

VERSION 1.0

Stormwater Solutions for Residential Sites

Section 1 - Introduction

Prepared for

EcoWater Solutions

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November 2004

1.1 Purpose

Stormwater generated from residential sites has the potential to cause a number of adverse affects. Flooding, erosion of stream channels and pollution of streams and beaches are all problems that can be associated with stormwater. These problems are often made worse by the process of in-filling and redevelopment of sites.

Traditionally, when a site located in an urban area was developed or subject to upgrades, the stormwater from roof and driveway areas would be connected directly into the existing drainage system. This can cause problems because older drainage networks often do not have capacity for more flow, nor incorporate any form of stormwater treatment.

This document promotes methodologies for on-site control of stormwater that are designed to control the effects of development in an existing urban environment. The document was developed by WCC Solutions (WCC) and is intended to provide guidance to landowners, developers, engineers and surveyors on the stormwater management methods applicable to urban residential sites located in Waitakere City. In this document “Council” refers to Waitakere City Council.

The document focuses on the management practices applicable to developments on individual residential lots. This includes new houses, house extensions, new garages and driveways. Methodologies described in the document generally apply to residential properties of 1,000 m² area or less.

The intent is that the document will be used by WCC engineers, and applicants for stormwater control for building permits for these types of developments.

1.2 What are the Adverse Effects

Residential development results in an increase in the area of impervious surfaces on a site (roofs, driveways, and roads). In addition, development often results in areas of earth around buildings being compacted, the removal of vegetation and changes in the natural drainage systems.

When impervious areas are added to a site the stormwater runoff from the property can potentially intensify. This can cause localised flooding problems and also contribute to any existing downstream flooding problems. In addition there is potential for an increase in contaminants associated with stormwater to be generated from a property. This can have localised adverse affects and contribute to cumulative degradation in downstream watercourses.

In summary the effects of development on stormwater flows can result in:

- Flooding as a result of the capacity of existing stormwater reticulation systems being exceeded;
- Stream bank erosion in nearby watercourses;
- Sedimentation in existing watercourses and downstream environments;

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- An increased tendency for more severe flooding and increased areas of flooding;
 - The increased contamination of receiving environments, both in local streams and in the marine environment where all stormwater eventually goes; and
 - Adverse impacts on aquatic resources.

1.3 Design Objectives

WCC are focused on implementing stormwater management solutions that mitigate against the adverse effects of development listed above. Key design objectives applied in this document are described below:

Objective.1 **To prevent downstream flooding.** The effect of providing increased impervious surface within a property is to reduce the volume of runoff that infiltrates naturally back into the ground, causing runoff to discharge faster. Without controls in place this can result in peak flows and discharge volumes associated with storm events increasing from a property. This additional flow can cause localised flooding and contributes to wider catchment flooding problems downstream.

Objective.2 **To prevent increased erosion and change to the hydrologic regime of downstream watercourses.** Development has the potential to cause a change in the pattern of stormwater discharges to streams. In particular, an increase in impervious surface areas within a catchment can result in stormwater being transmitted faster to streams. As a result there are more occurrences in a year of short, high flow events associated with regular rainfall conditions (i.e. less than a 1 in 1 year event) than would have occurred pre-development. This change in stream response to rainfall can result in significant channel erosion and downcutting, which in turn adversely affects stream habitat.

Objective.3 **To minimise the potential for increased discharge of contaminants associated with stormwater runoff from a site following development, to streams and coastal receiving environments.** Stormwater runoff generated on impervious areas, particularly roads, tends to pick up contaminants. These contaminants have the potential to degrade streams and sensitive coastal receiving environments.

The first two objectives can be achieved through mitigating against change in the peak flow, volume and time of concentration of stormwater runoff from an area during a rainfall event after residential development has occurred.

Incorporation of stormwater treatment into the design of conveyance and storage systems provides opportunity to achieve the third objective of mitigating against increased contaminant discharge.

1.4 Stormwater Management Methods

The objectives described above can be achieved in practical terms by the application and design of suitable stormwater management methods, described in this document as follows:

- Section 2 Stormwater Management Approach – this section outlines the overall approach to managing stormwater on site. This section also includes recommended conceptual layouts of stormwater management devices.
- Section 3 Which option to use - this section covers how to identify appropriate stormwater management options for a planned development.
- Section 4 Minimising Impervious Areas – this section outlines techniques that can be used to minimise the impervious area on a site. Minimising impervious areas is the most effective way to reduce the amount of stormwater management that is required.
- Section 5 Roof tanks – this section describes the use of roof tanks to attenuate flood flows. Roof tanks can be used to provide temporary storage and attenuate stormwater flows.
- Section 6 Rain Gardens –this section provides information about the use of a raingarden and basic design details. Rain gardens attenuate peak flows and provide stormwater treatment.
- Section 7 Permeable Paving – this section describes how the use of permeable pavement can provide both attenuation and treatment of stormwater.
- Section 8 Swales - this section describes how swales can retard flow and provide some infiltration especially when used to convey stormwater flows from larger areas of impervious surface like driveways.
- Section 9 Green roofs - this section provides conceptual details for green roofs, which can retard runoff and reduce runoff volumes through evapotranspiration.
- Section 10 Maintenance and Monitoring Requirements – this section outlines Councils expected requirements for monitoring and maintenance of the devices described in the document.
- Appendix A Checklists – Checklists have been provided to fill in to enable Council officers to assess applications in terms of effects on stormwater.
- Appendix B Recommended Plant Species– this appendix contains a list of the plant species recommended by WCC for Rain Gardens.

Table 1-1 illustrates devices covered in this document.

Table 1-1 - Stormwater Management Devices

Devices for Meeting Design Approach	Example
Roof tanks	
Rain gardens	

Permeable Pavement



Swales



Green Roofs



1.5 Auckland Regional Council Technical Publications

The ARC has developed a series of technical publications that promote a low impact design approach to the management of stormwater. Low impact design approaches are strongly supported by WCC. Of particular relevance are the:

- Low Impact Design Manual for the Auckland Region (Technical Publication 124)
- Stormwater Treatment Devices: Design Guideline Manual (Technical Publication No 10) - (<http://www.arc.govt.nz/arc/environment/water/>)

For sub-divisions reference should be made to these documents as they include information on devices not covered in this document. This applies in particular to devices more suited to servicing larger catchments such as wetlands, detention ponds and sand filters.

1.6 Limitations

- a) It is intended that this document be used as a guide to appropriate on-site management of stormwater. Effective stormwater management depends on correct application of systems to site constraints such as slope, vegetation, soil conditions and proposed site layout. Proper site assessment needs to be undertaken in conjunction with the use of this document to develop appropriate on-site stormwater management techniques; and
- b) This document is to be used as a guide to appropriate on-site management of stormwater for **lots of 1,000 m² or less**. Council reserves the right in any particular case to impose more restrictive requirements than those required under this document where Council considers it necessary to ensure appropriate stormwater management, including without limitation that Council may limit the methods of stormwater mitigation that are considered appropriate on a site by site or catchment basis; and
- c) As the ARC is the regulator of stormwater in the Auckland Region, this document may not in all instances meet their requirements. If for any reason the Auckland Regional Council do not accept the use of devices within this document to mitigate the effects of a development then a separate resource consent may be required from the Auckland Regional Council; and
- d) Where there is any conflict between Section 1.6 above, and the wording of this document, then Section 1.6 shall prevail; and
- e) Property owners are advised to use the services of a consulting engineer to assist in the development of appropriate on-site stormwater management options.