

Our Ref: C344/I117:167824_1

21/08/2013

Mr Eric Hausfeld
Penrith City Council
PO Box 60,
PENRITH NSW 2751

Dear Sir,

**Re: Subdivision of Lot 1 DP 1144668
Andromeda Drive, Cranebrook
DA – 339/2013/HA**

As requested by Council in pre DA meeting on Wednesday 7 August 2013, a Preliminary Maintenance Schedule and costing for the stormwater quality treatment measures is to be provided.

The stormwater quality treatment measures are shown generally in the design plans I117EG P11-1 to P11-4 and specifically in sheet no.4.

Preliminary Maintenance Schedule – Stormwater Treatment Measures

The stormwater quality treatment strategy is to provide a treatment train of measures to remove pollutants progressively along the drainage system. Primary treatment to filter out coarse and gross particles is provided by the GPT proposed near the intersection of Cassar Crescent and Road No. 1 which will cater for flows from the street drainage system. Major flows will bypass the GPT. This flow will then enter the shallow bioretention basin proposed in the north-west corner of the site. Flows will be treated by the filter media and effective nutrient removing vegetation. Vegetation details to be provided by a landscape architect at the Construction Certificate stage.

The maintenance planning and tasks for the system are described below.

A. Maintenance of Bioretention Basin

Regular inspections and maintenance are to be carried out to ensure the system functions as designed. The scope of maintenance tasks includes verifying the function and condition of the following elements:

- Filter media
- Horticultural
- Drainage infrastructure
- Other routine tasks

Table 1: Maintenance tasks and recommended frequencies for bioretention basin.

A) Filter Media Tasks – Inspection Frequency - 3 monthly, after rain or as required		
Issues to inspect	Potential Issues/Observation	Maintenance tasks
i. Sediment deposition	<ul style="list-style-type: none"> - Identify source of sediment and instigate rectification measures by notifying party responsible and requesting urgent action. Possibly advise authorities. - Minimal and isolated accumulation of sediment - Sediment build-up covering plants - Clogging of filter media - Immediate action is required if sediment accumulated to half the basin depth 	<ul style="list-style-type: none"> - Rectify and stabilize source - Remove accumulated sediment and replace the top 100 mm of filter media to design specifications (see Note 1) - If sediment build-up is minimal and isolated scrape away the accumulated sediment and the top 100mm of filter media and replace without disturbing the plants - If the sediment build-up is extensive and smothering vegetation, remove the plants and filter media and replace filter media replant in accordance with specification (see Note 1 & 2) - Lightly spread and compact replaced filter media using either hand tools, an excavator bucket or a pozitrack bobcat (DO NOT drive over the media with any vehicle but a pozitrack bobcat). - Replace any damaged plants to meet the design plant schedule (See note 2)
ii. Holes, scour and erosion	<ul style="list-style-type: none"> - Identify source of any holes, scour and erosion - Visible holes present 	<ul style="list-style-type: none"> - Schedule investigation to identify cause of profile damage and rectify - Once source of damage is rectified, scour holes should be replaced with filter media to design specifications (see Note 1). - Spread, compact and replant as described in i.
iii. Filter media surface porosity	<ul style="list-style-type: none"> - Inspect for the accumulation of an impermeable layer (such as oily or clayey sediment) - Ponding of water for more than a few hours after a rain event - Evidence of layer or leaf litter 	<ul style="list-style-type: none"> - Repair minor accumulations by raking away any mulch on the surface and scarifying the surface of the filter media between plants. - Till the bioretention trench surface if there is evidence of clogging - If required, replace, spread and compact filter media as outlined in i. - Any accumulation of leaf litter should be removed
iv. Compaction	<ul style="list-style-type: none"> - Identify cause of compaction - Localised compaction present - Extensive compaction present - Immediate action is required if water remains ponded for more than 24 hours after rain 	<ul style="list-style-type: none"> - Rectify cause of compaction - If compaction is localised, remove top 500 mm of filter media with auger. - Break-up removed filter media so that it is no longer compacted. - Refill hole with uncompacted filter media (that is, there is no need to replace with new filter media) - If compaction is extensive, seek expert advice
v. Litter control	<ul style="list-style-type: none"> - Presence of organic and inorganic litter in swale 	<ul style="list-style-type: none"> - Check for litter (including organic litter) in and around treatment areas. - Remove both organic and anthropogenic litter to ensure flow paths and infiltration through the filter media are not hindered.
vi. Oil Spills	<ul style="list-style-type: none"> - Occurrence of oil spill 	<ul style="list-style-type: none"> - Do not isolate bioretention system in the case of an oil spill - Notify the EPA of the spill and clean-up requirements - Do not add any fertilizer or other nitrogen based product to the system.
B) Drainage Tasks – Inspection frequency – 6 monthly, after rain or as required		

vii. Perforated pipe	<ul style="list-style-type: none"> - Filter media and plants being waterlogged 	<ul style="list-style-type: none"> - Ensure that perforated pipes are not blocked. A small steady clear flow of water may be observed discharging from the perforated pipe at its connection into the downstream pit some hours after rainfall. - Flush pipes - Note that smaller rainfall events after dry weather may be completely absorbed by the filter media and not result in flow. Remote camera (e.g. CCTV) inspection of pipelines for blockage and structural integrity could be useful.
viii. High flow inlet pits, overflow pits and other stormwater junction pits	<ul style="list-style-type: none"> - Blocked grates, pits & headwalls - Damaged pit covers 	<ul style="list-style-type: none"> - Ensure inflow areas and grates over pits are clear of litter and debris and in good and safe condition. - Inspect for dislodged or damaged pit covers and ensure general structural integrity. - Remove sediment from pits and entry sites/headwalls.
<i>C) Horticultural Tasks – Inspection Frequency – 3 monthly or as required</i>		
ix. Maintain original plant densities	<ul style="list-style-type: none"> - Plant density has been reduced 	<ul style="list-style-type: none"> - Infill planting to design specification (see landscaping plans) - Planting should be evenly spaced to help prevent scouring due to a concentration of flow. - Mow turf or slash vegetation (if required) to preserve the optimal design height for the vegetation.
x. Weeds	<ul style="list-style-type: none"> - It is important to identify the presence of any rapidly spreading weeds as they occur 	<ul style="list-style-type: none"> - Inspect for and manually remove weed species. - Application of herbicide should be limited to a wand or restrictive spot spraying and be approved for use around waterways.
xi. Pests and Diseases	<ul style="list-style-type: none"> - Stunted growth - Pest infection - Senescent plants - Disease on plants 	<ul style="list-style-type: none"> - Treat and replace plants as necessary to comply with the landscaping plans
D) <i>Other Routine Tasks</i> – Inspection frequency – 6 monthly, after rain	<ul style="list-style-type: none"> - Evidence of poor drainage 	<ul style="list-style-type: none"> - Occasionally observe the biofiltration system after a rainfall event to check infiltration. - Identify signs of poor drainage (extended ponding on the filter media surface). - If poor drainage is identified, check land use and assess whether it has altered from design capacity
E) <i>Resetting (complete reconstruction)</i> - Frequency – 10 - 15 years	<ul style="list-style-type: none"> - The system fails to drain adequately - The filter media has reached its maximum pollutant retention capacity - The available flow area of the overlying basin is reduced by 25 percent - The bioretention basin fails to drain adequately after tilling of the surface 	<ul style="list-style-type: none"> - Resetting (i.e., complete reconstruction) of the biofiltration system will be required

1. The filter media specifications provide that the filter media must contain:
Hydraulic Conductivity of 100-250mm/hour

- Clay and silt <3% (<0.05mm)
- Very fine sand 5-30% (0.05-0.15mm)
- Fine sand 10-30% (0.15-0.25mm)
- Medium to course sand 40-60% (0.25-1.0mm)
- Course sand 7-10% (1.0-2.0mm)
- Fine gravel <3% (2.0-3.4mm)

Soil Based filter media properties:

- Total Nitrogen (TN) content – <1000mg/kg
- Orthophosphate (PO₄³⁻) content – <80mg/kg
- Organic matter content – at least 3% (w/w)
- pH – as specified for ‘natural soils and soil blends’ – 5.5-7.5 (pH 1:5 in water)
- Electrical conductivity (EC) – as specified for ‘natural soils and soil blends’ – <1.2 dS/m

Source: *Biofiltration Filter Media Guidelines (Version 3.01), Prepared by the Facility for Advancing Water Biofiltration (FAWB), June 2009*

2. For plant specifications, a landscaping architect would be engaged at the Construction Certificate stage to prepare plans in accordance with FAWB Guidelines and with the instruction to include vegetation effective in removing nutrients as specified in the MUSIC model.

Maintenance should only occur after a reasonably rain free period, when the filter media in the biofiltration system is dry. Inspections are also recommended following large storm events to check for scour and other damage.

B. Maintenance of GPT unit – Dry Type – Baramy or similar

Table 2 Maintenance tasks and recommended frequencies for the GPT unit.

Issues to inspect	Potential Issues/Observation	Maintenance tasks
<i>Routine Inspections</i> – Frequency – Monthly and after heavy rain events	<ul style="list-style-type: none"> - Accumulated material - The unit must be emptied as required but at least once a year. - A suction clean is recommended at least once a year 	<ul style="list-style-type: none"> - Remove the access hatch in the GPT main lid and visually check the screen - A GPT Inspection Form is to be filled out after each inspection. - The recommended emptying options for the GPT unit: educator vacuum, backhoe/ bobcat clam shell and manual cleaning methods. Please refer to the GPT Operation and Maintenance Manual for detailed instructions on these procedures.
<i>Annual Inspection</i> – Frequency yearly	<ul style="list-style-type: none"> - The unit or any features are damaged - Evidence of wear and tear 	<ul style="list-style-type: none"> - Check the condition of the screen, area behind the screen, diversion chamber, weir and lids. Apply grease to the frame of cast iron lids and lubricate pad locks. - Report any damage or wear and tear to GPT

Pre-qualified contractors, may be employed to inspect and clean the GPT unit.

Referenced from: *CDS Technologies, Rocla, Operation and Maintenance Manual & Baramy GPT website <http://baramy.com.au>.*

C. Initial period (before 80% of houses built on lots):

Initially, the bioretention area is to be shaped to act as a sediment trap only with no filter soil material or planting while houses are being constructed. The reason for the delay in completing the bioretention basin is that the main pollutant to be controlled during the house building phase is sediment and a sediment basin (in addition to on site sediment control) is most suitable for this purpose. The earthworks for the basin is to be shaped in accordance with the sections as shown in P11-3, with a maximum 1:6 grade. All stormwater structures would be constructed to design, with blue metal to be placed around the stormwater pit outlet to the level of the grate. During this initial period, the sediment build-up resulting from the construction activities on site would be cleaned out 3 times per year or as required.

Once the majority of houses have been constructed, the basin area will need to be constructed to design levels. Soil and planting are then to be established in accordance with Notes 1 & 2 above and approved Construction Certificate plans.

Referenced from: Chapter 4: Practical Implementation, Stormwater Biofiltration Systems Adoption Guidelines, FAWB, 2009 and from Water Sensitive Urban Design, Book 4 Maintenance, Landcom (2009).

D. Contribution Costings of Stormwater Treatment Measures

Treatment train costs over a 10 year period are outlined in the table below for the bioretention basin and the GPT. These costs begin from practical completion of the civil works and include establishment of the bioretention basin, typical annual maintenance costs, annual renewal/adaptation costs and decommissioning costs as recommended by eWater (MUSIC). The life cycle expected for the GPT is 30 years, while the bioretention basin is recommended to be reset after 15 years.

The base year for costing is 2013 with an annual inflation rate of 2% and a 5.5% real discount rate.

Year	Bioretention Basin			GPT		
	Present Value costs	Future Value costs	Remaining funds	PV costs	FV costs	Remaining funds
0	\$0.00	\$0.00	\$62,856.02	\$0.00	\$0.00	\$7,382.26
1	\$6,300.00	\$6,426.00	\$60,107.55	\$909.00	\$927.18	\$6,890.37
2	\$6,300.00	\$6,554.52	\$57,077.78	\$909.00	\$945.72	\$6,352.52
3	\$6,300.00	\$6,685.61	\$53,748.30	\$909.00	\$964.64	\$5,765.73
4*	\$28,843.94	\$31,221.61	\$26,175.79	\$909.00	\$983.93	\$5,126.87
5	\$4,641.00	\$5,124.04	\$22,631.22	\$909.00	\$1,003.61	\$4,432.62
6	\$4,641.00	\$5,226.52	\$18,785.91	\$909.00	\$1,023.68	\$3,679.46
7	\$4,641.00	\$5,331.05	\$14,620.84	\$909.00	\$1,044.16	\$2,863.68
8	\$4,641.00	\$5,437.67	\$10,115.90	\$909.00	\$1,065.04	\$1,981.33
9	\$4,641.00	\$5,546.42	\$5,249.81	\$909.00	\$1,086.34	\$1,028.24
10	\$4,641.00	\$5,657.35	\$0.01	\$909.00	\$1,108.07	\$0.00
Total			\$62,856.02			\$7,382.26

* Sediment trap cleaned out and bioretention basin constructed to specifications

Source: e Water MUSIC modelling Life Cycle Costing of Treatment Measures

It is proposed to have the bioretention area acting as a sediment trap for the first 3 years while most of the houses are under construction. Years 1-3 show an estimated cost of cleaning out the sediment and is based upon the assumption that the sediment would be cleaned out 3-4 times a year. The requirement for the sediment to be cleaned out will be highly dependant on the erosion control established by the builders and how much this is monitored and enforced by Council. At the beginning of the fourth year, the basin area would be constructed to design, including the placing of filter media

and vegetation. For year 5 onwards, regular maintenance of the bioretention basin would occur according to the above maintenance schedule.

The estimated 10 year maintenance cost for the bioretention area, including the construction costs in year 4, is \$62,856.02 in present value. The GPT maintenance cost for 10 years is estimated at \$7,382.26, however, this would depend on the type of GPT chosen.

Yours faithfully

Whelans InSites Pty Ltd



Brian Lapham NPER CPEng