14 132 1/1/14	r Codos: P = Ungrasened Plastic: N = Mikie Preserved Plastic: Oit N Presened: VB = VOA Viel SodiAm Disulphate Preserved: VS = VOA 18 Ptostorred Glass, Z = Zito: Arcititis Preserved Botistic E = EDTA Pre-
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	CERTIF	ICATE OF ANALYSIS	
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	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
	WETHERILL PARK 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
Order number	: 10841		
C-O-C number	:	Date Samples Received	: 19-MAR-2014
Sampler	: JK	Issue Date	: 24-MAR-2014
Site	:		
		No. of samples received	: 14
Quote number	: EN/025/13	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	Signatories This document has been carried out in compliance with	electronically signed by the authorized procedures specified in 21 CFR Part 11.	signatories indicated below. Electronic	signing has been
MAIA	ISO/IEC 17025.	Signatories	Position	Accreditation Category	
\sim		Ankit Joshi	Inorganic Chemist	Sydney Inorganics	
ACCREDITATION					

Address 277-289 Woodpark Road Smithfield NSW Australia 2164 PHONE +61-2-8784 8555 Facsimile +61-2-8784 8500 Environmental Division Sydney ABN 84 009 936 029 Part of the ALS Group An ALS Limited Company



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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)		Cli	ent sample ID	S284	285	286	261	260
	Cl	ient sampli	ng date / time	14-MAR-2014 15:00				
Compound	CAS Number	LOR	Unit	ES1405892-001	ES1405892-002	ES1405892-003	ES1405892-004	ES1405892-005
EA010: Conductivity								
Electrical Conductivity @ 25°C		1	µS/cm	33	21	18	107	20



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Cli	ent sample ID	259	236	235	283	283/2
	Cl	ient sampli	ng date / time	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



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Clie	ent sample ID	208	182	132	130	
	Cl	ient sampli	ng 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

Work Order	ES1405892	Page	: 1 of 4
Client Contact Address	: SMEC TESTING SERVICES PTY LTD : ALL REPORTS (ENQUIRIES) : P O BOX 6989 WETHERILL PARK NSW, AUSTRALIA 2164	Laboratory Contact Address	: Environmental Division Sydney : Client Services : 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail Telephone Facsimile	: enquiries@smectesting.com.au : :	E-mail Telephone Facsimile	: sydney@alsglobal.com : +61-2-8784 8555 : +61-2-8784 8500
Project Site C-O-C number	: 19580 : :	QC Level Date Samples Received	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Sampler Order number	: JK : 10841	Issue Date	: 24-MAR-2014
Quote number	: EN/025/13	No. of samples analysed	: 14 : 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 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 Signatories

Laboratory 825 This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out ir compliance with procedures specified in 21 CFR Part 11.

Accredited for	Signatories	Position	Accreditation Category
compliance with ISO/IEC 17025.	Ankit Joshi	Inorganic Chemist	Sydney Inorganics

Address 277-289 Woodpark Road Smithfield NSW Australia 2164 PHONE +61-2-8784 8555 Facsimile +61-2-8784 8500 Environmental Division Sydney ABN 84 009 936 029 Part of the ALS Group An ALS Limited Company



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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 D	uplicate (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)		Laboratory Control Spike (LC	S) Report	
				Report	Spike	Spike Recovery (%)	Recovery	Limits (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	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.



	INTERPRETIV	<u>E QUALITY CONTROL I</u>	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	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
	WETHERILL PARK 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	:		
C-O-C number	:	Date Samples Received	: 19-MAR-2014
Sampler	: JK	Issue Date	: 24-MAR-2014
Order number	: 10841		
		No. of samples received	: 14
Quote number	: EN/025/13	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 Interpretive Quality Control Report contains the following information:

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

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Analysis Holding Time Compliance

Matrix: SOII

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 <u>VOC in soils</u> 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 <u>or</u> Vinyl Chloride and Styrene are not key analytes of interest/concern.

Evaluation: * = Holding time breach ; \checkmark = Within holding time.

Sample Date	Ex	traction / Preparation			Analysis	
	Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
14-MAR-2014	21-MAR-2014	21-MAR-2014	✓	21-MAR-2014	18-APR-2014	✓
	Sample Date	Sample Date Ex Date extracted 14-MAR-2014 21-MAR-2014	Sample Date Extraction / Preparation Date extracted Due for extraction I14-MAR-2014 21-MAR-2014	Sample Date Extraction / Preparation Date extracted Due for extraction Evaluation 14-MAR-2014 21-MAR-2014 21-MAR-2014	Sample Date Extraction / Preparation Date analysed Date extracted Due for extraction Evaluation Date analysed 14-MAR-2014 21-MAR-2014 21-MAR-2014 ✓ 21-MAR-2014	Sample Date Extraction / Preparation Analysis Date extracted Due for extraction Evaluation Date analysed Due for analysis Image: Sample Date I



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	n: × = Quality Cor	ntrol frequency n	ot within specification ; \checkmark = Quality Control frequency within specification.
Quality Control Sample Type		Co	unt		Rate (%)		Quality Control Specification
Analytical Methods	Method	OC	Reaular	Actual	Expected	Evaluation	
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	1	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
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)
Prenaration Methods	Method	Matrix	Method Descriptions
Preparation Methods	Method	Matrix	Method Descriptions
Preparation Methods 1:5 solid / water leach for soluble	Method EN34	Matrix SOIL	Method Descriptions 10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are



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.

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APPENDIX F – GEOTECHNICAL REPORT
```



Ingleside Precinct

Slope Risk Assessment Report

Prepared for: Department of Planning and Environment Date: 1 September, 2015



Title	Ingleside Precinct S	Slope Risk Assessment Report	
Prepared for	Department of Plan	ning and Environment	
Project Ref	30012289		
	Name	Position	Date
Originator	Ben Morris	Senior Geotechnical Engineer	
Review	Simon Baldock	Senior Engineering Geologist	15/08/2014
Approval	Daniel Saunders	Project Manager Senior Environmental Scientist	10,00/2014

DOCUMENT CONTROL

of Revisions		
Date	Description	WVR Number
15/08/2014	Draft Report	
01/09/2015	Final Report	001
	Date 15/08/2014 01/09/2015	Date Description 15/08/2014 Draft Report 01/09/2015 Final Report

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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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- APPENDIX B: EXAMPLES OF HILLSIDE PRACTICE
- APPENDIX C: RISK TO PROPERTY TERMINOLOGY

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.

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 resuidential 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.

Table 1 – Summary of Site Characteristics

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 Landsli

	Type of Material			
Type of Movement	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 interrelationship 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:

$$R(LoL) = P(H) \times P(S:H) \times P(T:S) \times V(D:T)$$

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 Sug	gested Tolerable	Risk (AGS,	2007).
-------------------	------------------	------------	--------

Situation	Suggested tolerable loss of life risk for the person most at risk
Existing Slope (1) / Existing Development (2)	1x10 ⁻⁴ /annum or 0.01%
New Constructed Slope (3) / New Development (4) / Existing Landslide (5)	1x10 ⁻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.

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.

 Table 4 – Adopted Temporal Probability

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.
		M1:M2:Block Falls (1.0m)Block Falls (1.0m)from Precipices upfrom Precipices upto 2m in Heightto 5m in Height		M3: Block Falls (up to 2m) from Overhangs	
Probability P(H)	Descriptor	Likely	Possible	Possible	
	Level	В	С	С	
	Rate	0.01	0.001	0.001	
Consequence	Level	Minor	Minor	Medium	
to Building	Descriptor	4	4	3	
Risk To Property		Moderate	Moderate	Moderate	

Table 5 – Summary of Risk Assessment – Risk to Property

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 (Р _{ѕ:н})		0.02 (1.0m block on 50m long section of slope)0.02 (1.0m block of 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)				
Drebebility	Residential Areas	0.021				
of Temporal	Roads	0.001				
Impact (P _{T:S})	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.

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

 Table 7 – Summary of Stabilisation Recommendations

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.

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- MacGregor et al (2007). "Assessment of Landslide Likelihood in the Pttwater Local Government Area", Australian Geomechanics, Vol 42, No. 1, March 2007.
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FIGURES



Location





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



Location

APPENDIX B: EXAMPLES OF HILLSIDE PRACTICE

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007



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 A Indicative Value	nnual Probability Notional Boundary	Implied Indicative Landslide Recurrence Interval		Description	Descriptor	Level
10-1	5x10 ⁻²	10 years	•	The event is expected to occur over the design life.	ALMOST CERTAIN	А
10 ⁻²	5 10-3	100 years	20 years	The event will probably occur under adverse conditions over the design life.	LIKELY	В
10-3	5x10	1000 years	200 years	The event could occur under adverse conditions over the design life.	POSSIBLE	С
10-4	5x10 ⁻⁴	10,000 years	2000 vears	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10-5	$5x10^{-6}$	100,000 years	20,000 years	The event is conceivable but only under exceptional circumstances over the design life.	RARE	Е
10-6	5710	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		r r	
200%	1000/	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%	100%	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%	170	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)

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	Н	M or L (5)
B - LIKELY	10 ⁻²	VH	VH	Н	М	L
C - POSSIBLE	10-3	VH	Н	М	М	VL
D - UNLIKELY	10^{-4}	Н	М	L	L	VL
E - RARE	10-5	М	L	L	VL	VL
F - BARELY CREDIBLE	10-6	L	VL	VL	VL	VL

QUALITATIVE RISK ANALYSIS MATRIX – LEVEL OF RISK TO PROPERTY

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.
Н	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.
М	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.