North Byron Parklands

Technical Paper

M2

Acid Sulfate Soil Management Plan

ARDILL PAYNE & PARTNERS

Civil & Structural Engineers – Project Managers – Town Planners – Surveyors

ACID SULFATE MANAGEMENT PLAN

Prepared for:

North Byron Parklands

Tweed Valley Way & Jones Road, Yelgun

A project of:

Billinudgel Property Pty Ltd
(Billinudgel Property Trust)

June 2010

79 Tamar Street
(PO Box 20)
BALLINA NSW 2478

Ph: (02) 6686 3280
Fax: (02) 6686 7920
Email: info@ardillpayne.com.au

Document Control Sheet

Filename:	6883 - ASS Management Plan.doc
Job No.:	6883
Job Captain:	Tony Cromack
Author:	Louisa Clarkson
Client:	Billinudgel Property Trust
File/Pathname:	S:\01 Jobs\6800-6899\6883 Splendour in the Grass Part 3A\01 Administration\02 Reports\6883 - ASS Management Plan.doc

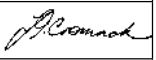
Revision No:	Date:	Checked By		Issued By	
		Name	Signed	Name	Signed
0	11/06/10	T. Cromack		L. Clarkson	
1	27/07/10			T. Cromack	
2					

Table of Contents

1 Executive Summary

Ardill Payne & Partners (APP) has prepared an Acid Sulfate Management Plan (ASMP) for the proposed cultural events site at North Byron Parklands (NBP), Tweed Valley Way and Jones Road, Yelgun.

The proposed development includes excavation works for road construction, open drains and service trenches to a depth generally not exceeding 1m below ground level. Some excavation to a depth greater than 1m may be required for the construction of pump wells or collection wells, however these excavations will be very localised and infrequent.

This report shall be read in conjunction with EAL Consulting Service's "*Preliminary Acid Sulfate Soil Assessment Report for the North Byron Parklands Project & Concept Plan Application at North Byron Parklands Site, Yelgun, NSW*", 9 May 2010.

The EAL report identified Actual Acid Sulfate Soils (AASS) on the site with sporadic occurrences of Potential Acid Sulfate Soils (PASS). All proposed excavations will be managed in accordance with the measures outline in Section 5.0 of this document.

The ASMP has been designed to:

- Prevent any detrimental effects on the environment associated with potential disturbances of PASS;
- Monitor any acid generation from exposure of PASS; and
- Treat ASS/PASS materials and validate that the acid has been appropriately neutralised.

2 Director General's Requirements

The Director General of the Department of Planning determined that the proposal was a Major Project pursuant to Part 3A of the Environmental Planning and Assessment Act 1979, and issued Environmental Assessment Requirements (DGRs) on 25 August 2009. The DGRs that are related to this report are as follows:

- *Attachment 1, Part B: Project Application, 6.2 Acid Sulfate Soils – Identify the presence and extent of acid sulfate soils on the site, and where relevant, appropriate mitigation measures. Identify the need for an Acid Sulfate Management Plan (prepared in accordance with the ASSMAC guidelines).*

This report is the Acid Sulfate Management Plan referred to in the EAL report.

3 Site Location and Description

The site is located on the eastern side of the Tweed Valley Way at Jones Road, approximately 6.5km south of Mooball, 5.5km north of Brunswick Heads north turnoff, and 23.5km north of Byron Bay. A topographic map of the site is included in **Attachment 1**.

In summary, the application area comprises the following land parcels:

Lot No	DP
403	755687
Pt. 402 & 404	755687
1	1145020
Pt. 46	755687
Pt. 10	875112
Pt. 2	848618
Pt. 30	880376
Pt. 102	1001878
Pt. 12	848618

The application area comprises an area of approximately 155.9 ha. A large proportion of the site is low lying, low relief alluvial plains. Levels in the low lying area range from approximately RL.2.0m AHD in the east, gently rising to approximately RL.3.5m AHD in the west. Low hills (to RL.60m AHD) border the site in the north west and along the Jones Road ridge. A network of surface agricultural drains dissect the low lying areas of the site draining into Yelgun and Billinudgel Creeks.

The southern portion of the site (south of Jones Road) is located within the lower catchments of Yelgun and Billinudgel Creeks which form part of the Marshall's Creek floodplain. The northern portion of the site is within the Crabbe's Creek floodplain. The central portion of the overall site incorporates a low east-west ridge upon which Jones Road is located.

Approximately 66% of the site is pasture land used for cattle grazing, while the balance is identified in Council mapping as High Conservation Vegetation

4 Proposed Development

The proposed development of the site involves the following main construction activities:

- Site earthworks including filling of existing shallow grassed drains in event areas
- Internal road construction (spine road and event laneways)
- External road construction and widening, including new intersections
- A new crossing of Jones Road (either an underpass or an at-grade intersection)
- Stormwater drainage, including piped culverts, open drains and stormwater management facilities
- Wastewater treatment system, including the construction of a sewage treatment plant, effluent holding dams, effluent polishing wetlands, effluent irrigation areas and reticulation mains
- Water supply, including the construction of a water treatment plant, bulk water storage tanks and reticulation mains, and the construction of a new dam
- Electricity and telecommunication distribution cables (overhead and/or underground)
- Construction of an administration building and gatehouse
- Pedestrian pathways and bridges.

4.1 Proposed Excavation Works

Excavation works for roadworks, service trenches, open drains, diversion drains, and during regular drain maintenance, may potentially disturb Acid Sulfate Soil material:

- Excavation during roadworks, drainage works, construction of open drains, erection of temporary or permanent structures, or service trenching will generally not exceed 1m below ground level.
- Some excavation to a depth greater than 1m may be required for the construction of pump wells or collection wells, however these excavations will be very localised and infrequent.
- Excavation for new road construction in low lying areas will generally only involve the removal of approximately 100-150 mm of topsoil before the placement of roadbase materials.
- Diversion drains and bunded drains require shallow excavations to no greater than 0.3m below ground level (mbgl).
- A new open drain will be constructed in the eastern part of the site, near Forest Block C, to duplicate an existing open drain (refer *'Stormwater Management Plan'*, Ardill Payne & Partners, June 2010).

This new drain will bypass an existing drain which is heavily vegetated and silted. Construction of the new open drain will reduce the likelihood of any adverse environmental outcomes associated with the maintenance of the existing drain, with acid sulfate soil management practices implemented in accordance with Section 5.0.

- Accumulated silt and debris will be removed from existing open drains to improve the drainage flow. No excavation into the underlying soils will occur.
- Shallow trenches of less than 1m in depth will be excavated to install services.

It is not expected that Acid Sulfate Soils will be exposed in any other construction on the site, including excavation for the Jones Road underpass.

An event area and land use structure plan is included in **Attachment 2**.

5 Acid Sulfate Management Measures

5.1 Site Conditions

Surface and sub-surface conditions have been described in the EAL report (2010).

5.2 Acid Sulfate Soil Identification

A Preliminary Acid Sulfate Soil Assessment has been undertaken by EAL Consulting Services, in accordance with ASSMAC guidelines.

Seventeen boreholes were investigated to varying depths of 1.0 – 2.0 mbgl. A total of 69 samples were collected every 0.5m or at changes in soil layers in the sub-surface profile and analysed for:

- Total Titratable Acidity (TAA – an indicator of the existing soil acidity before the oxidation of sulfidic material - Actual Acid Sulfate Soils - AASS);
- Total Potential Acidity (TPA – an indicator of the potential acidity likely to be generated from oxidation of sulfidic material - Potential Acid Sulfate Soils - PASS); and
- Total Sulfidic Acidity (TSA – a measure of the acidity after oxidation, which is used to calculate liming requirements for acid neutralisation for acid sulfate materials - ASM).

Results of this investigation indicated high levels of actual acidity (AASS) throughout the entire soil profile investigated below RL.3.0m AHD. Sporadic occurrences of potential sulfidic acidity (PASS) were detected in 6 boreholes. It is noted that the site ground level is approximately RL.2.0m AHD in the east of the site, therefore it is likely that ASM will be disturbed during excavations in this area. A plan showing the EAL borehole locations in included in **Attachment 3**.

Based on these results, the EAL report recommended the preparation of an Acid Sulfate Management Plan (ASMP) for civil works below RL.3.0m AHD, which addressed the following:

- Identification of activities that are expected to intersect and disturb ASM (refer to Section 4.1 of this report)
- Identification of the ASS risks and identified ASS layers on site (refer Section 5.3)
- The estimation of volumes of ASS requiring treatment and proposed treatment measures (refer Sections 5.4 and 5.5)
- Estimated liming rates and treatment procedures (refer Section 5.5)
- Validation procedures and target criteria of treated soils (refer Section 5.5)
- Monitoring protocols and target criteria for surface and groundwater within the site (refer Section 5.6).

This Management Plan shall be reviewed at Construction Certificate stage when details are known on specific construction activities (location and depth of excavations).

5.3 ASS Risks

The EAL report states that the occurrence of ASS within the identified soil types is typically highly localised, with disturbance and subsequent risk of exposure and oxidation primarily varying with elevation and depth of disturbance. The highest risk of disturbing acid sulphate materials is during excavation in the low lying areas of the site below RL.3.0m AHD.

The EAL report identified the presence of ASM (both actual and potential ASS) in areas across the site below RL.3.0m AHD. As stated in Section 4.1, excavations will generally not exceed 1m below natural ground level. However, excavations proposed as part of the development will potentially disturb soil layers where the ASM was encountered, and will therefore require management and treatment.

Potential impacts related to the disturbance of ASM include soil acidification, mobilisation of dissolved metals, and leaching of acidic

waters. If the management measures described in Sections 5.4 to 5.6 of this Management Plan are implemented during construction, it will reduce the likelihood of the above impacts eventuating as a result of on-site excavation works.

5.4 Bunding Requirements

No treatment of ASS or PASS soils may be performed without providing a bunded impervious pad, designed and constructed to achieve the following requirements:

- The bund is to be constructed of material free of ASS/PASS or contamination, such as imported clay fills. An apron of lime shall be spread across the base of the bunded area to neutralise any acid formed;
- The size of the bund is to be of sufficient capacity to accommodate a critical storm event;
- The bund should be compacted by rolling with a suitable roller to bind the material into a cohesive earth fill. A minimum of 95% Standard Compaction should be achieved in all earth bunds constructed for environmental protection; and
- Bunded areas should be graded to allow leachate and stormwater to flow to a sump (refer to Section 5.6 for further discussion on treatment of surface water). 'Clean' surface waters shall be directed away from bunded areas.

Sufficient lime is to be stored in a dry and bunded location on-site and shall be covered to permit the immediate implementation of the above contingency measures.

5.5 Soil Treatment Measures

The following measures shall be implemented during excavations in identified risk areas:

- Excavated PASS material should be spread within the bunded area in layers of workable depth (typically not more than 0.3m loose thickness);
- Lime shall be applied to the excavated material as well as around the base of the excavation, at a rate of up to 35 kg/m^3 of material disturbed based on the maximum acid content of the soils (Actual Acid Sulfate Soils - ASS) and its potential to generate further acid (Potential Acid Sulfate Soils – PASS). Actual application rates will be determined at Construction Certificate stage and will be related to the specific excavation. Laboratory testing results and associated liming rates include a safety mixing factor of 1.5 as recommended in the ASSMAC Manual to neutralise any ASS or PASS;

- Lime shall be thoroughly mixed with soil materials through use of a rotary hoe, pulvi-mixer or some similar mechanical process nominated by the contractor to achieve a thorough mix. The liming should be confined to areas of manageable size and an apron of fine lime shall be provided when stockpiling for any length of time;
- Field and laboratory testing of soil and water will be required to verify that the lime has neutralised ASS or PASS materials and increased the soil pH;
- Validation soil samples will be collected at a rate of one sample per 250m³ of excavated soil and submitted for laboratory analysis using the POCAS method Testing will be required to produce Total Potential Acidity (TPA) results of less than the action criteria in Table 4.4 of the ASSMAC guidelines (specific action criteria dependent on soil type and amount of material disturbed);
- Should the field pH tests and the laboratory tests show that the soil acidity has not achieved the above standard, then the material must be reworked and more lime added until it is verified that the soil meets the required standard;
- If the soil results show great variability then the treatment rates should be reassessed and a higher frequency of verification tests adopted; and
- Once adequate neutralisation is achieved the soil will be suitable for replacement as trench backfill. Excess spoil shall be treated as specified above and disposed of on-site.

We estimate that there will potentially be less than 2000m^3 of soil (ASM) disturbed during construction works. However, this will be confirmed at Construction Certificate stage.

Results of monitoring shall be kept on site during construction and be available for inspection by the Engineer, Council or State Government officers. Details of the treatment and monitoring activities should be provided to the Site Engineer on a monthly basis, until the completion of the works.

Delivery dockets for the agricultural lime should be kept with other site records to demonstrate that adequate neutralizing agent was used on site.

5.6 Water Treatment Measures

During excavation works exposed ASM in stockpiles or open trenches can oxidize and produce acidic conditions and mobilization of heavy metals, which can be transported by water into surface waterways and into groundwater. Since groundwater was recorded at depths between

0.4 – 0.9 mbgl during soil investigations, there is a high possibility that it will be encountered during service installation and at risk of contamination from exposed Acid Sulfate Soils. As such, the following measures will be performed:

- Sprinkle the sides and bottom of open trenches with lime at a rate of 10 kg/m^3 to avoid generation of acidic conditions;
- Given the naturally acidic conditions of the soil, it is expected that the groundwater will have a slightly acidic pH. Monitoring of the groundwater or surface water in open excavations will be conducted to assess for any reductions in pH;
- Neutralise acidic conditions by applying a hydrated lime slurry (depending on the salinity of the water to be treated), or use a mechanical lime spreader to spread lime over an area close to the inlet point of the collection area;
- Monitor the levels of the treated water to avoid creating excessively high pH levels;
- 'Clean' surface waters shall be directed away from bunded areas;
- Treatment pads should be limed as per Section 5.4, and ponded water monitored daily for the generation of acidic conditions. Additional lime shall be added at a rate of 10 kg/m^3 to neutralise any acidic water; and
- Receiving waters and groundwater in the area are typically mildly acidic due to underlying geology, and this represents normal conditions. Therefore treated water shall also be monitored to ensure water is not highly alkaline prior to its release into the drainage system onsite.

In addition to the above, any ponded water within the bunded area may be acidic. Bunded areas shall be inspected after each rainfall event and ponded water shall be monitored to comply with the lesser of the following standards prior to being released:

- Background water quality readings for pH and turbidity or;
- pH within the range 6.5-8.5; and
- Turbidity <50 NTU (max).

5.7 Responsible Parties

The construction manager (or any person or agent duly authorised by the construction manager) is to be responsible for undertaking all monitoring, testing and maintenance requirements detailed in this Plan.

6 Conclusion

Ardill Payne & Partners (APP) has prepared an Acid Sulfate Management Plan (ASMP) for the proposed cultural events site at North Byron Parklands, Tweed Valley Way and Jones Road, Yelgun.

A Preliminary Acid Sulfate Soil Assessment prepared by EAL Consulting Services has confirmed the presence of Actual Acid Sulfate Soils (AASS) with sporadic occurrences of Potential Acid Sulfate Soils (PASS) underlying the site, from depths ranging from natural surface level to 2.0 m below ground level (mbgl).

The proposed development includes excavation works for roadworks, service trenches, open drains, diversion drains, regular drain maintenance, and the construction of a new open drain near Forest Block C. It is proposed that excavations will generally not exceed 1m below ground level. Some limited excavation to a depth greater than 1m may be required for the construction of pump wells.

Based on the results of the EAL report, some excavations will intercept ASS/PASS layers, and will require management in accordance with the measures outline in Section 5.0 of this document.

The ASMP has been designed to prevent any detrimental effects on the environment associated with potential disturbances of ASM during on-site excavations. The ASMP addresses measures to monitor any acid generation from exposure of PASS, treatment of ASS/PASS materials and validation procedures to check that acidic materials have been appropriately neutralised by treatment actions. All materials shall meet Local and State Government ASS/PASS management requirements.

7 General Notes

General

Geotechnical and environmental reports present the results of investigations carried out for a specific project and usually for a specific phase of the project (e.g. preliminary design). The report is based on specific criteria, such as the nature of the project, underground utilities or scope of service limitations imposed by the Client. The report may not be relevant for other phases of the project (e.g. construction), after some time, or where project details and clients change.

Soil and Rock Description

Soil and rock descriptions are based on AS1726-1993 using visual and tactile assessment except at discrete locations where field and/or laboratory tests have been carried out.

Groundwater

The water levels indicated are taken at the time of measurement and depending on material permeability may not reflect the actual groundwater level at those specified locations. Also groundwater levels can vary with time due to seasonal or tidal fluctuation, construction activities and other external factors.

Interpretation of Results

The discussion and recommendations in the accompanying report are based on extrapolation/interpolation from data obtained at discrete locations and other external sources and guidelines. The actual interface between the materials may be far more gradual or abrupt than indicated. Also actual conditions in areas not sampled may differ from those predicted.

The report is based on significant background details that only the authors can be aware off, and therefore implementation of the recommendations by others may lead to misinterpretation and complications. Therefore this company should be consulted to explain the reports implications to other involved parties.

Reporting relies on interpretation of often limited factual information based on judgement and opinion which has a level of uncertainty and ambiguity attached to it, and is far less exact than other design disciplines. This should be considered by users of the report when assessing the implications of the recommendations.

Change in Conditions

Subsurface conditions can change with time and can vary between test locations. Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations can also affect subsurface conditions.

8 Scope of Engagement

This report has been prepared by Ardill Payne & Partners (APP) at the request of Billinudgel Property Trust for the purpose of preparing an Acid Sulfate Management Plan for the proposed cultural events site at North Byron Parklands, and is not to be used for any other purpose or by any other person or corporation.

This report has been prepared from the information provided to us and from other information obtained as a result of enquiries made by us. APP accepts no responsibility for any loss or damage suffered howsoever arising to any person or corporation who may use or rely on this document for a purpose other than that described above.

APP declares that it does not have, nor expects to have, a beneficial interest in the subject project.

To avoid this advice being used inappropriately it is recommended that you consult with APP before conveying the information to another who may not fully understand the objectives of the report. This report is meant only for the subject site/project and should not be applied to any other.

9 References

Acid Sulfate Soils Management Advisory Committee. August 1998. Acid Sulfate Soil Manual. Wollongbar, NSW.

Ardill Payne and Partners. June 2010. *Erosion and Sediment Control Plan, North Byron Parklands, Tweed Valley Way & Jones Road, Yelgun.* Report prepared for Billinudgel Property Trust.

Ardill Payne and Partners. June 2010. *Stormwater Management Plan, North Byron Parklands, Tweed Valley Way & Jones Road, Yelgun.* Report prepared for Billinudgel Property Trust.

Byron Shire Council. 1988. Byron Local Environmental Plan 1998.

EAL Consulting Service. 9 May 2010. *Preliminary Acid Sulfate Soil Assessment Report for the North Byron Parklands Project & Concept Plan Application, at North Byron Parklands Site, Yelgun, NSW .*

Morand, D.T. 1994. *Soil Landscapes of the Lismore-Ballina 1:100 000 Sheet Map*. Soil Conservation Service of NSW, Sydney.

Soil Conservation Service of NSW, Sydney. June 1995. *Byron Bay 1:25,000 ASS Risk Map*. Edition 1.

10 Attachments

Attachment 1 Topographic Map

Attachment 2 Event Area and Land Use Structure Plan

Attachment 3 Borehole Locations

ATTACHMENT 1

Attachment 1
Topographic Plan

Do not scale drawing. Use written dimensions only
This plan is copyright ©All rights reserved.

Client: Billinudgel Property Trust

Title: North Byron Parklands - Regional Location

ARDILL PAYNE & PARTNERS
Consulting Civil and Structural Engineers
Project Managers Town Planners & Surveyors
79 Tamar Street
P.O. Box 20
BALLINA NSW 2478
Ph. 02 6686 3280
Fax 02 6686 7920
Email: info@ardillpayne.com.au

Scale at A4	NTS	Datum	-
Design	TC	Date	June 2010
Drawn	NB	File	6883 LocPlan.dwg
Dwg No.	LP.01	Job No.	6883

ATTACHMENT 2

Attachment 2
Event Area and Land Use
Structure Plan

Legend:

The Site | Extents of Application Area (Dashed) | Car Parking

Event Area | Conference Centre Uses | Cultural Centre/Administration Uses | Gatehouse

Spine Road (7m wide) | Event access lane (6m wide) | Main pedestrian route

North Byron Parklands

0 160m

1:8000 (@ A3)

Prepared by

design team 9%

Date 21.07.10

Author SDR

Reference 09_120

IMPORTANT NOTE |
Cadastral information is subject to survey. The alignment of the aerial photograph and vectorial overlays is approximate only. This plan is conceptual only and subject to detailed survey and design.

Sources | Aerial Photography: Bill Mills (2009) | Cadastre: Andrè Payne (2009) | Major contour = 5m | Minor contour = 1m

Plan | 1.2

Event Area and Land Use Structure 14

North Byron Parklands | Tweed Valley Way & Jones Road

ATTACHMENT 3

Attachment 3
Borehole Locations

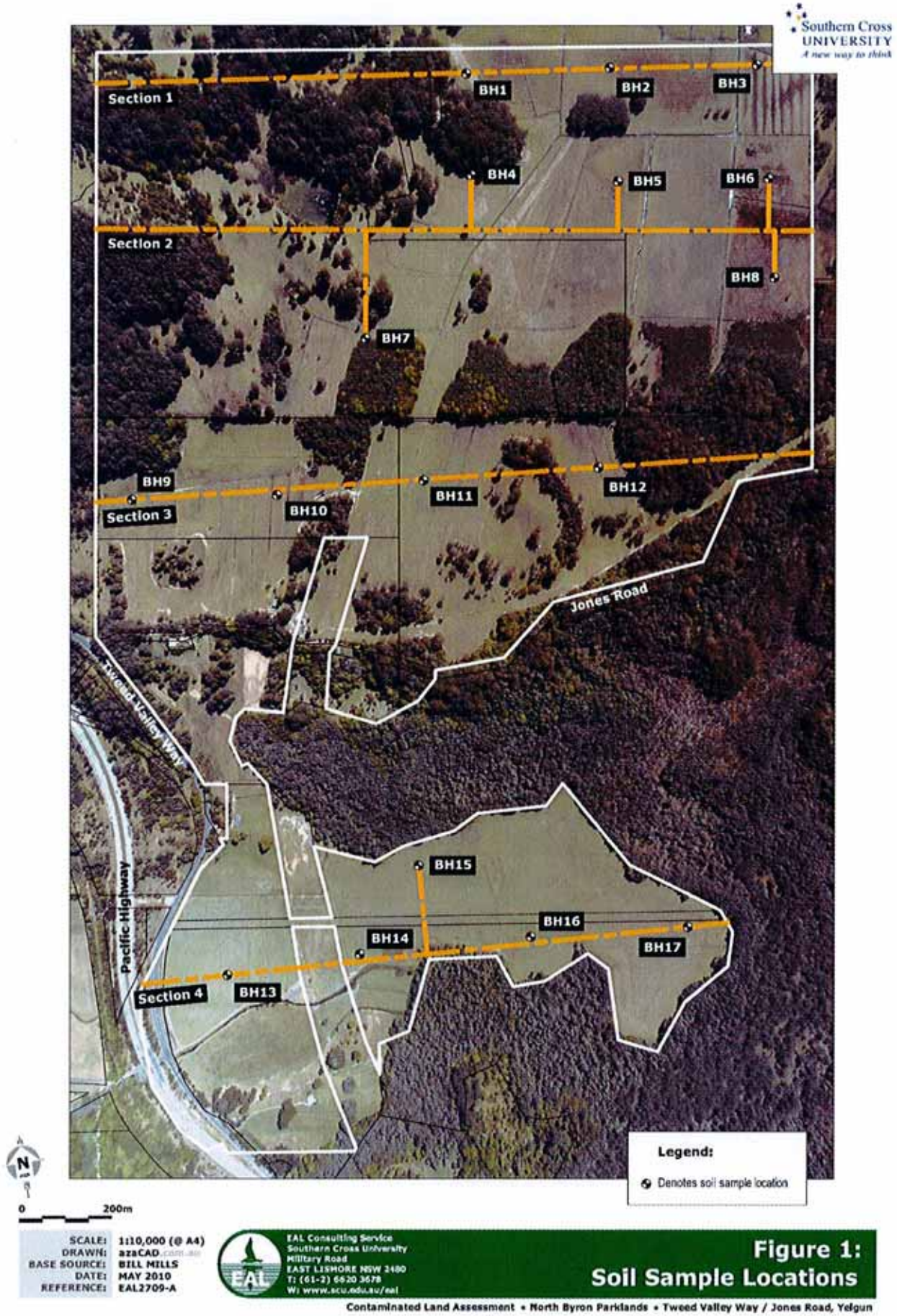


Figure 4: Soil sampling locations and section origins