

VERSION 1.0

Stormwater Solutions for Residential Sites

Section 6 – Rain Gardens

Prepared for

EcoWater Solutions

A Department of Waitakere City Council
113 Central Park Drive
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WAITAKERE CITY
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6.1 Introduction

A rain garden is used to attenuate peak flows and to provide stormwater treatment. Rain gardens use the concept of bioretention, a water quality practice in which plants and soils remove contaminants. Rain gardens are created in low-lying areas, with specific layers of soil, sand and organic mulch. These layers naturally filter the stormwater. During the inter-event dry period, the soil absorbs and stores the rainwater and nourishes the garden's grasses, trees and shrubs.

6.2 Description

Rain gardens look and function like any other garden except they treat runoff and are specifically designed with a layer of 100 mm of mulch, 600 (minimum) to 1,000 mm of planting soil, and vegetation (grasses and shrubs). Figure 6-1 illustrates a typical layout of a rain garden. In clay soils, an underdrain should always be incorporated into the design of a rain garden to provide adequate drainage during wet weather. The underdrain must discharge to an approved stormwater outlet. To prevent the migration of adjacent soil into the planting soil and the migration of planting soil into the underdrain material, filter fabric is required.

In Waitakere City rain gardens should be designed for a water quality design storm of 25 mm over the contributing catchment area (i.e. 1/3 of the 2 year 24 hour rainfall of 75 mm as required by ARC TP No 10). Provision of a maximum ponded water depth of 200 mm above the rain garden surface (as per ARC TP No 10) provides for storm events to be caught and treated. An overflow provision should be allowed for storm events that exceed the 200 mm freeboard.

6.3 Considerations

The main issue on the long-term performance of rain gardens is adequate maintenance. Over time, the planting soil permeability may reduce which will increase surface ponding time. Another issue relates to maintenance of the rain garden vegetation. During dry periods the underdrain may cause the rain garden to dry out, which may necessitate watering of the vegetation on an as needed basis to ensure a healthy appearance.

6.4 What to do?

The size of the rain garden depends on the area that drains into the rain garden. The area may include pervious areas as well as impervious areas. The rain garden depth should be 1.0 m deep unless underdrainage is difficult in which case the depth could be reduced to 0.6 m minimum.

The rain garden area for a 1 m deep garden is sized in accordance with the procedure given in ARC TP No 10 as follows:

$$A_f = WQV * d_f / (k * (h + d_f) * (t_f))$$

Where:

A_f = surface area of rain garden (m²)

WQV = water quality treatment volume (m³)

d_f = planting soil depth (m) – use 0.6 to 1.0 m

k = coefficient of permeability (m/day) – use 0.3 m/day

h = average height of water (m) i.e. half the maximum depth – use 0.11 m

t_f = time to pass WQV through soil bed (use one day to be conservative)

The WQV for a contributing catchment area includes runoff from impervious area ($A_{\text{impervious}}$) and pervious area (A_{pervious}) due to the water quality design storm.

From ARC TP No 10, water quality design storm = $1/3 * 75 = 25$ mm, and

$$\begin{aligned} WQV &= A_{\text{impervious}} * (0.025 - 0.002) + 0.5 * A_{\text{pervious}} * (0.025 - 0.015) \\ &= A_{\text{impervious}} * 0.022 + A_{\text{pervious}} * 0.01 \end{aligned}$$

Hence for a 1 m deep rain garden:

$$A_f = 3.03 * (A_{\text{impervious}} * 0.022 + A_{\text{pervious}} * 0.01)$$

For a 0.6 m deep rain garden the same volume of soil should be retained in the rain garden.

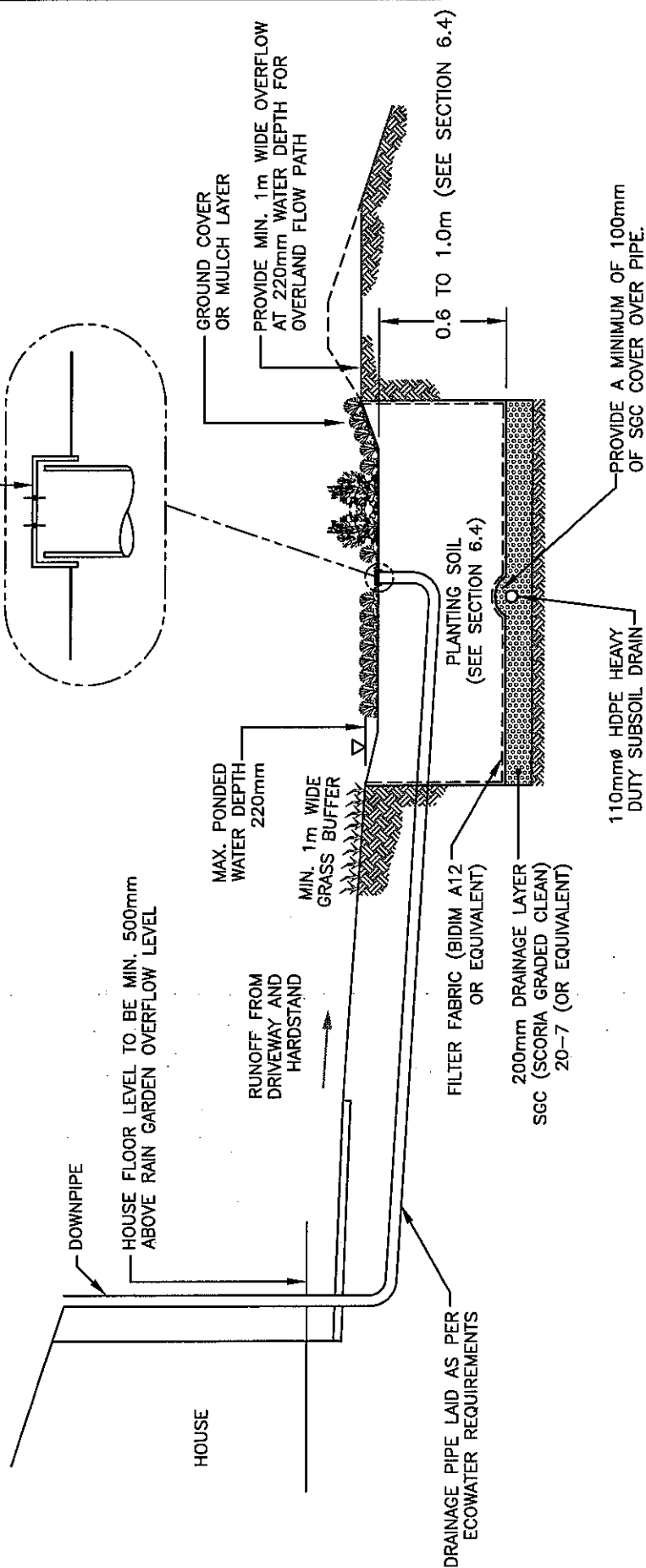
Hence for a 0.6 m deep rain garden:

$$A_f = 5.05 * (A_{\text{impervious}} * 0.022 + A_{\text{pervious}} * 0.01)$$

The soil composition must be permeable enough to allow runoff to filter through the media. The planting soil should be a sandy loam, loamy sand, loam, or a loam/sand mix (35-60% sand). The clay content should be less than 25% and the permeability should be at least 0.3 metres per day. The soil should be free of stones, stumps, roots, or other woody material over 25 mm in diameter. Brush or seeds from noxious plants should not be present in the soils. Placement of the soil should be in lifts of 300 - 400 mm and loosely compacted (tamped lightly with a backhoe bucket). A mulch layer (standard landscape type) should be included on the surface of the rain garden.

The construction of a rain garden will require two inspections. The first inspection will be conducted after the installation of the under drainpipe and drainage layer. The trench for the pipe connecting the rain garden and dispersal device should remain open for the inspection. The final inspection will be conducted upon completion of the rain garden, including planting of vegetation. Plants suitable for use in rain gardens are listed in Appendix B.

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SECTION

NOTES

- FOR SIZING RAIN GARDEN AREA REFER TO SECTION 6.4
- FOR GROUND COVER PLANTS AND PLANTING SOIL SPECIFICATION REFER TO APPENDIX B AND SECTION 6.4
- FOR RAIN GARDENS RECEIVING STORM WATER FROM PIPES, SPECIAL CONSIDERATION SHALL BE MADE TO DISPERSE FLOWS AND MINIMISE EROSION FROM THE CONCENTRATED FLOWS
- SELECTION OF RAIN GARDEN AND OVERFLOW LOCATION NEEDS TO CONSIDER IMPACTS TO SURROUNDING STRUCTURES AND DOWNSTREAM PROPERTIES
- SUBSOIL DRAIN TO DISCHARGE TO ECOWATER APPROVED OUTLET

Title
**CONCEPTUAL LAYOUT OF
RAIN GARDEN**
Figure No. 6-1

Waitakere City Council
Te Taiāo o Waitakere



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