

**Revised Acid Sulfate Soil
Management Plan, Fraser Drive
Tweed Heads South, NSW**

Prepared for
MFS Diversified Group

September, 2007

Document control

Document:	GJ0596-1.ASSMP.REH2.doc	Gilbert & Sutherland P/L ABN 56 077 310 840 Originating Office: Robina Riverwalk One 12/140 Robina Town Centre Drive, Q4230 PO Box 4115, Robina Q4230 Telephone 07 5578 9944 Facsimile 07 5578 9945 gsrobina@bigpond.com Also at Kawana and Brisbane
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Synopsis:	This revised acid sulfate soil management plan (ASSMP) was prepared in response to the NSW Department of Water and Energy’s request for further information dated August 16, 2007. The ASSMP incorporates the findings of two acid sulfate soil investigations previously conducted at the Fraser Drive development site and establishes responsibilities and procedures for the management of acid sulfate soils and a range of related issues.	

Revision History

Revision #	Date	Edition By		Approved By	
1	26.09.07	Erin Holton		Nathan Zurig	Lindsay Varcoe

Distribution

	Revision Number									
Distribution	1	2	3	4	5	6	7	8	9	10
MFS Diversified Group	1									
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Summary

Gilbert & Sutherland (G&S) was engaged by MFS Diversified Group to revise the acid sulfate soil management plan (ASSMP) previously prepared by G&S during January 2007 in response to the NSW Department of Water and Energy's (DWE) request for further information (dated August 16, 2007).

The ASSMP is based on two previous investigations conducted at Fraser Drive during November 2000 and October 2002. Since these investigations were conducted, the development layout has been revised. However, based on the proximity of the boreholes (constructed during November 2000 and October 2002) to the proposed excavations necessitated by the new development layout and the requirement to undertake Phase 2 and Phase 3 acid sulfate soil (ASS) testing it is considered that appropriate management of ASS would be achieved without the need for further Phase 1 investigations.

The results obtained from both investigations have been incorporated into this revised ASSMP to provide confidence to the DWE that the acid sulfate soils encountered at Fraser Drive have been adequately characterised and can thus be effectively managed.

This ASSMP establishes procedures to ensure that any acid sulfate soils (ASS) or potential acid sulfate soils (PASS) encountered at the Fraser Drive development site are appropriately identified and treated in accordance with proven management techniques. The ASSMP provides a clear management protocol based on operational policies, performance criteria, implementation strategies and corrective actions should they be necessary. The ASSMP identifies who is responsible for each specific aspect of ASS management using a working tabular format with provision for amendment if required.

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1) Introduction

Gilbert & Sutherland (G&S) was engaged by MFS Diversified Group to revise the acid sulfate soil management plan (ASSMP) previously prepared by G&S during January 2007 in response to the NSW Department of Water and Energy's (DWE) request for further information (dated August 16, 2007).

The ASSMP is based on two previous investigations conducted at Fraser Drive during November 2000 and October 2002. Since these investigations were conducted the development layout has been revised. The previously proposed pond excavation has been removed from the design and replaced with a 1.4ha detention basin to be excavated to a depth of approximately 1.5m below the current surface level. This detention basin is to be located to the west of the previously proposed pond. Other excavations at the site would be limited to the cutting of roads and trenching works for the installation of services.

1.1 Findings of previous investigations

1.1.1 ASSA November 2000

In November 2000, Gilbert & Sutherland conducted an acid sulfate soil investigation incorporating a drilling and sampling program within the low lying areas (<5m AHD) of the Fraser Drive development site.

In accordance with the New South Wales Acid Sulfate Soil Advisory Committee Acid Sulfate Soil Manual, August 1998 (ASSMAC Guidelines) ten boreholes were constructed at spacings of 50m to 100m across the subject area. The number and layout of boreholes was determined in accordance with the 2 holes per hectare requirement for sites greater than 4ha as stipulated in the ASSMAC Guidelines. The locations of these boreholes with respect to the current development layout are shown on Drawing No. GJ0596.1.2.

Samples were recovered from every 0.5m of the soil profile to a depth of 5m below NSL (near surface level) for boreholes within the proposed stormwater treatment area and to 3-4m below NSL in areas for proposed

services (based on the now superseded development layout).

A total of 81 samples were recovered from the 10 cores and screened for acid sulfate potential. Of the 81 samples screened, a total of 49 were subsequently sent to a suitable laboratory to undergo Chromium Reducible Sulfur Analysis (Method 22B)¹.

The initial pH values (pH_F) recorded during screening analysis ranged from 3.35 to 7.42 with the majority of the samples exhibiting a pH_F of >4. pH_F values greater than 4 indicate no appreciable Actual Acid Sulfate Soil (AASS) present within the soil profile. pH after oxidation (pH_{FOX}) ranged from 1.37 to 5.62 with 55 of the 81 samples exhibiting a pH_{FOX} of <3 thereby indicating the likely presence of Potential Acid Sulfate Soils (PASS) at the site.

The results of laboratory analysis for the 49 samples tested indicated that the majority of samples recovered from 1m below NSL exhibited acid sulfate potential with %S concentrations ranging from 0.06%S to 1.02%S and Total Potential Acidity (TPA) values of <2 to 320 moles H⁺/tonne.

The November 2000 investigation identified PASS material in the low lying floodplain areas of the site. These were generally of a moderate severity where fine silty sands were encountered to high severity where silty clays were encountered. Subsequently a Soil and Water Management Plan was prepared for the site².

All results for the November 2000 acid sulfate soil investigation conducted at Fraser Drive including borelogs, screening results and chromium reducible sulfur analyses are included in Appendix 1.

¹ The Chromium Reducible Sulfur (CRS) technique utilises the conversion of inorganic S to H₂S by a hot CrCl₂ solution. The H₂S generated is trapped in a zinc acetate solution and may be quantified by iodometric titration (Sullivan et al, 1998)⁴. CRS is an alternative to the Peroxide Oxidisable Sulfur (S_{POS} %) method of the POCAS technique and unlike S_{POS} % is not subject to significant interference from sulfur in either organic matter or sulfate minerals (Sullivan et al. 1998).

² Gilbert & Sutherland, 2000. *Soil Survey, Agricultural Land Capability Assessment, Acid Sulfate Soil Assessment and Soil and Water Management Plan Sullivan's Land*.

1.1.2 ASSA October 2002

In October 2002, Gilbert & Sutherland conducted a further acid sulfate soil investigation at Fraser Drive within the proposed pond excavation area.

In accordance with the specifications of the ASSMAC guidelines six (6) boreholes were drilled within the proposed excavation area to depths ranging from 2.5m – 3.5m below NSL. Samples were recovered at each soil horizon averaging one soil sample from every 0.5m of the soil profile. The locations of these boreholes with respect to the current development layout are shown on Drawing No. GJ0596.1.2.

A total of 24 samples were recovered from the 6 boreholes and screened for acid sulfate potential. Of the 24 samples screened, a total of 18 were forwarded to a suitable laboratory to undergo Chromium Reducible Sulfur Analysis (Method 22B).

The initial pH values (pH_F) recorded during screening analyses ranged from 5.06 to 8.61 with all 22 samples exhibiting a pH_F of >4 indicating no appreciable presence of AASS. pH after oxidation (pH_{FOX}) ranged from 0.66 to 4.98 with 12 of the 22 samples exhibiting a pH_{FOX} of <3 thereby indicating the likely presence of PASS at the site.

The results of laboratory analysis indicated that all samples recovered from approximately 1.0m below NSL and BH19 (between 0.05 to 0.9m below NSL) exhibited moderate to high acid sulfate potential with %S concentrations ranging from 0.11%S to 0.35%S. TPA values ranging from -203 (BH17) to -7 (BH20) moles H^+ /tonne were recovered across the bore network. The negative TPA values reflect the acid neutralising capacity of the shell material noted within the samples (refer to borelogs). The majority of samples analysed above 1.0m NSL had nil to slight acid sulfate potential with %S concentrations ranging from 0.00 to 0.01%S.

The October 2002 investigation identified PASS materials in the low lying floodplain areas of the site. These soils were generally of a moderate to high severity and associated with olive grey/greyish olive loamy sands. Subsequently an Acid Sulfate

Soil Management Plan was prepared for the site³.

All results for the October 2002 Acid Sulfate Soil investigation conducted at Fraser Drive including borelogs, screening results and chromium reducible sulfur analyses are included in Appendix 2.

1.2 Conclusions

Based on the proximity of the boreholes from the previous investigations to the currently proposed excavation area, the results of the previous works are directly applicable to the revised proposal. In order to reflect the changes to the layout and any revisions of legislation since the management plan was prepared, the original ASSMP (G&S, 2002) has been revised with regard to the *Environmental Planning and Assessment Act 1979*, the *Protection of the Environment Operations Act 1997*, the New South Wales Acid Sulfate Soil Advisory Committee (ASSMAC) Acid Sulfate Soil Manual (August 1998) and the NSW Department of Water and Energy's (DWE) request for further information (dated August 16, 2007).

The provisions proposed within this revised ASSMP for the identification, treatment and overall management of the site reflect best practice management and would be effective in managing any acid sulfate soil material encountered at the site.

³ Gilbert & Sutherland, 2002. *Acid Sulfate Management Plan Fraser Drive, Tweed Heads South*.

1.3 ASSMP structure

This ASSMP acknowledges the potential environmental impacts associated with the proposed future disturbance of Acid Sulfate Soils (ASS) at Fraser Drive, Tweed Heads South and details strategies to mitigate them.

Each control strategy is based upon proven environmental management methods and is presented as a commitment. The commitments made within this document will form the basis of future assessments, which will be made available to Tweed Shire Council for review.

The ASSMP is based on a series of tables for use during the construction phase of the proposed development. The person responsible for the implementation of the measures detailed is written on the table itself. The tables then detail the issue, the performance criteria, the implementation strategy, monitoring, auditing, reporting, failure identification and the corrective action. The detachable pages within each section detail the provisions of the ASSMP. An objective of the tabular format is to allow for change and allow the ASSMP to be a working document. If items need altering, changes may be made to the individual tables after appropriate consultation with the statutory authorities. The format is presented below for reference purposes.

Title #

Person responsible	This is the person who has accepted the responsibility of implementing the ASSMP provisions detailed on this page.
--------------------	--

Issue	The issue with which the table deals.
Operational policy	The operational policy or management objective that applies to the element.
Performance criteria	Performance criteria (outcomes) for each element of the operation.
Implementation strategy	The strategies or tasks (to nominated operational design standards) that will be implemented to achieve the performance criteria.
Monitoring	The monitoring requirements which will measure actual performance (i.e. specified limits to pre-selected indicators of change).
Auditing	The auditing requirements, which will verify implementation of, agreed construction and operation phase environmental management strategies and compliance with agreed performance criteria.
Reporting	Content, timing and responsibility for reporting and auditing of monitoring results.
Identification of incident or failure	The circumstances under which the agreed performance criteria are unlikely to be met and environmental harm is likely to result.
Corrective action	The action to be implemented in case a performance requirement is not reached and the company(s) responsible for action.

Commitment #

What management has committed the company to.

1.4 General commitments

Commitment 1

The Developer undertakes to comply with the environmental implementation strategy as contained within the approved Acid Sulfate Management Plan (ASSMP).

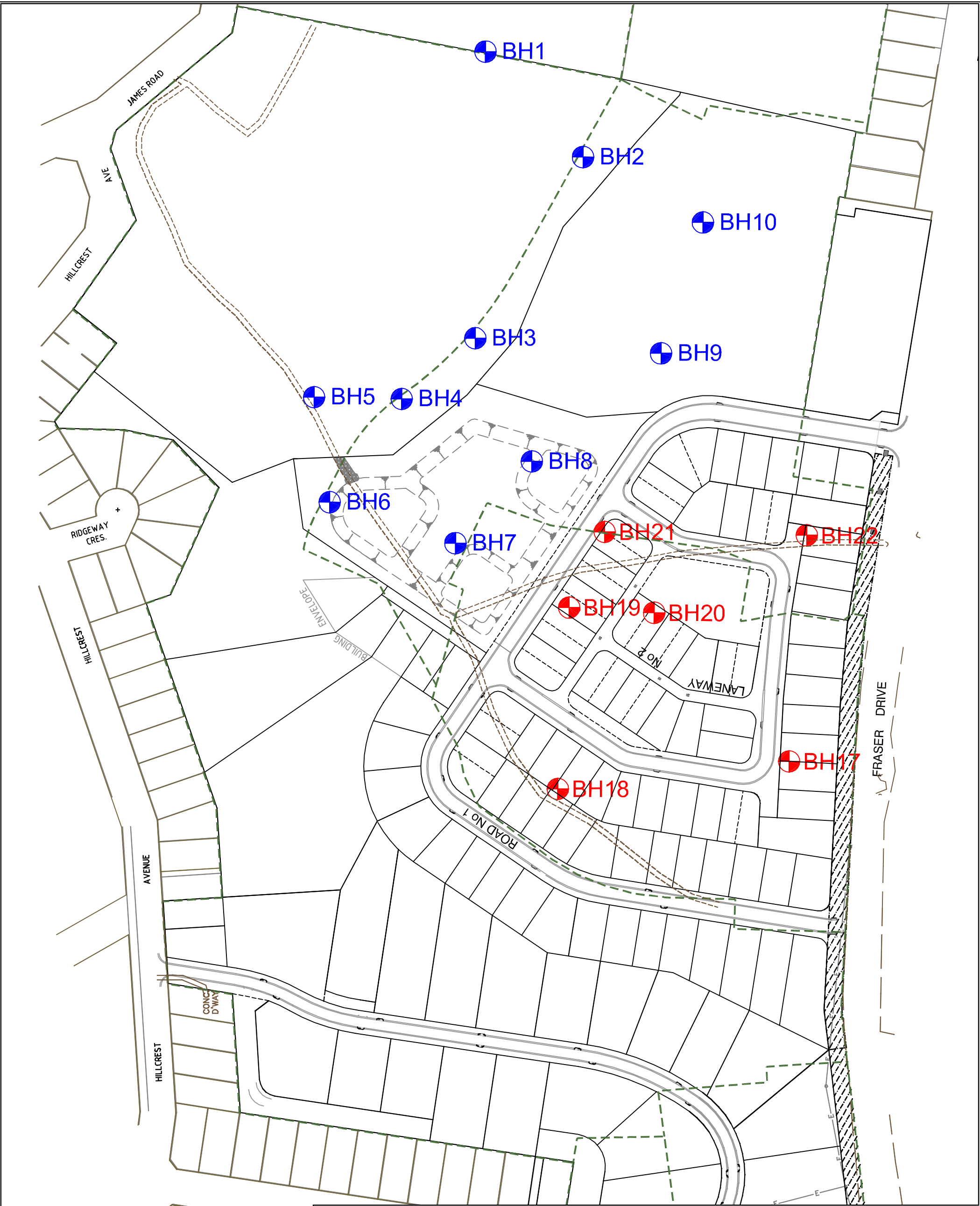
Commitment 2

The Developer undertakes to fulfil all commitments made in this ASSMP and to carry out their activities on the project site in accordance with relevant current statutory requirements and approved amendments.

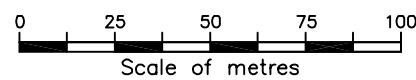
1.5 Definitions

In this ASSMP the terms have the following meanings;

- **ASSMP** means the approved Acid Sulfate Soil Management Plan and includes any amendments that may be approved from time to time.
- **EPA Act** means the *Environmental Planning and Assessment Act 1979*.
- **Development** means the development of the site as defined in a future development application.
- **TSC** means Tweed Shire Council.
- **DEC** means the Department of Environment and Conservation (NSW).
- **Proponent** means the person undertaking the development of the land and includes the person nominated as having the responsibility for implementing the provisions of the ASSMP.



 BH# November 2000 ASSA
 BH# October 2002 ASSA



GILBERT+SUTHERLAND agricultural and environmental scientists		PROJECT VILLA WORLD FRASER DRIVE, TWEED HEADS SOUTH BOREHOLE LOCATIONS	
12, Riverwalk One 140 Robina Town Centre Drive, Robina, Qld. 4226 Phone 55789944 Mobile 0418 760919 Fax 55789945		DRAWING No. GJ0596.1.2	
FIGURED DIMENSIONS TO BE READ IN PREFERENCE TO SCALING.	APPROVED	SCALE AS SHOWN DATE 02.01.07	DRAWN W.H CHECKED

2) Management of potential impacts

2.1 Contractor management

Person responsible:	Consulting Engineer
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Issue	Contractor management.
Operational policy	To verify the Proponent's duty of care is met by ensuring the contractor is aware of his/her responsibilities under the terms of the ASSMP.
Performance criteria	Each contractor is fully aware of his/her responsibilities under the terms of the ASSMP and their obligation to respond to environmental issues arising from construction activities.
Implementation strategy	Monitoring and verifying that the ASSMP is adhered to at all times and taking action if the specifications are not followed. Review of the ASSMP by TSC. The provision of advice, information and training to contractors and staff with regards to the implementation of the ASSMP.
Monitoring	Weekly site inspections are to be carried out by the site manager or Proponent's representative to ensure the provisions of the ASSMP are being adequately implemented.
Auditing	Auditing will be undertaken by the site manager and/or the proponent's nominated representative. Alternatively, auditing may be carried out by an independent consultant. The audit should include an inspection of site activities, complaints, corrective actions and reporting to assess compliance with the provisions outlined within the ASSMP.
Reporting	Full details shall be available to the contractor together with suggested corrective actions (if required).
Identification of incident or failure	Failure to comply with the conditions set out in the ASSMP resulting in environmental harm or unnecessary disturbance to neighbouring land users.
Corrective action	The Proponent has the right to call a halt to any activity being undertaken which is deemed in conflict with the ASSMP.

Commitment 3

All contractors will be managed to ensure compliance with the ASSMP for the duration of the site works.

2.2 Acid sulfate soil identification

Person responsible	Site Manager
Issue	Acid sulfate soil identification.
Operational policy	Identify actual and potential acid sulfate soils (AASS & PASS) and determine their acid producing potential prior to treatment.
Performance criteria	All ASS & PASS are appropriately identified prior to treatment.
Implementation strategy	All soils excavated during trenching works, road works or construction of bioretention basins from below the current surface level of the site will be sampled according to the following protocol during excavation. Frequency - During excavation of the bioretention basin a minimum of 1 soil sample would be collected at each colour or texture change with a minimum of 1 sample every 1000m³. All samples are to be analysed for Chromium Reducible Sulfur (CRS) and Titratable Actual Acidity (TAA) in accordance with the ASSMAC guidelines. During the excavation of trenches for the installation of services, soil sampling would be conducted at a rate of 1 soil sample per 75 metre interval in areas of the site occurring below RL5m AHD. All samples are to be analysed for Chromium Reducible Sulfur (CRS) and Titratable Actual Acidity (TAA) in accordance with the ASSMAC guidelines. Sample size - Soil samples of approximately 0.3kg each are to be collected from each soil horizon with a soil profile description recorded. Sampling - Soil samples to be tested on site or collected in sealed containers or plastic geological sampling bags that exclude air. Handling and storage – Samples are to be sent to laboratory or dried within 24 hours.
Monitoring	Laboratory analysis will employ the CRS/TAA Method as per ASSMAC Guidelines.
Auditing	Auditing will be undertaken by the site manager and/or the proponent's nominated representative. Alternatively, auditing may be carried out by an independent consultant. The audit should include an inspection of site activities, complaints, corrective actions and reporting to assess compliance with the provisions outlined within the EMP.
Reporting of monitoring results	Test results are to be forwarded to the Site Manager as they become available.
Identification of incident or failure	Excavation of soils occurring below the current surface level without acid sulfate testing and appropriate treatment.
Corrective action	Ensure sufficient sampling and analysis of all excavated soils. Adjust sampling rates as necessary with consent from TSC.

Commitment 4

All soils excavated from below the current surface level will be tested for the presence of AASS and PASS during excavation.

2.3 Acid sulfate soil treatment

Person responsible	Site Manager
Issue	Acid sulfate soil assessment and treatment.
Operational policy	No acid sulfate soils are to be disturbed or excavated without appropriate treatment.
Performance criteria	No material will be covered or removed from the site until validation tests indicate compliance with acceptance criteria based on the action levels of oxidisable sulfur as stated in the ASSMAC Guidelines.
Implementation strategy	Acid sulfate soil excavation to be conducted in accordance with the treatment measures described below. LIME TREATMENT. • Soils requiring treatment will be treated with lime or neutralising agent to neutralise their equivalent TPA or equivalent oxidisable sulfur concentrations based on sample testing at the rate of one sample per 1,000m³ of excavated material. In calculating the amount of lime or neutralising agent to be added, a mixing factor for safety of 1.5 will be used. If it can be demonstrated that this safety factor is not needed, this may be reduced with the written agreement of TSC. • Excavated material will be placed within bunded areas. • Material will be placed to a depth of <300mm and limed at the rate indicated by soil testing performed during excavation. Lime to be mixed to a minimum depth of 300mm with a rotary hoe or disc plough. • Materials used to construct bunds will be free from acid sulfate soils with the bunded area prepared with surface lime at a rate of 5kg/m² of material to be placed. • Exposed sides of open trenches, drains or bioretention basin batters are to be treated with lime immediately after excavation at a rate of 5kg/m².
Monitoring	Verification testing will be performed by assessing oxidisable sulfur sampled at the rate of one sample per 1,000m³ of treated material. Lime delivery dockets are to be retained and made available to the auditor. These dockets will be compared with required lime amounts (as per calculated liming rates) as an indication as to whether liming has occurred at the specified rates.
Auditing	Auditing will be undertaken by the site manager and/or the proponent's nominated representative. Alternatively, auditing may be carried out by an independent consultant. The audit should include an inspection of site activities, complaints, corrective actions and reporting to assess compliance with the provisions outlined within the ASSMP.
Reporting of monitoring results	Records are to be kept on site and should be available for inspection at all times. Records are to be sent to TSC and/or DEC as required.
Identification of incident or failure	Examination of works for evidence of: • yellow efflorescence on soil surface • iron staining of soils or water • sulphurous odour • low pH in water bodies. The acceptance criteria for the placed materials will be: • if any single sample exceeds the ASSMAC Guideline threshold then the average of any four consecutive samples shall be equal to or less than the ASSMAC Guideline threshold for that material texture or should exhibit an equal or greater acid neutralising capacity.
Corrective action	• Retesting of materials in vicinity of excavation using CRS/TAA method in accordance with the ASSMAC guidelines.

	• Any need for additional lime should be managed in accordance with the implementation strategies stated above. • If unforeseen environmental impacts occur due to excavation of acid sulfate soils (eg. fish kill) work should cease and TSC should be contacted.
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Commitment 5

All AASS and PASS material shall be treated in accordance with the ASSMAC guidelines.

2.4 Surface water quality management

Person responsible	Contractor's Site Manager																			
Issue	Surface water quality in the receiving environments surrounding the site will not be adversely impacted upon by site operations.																			
Operational policy	No adverse impact to the receiving environment shall result from the discharge of waters offsite.																			
Performance criteria	Surface water quality in the receiving environment will be maintained and not adversely impacted by the development of the site. Where practicable, surface water quality will be evaluated against the ANZECC (2000) guideline limits for the protection of aquatic ecosystems. Any surface water discharged from the site shall comply with the following release criteria: <table border="1"> <thead> <tr> <th>Water quality parameter</th><th>Release criteria</th><th>Criteria type</th></tr> </thead> <tbody> <tr> <td>pH</td><td>6.5 – 9.0</td><td>Range</td></tr> <tr> <td>Electrical conductivity</td><td><1500µS/cm</td><td>Maximum</td></tr> <tr> <td>Dissolved oxygen</td><td>>6.0mg/L</td><td>Minimum</td></tr> <tr> <td>Suspended Solids</td><td><50mg/L</td><td>Maximum</td></tr> <tr> <td>Visible oil and grease</td><td>None visible</td><td>Visible</td></tr> </tbody> </table>		Water quality parameter	Release criteria	Criteria type	pH	6.5 – 9.0	Range	Electrical conductivity	<1500µS/cm	Maximum	Dissolved oxygen	>6.0mg/L	Minimum	Suspended Solids	<50mg/L	Maximum	Visible oil and grease	None visible	Visible
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Suspended Solids	<50mg/L	Maximum																		
Visible oil and grease	None visible	Visible																		
Implementation strategy	- When constructed, surface water quality monitoring shall be undertaken within the stormwater detention basin for pH, EC, DO and turbidity prior to the release of any waters off site. - Existing surface water conditions shall be maintained outside the construction area. - When constructed, surface water flows will be directed towards the stormwater detention basin or grassed treatment area. Sediment and erosion control measures will be installed as detailed in the Table 2.6. - Reliable <i>in situ</i> monitoring equipment will be used for all monitoring. This equipment will be calibrated prior to each round of monitoring.																			
Monitoring	- Surface water quality monitoring within the stormwater detention basin for pH, EC, and DO to be conducted prior to the release of any waters off site. - Daily rainfall to be recorded by the civil contractor.																			
Auditing	Auditing will be undertaken by the site manager and/or the proponent's nominated representative. Alternatively, auditing may be carried out by an independent consultant during the construction phase of the development. The audit should include an inspection of site activities, complaints, corrective actions and reporting to assess compliance with the ASSMP.																			
Reporting of monitoring results	- Water quality monitoring results to be submitted to TSC as requested. - All results to be kept on site for inspection by local and state government officers at all times.																			
Identification of incident or failure	- Discharge of waters offsite without appropriate testing to ensure the above water quality criteria are met. - Deterioration in surface water quality downstream of the development resulting from discharge of waters from the development site.																			
Corrective action	- Take necessary steps to address the problem to prevent a recurrence. - Addition of hydrated lime to contained waters as required to maintain the pH within the recommended range. - Addition of gypsum to contained waters as required to reduce suspended solids concentrations. - Discharge from any contained waters will not be allowed until the water quality criteria are reached.																			

Commitment 6

Management will ensure that any surface water discharged off site is acceptable under the ANZECC (2000) water quality criteria prior to release from the site.

2.5 Groundwater management

Person Responsible	Contractor's Site Manager																
Issue	Management of groundwater intercepted during the course of excavations.																
Operational policy	Management of groundwater intercepted during the course of excavations to minimise potential impacts on the receiving environment.																
Performance criteria	- No discharge of groundwater intercepted during the excavation of trenches, roads or bioretention basins without appropriate testing and treatment if required. - No variation in groundwater levels and/or flow direction beyond the effects of drought or flood.																
Implementation strategy	- Limiting of all excavations including trenches and bioretention basins in accordance with Table 2.3. - No groundwater shall be discharged from the site until the specified water quality criteria are reached. - Reliable in situ monitoring equipment will be used for all monitoring. This equipment will be calibrated prior to each round of monitoring.																
Monitoring	Groundwater encountered during excavations shall be pumped to a holding area (such as the proposed bioretention basin) and monitored prior to release off site for the following parameters: <table border="1"> <thead> <tr> <th>Water quality parameter</th><th>Release criteria</th><th>Criteria type</th></tr> </thead> <tbody> <tr> <td>pH</td><td>6.5 – 9.0</td><td>Range</td></tr> <tr> <td>Electrical conductivity</td><td><1500µS/cm</td><td>Maximum</td></tr> <tr> <td>Dissolved oxygen</td><td>>6.0mg/L</td><td>Minimum</td></tr> <tr> <td>Suspended Solids</td><td><50mg/L</td><td>Maximum</td></tr> </tbody> </table>		Water quality parameter	Release criteria	Criteria type	pH	6.5 – 9.0	Range	Electrical conductivity	<1500µS/cm	Maximum	Dissolved oxygen	>6.0mg/L	Minimum	Suspended Solids	<50mg/L	Maximum
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Auditing	Auditing will be undertaken by the site manager and/or the proponent's nominated representative. Alternatively, auditing may be carried out by an independent consultant during the construction phase of the development. The audit should include an inspection of site activities, complaints, corrective actions and reporting to assess compliance with the ASSMP.																
Reporting of monitoring results	- Water quality monitoring results to be submitted to TSC as requested. - All results to be kept on site for inspection by local and state government officers at all times.																
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Corrective action	- Take necessary steps to address the problem to prevent a recurrence. - Addition of hydrated lime to contained waters as required to maintain the pH within the recommended range. - Addition of gypsum to contained waters as required to reduce suspended solids concentrations. Discharge from any contained waters will not be allowed until the water quality criteria are reached.																

Commitment 7

Management will ensure that on-site activities do not impact upon groundwater quality, levels or movement outside of conditions experienced during drought or flood.

2.6 Sediment and erosion controls

Person Responsible	Consulting Engineer, Contractor's Site Manager
Issue	Sediment and erosion control.
Operational policy	To prevent the displacement of sediment and acid sulfate soil material across the site, particularly during storm events.
Performance criteria	All excavated acid sulfate soil material shall be contained in such a manner so as to prevent the displacement of this material across the site. No erosion or sediment accumulation shall result from on-site activities.
Implementation strategy	Erosion and sediment control devices such as (but not limited to) silt fences, bunds and contour drains should be installed prior to commencement of site activities to the reasonable satisfaction of TSC and should be maintained throughout the life of site operations. All excavated material will be placed within bunded areas and tested for acid sulfate soil potential. Material will be placed to a depth of <300mm and limed at the rate indicated by soil testing. Materials used to construct bunds will be free from acid sulfate soils with the bunded area prepared with surface lime at a rate of 5kg/m² of material to be placed. Upslope runoff shall be diverted around any acid sulfate treatment areas or any cleared or disturbed regions of the site in a way that minimises erosion, the size of the upslope catchment and diverts waters to a legal point of discharge. Sediment control fences should be constructed at the downslope perimeter of acid sulfate soil treatment areas and any cleared or disturbed regions of the site. Where possible, the excavation/construction programme shall be scheduled to minimise the potential for soil loss to occur. Where excavation/construction activities cannot be altered, additional controls shall be implemented in the areas of high erosion potential. All erosion and sediment control measures should be maintained at operational capacity until disturbed land is effectively rehabilitated. Stripped topsoil shall be separated from subsoil materials and shall only be stripped from the areas designated on the appropriate plans. After undergoing any necessary acid sulfate soil treatment, soil should be stockpiled taking into account the following considerations: • stockpiles are not to be located on public footpaths, nature strips, roads, road shoulders or any other public land • stockpiles to be protected from upslope surface flows • sediment filters should be provided downslope of stockpiles • all stockpiles should be seeded within a fortnight of final forming with an appropriate seed mix.
Monitoring	Monthly visual inspections will be undertaken to ensure adequate erosion and sedimentation control devices are installed particularly in acid sulfate soil treatment areas.
Auditing	Auditing will be undertaken by the site manager and/or the proponent's nominated representative. Alternatively, auditing may be carried out by an independent consultant during the construction phase of the development. The audit should include an inspection of site activities, complaints, corrective actions and reporting to assess compliance with the ASSMP.
Reporting	Reporting is required if excessive sedimentation and/or erosion is identified. Full details to be available to the contractor together with suggested corrective actions if required.

Identification of incident or failure	• Displacement of acid sulfate soil material across the site. • Inadequate bunding of acid sulfate soil treatment areas. • Damaged or failed erosion and sediment control devices.
Corrective action	Identify the source of the problem and take the necessary steps required to prevent a recurrence. This may include: • the installation of additional erosion and sediment control measures • maintenance of existing controls • a review of work practices to minimise exposed areas and the duration of exposure.

Commitment 8

The Developer will ensure that appropriate and adequate erosion and sediment control measures are installed and maintained for the duration of the construction works.

3) Administration of the ASSMP

3.1 Amendment of the ASSMP

The Developer may make an application to TSC to amend the provisions of this ASSMP. The application shall:

1. be in writing
2. specify the provisions of the ASSMP to which the application relates
3. state how the proposed amendments achieve the objectives of the provisions to which the amendments relate.

TSC shall approve the amendment where TSC is satisfied acting reasonably that the proposed amendments achieve the objective of the provisions to which the amendment relates.

3.2 Incident management

The Developer and any person appointed by the Developer as having responsibility for a control strategy set out in this ASSMP have clearly defined responsibilities under the *Environmental Planning and Assessment Act 1979* to report any incidents likely to cause material or serious environmental harm.

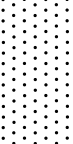
4) Appendix 1 – November 2000 ASSA Results

Borehole: BH1
Project: GJ0029
Client: Metricon

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:
Easting:
RL (m):
Depth: 4.50

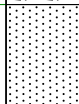
Drilled By: TBD
Start Date: 4/8/00
Completion Date: 4/8/00
Logged By: GLH

Depth NSL(m)	Drilling		Soil Description						ASS Interpretation		Assays								Depth NSL(m)								
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	S(pos) %	S(pos) %				TPA	TPA						
																0.2	0.4	0.6	0.8	1.		100	200	300	400	500	
.5				SILTY LIGHT CLAY , Grayish yellow brown and Brownish black, Very sandy. Organics throughout.	10YR5/2																						
				SANDY CLAY LOAM , Brownish black and Grayish yellow brown, Extremely organic, mostly fibric.	10YR3/1																						
				FINE SAND , Greyish yellow brown , Some root material present.	10YR6/2									6.60	3.30	0.00						12.00					
				SILTY SAND , Greyish yellow brown and Dark grey, Some root material.	10YR6/2																						
1.0				SILTY CLAYEY SAND , Dark olive grey , Sand present is fine.	2.5GY3/1								4.70	2.50	0.30							144.00					
1.5																											
2.0				SILTY FINE SAND , Dark olive grey , Flowing sand from 2.2m to 2.85m.	2.5GY4/1								4.50	2.50	0.25							107.00					
2.5																											
3.0													8.10	2.70	0.18							64.00					
3.5																											
4.0				SILTY FINE SAND , Dark olive grey , Minor clay inclusions throughout. Shells and shell fragments present as gastropods and bivalves from 3.4m to 3.6m. Scattered organics from 3.7m to 4.5m	2.5GY3/1								7.20	2.90	0.16							45.00					
4.5													6.70	4.90	0.20							0.00					

Borehole: BH2
Project: GJ0029
Client: Metricon

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:
Easting:
RL (m):
Depth: 5.00
Drilled By: TBD
Start Date: 4/8/00
Completion Date: 4/8/00
Logged By: GLH

Depth NSL(m)	Drilling		Soil Description						ASS Interpretation		Assays										Depth NSL(m)								
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	S(pos) %	S(pos) %						TPA	TPA						
																0.2	0.4	0.6	0.8	1.			100	200	300	400	500		
.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5				SANDY LOAM , Brownish black , Light. Very organic, with fibric roots throughout.		10YR3/1							5.50	3.90	0.00						10.00								
					FINE SAND , Light grey		2.5Y7/1																						
				SILTY FINE SAND , Dark olive grey , Shells and shell fragments from 1.4m to 1.8m, and 2.6m to 2.85m. Flowing sand from 1.6m to 1.9m.		2.5GY3/1										7.00	8.00	0.14						0.00					
																		7.10	7.90	0.11						0.00			
			SILTY FINE SAND , Dark olive grey , Increased slit content from above layer. Traces of thick fibric material throughout. Shells and shell fragments from 3.5m to 4m (concentrated), and 4.45m to 5m. Shells present are gastropods and bivalves.		2.5GY4/1							6.80	4.40	0.07						8.00									
													7.00	7.50	0.11						0.00								

Borehole: BH3
Project: GJ0029
Client: Metricon

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:
Easting:
RL (m):
Depth: 4.70

Drilled By: TBD
Start Date: 4/8/00
Completion Date: 4/8/00
Logged By: GLH

Depth NSL(m)	Drilling		Soil Description						ASS Interpretation		Assays								Depth NSL(m)	
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	S(pos) %	S(pos) %	TPA	TPA		
																0.2 0.4 0.6 0.8 1.		100 200 300 400 500		
.5				SANDY LOAM , Black and Light grey, Very organic, with root matter throughout.		N2/0								4.80	3.30	0.02		52.00		.5
					LOAMY SAND , Yellowish grey , Sand present is fine.		2.5Y4/1													
					FINE SAND , Light grey		2.5Y7/1													
	1.0			SILTY FINE SAND , Yellowish brown , Increasing moisture with depth. Flowing sand from 1.4m to 1.5m.		2.5Y5/4							4.80	3.90	0.00		41.00		1.0	
	1.5																		1.5	
2.0				SILTY FINE SAND , Dark olive grey and Dark olive grey, Siltiness increasing with depth. Flowing sand at 1.9m to 2.1m, 2.3m to 2.6m, 3.2m to 3.35m, 4.4m to 4.7m. Shell and shell fragments (gastropods and bivalves) from 3.8m to 3.85m, with traces from 3.85m to 4.7m. Colour lightening with increasing depth.		2.5GY3/1						4.60	2.40	0.28		166.00		2.0		
2.5																				2.5
3.0														4.30	2.30	0.31		197.00		3.0
3.5																				3.5
4.0																				4.0
4.5													6.80	7.90	0.11		0.00			4.5

Borehole: BH4
Project: GJ0029
Client: Metricon

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:
Easting:
RL (m):
Depth: 4.80

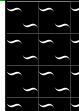
Drilled By: TBD
Start Date: 4/8/00
Completion Date: 4/8/00
Logged By: GLH

Depth NSL(m)	Drilling		Soil Description						ASS Interpretation		Assays										Depth NSL(m)						
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	S(pos) %	S(pos) %						TPA	TPA				
																0.2	0.4	0.6	0.8	1.			100	200	300	400	500
.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5				SANDY LOAM , Very dark brown , Light and organic. CLAY LOAM , Black and Very dark reddish brown, Very organic, with trace of fine sand.		7.5YR2/3 N2/0																					
				FINE SAND , Light grey , Colour lightening with depth.		2.5Y7/1							5.10	3.60	0.00						16.00						
				FINE SAND , Greyish yellow , Traces of organics.		2.5Y6/2																					
				FINE SAND , Dark olive grey , Colour change from above layer.		2.5GY4/1																					
				SILTY FINE SAND , Greyish yellow , Flowing sand.		2.5Y6/2							4.70	2.60	0.16						94.00						
				SILTY FINE SAND , Dark olive grey , Traces of shell from 2.65m, increasing with depth to 3.35m. Whole gastropod and bivalve shells towards 3.35m.		2.5GY3/1							6.40	3.10	0.22						23.00						
				SILTY SANDY LIGHT CLAY , Dark olive grey , Marine clay.		2.5GY3/1							7.00	2.60	0.48						123.00						
				SILTY MEDIUM CLAY , Dark olive grey , Marine. Traces of shell throughout. Slightly less moist than above layer.		2.5GY3/1																					
			SILTY FINE SAND , Dark olive grey , Some clayey inclusions.		2.5GY4/1							6.90	7.10	0.17						0.00							

Borehole: BH5
Project: GJ0029
Client: Metricon

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:
Easting:
RL (m):
Depth: 4.80
Drilled By: TBD
Start Date: 4/8/00
Completion Date: 4/8/00
Logged By: GLH

Depth NSL(m)	Drilling		Soil Description						ASS Interpretation		Assays										Depth NSL(m)													
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	S(pos) %	S(pos) %						TPA	TPA											
																	0.2	0.4	0.6	0.8		1.		100	200	300	400	500						
.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5				SANDY CLAY LOAM , Black , Very organic, with much root matter.		N2/0																												
				FINE SAND , Greyish yellow and Black, minor mottling of less than 5%.		2.5Y6/2							6.60	3.40	0.00							14.00												
				SILTY FINE SAND , Dark olive grey , Some organics and flowing sand from 0.55m to 0.7m. Many gastropod and bivalve shells from 2.95m to 3.05m.		2.5GY4/1							3.80	2.60	0.18							93.00												
				SANDY SILTY CLAY , Dark olive grey , Marine, and traces of shell throughout.		2.5GY3/1						5.90	2.70	0.13							62.00													
				SANDY SILTY CLAY , Dark olive grey , Marine, and traces of shell throughout.		2.5GY3/1						6.80	2.30	0.68							242.00													
				SILTY CLAY , Dark olive grey , Marine, with trace of sand.		2.5GY3/1							6.80	2.20	0.84						320.00													

Borehole: BH6
Project: GJ0029
Client: Metricon

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:
Easting:
RL (m):
Depth: 4.80

Drilled By: TBD
Start Date: 4/8/00
Completion Date: 4/8/00
Logged By: GLH

Depth NSL(m)	Drilling		Soil Description							ASS Interpretation		Assays								Depth NSL(m)							
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	S(pos) %	S(pos) %					TPA	TPA					
																0.2	0.4	0.6	0.8		1.		100	200	300	400	500
.5				SANDY LOAM , Black and Yellowish grey, Much root matter.		N2/0																					
				FINE SAND , Greyish yellow , Traces of heavier organics.		2.5Y6/2							4.30	3.10	0.00						18.00						
				SILTY FINE SAND , Dark olive grey , Traces of gastropod and bivalve shells from 2.3m to 3.6m.		2.5GY4/1							4.30	2.50	0.21						125.00						
				SILTY CLAY , Dark olive grey , Marine, with trace of fine sand.		2.5GY3/1							7.30	2.20	0.98					349.00							
													7.70	2.60	1.02					191.00							

Borehole: BH7

Project: GJ0029

Client: Metricon

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:

Easting: RL (m):

Depth: 3.00

Drilled By: TBD

Start Date: 4/8/00

Completion Date: 4/8/00

Logged By: GLH

[illegible]

Borehole: BH8
Project: GJ0029
Client: Metricon

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:
Easting:
RL (m):
Depth: 4.80

Drilled By: TBD
Start Date: 4/8/00
Completion Date: 4/8/00
Logged By: GLH

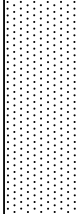
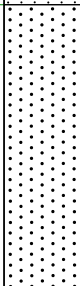
Depth NSL(m)	Drilling		Soil Description						ASS Interpretation		Assays										Depth NSL(m)						
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	S(pos) %	S(pos) %						TPA	TPA				
																0.2	0.4	0.6	0.8	1.		100	200	300	400	500	
.5				LOAMY SAND , Black and Grayish yellow brown, Very organic, with much root matter.		10YR1.7/1																					
				FINE SAND , Greyish brown , Semi organic, appearing slightly loamy.		7.5YR4/2							4.40	3.00	0.00							30.00					
1.0				LOAMY SAND , Black , Sand present is fine. Sapric organics present.		7.5YR2/1																					
				FINE SAND , Greyish brown , Semi organic, appearing slightly loamy.		7.5YR4/2																					
1.5				LOAMY SAND , Black , Sand present is fine. Sapric organics present.		7.5YR2/1							4.60	3.10	0.08							82.00					
				LOAMY SAND , Brownish black , Sand present is fine. Sapric organic content. Flowing sand from 1.0m to 1.2m.		7.5YR3/2																					
2.0				LOAMY SAND , Dull yellowish brown , Sand present is fine. Some silty clay inclusions from 1.4m to 1.55m.		10YR5/3							3.70	2.70	0.11							115.00					
				SILTY CLAYEY SAND , Brownish black , Some organic matter present as roots. Clear change from above layer.		2.5Y3/2																					
2.5				LOAMY SAND , Brownish black , Sand present is fine.		7.5YR3/2							4.00	2.50	0.20							154.00					
				SILTY CLAYEY SAND , Grey , Saturated from 2.1m to 2.7m.		5Y4/1																					
3.0				SILTY SAND , Grey , Sand present is fine.		5Y4/1																					
				SILTY CLAYEY SAND , Grey , Gastropod and bivalve shells present from 3.4m to 3.55m.		5Y4/1																					
3.5													6.50	2.60	0.23							88.00					
																											
4.0																											
																											
4.5																											
																											
				SILTY FINE SAND , Grey , Accumulation of gastropod and bivalve shells from 3.55m to 4.0m. Scattered woody organics from 4.1m to 4.75m. Flowing sand from 4.1m to 4.6m.		5Y4/1							7.00	8.80	0.06						0.00						

Borehole: BH9
Project: GJ0029
Client: Metricon

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:
Easting:
RL (m):
Depth: 4.50

Drilled By: TBD
Start Date: 4/8/00
Completion Date: 4/8/00
Logged By: GLH

Depth NSL(m)	Drilling		Soil Description						ASS Interpretation		Assays							Depth NSL(m)
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	S(pos) %	S(pos) %	TPA	
																0.2 0.4 0.6 0.8 1.		100 200 300 400 500
.5				SANDY LOAM , Black , Fibric organics throughout. Fine sand present from 0.05m to 0.2m. Gradual change into next layer.		7.5YR1.7/1												
				LOAMY SAND , Black , Sapric, semi cemented.		7.5YR1.7/1												
				LOAMY SAND , Brownish black , Sapric, semi cemented.		7.5YR2/2												
1.0				FINE SAND , Dull brown and Brownish black, Organic, with fibric organics at 1.1m. Saturated flow from 1.1m to 1.m. Clear boundary between next layer.		7.5YR5/4							4.30	2.90	0.02		59.00	
1.5																		
2.0				SILTY CLAYEY SAND , Grey , Sand present is fine.		7.5Y4/1							3.90	2.70	0.11		90.00	
2.5																		
3.0				SILTY FINE SAND , Grey , Accumulation of gastropod and bivalve shells from 3.4m to 3.m. Scattered shells from 3.6m to 4.5m. Flowing sand from 3.9m to 4.3m.		7.5Y4/1							4.10	2.40	0.19		131.00	
3.5																		
4.0													6.40	8.10	0.06		0.00	
4.5																		

Borehole: BH10

Project: GJ0029

Client: Metricon

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:

Easting:

RL (m):

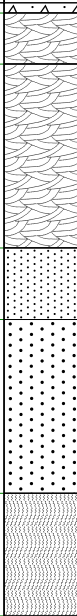
Depth: 3.00

Drilled By: TBD

Start Date: 4/8/00

Completion Date: 4/8/00

Logged By: GLH

Depth NSL(m)	Drilling		Soil Description						ASS Interpretation		Assays										Depth NSL(m)						
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	S(pos) %	S(pos) %						TPA	TPA				
																0.2	0.4	0.6	0.8	1.			100	200	300	400	500
.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5				SANDY LOAM , Black , Fibric organics present. LOAMY SAND , Black , Sand present is fine. Sapric organics present. Root matter throughout.		N1.6/0 10YR1.7/1							4.10	2.50	0.00						153.00						
				LOAMY SAND , Brownish black , Sand present is fine. Semi cemented from 0.6m to 0.7m. Flowing sand from 0.8m to 0.9m. Gradual change to underlying layer.		7.5YR3/2							4.60	3.30	0.02						43.00						
				FINE SAND , Dull yellowish brown , Organic, with occasional silty clay inclusion. Clear change to following layer.		10YR5/3																					
				SILTY CLAYEY SAND , Grey , Sand present is fine. Clay content is sporadic. Some root material present.		7.5Y4/1								4.20	2.40	0.21						144.00					
				SILTY FINE SAND , Grey , Woody organics present at 2.8m. No shells visible.		7.5Y4/1								4.20	2.70	0.13						84.00					

Borehole: BH11

Project: GJ0029

Client: Metricon

Soil Class Ferrosol

Gilbert & Sutherland

Specialist Soil & Water Scientists

Northing:

Easting:

RL (m):

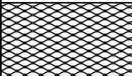
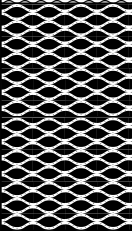
Depth: 0.40

Drilled By: G&S

Start Date: 4/8/00

Completion Date: 4/8/00

Logged By: GLH

Depth NSL(m)	Drilling		Soil Description						Testing Results								Depth NSL(m)					
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Sample ID	Emerson Class	pH(Field)	pH(Field)										
												1	2	3	4	5		6	7	8		
.1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1 1.2				HEAVY CLAY LOAM, Dark reddish brown , Moderate upper slope, waxing. Moderate 5-10mm angular blocky to polyhedral structure. Organics as roots present.	5YR3/4		EOH @ 0.40m on floater.			4/7M											.1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1 1.2	
				CLAY LOAM, Dark reddish brown , Moderate to strong 2-10mm angular blocky. Some weathered basalt gravel.	5YR3/6					4/7M												
				CLAY LOAM, Dark reddish brown , Moderate to strong 2-5mm granular to subangular blocky. Some weathered basalt gravel.	5YR3/6																	

Borehole: BH12

Project: GJ0029

Client: Metricon

Soil Class Ferrosol

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:

Easting:

RL (m):

Depth: 0.60

Drilled By: G&S

Start Date: 4/8/00

Completion Date: 4/8/00

Logged By: GLH

Depth NSL(m)	Drilling		Soil Description						Testing Results								Depth NSL(m)			
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Sample ID	Emerson Class	pH(Field)	pH(Field)								
												1	2	3	4	5		6	7	8
				HEAVY CLAY LOAM, Dark reddish brown , Moderate 2-5mm angular blocky to polyhedral. Organics (roots etc) present.	5YR3/4							1	2	3	4	5	6	7	8	
.1				CLAY LOAM, Dark reddish brown , Moderate to strong 2-5mm granular to subangular blocky.	5YR3/4					4/7M										.1
.2																				.2
.3				CLAY LOAM, Dark reddish brown , Moderate to strong 2-5mm granular to subangular.	5YR3/6					4/7M										.3
.4																				.4
.5				HEAVY CLAY LOAM, Dark reddish brown , Moderate to 2-5mm granular to subangular blocky.	5YR3/6															.5
.6																				.6
.7																				.7
.8																				.8
.9																				.9
1.0																				1.0
1.1																				1.1
1.2																				1.2

Borehole: BH13

Project: GJ0029

Client: Metricon

Soil Class Ferrosol

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:

Easting:

RL (m):

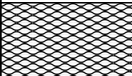
Depth: 0.30

Drilled By: G&S

Start Date: 4/8/00

Completion Date: 4/8/00

Logged By: GLH

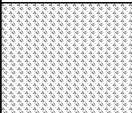
Depth NSL(m)	Drilling		Soil Description						Testing Results								Depth NSL(m)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
	Depth RL (m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Sample ID	Emerson Class	pH(Field)	pH(Field)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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.1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1 1.2				HEAVY CLAY LOAM, Dark reddish brown , Moderate 2-10mm angular blocky to polyhedral.	5YR3/4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																

Borehole: BH14
Project: GJ0029
Client: Metricon
Soil Class Dermosol

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:
Easting:
RL (m):
Depth: 0.65

Drilled By: G&S
Start Date: 4/8/00
Completion Date: 4/8/00
Logged By: GLH

Depth NSL(m)	Drilling		Soil Description						Testing Results								Depth NSL(m)					
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Sample ID	Emerson Class	pH(Field)	pH(Field)										
												1	2	3	4	5		6	7	8		
.1				SILTY CLAY LOAM, Brownish black , Moderate 2-10mm subangular blocky to angular blocky.	7.5YR3/2															.1		
.2				SILTY LOAM, Brownish black , Moderate to strong angular blocky. Some basalt gravel 5-20mm.	7.5YR3/2															.2		
.3																						.3
.4																						.4
.5				SILTY LOAM, Brownish black , Moderate to weak 2-5mm granular to subangular blocky. Some basalt gravel and rocks.	7.5YR3/2															.5		
.6																					.6	
.7																					.7	
.8																				.8		
.9																				.9		
1.0																				1.0		
1.1																				1.1		
1.2																				1.2		

Borehole: BH15

Project: GJ0029

Client: Metricon

Soil Class Ferrosol

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:

Easting:

RL (m):

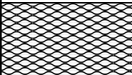
Depth: 0.25

Drilled By: G&S

Start Date: 4/8/00

Completion Date: 4/8/00

Logged By: GLH

Depth NSL(m)	Drilling		Soil Description						Testing Results								Depth NSL(m)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Sample ID	Emerson Class	pH(Field)	pH(Field)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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.1				HEAVY CLAY LOAM, Dark brown , Moderate 5-10mm angular blocky to polyhedral.	7.5YR3/4		EOH @ 0.25m on floater.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												

Borehole: BH16

Project: GJ0029

Client: Metricon

Soil Class Ferrosol

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:

Easting:

RL (m):

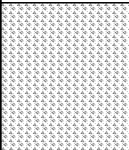
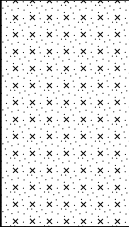
Depth: 0.50

Drilled By: G&S

Start Date: 4/8/00

Completion Date: 4/8/00

Logged By: GLH

Depth NSL(m)	Drilling		Soil Description						Testing Results								Depth NSL(m)			
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Sample ID	Emerson Class	pH(Field)	pH(Field)								
												1	2	3	4	5		6	7	8
.1				SILTY CLAY LOAM, Greyish brown , Moderate 2-10mm subangular blocky to angular blocky.	7.5YR4/2					4/7M										.1
.2				HEAVY SILTY LOAM, Brown , Moderate 2-5mm subangular blocky to angular blocky. Some weathered basalt gravel increasing with depth.	7.5YR4/4		EOH @ 0.5m on floater.			4/7M										.2
.3																				.3
.4																				.4
.5																				.5
.6																				.6
.7																				.7
.8																				.8
.9																				.9
1.0																				1.0
1.1																				1.1
1.2																				1.2

Borehole: BH17
Project: GJ0029
Client: Metricon
Soil Class Dermosol

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:
Easting:
RL (m):
Depth: 0.60

Drilled By: G&S
Start Date: 4/8/00
Completion Date: 4/8/00
Logged By: GLH

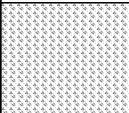
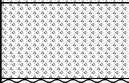
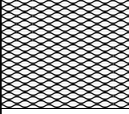
Depth NSL(m)	Drilling		Soil Description						Testing Results								Depth NSL(m)			
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Sample ID	Emerson Class	pH(Field)	pH(Field)								
												1	2	3	4	5		6	7	8
.1				SILTY CLAY LOAM, Greyish brown , Organic topsoil layer. Some 2-5mm gravel. Moderate angular blocky throughout. Diffuse boundary to	7.5YR4/2															.1
.2				HEAVY SILTY LOAM, Dull yellowish brown , Moderate to weak 2-5mm subangular blocky. Gravelly. 20-30% 2-5mm subangular quartz increasing with depth. Diffuse boundary to	10YR4/3					4/7M										.2
.3				HEAVY SILTY LOAM, Dull yellowish brown , Moderate to weak 2-5mm subangular blocky. Gravelly. 20-30% 2-5mm subangular quartz increasing with depth. Gradual change to	10YR5/4					4/7M										.3
.4				LIGHT CLAY, Bright yellowish brown, Reddish brown, Mottled. Strong 2-10mm angular blocky.	10YR6/6, 2.5YR4/8, 10YR6/2		EOH @ 0.60m.													.4
.5				LIGHT CLAY, Bright yellowish brown, Reddish brown, Mottled. Strong 2-10mm angular blocky.	10YR6/6, 2.5YR4/8, 10YR6/2		EOH @ 0.60m.			2M										.5
.6																				.6
.7																				.7
.8																				.8
.9																				.9
1.0																				1.0
1.1																				1.1
1.2																				1.2

Borehole: BH18
Project: GJ0029
Client: Metricon
Soil Class Dermosol

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:
Easting:
RL (m):
Depth: 0.60

Drilled By: G&S
Start Date: 4/8/00
Completion Date: 4/8/00
Logged By: GLH

Depth NSL(m)	Drilling		Soil Description						Testing Results								Depth NSL(m)			
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Sample ID	Emerson Class	pH(Field)	pH(Field)								
												1	2	3	4	5		6	7	8
.1				SILTY CLAY LOAM, Dull yellowish brown, Bright yellowish brown, Gentle slope. Organics present. Gradual change to	10YR4/3, 10YR6/8					2M										.1
.2				SILTY CLAY LOAM, Brown , Some small gravel present. Organics present. Gradual change to	10YR4/4					4/7M										.2
.3				SILTY CLAY LOAM, Dull yellowish brown , Gradual change to	10YR5/3					4/7M										.3
.4				HEAVY CLAY LOAM, Yellowish brown , Gradual change to	10YR5/6					2M										.4
.5				HEAVY CLAY LOAM, Dull yellowish brown	10YR5/4					1M										.5
.6																				.6
.7																				.7
.8																				.8
.9																				.9
1.0																				1.0
1.1																				1.1
1.2																				1.2



Gilbert & Sutherland

Job Number: GJ0029
Date: 17/08/00
H₂O₂ pH: 4.82
Bath Temp: 320C

Identification			Van Beers Screening			Petrographic Screening					
Borehole	Depth (m)	Initial pH	Oxid. pH	Peak Temp (oC)	Rxn during oxidation	Pyrite presence	Degree of rxn with peroxide	Pyrite grade	Shell presence	Degree of rxn with HCl	Shell grade
BH1	0.5	4.56	3.33	26	Nil						
BH1	1	5.54	1.4	30	Slight						
BH1	1.5	5.51	1.45	33	Slight						
BH1	2	6.24	1.45	31	Slight						
BH1	2.5	6.13	1.37	28	Slight						
BH1	3	7.34	1.46	32	Slight						
BH1	3.65	6.64	1.52	29	Slight						
BH1	4.25	5.9	1.39	30	Slight						
BH2	0.7	5.67	4.19	26	Nil						
BH2	1.3	6.98	3.86	26	V.Slight				Yes		Coarse
BH2	2	7.06	5.06	26	V.Slight				Yes		Coarse
BH2	2.5	7.26	5.35	27	V.Slight				Yes		Coarse
BH2	3	7.38	4.38	30	V.Slight				Yes		Coarse
BH2	3.45	7.15	1.9	30	V.Slight				Yes		Coarse
BH2	4.5	7.32	2.58	30	V.Slight				Yes		Coarse
BH2	5	7.3	2.81	28	V.Slight				Yes		Coarse
BH3	0.7	4.46	3.84	27	Nil						
BH3	1.2	4.67	3.9	27	Nil						
BH3	1.9	3.91	2.03	36	Medium						
BH3	2.4	3.8	2.05	89	Violent						
BH3	2.9	3.99	2.1	86	Violent	Yes	Slight	Fine			
BH3	3.4	4.35	2.14	85	Violent	Yes	Medium	Fine			
BH3	3.9	6.76	4.86	29	Slight	Yes	Medium	Fine	Yes		Coarse
BH3	4.4	6.57	5.22	27	Slight				Yes		Coarse
BH4	0.25	4.8	2.14	34	Slight						
BH4	0.75	5.14	4.28	31	V.Slight						
BH4	1.25	4.95	2.13	34	Medium						
BH4	1.75	4.41	2	87	Violent	Yes	Slight	Fine			
BH4	2.25	4.18	2.12	88	Violent	Yes	Slight	Fine			



Gilbert & Sutherland

Job Number: GJ0029
Date: 17/08/00
H₂O₂ pH: 4.82
Bath Temp: 32oC

Identification			Van Beers Screening			Petrographic Screening			Degree of rxn with HCl			Shell grade		
Borehole	Depth (m)	Initial pH	Oxid. pH	Peak Temp (oC)	Rxn during oxidation	Pyrite presence	Degree of rxn with peroxide	Pyrite grade	Shell presence	Degree of rxn with HCl	Shell grade	Degree of rxn with HCl	Shell grade	Degree of rxn with HCl
BH4	2.75	6.45	2.47	88	Violent	No	Nil		Yes		Coarse		Coarse	
BH4	3.25	6.75	1.8	83	Violent	No	Nil		Yes		Coarse		Coarse	
BH4	3.75	7.33	2.2	89	Violent	Yes	V.Slight	Fine	Yes		Coarse		Coarse	
BH4	4.25	7.4	2.66	89	Violent	No	Nil		Yes		Coarse		Coarse	
BH4	4.75	7.42	3.5	86	Violent	No	Nil		Yes		Coarse		Coarse	
BH5	0.5	7.35	3.57	32	Nil									
BH5	1	6.52	2.16	86	Violent	Yes	Moderate	Fine	No	None				
BH5	1.5	5.72	1.66	43	Moderate									
BH5	1.9	6.21	1.94	44	Moderate									
BH5	2.4	6.51	1.82	88	Violent	No	None		Yes	Violent	Coarse		Coarse	
BH5	2.9	7	2.04	91	Violent	No	None		Yes	Slight	Coarse		Coarse	
BH5	3.4	7.07	3.03	84	Violent	No	None		Yes	Violent	Coarse		Coarse	
BH5	3.9	6.88	1.67	79	Violent	No	None		Yes	Violent	Coarse		Coarse	
BH5	4.4	6.67	1.71	76	Violent	No	None		Yes	Medium	Medium		Medium	
BH6	0.5	5.66	2.66	32	Nil									
BH6	1	3.59	2.1	90	Violent	Yes	Medium	Medium	No	None				
BH6	1.8	5.37	2.11	88	Violent	Yes	Slight	Fine	No	None				
BH6	2.3	6.28	2.32	94	Violent	No	None		Yes	Violent	Coarse		Coarse	
BH6	2.8	6.92	2.33	91	Violent	No	None		Yes	Slight	Coarse		Coarse	
BH6	3.3	6.77	1.8	89	Violent	No	None		Yes	Violent	Coarse		Coarse	
BH6	3.8	6.81	1.75	88	Violent	No	None		Yes	Violent	Coarse		Coarse	
BH6	4.3	6.85	1.87	90	Violent	No	None		Yes	Medium	Fine		Fine	
BH6	4.8	6.91	2.08	87	Violent	No	None		Yes	Medium	Fine		Fine	
BH7	0.75	4.85	2.75	35	Slight froth									
BH7	1	5.76	2.93	36	Slight froth									
BH7	1.5	5.86	2.91	32	Slight froth									
BH7	1.8	5.76	2.23	8.7	Violent	No	None		No	None				
BH7	2	6.64	4.42	34	Froth				Yes		Coarse		Coarse	
BH7	2.5	7.07	2.52	89	Violent	No	None		Yes	Violent	Coarse		Coarse	

Job Number: GJ0029 H₂O₂ pH: 4.82
 Date: 17/08/00 Bath Temp: 320C

Identification			Van Beers Screening			Petrographic Screening					
Borehole	Depth (m)	Initial pH	Oxid. pH	Peak Temp (oC)	Rxn during oxidation	Pyrite presence	Degree of rxn with peroxide	Pyrite grade	shell presence	Degree of rxn with HCl	Shell grade
BH7	3	7.12	2.89	92	Violent	No	None		Yes	Slight	Coarse
BH8	0.5	6.08	4.1	30	Slight froth						
BH8	1	4.62	3.48	30	Slight froth						
BH8	1.6	3.35	2.36	93	Violent	Yes	Slight	Fine	No	None	
BH8	2	3.83	2.1	33	Slight froth						
BH8	2.5	3.84	2.2	92	Violent	Yes	Slight	Fine	No	None	
BH8	3	4.07	2.32	93	Violent	Yes	Slight	Fine	No	None	
BH8	3.5	6.82	3.72	92	Violent	No	None		Yes	Slight	Coarse
BH8	4	7.25	5.27	38	Slight froth				Yes		Coarse
BH8	4.75	7.14	5.62	32	Slight froth				Yes		Coarse
BH9	0.5	4.53	3.73	38	Nil						
BH9	1	4.67	3.88	38	Nil						
BH9	1.75	3.85	2.41	91	Violent	Yes	Slight	Fine	No	None	
BH9	2.5	4.11	2.21	87	Violent	Yes	Slight	Fine	No	None	
BH9	3	3.85	2.22	91	Violent	Yes	Slight	Fine	No	None	
BH9	3.75	7.05	3.85	89	Violent	No	None		Yes	Violent	Coarse
BH9	4.5	7.02	5.42	85	Violent	No	None		Yes	Violent	Coarse
BH10	0.25	4.58	2.8	38	Nil						
BH10	0.75	4.5	3.54	38	Nil						
BH10	1.25	4.6	3.26	38	Nil						
BH10	1.75	3.97	2.14	89	Violent	No	None		No	None	
BH10	2.25	3.81	2.23	92	Violent	No	None		No	None	
BH10	2.75	3.82	2.2	87	Violent	No	None		No	None	

ALS Environmental

CERTIFICATE OF ANALYSIS



Batch: EB31079
Sub Batch: 0

CONTACT: MR G HOLLAND
CLIENT: GILBERT & SUTHERLAND PTY LTD
ADDRESS: P O BOX 857
ROBINA QLD 4226

LABORATORY: BRISBANE
DATE RECEIVED: 11/08/2000
DATE COMPLETED: 30/08/2000
SAMPLE TYPE: SOIL
No. of SAMPLES: 49

ORDER No.: GJ0029

PROJECT:

COMMENTS

CAS as per method of Ahern et al (1998). Results expressed as mole
H+/tonne.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

ISSUING LABORATORY: BRISBANE

Address
32 Shand Street
Stafford QLD 4053
Australia

Phone: 61-7-3243 7222
Fax: 61-7-3243 7218
Email: paulv@als.com.au

Signatory

LABORATORIES

AUSTRALASIA

Brisbane
Melbourne
Sydney
Newcastle

Hong Kong
Singapore
Kuala Lumpur
Auckland

AMERICAS

Vancouver
Santiago
Lima

This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its terms of accreditation. This document shall not be reproduced except in full.



No. 825

Batch: EB31079

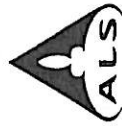
Sub Batch: 0

Date of Issue: 30/08/2000

Client: GILBERT & SUTHERLAND PTY LTD

Client Reference:

CERTIFICATE OF ANALYSIS



METHOD		ANALYSIS DESCRIPTION	SAMPLE IDENTIFICATION											
			Laboratory I.D.		1	2	3	4	5	6	7	8	9	10
			Date Sampled	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000
		UNIT	LOR	BH1 0.5	BH1 1.0	BH1 2.0	BH1 3.0	BH1 3.65	BH1 4.25	BH2 0.7	BH2 2	BH2 3	BH2 3.45	
EA-002	pH after Oxidation		0.1	3.3	2.5	2.5	2.7	2.9	4.9	3.9	8.0	7.9	4.4	
EA-022	Ca (Acid Reacted)	%	0.02	<0.02	<0.02	<0.02	<0.02	0.04	0.18	<0.02	0.26	0.15	<0.02	
EA-022	Ca (KCl)	%	0.02	<0.02	0.02	<0.02	0.02	0.05	0.02	<0.02	0.07	0.08	0.07	
EA-022	Ca (Peroxide)	%	0.02	<0.02	<0.02	<0.02	0.03	0.09	0.20	<0.02	0.33	0.23	0.08	
EA-022	Mg (Acid Reacted)	%	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
EA-022	Mg (KCl)	%	0.02	<0.02	0.03	0.02	0.02	0.02	0.03	<0.02	<0.02	<0.02	<0.02	
EA-022	Mg (Peroxide)	%	0.02	<0.02	0.03	0.03	0.03	0.02	0.04	<0.02	<0.02	<0.02	<0.02	
EA-022	Na (Acid Reacted)	%	0.02	<0.02	<0.02	0.03	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
EA-022	Na (KCl)	%	0.02	0.15	0.21	0.16	0.17	0.16	0.19	<0.02	<0.02	<0.02	0.02	
EA-022	Na (Peroxide)	%	0.02	0.12	0.19	0.19	0.19	0.16	0.16	<0.02	<0.02	<0.02	<0.02	
EA-022	S (KCl)	%	0.02	<0.02	0.06	0.04	0.02	0.04	0.04	<0.02	<0.02	<0.02	<0.02	
EA-022	S (Peroxide)	%	0.02	0.03	0.36	0.29	0.20	0.20	0.24	<0.02	0.14	0.12	0.08	
EA-022	S (Pos)	%	0.02	<0.02	0.30	0.25	0.18	0.16	0.20	<0.02	0.14	0.11	0.07	
EA-022	TAA	mole/tonne	2	<2	<2	4	<2	<2	<2	<2	<2	<2	<2	
EA-022	TPA	mole/tonne	2	12	144	107	64	45	<2	10	<2	<2	8	
EA-022	TSA	mole/tonne	2	12	144	103	64	45	<2	10	<2	<2	8	
EA-022	pH (KCl)		0.1	6.6	4.7	4.5	8.1	7.2	6.7	5.5	7.0	7.1	6.8	

Batch: EB31079
Sub Batch: 0
Date of Issue: 30/08/2000
Client: GILBERT & SUTHERLAND PTY LTD
Client Reference:

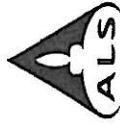
CERTIFICATE OF ANALYSIS



METHOD		ANALYSIS DESCRIPTION	SAMPLE IDENTIFICATION											
			Laboratory I.D.		11	12	13	14	15	16	17	18	19	20
			Date Sampled		10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000
UNIT		LOR		BH2 5	BH3 0.7	BH3 1.2	BH3 2.4	BH3 3.4	BH3 4.5	BH4 0.75	BH4 1.75	BH4 2.75	BH4 3.75	
EA-002	pH after Oxidation	0.1		7.5	3.3	3.9	y2.4	2.3	7.9	3.6	2.6	3.1	2.6	
EA-022	Ca (Acid Reacted)	%	0.02	0.15	0.02	<0.02	<0.02	<0.02	0.16	<0.02	<0.02	0.12	0.14	
EA-022	Ca (KCl)	%	0.02	0.07	<0.02	<0.02	<0.02	<0.02	0.06	<0.02	<0.02	0.10	0.16	
EA-022	Ca (Peroxide)	%	0.02	0.22	0.02	<0.02	<0.02	<0.02	0.22	<0.02	<0.02	0.22	0.30	
EA-022	Mg (Acid Reacted)	%	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
EA-022	Mg (KCl)	%	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	
EA-022	Mg (Peroxide)	%	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.04	
EA-022	Na (Acid Reacted)	%	0.02	<0.02	0.12	0.04	<0.02	<0.02	<0.02	0.12	<0.02	<0.02	<0.02	
EA-022	Na (KCl)	%	0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	
EA-022	Na (Peroxide)	%	0.02	<0.02	0.12	0.07	<0.02	<0.02	<0.02	0.12	<0.02	<0.02	<0.02	
EA-022	S (KCl)	%	0.02	<0.02	<0.02	<0.02	0.03	0.05	<0.02	<0.02	0.03	0.02	0.05	
EA-022	S (Peroxide)	%	0.02	0.12	0.02	<0.02	0.31	0.36	0.12	<0.02	0.19	0.24	0.53	
EA-022	S (Pos)	%	0.02	0.11	0.02	<0.02	0.28	0.31	0.11	<0.02	0.16	0.22	0.48	
EA-022	TAA	mole/tonne	2	<2	11	10	12	14	<2	2	6	<2	<2	
EA-022	TPA	mole/tonne	2	<2	52	41	166	197	<2	16	94	23	123	
EA-022	TSA	mole/tonne	2	<2	41	31	154	183	<2	14	88	23	123	
EA-022	pH (KCl)	0.1		7.0	4.8	4.8	4.6	4.3	6.8	5.1	4.7	6.4	7.0	

Batch: EB31079
Sub Batch: 0
Date of Issue: 30/08/2000
Client: GILBERT & SUTHERLAND PTY LTD
Client Reference:

CERTIFICATE OF ANALYSIS



METHOD		ANALYSIS DESCRIPTION		SAMPLE IDENTIFICATION																		
				Laboratory I.D.		21	22	23	24	25	26	27	28	29	30							
				Date Sampled	10/08/2000	BH4 4.75	10/08/2000	BH5 0.50	10/08/2000	BH5 1.50	10/08/2000	BH5 2.40	10/08/2000	BH5 3.40	10/08/2000	BH5 4.40	10/08/2000	BH6 0.50	10/08/2000	BH6 1.80	10/08/2000	BH6 2.80
UNIT		LOR																				
EA-002	pH after Oxidation		0.1	7.1	3.4	2.6	2.7	2.3	2.2	3.1	2.5	2.8	2.2	3.1	2.5	2.8	2.2					
EA-022	Ca (Acid Reacted)	%	0.02	0.18	<0.02	<0.02	<0.02	0.08	0.09	<0.02	<0.02	0.03	0.08	<0.02	<0.02	0.03	0.16					
EA-022	Ca (KCl)	%	0.02	0.08	<0.02	<0.02	0.03	0.19	0.22	<0.02	0.02	0.06	0.22	<0.02	0.02	0.06	0.31					
EA-022	Ca (Peroxide)	%	0.02	0.27	<0.02	0.02	0.02	0.28	0.31	<0.02	0.02	0.09	0.31	<0.02	0.02	0.09	0.46					
EA-022	Mg (Acid Reacted)	%	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02					
EA-022	Mg (KCl)	%	0.02	<0.02	<0.02	<0.02	<0.02	0.08	0.08	<0.02	<0.02	<0.02	0.08	<0.02	<0.02	<0.02	0.07					
EA-022	Mg (Peroxide)	%	0.02	<0.02	<0.02	0.02	<0.02	0.09	0.10	<0.02	<0.02	<0.02	0.09	<0.02	<0.02	<0.02	0.08					
EA-022	Na (Acid Reacted)	%	0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02					
EA-022	Na (KCl)	%	0.02	<0.02	0.02	0.11	0.11	0.39	0.37	0.10	0.10	0.37	0.37	<0.02	<0.02	<0.02	0.30					
EA-022	Na (Peroxide)	%	0.02	<0.02	0.02	0.14	0.10	0.37	0.37	0.03	0.03	0.18	0.22	<0.02	<0.02	<0.02	0.25					
EA-022	S (KCl)	%	0.02	<0.02	<0.02	0.04	0.03	0.18	0.22	0.03	0.03	0.18	0.22	<0.02	<0.02	0.02	0.14					
EA-022	S (Peroxide)	%	0.02	0.19	0.02	0.23	0.16	0.86	1.05	0.16	0.16	0.86	1.05	0.02	0.02	0.21	1.13					
EA-022	S (Pos)	%	0.02	0.17	<0.02	0.18	0.13	0.68	0.84	0.13	0.13	0.68	0.84	<0.02	<0.02	0.19	0.98					
EA-022	TAA	mole/tonne	2	<2	<2	4	<2	<2	<2	<2	<2	<2	<2	2	4	<2	<2					
EA-022	TPA	mole/tonne	2	<2	14	93	62	242	320	62	62	242	320	18	125	53	349					
EA-022	TSA	mole/tonne	2	<2	14	88	62	242	320	62	62	242	320	16	121	53	349					
EA-022	pH (KCl)		0.1	6.9	6.6	3.8	5.9	6.8	6.8	5.9	4.3	6.3	6.8	4.3	4.3	6.3	7.3					

Batch: EB31079

Sub Batch: 0

Date of Issue: 30/08/2000

Client: GILBERT & SUTHERLAND PTY LTD

Client Reference:

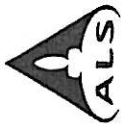
CERTIFICATE OF ANALYSIS



METHOD		SAMPLE IDENTIFICATION											
		Laboratory I.D.		31	32	33	34	35	36	37	38	39	40
		Date Sampled		10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000
		UNIT		LOR									
EA-002	pH after Oxidation			0.1	2.6	3.9	7.1	4.6	3.0	3.1	2.7	2.5	2.6
EA-022	Ca (Acid Reacted)	%		0.02	0.53	<0.02	0.18	0.18	<0.02	0.02	<0.02	<0.02	0.06
EA-022	Ca (KCl)	%		0.02	0.28	<0.02	0.08	0.10	<0.02	<0.02	<0.02	<0.02	0.11
EA-022	Ca (Peroxide)	%		0.02	0.80	<0.02	0.26	0.28	<0.02	0.02	<0.02	<0.02	0.16
EA-022	Mg (Acid Reacted)	%		0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
EA-022	Mg (KCl)	%		0.02	0.06	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
EA-022	Mg (Peroxide)	%		0.02	0.08	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
EA-022	Na (Acid Reacted)	%		0.02	<0.02	0.03	<0.02	<0.02	0.11	0.13	<0.02	<0.02	<0.02
EA-022	Na (KCl)	%		0.02	0.28	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
EA-022	Na (Peroxide)	%		0.02	0.27	0.05	<0.02	<0.02	0.11	0.13	<0.02	<0.02	<0.02
EA-022	S (KCl)	%		0.02	0.15	<0.02	0.02	0.02	<0.02	<0.02	0.05	0.05	0.03
EA-022	S (Peroxide)	%		0.02	1.16	0.05	0.10	0.20	<0.02	0.08	0.15	0.25	0.27
EA-022	S (Pos)	%		0.02	1.02	0.05	0.08	0.18	<0.02	0.08	0.11	0.20	0.23
EA-022	TAA	mole/tonne		2	<2	8	<2	<2	5	14	24	20	<2
EA-022	TPA	mole/tonne		2	191	126	<2	4	30	82	115	154	88
EA-022	TSA	mole/tonne		2	191	118	<2	4	25	68	91	134	88
EA-022	pH (KCl)			0.1	7.7	4.6	6.6	7.1	4.4	4.6	3.7	4.0	6.5

Batch: EB31079
Sub Batch: 0
Date of Issue: 30/08/2000
Client: GILBERT & SUTHERLAND PTY LTD
Client Reference:

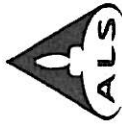
CERTIFICATE OF ANALYSIS



METHOD		ANALYSIS DESCRIPTION	SAMPLE IDENTIFICATION										
			Laboratory I.D.		41	42	43	44	45	46	47	48	49
			Date Sampled		10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000
UNIT		LOR	BH8 4.75	BH9 0.50	BH9 1.75	BH9 3.00	BH9 4.50	BH10 0.25	BH10 1.25	BH10 1.75	BH10 2.75		
EA-002	pH after Oxidation	0.1	8.8	2.9	2.7	2.4	8.1	2.5	3.3	2.4	2.7		
EA-022	Ca (Acid Reacted)	%	0.28	<0.02	<0.02	<0.02	0.23	<0.02	<0.02	<0.02	<0.02		
EA-022	Ca (KCl)	%	0.08	<0.02	<0.02	<0.02	0.06	0.11	<0.02	<0.02	<0.02		
EA-022	Ca (Peroxide)	%	0.35	<0.02	<0.02	<0.02	0.29	0.08	<0.02	<0.02	<0.02		
EA-022	Mg (Acid Reacted)	%	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		
EA-022	Mg (KCl)	%	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		
EA-022	Mg (Peroxide)	%	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		
EA-022	Na (Acid Reacted)	%	<0.02	0.11	<0.02	<0.02	<0.02	0.10	0.09	<0.02	<0.02		
EA-022	Na (KCl)	%	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02		
EA-022	Na (Peroxide)	%	<0.02	0.11	<0.02	<0.02	<0.02	0.13	0.09	<0.02	<0.02		
EA-022	S (KCl)	%	<0.02	<0.02	0.02	0.03	<0.02	<0.02	<0.02	0.04	<0.02		
EA-022	S (Peroxide)	%	0.08	0.02	0.14	0.22	0.06	<0.02	0.02	0.24	0.13		
EA-022	S (Pos)	%	0.06	0.02	0.11	0.19	0.06	<0.02	0.02	0.21	0.13		
EA-022	TAA	mole/tonne	<2	9	14	12	<2	12	10	18	10		
EA-022	TPA	mole/tonne	<2	59	90	131	<2	153	43	144	84		
EA-022	TSA	mole/tonne	<2	50	76	119	<2	141	33	126	74		
EA-022	pH (KCl)	0.1	7.0	4.3	3.9	4.1	6.4	4.1	4.6	4.2	4.2		

Batch: EB31079
 Sub Batch: 0
 Date of Issue: 30/08/2000
 Client: GILBERT & SUTHERLAND PTY LTD
 Client Reference:

QUALITY CONTROL REPORT



METHOD			ANALYSIS DESCRIPTION	Laboratory I.D.		SAMPLE IDENTIFICATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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EA-002	pH after Oxidation	0.1	—																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	

ALS Environmental

CERTIFICATE OF ANALYSIS



Batch: EB31079
Sub Batch: 1

CONTACT: MR G HOLLAND
CLIENT: GILBERT & SUTHERLAND PTY LTD
ADDRESS: P O BOX 857
ROBINA QLD 4226

LABORATORY: BRISBANE
DATE RECEIVED: 11/08/2000
DATE COMPLETED: 30/08/2000
SAMPLE TYPE: SOIL
No. of SAMPLES: 22

ORDER No.: GJ0029

PROJECT:

COMMENTS

Chromium Reducible Sulphur as per method 22B ASSMAC Laboratory Methods
Guidelines, Aug '98. Chromium Reducible Sulphur: NATA accreditation
does not cover performance of this service.

NOTES

This is the Final Report and supersedes any preliminary reports with this batch number.
Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

ISSUING LABORATORY: BRISBANE

Address
32 Shand Street
Stafford QLD 4053
Australia

Phone: 61-7-3243 7222
Fax: 61-7-3243 7218
Email: paulv@als.com.au

Signatory _____

LABORATORIES

AUSTRALASIA

Brisbane
Melbourne
Sydney
Newcastle

Hong Kong
Singapore
Kuala Lumpur
Auckland

AMERICAS

Vancouver
Santiago
Lima

This Laboratory is accredited by the National
Association of Testing Authorities, Australia. The
test(s) reported herein have been performed in
accordance with its terms of accreditation. This
document shall not be reproduced except in full.



Batch:

7

30/08/2000

GILBERT & SUTHERLAND PTY LTD

CERTIFICATE OF ANALYSIS



		SAMPLE IDENTIFICATION											
		Laboratory I.D.		3	6	9	11	14	16	19	20	21	24
		Date Sampled		10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000
		UNIT		BH1 2.0	BH1 4.25	BH2 3	BH2 5	BH3 2.4	BH3 4.5	BH4 2.75	BH4 3.75	BH4 4.75	BH5 2.40
		ANALYSIS DESCRIPTION		LOR									
METHOD				%									
EA-026		Chromium Reducible Sulphur		0.01	0.21	0.12	0.11	0.27	0.11	0.22	0.49	0.20	0.07

Batch: EB31079
 Sub Batch: 1
 Date of Issue: 30/08/2000
 Client: GILBERT & SUTHERLAND PTY LTD
 Client Reference:

CERTIFICATE OF ANALYSIS



METHOD		ANALYSIS DESCRIPTION	SAMPLE IDENTIFICATION											
			Laboratory I.D.		26	28	29	31	34	35	39	41	43	44
			Date Sampled		10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000	10/08/2000
			UNIT	LOR	BH5 4.40	BH6 1.80	BH6 2.80	BH6 4.80	BH7 2.00	BH7 3.00	BH8 2.50	BH8 4.75	BH9 1.75	BH9 3.00
EA-026		Chromium Reducible Sulphur	%	0.01	0.88	0.20	0.19	1.22	0.16	0.18	0.22	0.14	0.14	0.20

Batch: EB31079

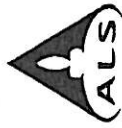
Sub Batch: 1

Date of Issue: 30/08/2000

Client: GILBERT & SUTHERLAND PTY LTD

Client Reference:

CERTIFICATE OF ANALYSIS



METHOD		ANALYSIS DESCRIPTION		SAMPLE IDENTIFICATION					
				Laboratory I.D.		45	49		
				Date Sampled		10/08/2000	10/08/2000		
				UNIT	LOR	BH9 4.50	BH10 2.75		
EA-026		Chromium Reducible Sulphur		%	0.01	0.07	0.14		

5) Appendix 2 – October 2002 ASSA Results

Borehole: BH17

Project: GJ0240

Client: Greenview Developments

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:

Easting:

RL (m):

Depth: 2.50

Drilled By: B.T

Start Date: 15.10.02

Completion Date: 15.10.02

Logged By: N.S.

Depth NSL(m)	Drilling		Soil Description						ASS Interpretation		Assays								Depth NSL(m)					
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	%S	%S		TAA		TAA				
																1	2			400.	800.	1200.	1600.	2000.
.5 1.0 1.5 2.0 2.5 3.0 3.5				SANDY CLAY LOAM , Brownish black , Silty. Fine. Weak to moderate polyhedral. Roots and organics throughout. Moist.		10YR3/1							8.20	3.84	0.01									
				SAND , Light grey , Fine to medium. Massive. Moist.		7.5yr8/1																		
				LOAMY SAND , Dark greyish yellow , Silty. Fine to Medium. Massive. Wet.		2.5Y5/2							8.44	4.85	0.01									
				LOAMY SAND , greyish olive , Silty. Fine to medium. Massive. Abundant shell material throughout. Wet.		5y4/2							8.57	2.93	0.15									
				LOAMY SAND , greyish olive , Silty. Fine to medium. Massive. Abundant shell material throughout. Wet.		5y4/2																		
				LOAMY SAND , greyish olive , Silty. Fine to medium. Massive. Abundant shell material throughout. Wet.		5y4/2							8.14	2.46										

Borehole: BH18

Project: GJ0240

Client: Greenview Developments

Gilbert & Sutherland

Specialist Soil & Water Scientists

Northing:

Easting:

RL (m):

Depth: 2.50

Drilled By: B.T

Start Date: 15.10.02

Completion Date: 15.10.02

Logged By: N.S.

Depth NSL(m)	Drilling		Soil Description						ASS Interpretation		Assays								Depth NSL(m)				
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	%S	%S		TAA		TAA			
																1	2			400.	800.	1200.	1600.
.5				SANDY CLAY LOAM , Brownish black , Fine. Weak to moderate polyhedral. Trace of roots and organics. Moist.		7.5yr3/2																	
				MEDIUM CLAY , Brownish black , Silty. Fine. Medium polyhedral. Moist.		7.5yr3/1							7.93	4.61	0.01								
				SAND , Greyish yellow brown , Silty. Fine to medium. Massive. Wet.		10YR6/2							8.00	4.76	0.00								
	1.0			SAND , Dark greyish yellow , Silty. Fine to medium. Massive. Wet.		2.5Y5/2							7.90	4.01	0.01								
					LOAMY SAND , greyish olive , Silty. Fine to medium. Massive. Abundant shell material throughout. Trace of clay throughout. Wet.		5y4/2																
	1.5				LOAMY SAND , greyish olive , Silty. Fine to medium. Massive. Abundant shell material throughout. Trace of clay throughout. Trace of charcoal fragments throughout. Wet.		5y4/2																
					LOAMY SAND , greyish olive , Silty. Fine to medium. Massive. Abundant shell material throughout. Trace of clay throughout. Trace of charcoal fragments throughout. Wet.		5y4/2																
2.0				LOAMY SAND , greyish olive , Silty. Fine to medium. Massive. Abundant shell material throughout. Trace of clay throughout. Trace of charcoal fragments throughout. Wet.		5y4/2							8.09	2.45									
2.5																							
3.0																							
3.5																							

Borehole: BH19

Project: GJ0240

Client: Greenview Developments

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:

Easting:

RL (m):

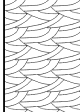
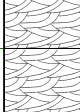
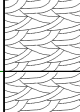
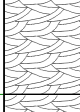
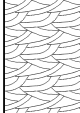
Depth: 3.50

Drilled By: B.T

Start Date: 15.10.02

Completion Date: 15.10.02

Logged By: N.S.

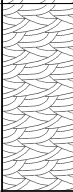
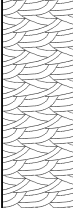
Depth NSL(m)	Drilling		Soil Description						ASS Interpretation		Assays								Depth NSL(m)				
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	%S	%S		TAA		TAA			
																1	2			400.	800.	1200.	1600.
				SANDY CLAY LOAM , Black , Silty. Fine. (topsoil). Weak polyhedral. Roots and organics throughout. Moist.		7.5yr1.7/1																	
.5				SAND , Greyish yellow brown , Fine to medium. Moist		10YR6/2																	
				LOAMY SAND , Greyish yellow brown , Fine to medium. Silty. Wet.		10YR5/2							8.61	0.66	0.11								
1.0				LOAMY SAND , Greyish brown , Silty. Fine to medium. Abundant shell material throughout. Trace of charcoal fragments throughout. Wet.		5yr4/2							7.98	2.32	0.20								
1.5				LOAMY SAND , Greyish brown , Silty. Fine to medium. Abundant shell material throughout. Trace of charcoal fragments throughout. Wet.		5yr4/2																	
2.0				LOAMY SAND , Greyish brown , Silty. Fine to medium. Layers of silty loamy clay throughout. Abundant shell material throughout. Trace of charcoal fragments throughout. Wet.		5yr4/2							7.17	2.15									
2.5				LOAMY SAND , greyish olive , Silty. Fine to medium. Layers of silty fine to medium sandy loam clay throughout. Trace of shell material. Wet.		5y4/2																	
3.0				LOAMY SAND , greyish olive , Silty. Fine to medium. Trace of shell material. Wet.		5y4/2							6.77	2.27	0.35								
3.5								Borehole terminated at 3.5m.															

Borehole: BH20
Project: GJ0240
Client: Greenview Developments

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:
Easting:
RL (m):
Depth: 3.50

Drilled By: B.T
Start Date: 15.10.02
Completion Date: 15.10.02
Logged By: N.S.

Depth NSL(m)	Drilling		Soil Description						ASS Interpretation		Assays								Depth NSL(m)					
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	%S	%S		TAA		TAA				
																1	2			400.	800.	1200.	1600.	2000.
.5				SILTY CLAYEY SAND , Black , Fine to medium. (topsoil). Weak to moderate polyhedral. Trace of roots and organics. Moist.		10YR2/1																		
				LOAMY SAND , Light grey , Fine to medium. Moist.		7.5yr8/1							7.50	4.83										
				LOAMY SAND , Greyish yellow brown , Fine to medium. Strong organic odour. Wet.		10YR6/2							7.21	4.98	0.01									
				LOAMY SAND , Greyish yellow brown , Wet.		10YR5/2							7.33	2.22	0.18									
				LOAMY SAND , greyish olive , Silty. Fine to medium. Abundant shell material throughout increasing with depth. Wet.		5y4/2																		
																								
				LOAMY SAND , greyish olive , Silty. Fine to medium. Abundant shell material throughout. Wet.		5y4/2		Borehole terminated at 3.5m.						7.06	2.43	0.18								
3.5																								

Borehole: BH21

Project: GJ0240

Client: Greenview Developments

Gilbert & Sutherland
Specialist Soil & Water Scientists

Northing:

Easting:

RL (m):

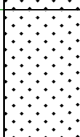
Depth: 3.50

Drilled By: B.T

Start Date: 15.10.02

Completion Date: 15.10.02

Logged By: N.S.

Depth NSL(m)	Drilling		Soil Description						ASS Interpretation		Assays							Depth NSL(m)					
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	%S	%S			TAA	TAA			
																1	2			400.	800.	1200.	1600.
.5 1.0 1.5 2.0 2.5 3.0 3.5				SANDY CLAY LOAM , Black , Fine. Weak to moderate polyhedral. (Topsoil). Moist.		10YR2/1							6.53	4.24									
				SAND , Light grey , Fine to medium. Massive. Moist.		2.5Y7/1																	
				SAND , Light grey , Fine to medium. Trace of silt. Massive. Moist.		2.5Y7/1							6.88	4.89	0.00								
				LOAMY SAND , Dark greyish yellow , Silty. Fine to medium. Massive. Wet.		2.5Y5/1																	
				LOAMY SAND , greyish olive , Silty. Fine. Massive. Abundant shell material throughout. Wet.		5y4/2							6.97	2.21	0.15								
				LOAMY SAND , greyish olive , Silty. Fine. Massive. Abundant shell material throughout. Trace of charcoal fragments throughout. Wet.		5y4/2																	
				LOAMY SAND , greyish olive , Silty. Fine. Massive. Abundant shell material throughout. Trace of charcoal fragments throughout. Wet.		5y4/2																	
				LOAMY SAND , greyish olive , Silty. Fine. Massive. Abundant shell material throughout. Trace of charcoal fragments throughout. Trace of silty fine to medium sandy clay layers throughout. Wet.		5y4/2							6.64	2.38	0.31								

Borehole: BH22

Project: GJ0240

Client: Greenview Developments

Gilbert & Sutherland

Specialist Soil & Water Scientists

Northing:

Easting:

RL (m):

Depth: 2.50

Drilled By: B.T

Start Date: 15.10.02

Completion Date: 15.10.02

Logged By: N.S.

Depth NSL(m)	Drilling		Soil Description						ASS Interpretation		Assays								Depth NSL(m)					
	Depth RL(m)	Method	Graphic Log	Soil Description (as per McDonald et.al1990)	Aust. Soil Class.	Revised Standard Colour	Depositional Environment	Accessories	Additional Comments	Assigned Category	Representative Strata	Sample ID	pH(Field)	pH(FieldOx)	%S	%S		TAA		TAA				
																1	2		400.	800.	1200.	1600.	2000.	
.5 1.0 1.5 2.0 2.5 3.0 3.5				SANDY CLAY LOAM , Black , Fine. Weak to moderate polyhedral. Roots and organic throughout. (Topsoil). Moist.		10YR2/1																		
				SAND , Brownish black , Fine to medium. Weak to moderate polyhedral. Moist.		10YR2/2							5.06	4.81										
				SAND , Dull Yellow Orange , Fine to medium. Wet.		10yr6/3							5.13	4.78	0.00									
				SAND , Dull Yellow Orange , Fine to medium. Wet.		10yr6/3																		
				LOAMY SAND , Dark greyish yellow , Silty. Fine to medium. Abundant shell material throughout. Trace of charcoal throughout. Wet.		2.5y4/2							7.82	2.88	0.13									
				LOAMY SAND , greyish olive , Silty. Fine to medium. Abundant shell material throughout. Trace of charcoal. Wet.		5y4/2			Borehole terminated at 2.5m.				7.81	4.20	0.16									

Acid sulfate soil screening results October 2002

Borehole	Depth from NSL (m)	Initial pH (pH _F) (1:5 H ₂ O)	pH after oxidation (pH _{FOX}) (1:5 H ₂ O ₂)	Peak temperature (°C)	Reaction during oxidation
BH17	0.0-0.1	8.20	3.84	46	Moderate
BH17	0.6-1.1	8.44	4.85	46	Moderate
BH17	1.1-1.6	8.57	2.93	89	Violent
BH17	2.0-2.5	8.14	2.46	92	Violent
BH18	0.2-0.5	7.93	4.61	50	Moderate
BH18	0.5-0.7	8.00	4.76	50	Moderate
BH18	0.7-1.0	7.90	4.01	49	Moderate
BH18	2.0-2.5	8.09	2.45	95	Violent
BH19	0.5-0.9	8.61	0.66	49	Moderate
BH19	1.0-1.5	7.98	2.32	86	Violent
BH19	2.0-2.5	7.17	2.15	92	Violent
BH19	3.0-3.5	6.77	2.27	93	Violent
BH20	0.2-0.5	7.50	4.83	49	Slight
BH20	0.5-1.0	7.21	4.98	49	Slight
BH20	1.0-1.5	7.33	2.22	89	Violent
BH20	3.0-3.5	7.06	2.43	84	Violent
BH21	0.0-0.2	6.53	4.24	46	Slight
BH21	0.5-1.0	6.88	4.89	47	Slight
BH21	1.6-2.0	6.97	2.21	83	Violent
BH21	3.0-3.5	6.64	2.38	89	Violent
BH22	0.3-0.5	5.06	4.81	48	Violent
BH22	0.5-1.0	5.13	4.78	48	Violent
BH22	1.4-1.8	7.82	2.88	65	Moderate
BH22	2.0-2.5	7.81	4.20	58	Moderate

MAZLAB PTY. LIMITEDA.C.N. 083 815 338
A.B.N. 87 083 815 3381 Anne Street Phone (02) 6674 3965
Chinderah Fax (02) 6674 4469
NSW 2487 Mobile 015 149 374
email: mazlab@better.net.au**Provisional Test Results - Chromium Reducible Sulphur**

Issued: 20/10/02, 4:59 PM

Ref. No. : GSM0654 Project : GJ0240, for Gilbert & Sutherland

Ref. No.	I.D.	Date Sampled / Tested	Description	Reactions Peroxide Acid Shell Size	Density (t/m ³) M/C (%)	pH _{NaCl}	Scr (molH ⁺ /t) (%)S	TAA (mol H ⁺ /t) %S	Liming Rate (Kg/dry t)
1	BH17 0.00-0.10	15/10/2002 17/10/2002	Clayey SAND (SC), fine to medium grained, dark grey, high pl. fines, occas. organics, moist.	Moderate Nil	- 31.5	5.0	9 0.01	15 0.02	1.9
2	BH17 0.60-1.10	15/10/2002 17/10/2002	SAND (SP), fine to medium grained, light grey-brown, moist.	Slight Nil	- 21.3	6.5	6 0.01	-11 -0.02	nil
3	BH17 1.10-1.60	15/10/2002 17/10/2002	SAND (SP), fine to medium grained, grey, with shell, moist.	Moderate Strong	- 20.9	8.0	95 0.15	-203 -0.32	nil
4	BH18 0.20-0.50	15/10/2002 17/10/2002	Sandy CLAY (CH), high plasticity, dark grey, fine to medium grained sand, moist.	Moderate Slight	- 24.6	5.9	5 0.01	-42 -0.07	nil
5	BH18 0.50-0.70	15/10/2002 17/10/2002	SAND (SP), fine to medium grained, pale grey-brown, moist.	Slight Nil	- 21.7	6.4	2 0.00	-11 -0.02	nil
6	BH18 0.70-1.00	15/10/2002 18/10/2002	SAND (SP), fine to medium grained, light grey, moist.	Slight Slight	- 20.7	6.8	7 0.01	-6 -0.01	nil
7	BH19 0.50-0.90	15/10/2002 18/10/2002	SAND (SP), fine to medium grained, light grey mottled grey, moist.	Moderate Slight	- 21.7	6.9	66 0.11	-10 -0.02	4.7
8	BH19 1.00-1.50	15/10/2002 18/10/2002	Silty SAND (SM), fine to medium grained, grey, low pl. fines, moist.	Moderate Moderate	- 22.0	7.8	123 0.20	-93 -0.15	4.9
9	BH19 3.00-3.50	15/10/2002 18/10/2002	Silty SAND (SM), fine to medium grained, dark grey, low pl. fines, occas. shell, moist.	Moderate Moderate	- 25.5	7.8	219 0.35	-158 -0.25	9.1
10	BH20 0.50-1.00	15/10/2002 18/10/2002	SAND (SP), fine to medium grained, light brown, moist.	Slight Slight	- 23.8	7.2	8 0.01	-9 -0.01	nil
11	BH20 1.00-1.50	15/10/2002 18/10/2002	SAND (SP), fine to medium grained, light brown mottled grey, moist.	Moderate Slight	- 20.8	7.1	114 0.18	-7 -0.01	8.5
12	BH20 3.00-3.50	15/10/2002 18/10/2002	SAND (SP), fine to medium grained, grey, occas. shell, moist.	Slight Moderate	- 20.9	8.1	109 0.18	-121 -0.19	2.4
13	BH21 0.50-1.00	15/10/2002 18/10/2002	SAND (SP), fine to medium grained, light brown, moist.	Slight Slight	- 21.0	6.1	1 0.00	-4 -0.01	nil
14	BH21 1.60-2.00	15/10/2002 18/10/2002	SAND (SP), fine to medium grained, grey, occas. shell, moist.	Slight Strong	- 22.1	8.0	94 0.15	-132 -0.21	nil
15	BH21 3.00-3.50	15/10/2002 18/10/2002	SAND (SP), fine to medium grained, grey, occas. shell, wet.	Slight Strong	- 25.0	7.7	193 0.31	-155 -0.25	7.2

Test methods follow procedures described in ASS Laboratory Methods 1998 Vers 1.11
& Mazlab In-House Method 22 [After ASS Method 22]Liming rate is calculated from Scr + TAA using a supplied combined safety and neutralising factor of 155.0% and composite action level of 18molH⁺/t TAA & 0.03% Scr. (Factor only applied to +ve TAA values)

Provisional Test Results - Chromium Reducible Sulphur

Issued: 20/10/02, 4:59 PM

Ref. No. : GSM0654 Project : GJ0240, for Gilbert & Sutherland

Ref. No.	I.D.	Date Sampled / Tested	Description	Reactions Peroxide Acid Shell Size	Density (t/m ³) M/C (%)	pH _{NaCl}	SCr (mol H ⁺ /t) (%S)	TAA (mol H ⁺ /t) %S	Liming Rate (Kg/dry t)
16	BH22 0.50-1.00	15/10/2002 18/10/2002	SAND (SP), fine to medium grained, brown, wet.	Slight Slight	- 25.8	4.3	3 0.00	14 0.02	nil
17	BH22 1.40-1.80	15/10/2002 18/10/2002	SAND (SP), fine to medium grained, light brown mottled grey, occas. shell, moist.	Moderate Slight	- 21.9	7.5	79 0.13	-125 -0.20	nil
18	BH22 2.00-2.50	15/10/2002 18/10/2002	SAND (SP), fine to medium grained, grey, with shell, moist.	Slight Moderate	- 20.5	7.8	98 0.16	-160 -0.26	nil

Test methods follow procedures described in ASS Laboratory Methods 1998 Vers 1.11

& Mazlab In-House Method 22 [After ASS Method 22]

Liming rate is calculated from SCr + TAA using a supplied combined safety and neutralising factor of 155.0% and composite action level of 18molH⁺/t TAA & 0.03% Scr. (Factor only applied to +ve TAA values)