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**PROJECT No.** 1525905-060-TM-Rev0

**TO** Project Manager  
Department of State Development

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**ABBOT POINT GROWTH GATEWAY  
ASS TESTING OF HISTORICAL OFFSHORE SAMPLES**

At the Abbot Point Growth Gateway project, dredged material from the T0 berth and apron areas will be placed in the dredged material containment ponds (DMCP). Post-dredging, the dredged material may remain in the DMCP for some time. Over time, the dredged material will be subject to both drainage and surface evaporation, resulting in a caked crust which will crack and provide oxidized conditions around the cracks. Where Potentially Acid Sulfate Soil (PASS) is present, this can result in acid formation in these exposed materials.

However, the previous characterisation of recovered offshore materials at Abbot Point (GHD, 2012c) has indicated that the marine sediments were PASS with a natural neutralising capacity greater than the acid generating capacity, likely due to the presence of shell and other calcareous materials throughout the sediment. This suggests that these marine sediments are “self-neutralising”.

To assist in characterising the possible behaviour of the “self-neutralising” dredged material when stored in the DMCP, a number of vibrocore and soil core samples from previous 2011 offshore investigations (GHD 2012a, 2012b) were identified in storage at Abbot Point and have subsequently been assessed. These soil samples included both darker hued, marine sediments and lighter hued deposits of consolidated alluvium/residual soils which are expected to be similar to the materials to be dredged from the T0 berth and apron. The unrefrigerated historical storage of marine sediments is expected to simulate possible post dredging conditions within the DMCP.

The assessment completed included visual observations and laboratory testing as summarised below:

- Vibrocore Samples – (20 samples from MCF offshore investigation locations marked on Figure 1)
  - Open each sample bag and inspect for the presence of jarosite or iron staining to evaluate if acid has been generated and subsequently neutralised, and then photograph.
  - Collect 100g subsample from all bags except VC401-31A 4.2-4.3m, VC401-23B 2.8-2.9m and VC401-33 3.5-3.9m (deeper deposits of stiffer soils) i.e. 17 samples. Remove any visible shell fragments greater than about 3mm. Place sample in lock sealed and labelled bag.
  - Conduct Chromium Suite tests on the 17 samples to give current pH and existing acidity to compare against previous GHD testing.
- Soil Cores (GHD BHW2-02, 03 and 09 marked on Figure 2)
  - Core trays were opened and cores were inspected for the presence of jarosite or iron staining and then photographed.
  - Collect 100g subsample from the top of each of these holes (3 samples).
  - Conduct Chromium Suite test on above 3 samples. These are aimed at demonstrating the absence of ASS in the stiffer non-marine sediments.



## Visual Observations

Attachment 1 shows photographs of the soil samples in July 2015 presented alongside vibrocore photographs from 2011. The following general observations were made:

- All samples appeared drier than indicated in 2011 photographs.
- Some iron staining was observed in all marine sediment samples in 2015 (no iron staining was noted when the samples were collected in 2011). *This suggests that some acid formation and neutralisation has occurred within these bagged samples since 2011.*
- Possible new iron staining was observed in some of the alluvium/residual soil samples inspected in 2015 in comparison to the 2011 photographs (where iron coloured mottling was generally present to some degree). Although this may have been present but not obvious in the 2011 photographs.
- No jarosite was observed in any of the samples.
- Large coral and shell fragments were typically present in the marine sediment samples. The sand fraction of these samples also appeared to be predominantly comprised of shell grit.

## Laboratory Test Results

Laboratory test certificates are presented in Attachment 2 and the results are summarised in Table 1 along with previous test results from this area in 2011. A statistical summary of marine sediment results is also included in this table.

The results of the current testing indicate the following:

- pH in marine sediments are generally similar to those measured in 2011 with drops of less than 0.1 pH unit and increases of up to 0.3 pH units. pH in all samples remains above 9.  
*This indicates that alkaline conditions continue to dominate in these soils.*
- No existing acidity was detected in any of the samples analysed.  
*For the marine sediment samples, this indicates that any acid that was generated whilst these materials were in storage (as evidenced by the iron staining) has been neutralised and that alkaline conditions continue to dominate in these soils.*
- All marine sediment samples had Chromium Reducible Sulfur concentrations above QASSIT Action Levels.  
*The presence of PASS in these marine sediments is confirmed.*
- All marine sediments had acid neutralising capacities (following removal of large shell and coral fragments) ranging from 4 to 200 times their acid generating potential.  
*This indicates that these sediments are “self-neutralising”.*
- It is noted that if the acid neutralising capacity was *not* included in net acidity calculations, then lime treatment rates in the order of 3 to 12 kg of lime per m<sup>3</sup> would be required to neutralise the potential acidity within these marine sediments.
- All alluvium/residual soil samples had Chromium Reducible Sulfur concentrations below QASSIT Action Levels.  
*The absence of PASS in the alluvium/residual soil samples is confirmed.*

The results of other historical tests on marine sediments from the proposed T0, T2 and T3 apron dredging areas from 2012 are summarised in Table 2. A statistical summary of these results is also provided. This summary indicates that the 2012 T0, T2 and T3 area samples have similar PASS characteristics to those from the recent tests on vibrocore samples apart from slightly higher Chromium Reducible Sulfur concentration across the T0 apron.

## CONCLUSIONS

The following conclusions can be drawn from the observations and testing conducted on stored offshore samples:

### **Marine Sediments**

- All of the samples of stored marine sediments analysed were confirmed to be self-neutralising PASS. These findings are similar to those identified in previous offshore marine sediment sampling programs from Abbot Point.
- The presence of iron staining in these bagged samples indicates that some oxidisation and acid generation has occurred during the 4 years of storage and that this acid has been neutralised within these alkaline soils. This also suggests that relatively low levels of acid generation will occur whilst these soils are stored in a saturated to semi-saturated condition.
- The stored marine sediments continue to have a potential to generate additional acid but have significant neutralising capacity, well in excess of the potential acid generation (ie. self-neutralising soils are indicated). Again this suggests that oxidisation and hence acid generation is relatively minor whilst these materials are stored in a saturated to semi-saturated condition.
- It is noted that if acid neutralising capacity is not considered (e.g. conservatively simulating segregation during dredging, settlement of only the finer sediment fractions in the secondary containment pond, limited availability of shell and coral fragments), and ignoring the buffering effect of seawater within the ponds on the dredged material, then potential liming rates range from 3 to 12 kg of lime per m<sup>3</sup> (with a 95% UCL of 9 kg lime per m<sup>3</sup>) would be required to neutralise the potential acidity within these marine sediments. Using this same rationale, historical results on offshore samples from T0, T2 and T3 aprons suggests a range of potential liming rates from 2 to 32 kg of lime per m<sup>3</sup> (with a 95% UCL of 10 kg lime per m<sup>3</sup>).

### **Alluvium/Residual Soils**

- All 12 samples of alluvium/residual soils tested had Chromium Reducible Sulfur concentrations below QASSIT Action Levels and confirm the absence of PASS in these underlying soils.

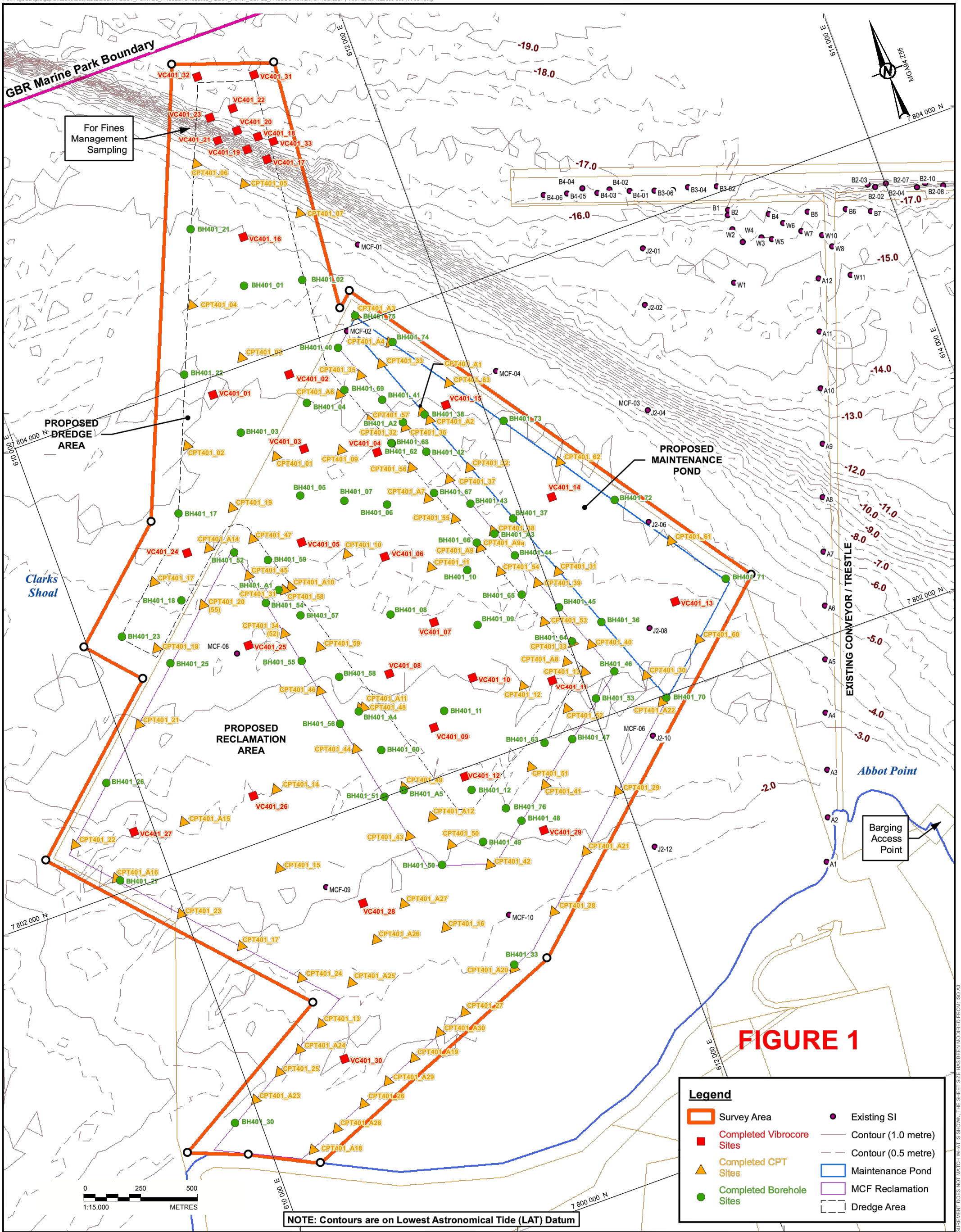
## REFERENCES

- GHD. 2012a. Abbot Point Multi Cargo Facility - Offshore Geotechnical Investigations - Factual Geotechnical Report, May 2012, Report No. 41-23408-C-RP-003 Rev. 2
- GHD. 2012b. Hancock Wharf and Trestle - Offshore Geotechnical Investigation Factual Geotechnical Report, May 2012, Report No.: 41-23408-C-RP-004 Rev.0
- GHD. 2012c. Abbot Point, Terminals 0, 2 and 3 Capital Dredging Sediment Sampling and Analysis Plan Implementation Report, GHD July 2012.

PKS/RDM/ps

Attachments: Figure 1 – Vibrocore Locations  
Figure 2 – Soil Core Locations  
Table 1 – Summary of Acid Sulfate Test Results  
Table 2 – Summary of Historical Acid Sulfate Test Results T0, T2 and T3 Aprons  
Attachment 1 – Sample Photographs  
Attachment 2 – Laboratory Certificates

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**FIGURE 1**

REFERENCE(S)  
 BASE MAP TAKEN FROM GHD DRAWING 41-23408\_006\_marineGeophysWorks\_BH\_CPT\_revX.mxd  
 DATED 2011-12-01 : Abbot Point Multi Cargo Facility - Offshore Geotechnical Investigations - Factual  
 Geotechnical Report, May 2012, Report No. 41-23408-C-RP-003 Rev. 2

CLIENT  
 DEPARTMENT OF STATE DEVELOPMENT

PROJECT  
 ABBOT POINT GROWTH GATEWAY PROJECT  
 DREDGED MATERIAL CONTAINMENT PONDS

CONSULTANT

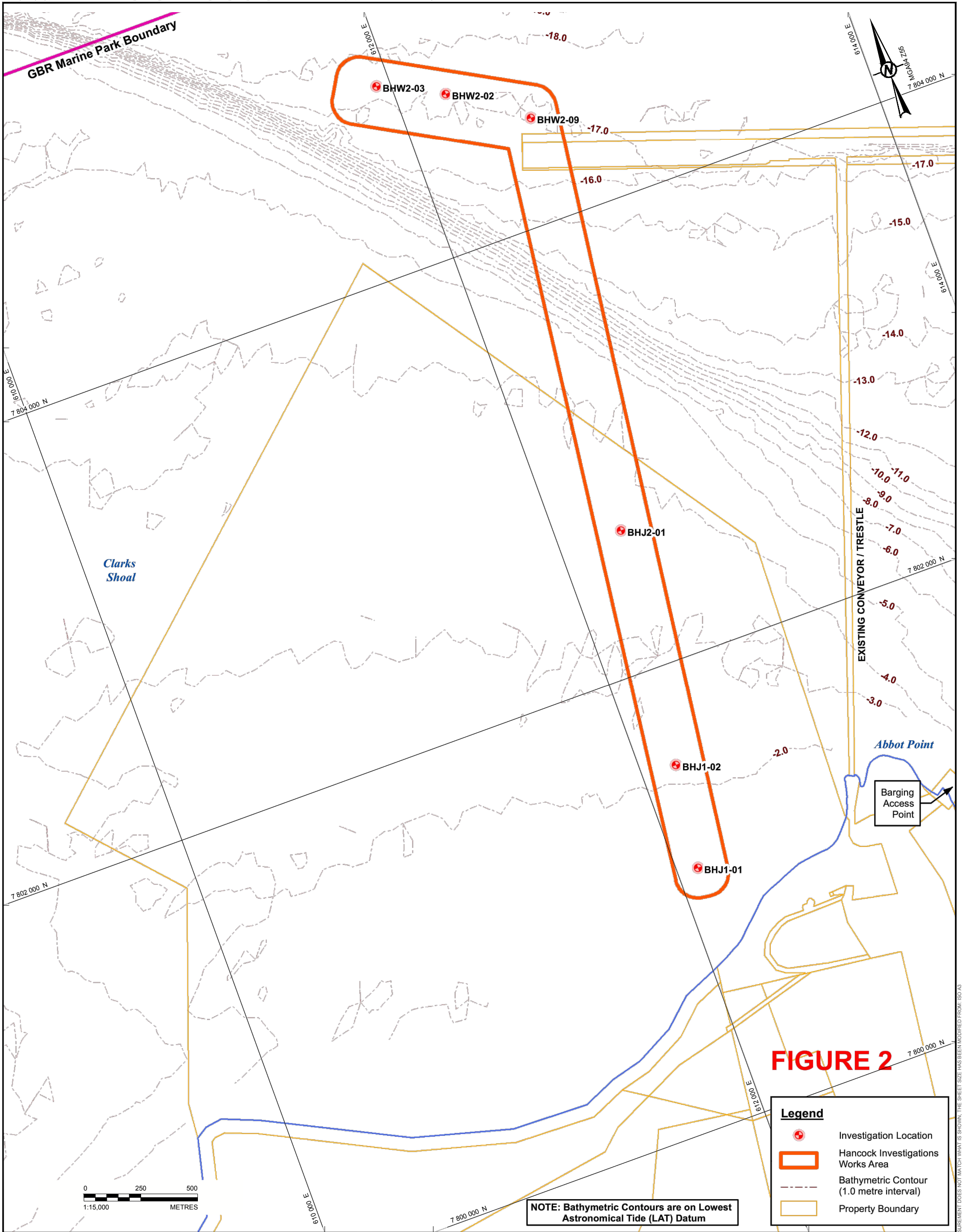
YYYY-MM-DD 2015-08-06  
 DESIGNED GPG  
 PREPARED DCR  
 REVIEWED AMB  
 APPROVED RDM

TITLE  
**INVESTIGATION HOLES WORKS, COMPLETED 01 DEC 2011**



PROJECT NO. 1525905      DOC No. 060      REV. 0      FIGURE F001

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3



**REFERENCE(S)**  
 BASE MAP TAKEN FROM GHD DRAWING 41-23408\_019\_Geophys\_Hancock\_BHs\_revA.mxd  
 DATED 2012-03-26 : Hancock Wharf and Trestle - Offshore Geotechnical Investigation Factual  
 Geotechnical Report, May 2012, Report No.: 41-23408-C-RP-004 Rev.0

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**PROJECT**  
 ABBOT POINT GROWTH GATEWAY PROJECT  
 DREDGED MATERIAL CONTAINMENT PONDS

**CONSULTANT**



YYYY-MM-DD 2015-06-08  
 DESIGNED GPG  
 PREPARED DCR  
 REVIEWED AMB  
 APPROVED RDM

**TITLE**  
 GEOTECHNICAL INVESTIGATION LOCATIONS

PROJECT NO.  
 1525905

DOC No.  
 060

REV.  
 0

FIGURE  
 F002

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ISO A3

Table 1: Summary of 2011 and 2015 Acid Sulfate Test Results

Test Location	Depth Range (m - BGL)	Material Description	pH <sub>FIELD</sub> (GHD, 2012a)	pH <sub>FOX</sub> (GHD, 2012a)	pH <sub>KCl</sub> 2015 (Golder)	sTAA Converted to %S*	S <sub>NAS</sub> (if pH less than 4.5)	Existing Acidity %S (sTAA + 0.75 x S <sub>NAS</sub> )	Chromium Reducible Sulfur (S <sub>CR</sub> ) %S	Acid Neutralising Capacity %CaCO <sub>3</sub> (if pH more than 6.5)	Net Acidity %S (S <sub>CR</sub> +Existing Acidity - ANC/FF)	Is This AASS	Is This PASS	Liming Rate for Net Acidity (kg/m <sup>3</sup> )	Liming Rate for Net Acidity Ignoring ANC (kg/m <sup>3</sup> )
VC401-18	0.00 0.10	Sand (Marine)	9.10	7.20											
VC401-18	0.40 0.50	Sand (Marine)	9.20	6.90											
VC401-18	0.90 1.00	Sand (Marine)	9.20	6.80											
VC401-18	1.40 1.50	Sand (Marine)	9.20	7.60											
<b>VC401-18</b>	<b>1.70 1.80</b>	Sand (Marine)			<b>9.1</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.153</b>	<b>24.3</b>	<b>-2.442</b>	<b>No</b>	<b>YES</b>	<b>No Additional Lime Required</b>	<b>11.6</b>
VC401-18	1.90 2.00	Sand (Marine)	9.20	8.20											
VC401-18	2.40 2.50	Silty SAND (Marine)	9.40	5.20											
VC401-18	2.90 3.00	Clayey SAND (Residual)	9.50	7.00											
VC401-18	3.40 3.50	Clayey SAND (Residual)	9.30	9.30											
<b>VC401-18</b>	<b>3.60 3.70</b>	Clayey SAND (Residual)			<b>9.3</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>&lt; 0.005</b>	<b>42.8</b>	<b>-4.571</b>	<b>No</b>	<b>No</b>	<b>NA</b>	<b>NA</b>
VC401-18	3.90 4.00	Sandy gravely CLAY	9.30	9.80											
VC401-18	4.40 4.50	Sandy gravely CLAY	9.20	9.60											
<b>VC401-18</b>	<b>4.50 4.90</b>	Sandy gravely CLAY			<b>9.1</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.005</b>	<b>34.7</b>	<b>-3.706</b>	<b>No</b>	<b>No</b>	<b>NA</b>	<b>NA</b>
VC401-18	4.90 5.00	Sandy gravely CLAY	9.20	9.60											
VC401-18	5.25 5.35	Sandy CLAY	8.90	5.80											
<b>VC401-20</b>	<b>3.70 3.80</b>	Clayey SAND (Residual)			<b>9.3</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>&lt; 0.005</b>	<b>45.2</b>	<b>-4.828</b>	<b>No</b>	<b>No</b>	<b>NA</b>	<b>NA</b>
VC401-22	0.00 0.10	Clayey SAND (marine)	9.00	6.90											
VC401-22	0.40 0.50	Clayey SAND (marine)	9.20	6.80											
VC401-22	0.90 1.00	Clayey SAND (marine)	9.20	7.10											
VC401-22	1.40 1.50	Clayey SAND (marine)	9.10	6.80											
<b>VC401-22</b>	<b>1.60 1.70</b>	Clayey SAND (marine)			<b>9.1</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.116</b>	<b>1.36</b>	<b>-0.029</b>	<b>No</b>	<b>YES</b>	<b>No Additional Lime Required</b>	<b>8.8</b>
VC401-22	1.90 2.00	Clayey SAND (marine)	8.90	6.70											
VC401-22	2.40 2.50	Clayey SAND (marine)	9.30	6.80											
<b>VC401-22</b>	<b>2.70 2.90</b>	Clayey SAND (Residual)			<b>9.3</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>&lt; 0.005</b>	<b>36.4</b>	<b>-3.888</b>	<b>No</b>	<b>No</b>	<b>NA</b>	<b>NA</b>
VC401-22	2.90 3.00	Clayey SAND (Residual)	8.80	6.80											
VC401-22	3.40 3.50	Clayey SAND (Residual)	8.70	9.20											
<b>VC401-22</b>	<b>3.50 3.90</b>	Clayey SAND (Residual)			<b>9.3</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>&lt; 0.005</b>	<b>40.8</b>	<b>-4.358</b>	<b>No</b>	<b>No</b>	<b>NA</b>	<b>NA</b>
VC401-22	3.90 4.00	Clayey SAND (Residual)	8.80	9.50											
VC401-22	4.40 4.45	Clayey SAND (Residual)	9.00	6.60											
VC401-23B	0.00 0.10	Clayey SAND (marine)	9.00	6.90											
<b>VC401-23B</b>	<b>0.20 0.30</b>	Clayey SAND (marine)			<b>9.4</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.047</b>	<b>29.7</b>	<b>-3.125</b>	<b>No</b>	<b>YES</b>	<b>No Additional Lime Required</b>	<b>3.6</b>
VC401-23B	0.40 0.50	Clayey SAND (marine)	9.20	6.90											
VC401-23B	0.90 1.00	Clayey SAND (marine)	9.20	6.90											
VC401-23B	1.40 1.50	Clayey SAND (marine)	9.40	6.50											
VC401-23B	1.90 2.00	Sand	9.60	6.20											
<b>VC401-23B</b>	<b>2.10 2.40</b>	Clayey SAND (Residual)			<b>9.4</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.008</b>	<b>27.2</b>	<b>-2.905</b>	<b>No</b>	<b>No</b>	<b>NA</b>	<b>NA</b>
VC401-23B	2.40 2.50	Clayey SAND (Residual)	9.20	6.80											
VC401-23B	2.90 3.00	Sandy CLAY (residual)	9.20	6.70											
VC401-31A	0.00 0.10	Clayey SAND (marine)	9.10	7.30											
VC401-31A	0.40 0.50	Clayey SAND (marine)	8.80	7.00											

Table 1: Summary of 2011 and 2015 Acid Sulfate Test Results (continued)

Test Location	Depth Range (m - BGL)	Material Description	pH <sub>FIELD</sub> (GHD, 2012a)	pH <sub>FOX</sub> (GHD, 2012a)	pH <sub>KCl</sub> 2015 (Golder)	sTAA Converted to %S*	S <sub>NAS</sub> (if pH less than 4.5)	Existing Acidity %S (sTAA + 0.75 x S <sub>NAS</sub> )	Chromium Reducible Sulfur (S <sub>CR</sub> ) %S	Acid Neutralising Capacity %CaCO <sub>3</sub> (if pH more than 6.5)	Net Acidity %S (S <sub>CR</sub> +Existing Acidity - ANC/FF)	Is This AASS	Is This PASS	Liming Rate for Net Acidity (kg/m <sup>3</sup> )	Liming Rate for Net Acidity Ignoring ANC (kg/m <sup>3</sup> )
<b>VC401-31A</b>	<b>0.60 0.70</b>	Clayey SAND (marine)			<b>9.1</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.119</b>	<b>16.5</b>	<b>-1.643</b>	<b>No</b>	<b>YES</b>	<b>No Additional Lime Required</b>	<b>9.0</b>
VC401-31A	0.90 1.00	Clayey SAND (marine)	9.10	6.90											
VC401-31A	1.40 1.50	Clayey SAND (Residual)	8.90	6.80											
<b>VC401-31A</b>	<b>1.60 1.70</b>	Clayey SAND (Residual)			<b>9.4</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.025</b>	<b>35.8</b>	<b>-3.824</b>	<b>No</b>	<b>No</b>	<b>NA</b>	<b>NA</b>
VC401-31A	1.90 2.00	Clayey SAND (Residual)	9.30	6.90											
VC401-31A	2.40 2.50	Clayey SAND (Residual)	9.20	7.00											
VC401-31A	2.90 3.00	Clayey SAND (Residual)	8.60	8.80											
VC401-31A	3.40 3.50	Clayey SAND (Residual)	8.90	9.50											
VC401-31A	3.90 4.00	Clayey SAND (Residual)	8.90	9.60											
VC401-32	0.00 0.10	Clayey SAND (marine)	9.00	6.90											
VC401-32	0.40 0.50	Clayey SAND (marine)	9.00	6.90											
<b>VC401-32</b>	<b>0.70 0.80</b>	Clayey SAND (marine)			<b>9.4</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.056</b>	<b>26.4</b>	<b>-2.764</b>	<b>No</b>	<b>YES</b>	<b>No Additional Lime Required</b>	<b>4.2</b>
VC401-32	0.90 1.00	Clayey SAND (marine)	9.00	6.80											
VC401-32	1.40 1.50	Clayey SAND (marine)	9.20	7.00											
<b>VC401-32</b>	<b>1.60 1.70</b>	Clayey SAND (marine)			<b>9.3</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.048</b>	<b>25.6</b>	<b>-2.686</b>	<b>No</b>	<b>YES</b>	<b>No Additional Lime Required</b>	<b>3.6</b>
VC401-32	1.90 2.00	Sand	9.20	6.80											
VC401-32	2.40 2.50	Sand	9.00	6.70											
VC401-32	2.90 3.00	Clayey SAND (Residual)	9.10	7.10											
<b>VC401-32</b>	<b>3.20 3.30</b>	Clayey SAND (Residual)			<b>9.4</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.029</b>	<b>47.6</b>	<b>-5.084</b>	<b>No</b>	<b>No</b>	<b>NA</b>	<b>NA</b>
VC401-32	3.40 3.50	Clayey SAND (Residual)	9.20	7.10											
VC401-32	3.90 4.00	Clayey SAND (Residual)	9.20	7.10											
VC401-32	4.40 4.50	Clayey SAND (Residual)	8.90	6.00											
VC401-33	0.00 0.10	Clayey SAND (marine)	8.90	7.00											
VC401-33	0.40 0.50	Clayey SAND (marine)	9.10	6.90											
<b>VC401-33</b>	<b>0.50 0.90</b>	Clayey SAND (marine)			<b>9.4</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.072</b>	<b>31.9</b>	<b>-3.335</b>	<b>No</b>	<b>YES</b>	<b>No Additional Lime Required</b>	<b>5.4</b>
VC401-33	0.90 1.00	Clayey SAND (marine)	9.20	7.00											
VC401-33	1.40 1.50	Clayey SAND (marine)	9.00	6.90											
<b>VC401-33</b>	<b>1.70 1.80</b>	Clayey SAND (marine)			<b>9.2</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.140</b>	<b>25.8</b>	<b>-2.616</b>	<b>No</b>	<b>YES</b>	<b>No Additional Lime Required</b>	<b>10.6</b>
VC401-33	1.90 2.00	Clayey SAND (marine)	9.10	7.20											
VC401-33	2.40 2.50	Clayey SAND (marine)	9.60	6.70											
<b>VC401-33</b>	<b>2.70 2.80</b>	Clayey SAND (marine)			<b>9.5</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.052</b>	<b>2.39</b>	<b>-0.203</b>	<b>No</b>	<b>YES</b>	<b>No Additional Lime Required</b>	<b>3.9</b>
VC401-33	2.90 3.00	Clayey SAND (marine)	9.60	6.80											
VC401-33	3.40 3.50	Clayey SAND (Residual)	9.20	6.90											
VC401-33	3.90 4.00	Clayey SAND (Residual)	9.00	7.30											
VC401-33	4.40 4.50	Clayey SAND (Residual)	9.00	7.10											
VC401-33	4.90 5.00	Clayey SAND (Residual)	8.90	9.70											
<b>BHW2-02</b>	<b>0.95 0.99</b>	<b>Stiff CLAY</b>			<b>9.50</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.007</b>	<b>47.8</b>	<b>-5.098</b>	<b>No</b>	<b>No</b>	<b>NA</b>	<b>NA</b>
<b>BHW2-03</b>	<b>0.95 1.00</b>	<b>Stiff Sandy CLAY/Clayey SAND</b>			<b>9.30</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.005</b>	<b>48.8</b>	<b>-5.207</b>	<b>No</b>	<b>No</b>	<b>NA</b>	<b>NA</b>
<b>BHW2-09</b>	<b>1.06 1.10</b>	<b>Clayey SAND (marine)</b>			<b>9.10</b>	<b>&lt; 0.020</b>		<b>0.000</b>	<b>0.04</b>	<b>19</b>	<b>-1.989</b>	<b>No</b>	<b>YES</b>	<b>No Additional Lime Required</b>	<b>3.0</b>

Input By: SB  
Date: 27/07/2015  
Checked By: PS  
Date: 27/07/2015

Note: Liming rates assume a bulk density of 1.60 t/m<sup>3</sup>  
Fineness Factor = 3  
**Bold** text is from Golder 2015 testing  
Regular text is from GHD, 2012a  
BHW2 series samples are from GHD, 2012b

Statistical Summary		Chromium Reducible Sulfur (%S)	Net Acidity (%S)	Liming Treatment Rate excluding ANC (kg lime/m <sup>3</sup> )
<b>Marine Sediment Statistical Summary MCF</b>				
Sample count	9		9	9
Average concentration	0.089		-3.059	6.7
minimum concentration	0.047		-5.084	3.6
maximum concentration	0.153		-0.029	11.6
standard deviation	0.043		1.439	3.2
95% UCL of Mean	0.117		-2.119	8.9





**Table 2: Summary of Historical Acid Sulfate Test Results T0, T2 & T3 Aprons (continue)**

Test Location	Material Description	pH <sub>KCl</sub>	sTAA (%S)	S <sub>NAS</sub> (if pH less than 4.5)	Existing Acidity %S (sTAA + 0.75 x S <sub>NAS</sub> )	Chromium Reducible Sulfur (S <sub>CR</sub> ) %S	Acid Neutralising Capacity %CaCO <sub>3</sub> (if pH more than 6.5)	Net Acidity %S (S <sub>CR</sub> +Existing Acidity - ANC/FF)	Is This AASS	Is This PASS	Liming Rate for Net Acidity (kg/m3)	Liming Rate for Net Acidity Ignoring ANC (kg/m3)
<b>T2 Apron Dredging Area</b>												
SC01-1	Marine Sediment	9.3	< 0.020		0.000	0.146	22.6	-2.268	No	YES	No Additional Lime Required	9.0
SC01-2	Marine Sediment	9.2	< 0.020		0.000	0.128	8.72	-0.803	No	YES	No Additional Lime Required	7.9
SC01-3	Marine Sediment	9.1	< 0.020		0.000	0.116	3.18	-0.224	No	YES	No Additional Lime Required	7.1
SC01-4	Marine Sediment	9.3	< 0.020		0.000	0.022	1.58	-0.147	No	No	NA	NA
SC24-1	Marine Sediment	9.2	< 0.020		0.000	0.198	24.7	-2.440	No	YES	No Additional Lime Required	12.2
SC24-2	Marine Sediment	9.3	< 0.020		0.000	0.285	23.1	-2.182	No	YES	No Additional Lime Required	17.5
SC24-3	Marine Sediment	9.1	< 0.020		0.000	0.069	5.87	-0.558	No	YES	No Additional Lime Required	4.2
SC24-4	Marine Sediment	9.3	< 0.020		0.000	0.04	1.93	-0.166	No	YES	No Additional Lime Required	2.5
SC24-5	Marine Sediment	9.3	< 0.020		0.000	0.054	0.94	-0.046	No	YES	No Additional Lime Required	3.3
SC24-6	Marine Sediment	9.3	< 0.020		0.000	0.032	25	-2.638	No	YES	No Additional Lime Required	2.0
SC27-1	Marine Sediment	9.2	< 0.020		0.000	0.118	23.8	-2.424	No	YES	No Additional Lime Required	7.2
SC27-2	Marine Sediment	9.2	< 0.020		0.000	0.148	22.1	-2.212	No	YES	No Additional Lime Required	9.1
SC27-3	Marine Sediment	9.3	< 0.020		0.000	0.049	18.3	-1.906	No	YES	No Additional Lime Required	3.0
SC27-4	Marine Sediment	9.3	< 0.020		0.000	0.093	2.9	-0.217	No	YES	No Additional Lime Required	5.7
SC27-5	Marine Sediment	9.4	< 0.020		0.000	0.089	3.69	-0.305	No	YES	No Additional Lime Required	5.5
SC28-1	Marine Sediment	9.3	< 0.020		0.000	0.097	24.4	-2.509	No	YES	No Additional Lime Required	6.0
SC28-2	Marine Sediment	9.2	< 0.020		0.000	0.107	11.3	-1.100	No	YES	No Additional Lime Required	6.6
SC28-3	Marine Sediment	9.3	< 0.020		0.000	0.118	11.4	-1.100	No	YES	No Additional Lime Required	7.2
SC29-1	Marine Sediment	9.4	< 0.020		0.000	0.114	30.4	-3.133	No	YES	No Additional Lime Required	7.0
SC29-2	Marine Sediment	9.4	< 0.020		0.000	0.195	21.2	-2.069	No	YES	No Additional Lime Required	12.0
SC29-3	Marine Sediment	9.3	< 0.020		0.000	0.038	8.79	-0.901	No	YES	No Additional Lime Required	2.3
SC29-4	Marine Sediment	9.4	< 0.020		0.000	0.038	1.15	-0.085	No	YES	No Additional Lime Required	2.3
SC29-5	Marine Sediment	9.5	< 0.020		0.000	0.073	2.05	-0.146	No	YES	No Additional Lime Required	4.5
SC29-6	Marine Sediment	9.4	< 0.020		0.000	0.088	7.88	-0.754	No	YES	No Additional Lime Required	5.4
SC30-1	Marine Sediment	9.4	< 0.020		0.000	0.114	29.2	-3.005	No	YES	No Additional Lime Required	7.0
SC30-2	Marine Sediment	9.3	< 0.020		0.000	0.176	14.1	-1.330	No	YES	No Additional Lime Required	10.8
SC30-3	Marine Sediment	9.3	< 0.020		0.000	0.173	16.5	-1.589	No	YES	No Additional Lime Required	10.6
SC30-4	Marine Sediment	9.4	< 0.020		0.000	0.186	29.4	-2.954	No	YES	No Additional Lime Required	11.4
SC31-1	Marine Sediment	9.4	< 0.020		0.000	0.094	23.7	-2.437	No	YES	No Additional Lime Required	5.8
SC31-2	Marine Sediment	9.3	< 0.020		0.000	0.2	20.6	-2.000	No	YES	No Additional Lime Required	12.3
SC31-3	Marine Sediment	9.1	< 0.020		0.000	0.295	7.4	-0.495	No	YES	No Additional Lime Required	18.1
SC31-4	Marine Sediment	9.2	< 0.020		0.000	0.198	33.3	-3.359	No	YES	No Additional Lime Required	12.2
SC32-1	Marine Sediment	9.4	< 0.020		0.000	0.128	29.7	-3.044	No	YES	No Additional Lime Required	7.9
SC32-2	Marine Sediment	9.4	< 0.020		0.000	0.229	22.3	-2.153	No	YES	No Additional Lime Required	14.1
SC32-3	Marine Sediment	9.3	< 0.020		0.000	0.189	19.9	-1.936	No	YES	No Additional Lime Required	11.6
SC32-4	Marine Sediment	9.5	< 0.020		0.000	0.069	34.3	-3.594	No	YES	No Additional Lime Required	4.2
SC33-1	Marine Sediment	9.4	< 0.020		0.000	0.134	29.3	-2.995	No	YES	No Additional Lime Required	8.2
SC33-2	Marine Sediment	9.4	< 0.020		0.000	0.138	29	-2.959	No	YES	No Additional Lime Required	8.5
SC33-3	Marine Sediment	9.4	< 0.020		0.000	0.051	40.9	-4.317	No	YES	No Additional Lime Required	3.1
SC34-1	Marine Sediment	9.4	< 0.020		0.000	0.174	28.5	-2.870	No	YES	No Additional Lime Required	10.7
SC34-2	Marine Sediment	9.4	< 0.020		0.000	0.166	33.9	-3.455	No	YES	No Additional Lime Required	10.2
SC34-3	Marine Sediment	9.4	< 0.020		0.000	0.045	38.9	-4.110	No	YES	No Additional Lime Required	2.8
SC35-1	Marine Sediment	9.4	< 0.020		0.000	0.15	30	-3.054	No	YES	No Additional Lime Required	9.2
SC35-2	Marine Sediment	9.4	< 0.020		0.000	0.256	23.1	-2.211	No	YES	No Additional Lime Required	15.7
SC35-3	Marine Sediment	9.5	< 0.020		0.000	0.157	34.2	-3.496	No	YES	No Additional Lime Required	9.6
SC35-4	Marine Sediment	9.6	< 0.020		0.000	0.068	43.1	-4.535	No	YES	No Additional Lime Required	4.2
SC36-1	Marine Sediment	9.4	< 0.020		0.000	0.159	23.2	-2.319	No	YES	No Additional Lime Required	9.8
SC36-2	Marine Sediment	9.4	< 0.020		0.000	0.222	23.2	-2.256	No	YES	No Additional Lime Required	13.6
SC36-3	Marine Sediment	9.4	< 0.020		0.000	0.153	31.1	-3.169	No	YES	No Additional Lime Required	9.4
SC36-4	Marine Sediment	9.5	< 0.020		0.000	0.087	43.3	-4.538	No	YES	No Additional Lime Required	5.3
SC37-1	Marine Sediment	9.3	< 0.020		0.000	0.234	23.1	-2.233	No	YES	No Additional Lime Required	14.4
SC37-2	Marine Sediment	9.3	< 0.020		0.000	0.226	23.1	-2.241	No	YES	No Additional Lime Required	13.9
SC37-3	Marine Sediment	9.2	< 0.020		0.000	0.135	18.2	-1.809	No	YES	No Additional Lime Required	8.3
SC40-1	Marine Sediment	9.4	< 0.020		0.000	0.096	23.5	-2.414	No	YES	No Additional Lime Required	5.9
SC40-2	Marine Sediment	9.3	< 0.020		0.000	0.153	23.5	-2.357	No	YES	No Additional Lime Required	9.4
SC40-3	Marine Sediment	9.2	< 0.020		0.000	0.146	30.6	-3.122	No	YES	No Additional Lime Required	9.0
SC42-1	Marine Sediment	9.3	< 0.020		0.000	0.164	22.3	-2.218	No	YES	No Additional Lime Required	10.1
SC42-2	Marine Sediment	9.2	< 0.020		0.000	0.264	21.8	-2.064	No	YES	No Additional Lime Required	16.2
SC43-1	Marine Sediment	9.4	< 0.020		0.000	0.109	23.3	-2.380	No	YES	No Additional Lime Required	6.7
SC43-2	Marine Sediment	9.3	< 0.020		0.000	0.229	23.4	-2.270	No	YES	No Additional Lime Required	14.1
SC43-3	Marine Sediment	9.2	< 0.020		0.000	0.253	23.1	-2.214	No	YES	No Additional Lime Required	15.5
SC44-1	Marine Sediment	9.3	< 0.020		0.000	0.123	33.6	-3.466	No	YES	No Additional Lime Required	7.6
SC44-2	Marine Sediment	9.2	< 0.020		0.000	0.23	32.8	-3.273	No	YES	No Additional Lime Required	14.1
SC44-3	Marine Sediment	9.3	< 0.020		0.000	0.053	55.1	-5.832	No	YES	No Additional Lime Required	3.3
SC46-1	Marine Sediment	9.4	< 0.020		0.000	0.096	34.5	-3.589	No	YES	No Additional Lime Required	5.9
SC46-2	Marine Sediment	9.3	< 0.020		0.000	0.141	32	-3.277	No	YES	No Additional Lime Required	8.7
SC46-3	Marine Sediment	9.3	< 0.020		0.000	0.199	21.7	-2.119	No	YES	No Additional Lime Required	12.2
SC47-1	Marine Sediment	9.3	< 0.020		0.000	0.139	23.1	-2.328	No	YES	No Additional Lime Required	8.5
SC47-2	Marine Sediment	9.2	< 0.020		0.000	0.28	22.2	-2.091	No	YES	No Additional Lime Required	17.2
SC47-3	Marine Sediment	9.1	< 0.020		0.000	0.309	16.8	-1.485	No	YES	No Additional Lime Required	19.0
SC48-1	Marine Sediment	9.4	< 0.020		0.000	0.097	23.4	-2.402	No	YES	No Additional Lime Required	6.0
SC48-2	Marine Sediment	9.2	< 0.020		0.000	0.257	21.5	-2.039	No	YES	No Additional Lime Required	15.8
SC48-3	Marine Sediment	9.1	< 0.020		0.000	0.276	10.5	-0.845	No	YES	No Additional Lime Required	17.0
SC49-1	Marine Sediment	9.4	< 0.020		0.000	0.101	32.9	-3.413	No	YES	No Additional Lime Required	6.2
SC49-2	Marine Sediment	9.4	< 0.020		0.000	0.143	33.2	-3.403	No	YES	No Additional Lime Required	8.8
SC50-1	Marine Sediment	9.5	< 0.020		0.000	0.087	32.7	-3.405	No	YES	No Additional Lime Required	5.3
SC50-2	Marine Sediment	9.3	< 0.020		0.000	0.186	34.2	-3.467	No	YES	No Additional Lime Required	11.4
SC51-1	Marine Sediment	9.3	< 0.020		0.000	0.119	33.8	-3.491	No	YES	No Additional Lime Required	7.3
SC51-2	Marine Sediment	9.2	< 0.020		0.000	0.217	33.6	-3.372	No	YES	No Additional Lime Required	13.3
SC52-1	Marine Sediment	9.4	< 0.020		0.000	0.083	45.1	-4.734	No	YES	No Additional Lime Required	5.1
SC52-2	Marine Sediment	9.3	< 0.020		0.000	0.151	47	-4.869	No	YES	No Additional Lime Required	9.3
SC53-1	Marine Sediment	9.3	< 0.020		0.000	0.104	34.2	-3.549	No	YES	No Additional Lime Required	6.4
SC54-1	Marine Sediment	9.4	< 0.020		0.000	0.089	34.8	-3.628	No	YES	No Additional Lime Required	5.5
SC54-2	Marine Sediment	9.3	< 0.020		0.000	0.174	33.4	-3.393	No	YES	No Additional Lime Required	10.7
SC55-1	Marine Sediment	9.3	< 0.020		0.000	0.081	26.2	-2.717	No	YES	No Additional Lime Required	5.0
SC57-1	Marine Sediment	9.4	< 0.020		0.000	0.171	21.2	-2.093	No	YES	No Additional Lime Required	10.5
SC57-2	Marine Sediment	9	< 0.020		0.000	0.285	3.96	-0.138	No	YES	No Additional Lime Required	17.5

Table 2: Summary of Historical Acid Sulfate Test Results T0, T2 & T3 Aprons (continue)



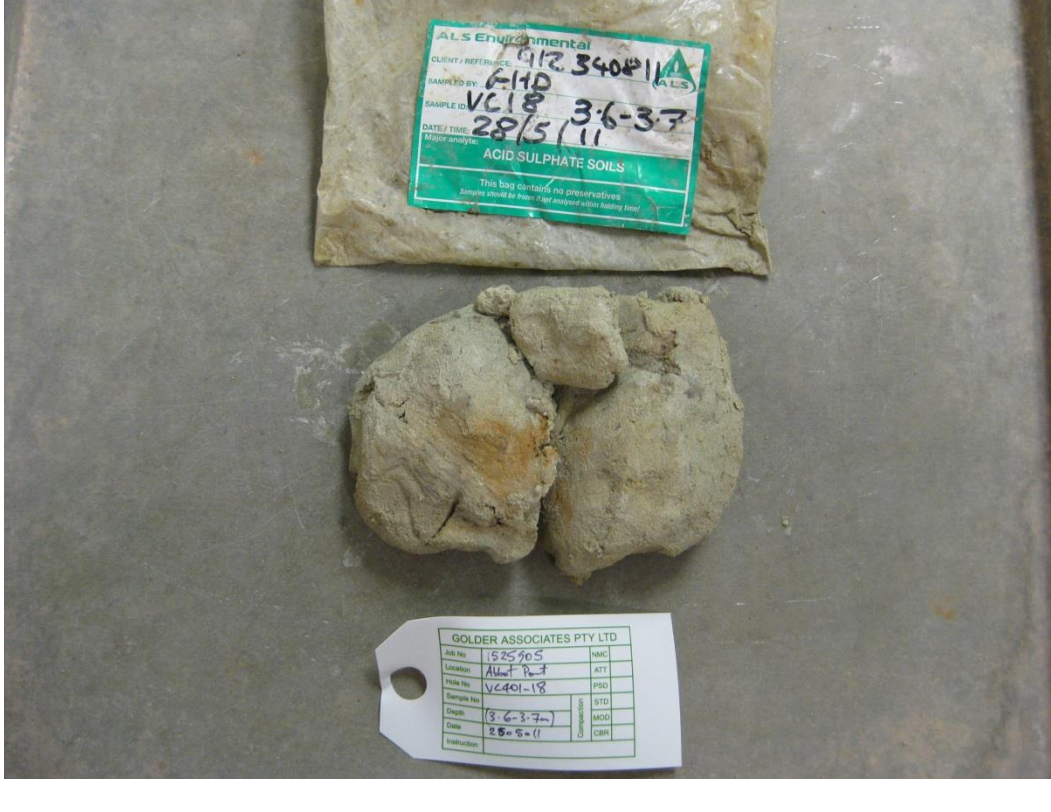
Test Location	Material Description	pH <sub>KCl</sub>	sTAA (%S)	S <sub>NAS</sub> (if pH less than 4.5)	Existing Acidity %S (sTAA + 0.75 x S <sub>NAS</sub> )	Chromium Reducible Sulfur (S <sub>CR</sub> ) %S	Acid Neutralising Capacity %CaCO <sub>3</sub> (if pH more than 6.5)	Net Acidity %S (S <sub>CR</sub> +Existing Acidity - ANC/FF)	Is This AASS	Is This PASS	Liming Rate for Net Acidity (kg/m <sup>3</sup> )	Liming Rate for Net Acidity Ignoring ANC (kg/m <sup>3</sup> )
<b>T0 Apron Dredging Area</b>												
SC58-1	Marine Sediment	9.2	< 0.020		0.000	0.142	23.1	-2.325	No	YES	No Additional Lime Required	8.7
SC58-2	Marine Sediment	9.3	< 0.020		0.000	0.195	29.8	-2.988	No	YES	No Additional Lime Required	12.0
SC58-3	Marine Sediment	9.2	< 0.020		0.000	0.231	29.4	-2.909	No	YES	No Additional Lime Required	14.2
SC59-1	Marine Sediment	9.4	< 0.020		0.000	0.091	30.6	-3.177	No	YES	No Additional Lime Required	5.6
SC59-2	Marine Sediment	9.4	< 0.020		0.000	0.144	30	-3.060	No	YES	No Additional Lime Required	8.8
SC59-3	Marine Sediment	9.3	< 0.020		0.000	0.209	29.2	-2.910	No	YES	No Additional Lime Required	12.8
SC59-4	Marine Sediment	9.3	< 0.020		0.000	0.266	22.4	-2.126	No	YES	No Additional Lime Required	16.3
SC59-5	Marine Sediment	9.1	< 0.020		0.000	0.262	17.6	-1.618	No	YES	No Additional Lime Required	16.1
SC60-1	Marine Sediment	9.4	< 0.020		0.000	0.068	31.3	-3.275	No	YES	No Additional Lime Required	4.2
SC60-2	Marine Sediment	9.3	< 0.020		0.000	0.188	31.6	-3.187	No	YES	No Additional Lime Required	11.6
SC60-3	Marine Sediment	9.1	< 0.020		0.000	0.200	21.7	-2.118	No	YES	No Additional Lime Required	12.3
SC61-1	Marine Sediment	9.4	< 0.020		0.000	0.126	31.8	-3.270	No	YES	No Additional Lime Required	7.7
SC61-2	Marine Sediment	9.2	< 0.020		0.000	0.200	21.7	-2.118	No	YES	No Additional Lime Required	12.3
SC62-1	Marine Sediment	9.4	< 0.020		0.000	0.080	33.4	-3.487	No	YES	No Additional Lime Required	4.9
SC62-2	Marine Sediment	9.3	< 0.020		0.000	0.141	33.6	-3.448	No	YES	No Additional Lime Required	8.7
SC62-3	Marine Sediment	9.2	< 0.020		0.000	0.210	23	-2.246	No	YES	No Additional Lime Required	12.9
SC63-1	Marine Sediment	9.3	< 0.020		0.000	0.190	32.3	-3.260	No	YES	No Additional Lime Required	11.7
SC63-2	Marine Sediment	9.4	< 0.020		0.000	0.108	33.2	-3.438	No	YES	No Additional Lime Required	6.6
SC64-1	Marine Sediment	9.4	< 0.020		0.000	0.069	34.1	-3.573	No	YES	No Additional Lime Required	4.2
SC64-2	Marine Sediment	9.3	< 0.020		0.000	0.191	33.3	-3.366	No	YES	No Additional Lime Required	11.7
SC65-1	Marine Sediment	8.9	< 0.020		0.000	0.226	7.04	-0.526	No	YES	No Additional Lime Required	13.9
SC66-1	Marine Sediment	9.1	< 0.020		0.000	0.088	10.4	-1.023	No	YES	No Additional Lime Required	5.4
SC67-1	Marine Sediment	9.4	< 0.020		0.000	0.104	29.5	-3.047	No	YES	No Additional Lime Required	6.4
SC67-2	Marine Sediment	9.3	< 0.020		0.000	0.166	29.5	-2.985	No	YES	No Additional Lime Required	10.2
SC67-3	Marine Sediment	9.3	< 0.020		0.000	0.202	23.4	-2.297	No	YES	No Additional Lime Required	12.4
SC67-4	Marine Sediment	9.1	< 0.020		0.000	0.268	18.3	-1.687	No	YES	No Additional Lime Required	16.5
SC67-5	Marine Sediment	9.1	< 0.020		0.000	0.170	20.7	-2.041	No	YES	No Additional Lime Required	10.4
SC68-1	Marine Sediment	9.5	< 0.020		0.000	0.071	30.1	-3.144	No	YES	No Additional Lime Required	4.4
SC68-2	Marine Sediment	9.4	< 0.020		0.000	0.156	30	-3.048	No	YES	No Additional Lime Required	9.6
SC68-3	Marine Sediment	9.1	< 0.020		0.000	0.469	16.3	-1.272	No	YES	No Additional Lime Required	28.8
SC68-4	Marine Sediment	9	< 0.020		0.000	0.529	1.86	0.330	No	YES	20.3	32.5
SC69-1	Marine Sediment	9.4	< 0.020		0.000	0.076	27.6	-2.872	No	YES	No Additional Lime Required	4.7
SC69-2	Marine Sediment	9.4	< 0.020		0.000	0.169	29.2	-2.950	No	YES	No Additional Lime Required	10.4
SC69-3	Marine Sediment	9.3	< 0.020		0.000	0.216	23.1	-2.251	No	YES	No Additional Lime Required	13.3
SC69-4	Marine Sediment	9.1	< 0.020		0.000	0.273	14.8	-1.308	No	YES	No Additional Lime Required	16.8
SC69-5	Marine Sediment	8.9	< 0.020		0.000	0.270	3.69	-0.124	No	YES	No Additional Lime Required	16.6

Input By: SB  
Date: 27/7/15  
Checked: PS  
Date: 27/7/15



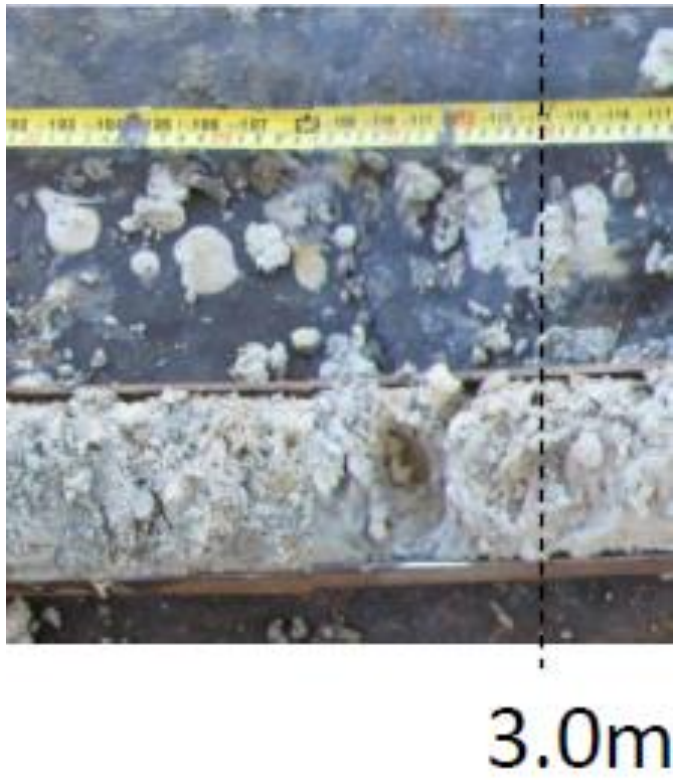

Note: \* Equivalent oxidisable sulfur calculated as TAA/30.59  
Liming rates assume a bulk density of 1.30 t/m<sup>3</sup>  
Fineness Factor = 3

	Chromium Reducible Sulfur (%S)	Net Acidity (%S)	Lime Treatment Rate excluding ANC (kg lime/m <sup>3</sup> )
<b>Statistical Summary</b>			
<b>Marine Sediment Summary T0 only</b>			
Sample count	36	36	36
Average concentration	0.188	-2.448	11.5
minimum concentration	0.068	-3.573	4.2
maximum concentration	0.529	0.330	32.5
standard deviation	0.099	0.995	6.1
95% UCL of Mean	0.220	-2.123	13.5
<b>Marine Sediment Summary T2 only</b>			
Sample count	87	87	86
Average concentration	0.146	-2.394	9.0
minimum concentration	0.022	-5.832	2.0
maximum concentration	0.309	-0.046	19.0
standard deviation	0.070	1.239	4.3
95% UCL of Mean	0.160	-2.133	9.9
<b>Marine Sediment Summary T3 only</b>			
Sample count	99	99	94
Average concentration	0.129	-2.807	8.3
minimum concentration	0.017	-6.060	2.5
maximum concentration	0.250	-0.278	15.4
standard deviation	0.059	1.161	3.4
95% UCL of Mean	0.140	-2.578	8.9
<b>Marine Sediment Summary T0, T2 and T3</b>			
Sample count	222	222	216
Average concentration	0.145	-2.587	9.1
minimum concentration	0.017	-6.060	2.0
maximum concentration	0.529	0.330	32.5
standard deviation	0.074	1.180	4.4
95% UCL of Mean	0.155	-2.432	9.7

## Attachment 1 – Sample Photographs

Sample Location	Material Type	Observations	Photographs	
			GHD 2011	Golder 2015
VC401_18 (1.7-1.8 m)	Marine Sediment	Minor iron staining near edge of sample where air may have entered degraded bag. Sample still relatively moist.	 <p style="text-align: right; font-size: 2em;">2.0m</p>	 <p style="text-align: right;">Iron Staining</p>
VC401_18 (3.6-3.7 m)	Alluvium/Residual Soil	Similar appearance to 2011 photo, but slightly drier.	 <p style="text-align: right; font-size: 2em;">4.0m</p>	





Sample Location	Material Type	Observations	Photographs	
			GHD 2011	Golder 2015
VC401_18 (4.5-4.9 m)	Alluvium/Residual Soil	Similar appearance to 2011 photo, but drier.	 <p style="text-align: center;">5.0m</p>	
VC401_20 (3.7-3.8 m)	Alluvium/Residual Soil	Similar appearance to 2011 photo, but drier.	 <p style="text-align: center;">3.95m</p>	

Sample Location	Material Type	Observations	Photographs	
			GHD 2011	Golder 2015
VC401_22 (1.6-1.7 m)	Marine Sediment	Minor iron staining. Sample still relatively moist.		 <div style="border: 1px solid black; padding: 2px;">Iron Staining</div>
VC401_22 (2.7-2.9 m)	Alluvium/Residual Soil	Similar appearance to 2011 photo, but drier.	 <div style="text-align: center; font-size: 24px;">3.0m</div>	

Sample Location	Material Type	Observations	Photographs	
			GHD 2011	Golder 2015
VC401_22 (3.5-3.9 m)	Alluvium/Residual Soil	Similar appearance to 2011 photo, but drier.		
VC401_23B (0.2-0.3 m)	Marine Sediment	Moderate iron staining. Sample remains relatively moist.		

Sample Location	Material Type	Observations	Photographs	
			GHD 2011	Golder 2015
VC401_23B (2.1-2.4 m)	Alluvium/Residual Soil	Some iron staining		
VC401_23B (2.8-2.9 m)	Alluvium/Residual Soil	Significant drying, some iron staining		



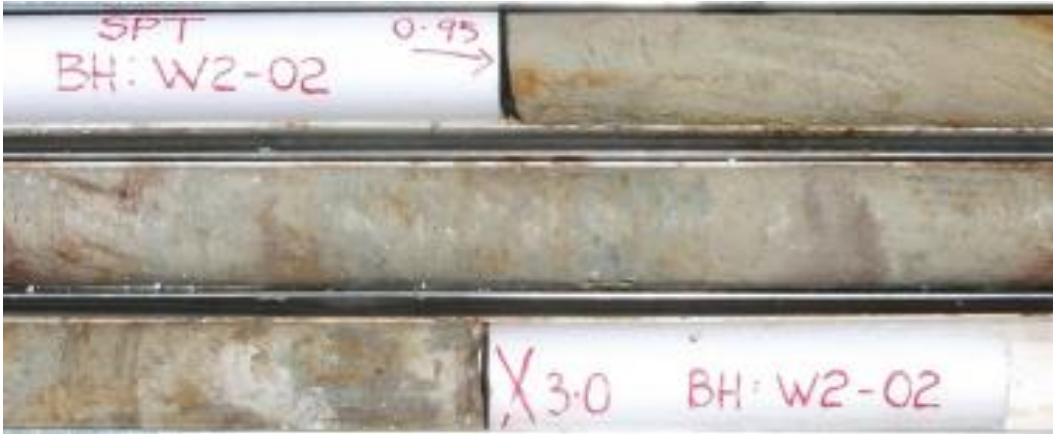

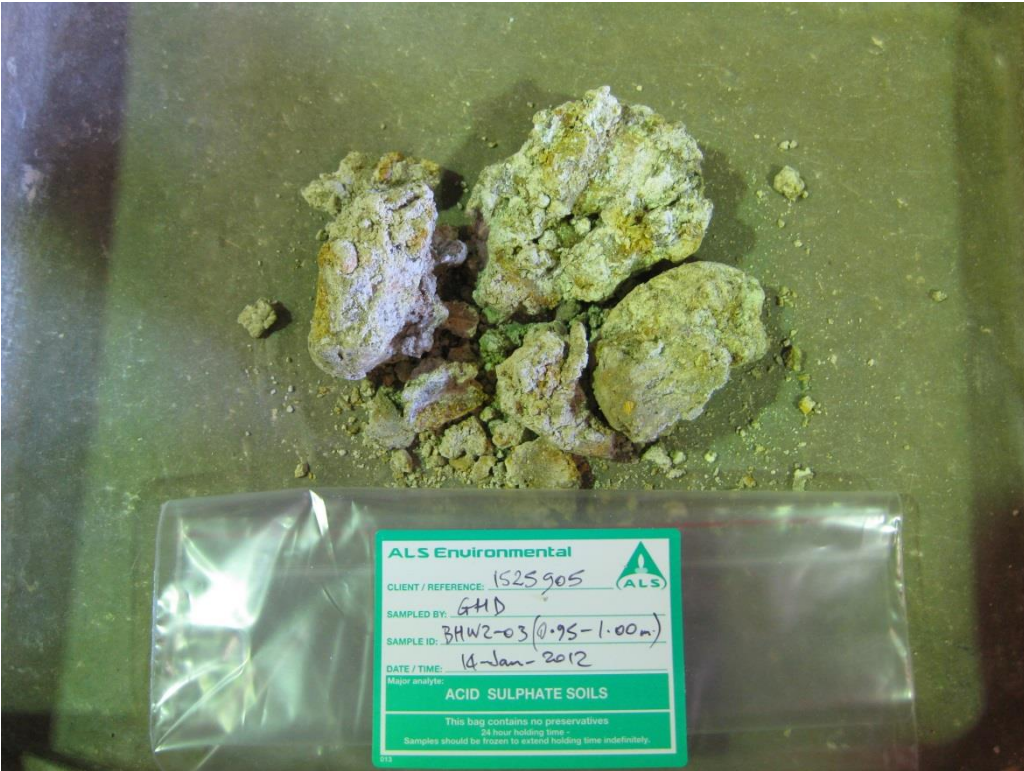
Sample Location	Material Type	Observations	Photographs	
			GHD 2011	Golder 2015
VC401_31A (0.6-0.7 m)	Marine Sediment	Minor iron staining. Sample bag had deteriorated allowing outer surface of sample to dry and oxidise. Centre of sample remains moist.		
VC401_31A (1.6-1.7 m)	Alluvium/Residual Soil	Significant drying, some iron staining		


Sample Location	Material Type	Observations	Photographs	
			GHD 2011	Golder 2015
VC401_31A (4.2-4.3 m)	Alluvium/Residual Soil	Similar appearance to 2011 photo, but drier.	 <p style="text-align: center; font-size: 24pt; font-weight: bold;">4.3m</p>	
VC401_32 (0.7-0.8 m)	Marine Sediment	Minor iron staining. Sample remains relatively moist.		

Sample Location	Material Type	Observations	Photographs	
			GHD 2011	Golder 2015
VC401_32 (1.6-1.7 m)	Marine Sediment	Sample has dried. Slight iron staining present.		
VC401_32 (3.2-3.3 m)	Alluvium/Residual Soil	Similar appearance to 2011 photo, but drier. Slight iron staining.		

Sample Location	Material Type	Observations	Photographs	
			GHD 2011	Golder 2015
VC401_33 (0.5-0.9 m)	Marine Sediment	Sample is much drier than 2011. Iron staining and shells present.		
VC401_33 (1.7-1.8 m)	Marine Sediment	Sample drier. Iron staining in corner where bag had deteriorated.		

Sample Location	Material Type	Observations	Photographs	
			GHD 2011	Golder 2015
VC401_33 (2.7-2.8 m)	Marine Sediment	Very slight iron staining		
VC401_33 (3.5-3.9 m)	Marine Sediment	Similar appearance to 2011 photo, but drier.		

Sample Location	Material Type	Observations	Photographs	
			GHD 2011	Golder 2015
BHW2-02 (0.95-0.99 m)	Alluvium/Residual Soil	Stiff mottled clayey sand/sandy clay		
BHW2-03 (0.95-1.00 m)	Alluvium/Residual Soil	Stiff mottled clayey sand/sandy clay	No Photo	

Sample Location	Material Type	Observations	Photographs	
			GHD 2011	Golder 2015
BHW2-09 (1.06-1.10 m)	Marine Sediment	Faint iron staining.	No Photo	

## Attachment 2 – Laboratory Certificates



## CERTIFICATE OF ANALYSIS

<b>Work Order</b>	: <b>EB1523405</b>	<b>Page</b>	: 1 of 6
<b>Client</b>	: <b>GOLDER ASSOCIATES</b>	<b>Laboratory</b>	: Environmental Division Brisbane
<b>Contact</b>	: MR PAUL SCELLS	<b>Contact</b>	: Augustin Raj
<b>Address</b>	: P O BOX 1734 MILTON QLD, AUSTRALIA 4064	<b>Address</b>	: 2 Byth Street Stafford QLD Australia 4053
<b>E-mail</b>	: pscells@golder.com.au	<b>E-mail</b>	: ALSEnviro.Brisbane@alsglobal.com
<b>Telephone</b>	: 4724 0311	<b>Telephone</b>	: +61-7-3243 7222
<b>Facsimile</b>	: ----	<b>Facsimile</b>	: +61-7-3243 7218
<b>Project</b>	: 1525905-500-507	<b>QC Level</b>	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
<b>Order number</b>	: Q002109	<b>Date Samples Received</b>	: 17-Jul-2015 05:00
<b>C-O-C number</b>	: ----	<b>Date Analysis Commenced</b>	: 22-Jul-2015
<b>Sampler</b>	: ----	<b>Issue Date</b>	: 22-Jul-2015 13:09
<b>Site</b>	: ----		
<b>Quote number</b>	: ----	<b>No. of samples received</b>	: 20
		<b>No. of samples analysed</b>	: 20

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



WORLD RECOGNISED  
**ACCREDITATION**

NATA Accredited Laboratory 825

Accredited for compliance with  
ISO/IEC 17025.

### *Signatories*

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils



## General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
LOR = Limit of reporting  
^ = This result is computed from individual analyte detections at or above the level of reporting  
∅ = ALS is not NATA accredited for these tests.

- ASS: EA033 (CRS Suite): Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO<sub>3</sub>) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m<sup>3</sup> in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m<sup>3</sup>'.



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	VC401_18(1.7-1.8m)	VC401_18(3.6-3.7m)	VC401_18(4.5-4.9m)	VC401_20(3.7-3.8m)	VC401_22(1.6-1.7m)
Client sampling date / time				[28-May-2015]	[28-May-2015]	[28-May-2015]	[28-May-2015]	[29-May-2015]	
Compound	CAS Number	LOR	Unit	EB1523405-001	EB1523405-002	EB1523405-003	EB1523405-004	EB1523405-005	
				Result	Result	Result	Result	Result	
<b>EA033-A: Actual Acidity</b>									
pH KCl (23A)	----	0.1	pH Unit	9.1	9.3	9.1	9.3	9.1	
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2	
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02	
<b>EA033-B: Potential Acidity</b>									
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.153	<0.005	0.005	<0.005	0.116	
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	95	<10	<10	<10	72	
<b>EA033-C: Acid Neutralising Capacity</b>									
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	24.3	42.8	34.7	45.2	1.36	
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	4850	8550	6940	9020	271	
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	7.78	13.7	11.1	14.5	0.44	
<b>EA033-E: Acid Base Accounting</b>									
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5	
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02	
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10	
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	<1	



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	VC401_22(2.7-2.9m)	VC401_22(3.5-3.9m)	VC401_23B(0.2-0.3m)	VC401_23B(2.1-2.4m)	VC401_31A(0.6-0.7m)
Client sampling date / time				[29-May-2015]	[29-May-2015]	[29-May-2015]	[29-May-2015]	[29-May-2015]	
Compound	CAS Number	LOR	Unit	EB1523405-006	EB1523405-007	EB1523405-008	EB1523405-009	EB1523405-010	
				Result	Result	Result	Result	Result	
<b>EA033-A: Actual Acidity</b>									
pH KCl (23A)	----	0.1	pH Unit	9.3	9.3	9.4	9.4	9.1	
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2	
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02	
<b>EA033-B: Potential Acidity</b>									
Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	<0.005	0.047	0.008	0.119	
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	29	<10	74	
<b>EA033-C: Acid Neutralising Capacity</b>									
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	36.4	40.8	29.7	27.2	16.5	
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	7260	8150	5940	5430	3300	
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	11.6	13.1	9.52	8.71	5.29	
<b>EA033-E: Acid Base Accounting</b>									
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5	
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02	
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10	
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	<1	



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	VC401_31A(1.6-1.7m)	VC401_32(0.7-0.8m)	VC401_32(1.6-1.7m)	VC401_32(3.2-3.3m)	VC401_33(0.5-0.9m)
Client sampling date / time			[29-May-2015]	[29-May-2015]	[29-May-2015]	[29-May-2015]	[29-May-2015]	[29-May-2015]
Compound	CAS Number	LOR	Unit	EB1523405-011	EB1523405-012	EB1523405-013	EB1523405-014	EB1523405-015
				Result	Result	Result	Result	Result
<b>EA033-A: Actual Acidity</b>								
pH KCl (23A)	----	0.1	pH Unit	9.4	9.4	9.3	9.4	9.4
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
<b>EA033-B: Potential Acidity</b>								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.025	0.056	0.048	0.029	0.072
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	15	35	30	18	45
<b>EA033-C: Acid Neutralising Capacity</b>								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	35.8	26.4	25.6	47.6	31.9
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	7150	5270	5110	9510	6370
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	11.4	8.46	8.20	15.2	10.2
<b>EA033-E: Acid Base Accounting</b>								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	<1



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	VC401_33(1.7-1.8m)	VC401_33(2.7-2.8m)	BHW2-02(0.95-0.99m)	BHW2-03(0.95-1.00m)	BHW2-09(1.06-1.10m)
Client sampling date / time			[29-May-2015]	[29-May-2015]	[29-May-2015]	[29-May-2015]	[29-May-2015]	[29-May-2015]
Compound	CAS Number	LOR	Unit	EB1523405-016	EB1523405-017	EB1523405-018	EB1523405-019	EB1523405-020
				Result	Result	Result	Result	Result
<b>EA033-A: Actual Acidity</b>								
pH KCl (23A)	----	0.1	pH Unit	9.2	9.5	9.5	9.3	9.1
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
<b>EA033-B: Potential Acidity</b>								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.140	0.052	0.007	0.005	0.040
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	87	33	<10	<10	25
<b>EA033-C: Acid Neutralising Capacity</b>								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	25.8	2.39	47.8	48.8	19.0
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	5140	477	9560	9750	3800
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	8.25	0.76	15.3	15.6	6.09
<b>EA033-E: Acid Base Accounting</b>								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	<1	<1