North Silverdale Land Owner Group

‘The Village’

Silverdale Road, Silverdale

Water Cycle Management Plan

11/104 – September 2011

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WATER CYCLE MANAGEMENT PLAN

SILVERDALE ROAD, SILVERDALE

PREPARED FOR

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PREPARED BY

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EXECUTIVE SUMMARY

Siteplus Pty Ltd has been commissioned by B & M Lopreiato to prepare a Water Cycle Management Plan for the site on Silverdale Road, Silverdale.

The proposed site has a total area of 3.34 hectares. The proposed rezoning will consist of expanding Silverdale's retail precinct including the provision of a supermarket and other essential retail services.

The existing site generally slopes south to an existing dam and water courses adjacent to the subject site. The site lies on an existing ridge line with Silverdale Road dividing the two catchments on the east and west. The site contains one singular discharge point in the south eastern corner.

This report presents a concept Water Sensitive Urban Design (WSUD) strategy for the site incorporating elements such as bio-retention swales systems and gross pollutant traps.

The conceptual strategy has been designed and assessed to meet and comply with WSUD targets and best practice. The WSUD elements will reduce potable water demand, reduce wastewater generation and protect downstream environments.

The results show that the proposed treatment train has a positive impact on the water quality discharging from the site. Improvements are achieved for all pollutants and reductions occur across all of the modeled pollutants.

In summary, the analysis shows that the proposed WSUD elements have a positive impact on the water quality discharging from the site, and the standards imposed by Council and State government agencies are satisfied and as such, the development can be supported on stormwater quality considerations.

1. INTRODUCTION

1.1. Preliminary

1.1.1. Siteplus Engagement

Siteplus Pty Ltd has been commissioned by Silverdale Land Owner Group to prepare a Water Cycle Management Plan for the proposed retail expansion of Silverdale's retail precinct on Silverdale Road, Silverdale. The Water Cycle Management Plan focuses on the possible treatment areas and measures available within the site. The aim of the Water Cycle Management Plan is to ensure that the downstream receiving waters are protected from pollutants resulting by proposed development.

1.1.2. Scope of Work

Siteplus Pty Ltd has been engaged by the Silverdale Land Owner Group to carry out the following services:

- Examine the existing site and determine the mean annual pollutant loads leaving the site within the stormwater;
- Study the possible development area and its effects on water quality;
- Design appropriate water quality devices to remove pollutants from site storm water.

This study does not consider any pollutants outside the scope of MUSIC. Pollutants such as oils and metals within the stormwater have not been considered.

1.2. Subject Land

The site is located on the eastern side of Silverdale Road and the land subject to the rezoning proposal is shown in Figure 2.1 below.

Source: www.nearmaps.com.au.

1.3. Existing Site Features and Catchment

1.3.1. Topography and Landscape

The subject site slopes south east towards an existing farm dam and water course which conveys water east into the Nepean River. The site consists of minor grades (under 10%) sloping grades and suits a retail development topography as only minimal earthworks would be required.

1.4. Stormwater Pollution Control Targets

The targets outlined below are the objectives and targets consistent with state wide water management objectives for new developments established by the NSW Government, and are accepted best practice WSUD targets. The NSW Government target prevail as no localised standards have been set by other authorities such as Local Government.

The following targets are considered minimum standards for the proposed development at Silverdale Road:

- 45% reduction in the mean annual load of Total Nitrogen (TN), compared to a typical urban development.
- 65% reduction in the mean annual load of Total Phosphorous (TP), compared to a typical urban development.
- 85% reduction in the mean annual load of Total Phosphorous (TSS), compared to a typical urban development.

The water quality targets are based on the EPA best practice guidelines 'Managing Urban Stormwater'. The updated draft targets are 80:65:45 these targets have not yet been adopted but remain in draft form.

This study accepts the Best management practices as set by the EPA and meets each target to ensure that the site meets stormwater quality targets into the future.

1.5. Stormwater Quality Improvement strategy

The proposed system implements a systematic approach to the removal of pollutants before disposal offsite. The system proposed removes the larger pollutants first at the source followed by the smaller and dissolved pollutants.

The larger gross pollutants will be removed by proposed gross pollutant traps (GPT). Each GPT will remove the litter and course sediment. Each GPT will also ensure that the downstream Bio-retention swales and basins function correctly and do not clog the filter media voids with sediment thus reducing its pollutant removal capacity. The end of line bio-retention swales remove the finer sediment and dissolved pollutants. This strategy ensures that all of the stormwater leaving the site from each catchment meets the 'Best Practice' requirements of the EPA.

2. CLIMATE INFORMATION

2.1. Climate Information

2.1.1. General

MUSIC requires historical rainfall data to determine the pollutant loadings leaving the site. It is best practice to use a sample year which consists of higher than average rainfall or wet year. The data used was sourced from Penrith rain gauge in the period from 1997 to 2006 which has no non-recording periods and no accumulative rainfall periods. The Penrith rain gauge is the closest rain gauge straight line distance to the site with historical recordings. The data was recorded in 5 minute intervals to attain an accurate Metrological template.

2.1.2. Bureau of Meteorology Data

The Historical rainfall data used within the MUSIC model was attained from the Penrith rain gauge and consisted of 5 minute recordings from the year 1997 Figure 3 illustrates the recorded historical rainfall during the period from 1997 to 2005.

2.1.3. Evapo-transpiration Data

The evaporation or evapo-transpiration data is a required input for MUSIC. The evaporation data used for the subject model was also attained for the Silverdale region. A monthly average was used within the model and is shown through the red line in Figure 3.

2.1.4. Meteorological Template

The meteorological template combines both the evapo-transpiration and historical rainfall data. The meteorological template is shown in Figure 3 for the period from 1997 to 2005.

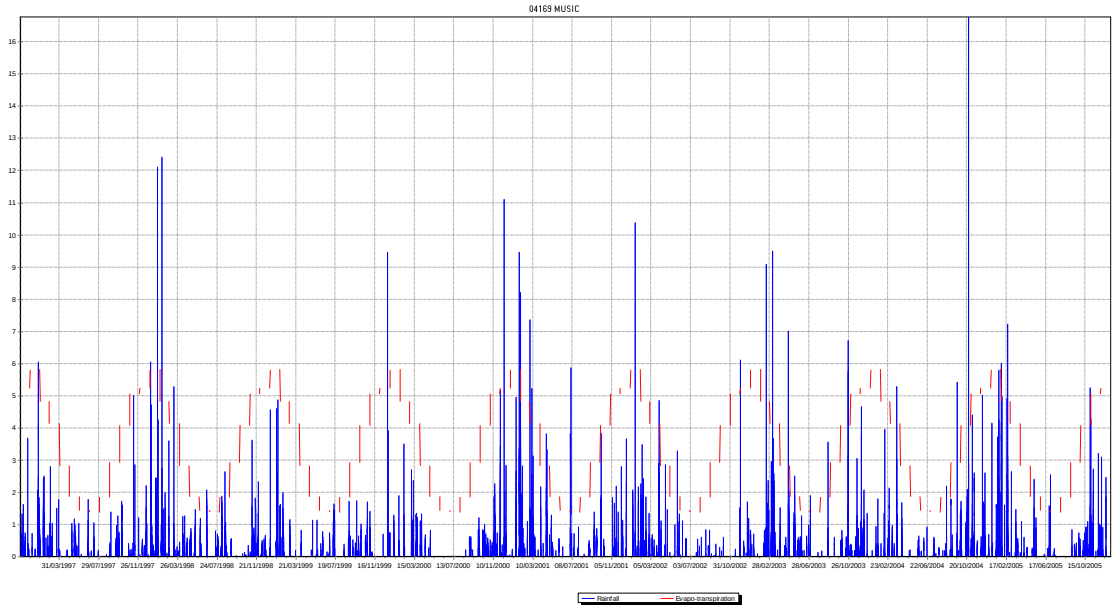


Figure 3. Meteorological Template for period from 1997 to 2006 source: MUSIC model

3. SOURCE NODES

3.1. Site and Area Characteristics

The site abuts both rural residential development and agricultural development.

3.2. Proposed Development Sources

3.2.1. Urban Nodes

The site drains to a singular outlet in the south eastern corner of the site. the proposed development has been modelled as one catchment with 80% imperious area.

The default source node values have been used for each of the catchments modelled.

3.3. Treatment nodes

3.3.1. Treatment Train Proposed

The treatment train proposed for the site consists of a number of treatment measures to remove pollutants whilst conveying the stormwater offsite. The proposed treatment train removes pollutants in a systematic order. Larger pollutants are removed higher up the treatment train, and the smaller or dissolved pollutants are removed at the end of the treatment train through bio-mechanical means.

3.3.2. Gross Pollutant Traps

Gross Pollutant Traps (GPT's) are to be proposed upstream of piped drainage lines entering the proposed bio-retention systems. The GPT's will ensure that both large and small pollutants and debris are removed from the stormwater before entering the bio-retention swales. This systematic removal of larger pollutants minimises the maintenance requirement of the bio-retention swale as it reduces their sediment load. The conservative GPT parameters used within the MUSIC model are as follows:

- 80% removal of Gross pollutants
- 15% removal of suspended solids
- 0% removal of Nitrogen and Phosphorus

3.3.3. Bio-retention System

Two main bio-retention systems are proposed on the southern boundary of the site. The bio swales are to treat and removed the dissolved pollutants (nitrogen and phosphorus) from the stormwater column before entering the downstream tributary.

The bio-retention swales have been on the lower side of the site allowing all of the stormwater leaving the site to be treated prior to discharge.

The bio-retention systems will also double as detention basins, slowing the outlet flow and also maximising filtration through each system.

To treat the proposed development areas shown and Appendix A to meet the necessary EPA standards the bio-retention system requires a total area of 1,150m^2 with a filtration area of 805m^2.

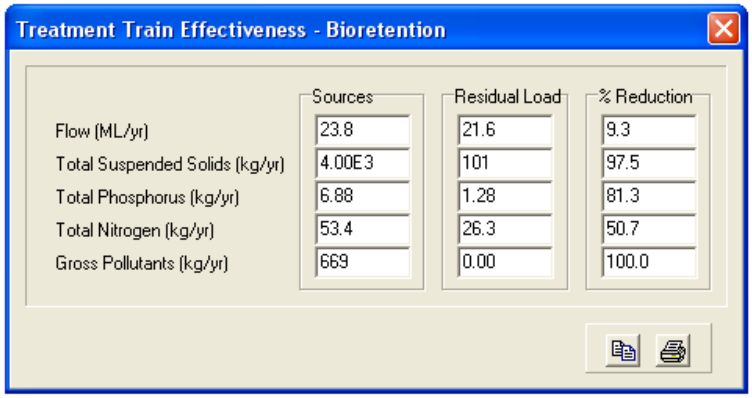
The above parameters are subject to change as the residential developable areas change.

4. RESULTS

4.1. Mean Annual Pollutant Loads

To determine the effectiveness of the treatment train the historical metrological template was simulated through the treatment measures proposed. The table below outlines the annual percentage reduction of pollutants when the proposed water treatment controls have been implemented.

The MUSIC model finds that all the pollutants modelled have achieved the required urban stormwater best practice targets of 80% reduction in Total Suspended Solids, a 65% reduction of total Phosphorus, and a 45% total reduction in total Nitrogen.



The results confirm that the proposed treatment measures have an impact on the water quality discharging from the site. Improvements are achieved for all pollutants.

There are benefits across the full suite of pollutants modelled.

5. CONCLUSION

In conclusion the proposed stormwater treatment measures effectively remove pollutants to the EPA best practice requirements. The proposed measures remove a full range of pollutants from larger gross pollutants to smaller dissolved pollutants

The results indicate that the stormwater runoff from the site after the development will improve the water quality and therefore the receiving water bodies downstream will benefit as a result of this development.

6. REFERENCES

http://www.toolkit.net.au/music

Upper Parramatta River Trust, 2004, *Water Sensitive Urban Design Technical Guidelines for Western Sydney*, Stormwater Trust, Sydney.

APPENDIX A

Drainage Concept Plan