Appendix 6

Cardno Pty Ltd

Water Engineering and Environmental Report

April 2010

APPENDIX A

Acid Sulfate Soil Management Plan

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A1. ASS MANAGEMENT PLAN OBJECTIVES AND METHODOLOGY

This ASS (Acid Sulfate Soils) Management Plan (ASSMP) has been compiled to-

- Ensure that the construction of the proposed development does not result in release of acidic leachate and subsequent environmental harm;
- Provide appropriate design, management, monitoring and corrective action measures required to minimise the potential impact on the environment.
- Comply with relevant legislation and regulations.

The ASSMP has been prepared in accordance with the NSW Acid Sulfate Soils Manual 1998 prepared by the Acid Sulfate Soils Management Advisory Committee (ASSMAC) (ASS Manual) as required under the Hastings Local Environment Plan 2001.

The ASSMP is designed to assist construction staff in complying with their obligations under the NSW Protection of the Environment Operation Act 1999 (PEOA 1999).

A2. PROPOSED CONSTRUCTION ACTIVITIES

Construction activities associated with the subject development may cause potential oxidation of the PASS materials. These include:

- bulk earthworks including the excavation of material from the waterways at the site;
- dewatering associated with the above; and
- excavation associated with the construction of stormwater, sewer and other buried infrastructure during civil works.

Detailed control measures, in line with the construction activities listed above, are provided in the following sections.

A3. RESPONSIBILITY OF THE CONTRACTOR

The Contractor(s) for earthworks and civil works on the site shall conduct operations in accordance with this ASS Management Plan. Prior to the commencement of works, the Contractor shall provide the following information to the Consultant:

- Contractor's environmental policy.
- Names and responsibilities of supervisory staff involved with the implementation of the ASS Management Plan.
- Schedule of site inspections (and personnel responsible) to identify environmental problems, and maintenance actions to remedy any environmental problems identified.
- An Incidents and Events Register, in which all environmental problems identified during inspections and monitoring, and complaints received are recorded and acted upon.
- Environmental Training Plan and Training Record Plan for all personnel involved in development of the site.

Emphasis shall be placed upon the timely resolution of any complaints received in relation to development of the site and the development and implementation of corrective actions in response to non-conformities to the Management Plan (identified by the monitoring process).

The Performance Objective regarding complaint resolution is for the issue causing each complaint to be resolved in such a manner that there is no further complaint for the same reason.

The Contractor is to maintain an "Incidents and Events Register" which lists the date of the incident or complaint and the type of incident or complaint. For each incident, an incident/complaint log is to be completed nominating:

- Date of incident;
- Nature of incident and associated information;
- Location of incident;
- Name of person or body which reported incident;
- Employee who received notice of incident;
- Project Manager's review and comment;
- Recommended action to resolve incident;
- List of organisations to be contacted with regard to incident;
- Outcome of actions undertaken subsequent to incident being recorded; and
- Date of resolution of incident.

Each incident is to be assigned a number to be entered on the master Incident and Event Register. Further, Council and the Environment Protection Agency are to be notified with regard to corrective action sought for incidents which have the potential to cause environmental harm.

A4. POLICY STATEMENT

- To avoid detrimental impact on the water quality through the effective identification, treatment and management of acid sulfate soils at the site.
- To comply with the *NSW Protection of the Environment Operation Act 1999 (PEOA 1999).*
- To manage acid sulfate soils in accordance with the NSW *Acid Sulfate Soils Manual 1998* prepared by the Acid Sulfate Soils Management Advisory Committee (ASSMAC) (ASS Manual).

A5. PERFORMANCE OBJECTIVES

The objectives of the ASS Management Plan are to ensure the following:

- Implementation of additional assessment procedures during earthworks operations to confirm neutralising dosing rates for the effective treatment and management of any drained, disturbed or excavated ASS in accordance with the *ASS Manual.*
- Remediation of acid trend waters if discovered, and provision of control structures to prevent leachate discharge off-site which does not meet specific water quality criteria.
- The control of erosion and sedimentation of ASS during earthworks.
- Where possible all site water shall be reused on site. If it is necessary to discharge site water off site it shall comply with the following criteria:

Table A1 Water Quality Release Criteria

Water Quality Parameter	Release Criteria
pH	6.5 - 8.5
Oil and grease	No visible film. No detectable odour.
Iron floc and scum	None visible
Floating matter	None visible
Suspended Solids	< 50 mg/L
Dissolved Oxygen	80-100 %
Iron	300 µg/L
Aluminium	Equal to background levels

The performance criteria for hydrosluiced materials are specified below.

- No sample shall exceed 25 moles H^+/tonne (0.04% S).
- If any single sample exceeds 18 moles H+/tonne (0.03% S), then the average of any 6 consecutive samples (including the exceeding sample) shall have an average not exceeding 25 moles H+/tonne (0.03% S).
- If more than one sample in any 6 consecutive sample exceeds 25 moles H^+/tonne (0.03% S), then the average of any 6 consecutive samples (including the exceeding samples) shall have an average content not exceeding 16 moles H^+/tonne (0.03% S).

The following best environmental management practices shall also be employed:

- The area of disturbance during construction shall be limited to the immediate construction area and access routes.

- All earthworks areas shall be isolated by the provision of perimeter cutoff drains or bunds.
- Excavated material shall be retained within secure bunded areas until it has been assessed for acid sulfate potential and treated as required.
- Runoff shall be contained within the construction site for treatment prior to reuse on site, or if necessary discharge off site. This will require the construction of catch drains, perimeter bunds, temporary sediment ponds, etc.

A6. SITE MANAGEMENT PROCEDURES

A6.1 Introduction

Management of both excavated and in-situ soils are required under this Plan to ensure that the impacts of disturbance are within acceptable limits.

A6.2 Training

The Contractor shall employ suitably qualified personnel during all earthworks operations to supervise and monitor acid sulfate assessment, management and treatment, so as to comply with this Plan. These personnel shall be trained in the recognition of possible ASS.

A6.3 Excavation Techniques

Excavation shall be undertaken in stages to ensure that groundwater drawdown associated with dewatering of the excavation areas is minimised.

Only a single excavation cell within the waterways shall be completely dewatered at a time. Each excavation cell will be separated by a section of unexcavated material and once excavation of each cell is complete the cell will be re-flooded to reduce the potential for groundwater drawdown associated with the dewatering and excavation of the adjacent cell.

Excavated slopes shall be inspected on a daily basis and shall be treated by surface sprays and liming to prevent any acid formation.

All excavation and treatment areas shall be isolated from external areas by perimeter drains and/or bunds. All waters collected on the site shall be contained, collected, tested and treated prior to disposal to external areas. All excavated material shall be subjected to appropriate testing, and treated where required.

All soils including sands and the clay strata shall be sampled during excavation. The sampling frequency shall be 1 sample per 500 cubic metres. The soils Acid Neutralising Capacity (ANC) shall also be undertaken throughout the construction phase. The samples shall be tested in accordance with the Acid Sulfate Soils, Laboratory Methods Guidelines. The location and depth of all test samples shall be accurately recorded on a plan of the works area.

A6.4 Treatment

All soils indicated to exceed the oxidisable sulphur criteria shall be treated with fine agricultural lime after excavation. If ANC is included in calculations for liming rates, a fineness factor of at least 1.5 must be applied to account for likely lower acid neutralising capacity in the field.

The base of any stockpiling areas of excavated PASS shall be limed with a guard layer of at least 5kg/m^2/m depth of material excavated.

Mixing shall be carried out by spreading in layers of not more than 300 mm, and use of an agricultural spreader and disc plough, rotary hoe or similar. Care shall be taken to ensure that mixing occurs throughout the depth of the layer prior to placement of new material. The rate of lime application shall be determined in accordance with the Acid Sulfate Soils, Laboratory Methods Guidelines.

Following the successful treatment of the lot (as determined through the verification testing), the material shall be compacted and the next layer of excavated material to be treated shall be placed over the already treated material. This process shall be continued until the required site elevation is achieved.

A6.5 Validation Testing

The treated PASS shall be subject to validation testing at a rate of 1 test per 500 m^3 of treated soil (as per the QASSIT *2003 Laboratory Methods Guidelines*). The validation testing shall consist of the measurement of Scr, TAA, the pH of the soil (pH_{KCL}) and the measurement of excess acid neutralising capacity (ANC). A soil may be deemed to be effectively treated when it has no net acidity.

An excess ANC of 0.5 times the existing + potential acidity shall be used as the criteria for adequate neutralisation of ASS.

Verification testing shall include retained acidity where pH is < 4.5.

A6.6 Treatment of Fill Areas

The base of all fill areas where treated PASS are to be placed shall be treated with a guard layer of 5 kilograms per square metre of fine agricultural lime per metre depth of fill prior to the placement of any fill soils.

A6.7 Control of Discharge

All water generated from dewatering activities, seepage and site runoff shall be held on site. Ponded water shall be tested for pH on a daily basis, and no water shall be discharged from site unless it complies with the requirements of Table 1.

Treatment may include the addition of flocculating agents to reduce the suspended solids concentration, and the addition of hydrated or agricultural lime to control pH.

A6.8 Groundwater Monitoring and Treatment

Groundwater monitoring bores shall be drilled approximately 50 metres beyond the excavated area to monitor the effect of the earthworks operations on the surrounding groundwater. In addition, a baseline groundwater monitoring bore shall also be drilled at the boundary of the site remote from the excavations.

The groundwater level and pH in the bores shall be monitored prior to commencement of dewatering of the water body at the site and shall be monitored on a daily basis during excavation to determine if any remedial works are required. The groundwater pH value shall be maintained to within 1 of the baseline monitoring bore pH reading.

Remedial works may include temporary halt of excavation works to allow sufficient time for groundwater recharge, the construction of recharge trenches and addition of soluble lime to the water in recharge trenches.

A6.9 Storage of Lime

A sufficient supply of agricultural lime ($CaCO_3$) shall be retained at the site at all times for treatment of ASS. The supply shall be stored in a covered and bunded area to prevent accidental release to waters.

A quantity of hydrated lime shall be retained at the site at all times for treatment of acidic waters. Storage requirements for hydrated lime shall be identical to that specified above for agricultural lime.

A6.10 Monitoring

The Contractor shall monitor the works on a daily basis for evidence of:

- yellow efflorescence on soil surfaces
- sulfurous odour.

Laboratory analysis of soils during construction shall be in accordance with the ASS Manual.

Excavated soils subjected to analysis shall be sampled and tested at the rate of one test per 500 m^3 of placed material.

Satisfactory completion of treatment shall be validated in accordance with the ASS Manual. Validation testing of PASS material shall be undertaken at the rate of one test per 500 m^3 of placed material.

Lime delivery dockets are to be collected and checked against calculated amounts of lime used.

Daily on-site monitoring of water quality shall be required. All discharges from the site shall be continuously monitored for pH and turbidity. All water discharged from the site shall comply with the requirements of Table 1. Specifically, pH level must be between 6.5 and 8.5, and suspended solids (or equivalent turbidity) must not exceed 50 mg/L.

A7. REPORTING

The Contractor shall submit monthly reports on his activities to the Consultant and the Council including any non-conformances with this plan.

A8. CORRECTIVE ACTION

Corrective action shall be implemented if any complaints are received by the Contractor, Council or EPA.

Non-conformance with this plan shall be documented and a Corrective Action Request (CAR) issued. All CARs shall be included in the Non-Conformance Register.

The Contractor shall implement the corrective action as required within the agreed time frame noted on the CAR.

The Contractor shall advise Council and the Consultant upon completion of the corrective action.