

THREE WATERS MANAGEMENT PRACTICE NOTE

HCC 05: Rainwater Reuse and Detention System

This practice note has been developed to provide guidance on the design and sizing requirements for rainwater reuse and detention tanks which are used in both residential and non-residential applications for on-site stormwater management. Refer to Section 1 for residential applications and Section 2 for non-residential applications.

Note: The Three Waters Management Practice Notes are a Hamilton City Council controlled document and will be subject to an ongoing review process. The latest version of the Practice Notes can be downloaded from the Hamilton City Council Website www.hamilton.govt.nz

The following information on rainwater reuse and detention systems is intended as a guide only. All rainwater reuse and detention tanks within Hamilton City boundaries require specific design and approval from Hamilton City Council's Building Control Unit.

1. RESIDENTIAL APPLICATIONS

1.1 Introduction

Rainwater reuse and detention tanks are tanks which combine the benefits from both rainwater harvesting and detention into a single tank. These tanks are applicable in an urban environment where there is a public water supply available for potable use and to supplement the tank water. The harvested water from these tanks should be used primarily for toilet flushing and laundry supply but can also be used for other non-potable purposes such as garden watering and car washing.



Rainwater reuse and detention tanks comprise two sections, above and below a small diameter orifice part way up the side of the tank. The volume below the orifice is used to store rainfall collected from roof areas for non-potable use within the building, while the volume above the orifice is used for detention and the orifice allows the slow-release of roof run-off during and after rainfall events.

Hamilton City Council recommends a minimum volume of **5,000 litres** or **5m³** for the reuse portion of the tank, unless the roof area is less than 60m² and the building is single level, in this case Hamilton City Council recommends a **3,000 litre** or **3m³** volume.

1.2 When should rainwater reuse and detention tanks be used?

Rainwater reuse and detention tanks may be used as one of the on-site stormwater mitigation methods in accordance with council's Drainage Disposal Hierarchy¹.

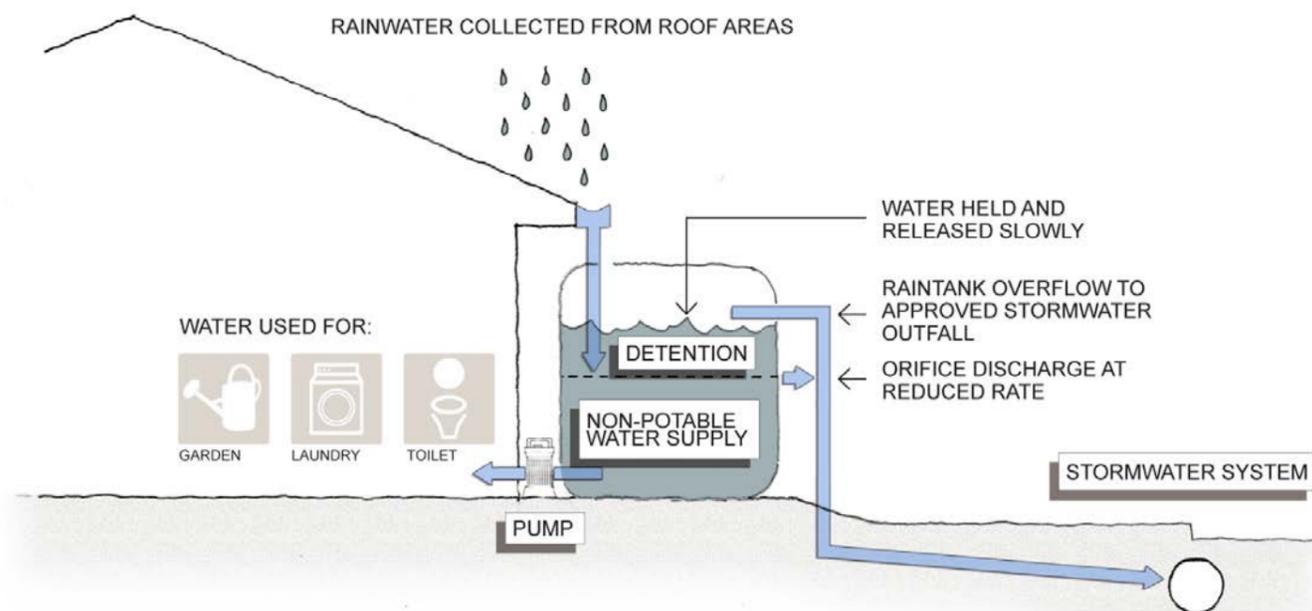
Retention for reuse is the preferred water sensitive technique for both water supply and stormwater, and will generally be suitable for roof areas of 50m² or more.

The requirement for onsite stormwater quantity mitigation (detention) will depend on whether or not there is a downstream detention facility, such as a pond or wetland, designed to accept runoff from the site. If onsite quantity mitigation is required, detention can only be considered if onsite soakage has been found not to be appropriate for the particular site conditions. Site suitability for soakage will need to be assessed for every new building consent application. Detention is one of the options that can be used to manage stormwater if soakage is not an option.

1.3 Advantages of rainwater reuse and detention tanks

Rainwater reuse and detention tanks provide the following benefits:

- *Reduces the use of potable water from the public water supply system.*
- *Reduces the annual volume of water which runs off from your site.*
- *Reduces peak flows from storm events up to a 10 year event.*
- *Capture the first flush of runoff and thereby improve water quality.*



¹ Refer Practice Note - HCC 01: Overview for details of the drainage hierarchy.

1.4 Minimum Design Requirements

The reuse and detention tank must meet the following minimum design requirements:

- **Tank volume:** The tank should be sized according to the roof area draining to the tank and the design procedure in Section 1.5 below. A minimum rainwater reuse volume of **5,000L (5m³)** is recommended unless the roof area is less than 60m² and the building is single level then **3,000L (3m³)** is recommended. If water reuse is plumbed to the laundry as well as to the toilet(s) and irrigation, the reuse volume can be halved where a reuse and detention tank is being used, so **2,500L (2.5m³)** unless the roof area is less than 60m² and the building is single level then **1,500L (1.5m³)**.

The required detention volume will depend on the area that requires mitigation and the proportion of the impervious area that is able to be drained via the tank.

Onsite residential detention systems within Hamilton City shall be designed to manage peak flows from the 10 year ARI rainfall event and discharge it at 80% of the pre-development 2 year ARI rate.

- **Catchment:** The whole roof area should be connected where practicable. Only roof water should be drained to the rain tank.
- **Offset mitigation:** It is possible for a tank to provide mitigation for some area (up to 15%) that does not drain to it. This is called offset mitigation and results in a slightly larger tank and slightly smaller orifice to compensate for the area not draining to the tank.
- **Tank use:** The tank is connected via a pump to all toilets, irrigation and ideally to the laundry, and may be connected to the outside taps.
- **Backup water supply:** A backup water supply must be provided from the potable water supply for those occasions when the tank approaches empty. The first option is to plumb the backup mains water supply into the top of the tank with a registered air gap at the top of the tank, or to provide a testable backflow device. It is important that whichever option is installed that the provision is made to protect the potable water supply from cross contamination by means of an approved backflow prevention device or air-gap.
- **Contamination:** The tank may be above or below ground but if it is below ground then it must be clearly identified as 'contaminated'. Water from non-roof areas must be prevented from getting into the tank, including the provision of backflow prevention methods to ensure no stormwater surcharges back into the tank.
- **Pipework:** Pipes supplying non-potable water must be coloured (lilac) and clearly marked. All taps connected to the non-potable water source must be clearly marked as not for drinking (see symbol). These taps are generally outdoor garden taps but it also applies for indoor taps such as the laundry cold water tap. The taps should also be colour coded with either a lilac ring or lilac powder coated.

- **Access:** Suitable access must be provided to the tank, the pump, and any screens or filters and the for maintenance and regular inspections. The location of these items must be clearly identified.
- **Orifice location:** A small diameter orifice should be positioned part way up the tank to provide the detention part of the tank. The location of the orifice is to be determined using the methodology outlined in Section 1.5 - Step 6 below.
- **Dead storage zone:** A dead storage volume is required at the bottom of the tank for sediment build-up. The lowest outlet for reuse purposes should be located a minimum of 100mm above the bottom of the tank to allow for sediment accumulation.
- It is advisable to provide some or all of the following:
 - Some form of leaf guards on your gutters.
 - Insect screens.
 - A first flush diverter which diverts the most 'contaminated' roof runoff.
 - A tank vacuum type overflow which helps to remove sediment build up from the bottom of your tank.
 - A filter at the pump.
 - An inlet system which prevents sediment from being stirred up when the tank is nearly empty.

Refer to NZ Building Code E1 Surface Water, G12 Water Supplies and F8 Signs, and NZS 5807: Part 2 for additional requirements.

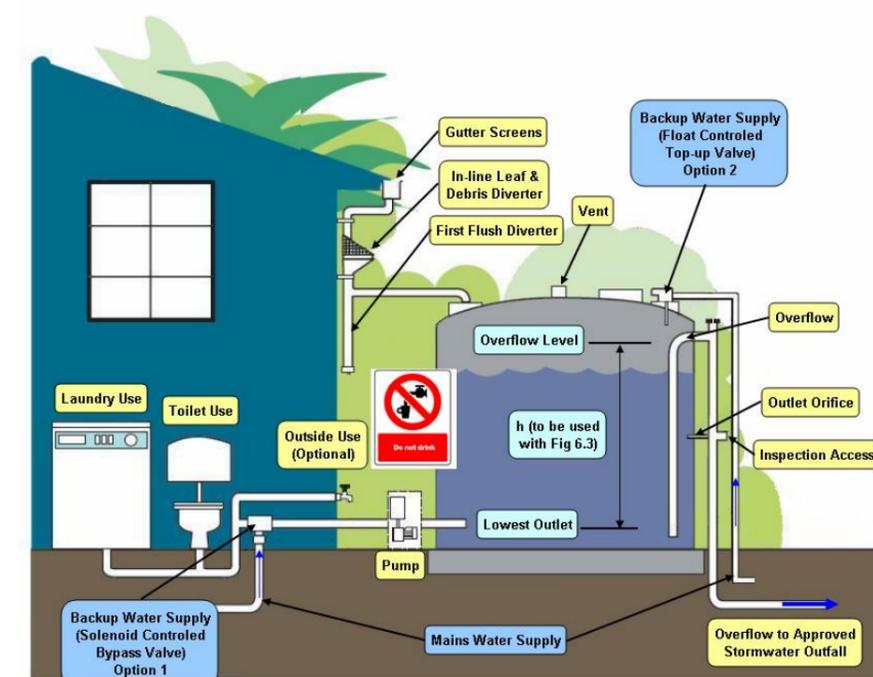


Figure 1.1: Above Ground Rainwater Reuse and Detention System Typical Components

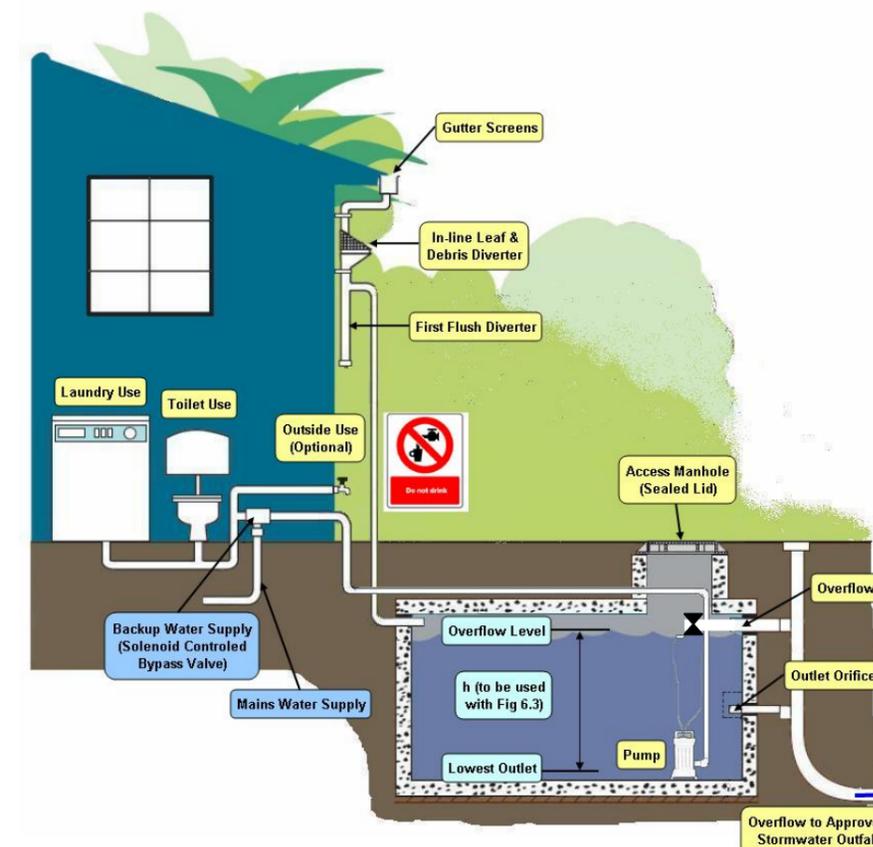


Figure 1.2: Below Ground Rainwater Reuse and Detention System Typical Components

1.5 Procedure for calculating Rainwater Reuse and Detention System tank sizing and configuration

This procedure should be used for residential applications. It refers to the three areas of the tank, the temporary volume which buffers storm flows, the permanent reuse volume and the dead storage volume of the tank.

This procedure should be used for residential applications that comply with the following conditions:

- Maximum impervious area to be mitigated of 600m²
- Offset mitigation area no greater than 15% of the total impervious area draining to the detention tank.
- Only roof water should be drained to the Rainwater Reuse and Detention System.
- Pre-development site assumed to be undeveloped (greenfields) – Runoff Coefficient, C = 0.30.
- Outlet of tank located above the level of the stormwater reticulation into which it will discharge, with no back water effects.

Should site conditions or design requirements not comply with the above conditions, specific design of the detention system will be required. Refer to HCC06 Detention Tank Practice Note for the general methodology to be followed in these circumstances.

Step 1: Determine the total roof area of the building [A_r]

Measure the total roof area which shall be connected to the tank, including the eaves. (Note it is advantageous to maximise the roof area connected to the tank as this increases the water captured for re-use and also minimises the over-attenuation required impervious bypassing the tank.

Step 2: Check Offset Mitigation limit [A_i]

Measure the areas of concrete driveway, pathways and other impervious areas [A_i] and compare to the total roof area connected to the tank. If A_i/A_r > 15%, specific design incorporating onsite detention of runoff from the additional impervious surfaces is required.

Step 3: Determine the Detention volume [DV]

Based on the values measured above the required Detention Volume should be sized according to the chart in Figure 1.1.

Step 4: Determine the Reuse Volume [RV]

The minimum Reuse Volume for Residential Zones is 5,000L or 5m³ unless the dwelling is less than 60m² and single level then the Reuse Volume is 3,000L or 3m³. Or if laundry is plumbed for water reuse as well as toilet(s) and irrigation, then you can halve the minimum Reuse Volume to 2,500L or 2.5m³ unless the dwelling is less than 60m² and single level then it is 1,500L or 1.5m³.

Step 5: Determine the Minimum Total Tank Volume [V_t]

The Minimum Total Tank Volume [V_t] is the sum of the Detention Volume [DV] determined in Step 3 and the Reuse Volume [RV] determined in Step 4.

$$V_t = DV + RV$$

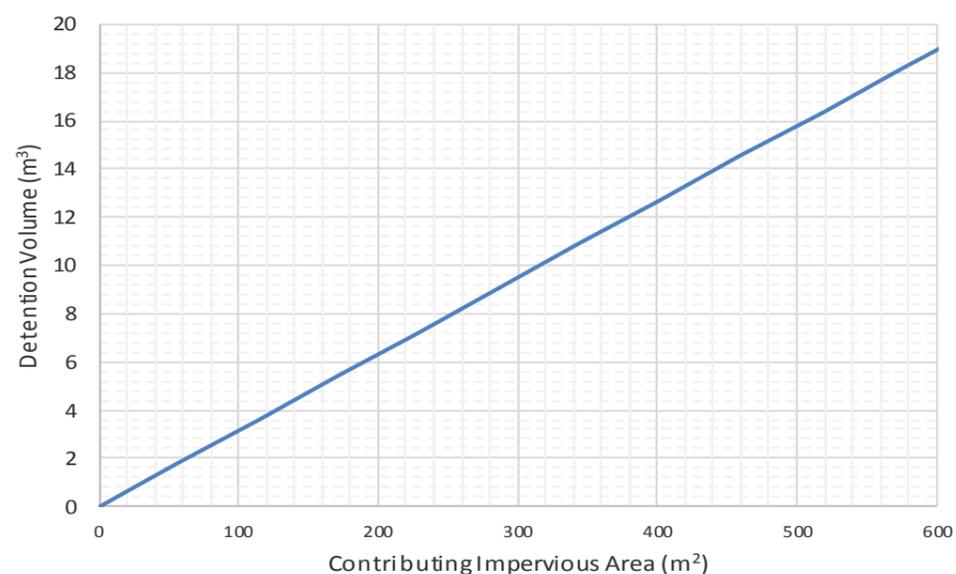


Figure 1.1: Detention Volume Selection Chart

Step 6: Select the desired tank make and model.

Based on the total tank volume [V_t] determined in Step 5. Once the tank make and model has been chosen, obtain the tank dimensions from the manufacturer's specifications.

Step 7: Determine the tank configuration.

Using the chosen tank dimensions – Total Height [H] and Tank Plan Area [PA], and the required tank volumes – Detention Volume [DV], Reuse Volume [RV] from Steps 3 and 4, determine the required configuration for the Rainwater Reuse and Detention Tank.

7.1. Dead Storage Height h_3 = Minimum 100mm above the base of the tank for sediment accumulation

7.2. Reuse Height h_2 = Reuse Volume [RV] / Tank Plan Area [PA]

7.3. Detention Height h_1 = Detention Volume [DV] / Tank Plan Area [PA]

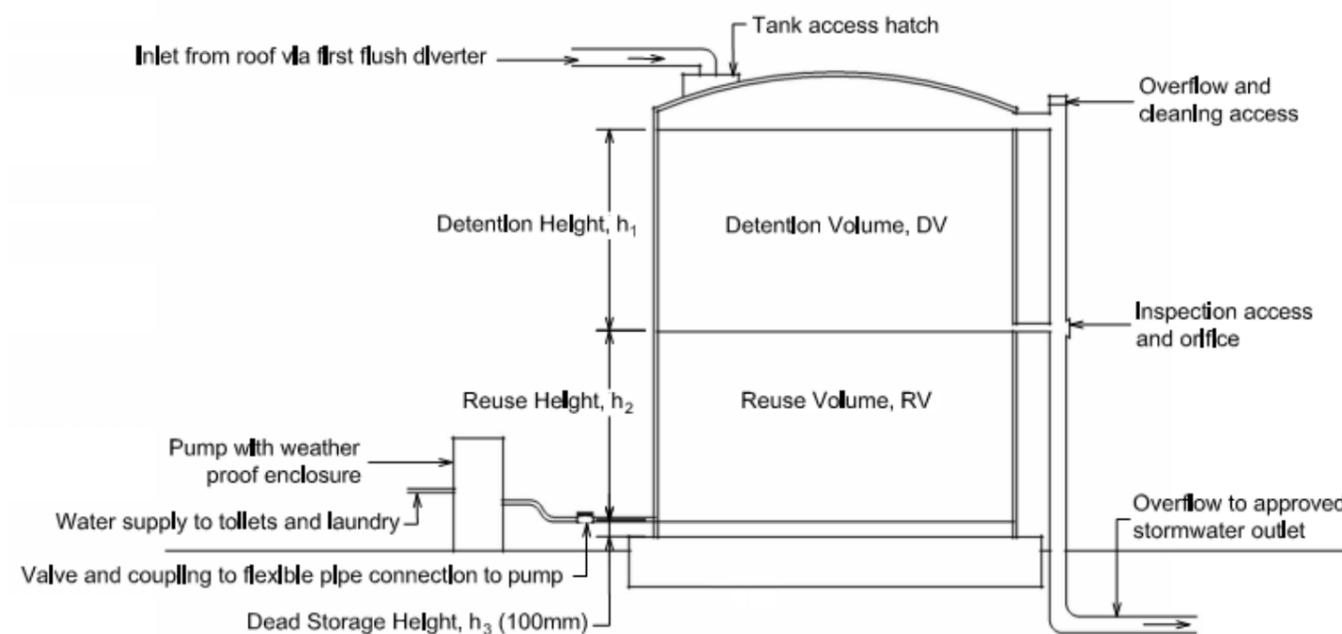


Figure 1.2. Schematic of Rainwater Reuse and Detention tank configuration.

Step 7: Determine the size of the orifice.

The size of the orifice is related to the roof area and the adopted Detention height, h_1 and should be designed as per the chart in Figure 1.3 below. For maintenance reasons the minimum size of the orifice should be 10mm.

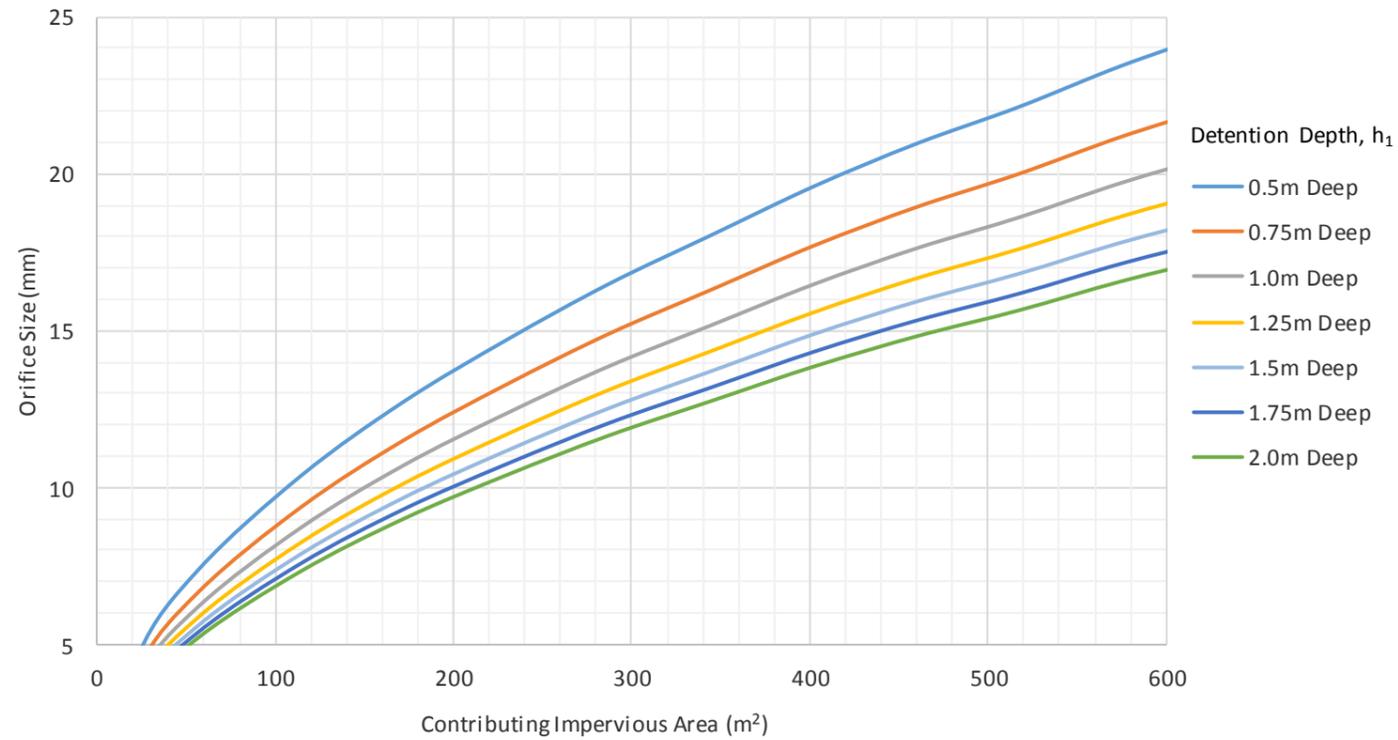


Figure 1.3: Orifice Sizing Chart

2. NON-RESIDENTIAL APPLICATIONS

This section provides general information on the minimum design and sizing requirements for Rainwater Reuse and Detention System tanks which are used in non-residential applications for on-site stormwater management.

2.1 Reuse Volume for non-residential applications

Refer to Three Waters Demand Management Practice Note HCC02 for details on sizing the Reuse Volume for Non-Residential Applications.

2.2 Detention Volume for non-residential applications

Refer to Three Waters Demand Management Practice Note HCC06 Detention Tanks for details on sizing the Detention Volume for Non-Residential Applications.