SEDIMENT AND EROSION MANAGEMENT REPORT

For

45 HEARNES LAKE ROAD

August 2009

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1 INTRODUCTION

In order to limit the impact on Hearne's Lake and surrounding wetlands DeGroot and Benson has been employed to draft a storm water quality management report for the development of Hearne's Lake. The Proposed development consists of 38 lots of land located to the north of Hearne's Lake Road Woolgoolga to the east of the current Pacific Highway. A Stormwater Management Strategy has been prepared for the site by BMT WMB and formed part of the DA submission. It examined post construction activities.

This report examines issues relating to the construction process of the subdivision and methods to minimise erosion and sediment loss according to current best practice.

2 COFFS HARBOUR CITY COUNCIL URBAN STORMWATER MANAGEMENT PLAN 2000

Coffs Harbour City Council has in affect a detailed list of aims and goals for stormwater treatment and WSUD. The design of the treatment system seeks to meet the aims and objectives outlined below in Coffs Harbour City Councils Stormwater Management Plan. Councils plan sets out that the development must comply with two sets of objectives out of the three displayed, thus the most appropriate circumstances must be adhered to. For the purpose of this report we are examining only Objective Set C which deals with construction. The other objectives are covered by the BMT report.

The guidelines state:

Objective Set C

Construction Phase
C.1 – Soil Type C* *To ensure suspended solids concentrations do not exceed 50mg/L for all flow events up to 25% of the 1 year ARI flow*
C.1 – Soil Types F** and D* *To ensure suspended solid concentrations do not exceed 50mg/L for all 5 day rainfall totals up to the 75th percentile rainfall event (75th%ile rainfall event in Coffs Harbour = 34.4mm)*
C.2 *To limit the application, generation and migration of toxic substances to the maximum extent practical*

Post Construction Phase
C.3 *To retain 80% of the average annual load of suspended solids*
C.4 *To retain 45% of the average annual load of Total Phosphorus*
C.5 *To retain 45% of the average annual load of Total Nitrogen*
C.6 *To retain litter greater than 50mm for flows up to 25% of the 1 year ARI peak flow*
C.7 *To retain sediment coarser than 0.125mm for flows up to 25% of the 1 year ARI peak flow*
C.8 *To ensure no visible oils for flows up to 25% of the 1 year ARI peak flow, in areas with concentrated hydrocarbon deposition*
* ***SoilTypeC****= Coarse soils, with less than 33% finer than 0.02mm*
** ***Soil Type F*** *= Fine soils, with more than 33% finer than 0.02mm*
*** ***Soil Type D*** *= Dispersible soils, with more than 33% finer than 0.02mm and more than 10% dispersible materials*
For further details, consult the Department of Housing's Managing Urban Stormwater: Soils and Construction.

3 MANAGEMENT OF POTENTIAL IMPACTS-CONSTRUCTION PHASE

The DCP for the Hearne's Lake area requires that construction on site be able to mitigate potential environmental impacts associated with the construction of the development.

Prior to construction in any stage, detailed erosion and sediment control plans will be prepared, based on the requirements of the DCP and submitted to council.

The estate will developed in a number of stages to minimise the potential for soil erosion and water pollution and places less strain on the immediate ecosystem. This would also mean less impact on residents surrounding the development. By developing in stages it enables the environment to be progressively rehabilitated as the development proceeds.

Wherever possible the site will remain undisturbed until construction of that area or stage is to take place.

Prior to commencement of bulk earthworks, temporary sediment and erosion control measures should be installed in accordance with the management plan and the Institution of Engineers Soil Erosion and Sediment Control Guidelines. All the runoff from disturbed areas is to be managed by the installation of silt fences and contour drains. Runoff should be dispersed evenly and concentrated flows should be limited. Runoff from undisturbed area should be diverted around disturbed areas wherever practical to minimise erosion of construction site.

Control measures such as sediment ponds, silt fences, contour drains should be installed and maintained in accordance with the recommendations contained in the "Soil Erosion and Sediment Control Engineering Guidelines for Queensland Construction Sites" June 1996, by the institution of engineers Australia (Queensland Division).

Sediment and erosion control must remain in place through out the entire construction process until final landscaping is finished and established.

The soil on site has been earmarked as being low fertility soil, however nutrient transport from site should be minimised with appropriate measures.

The following pages outline control measures for issues that will arise during construction, operation and maintenance stages.

4 DUST MANAGEMENT

Persons Responsible: Contractor's Site Manager

Issue	Minimisation of movement of dust offsite
Operational policy	To achieve acceptable air quality standards through the control of the movement of dust offsite from site works.
Performance criteria	The target level for complaints by nearby residents is no more than one in any seven day period. Ambient air quality should not deteriorate by more than 30% over a period of seven consecutive days. Dust deposition at any nearby residence should not exceed 100mg/m_2/day.
Implementation strategy	The minimisation of the movement of dust offsite will be achieved through the following onsite practices: 1. All permanent bunds and reshaped areas will be revegetated within 10 days after completion of earthworks (including excavation and backfilling of services trenches). 2. Stockpiling onsite will be minimised where possible. 3. An on-site water cart will be available at all times. The site will be watered daily and additional watering will be conducted during high-risk times such as high winds and low rainfall and after receipt of complaints. 4. All dust creating activities to cease if wind speed exceeds 10m/sec. 5. Contractors staff to be trained to implement dust minimisation measures.
Monitoring	Daily inspections will be carried out to verify that dust mitigation measures are being implemented. Dust monitoring will be conducted upon receipt of complaints by residents. If dust monitoring is to take place, the following will occur: • Temporary dust deposition gauges will monitor the movement of dust offsite at the nearest residences adjacent to the proposed stages and within the predominant wind directions . • Monitoring will be undertaken in accordance with AS 3580.10.1 (1991).
Auditing	Management to examine the complaints register weekly and review corrective action taken
Reporting	The contractor to notify EPA of a possible environmental nuisance on receipt of 3 or more dust complaints in any 24 hour period. Reports will be provided to CHCC upon request. Complaints by residents are to be recorded in a Complaints Register and notified to CHCC.
Identification of incident or failure	Any dust-related complaints by residents will indicate a failure of the dust control measures.
Corrective Action	Locate the source of the dust and implement the following measures: • apply water sprays to vegetation • cover or water exposed areas • if dust persists, cease the dust creating activities All dust complaints to be addressed in consultation with Council Officers.

5 SEDIMENT AND EROSION CONTROL

Person Responsible: Contractor's Site Manager, Consulting Engineer

Issue	Sediment and Erosion Controls
Operational policy	To prevent the displacement of sediment and soil across and offsite during storm events.
Performance criteria	• Off-site discharges to comply with requirements for suspended sediments as detailed in Section 6.3 of the SWMP. • No visual indication of erosion on stages under construction, including evidence of rilling (an indicator of sheet erosion).
Implementation strategy	1. Erosion and sediment control devices shall be installed prior to commencement of work in each stage in accordance with the approved engineering plans and to the reasonable satisfaction of CHCC. 2. Temporary erosion measures (eg. silt fences) are to be employed onsite during construction where reasonably deemed necessary by CHCC from an assessment of slope and soil type. Such measures should be in accordance with the recommendations in the IE Aust. Qld. Soil Erosion and Sediment Control Guidelines. 3. Stockpiled soil should be stored/bunded in a manner to prevent soil being washed offsite (ie. bunding where necessary). 4. Outside the construction area of each stage existing surface water conditions shall be maintained.
Monitoring	• Carry out visual inspections daily and after rainfall events (>25mm in 24hrs.) to ensure that erosion measures are in place and operational to suit the activities taking place at the time, . • Surface water quality to be monitored fortnightly (refer to the section titled 'Surface Water Monitoring' which details monitoring of surface water and stormwater quality including during storm events).
Auditing	Visual inspections to be carried out monthly and after rainfall events to verify that control measures are in place and properly maintained.
Reporting of Monitoring Results	Reporting only required if insufficient sediment and erosion measures are identified.
Identification of incident or failure	1. Signs of erosion on site. 2. Damaged or failed erosion control devices. 3. Falling water quality as identified by Environmental Consultant. 4. Build-up of sediment.
Corrective action	Apply remedial measures to Improve sediment and erosion measures, for example; silt fences, and shake down areas.

6 SURFACE WATER MODELLING

Person Responsible: Contractor's Site Manager, Environmental Consultant

<table>
<tr><td>Issue</td><td>Surface water monitoring</td></tr>
<tr><td>Operational policy</td><td>To maintain water quality conditions of receiving waters during the construction phase.</td></tr>
<tr><td>Performance criteria</td><td>All water discharged from the site during the construction phase should comply with the following criteria:
<table>
<tr><th>Water Quality Parameter</th><th>Release Criteria</th><th>Criteria Type</th></tr>
<tr><td>pH</td><td>6.5 – 9.0</td><td>Range</td></tr>
<tr><td>EC</td><td>1500µS/cm</td><td>Maximum</td></tr>
<tr><td>Turbidity</td><td><60NTUI</td><td>Maximum</td></tr>
</table></td></tr>
<tr><td>Implementation strategy</td><td>• Insitu surface water samples to be conducted during rainfall events from established monitoring points at the site outlets.

• Monitoring results should be reviewed after 6 months and sampling frequency revised in consultation with Council Officers.

• Stormwater control should be achieved by directing as much runoff as practicable from disturbed areas to the temporary control measures. "Clean" runoff from undisturbed areas should be diverted around disturbed areas if possible.</td></tr>
<tr><td>Monitoring</td><td>1. Surface water monitoring during construction should be conducted at the monitoring points for the parameters shown above. Flow rates are to be estimated and recorded at the time of sampling.
2. Sampling frequency is to be during rainfall events (>25mm in any 24hr period).</td></tr>
<tr><td>Auditing</td><td>The Consulting Engineer to audit water quality results to ensure all discharges comply with the performance criteria.</td></tr>
<tr><td>Reporting</td><td>• Monthly reports to CHCC including raw data, a results summary and a discussion comparing results with baseline values and ANZECC guidelines.

• Result sheets to be compiled for monitoring results. All results to be kept on site for inspection by local and state government officers at all times.</td></tr>
<tr><td>Identification of incident or failure</td><td>1. Degradation of surface water quality at the monitoring points to below the levels specified in "Performance Criteria" above prior to discharge.
2. Apparent visual changes in water body conditions.</td></tr>
<tr><td>Corrective action</td><td>Locate the source of the contaminant</td></tr>
</table>

	Take all possible actions to contain and control the contaminant. Investigate the cause of the contamination and take action to prevent a recurrence. If the test result for any parameter fails to meet the performance criteria, then weekly monitoring shall commence and continue until the recorded value/s meets the performance criteria. For Example; If the turbidity exceeds the water quality criteria for this parameter, then water may need to be contained on site for a period sufficient to allow suspended solids to settle out prior to release, or settling shall be aided by dosing with flocculation agents at the rate recommended by the manufacturer. Erosion control devices should be immediately inspected and cleaned if necessary. Additional devices should be installed if a need is detected to prevent future breaches of the suspended solids criteria. The placement of stockpiles and management of disturbed areas should be reviewed with regard to sediment and silt control.

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CONTRACTOR MANAGEMENT

Person Responsible: Consulting Engineer

Issue	Contractor management
Operational policy	To ensure the proponents Duty of Care is met by ensuring the Contractor is aware of his responsibilities under the terms of the SWMP and the EPA
Performance criteria	Contractor is fully aware of his responsibilities under the terms of the SWMP.
Implementation strategy	• Review of the SWMP and the construction phase contracts by the proponent. • Periodic checks to be made by an independent Environmental Consultant; • Training for construction staff in implementation of SWMP provisions.
Monitoring	Weekly site inspections to be carried out
Auditing	Inspections will be carried out monthly during the construction phase by an Environmental Consultant for every stage of development.
Reporting	Full details to be available to the contractor together with suggested corrective actions if required
Corrective action	To be detailed at the time

8 MAINTENANCE PHASE

8.1 SEDIMENT AND EROSION CONTROL

Person Responsible: Contractor's Site Manager, Consulting Engineer

Issue	Sediment and Erosion Controls
Operational policy	To prevent the displacement of sediment and soil across and offsite during storm events.
Performance criteria	Off-site discharges to comply with requirements for suspended sediments as detailed in Section 7.3 of the SWMP.
Implementation strategy	Temporary erosion and sediment control devices shall be maintained in an operational state during the maintenance period.
Monitoring	Temporary erosion control measures are to be inspected monthly and after storm events. Permanent control measures are to be inspected monthly and after storm events
Auditing	Quarterly inspections to be carried out by an Independent Environmental Consultant
Reporting of Monitoring Results	Reporting only required in the event of failure of the sediment and erosion measures.
Identification of incident or failure	• Signs of erosion on site • Build up of sediment • Falling water quality
Corrective action	Repair temporary sediment and erosion control measures. Check permanent measures for build up of sediment and clean out as necessary.

8.2 SURFACE WATER MONITORING

Person Responsible: Contractor's Site Manager, Environmental Consultant

<table>
<tr><td>Issue</td><td>Surface Water Monitoring</td></tr>
<tr><td>Operational policy</td><td>To -establish stable surface water conditions and verify that development management is appropriate.</td></tr>
<tr><td>Performance criteria</td><td>All water discharged from the site will comply with the following criteria: pH
<table>
<tr><th>Water Quality Parameter</th><th>Release Criteria</th><th>Criteria Type</th></tr>
<tr><td>pH</td><td>6.5 – 9.0</td><td>Range</td></tr>
<tr><td>EC</td><td>1500µS/cm</td><td>Maximum</td></tr>
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</table></td></tr>
<tr><td>Implementation strategy</td><td>1. Surface water entering and exiting the development shall be monitored at the environmental monitoring points during the “On-Maintenance” period.
2. Surface water monitoring shall be undertaken at the discharge points from the development stages until stable water quality criteria have been established.
3. Monitoring will also be undertaken during flood events where practicable. This monitoring will allow water quality comparisons to be made.</td></tr>
<tr><td>Monitoring</td><td>Surface water monitoring will be conducted during the first rainfall event in each month.
• Rainfall events are defined as >25mm rainfall in 24 hours.
• To revert to construction phase provisions if problems are identified.
• If problems are identified, laboratory analysis at a NATA registered laboratory for the total suspended solids, total nitrogen and total phosphorus to be undertaken until such time as CHCC is satisfied that the Proponent’s duty of care under the EPA has been discharged.
• These provisions will conclude at the end of the “On Maintenance” period.</td></tr>
<tr><td>Auditing</td><td>• Management to audit water quality results quarterly to verify that discharges comply with the performance criteria.</td></tr>
<tr><td>Reporting of Monitoring Results</td><td>1. Monitoring test results are to be compiled on monthly result sheets. Monthly reports containing raw data and an interpretation to be sent to CHCC.
2. Results to be available at all times.</td></tr>
<tr><td>Identification of incident or failure</td><td>Fall in surface water quality at the environmental monitoring points.</td></tr>
<tr><td>Corrective action</td><td>1. Identify reason for deterioration in surface water quality to identify if it is linked to the development.
2. Take necessary steps to address the problem such as Improved temporary sediment and erosion controls.</td></tr>
</table>

8.3 MAINTENANCE

Person Responsible: Contractors site Manager, Consulting Engineer

Issue	Maintenance
Operational policy	To maintain the water quality control structures to ensure adequate performance during the maintenance period.
Performance criteria	The control measures are maintained and operational.
Implementation strategy	1. Ensure inlets and outlets are not blocked and are structurally stable. 2. All waste to be disposed of at Council approved waste facilities.
Monitoring	• Monthly inspection of control structures during the maintenance period • Any recurring problems with the control structures to be rectified during the maintenance period • Structures also to be inspected following major rainfall events
Auditing	• Management to carry out quarterly inspections to verify that the control measures are properly maintained.
Reporting of Monitoring Results	• Record inspection details. • Record details of all maintenance activities including volume of material removed from wetlands, etc. and include in monthly reports to CHCC. • Results to be available to EPA at all times
Identification of incident or failure	1. Blockage of stormwater system 2. Re-entrainment of trapped sediments 3. Deterioration of water quality within or downstream of control structure.
Corrective action	1. Clean or maintain stormwater control structures as appropriate. 2. neessary steps to address the problem to prevent a recurrence.

9 REFERENCES

Coffs Harbour City Council (2000), Urban Stormwater Management Plan.

BMT WMB, July 2008, Revised stormwater Management Strategy, 45 Hearnes Lake Rd, Woolgoolga.

Brisbane City Council (2005), Draft Water Sensitive Urban Design Engineering Guidelines: Stormwater

John R Argue (2004), Water Sensitive Urban Design: Basic Procedures for 'Source Control' of Stormwater, University of South Australia.

Department of Environment and Climate Change, Floodplain Risk Management Guideline Annexure 17(b) 'Practical Consideration of Climate Change'.

Gilbert and Sutherland (2004), Stormwater Management Plan for Proposed Hearnes Lake Road Development Coffs Harbour, Robina