



Salinity and Acid Sulfate Soil Assessment

260 Fellows Road & 61-75 Murray Road, Queenscliff

Prepared for:

Planisphere Pty Ltd

L1/160 Johnston Street

Fitzroy Vic 3054

22 May 2014





Distribution

Salinity and Acid Sulfate Soil Assessment, 260 Fellows Road & 61-75 Murray Road, Queenscliff

22 May 2014

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List of Acronyms

Acronym	Definition
ASS	Acid Sulfate Soil
COC	Chain of custody
EPA	Victorian Environment Protection Authority
LOR	Limit of reporting
m	Metre
m³	Cubic metres
m bgl	Metres below ground level
mg/kg	Milligrams per kilogram
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
PASS	Potential acid sulfate soil
QA	Quality assurance
QC	Quality control
RPD	Relative percentage difference
SEPP	State Environment Protection Policy. Commonly used SEPPs include: <ul style="list-style-type: none"> - Groundwaters of Victoria (SEPP GoV) - Waters of Victoria (SEPP WoV) - Prevention and Management of Contaminated Land (SEPP Land)
SPOCAS	Suspension Peroxide Oxidation Combined Acidity and Sulfur



1.0 Introduction and Objectives

1.1 Background

Planisphere Pty Ltd engaged Senversa Pty Ltd to undertake a salinity and acid sulfate soil assessment at the land located at 260 Fellows Road & 61-75 Murray Road, Queenscliff, Victoria (the site). The site location is defined in **Figure 1**.

Planisphere requires a salinity and acid sulfate soil assessment of soils to assess whether salinity or potential/actual acid sulfate soil is present at the site and what implications this may have on proposed future subdivision and residential development of the site.

1.2 Project Understanding

The site is approximately 7 hectares in size, and comprises Council (Borough of Queenscliff) owned vacant land. It is understood that Council wishes to facilitate the production of a Development Plan and planning permit documentation for the subdivision and residential development of the land.

Other aspects including flora/fauna values, the location of services and planning issues are being considered separately by Planisphere in assessing suitability of the site for development.

1.3 Project Objective

The project objective was to assess the potential for acid sulfate and/or saline soils to be present at the site. In doing so, recommendations for management plans required and/or further assessment have been made.

1.4 What are Acid Sulfate Soils?

Acid sulfate soil (ASS) is the common name given to naturally occurring soils, rock and sediments that contain elevated levels of metal sulfides. Most ASS were deposited during the Holocene geological age (the last 10,000 years)¹ as a result of elevated sea levels infiltrating freshwater environments. Sea-water sulfates reacted with iron-rich sediments of the freshwater systems producing iron sulfide deposits in the soil.

ASS may present a risk to human health and the environment when oxidised by exposure to air (oxygenated) from disturbance activities such as excavation or dewatering works. Typically, the most common metal sulfides associated with ASS are present in the form of iron pyrite which, when exposed to air, readily oxidises to produce sulfuric acid. Consequently, acidification of rock, soil, sediment and run-off can occur. Surface and groundwater systems may also be affected. ASS can have significant adverse affects on aquatic ecosystems, agricultural, fisheries and engineering practices, land use and development.

Excavation or dewatering works, drilling, dredging or lowering of the groundwater table may disturb acid sulfate soils. Subsequently, these activities should be avoided where possible, or minimised where unavoidable. However, many factors influence the environmental risk posed by ASS.

The reader is directed to the following link which provides an animation on the formation of ASS and how it may be disturbed by various means resulting in exposure to oxygen and generation of acidic conditions: http://www.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/soil_acid_sulfate_soils.

¹ EPA Publication 655.1: Acid Sulfate Soil and Rock, July 2009.



1.5 Scope of Work

Based on the project understanding and objectives, Senversa undertook the following scope of work:

- Preparation of a Health and Safety Plan for fieldwork including a job safety risk assessment and safe work method statements.
- Inspection of the site and surrounding land to identify visible potential contamination sources/activities, record the current site infrastructure, surface cover, surrounding land uses, topography and drainage.
- Visual inspection and clearance of underground services in the vicinity of the proposed investigation locations using Senversa Borehole Clearance checklist and a review of available service plans provided by dial-before-you-dig (DBYD).
- Collection of soil samples from 14 locations using a hand auger.
- Submission of soil samples for analysis by laboratories accredited by the National Association of Testing Authorities (NATA) for the methods used.
- Collation and interpretation of field and laboratory data, including conducting a quality assurance / quality control (QA/QC) data validation process.
- Preparation of this report.



2.0 Site Description and Environmental Setting

2.1 Site Details

The following table summarises the relevant details that describe the site.

Item	Relevant Site Information
Site Address	260 Fellows Road & 61-75 Murray Road, Queenscliff
Municipality	Queenscliff Shire Council
Current Land Use Zoning	Residential 1 Zone (R1Z)
Lot and Plan Number	Lot A PS409244

2.2 Investigation Reports

2.2.1 Environmental Site Assessments

Planisphere provided Senversa with the following reports documenting previous soil and groundwater assessments:

- GHD Pty Ltd, *Phase 1 Environmental Assessment and Preliminary Geotechnical Assessment, Corner of Fellows Road and Murray Road, Queenscliff*. May 2004.
- Hygienics Pty Ltd, *Preliminary Site Assessment, Murray Road, Point Lonsdale*. June 2005
- EarthTech Pty Ltd, *Environmental Site Assessment, Murray Road, Point Lonsdale*. December 2005.

The reports document historical uses of the site and assessment of soil contamination, particularly in the northwest corner where filling occurred. They are referenced in this report where appropriate.

2.2.2 Acid Sulfate Soil

Department of Environment and Primary Industries provides a series of maps for coastal areas in Victoria that identify areas where acid sulfate soils may be found (www.depi.vic.gov.au). The map that covers Queenscliff (Map 3 for Central Coast Victoria) identifies the site as being within an area of “*Prospective Land: land that has the potential to contain Coastal Acid Sulfate Soils as indicated by geomorphology.*”

The Australian Soil Resource Information System (<http://www.asris.csiro.au/mapping/viewer.htm>) [maps the site as being within a larger area where there is a “high probability/high confidence\) of acid sulfate](#) being present.

2.2.3 Salinity Assessment

A report regarding salinity management was identified based on a discussion with Geoff Brooks (Department of Environment and Primary Industries). It is Dalhaus Environmental Geology Pty Ltd, Borough of Queenscliffe Salinity Management Overlay: salinity occurrences and mapping. Background Report 4. March 2008. It is noted that most of the site was identified as a “salinity site of concern” in that report and it was recommended that it be within a Salinity Management Overlay (SMO). The identification of the site appears to have been based on its location (i.e. low lying land adjacent to a saline wetland), survey of the vegetation and the likelihood of a shallow, saline water table.



In the discussion with Geoff Brooks he indicated that some properties on Murray Road showed signs of being affected by saline conditions.

2.3 Topography

The site is generally flat and low lying with two raised areas (approximately 1.5 m higher than other areas of the site) in the northeast and northwest corners where filling has occurred.

2.4 Local Geology

The Geological Survey of Victoria map (No. 867, Zone 7) indicates that the site is within an area of Quaternary coastal deposits consisting of siliceous sands and shell beds. It is noted that the northeast and northwest areas of the site have been subject to filling (EarthTech, 2005).

2.5 Hydrogeology

A previous investigation found that groundwater was approximately 1.7 m below ground surface (EarthTech, 2005). It is noted that the groundwater wells were installed in the areas that had been filled, so groundwater may be encountered at shallower depths outside those areas. EarthTec (2005) also concluded that standing water levels were influenced by tidal fluctuations, and that groundwater flow was to the north, towards Swan Bay.



3.0 Field Work Program

The following sections describe the guidelines, standards and investigation methods adopted and used during this assessment.

3.1 Relevant Guidelines and Standards

This assessment was undertaken in accordance with relevant guidelines, standards and policies published by Standards Australia (1999, 2005), DSE (2010), EPA Victoria (2009a, 2009b), NEPC (2013) and the State of Victoria (2002).

3.2 Sample Location Rationale

The investigation locations are illustrated in **Figure 2**. The locations were selected to provide broad spatial coverage across each of the cleared or filled areas (i.e. those outside the areas of remnant native vegetation). The target investigation depth could not be reached due to the presence of compacted fill at some locations.

3.3 Field Work Methodology

The following table describes the field work methodology:

Activity	Item	Description
Soil Sampling	Date	16 April 2014
	Method	<p>The scope of work for the soil sampling was as follows:</p> <ul style="list-style-type: none"> • Hand auger holes were advanced to the depth of ground water (i.e. 1 m to 1.5 m) where possible. This was not possible in some areas of filling. • Samples were collected from the near surface and approximately 0.5 m intervals thereafter, or where changes in lithology were noted. • Logging of the soil profile was undertaken in accordance with Australian Standard AS1726, 1997. Lithological logs are included in Appendix A. • Depth to groundwater, where intercepted, was noted on the lithological log. • Samples were collected in laboratory supplied jars (for contaminant analysis) and plastic zip lock bags (for analysis of ASS parameters) and kept in a cool box with ice while on-site prior to forwarding for laboratory analysis. • Upon completion of bore hole, the drilling spoil was used to backfill the hole.
Laboratory Analysis	Method	<p>Laboratory Analysis – Acid Sulfate Soil Assessment</p> <p>Up to three samples per location were submitted for a 'pH field test', comprising analysis of soil pH (pH_F) and soil pH after oxidation with hydrogen peroxide (pH_{F_{OX}}), and recording of reaction rate after addition of hydrogen peroxide. It is noted that these tests are often conducted in the field, however were conducted in the laboratory for logistical reasons.</p> <p>Based on the results of the pH screening, selected samples were also analysed for Suspension Peroxide Oxidation Combined Acidity Sulfur (SPOCAS). As a quality control measure one sample was also selected for Chromium Reducible Sulfur (S_{cr}) analysis.</p> <p>Laboratory Analysis – Salinity Assessment</p> <p>Selected soil samples were analysed for chloride, conductivity and sulphate as indicators of saline conditions.</p>



Activity	Item	Description
Avoidance of Cross Contamination	Procedure	<p>Measures incorporated to prevent cross contamination included:</p> <ul style="list-style-type: none"> • The use of new disposable gloves for each soil sample. • Collection of samples from in-tact soil from the interior section of the auger (i.e. avoiding collecting samples that has come into contact with the auger).
Sample Handling and Preservation	Procedure	<p>Samples were collected placed in clean laboratory-supplied jars and Senversa-purchased zip-lock bags. Samples were collected and immediately stored in a cooler box containing ice prior to delivery and during transit to the laboratory. Samples were transported to the laboratory with an accompanying chain of custody (COC) document and laboratory-supplied security seals. Samples intended to be analysed for SPOCAS were frozen within 24 hours as per the advice of the receiving laboratory.</p> <p>Sample transportation and handling information is provided on the COC and sample receipt notification summaries provided as part of the Laboratory Analytical Reports in Appendix B.</p>

3.4 Quality Assurance / Quality Control

The QA/QC procedures adopted by Senversa provide a consistent approach to evaluate whether the target data quality objectives (DQOs) have been achieved. This process focuses on the assessment of data useability, in terms of accuracy and reliability, when forming conclusions on the condition of the element of the environment being investigated. The approach is based on guidance published by Standards Australia (2005), NEPC (2013) and USEPA (2000, 2002).

The data validation process undertaken is detailed within **Appendix C**. Based on the data validation the data is considered suitable for use in forming conclusions relating to acid sulphate soil and salinity conditions at the site.



4.0 Legislative Framework

4.1 Acid Sulfate Soil

Waste acid sulfate soils must be managed in accordance with the requirements of *Industrial Waste Management Policy (Waste Acid Sulfate Soils) 1999*. EPA Publication 655.1, *Acid Sulfate Soil and Rock*, July 2009 provides guidance regarding identifying, classifying and managing acid sulfate soils and rock.

Appendix 3 of EPA Publication 655.1 presents 'texture based' net acidity criteria for determining whether soils are classified as acid sulfate soils. The criteria are specified for both the 'sulfur trail' (as %S oven-dry basis) and the 'acid trail (as mol H⁺/tonne oven-dry basis), as follows:

Soil or Sediment texture	Approx. Clay Content (%)	Net Acidity Criteria (1-1000 tonnes)		Net Acidity Criteria (>1000 tonnes)	
		%S	mol H+/tonne	%S	mol H+/tonne
Sands to loamy sands	<5	0.03	18	0.03	18
Sandy loams to light clays	5-40	0.06	36	0.03	18
Medium to heavy clays and silty clays	>40	0.1	62	0.03	18

In addition to the above Victorian guidance documents, the *Queensland Acid Sulfate Soil Technical Manual, Soil Management Guidelines* (DNRM, 2002) provide guidance with respect to risk categorisation and management of acid sulfate soils where they are identified.

4.2 Soil Salinity

There are no specific legislative requirements relating to soil salinity assessment. However, guidelines for assessing soil salinity have been drawn from the following:

- Australian Standard 2159–2009 *Piling Design and Installation*, in which levels of pH, chloride and sulphate which are considered to represent mild and/or non-aggressive conditions for concrete or steel piles are specified. The values adopted for initial screening (<5,000 mg/kg sulphate, pH >5 and <5,000 mg/kg chloride) are the most conservative of those reported in AS2159 for concrete and steel piles, and are considered to be associated with mild or non-aggressive conditions only where all objectives are met. Where one or more objective is not met, conditions may still be acceptable, but exposure conditions should be further evaluated in accordance with Tables 6.4.2(C) and 6.5.2(C) within AS2159.
- *Site Investigations for Urban Salinity* (DMWC, 2002), provides guidance regarding the salinity assessment process and references AS2159 for measures of corrosivity. It notes that assessing the impact of salinity requires consideration of a number of factors given that, "*The impact of salts on building material is related to the amount of salt and water present, the types of salts present, chemical and physical reactions with the building materials and the amount of wetting and drying occurring.*"



5.0 Results and Discussion

5.1 Site Specific Geology

Based on the soil investigation undertaken by Senversa, the site geology was consistent with expected geology as described in **Section 2.3**. Lithological logs are presented in **Appendix A**. The natural soil profile consisted of silty sand with some sandy clay encountered. Fill material was present in the northwest and northeast areas of the site at a thickness of approximately 1.5 m. It consisted of brown to dark brown silt with gravel and fragments of brick, metal and concrete. It is noted that previous investigations also observed other debris in fill including wood, plastic, ceramic and asphalt (EarthTech, 2005).

5.2 Field Observations

There was no visual evidence of salinity impacts such as salt crusts on soil. In addition, there was no visual evidence of acid sulfate soil such as staining of water and soil.

Saturated soil, indicative of the groundwater table, was encountered at depths between approximately 0.9 m bgl and 1.5 m bgl.

5.3 Soil Laboratory Analytical Results

5.3.1 Acid Sulfate Soil

Soil field pH and SPOCAS laboratory analytical results are presented in **Table 1**. The NATA certified laboratory analytical reports are provided in **Appendix B**. Comments on the laboratory analysis results are as follows:

- Field pH analysis results were compared against Table 2 of EPA Publication 655.1. The change in pH was greater than 2 and/or the reaction rate was greater than 2 for some samples. Those samples were selected for SPOCAS analysis. They were predominantly from natural soil samples with two from fill material.
- pH_{KCL} values ranged from 7.0 to 9.6, indicating neutral to slightly alkaline conditions.
- Reported net acidity values were all less than the limit of reporting, which was less than EPA Publication 655.1 criteria for classification of acid sulfate soil.
- The KCL extractable and HCl extractable sulfur contents of all samples were less than detection limits indicating very low existing sulfidic acidity.
- Oxidisable sulphur contents were low (a maximum of 0.08% S) indicating low potential sulfidic acidity.

These results indicate an overall low environmental risk due to acid sulfate soils at the locations investigated.

5.3.2 Soil Salinity

Soil salinity laboratory analytical results are presented in **Table 1**. The NATA certified laboratory analytical reports are provided in the **Appendix B**. Comments on the laboratory analysis results are as follows:

- All results for chloride (maximum of 3,000 mg/kg), pH (8.2 to 9.4) and sulphate (maximum of 330 mg/kg) were indicative of mild or non-aggressive conditions in accordance with AS2159.



6.0 Conclusions and Recommendations

6.1 Conclusions

Based on the soil investigation undertaken, the following conclusions are made:

- The local geology consists of silty sands with approximately 1.5 m of imported fill overlying the natural soil in the northeast and northwest parts of the site. The fill consisted of brown to dark brown silt with gravel and fragments of brick, metal and concrete.
- Analysis results did not indicate the presence of potential or actual acid sulfate soil at the locations investigated. However, the site is within an area identified as having the potential for acid sulfate soil based on its geomorphology. It is noted that the investigation locations were limited to accessible areas outside existing remnant native vegetation areas in the central portion of the site. Given that these native vegetation areas are at a lower elevation than those investigated, further acid sulfate soil assessment may be warranted if they are to be developed. Whilst it is expected that the ground levels in the vegetated area would need to be raised by filling to allow development, if existing soils need to be disturbed, the potential for acid sulfate soil to be present should be further considered.
- Analysis results for parameters to assess for salinity indicated mild or non-aggressive conditions. However, it is considered that the presence of shallow, saline groundwater is a potential source of saline conditions at the site. In addition, a study of salinity in the region identified the site as a “salinity site of concern” recommended that it be within a Salinity Management Overlay (Dalhaus, 2008).

6.2 Recommendations

Based on the soil investigation undertaken, the following recommendations are made:

- An acid sulfate soil management plan is not considered warranted based on the results of laboratory analysis. However, given the site is within an area identified as having the potential for acid sulfate soils it is recommended that, should indicators of acid sulfate soil be identified during any future excavations, the site is managed in accordance with EPA Publication 655.1 to control any adverse environmental impacts.
- A salinity management plan should be a requirement for any future development involving construction of buildings on the site. The timing and specific requirement for salinity management would be up to the responsible planning authority.



7.0 Principles and Limitations of Investigation

The following principles are an integral part of site contamination assessment practices and are intended to be referred to in resolving any ambiguity or exercising such discretion as is accorded the user or site assessor.

Elimination of Uncertainty

Some uncertainty is inherent in all site investigations. Furthermore, any sample, either surface or subsurface, taken for chemical testing may or may not be representative of a larger population or area. Professional judgment and interpretation are inherent in the process, and even when exercised in accordance with objective scientific principles, uncertainty is inevitable. Additional assessment beyond that which was reasonably undertaken may reduce the uncertainty.

Failure to Detect

Even when site investigation work is executed competently and in accordance with the appropriate guidance, it must be recognised that certain conditions present especially difficult target analyte detection problems. Such conditions may include, but are not limited to, complex geological settings, unusual or generally poorly understood behaviour and fate characteristics of certain substances, complex, discontinuous, random, or heterogeneous distributions of existing target analytes, physical impediments to investigation imposed by the location of services, structures and other man-made objects, and the inherent limitations of assessment technologies.

Limitations of Information

The effectiveness of any site investigation may be compromised by limitations or defects in the information used to define the objectives and scope of the investigation, including inability to obtain information concerning historic site uses or prior site assessment activities despite the efforts of the user and assessor to obtain such information.

Chemical Analysis Error

Chemical testing methods have inherent uncertainties and limitations. Senversa routinely seeks to require the laboratory to report any potential or actual problems experienced, or non-routine events which may have occurred during the testing, so that such problems can be considered in evaluating the data.

Level of Assessment

The investigation herein should not be considered to be an exhaustive assessment of environmental conditions on a property. There is a point at which the effort of information obtained and the time required to obtain it outweigh the benefit of the information gained and, in the context of private transactions and contractual responsibilities, may become a material detriment to the orderly conduct of business. If the presence of target analytes is confirmed on a property, the extent of further assessment is a function of the degree of confidence required and the degree of uncertainty acceptable in relation to the objectives of the assessment.

Comparison with Subsequent Inquiry

The justification and adequacy of the investigation findings in light of the findings of a subsequent inquiry should be evaluated based on the reasonableness of judgments made at the time and under the circumstances in which they were made.



Data Usability

Investigation data generally only represent the site conditions at the time the data were generated. Therefore, the usability of data collected as part of this investigation may have a finite lifetime depending on the application and use being made of the data. In all respects, a future reader of this report should evaluate whether previously generated data are appropriate for any subsequent use beyond the original purpose for which they were collected, or are otherwise subject to lifetime limits imposed by other laws, regulations or regulatory policies.

Nature of Advice

The investigation works herein are intended to develop and present sound, scientifically valid data concerning actual site conditions. Senversa does not seek or purport to provide legal or business advice.



8.0 References

Dalhaus, P.G. 2008, Borough of Queenscliffe Salinity Management Overlay: salinity occurrences and mapping. Background Report 4, prepared for EnPlan Australian Pty Ltd, Borough of Queenscliff and the Corangamite Catchment Management Authority by Dalhaus Environmental Geology Pty Ltd.

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Figures



Figure 1: Sample Location Plan



Path: Y:\16_GIS\obsm1090700 - Queenscliff\MXDsl\M1090702 Fig1_sample location plan.mxd



Address: Ground Floor 51 Clarke Street
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Legend
 Soil Bore Sample Location
 Site Boundary

Aerial sourced from Nearmap.com

Designed:	D. Ahearne	Date:	19/05/2014
Drawn:	S. Koroblitsas	Revision:	0
Checked:		Scale:	1:1,500 (A3)
File:	M1090702 Fig1_sample location plan		

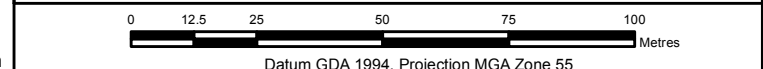


Figure No:	1
Title:	Sample Location Plan
Project:	Salinity and Acid Sulfate Soil Assessment
Location:	Fellows and Murray Roads, Queenscliff
Client:	Planisphere Pty Ltd



Tables

Table 1: Acid Sulfate Soil and Salinity Analysis Results

Location	SB01		SB02		SB03		SB04		SB04	
Sample Depth (m)	0-0.1		0.5-0.7		1-1.2		1-1.2		1-1.2	
Sample ID	SB01_0-0.1		SB01_0.5-0.7		SB02_0-0.1		SB02_0.5-0.7		SB03_1-1.2	
Sample Date	16/04/2014		16/04/2014		16/04/2014		16/04/2014		16/04/2014	
Matrix Description	Fine-medium grained Sand		Silty Sand		Sandy Silt		Silty Sand / Silty Sand Interface		Silty Sand	
Lab Report Number	415809	416256	415809	416256	415809	416256	415809	415809	416256	415809

Group	Chemical Name	Units	EQL	Exceeds EPAV Criteria for ASS - Sands to Loamy Sands	Exceeds EPAV Criteria for ASS - Sandy Loams to Light Clays	Exceeds EPAV Criteria for ASS - Medium to Heavy Clays and Silty Clays																
Sample Parameters	Moisture Content (dried @ 103°C)	%	0.1				12	12	17	17	12	12	19	22	12	12	20	23	18	18	12	28
	Conductivity (1:5 aqueous extract)	µS/cm	10				-	-	-	-	910	-	1100	1400	610	-	1100	920	-	-	-	-
	Sulphate (as S)	mg/kg	10				-	-	-	-	92	-	150	330	80	-	130	210	-	-	-	-
	Chloride	mg/kg	5				-	-	-	-	1400	-	1900	2500	800	-	2100	1500	-	-	-	-
	pH (field)	pH_Units	0.1				8.4	-	8.1	-	8.4	-	7.9	7.7	8.5	-	8.3	7.8	8.1	-	8.6	7.9
SPOCAS Suite	pH (lab)	pH_Units	0.1				-	-	-	-	8.7	-	8.7	8.7	9.1	-	9.2	8.8	-	-	-	-
	pH (KCl)	pH_Units	0.1				-	8.7	-	7	-	8.1	-	-	-	8.3	-	-	-	9.3	-	-
	pH (Ox)	pH_Units	0.1				5.7	5.4	5.7	5.9	5.9	4.7	6.6	6.4	6	4.2	6.8	6.5	5.9	7.5	6.7	6.5
	Acid Neutralising Capacity	%CaCO3	0.01				-	-	-	-	-	-	-	-	-	-	-	-	-	13	-	-
	Acid Neutralising Capacity - acidity units	MOL H+/T	10				-	-	-	-	-	-	-	-	-	-	-	-	-	2500	-	-
	Acid Neutralising Capacity - equivalent % pyrite S	% pyrite S	0.02				-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-
	ANC Fineness Factor	Unit					-	1.5	-	1.5	-	1.5	-	-	-	1.5	-	-	-	1.5	-	-
	Liming Rate	kg CaCO3/t	1				-	<1	-	<1	-	<1	-	-	-	1	-	-	-	<1	-	-
	TAA (titratable actual acidity)	mole H+/t	2				-	<2	-	<2	-	<2	-	-	-	<2	-	-	-	<2	-	-
	TPA (titratable peroxide acidity)	mole H+/t	2				-	<2	-	<2	-	<2	-	-	-	<2	-	-	-	<2	-	-
	TSA (titratable sulfidic acidity)	mole H+/t	2				-	<2	-	<2	-	<2	-	-	-	<2	-	-	-	<2	-	-
	sulfidic - TAA	% pyrite S	0.02				-	<0.02	-	<0.02	-	<0.02	-	-	-	<0.02	-	-	-	<0.02	-	-
	sulfidic - TPA	% pyrite S	0.02				-	<0.02	-	<0.02	-	<0.02	-	-	-	<0.02	-	-	-	<0.02	-	-
	sulfidic - TSA	% pyrite S	0.02				-	<0.02	-	<0.02	-	<0.02	-	-	-	<0.02	-	-	-	<0.02	-	-
	acidity - Peroxide Oxidisable Sulfur	mole H+/t	10				-	15	-	<10	-	13	-	-	-	22	-	-	-	47	-	-
	Sulfur - KCl Extractable	% S	0.02				-	<0.02	-	<0.02	-	<0.02	-	-	-	<0.02	-	-	-	<0.02	-	-
	Sulfur - Peroxide Oxidisable	% S	0.02				-	0.02	-	<0.02	-	0.02	-	-	-	0.04	-	-	-	0.08	-	-
	Sulfur - in Peroxide	% S	0.02				-	0.02	-	<0.02	-	0.02	-	-	-	0.04	-	-	-	0.08	-	-
	acidity - Acid Reacted Calcium	mole H+/t	10				-	13	-	<10	-	19	-	-	-	33	-	-	-	2600	-	-
	sulfidic - Acid Reacted Calcium	% pyrite S	0.02				-	0.02	-	<0.02	-	0.03	-	-	-	0.05	-	-	-	4.1	-	-
	Acid Reacted Calcium	% Ca	0.02				-	0.03	-	<0.02	-	0.04	-	-	-	0.07	-	-	-	5.2	-	-
	Calcium - KCl Extractable	% Ca	0.02				-	0.07	-	0.03	-	0.07	-	-	-	0.15	-	-	-	0.26	-	-
	Calcium - in Peroxide	% Ca	0.02				-	0.1	-	0.03	-	0.1	-	-	-	0.21	-	-	-	5.4	-	-
acidity - Acid Reacted Magnesium	mole H+/t	10				-	<10	-	<10	-	<10	-	-	-	<10	-	-	-	140	-	-	
sulfidic - Acid Reacted Magnesium	% pyrite S	0.02				-	<0.02	-	<0.02	-	<0.02	-	-	-	<0.02	-	-	-	0.22	-	-	
Acid Reacted Magnesium	% Mg	0.02				-	<0.02	-	<0.02	-	<0.02	-	-	-	<0.02	-	-	-	0.17	-	-	
Magnesium - KCl Extractable	% Mg	0.02				-	0.02	-	0.02	-	0.03	-	-	-	0.04	-	-	-	0.03	-	-	
Magnesium - in Peroxide	% Mg	0.02				-	0.03	-	0.02	-	0.04	-	-	-	0.04	-	-	-	0.2	-	-	
Chromium Suite	Acid Neutralising Capacity - acidity units (ANCbt)	mole H+/t	2				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Chromium Reducible Sulphur (acidity units)	mole H+/t	3				-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Chromium Reducible Sulfur	% S	0.02				-	0.03	-	0.06	-	0.1	-	-	-	-	-	-	-	-	-	
Acid Base Accounting	Acid Neutralising Capacity - equivalent % pyrite S (ANCbt)	% pyrite S	0.02				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Net Acidity (acidity units)	mole H+/t	10				-	<10	-	<10	-	<10	-	-	<10	-	-	-	<10	-	-	
	Net Acidity (sulfur units)	% S	0.02				-	<0.02	-	<0.02	-	<0.02	-	-	<0.02	-	-	-	<0.02	-	-	

Location	SB05	SB05	SB06	SB06	SB07	SB07	SB08	SB08	SB11	SB11	SB11
Sample Depth (m)	0.5-0.7	1.2-1.4	0.5-0.7	1-1.2	0.5-0.7	1.3-1.5	0.5-0.7	1-1.2	0-0.1	0.5-0.7	1.3-1.5
Sample ID	SB05_0.5-0.7	SB05_1.2-1.4	SB06_0.5-0.7	SB06_1-1.2	SB07_0.5-0.7	SB07_1.3-1.5	SB08_0.5-0.7	SB08_1-1.2	SB11_0-0.1	SB11_0.5-0.7	SB11_1.3-1.5
Sample Date	16/04/2014	16/04/2014	16/04/2014	16/04/2014	16/04/2014	16/04/2014	16/04/2014	16/04/2014	16/04/2014	16/04/2014	16/04/2014
Matrix Description	Silty Sand	Medium-coarse grained Sand	Silty Sand	Sand	Silty Sand	Sand	Gravelly Silt / Silty Sand Interface	Sand	Gravelly Silt	Gravelly Silt	Sand
Lab Report Number	415809	416256	415809	415809	415809	415809	415809	415809	416256	415809	416256

Group	Chemical Name	Units	EQL	Exceeds EPAV Criteria for ASS - Sands to Loamy Sands	Exceeds EPAV Criteria for ASS - Sandy Loams to Light Clays	Exceeds EPAV Criteria for ASS - Medium to Heavy Clays and Silty Clays															
Sample Parameters	Moisture Content (dried @ 103°C)	%	0.1				5.9	5.9	20	21	12	26	17	7.8	13	13	17	17	6.9	6.9	19
	Conductivity (1:5 aqueous extract)	µS/cm	10				1100	-	1800	120	700	73	600	86	510	-	150	-	94	-	1300
	Sulphate (as S)	mg/kg	10				280	-	280	13	92	14	120	10	53	-	21	-	12	-	110
	Chloride	mg/kg	5				1400	-	3000	110	1100	<5	940	9.2	660	-	85	-	14	-	1600
	pH (field)	pH_Units	0.1				7.6	-	7.9	7.8	8.5	8.1	8.4	8	8.3	-	7.6	-	8	-	8.8
SPOCAS Suite	pH (lab)	pH_Units	0.1				8.3	-	8.7	8.8	9.2	8.9	9.2	8.7	9.1	-	8.2	-	8.5	-	9.4
	pH (KCl)	pH_Units	0.1				-	9.4	-	-	-	-	-	-	-	9.6	-	8.9	-	9.1	-
	pH (Ox)	pH_Units	0.1				6	7.5	6.8	6.6	6.8	6.6	6.6	6.3	6.3	7.7	5.8	6.7	6.4	7.5	7.3
	Acid Neutralising Capacity	%CaCO3	0.01				-	22	-	-	-	-	-	-	-	24	-	12	-	17	-
	Acid Neutralising Capacity - acidity units	MOL H+/t	10				-	4400	-	-	-	-	-	-	-	4900	-	2500	-	3400	-
	Acid Neutralising Capacity - equivalent % pyrite S	% pyrite S	0.02				-	7	-	-	-	-	-	-	-	7.8	-	3.9	-	5.4	-
	ANC Fineness Factor	Unit					-	1.5	-	-	-	-	-	-	-	1.5	-	1.5	-	1.5	-
	Liming Rate	kg CaCO3/t	1				-	<1	-	-	-	-	-	-	-	<1	-	<1	-	<1	-
	TAA (titratable actual acidity)	mole H+/t	2				-	<2	-	-	-	-	-	-	-	<2	-	<2	-	<2	-
	TPA (titratable peroxide acidity)	mole H+/t	2				-	<2	-	-	-	-	-	-	-	<2	-	<2	-	<2	-
	TSA (titratable sulfidic acidity)	mole H+/t	2				-	<2	-	-	-	-	-	-	-	<2	-	<2	-	<2	-
	sulfidic - TAA	% pyrite S	0.02				-	<0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	<0.02	-
	sulfidic - TPA	% pyrite S	0.02				-	<0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	<0.02	-
	sulfidic - TSA	% pyrite S	0.02				-	<0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	<0.02	-
	acidity - Peroxide Oxidisable Sulfur	mole H+/t	10				-	24	-	-	-	-	-	-	-	30	-	39	-	26	-
	Sulfur - KCl Extractable	% S	0.02				-	0.02	-	-	-	-	-	-	-	<0.02	-	<0.02	-	<0.02	-
	Sulfur - Peroxide Oxidisable	% S	0.02				-	0.04	-	-	-	-	-	-	-	0.05	-	0.06	-	0.04	-
	Sulfur - in Peroxide	% S	0.02				-	0.06	-	-	-	-	-	-	-	0.05	-	0.06	-	0.04	-
	acidity - Acid Reacted Calcium	mole H+/t	10				-	4500	-	-	-	-	-	-	-	4800	-	2500	-	3200	-
	sulfidic - Acid Reacted Calcium	% pyrite S	0.02				-	7.2	-	-	-	-	-	-	-	7.8	-	4	-	5.2	-
	Acid Reacted Calcium	% Ca	0.02				-	9	-	-	-	-	-	-	-	9.7	-	4.9	-	6.5	-
	Calcium - KCl Extractable	% Ca	0.02				-	0.26	-	-	-	-	-	-	-	0.19	-	0.33	-	0.3	-
	Calcium - in Peroxide	% Ca	0.02				-	9.2	-	-	-	-	-	-	-	9.9	-	5.3	-	6.8	-
	acidity - Acid Reacted Magnesium	mole H+/t	10				-	190	-	-	-	-	-	-	-	260	-	110	-	130	-
	sulfidic - Acid Reacted Magnesium	% pyrite S	0.02				-	0.31	-	-	-	-	-	-	-	0.42	-	0.18	-	0.22	-
Acid Reacted Magnesium	% Mg	0.02				-	0.23	-	-	-	-	-	-	-	0.32	-	0.13	-	0.16	-	
Magnesium - KCl Extractable	% Mg	0.02				-	<0.02	-	-	-	-	-	-	-	0.02	-	0.03	-	0.02	-	
Magnesium - in Peroxide	% Mg	0.02				-	0.23	-	-	-	-	-	-	-	0.34	-	0.16	-	0.18	-	
Chromium Suite	Acid Neutralising Capacity - acidity units (ANCbt)	mole H+/t	2				-	-	-	-	-	-	-	-	5000	-	-	-	-	-	
	Chromium Reducible Sulphur (acidity units)	mole H+/t	3				18	-	-	-	-	-	-	-	<3	-	-	-	-	-	
	Chromium Reducible Sulfur	% S	0.02				0.03	-	-	-	-	-	-	-	<0.02	-	-	-	-	-	
Acid Base Accounting	Acid Neutralising Capacity - equivalent % pyrite S (ANCbt)	% pyrite S	0.02				-	-	-	-	-	-	-	-	8	-	-	-	-	-	
	Net Acidity (acidity units)	mole H+/t	10				18	<10	-	-	-	-	-	-	<10	-	<10	-	<10	-	
	Net Acidity (sulfur units)	% S	0.02				0.03	<0.02	-	-	-	-	-	-	<0.02	-	<0.02	-	<0.02	-	



Appendix A: Lithological Logs



CLIENT Planisphere Pty Ltd **PROJECT NAME** Salinity and Acid Sulfate Soil Assessment
PROJECT NUMBER M1090702 **PROJECT LOCATION** 260 Fellows Rd & 61-75 Murray Rd, Queenscliff
DATE STARTED 16/04/13 **COMPLETED** 16/04/13 **R.L. SURFACE** _____ **DATUM** _____
DRILLING CONTRACTOR Senversa **RL Casing** _____
EQUIPMENT Hand Auger **HOLE LOCATION (Easting, Northing)** Area C
HOLE SIZE 90mm **LOGGED BY** Jl **CHECKED BY** DA

NOTES

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING		
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Odour/Staining	PID (ppm)	Sample ID & Interval (QA/QC)
Hand Auger				0.5		FILL	FILL: Dark brown/grey fine to medium grained sand with minor rootlets. Poorly graded.	M-D	Slight organic odour	0.0	SB01_0.00 - 0.10
						SP-SM	Silty SAND: Low plasticity, grey, coarse grained, silty sand with minor shells. Poorly graded, sub rounded sand.	M	No visual or olphactory signs of contamination		
							increasing moisture with depth	M-W		0.0	SB01_0.50 - 0.70
								W			
				1.0			SB01 terminated at 0.90 m bgl EOH @ 0.9 m bgl water entering borehole.				
				1.5							
				2.0							



CLIENT Planisphere Pty Ltd PROJECT NAME Salinity and Acid Sulfate Soil Assessment
 PROJECT NUMBER M1090702 PROJECT LOCATION 260 Fellows Rd & 61-75 Murray Rd, Queenscliff




DATE STARTED 16/04/13 COMPLETED 16/04/13 R.L. SURFACE _____ DATUM _____

DRILLING CONTRACTOR Senversa RL Casing _____

EQUIPMENT Hand Auger HOLE LOCATION (Easting, Northing) Area C

HOLE SIZE 90mm LOGGED BY Jl CHECKED BY DA

NOTES _____

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING		
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Odour/Staining	PID (ppm)	Sample ID & Interval (QA/QC)
Hand Auger						FILL	FILL: Dark brown/grey fine to medium grained sandy silt with minor rootlets. Poorly graded.	M-D	No visual or olfactory signs of contamination	0.0	SB02_0.00 - 0.10
						SP-SC	Sandy CLAY: High plasticity, orange and grey, coarse grained sandy clay. Poorly graded sub rounded sand.				
				0.5			decreasing clay content.	M		0.0	SB02_0.50 - 0.70
						SP-SM	Silty SAND: Low plasticity, grey, coarse grained, silty sand with minor shells. Poorly graded, sub rounded sand.				
				1.0				M-W		0.0	SB02_1.00 - 1.20
								W			
				1.5			SB02 terminated at 1.20 m bgl EOH @ 1.2 m bgl water entering borehole.				
				2.0							

WELL M1090702_QUEENSCLIFF.GPJ SENVERSA 3.00.GPJ 22/05/14



CLIENT Planisphere Pty Ltd PROJECT NAME Salinity and Acid Sulfate Soil Assessment
 PROJECT NUMBER M1090702 PROJECT LOCATION 260 Fellows Rd & 61-75 Murray Rd, Queenscliff


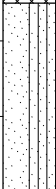
DATE STARTED 16/04/13 COMPLETED 16/04/13 R.L. SURFACE _____ DATUM _____

DRILLING CONTRACTOR Senversa RL Casing _____

EQUIPMENT Hand Auger HOLE LOCATION (Easting, Northing) Area C

HOLE SIZE 90mm LOGGED BY Jl CHECKED BY DA

NOTES _____

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING		
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Odour/Staining	PID (ppm)	Sample ID & Interval (QA/QC)
Hand Auger						FILL	FILL: Dark brown/grey fine to medium grained sandy silt with minor rootlets and trace gravels. Poorly graded.	D		0.0	SB03_0.00 - 0.10
				0.5		SP-SM	Silty SAND: Low plasticity, grey, coarse grained, silty sand with trace shells. Poorly graded, sub rounded sand.	D-M			
								M	No visual or olfactory signs of contamination	0.0	SB03_0.50 - 0.70
				1.0				M-W			
								W		0.0	SB03_1.00 - 1.20
				1.5			becoming grey increasing shell content				
				2.0			SB03 terminated at 1.30 m bgl EOH @ 1.3 m bgl water entering borehole.				

WELL M1090702_QUEENSCLIFF.GPJ SENVERSA 3.00.GPJ 22/05/14



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PROJECT NUMBER M1090702 **PROJECT LOCATION** 260 Fellows Rd & 61-75 Murray Rd, Queenscliff
DATE STARTED 16/04/13 **COMPLETED** 16/04/13 **R.L. SURFACE** _____ **DATUM** _____
DRILLING CONTRACTOR Senversa **RL Casing** _____
EQUIPMENT Hand Auger **HOLE LOCATION (Easting, Northing)** Area C
HOLE SIZE 90mm **LOGGED BY** Jl **CHECKED BY** DA

NOTES

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING		
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Odour/Staining	PID (ppm)	Sample ID & Interval (QA/QC)
Hand Auger				0.0		FILL	FILL: Dark brown/grey fine to medium grained sand with minor rootlets. Poorly graded.	D	No visual or olfactory signs of contamination	0.0	SB04_0.00 - 0.10
				0.5		SP-SM	Silty SAND: Low plasticity, grey, coarse grained, silty sand with minor shells. Poorly graded, sub rounded sand.	D-M		0.0	SB04_0.50 - 0.70
				1.0			becoming predominately grey/blue increasing shell content and moisture with depth	M-W		0.0	SB04_1.20 - 1.40
				1.5			SB04 terminated at 1.40 m bgl EOH @ 1.4 m bgl water entering borehole.	W			
				2.0							

WELL M1090702_QUEENSCLIFF.GPJ SENVERSA 3.00.GPJ 22/05/14



CLIENT Planisphere Pty Ltd PROJECT NAME Salinity and Acid Sulfate Soil Assessment
 PROJECT NUMBER M1090702 PROJECT LOCATION 260 Fellows Rd & 61-75 Murray Rd, Queenscliff

DATE STARTED 16/04/13 COMPLETED 16/04/13 R.L. SURFACE _____ DATUM _____

DRILLING CONTRACTOR Senversa RL Casing _____

EQUIPMENT Hand Auger HOLE LOCATION (Easting, Northing) Area B

HOLE SIZE 90mm LOGGED BY Jl CHECKED BY DA

NOTES _____

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING		
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Odour/Staining	PID (ppm)	Sample ID & Interval (QA/QC)
Hand Auger						FILL	FILL: Brown to dark brown, gravelly silt with trace rootlets. Poorly graded angular gravel. Anthropogenic material including trace brick fragments.	D	No visual or olfactory signs of contamination		
				0.5		FILL	FILL: Dark brown to grey fine to medium grained silty sand with minor rootlets, shells and angular gravel. Poorly graded.	D-M		0.0	SB05_0.50 - 0.70
				1.0		CLS	Sandy CLAY: High plasticity, brown/orange, coarse grained, sandy clay. Poorly graded, sub rounded sand.	M			
						SP-SM	Silty SAND: Low plasticity, blue/grey, coarse grained, silty sand with minor shells. Poorly graded, sub rounded sand.				
						SP	SAND: Orange/grey, medium to coarse grained sand with minor shells. Poorly graded sub rounded.	M-W		0.0	SB05_1.20 - 1.40
				1.5				W			
				2.0			SB05 terminated at 1.50 m bgl EOH @ 1.5 m bgl water entering borehole.				

WELL M1090702_QUEENSCLIFF.GPJ SENVERSA 3.00.GPJ 22/05/14



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 PROJECT NUMBER M1090702 PROJECT LOCATION 260 Fellows Rd & 61-75 Murray Rd, Queenscliff

DATE STARTED 16/04/13 COMPLETED 16/04/13 R.L. SURFACE _____ DATUM _____

DRILLING CONTRACTOR Senversa RL Casing _____

EQUIPMENT Hand Auger HOLE LOCATION (Easting, Northing) Area B

HOLE SIZE 90mm LOGGED BY Jl CHECKED BY DA

NOTES _____

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING		
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Odour/Staining	PID (ppm)	Sample ID & Interval (QA/QC)
Hand Auger						FILL	FILL: Brown to dark brown, gravelly silt with trace rootlets. Poorly graded angular gravel. Anthropogenic material including trace brick fragments.	D	No visual or olfactory signs of contamination		
				0.5			FILL: Dark brown to grey fine to medium grained silty sand with minor rootlets, shells and angular gravel. Poorly graded.	M-D		0.0	SB06_0.50 - 0.70
				1.0		CLS	Sandy CLAY: High plasticity, brown/orange, coarse grained, sandy clay. Poorly graded, sub rounded sand.	M			
						SP	SAND: Orange/grey, medium to coarse grained sand with minor shells. Poorly graded sub rounded.	M-W		0.0	SB06_1.00 - 1.20
				1.5			SB06 terminated at 1.30 m bgl EOH @ 1.3 m bgl water entering borehole.	W			
				2.0							

WELL M1090702_QUEENSCLIFF.GPJ SENVERSA 3.00.GPJ 22/05/14



CLIENT Planisphere Pty Ltd **PROJECT NAME** Salinity and Acid Sulfate Soil Assessment
PROJECT NUMBER M1090702 **PROJECT LOCATION** 260 Fellows Rd & 61-75 Murray Rd, Queenscliff

DATE STARTED 16/04/13 **COMPLETED** 16/04/13 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR Senversa **RL Casing** _____

EQUIPMENT Hand Auger **HOLE LOCATION (Easting, Northing)** Area B

HOLE SIZE 90mm **LOGGED BY** Jl **CHECKED BY** DA

NOTES _____

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING		
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Odour/Staining	PID (ppm)	Sample ID & Interval (QA/QC)
Hand Auger						FILL	FILL: Brown to dark brown, gravelly silt with trace rootlets. Poorly graded angular gravel. Anthropogenic material including trace brick fragments.	D	No visual or olfactory signs of contamination		
				0.5		FILL	FILL: Dark brown to grey fine to medium grained silty sand with minor rootlets, shells and angular gravel. Poorly graded.	M-D		0.0	SB07_0.50 - 0.70
				1.0		CLS	Sandy CLAY: High plasticity, brown/orange, coarse grained, sandy clay. Poorly graded, sub rounded sand.	M-W			
				1.5		SP	SAND: Orange/grey, medium to coarse grained sand with minor shells. Poorly graded sub rounded.	W		0.0	SB07_1.30 - 1.50
				2.0			SB07 terminated at 1.50 m bgl EOH @ 1.5 m bgl water entering borehole.				

WELL M1090702_QUEENSCLIFF.GPJ SENVERSA 3.00.GPJ 22/05/14



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PROJECT NUMBER M1090702 **PROJECT LOCATION** 260 Fellows Rd & 61-75 Murray Rd, Queenscliff
DATE STARTED 16/04/13 **COMPLETED** 16/04/13 **R.L. SURFACE** _____ **DATUM** _____
DRILLING CONTRACTOR Senversa **RL Casing** _____
EQUIPMENT Hand Auger **HOLE LOCATION (Easting, Northing)** Area B
HOLE SIZE 90mm **LOGGED BY** Jl **CHECKED BY** DA

NOTES _____

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING		
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Odour/Staining	PID (ppm)	Sample ID & Interval (QA/QC)
Hand Auger				0.5		FILL	FILL: Brown to dark brown, gravelly silt with trace rootlets. Poorly graded angular gravel. Anthropogenic material including trace brick fragments.	D	No visual or olfactory signs of contamination		
						FILL	FILL: Dark brown to grey fine to medium grained silty sand with minor rootlets, shells and angular gravel. Poorly graded.			0.0	SB08_0.50 - 0.70
				1.0		CLS	Sandy CLAY: High plasticity, brown/orange, coarse grained, sandy clay. Poorly graded, sub rounded sand.	M			
						SP	SAND: Orange/grey, medium to coarse grained sand with minor shells. Poorly graded sub rounded.	M-W		0.0	SB08_1.00 - 1.20
				1.5			SB08 terminated at 1.40 m bgl EOH @ 1.4 m bgl water entering borehole.	W			
				2.0							

WELL M1090702_QUEENSCLIFF.GPJ SENVERSA 3.00.GPJ 22/05/14



CLIENT Planisphere Pty Ltd **PROJECT NAME** Salinity and Acid Sulfate Soil Assessment
PROJECT NUMBER M1090702 **PROJECT LOCATION** 260 Fellows Rd & 61-75 Murray Rd, Queenscliff

DATE STARTED 16/04/13 **COMPLETED** 16/04/13 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR Senversa **RL Casing** _____

EQUIPMENT Hand Auger **HOLE LOCATION (Easting, Northing)** Area A

HOLE SIZE 90mm **LOGGED BY** Jl **CHECKED BY** DA

NOTES _____

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING		
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Odour/Staining	PID (ppm)	Sample ID & Interval (QA/QC)
Hand Auger						FILL	FILL: Brown to dark brown, gravelly silt with minor rootlets. Poorly graded angular gravel. Anthropogenic material including brick and concrete fragments.		No visual or olfactory signs of contamination		
				0.5			SB09 terminated at 0.40 m bgl EOH @ 0.4 m bgl refusal on large gravel fragments and concrete at four separate locations				
				1.0							
				1.5							
				2.0							



CLIENT Planisphere Pty Ltd **PROJECT NAME** Salinity and Acid Sulfate Soil Assessment
PROJECT NUMBER M1090702 **PROJECT LOCATION** 260 Fellows Rd & 61-75 Murray Rd, Queenscliff

DATE STARTED 16/04/13 **COMPLETED** 16/04/13 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR Senversa **RL Casing** _____

EQUIPMENT Hand Auger **HOLE LOCATION (Easting, Northing)** Area A

HOLE SIZE 90mm **LOGGED BY** Jl **CHECKED BY** DA

NOTES _____

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING		
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Odour/Staining	PID (ppm)	Sample ID & Interval (QA/QC)
Hand Auger						FILL	FILL: Brown to dark brown, gravelly silt with minor rootlets. Poorly graded angular gravel. Anthropogenic material including brick and concrete fragments.		No visual or olfactory signs of contamination		
				0.5			SB10 terminated at 0.40 m bgl EOH @ 0.4 m bgl refusal on large gravel fragments and concrete at four separate locations				
				1.0							
				1.5							
				2.0							



CLIENT Planisphere Pty Ltd PROJECT NAME Salinity and Acid Sulfate Soil Assessment
 PROJECT NUMBER M1090702 PROJECT LOCATION 260 Fellows Rd & 61-75 Murray Rd, Queenscliff

DATE STARTED 16/04/13 COMPLETED 16/04/13 R.L. SURFACE _____ DATUM _____

DRILLING CONTRACTOR Senversa RL Casing _____

EQUIPMENT Hand Auger HOLE LOCATION (Easting, Northing) Area A

HOLE SIZE 90mm LOGGED BY Jl CHECKED BY DA

NOTES _____

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING		
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Odour/Staining	PID (ppm)	Sample ID & Interval (QA/QC)
Hand Auger				0.5		FILL	FILL: Brown to dark brown, gravelly silt with minor rootlets. Poorly graded angular gravel. Anthropogenic material including trace brick and concrete fragments.	D	No visual or olfactory signs of contamination	0.0	SB11_0.00 - 0.10
							rootlets decreasing			0.1	SB11_0.50 - 0.70
						CLS	Sandy CLAY: High plasticity, brown/orange, coarse grained, sandy clay with minor shell content. Poorly graded, sub rounded sand.			M	
						SP	SAND: Orange/grey, medium to coarse grained sand with minor shells. Poorly graded sub rounded.			M-W	
				1.5				W	0.0	SB11_1.30 - 1.50	
				2.0			SB11 terminated at 1.50 m bgl EOH @ 1.5 m bgl water entering borehole.				

WELL M1090702_QUEENSCLIFF.GPJ SENVERSA 3.00.GPJ 22/05/14



CLIENT Planisphere Pty Ltd **PROJECT NAME** Salinity and Acid Sulfate Soil Assessment
PROJECT NUMBER M1090702 **PROJECT LOCATION** 260 Fellows Rd & 61-75 Murray Rd, Queenscliff

DATE STARTED 16/04/13 **COMPLETED** 16/04/13 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR Senversa **RL Casing** _____

EQUIPMENT Hand Auger **HOLE LOCATION (Easting, Northing)** Area A

HOLE SIZE 90mm **LOGGED BY** Jl **CHECKED BY** DA

NOTES _____

DRILLING						FIELD MATERIAL DESCRIPTION			SAMPLING		
Method	Core Recovery (%)	Water	Well Details	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Odour/Staining	PID (ppm)	Sample ID & Interval (QA/QC)
Hand Auger				0.5		FILL	FILL: Brown to dark brown, gravelly silt with minor rootlets. Poorly graded angular gravel. Anthropogenic material including brick, metal and concrete fragments.	D	No visual or olphactory signs of contamination		
				1.0			SB12 terminated at 0.60 m bgl EOH @ 0.6 m bgl refusal on large gravel fragments and concrete at four seperate locations				
				1.5							
				2.0							

WELL M1090702_QUEENSCLIFF.GPJ SENVERSA 3.00.GPJ 22/05/14



Appendix B: Laboratory Certificates of Analysis

Sonversa Pty Ltd
 Ground Floor, 51 Clarke Street
 Southbank Vic 3006
 Ph: 03 9606 0070 Fax: 03 9606 0074

Laboratory:
 Address: 3-5 Kingston Town Close, Oakleigh
 Contact: Adrian Tabachiera / Sample Log in
 Phone: 03 9564 7055

Chain of Custody Documentation

Job Number: M1090702
 Project Name: Queensoftt ESA
 Sampled By: Jarrod Irving
 Project Manager: Doug Ahearn
 Email Report To: doug.ahearn@sonversa.com.au
 Purchase Order: 0411 538 823
 Quote No.:
 Turn Around Time: Standard
 Page: 1 of 2
 Phone/Mobile:

Lab ID	Sample ID	Matrix *	Date	Time	Container Information	Type / Code	Total Bottles	Analysis Required				
								pH - Field Screen (acid sulphate assessment)	Sulphate	Chloride	Conductivity (EC)	pH
	SB01_0-0.1	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB01_0.5-0.7	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB02_0-0.1	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB02_0.5-0.7	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB02_1-1.2	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB03_0-0.1	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB03_0.5-0.7	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB03_1-1.2	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB04_0-0.1	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB04_0.5-0.7	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB04_1-1.2	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB05_0.5-0.7	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB05_1-2-1.4	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB06_0.5-0.7	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB06_1-1.2	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB07_0.5-0.7	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB07_1.3-1.5	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB08_0.5-0.7	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		
	SB08_1-1.2	Soil	16/04/2014		1 plastic bag, 1 glass jar		X	X	X	X		

Sampler: I attest that proper field sampling procedures in accordance with Sonversa standard procedures and/or project specifications were used during the collection of these samples:
 Sampler Name: _____ Signature: _____ Date: _____

Relinquished By: Jarrod Irving Date: 17/4/14 Method of Shipment (if applicable): 4177414
 Name/Signature: Jarrod Irving Date: 16:10 Carrier / Reference #: 4177414
 Name/Signature: _____ Date: _____ Carrier / Reference #: _____
 Name/Signature: _____ Date: _____ Carrier / Reference #: _____

Received by: John Date: 17/4/14
 Name/Signature: John Date: 2:19pm
 Name/Signature: _____ Date: _____
 Name/Signature: _____ Date: _____

Completed by: _____
 Checked by: _____
 M10907_co

Note: Please freeze plastic bag samples for potential SPCCAS analysis. That analysis will be requested for some samples following the receipt of pH - field screen results.
 Report # 415809
 E-mail's Mgt

Senversa Pty Ltd
 Ground Floor 51 Clarke Street
 Southbank Vic 3006
 Ph: 03 9606 0070 Fax: 03 9606 0074

Laboratory:
 Address: 3-5 Kingston Town Close, Oakleigh
 Contact: Adrian Tabachiera / Sample Log in
 Phone: 03 9564 7055

Chain of Custody Documentation

17 APR 14 PM 2:19:09
 mgt i.e 3.2

Job Number: M1090702
 Project Name: Queenscliff ESA
 Sampled By: Jarrod Irving
 Project Manager: Doug Ahearne
 Email Report To: doug.ahearne@senversa.com.au

Purchase Order: M1090702
 Quote No.:
 Turn Around Time: Standard
 Page: 2 of 2
 Phone/Mobile: 0411 538 823

Lab ID	Sample ID	Matrix *	Date	Time	Container Information		pH - Field Screen (acid sulphate assessment)	Sulphate	Chloride	Conductivity (EC)	pH	Please Hold	Analysis Required
					Type / Code	Total Bottles							
	SB11_0-0.1	Soil	16/04/2014			1 plastic bag, 1 glass jar	X	X	X	X			
	SB11_0.5-0.7	Soil	16/04/2014			1 plastic bag, 1 glass jar	X	X	X	X			
	SB11_1.3-1.5	Soil	16/04/2014			1 plastic bag, 1 glass jar	X	X	X	X			
	QC01	Soil	16/04/2014			1 glass jar					X		
	QC02	Soil	16/04/2014			1 glass jar					X		

Sampler: I attest that proper field sampling procedures in accordance with Senversa standard procedures and/or project specifications were used during the collection of these samples.

Sampler Name: _____ Signature: _____ Date: _____

Relinquished By: *Jarrod Irving* Date: *16/4/14* Method of Shipment (if applicable): *17/4/14*

Name/Signature: *Senversa* Time: *15:10* Carrier / Reference #: *10-10*

Name/Signature: _____ Date: _____ Carrier / Reference #: _____

Name/Signature: _____ Date: _____ Carrier / Reference #: _____

Name/Signature: _____ Date: _____ Carrier / Reference #: _____

Received by: *Senversa mgt* Date: *17/4/14*

Name/Signature: _____ Time: *2:19pm*

Name/Signature: _____ Date: _____

Name/Signature: _____ Date: _____

Water Container Codes: P = Unpreserved Plastic; N = Nitric Acid (HNO₃) Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide (NaOH)/Cadmium (Cd) Preserved; S = Sodium Hydroxide Preserved Plastic; STH = Sodium thiosulfate preserved plastic; V = VOA Vial Hydrochloric Acid (HCl) Preserved; VS = VOA Vial Sulphuric Preserved; VSA = Sulphuric Preserved Amber Glass; H = HCl Preserved Speciation Bottle; HS = HCl Preserved Speciation Bottle; SP = Sulphuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottle; SI = Sterile Bottle; UA = Unpreserved Amber Glass; L = Lugol's iodine preserved white plastic bottle; SW = sulfuric acid preserved wide mouth glass jar

Completed by: _____
 Checked by: _____

Certificate of Analysis

Senversa
 Ground Floor, 51 Clarke St
 Southbank
 VIC 3006



NATA Accredited
 Accreditation Number 1261
 Site Number 1254

Accredited for compliance with ISO/IEC 17025.
 The results of the tests, calibrations and/or
 measurements included in this document are traceable
 to Australian/national standards.

Attention: Doug Ahearne

Report 415809-S
 Client Reference QUEENSCLIFF ESA M1090702
 Received Date Apr 17, 2014

Client Sample ID			SB01_0-0.1	SB01_0.5-0.7	SB02_0-0.1	SB02_0.5-0.7
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins mgt Sample No.			M14-Ap16892	M14-Ap16893	M14-Ap16894	M14-Ap16895
Date Sampled			Apr 16, 2014	Apr 16, 2014	Apr 16, 2014	Apr 16, 2014
Test/Reference	LOR	Unit				
Chloride	5	mg/kg	-	-	1400	1900
Conductivity (1:5 aqueous extract at 25°C)	10	uS/cm	-	-	910	1100
pH (1:5 Aqueous extract)	0.1	units	-	-	8.7	8.7
Sulphate (as S)	10	mg/kg	-	-	92	150
% Moisture	0.1	%	12	17	12	19
Acid Sulphate Soils Field pH Test						
pH-F (Field pH test)	0.1	units	8.4	8.1	8.4	7.9
pH-FOX (Field pH Peroxide test)	0.1	units	5.7	5.7	5.9	6.6
Reaction Ratings		comment	Medium	Low	Medium	Low

Client Sample ID			SB02_1-1.2	SB03_0-0.1	SB03_0.5-0.7	SB03_1-1.2
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins mgt Sample No.			M14-Ap16896	M14-Ap16897	M14-Ap16898	M14-Ap16899
Date Sampled			Apr 16, 2014	Apr 16, 2014	Apr 16, 2014	Apr 16, 2014
Test/Reference	LOR	Unit				
Chloride	5	mg/kg	2500	800	2100	1500
Conductivity (1:5 aqueous extract at 25°C)	10	uS/cm	1400	610	1100	920
pH (1:5 Aqueous extract)	0.1	units	8.7	9.1	9.2	8.8
Sulphate (as S)	10	mg/kg	330	80	130	210
% Moisture	0.1	%	22	12	20	23
Acid Sulphate Soils Field pH Test						
pH-F (Field pH test)	0.1	units	7.7	8.5	8.3	7.8
pH-FOX (Field pH Peroxide test)	0.1	units	6.4	6.0	6.8	6.5
Reaction Ratings		comment	Low	Medium	Low	Low

Client Sample ID			SB04_0-0.1	SB04_0.5-0.7	SB04_1-1.2	SB05_0.5-0.7
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins mgt Sample No.			M14-Ap16900	M14-Ap16901	M14-Ap16902	M14-Ap16903
Date Sampled			Apr 16, 2014	Apr 16, 2014	Apr 16, 2014	Apr 16, 2014
Test/Reference	LOR	Unit				
Chloride	5	mg/kg	-	-	-	1400
Conductivity (1:5 aqueous extract at 25°C)	10	uS/cm	-	-	-	1100
pH (1:5 Aqueous extract)	0.1	units	-	-	-	8.3
Sulphate (as S)	10	mg/kg	-	-	-	280
% Moisture	0.1	%	18	12	28	5.9
Acid Sulphate Soils Field pH Test						
pH-F (Field pH test)	0.1	units	8.1	8.6	7.9	7.6
pH-FOX (Field pH Peroxide test)	0.1	units	5.9	6.7	6.5	6.0
Reaction Ratings		comment	High	Low	Low	High

Client Sample ID			SB05_1.2-1.4	SB06_0.5-0.7	SB06_1-1.2	SB07_0.5-0.7
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins mgt Sample No.			M14-Ap16904	M14-Ap16905	M14-Ap16906	M14-Ap16907
Date Sampled			Apr 16, 2014	Apr 16, 2014	Apr 16, 2014	Apr 16, 2014
Test/Reference	LOR	Unit				
Chloride	5	mg/kg	3000	110	1100	< 5
Conductivity (1:5 aqueous extract at 25°C)	10	uS/cm	1800	120	700	73
pH (1:5 Aqueous extract)	0.1	units	8.7	8.8	9.2	8.9
Sulphate (as S)	10	mg/kg	280	13	92	14
% Moisture	0.1	%	20	21	12	26
Acid Sulphate Soils Field pH Test						
pH-F (Field pH test)	0.1	units	7.9	7.8	8.5	8.1
pH-FOX (Field pH Peroxide test)	0.1	units	6.8	6.6	6.8	6.6
Reaction Ratings		comment	Low	Medium	Low	Low

Client Sample ID			SB07_1.3-1.5	SB08_0.5-0.7	SB08_1-1.2	SB11_0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins mgt Sample No.			M14-Ap16908	M14-Ap16909	M14-Ap16910	M14-Ap16911
Date Sampled			Apr 16, 2014	Apr 16, 2014	Apr 16, 2014	Apr 16, 2014
Test/Reference	LOR	Unit				
Chloride	5	mg/kg	940	9.2	660	85
Conductivity (1:5 aqueous extract at 25°C)	10	uS/cm	600	86	510	150
pH (1:5 Aqueous extract)	0.1	units	9.2	8.7	9.1	8.2
Sulphate (as S)	10	mg/kg	120	10	53	21
% Moisture	0.1	%	17	7.8	13	17
Acid Sulphate Soils Field pH Test						
pH-F (Field pH test)	0.1	units	8.4	8.0	8.3	7.6
pH-FOX (Field pH Peroxide test)	0.1	units	6.6	6.3	6.3	5.8
Reaction Ratings		comment	Low	Medium	Medium	High

Client Sample ID			SB11_0.5-0.7	SB11_1.3-1.5
Sample Matrix			Soil	Soil
Eurofins mgt Sample No.			M14-Ap16912	M14-Ap16913
Date Sampled			Apr 16, 2014	Apr 16, 2014
Test/Reference	LOR	Unit		
Chloride	5	mg/kg	14	1600
Conductivity (1:5 aqueous extract at 25°C)	10	uS/cm	94	1300
pH (1:5 Aqueous extract)	0.1	units	8.5	9.4
Sulphate (as S)	10	mg/kg	12	110
% Moisture	0.1	%	6.9	19
Acid Sulphate Soils Field pH Test				
pH-F (Field pH test)	0.1	units	8.0	8.8
pH-FOX (Field pH Peroxide test)	0.1	units	6.4	7.3
Reaction Ratings		comment	High	Medium

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported. A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chloride - Method: MGT 1100A	Melbourne	Apr 22, 2014	28 Day
Conductivity (1:5 aqueous extract at 25°C) - Method: LM-LTM-INO-4010	Melbourne	Apr 23, 2014	7 Day
pH (1:5 Aqueous extract) - Method: LM-LTM-INO-4000	Melbourne	Apr 23, 2014	7 Day
Sulphate (as S) - Method: In house MGT1110A (SO4 by Discrete Analyser)	Melbourne	Apr 22, 2014	28 Day
% Moisture - Method: Method 102 - ANZECC - % Moisture	Melbourne	Apr 22, 2014	14 Day
Acid Sulphate Soils Field pH Test - Method: Acid Sulphate Soils Guideline Series	Melbourne	Apr 23, 2014	7 Day

Company Name: Senversa Address: Ground Floor, 51 Clarke St Southbank VIC 3006 Client Job No.: QUEENSCLIFF ESA M1090702	Order No.: Report #: 415809 Phone: 9606 0070 Fax:	Received: Apr 17, 2014 2:19 PM Due: Apr 29, 2014 Priority: 5 Day Contact Name: Jarrod Irving
Eurofins mgt Client Manager: Adrian Tabacchiera		

Sample Detail					% Moisture	Chloride	Conductivity (1:5 aqueous extract at 25°C)	HOLD	pH (1:5 Aqueous extract)	Sulphate (as S)	Acid Sulphate Soils Field pH Test
Laboratory where analysis is conducted											
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
External Laboratory											
Sample ID	Sample Date	Sampling Time	Matrix	LAB ID							
SB01_0-0.1	Apr 16, 2014		Soil	M14-Ap16892	X						X
SB01_0.5-0.7	Apr 16, 2014		Soil	M14-Ap16893	X						X
SB02_0-0.1	Apr 16, 2014		Soil	M14-Ap16894	X	X	X		X	X	X
SB02_0.5-0.7	Apr 16, 2014		Soil	M14-Ap16895	X	X	X		X	X	X
SB02_1-1.2	Apr 16, 2014		Soil	M14-Ap16896	X	X	X		X	X	X
SB03_0-0.1	Apr 16, 2014		Soil	M14-Ap16897	X	X	X		X	X	X
SB03_0.5-0.7	Apr 16, 2014		Soil	M14-Ap16898	X	X	X		X	X	X
SB03_1-1.2	Apr 16, 2014		Soil	M14-Ap16899	X	X	X		X	X	X
SB04_0-0.1	Apr 16, 2014		Soil	M14-Ap16900	X						X
SB04_0.5-0.7	Apr 16, 2014		Soil	M14-Ap16901	X						X

Company Name: Senversa	Order No.:	Received: Apr 17, 2014 2:19 PM
Address: Ground Floor, 51 Clarke St Southbank VIC 3006	Report #: 415809	Due: Apr 29, 2014
	Phone: 9606 0070	Priority: 5 Day
	Fax:	Contact Name: Jarrod Irving
Client Job No.: QUEENSCLIFF ESA M1090702		

Eurofins | mgt Client Manager: Adrian Tabacchiera

Sample Detail					% Moisture	Chloride	Conductivity (1:5 aqueous extract at 25°C)	HOLD	pH (1:5 Aqueous extract)	Sulphate (as S)	Acid Sulphate Soils Field pH Test
Laboratory where analysis is conducted											
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
External Laboratory											
SB04_1-1.2	Apr 16, 2014		Soil	M14-Ap16902	X						X
SB05_0.5-0.7	Apr 16, 2014		Soil	M14-Ap16903	X	X	X		X	X	X
SB05_1.2-1.4	Apr 16, 2014		Soil	M14-Ap16904	X	X	X		X	X	X
SB06_0.5-0.7	Apr 16, 2014		Soil	M14-Ap16905	X	X	X		X	X	X
SB06_1-1.2	Apr 16, 2014		Soil	M14-Ap16906	X	X	X		X	X	X
SB07_0.5-0.7	Apr 16, 2014		Soil	M14-Ap16907	X	X	X		X	X	X
SB07_1.3-1.5	Apr 16, 2014		Soil	M14-Ap16908	X	X	X		X	X	X
SB08_0.5-0.7	Apr 16, 2014		Soil	M14-Ap16909	X	X	X		X	X	X
SB08_1-1.2	Apr 16, 2014		Soil	M14-Ap16910	X	X	X		X	X	X
SB11_0-0.1	Apr 16, 2014		Soil	M14-Ap16911	X	X	X		X	X	X
SB11_0.5-0.7	Apr 16, 2014		Soil	M14-Ap16912	X	X	X		X	X	X

Company Name: Senversa Address: Ground Floor, 51 Clarke St Southbank VIC 3006 Client Job No.: QUEENSCLIFF ESA M1090702	Order No.: Report #: 415809 Phone: 9606 0070 Fax:	Received: Apr 17, 2014 2:19 PM Due: Apr 29, 2014 Priority: 5 Day Contact Name: Jarrod Irving
Eurofins mgt Client Manager: Adrian Tabacchiera		

Sample Detail					% Moisture	Chloride	Conductivity (1:5 aqueous extract at 25°C)	HOLD	pH (1:5 Aqueous extract)	Sulphate (as S)	Acid Sulphate Soils Field pH Test
Laboratory where analysis is conducted											
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X	X	X	X	X	X
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794											
External Laboratory											
SB11_1.3-1.5	Apr 16, 2014		Soil	M14-Ap16913	X	X	X		X	X	X
QC01	Apr 16, 2014		Soil	M14-Ap16914				X			
QC02	Apr 16, 2014		Soil	M14-Ap16915				X			

Eurofins | mgt Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual PQLs are matrix dependant. Quoted PQLs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Acknowledgment.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

UNITS

mg/kg: milligrams per Kilogram

mg/l: milligrams per litre

ug/l: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100ml: Organisms per 100 millilitres

NTU: Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

TERMS

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - ACCEPTANCE CRITERIA

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC DATA GENERAL COMMENTS

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
9. For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test				Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Chloride				mg/kg	< 5		5	Pass	
Sulphate (as S)				mg/kg	< 10		10	Pass	
LCS - % Recovery									
Chloride				%	93		70-130	Pass	
Sulphate (as S)				%	114		70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
					Result 1				
Chloride	M14-Ap16894	CP	%	106			70-130	Pass	
Spike - % Recovery									
					Result 1				
Chloride	M14-Ap16907	CP	%	91			70-130	Pass	
Sulphate (as S)	M14-Ap16907	CP	%	99			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
					Result 1	Result 2	RPD		
Chloride	M14-Ap16894	CP	mg/kg	1400	1400	3.3	30%	Pass	
Conductivity (1:5 aqueous extract at 25°C)	M14-Ap16894	CP	uS/cm	910	890	3.0	30%	Pass	
Duplicate									
					Result 1	Result 2	RPD		
Chloride	M14-Ap16907	CP	mg/kg	< 5	< 5	<1	30%	Pass	
Conductivity (1:5 aqueous extract at 25°C)	M14-Ap16907	CP	uS/cm	73	64	14	30%	Pass	
Sulphate (as S)	M14-Ap16907	CP	mg/kg	14	13	8.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Organic samples had Teflon liners	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Adrian Tabacchiera	Client Services
Glenn Jackson	Senior Analyst-SPOCAS (VIC)
Huong Le	Senior Analyst-Inorganic (VIC)



Glenn Jackson

Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

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EnviroSampleVIC

From: Natalie Krasselt
Sent: Monday, 28 April 2014 3:38 PM
To: EnviroSampleVIC
Cc: Adrian Tabacchiera
Subject: analysis request : Site QUEENSCLIFF ESA M1090702

Hi Catherine,

Can you please log in the analysis request below?

Kind regards,

-----Original Message-----

From: Doug Ahearne [<mailto:Doug.Ahearne@senversa.com.au>]
Sent: Monday, 28 April 2014 3:35 PM
To: Natalie Krasselt
Cc: Jarrod Irving
Subject: RE: Eurofins | mgt Test Results - Report 415809 : Site QUEENSCLIFF ESA M1090702

Hi Natalie,

I would like to request further analysis as follows:

- SPOCAS/acid sulphate soil assessment for SB01_0-0.1, SB01_0.5-0.7, SB02_0-0.1, SB03_0-0.1, SB04_0-0.1, SB05_0.5-0.7, SB08_1-1.2, SB11_0-0.1 and SB11_0.5-0.7.
- Chromium reducible sulphur suite for SB08_1-1.2. *

Please let me know if you need further information.

Regards,

Doug Ahearne
Senior Associate

Senversa Pty Ltd
Ground Floor, 51 Clarke Street, Southbank VIC 3006

m: +61 411 538 823 | e: doug.ahearne@senversa.com.au
t: +61 3 9606 0070 | f: +61 3 9606 0074 | www.senversa.com.au

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Please consider the environment before printing this email.

-----Original Message-----

From: NatalieKrasselt@eurofins.com.au [<mailto:NatalieKrasselt@eurofins.com.au>]
Sent: Thursday, 24 April 2014 6:23 PM

John - Eurofins mgt
Report #
416256

To: Doug Ahearne
Cc: Jarrod Irving
Subject: Eurofins | mgt Test Results - Report 415809 : Site QUEENSCLIFF ESA M1090702

Doug and Jarrod,

Please find attached report for QUEENSCLIFF ESA M1090702.

Kind regards,

Natalie Krasselt
Analytical Services Manager

Eurofins | mgt
2-5 Kingston Town Close
OAKLEIGH VIC 3166
AUSTRALIA
Phone : +61 3 8564 5051
Mobile : +61 421 233 772
Fax : +61 3 8564 5090

Email : NatalieKrasselt@eurofins.com.au
Website : <http://environment.eurofins.com.au>

For details regarding our supply of deionised water-
[http://environment.eurofins.com.au/media/9777286/envirnotnote_1042 - deionised water.pdf](http://environment.eurofins.com.au/media/9777286/envirnotnote_1042_-_deionised_water.pdf)

This message has been scanned for malware by Websense. www.websense.com

Certificate of Analysis

Senversa
Ground Floor, 51 Clarke St
Southbank
VIC 3006



NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025.
 The results of the tests, calibrations and/or
 measurements included in this document are traceable
 to Australian/national standards.

Attention: **Doug Ahearne**

Report **416256-S**
 Client Reference **QUEENSCLIFF ESA M1090702**
 Received Date **Apr 28, 2014**

Client Sample ID			SB01_0-0.1	SB01_0.5-0.7	SB02_0-0.1	SB03_0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins mgt Sample No.			M14-Ap20634	M14-Ap20635	M14-Ap20636	M14-Ap20637
Date Sampled			Apr 16, 2014	Apr 16, 2014	Apr 16, 2014	Apr 16, 2014
Test/Reference	LOR	Unit				
SPOCAS Suite						
pH-KCL	0.1	units	8.7	7.0	8.1	8.3
pH-OX	0.1	units	5.4	5.9	4.7	4.2
Acid trail - Titratable Actual Acidity	2	mol H+/t	< 2	< 2	< 2	< 2
Acid trail - Titratable Peroxide Acidity	2	mol H+/t	< 2	< 2	< 2	< 2
Acid trail - Titratable Sulfidic Acidity	2	mol H+/t	< 2	< 2	< 2	< 2
sulfidic - Titratable Actual Acidity - equivalent S% pyrite	0.02	% pyrite S	< 0.02	< 0.02	< 0.02	< 0.02
sulfidic - Titratable Peroxide Acidity - equivalent S% pyrite	0.02	% pyrite S	< 0.02	< 0.02	< 0.02	< 0.02
sulfidic - Titratable Sulfidic Acidity - equivalent S% pyrite	0.02	% pyrite S	< 0.02	< 0.02	< 0.02	< 0.02
Sulfur - KCl Extractable	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Sulfur - Peroxide	0.02	% S	0.02	< 0.02	0.02	0.04
Sulfur - Peroxide Oxidisable Sulfur	0.02	% S	0.02	< 0.02	0.02	0.04
acidity - Peroxide Oxidisable Sulfur	10	mol H+/t	15	< 10	13	22
HCl Extractable Sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - equivalent S% pyrite ^{S02}	0.02	% S	n/a	n/a	n/a	n/a
Calcium - KCl Extractable	0.02	% Ca	0.07	0.03	0.07	0.15
Calcium - Peroxide	0.02	% Ca	0.10	0.03	0.10	0.21
Acid Reacted Calcium	0.02	% Ca	0.03	< 0.02	0.04	0.07
acidity - Acid Reacted Calcium	10	mol H+/t	13	< 10	19	33
sulfidic - Acid Reacted Calcium equivalent S% pyrite	0.02	% S	0.02	< 0.02	0.03	0.05
Magnesium - KCl Extractable	0.02	% Mg	0.02	0.02	0.03	0.04
Magnesium - Peroxide	0.02	% Mg	0.03	0.02	0.04	0.04
Acid Reacted Magnesium	0.02	% Mg	< 0.02	< 0.02	< 0.02	< 0.02
acidity - Acid Reacted Magnesium	10	mol H+/t	< 10	< 10	< 10	< 10
sulfidic - Acid Reacted Magnesium equivalent S% pyrite	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Acid Neutralising Capacity	0.02	%CaCO3	n/a	n/a	n/a	n/a
Acid Neutralising Capacity - Acidity units	10	mol H+/t	n/a	n/a	n/a	n/a
Acid Neutralising Capacity equivalent S% pyrite	0.02	% S	n/a	n/a	n/a	n/a
ANC Fineness Factor			1.5	1.5	1.5	1.5
Net Acidity (sulfur units) - SPOCAS	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Net Acidity (acidity units) - SPOCAS	10	mol H+/t	< 10	< 10	< 10	< 10
Liming rate - SPOCAS	1	kg CaCO3/t	< 1	< 1	< 1	1.0
% Moisture	0.1	%	12	17	12	12

Client Sample ID			SB04_0-0.1	SB05_0.5-0.7	SB08_1-1.2	SB11_0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins mgt Sample No.			M14-Ap20638	M14-Ap20639	M14-Ap20640	M14-Ap20641
Date Sampled			Apr 16, 2014	Apr 16, 2014	Apr 16, 2014	Apr 16, 2014
Test/Reference	LOR	Unit				
SPOCAS Suite						
pH-KCL	0.1	units	9.3	9.4	9.6	8.9
pH-OX	0.1	units	7.5	7.5	7.7	6.7
Acid trail - Titratable Actual Acidity	2	mol H+/t	< 2	< 2	< 2	< 2
Acid trail - Titratable Peroxide Acidity	2	mol H+/t	< 2	< 2	< 2	< 2
Acid trail - Titratable Sulfidic Acidity	2	mol H+/t	< 2	< 2	< 2	< 2
sulfidic - Titratable Actual Acidity - equivalent S% pyrite	0.02	% pyrite S	< 0.02	< 0.02	< 0.02	< 0.02
sulfidic - Titratable Peroxide Acidity - equivalent S% pyrite	0.02	% pyrite S	< 0.02	< 0.02	< 0.02	< 0.02
sulfidic - Titratable Sulfidic Acidity - equivalent S% pyrite	0.02	% pyrite S	< 0.02	< 0.02	< 0.02	< 0.02
Sulfur - KCl Extractable	0.02	% S	< 0.02	0.02	< 0.02	< 0.02
Sulfur - Peroxide	0.02	% S	0.08	0.06	0.05	0.06
Sulfur - Peroxide Oxidisable Sulfur	0.02	% S	0.08	0.04	0.05	0.06
acidity - Peroxide Oxidisable Sulfur	10	mol H+/t	47	24	30	39
HCl Extractable Sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur	0.02	% S	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	n/a	n/a	n/a
Net Acid soluble sulfur - equivalent S% pyrite ^{S02}	0.02	% S	n/a	n/a	n/a	n/a
Calcium - KCl Extractable	0.02	% Ca	0.26	0.26	0.19	0.33
Calcium - Peroxide	0.02	% Ca	5.4	9.2	9.9	5.3
Acid Reacted Calcium	0.02	% Ca	5.2	9.0	9.7	4.9
acidity - Acid Reacted Calcium	10	mol H+/t	2600	4500	4800	2500
sulfidic - Acid Reacted Calcium equivalent S% pyrite	0.02	% S	4.1	7.2	7.8	4.0
Magnesium - KCl Extractable	0.02	% Mg	0.03	< 0.02	0.02	0.03
Magnesium - Peroxide	0.02	% Mg	0.20	0.23	0.34	0.16
Acid Reacted Magnesium	0.02	% Mg	0.17	0.23	0.32	0.13
acidity - Acid Reacted Magnesium	10	mol H+/t	140	190	260	110
sulfidic - Acid Reacted Magnesium equivalent S% pyrite	0.02	% S	0.22	0.31	0.42	0.18
Acid Neutralising Capacity	0.02	%CaCO3	13	22	24	12
Acid Neutralising Capacity - Acidity units	10	mol H+/t	2500	4400	4900	2500
Acid Neutralising Capacity equivalent S% pyrite	0.02	% S	4.0	7.0	7.8	3.9
ANC Fineness Factor			1.5	1.5	1.5	1.5
Net Acidity (sulfur units) - SPOCAS	0.02	% S	< 0.02	< 0.02	< 0.02	< 0.02
Net Acidity (acidity units) - SPOCAS	10	mol H+/t	< 10	< 10	< 10	< 10
Liming rate - SPOCAS	1	kg CaCO3/t	< 1	< 1	< 1	< 1
Chromium Suite						
pH-KCL	0.1	units	-	-	9.6	-
Acid trail - Titratable Actual Acidity	2	mol H+/t	-	-	< 2	-
sulfidic - Titratable Actual Acidity - equivalent S% pyrite	0.02	% pyrite S	-	-	< 0.02	-
Chromium Reducible Sulfur ^{S04}	0.02	% S	-	-	< 0.02	-
Chromium Reducible Sulfur -acidity units	3	mol H+/t	-	-	< 3	-
Sulfur - KCl Extractable	0.02	% S	-	-	< 0.02	-
HCl Extractable Sulfur	0.02	% S	-	-	n/a	-
Net Acid soluble sulfur	0.02	% S	-	-	n/a	-
Net Acid soluble sulfur - acidity units	10	mol H+/t	-	-	n/a	-
Net Acid soluble sulfur - equivalent S% pyrite ^{S02}	0.02	% S	-	-	n/a	-
Acid Neutralising Capacity (ANCbt)	0.01	%CaCO3	-	-	25	-
Acid Neutralising Capacity - acidity (ANCbt)	2	mol H+/t	-	-	5000	-
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt) ^{S03}	0.02	% S	-	-	8.0	-

Client Sample ID			SB04_0-0.1	SB05_0.5-0.7	SB08_1-1.2	SB11_0-0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins mgt Sample No.			M14-Ap20638	M14-Ap20639	M14-Ap20640	M14-Ap20641
Date Sampled			Apr 16, 2014	Apr 16, 2014	Apr 16, 2014	Apr 16, 2014
Test/Reference	LOR	Unit				
Chromium Suite						
ANC Fineness Factor			-	-	1.5	-
Net Acidity (Sulfur Units)	0.02	% S	-	-	< 0.02	-
Net Acidity (Acidity Units)	10	mol H+/t	-	-	< 10	-
Liming Rate ^{S01}	1	kg CaCO ₃ /t	-	-	< 1	-
Extraneous Material						
Analysed Material	0.1	%	-	-	100%	-
Extraneous Material	0.1	%	-	-	0%	-
% Moisture	0.1	%	18	5.9	13	17

Client Sample ID			SB11_0.5-0.7
Sample Matrix			Soil
Eurofins mgt Sample No.			M14-Ap20642
Date Sampled			Apr 16, 2014
Test/Reference	LOR	Unit	
SPOCAS Suite			
pH-KCL	0.1	units	9.1
pH-OX	0.1	units	7.5
Acid trail - Titratable Actual Acidity	2	mol H+/t	< 2
Acid trail - Titratable Peroxide Acidity	2	mol H+/t	< 2
Acid trail - Titratable Sulfidic Acidity	2	mol H+/t	< 2
sulfidic - Titratable Actual Acidity - equivalent S% pyrite	0.02	% pyrite S	< 0.02
sulfidic - Titratable Peroxide Acidity - equivalent S% pyrite	0.02	% pyrite S	< 0.02
sulfidic - Titratable Sulfidic Acidity - equivalent S% pyrite	0.02	% pyrite S	< 0.02
Sulfur - KCl Extractable	0.02	% S	< 0.02
Sulfur - Peroxide	0.02	% S	0.04
Sulfur - Peroxide Oxidisable Sulfur	0.02	% S	0.04
acidity - Peroxide Oxidisable Sulfur	10	mol H+/t	26
HCl Extractable Sulfur	0.02	% S	n/a
Net Acid soluble sulfur	0.02	% S	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a
Net Acid soluble sulfur - equivalent S% pyrite ^{S02}	0.02	% S	n/a
Calcium - KCl Extractable	0.02	% Ca	0.30
Calcium - Peroxide	0.02	% Ca	6.8
Acid Reacted Calcium	0.02	% Ca	6.5
acidity - Acid Reacted Calcium	10	mol H+/t	3200
sulfidic - Acid Reacted Calcium equivalent S% pyrite	0.02	% S	5.2
Magnesium - KCl Extractable	0.02	% Mg	0.02
Magnesium - Peroxide	0.02	% Mg	0.18
Acid Reacted Magnesium	0.02	% Mg	0.16
acidity - Acid Reacted Magnesium	10	mol H+/t	130
sulfidic - Acid Reacted Magnesium equivalent S% pyrite	0.02	% S	0.22
Acid Neutralising Capacity	0.02	%CaCO ₃	17
Acid Neutralising Capacity - Acidity units	10	mol H+/t	3400
Acid Neutralising Capacity equivalent S% pyrite	0.02	% S	5.4
ANC Fineness Factor			1.5

Client Sample ID			SB11_0.5-0.7
Sample Matrix			Soil
Eurofins mgt Sample No.			M14-Ap20642
Date Sampled			Apr 16, 2014
Test/Reference	LOR	Unit	
SPOCAS Suite			
Net Acidity (sulfur units) - SPOCAS	0.02	% S	< 0.02
Net Acidity (acidity units) - SPOCAS	10	mol H+/t	< 10
Liming rate - SPOCAS	1	kg CaCO ₃ /t	< 1
% Moisture			
	0.1	%	6.9

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported. A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
SPOCAS Suite - Method: LTM-GEN-7050	Brisbane	May 05, 2014	6 Week
% Moisture - Method: Method 102 - ANZECC - % Moisture	Brisbane	Apr 29, 2014	14 Day
Chromium Suite Chromium Suite - Method: LTM-GEN-7070	Brisbane	May 05, 2014	6 Week
Extraneous Material	Brisbane	May 05, 2014	0 Day

Eurofins | mgt Internal Quality Control Review and Glossary

General

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2. All soil results are reported on a dry basis, unless otherwise stated.
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4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

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UNITS

mg/kg: milligrams per Kilogram

mg/l: milligrams per litre

ug/l: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100ml: Organisms per 100 millilitres

NTU: Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

TERMS

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - ACCEPTANCE CRITERIA

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

QC DATA GENERAL COMMENTS

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
9. For Matrix Spikes and LCS results a dash " - " in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
SPOCAS Suite				Result 1	Result 2	RPD			
pH-KCL	M14-Ap20634	CP	units	8.7	8.7	1.0	30%	Pass	
pH-OX	M14-Ap20634	CP	units	5.4	5.3	1.0	30%	Pass	
Acid trail - Titratable Actual Acidity	M14-Ap20634	CP	mol H+/t	< 2	< 2	<1	30%	Pass	
Acid trail - Titratable Peroxide Acidity	M14-Ap20634	CP	mol H+/t	< 2	< 2	<1	30%	Pass	
Acid trail - Titratable Sulfidic Acidity	M14-Ap20634	CP	mol H+/t	< 2	< 2	<1	30%	Pass	
sulfidic - Titratable Actual Acidity - equivalent S% pyrite	M14-Ap20634	CP	% pyrite S	< 0.02	< 0.02	<1	30%	Pass	
sulfidic - Titratable Peroxide Acidity - equivalent S% pyrite	M14-Ap20634	CP	% pyrite S	< 0.02	< 0.02	<1	30%	Pass	
sulfidic - Titratable Sulfidic Acidity - equivalent S% pyrite	M14-Ap20634	CP	% pyrite S	< 0.02	< 0.02	<1	30%	Pass	
Sulfur - KCl Extractable	M14-Ap20634	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Sulfur - Peroxide	M14-Ap20634	CP	% S	0.02	0.02	<1	30%	Pass	
Sulfur - Peroxide Oxidisable Sulfur	M14-Ap20634	CP	% S	0.02	0.02	<1	30%	Pass	
acidity - Peroxide Oxidisable Sulfur	M14-Ap20634	CP	mol H+/t	15	15	<1	30%	Pass	
Calcium - KCl Extractable	M14-Ap20634	CP	% Ca	0.07	0.07	<1	30%	Pass	
Calcium - Peroxide	M14-Ap20634	CP	% Ca	0.10	0.10	2.0	30%	Pass	
Acid Reacted Calcium	M14-Ap20634	CP	% Ca	0.03	0.02	9.0	30%	Pass	
acidity - Acid Reacted Calcium	M14-Ap20634	CP	mol H+/t	13	12	9.0	30%	Pass	
sulfidic - Acid Reacted Calcium equivalent S% pyrite	M14-Ap20634	CP	% S	0.02	0.02	9.0	30%	Pass	
Magnesium - KCl Extractable	M14-Ap20634	CP	% Mg	0.02	0.02	1.0	30%	Pass	
Magnesium - Peroxide	M14-Ap20634	CP	% Mg	0.03	0.03	6.0	30%	Pass	
Acid Reacted Magnesium	M14-Ap20634	CP	% Mg	< 0.02	< 0.02	<1	30%	Pass	
acidity - Acid Reacted Magnesium	M14-Ap20634	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
sulfidic - Acid Reacted Magnesium equivalent S% pyrite	M14-Ap20634	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
ANC Fineness Factor	M14-Ap20634	CP		1.5	1.5	<1	30%	Pass	
Net Acidity (sulfur units) - SPOCAS	M14-Ap20634	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Net Acidity (acidity units) - SPOCAS	M14-Ap20634	CP	mol H+/t	< 10	< 10	<1	30%	Pass	
Liming rate - SPOCAS	M14-Ap20634	CP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	
Duplicate									
SPOCAS Suite				Result 1	Result 2	RPD			
pH-KCL	M14-Ap20640	CP	units	9.6	9.6	<1	30%	Pass	
Acid trail - Titratable Actual Acidity	M14-Ap20640	CP	mol H+/t	< 2	< 2	<1	30%	Pass	
sulfidic - Titratable Actual Acidity - equivalent S% pyrite	M14-Ap20640	CP	% pyrite S	< 0.02	< 0.02	<1	30%	Pass	
Sulfur - KCl Extractable	M14-Ap20640	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
ANC Fineness Factor	M14-Ap20640	CP		1.5	1.5	<1	30%	Pass	
Duplicate									
Chromium Suite				Result 1	Result 2	RPD			
Chromium Reducible Sulfur	M14-Ap20640	CP	% S	< 0.02	< 0.02	<1	30%	Pass	
Chromium Reducible Sulfur -acidity units	M14-Ap20640	CP	mol H+/t	< 3	< 3	<1	30%	Pass	
Acid Neutralising Capacity (ANCbt)	M14-Ap20640	CP	%CaCO3	25	25	<1	30%	Pass	
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)	M14-Ap20640	CP	% S	8.0	8.0	<1	30%	Pass	
Liming Rate	M14-Ap20640	CP	kg CaCO3/t	< 1	< 1	<1	30%	Pass	

Comments
Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Organic samples had Teflon liners	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
S01	Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO ₃) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m ³ in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m ³ '
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5
S03	Acid Neutralising Capacity is only required if the pHKCl is greater than or equal to pH 6.5
S04	Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period

Authorised By

Adrian Tabacchiera Client Services



Glenn Jackson

Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

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Appendix C: Analytical Data Quality

Appendix C: Quality Assurance / Quality Control

The data quality assurance and control (QA/QC) procedures adopted by Senversa provide a consistent approach to evaluation of whether the data quality objectives (DQO's) required by the project have been achieved. The process focuses on assessment of the useability of the data in terms of accuracy and reliability in forming conclusions on the condition of the element of the environment being investigated. The approach is generally based on guidance from the following sources:

- Australian Standard (AS) 4482.1-2005: *Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds.*
- National Environment Protection Council (NEPC), *National Environment Protection (Assessment of Site Contamination) Amendment Measure No. 1 2013 (NEPM), Schedule B2: Guideline on Site Characterisation.*
- NEPC – *National Environment Protection (Assessment of Site Contamination) Amendment Measure No. 1 2013 (NEPM), Schedule B3: Guideline on Laboratory Analysis of Potentially Contaminated Soils.*
- United States Environmental Protection Agency (USEPA) – *Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4).*
- USEPA – *Guidance on Environmental Data Verification and Data Validation (EPA QA/G-8).*

Quality Assurance Procedure

The following data quality objectives, measures and acceptance criteria were adopted to verify compliance with the planned QA procedures:

Quality Assurance Process	Data Quality Element	Objectives and Measure	Acceptance Criteria
Standard Procedures	Comparability, Reproducibility, Representativeness	Standard field sampling procedures and forms used	No deviation from standard procedure and forms used
Equipment Calibration	Accuracy	All equipment calibrated in accordance with manufacturers specifications	All equipment calibrated in accordance with manufacturers specifications
Testing Method Accreditation	Accuracy and Comparability	NATA accredited methods used for all analyses determined	Primary and secondary laboratories to use NATA accredited methods for all analytes determined
Quality Control Sampling Frequency	Precision and Repeatability	Field QC sampling frequency in accordance with AS4482.1-2005	Field Duplicates – ≥ 1 in 20 primary samples Secondary Duplicates – ≥ 1 in 20 primary samples Rinsate Blanks – ≥ 1 per day, per matrix per equipment Trip Blanks – ≥ 1 per esky containing samples for volatile analyses

Quality Assurance Process	Data Quality Element	Objectives and Measure	Acceptance Criteria
	Accuracy, Precision and Comparability	Laboratory QC analysis frequency in accordance with NEPC (2013), Schedule B3	Laboratory Duplicates – at least 1 in 10 analyses or one per process batch Method Blanks – at least 1 per process batch Surrogate Recoveries – all samples spiked where appropriate (e.g. chromatographic analysis of organics) Laboratory Control Samples – at least 1 per process batch Matrix Spikes – at least 1 per matrix type per process batch
Sample Preservation, Handling and Holding Times	Accuracy	Samples appropriately preserved upon collection, stored and transported, and analysed within holding times	Sample containers, holding times and preservation in accordance with EPA Victoria Industrial Waste Resource Guidelines – Sampling and Analysis of Waters, Wastewaters, Soils and Wastes (IWRG701, 2009) and the laboratory specific method requirements.
Data Management	Accuracy	No errors in data transcription	Entry of field data verified by peer.
Data Useability	Completeness	Limits of reporting less than adopted beneficial use investigation levels. Sample volumes and analytical methods selected to enable required limits of reporting to be achieved	Limits of reporting less than investigation levels.

Quality Control Sampling and Analysis

The following data quality objectives, measures and acceptance criteria were adopted to evaluate the validity of the analytical data produced.

Quality Control Process	Data Quality Element	Objectives and Measure	Acceptance Criteria
Field Duplicate Sampling and Analysis	Precision and Field Repeatability	Field duplicate samples used to assess the variability in analyte concentration between samples collected from the sample location and the reproducibility of the laboratory analysis. Where required, resubmission of previously analysed samples for chemicals within their holding times may be undertaken to further assess precision level of precision	Analysed for same chemicals as primary sample RPD ¹ <30% of mean concentration where both concentrations >20 x limit of reporting RPD <50% of mean concentration where higher concentration 10 – 20 x limit of reporting RPD - No limit where both concentrations < 10 x limit of reporting

¹ Relative Percent Difference (%): Calculated as: (Result No.1 – Result No. 2/Mean Result)*100

Quality Control Process	Data Quality Element	Objectives and Measure	Acceptance Criteria
Secondary Duplicate Sampling and Analysis	Accuracy	Results are accurate and free from laboratory error. Secondary duplicate samples sent to a secondary laboratory to assess the accuracy of the analyte concentrations reported by the primary laboratory	<p>Analysed for same chemicals as primary sample</p> <p>RPD <30% of mean concentration where both concentrations >20 x limit of reporting</p> <p>RPD <50% of mean concentration where higher concentration 10 – 20 x limit of reporting</p> <p>RPD - No limit where both concentrations < 10 x limit of reporting</p>
Field Rinsate Blank Preparation and Analysis	Accuracy and Representativeness	<p>Cross contamination of samples does not occur between sampling locations due to carry-over from sampling equipment.</p> <p>Rinsate blank samples prepared for each sampling procedure. Where possible the rinsate blanks are prepared immediately after sampling locations known to contain concentrations of the chemicals of concern above the limit of quantification and / or before sampling locations where the chemicals being targeted in the laboratory analysis are to be compared to investigation levels near the limit of quantification of the chemical.</p>	Analyte concentrations below limits of reporting
Trip Blank Sampling and Analysis	Accuracy and Representativeness	<p>Cross contamination between samples does not occur in transit or as an artefact of the sample handling procedure.</p> <p>Trip blank samples prepared by the laboratory which accompany the empty sampling containers from the laboratory to the sampling site, and return with the samples to the laboratory to assess whether cross contamination occurs between samples or as an artefact of the sampling procedure.</p>	Analyte concentrations below limits of reporting
Laboratory QC Analysis	Laboratory Precision and Accuracy	<p>Laboratory duplicates</p> <p>Laboratory control spike</p>	<p>As specified by the laboratory.</p> <p>Dynamic recovery limits as specified by the laboratory.</p>

Quality Control Process	Data Quality Element	Objectives and Measure	Acceptance Criteria
		Certified reference material	As specified by the laboratory (generally dynamic recovery limits).
		Surrogate recovery	Dynamic recovery limits as specified by the laboratory.
		Matrix spike recovery	Recovery 70% – 130% or dynamic recovery limits specified by laboratory. However note that recovery of phenols is generally significantly lower and a recovery in the range 20% to 130% is considered acceptable by most laboratories.
		Matrix spike recovery duplicate	RPD < 30%, or as specified by the laboratory.

Data Verification and Validation

The data validation process involved the checking of analytical procedure compliance with acceptance criteria and an assessment of the accuracy and precision of analytical data from the range of quality control indicators generated from both the sampling and analytical programmes.

The checks undertaken are summarised in the attached data validation checklist tables (one table per sample batch/delivery group). Instances where the data quality acceptance criteria were not achieved are discussed in the data validation checklist tables.

Data Suitability

While a small number of QC results were outside specified acceptance criteria, these were not considered to significantly impact on the quality or representativeness of the data, and majority of results indicated that the precision and accuracy of the data was within acceptable limits. The results are therefore considered to be representative of chemical concentrations in the environmental media sampled at the time of sampling, and to be suitable to be used for their intended purpose in forming conclusions relating to the contamination status of soil at the site.

Data Validation Checklist



SAMPLE DELIVERY GROUP (SDG):			
Laboratory:	Eurofins mgt (primary)	Job Number:	M1090702
Sample Dates:	16-Apr-14	Report Title:	Salinity and Acid Sulfate Soil Assessment
Sample Media:	Soil	Client:	Planisphere Pty Ltd
Completed By:	D Ahearn	Verified By:	K. Hanson
Date:	11-May-14	Date:	19-May-14

Quality Assurance Process	Objectives & Measure	Acceptance Criteria	Source of Information	Acceptance Criteria Met?	Notes/Details of Nonconformance	
Standard Procedures	Standard field sampling procedures and forms used	No deviation from standard procedure and forms used.	Borelogs, field sheets, COCs, data tables	Yes	See relevant appendices containing field records	
Equipment Calibration	All equipment calibrated in accordance with manufacturers specifications	All equipment calibrated in accordance with manufacturers specifications.	Calibration Certificates / Records	Yes	Not applicable	
Testing Method Accreditation	NATA accredited methods used for all analyses determined	Primary and secondary laboratories to use NATA accredited methods for all analytes determined.	Laboratory Report	Yes	See relevant appendix containing laboratory supplied analytical reports	
Quality Control Sampling Frequency	Field QC sampling frequency in accordance with AS4482.1-2005	Field Duplicates - ≥ 1 in 20 primary samples.	QA/QC register (within field book)	No	Field duplicates were not collected given that the purpose of the investigation was a preliminary screening for salinity and acid sulfate soil. No conclusions have been made regarding the suitability of the site for future uses.	
		Secondary Duplicates - ≥ 1 in 20 primary samples.	QA/QC register (within field book)	No	See comments from above in "Field Duplicates"	
		Rinsate Blanks - ≥ 1 per day, per matrix per equipment.	QA/QC register (within field book)	No	Rinsates were not collected for this field program. Cross-contamination during soil sampling were minimised with the use of new gloves between samples and soil not in contact with potentially contaminated equipment.	
		Trip Blanks - ≥ 1 per esky containing samples for volatiles.	QA/QC register (within field book)	No	No trip blanks were submitted for analysis in this field program. This non-conformance is not considered to adversely affect data integrity as volatiles were not detected above the laboratories reporting limits.	
		Laboratory QC analysis frequency in accordance with NEPC 2013	Laboratory Duplicates - at least 1 in 10 analyses or 1 per process batch.	Laboratory Reports	Yes	
		Method Blanks - at least 1 per process batch.	Laboratory Reports	No	Method blanks were not performed at laboratory adopted frequencies for acid sulfate soil. This is considered to be standard practice as acid sulfate soil parameters are not contamination.	
Surrogate Recoveries - all samples spiked where appropriate (e.g. chromatographic analysis of organics).	Laboratory Reports	No	See explanation for method blanks.			
	Laboratory Control Samples - at least 1 per process batch.	Laboratory Reports	No	See explanation for method blanks.		
Matrix Spikes - at least 1 per matrix type per process batch.	Laboratory Reports	No	See explanation for method blanks.			
Sample Preservation, Handling and Holding Times	Samples appropriately preserved upon collection, stored and transported, and analysed within holding times	In accordance with EPAIWRG701 and laboratory specific method requirements.	Laboratory Reports	Yes	No holding time exceedences were reported by any of the laboratories	
Data Management	No errors in data transcription	Entry of field data verified by peer.	10% check of electronically imported data (e.g. ESDAT). 100% check of manually entered data (e.g. field parameters, gauging data). Evidence of checks recorded in project file.	Yes	10% electronically imported data check conducted. RO 25-Mar-14. 100% manually entered borehole log data check conducted as indicated on finalised borehole logs.	
Data Useability	Limits of reporting less than investigation levels	Limits of reporting less than relevant investigation levels.	Results Tables	Yes	LORs are appropriate for the adopted soil investigation levels.	

Quality Control Process	Objectives & Measure	Acceptance Criteria	How? (i.e. ESDAT output, review lab reports, review data)		
Field Duplicate (intralaboratory field duplicate) Sampling and Analysis	Field Duplicate samples used assess the variability in analyte concentration between samples collected from the sample location and the reproducibility of the laboratory analysis. Where required, resubmission of previously analysed samples for chemicals within their holding times may be undertaken to further assess precision level of precision.	Analysed for same chemicals as primary sample. RPD <30% of mean conc. where both conc. >20 x LOR RPD <50% of mean conc. where both conc. 10-20 x LOR RPD No limit where both conc. < 10 x LOR	ESDAT generated summary of relative percent difference (RPD) results for field duplicate samples.	N/A	
Secondary Duplicate (interlaboratory field duplicate) Sampling and Analysis	Results are accurate and free from laboratory error. Secondary duplicate samples sent to a secondary laboratory to assess the accuracy of the analyte concentrations reported by the primary laboratory.	Analysed for same chemicals as primary sample. RPD <30% of mean conc. where both conc. >20 x LOR. RPD <50% of mean conc. where both conc. 10-20 x LOR. RPD no limit where both conc. < 10 x LOR.	ESDAT generated summary of relative percent difference (RPD) results for field duplicate samples.	N/A	
Field Rinsate Blank Preparation & Analysis	Cross contamination of samples does not occur between sampling locations due to carry-over from sampling equipment.	Analyte concentrations below LORS.	ESDAT generated summary of field blank analytical results.	N/A	
Trip Blank Sampling and Analysis	Cross contamination between samples does not occur in transit or as an artefact of the sampling handling procedure.	Analyte concentrations below LORS.	ESDAT generated summary of field blank analytical results.	N/A	
Laboratory Duplicates	Laboratory duplicates are used to test the precision of the laboratory measurements.	As specified by laboratory.	Laboratory reports	Yes	
Laboratory Control Samples	Laboratory control samples (LCS) are used to assess overall method performance. In general these samples are similar in composition to environmental samples, and contain known amounts of the analytes of interest.	Dynamic recovery limits as specified by laboratory.	Laboratory reports	Yes	
Certified Reference Material	CRM samples are used to monitor the accuracy of analyses performed by the laboratory.	As specified by laboratory (generally dynamic recovery limits). Usually not performed and assessed based on LCS results.	Laboratory reports	N/A	
Surrogate Recovery	Surrogates are organic compounds that are similar in chemical composition to analytes of interest and are spiked into environmental samples prior to sample preparation and analysis. Surrogate recoveries are used to evaluate matrix interference on a sample-specific basis.	Dynamic recovery limits as specified by laboratory.	Laboratory reports	Yes	
Matrix Spike Recovery	A matrix spike is an aliquot of a sample spiked with a known concentration of target analyte(s). Spiking occurs prior to sample preparation and analysis, and the results are used to assess the bias of a method in a given sample matrix.	Recovery 70 - 130% or dynamic limits if specified by laboratory.	Laboratory reports	Yes	
Laboratory Method Blanks	Method blanks are prepared to represent the sample matrix as closely as possible and prepared/extracted/digested and analysed exactly like field samples. These blanks are used by the laboratory to assess contamination introduced during sample preparation activities.	Analyte concentrations below LORS.	Laboratory reports	Yes	
Potentially Anomalous Data				N/A	



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