Wellington Water

Managing Stormwater Runoff

The use of approved solutions for hydraulic neutrality

Version 4

Our water, our future.

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V1	*June 2019*	*Approved Solution #1*
V2	*June 2020*	*Amended layout and minor text changes*
V3	*August 2020*	*Approved Solution #2*
V4	*June 2022*	*Approved Solution #3*

Executive Summary

Purpose of this document

This document has been written for anyone thinking about developing their land by explaining some of the concepts behind managing stormwater runoff. This document explains the impact the development may have on stormwater runoff and consequently flooding, why Wellington Water care, and what we are doing about it. There is a focus on smaller residential developments, 10 properties or less, or backyard add-ons by providing an approved solution to manage the change in stormwater runoff. Specifically this document explains:

- Why managing stormwater runoff is important
- Hydraulic neutrality – what it means and what we are trying to achieve
- What residential developers need to consider to manage stormwater runoff (from a flooding perspective)

Appended to this document are approved solutions to assist in managing the effects of stormwater runoff in residential developments. The approved solutions provide simple solutions where developers need to achieve hydraulic neutrality.

Wellington Water will accept the use of approved solutions as evidence of compliance with hydraulic neutrality where hydraulic neutrality is required for residential development and where the requirement does not refer to specific methods or specific outcomes. Approved solutions in this document contain design specifications and are not endorsements of specific products. The use of approved solutions is not mandatory. If another solution or variation is proposed, you may need to provide hydraulic and/or engineering calculations from a suitably qualified person that demonstrate compliance with the required hydraulic neutrality. This document will be reviewed every five years.

The objective is for all of us to think more widely about the impact our development has on the environment and in particular how we are altering the natural drainage characteristics of our catchment. We need to act appropriately to ensure these changes do not impact negatively on our neighbours and downstream users by increasing their flood risk. Ultimately we need to think about smarter, more adaptable solutions to manage the risk of flooding that reduces the need for costly infrastructure upgrades, while providing greater resilience within a changing climate. We believe the best solutions will come from multiple approaches, managing runoff at the source and throughout its journey as it drains to the sea.

Flooding in Porirua, 5 May 2016.

Why we need to consider stormwater runoff

Development contributes to the increased impervious area of catchments. Through the building of houses, driveways, roads and decks, we change the natural hydrological cycle. Rainfall that used to directly infiltrate through the soils or slowly drain overland now runs off the land much faster across sealed surfaces and through the piped stormwater network. In hydrological terms both the volume of water and the peak flow have increased as a direct result of development.

Water quality may also be adversely affected by developments, and water sensitive design should be considered. Specifically this document explains flooding aspects of development. Other literature should be consulted for best practice approaches for water sensitive design.

Why do we care?

Most catchments have people and properties that are at risk of flooding. This has economic, environmental and social impacts.

What does this mean?

The stormwater network includes the primary network: stormwater sumps (these are the grates you see in roads which convey runoff to the piped stormwater network); stormwater pipes; and open channels. This network is effective at managing runoff from low to medium intensity rainfall events. However, the primary network does not have the capacity to transfer runoff from heavy rainfall events. It is usually impractical to put all this floodwater under the ground.

During heavy rainfall events we rely on overland flowpaths. We refer to these as the secondary network. The secondary network includes natural drainage paths based on the topography of the land and built paths like many of our roads. The drainage paths convey runoff so that flood waters do not enter buildings. If the primary or secondary networks block, for whatever reason, we can get flooding. This may be minor 'nuisance' flooding or major flooding that impacts our livelihoods.

Ponding areas are also part of the stormwater network. These areas may be natural or the result of changed topography which formed basins or bunds. It is important to manage these ponding areas as they often provide storage during flooding and attenuation (the slow release of runoff back into the network).

Wellington Water uses a number of approaches to manage flood risk. This includes:

- developing hydraulic models to identify high risk areas and overland flowpaths
- installation of stormwater pipes where it makes sense to do so
- creating flood storage in low risk areas.

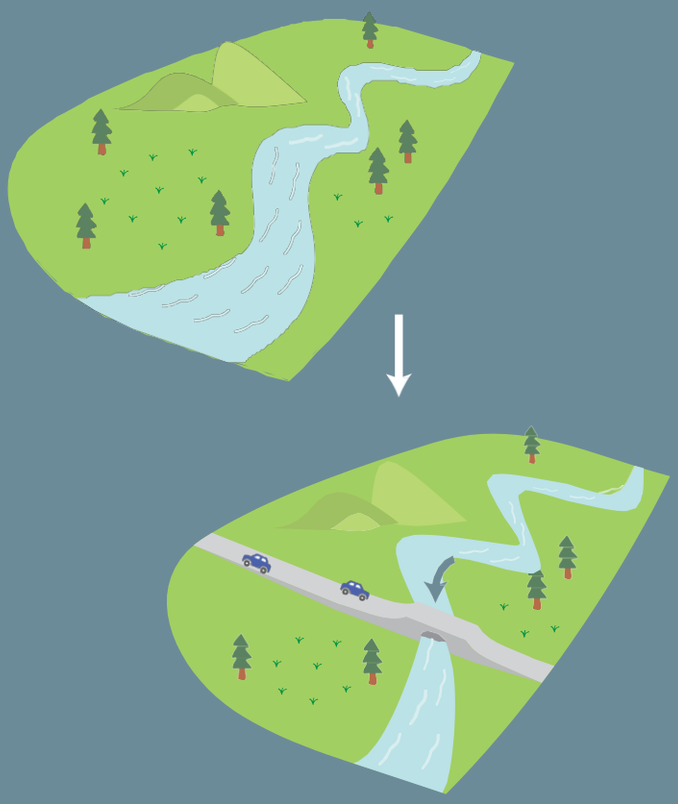
Increasing the size of the piped stormwater network may be an option in high value areas, such as hospitals or the central business district. In other areas the costs associated with upgrading the stormwater network will often outweigh the benefits. A more cost-effective alternative is attenuating runoff at the source. This means storing rainfall close to where it lands, and slowly releasing it back into the stormwater network after the flood peak has passed.

In addition, the effects of climate change may lead to reduced effectiveness of our primary networks. The smart way to combat reduced effectiveness and unpredictability is to combine several approaches (big and small) to create an adaptable, resilient solution.

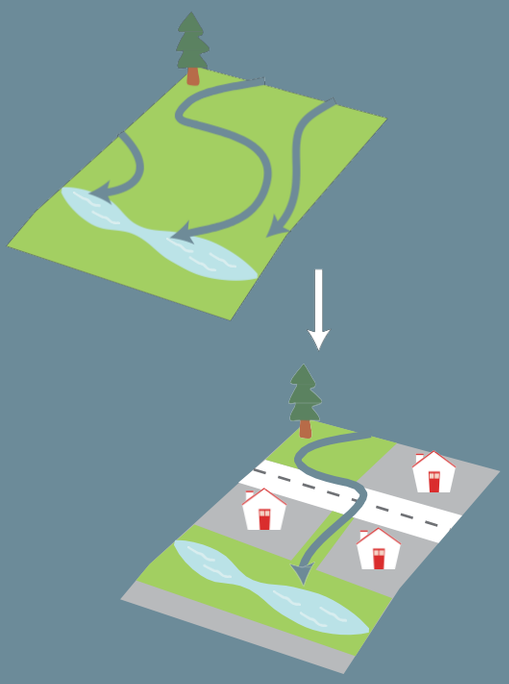
We need to think about smarter, more adaptable solutions when growing our cities.

Development may impact the natural hydrological cycle in four ways

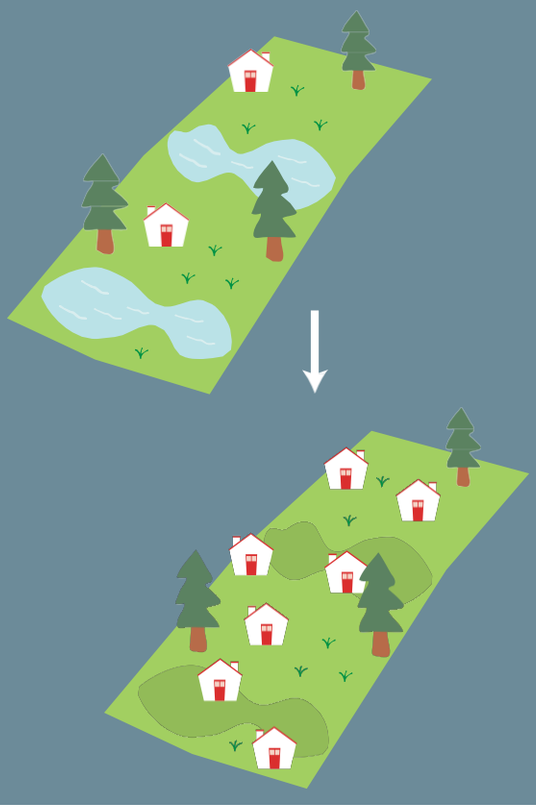
1 Changes to Primary Flow



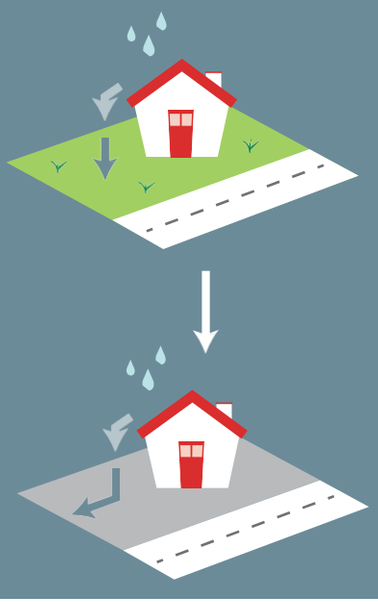
2 Changes to Overland Flow



3 Loss of Natural Ponding Areas



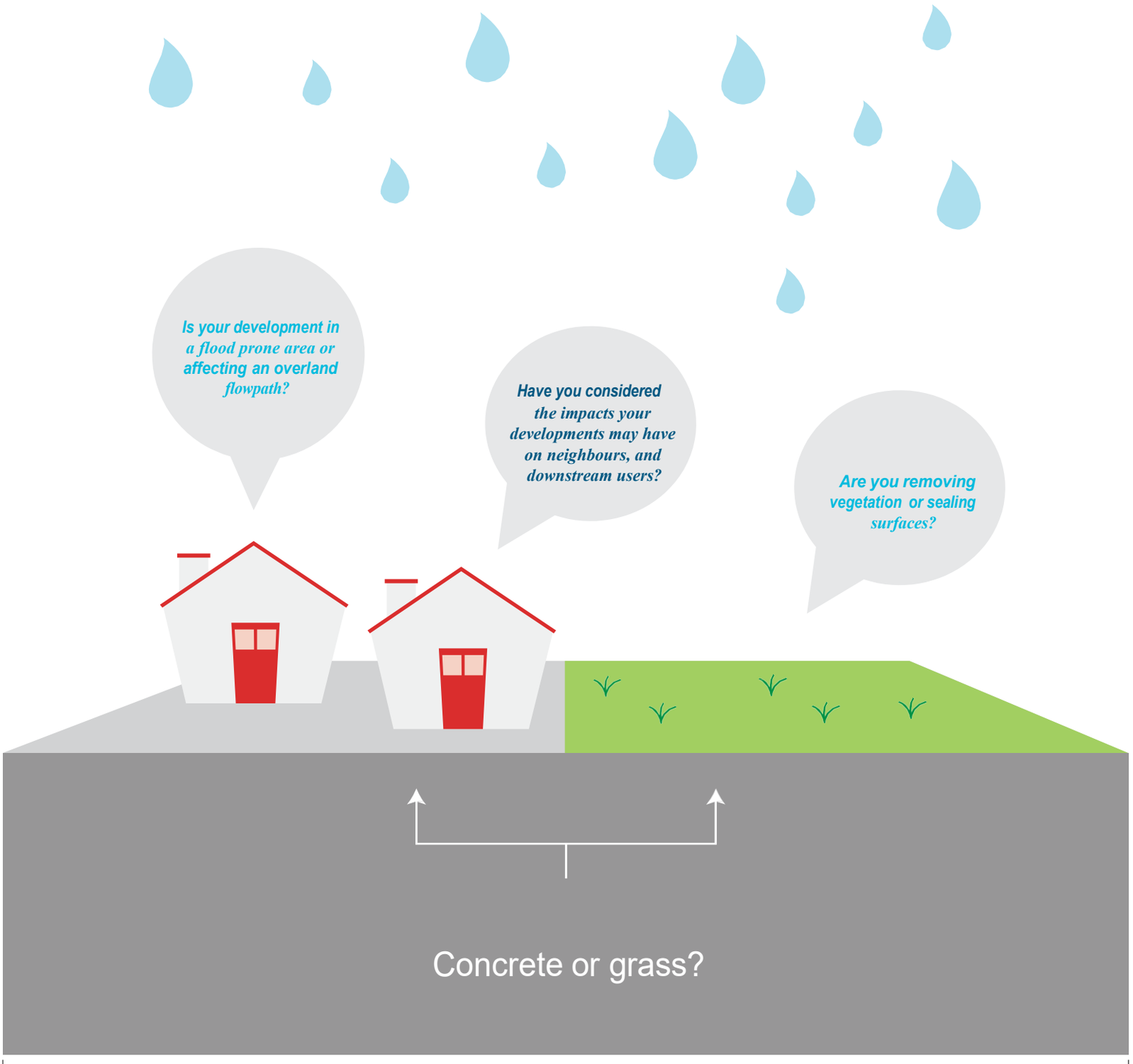
4 Increased Impervious Areas



Your Residential Development

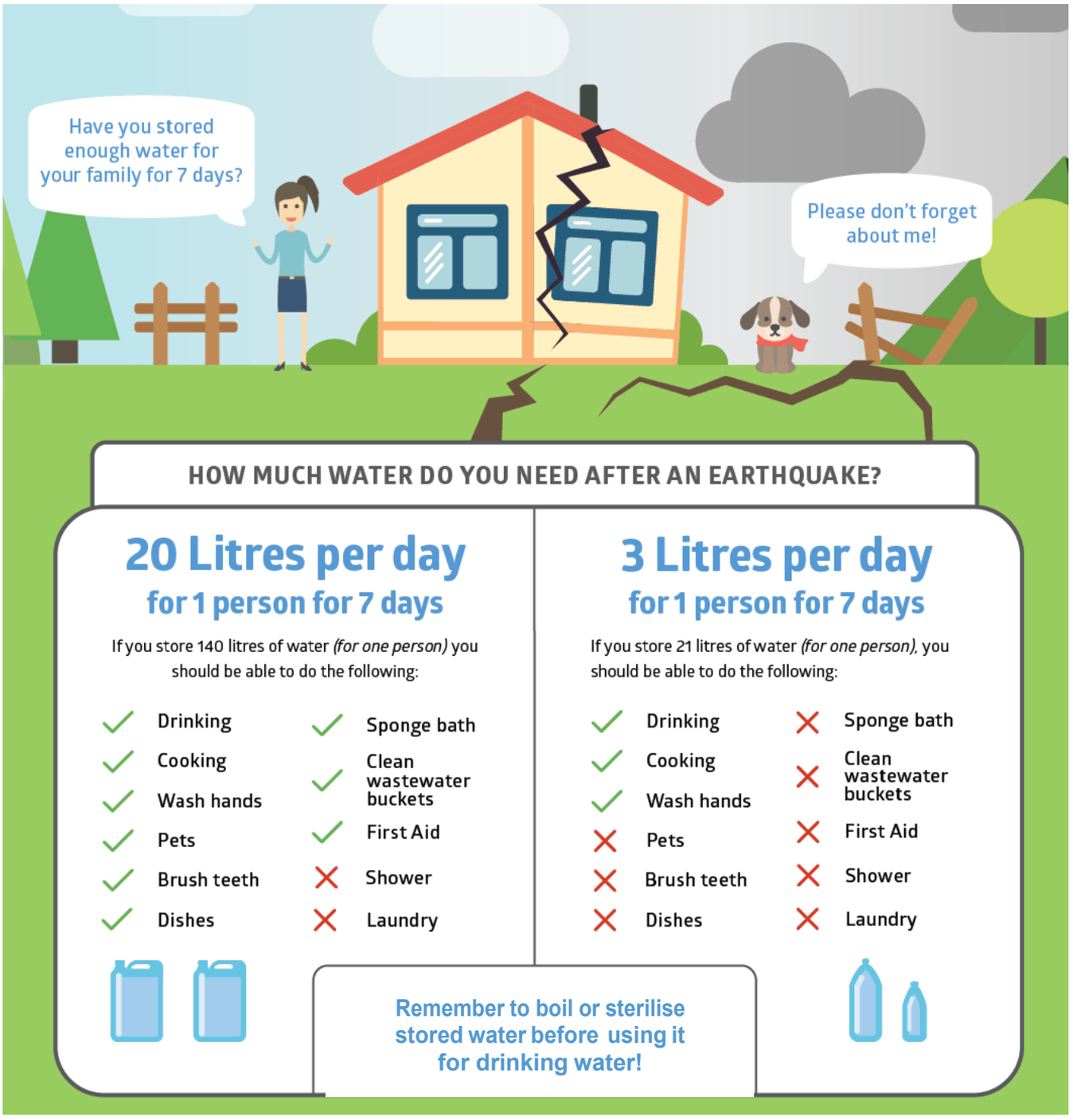
Considerations when designing a new residential development

It is important to understand where, what, and how your development could affect the immediate area and wider region. Under the Resource Management Act you have an obligation to 'avoid, remedy, or mitigate any adverse effects of activities on the environment'. Therefore you have a requirement to ensure your development does not cause flooding to others. If you are required to lodge a Resource Consent application, you will need to outline the adverse effects your development may cause and what you are doing to manage it.



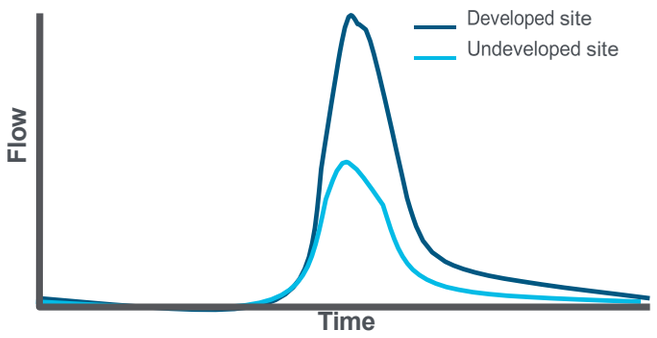
Emergency water supply

Many of the approved solutions include a requirement for a portion of the storage attenuation to be reserved to provide you with an emergency water supply following a major earthquake. We are all encouraged to store 20 litres of water per person per day for seven days. That is 140 litres for one person or 560 litres for a family of four. Following this seven day period community stations will be established to provide a centralised source of drinking water as it may take more than 100 days before the water supply network is repaired. The water held in storage is not treated so remember to boil or sterilise it before using it for drinking water.

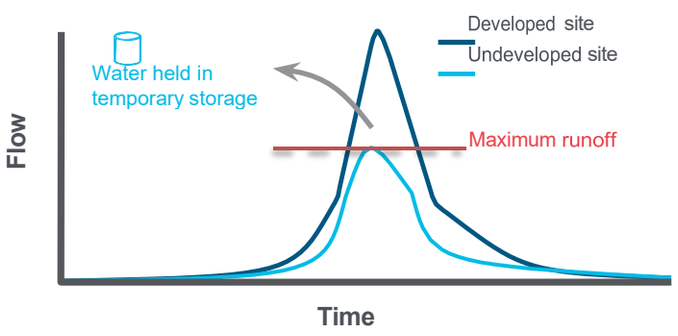


To manage the additional runoff directly attributed to your development, you need to ensure the maximum peak flow off your land is no greater than what it was pre-development. This is our definition of hydraulic neutrality. The figure (below) helps to explain this.

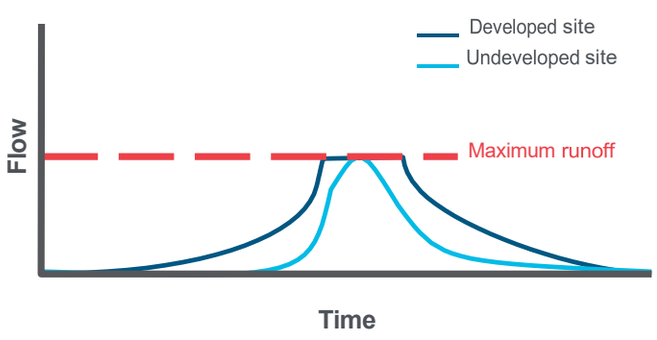
1. Increased sealed surfaces as a result of development mean that water is unable to infiltrate into soil or drain slowly overland. This results in a higher peak flow and greater volume of runoff.



2. The increased difference in peak flow can be captured and held in temporary storage devices to be used in other applications or slowly released back into the stormwater network.



3. This method can bring peak flow rates during significant rainfall events to a level much closer to that of undeveloped sites. Our goal is to meet the definition of hydraulic neutrality.

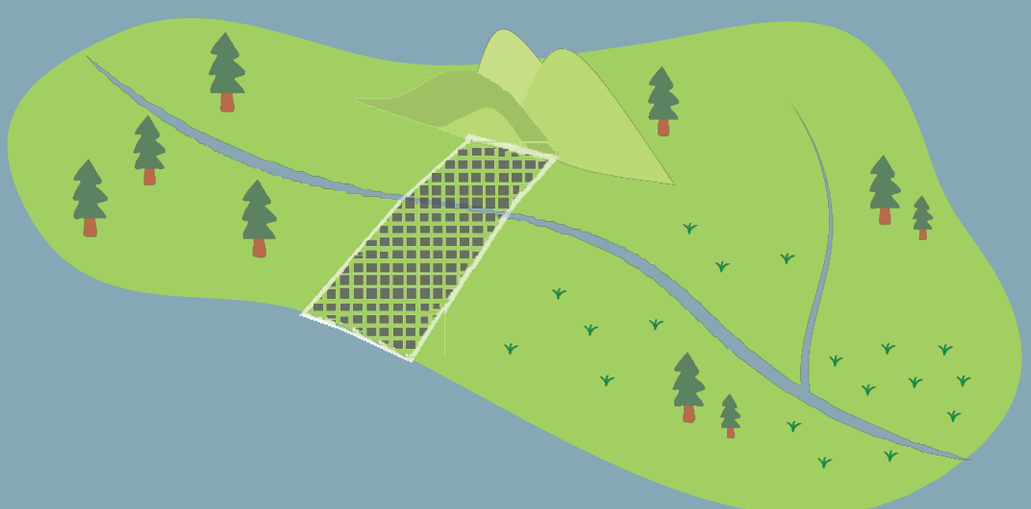


We define hydraulic neutrality as capturing post-development peak runoff so that it does not exceed the pre-development peak flow rate.

If a property is hydraulically neutral then the peak flow rate from the site will be the same, or less than, what it was prior to development. A hydraulically neutral development will not cause additional stress to the stormwater network and will not increase flooding. Your storage attenuation solution should be effective for both small and large flood events, including floods occurring once in 10-years (10% annual exceedance probability (AEP)) through to once in 100-years incorporating climate change predictions (1% AEP with climate change).

How to achieve hydraulic neutrality

Hydrological Modelling



Approved Solutions

01

Approved Solution #1

Approved Solution #1

Approved Solution 1 requires the diversion and attenuation of roof runoff into a rainwater tank. The required size of the rainwater tank is based on your house roof area (Table 1-1).

Table 1-1: Sizing your rainwater tank

House roof area	Rainwater tank capacity
> 40m² to < 100m²	2,000 litre
≥ 100m² to < 200m²	3,000 litre
≥200m²	5,000 litre

Rainwater tanks will help store, slow and reduce peak runoff from a development, acting to control runoff at the source and to reduce the flood peak.

Rainwater tanks

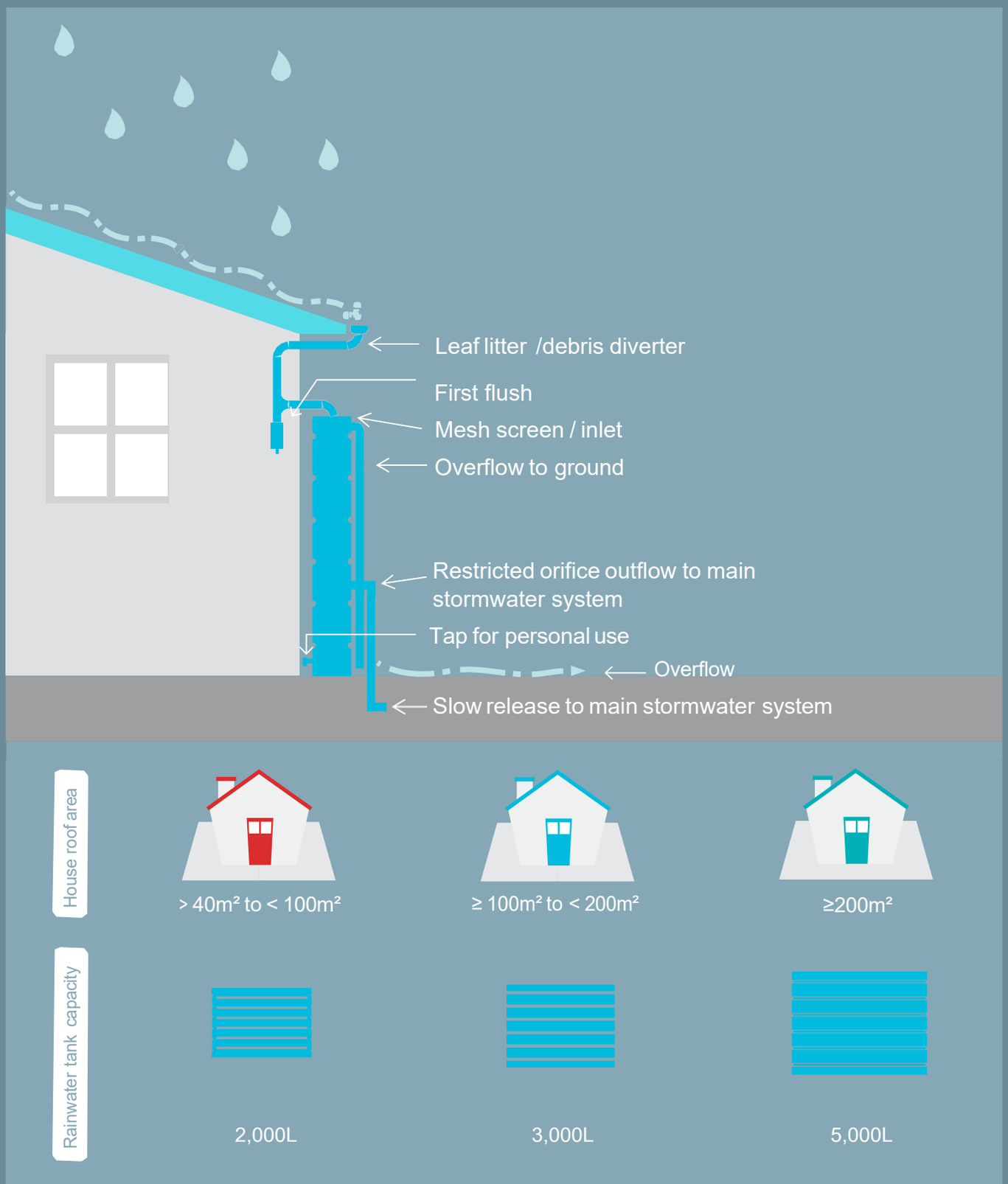
The purpose of rainwater tanks is to temporarily store runoff from your roof, slowly releasing this water back into the stormwater network over a longer duration. Water will flow out from the tank via an orifice and outlet pipe and an overflow pipe should the tank reach its capacity. During a storm the peak runoff from your house will be significantly reduced as water is stored in your tank.

Approved Solution #1 requirements and limitations

The basic requirements of all set-ups will be the same:

1. This solution is only applicable to lot sizes where the total impervious area is less than 400m². Runoff from no less than 80% of all new roof areas must be diverted to, and attenuated by, your rainwater tank.
2. Runoff from no less than 80% of all new roof areas must be diverted to, and attenuated by, your rainwater tank.
3. You must have a leaf litter/debris diverter (or equivalent product) between your roof gutter and downpipe(s), or on the downpipe to your tank.
4. Your overflow pipe must not be connected to the main stormwater system. The overflow should discharge to the ground surface and be directed to an appropriate and visible overland flow path that flows to an acceptable outfall or public system. This is to provide a visible indicator if your primary outlet is blocked.
5. A portion of the water in the tank (15-25% depending on tank volume) is reserved for you. This water is not treated so you shouldn't drink it directly from the tank but it can be used for the garden, washing property, cars, or as your emergency water supply. The pressure will be low, though this may be sufficient for garden use, otherwise a small pump can be added to the system.
6. These tanks must be above ground to allow you to access the lower portion of water in an emergency, for ease of maintenance and inspection and for the tank to drain to the stormwater network. In addition the bottom of the tank must not be more than 0.5m above ground to avoid the need for Building Consent.
7. This solution is acceptable for developments of 1- 10 resident buildings. It may be considered as part of a wider solution to managing stormwater runoff in developments greater than 10 buildings, though full hydrological analyses of the development will be necessary. This is to ensure that stormwater detention devices are appropriately sized for the specific conditions of the local area and will consider the total impervious area within the development such as driveways, roads and footpaths.
8. Rainwater tanks must be installed in accordance with the manufacturer's specifications.
9. During installation you'll need to install an outlet to slowly release runoff back into the stormwater network. The diameter of the outlet and its height above the ground has been carefully sized to maximise the storage within your tank, while minimising the rate of flow back into the stormwater network. As such the tank dimensions, outlet diameters and height of the outlets stated in Table 1-2 must be adhered to. Any variation to this setup will mean your solution to managing stormwater runoff does not fall within Acceptable Solution #1.
10. You may choose to have multiple downpipes entering the tank conveying discharge directly from the roof, or alternatively the downpipes may be brought together in a junction underground with a single larger pipe conveying runoff to the tank.

Approved Solution #1 – Rainwater tanks



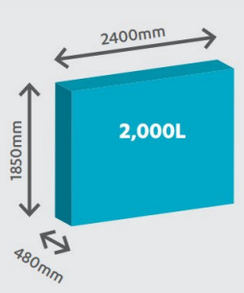
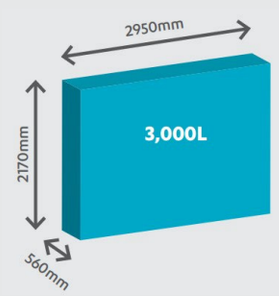
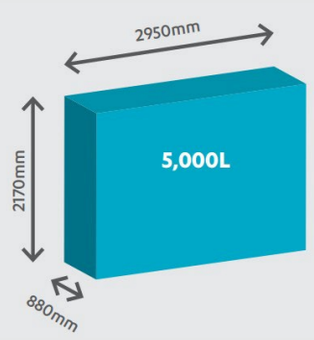
Your rainwater tank when installed to the requirements of Approved Solution #1 does not require a building consent, though the drainage works associated with your development are likely to require a consent. Your tank and connections will need to be shown on as-builts provided to your council.

Rainwater tanks do not address increased runoff from sealed surfaces on your property. When you're developing your property we'd love you to consider this and minimise sealed surfaces where possible.

Wind and Seismic Restraint

It is important to ensure your tank is appropriately restrained to withstand very high winds and seismic activity. Please consult your tank manufacture for specific details regarding how to safely site and secure your tank. This may include a requirement to have a flat and level concrete foundation and restraining brackets or posts.

Table 1-2: Required tank setup

Tank Dimensions			
Orifice Nominal Diameter (mm)	15	15	15
Orifice Height above Base of Tank* (mm)	490	430	430
Minimum Overflow Nominal Diameter (mm)†	90	90	90
Overflow Height above Base of Tank* (mm)	1770	2095	2095

*Measured to the centre of the orifice

† The diameter of the overflow outlet may need to be larger to provide equivalent capacity to that of all inflows.

Emergency water supply

The lower portion of your rainwater tank is reserved for personal use and to provide you with an emergency water supply following a major earthquake. Your rainwater tank should have enough water to meet your immediate requirements (depending on how your tank is used). A 2,000L tank will meet the emergency water supply requirements for 2 people for 7 days. The 3,000L tank will meet the emergency water supply requirements for 4 people for 7 days, and the 5,000L tank will meet the emergency water supply requirements for 7 people for 7 days. This will be topped up after every rainfall

event, so in an emergency may save you a trip or two to your community station.

Tank Setup

If you decide to install a rainwater tank as your stormwater management solution, the following considerations are standard tank setup requirements. It is recommended you follow the instructions of your tank manufacturer in regard to your rainwater tank site setup and connections to your gutter system and downpipes. As a minimum you should:

Have a flat and level site, free from rocks, stones or anything else that may damage the tank base. You'll also want the site to be well compacted. If a sand base is used, a retaining cover must be provided to prevent sand from washing away after installation.

Ensure your tank is secured as per the seismic requirements of the manufacturer so that it won't topple over in an earthquake or under high winds.

Ensure the overflow capacity equals or exceeds the inflow capacity (from your downpipes).

Avoid any lead, chromium or cadmium products in any of your roof materials, soldering, flashings paint or any other part of your roof. Uncoated metal roofs can also pose a problem. Your roof should be painted with product suitable for drinking water supply.

It is strongly recommended that you have a first flush diverter to divert the initial flow of contaminant-laden water from your roof away from your tank.

Consider whether a screen over your inlet/ outlet pipe is necessary to keep insects, birds, and other organic matter out of your tank.

Install a leaf litter / debris diverter (or equivalent product) between your roof gutter and downpipe(s) or on your downpipe, to divert debris away from your tank.

Put a bend in the top downpipe to minimise light, and consequently reducing the likelihood of algae growth.

Tank Maintenance

Your rainwater tank system will require some maintenance to prevent blockages and to keep the tank operating efficiently and the water clean. Please see your tank manufacturer for their specific maintenance instructions. For optimal performance and clean usable water it's likely that you'll be required to:

Clean your roof of animal droppings, pollen, ash and other organic matter. It is recommended you inspect your roof six-monthly, though depending on your location this may need to be done more frequently.

Remove leaf litter and debris from your gutters regularly. It is recommended you inspect your gutters every six months, though if you have a lot of trees around your property you will need to do this more frequently. You may want to consider trimming back any overhanging vegetation.

Wash out leaf litter/ debris diverters and first flush diverts every few months. This should take only 10 minutes.

Inspect and maintain any mesh screens, orifice outlets and filters annually. Likewise inspect and repair any seals, pipes and valves annually.

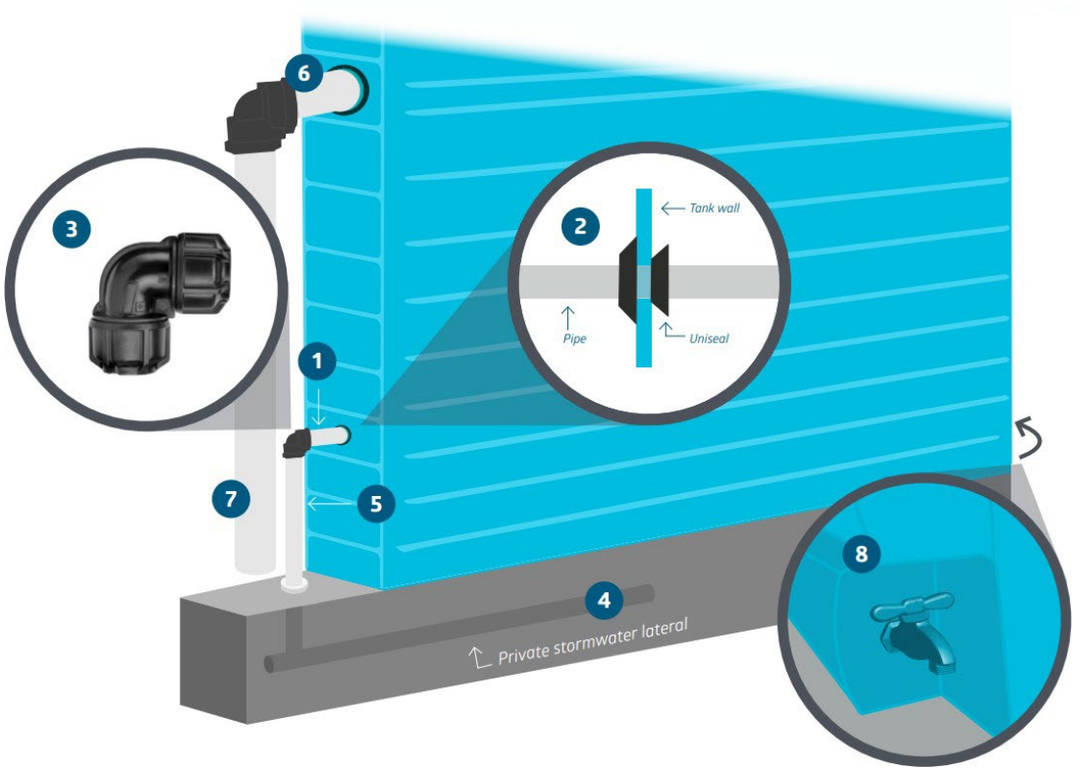
Clean your tank by draining it and remove any sediment and debris from the rainwater tank floor every 2-3 years. There are a number of rainwater tank cleaning and servicing companies that can assist you with this task if necessary.

The tank design and its function as an attenuation device will be recorded on the Council Property file. Altering the tank from its intended use may result in a fine or restoration of its intended function.

Rainwater tanks typically have a warranty period of 10-20 years.

Technical Specifications

The installation of your tank to the required setup is a fairly straight forward process. However, it is recommended that you work with your plumber to install the pipe network correctly. The following diagram details the setup requirements.



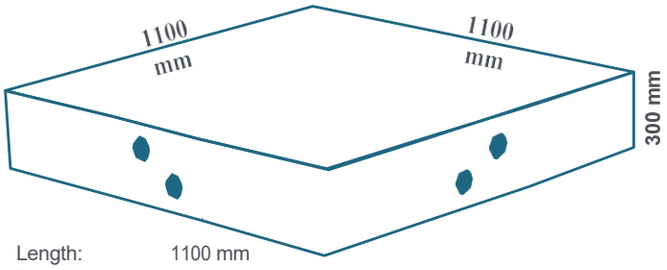
1. A short 20mm diameter pipe is inserted into the tank end at the required height (see Table 1-2). The pipe is held secure to the tank using a Uniseal or similar product. For a 20mm diameter pipe it is recommended to use a 31.7mm holesaw size to drill your outlet.
2. Your pipe should protrude into your tank slightly. Approximately 5-10cm is appropriate.
3. This pipe must be connected to an elbow bend that is easily removable or has an access cap to allow you to clear any blockages from the orifice. A Philmac 20mm x 20mm elbow fitting or similar would be appropriate.
4. A longer 20mm diameter pipe connects the downstream end of the elbow fitting to the private stormwater lateral network that conveys runoff from your property to your council's main stormwater network, or to an acceptable and appropriately sized soakage device.
5. This pipe should be appropriately fastened so that there is no risk of it becoming dislodged.
6. Depending on the rainwater tank purchased it may already come with an overflow orifice, or you may need to drill it yourself. You must ensure that the size of the overflow orifice provides equivalent capacity to that of all inflows. Similar to the 20mm diameter pipe, drill the overflow orifice hole to the required size, insert a Uniseal or similar produce, and connect your overflow outlet pipe. This pipe should pass through an elbow bend before discharging to an appropriate and visible overland flowpath draining to an acceptable outfall.
7. This pipe should be appropriately fastened so that there is no risk of it becoming dislodged.
8. Your personal use outlet can be fitted with a hose to allow use of the stored water, or to drain the tank for cleaning and maintenance purposes. The outlet must be closed off when it is not being used so that water is attenuated within the tank.

02

Approved Solution #2

Approved Solution #2

Approved solution #2 requires the diversion and attenuation of roof runoff into modular storage tanks. The number of modular storage tanks and the required orifice size at the outlet is based on your house roof area (Table 2-1).

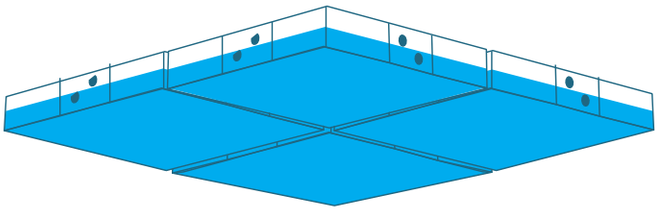


Length: 1100 mm
Breadth 1100 mm
Height: 300 mm

Modular storage tanks

Similarly to rainwater tanks, modular tanks are used to store stormwater runoff from your development and release it slowly to the stormwater network.

Typically modular tanks can be installed under any hard ground surface such as driveways, paved areas, and decks and as such are a great option for sites with limited space, high stormwater network invert levels, curb discharge or rocky ground, or where there is a preference for stormwater infrastructure to be hidden from view.



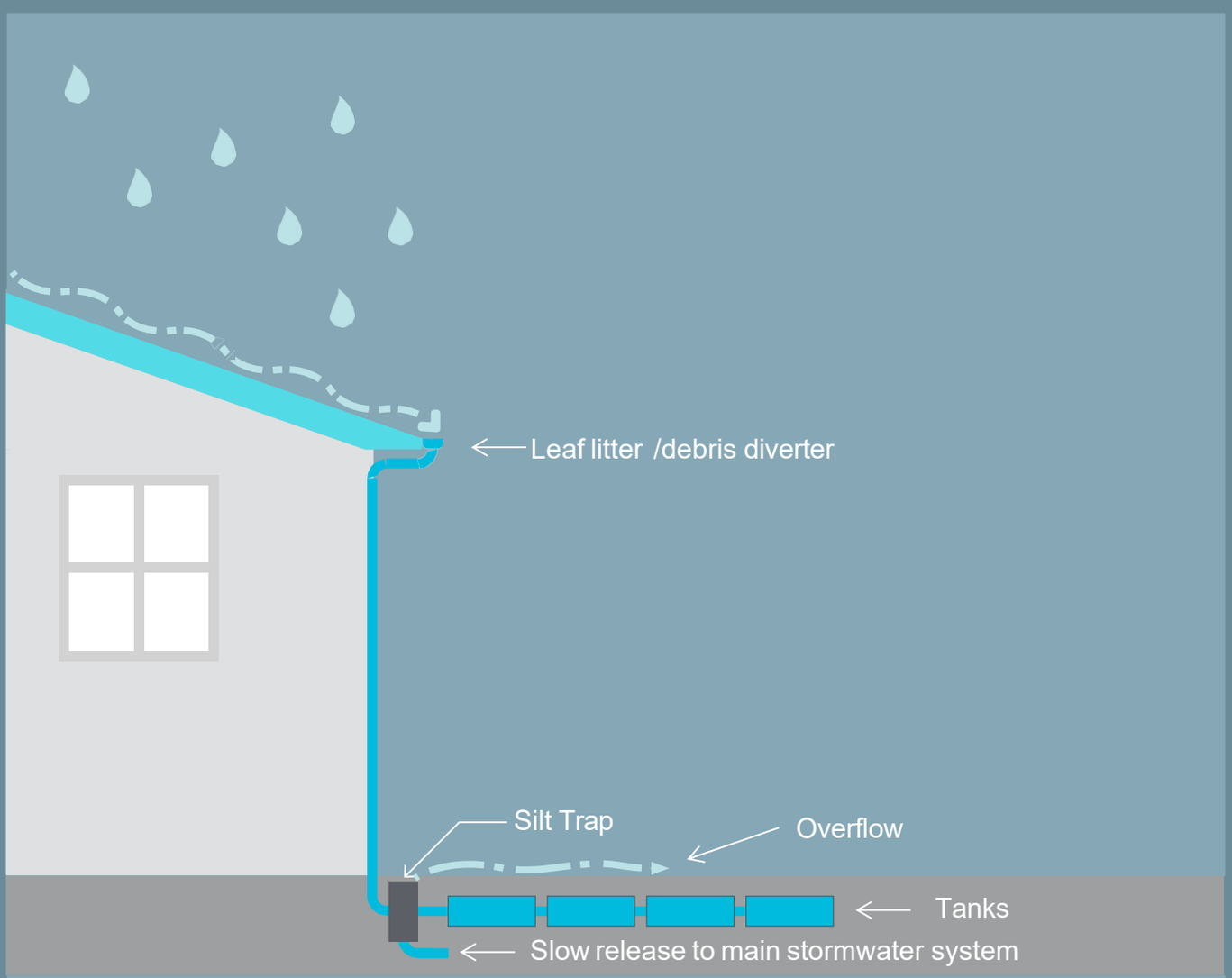
This solution is for modular tanks with a capacity of 350 litres – additional tanks are added to build up the storage capacity to the volume required to achieve hydraulic neutrality. The tanks lock together using connector pipes that allow stormwater to flow between tanks. Water will flow out of the tanks via an orifice and outlet pipe that will be connected to the stormwater network.

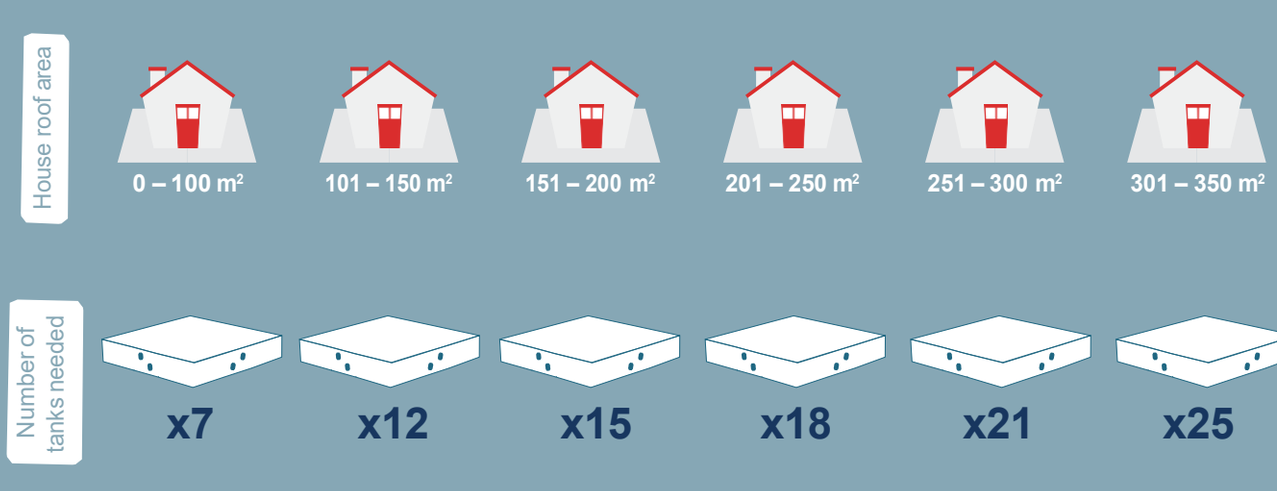
Approved Solution #2 requirements and limitations

The basic requirements of all set-ups will be the same:

1. This solution is only applicable to lot sizes where the total impervious area is less than 350 m^2. Tanks can be used for larger sites; however modelling will need to be undertaken to determine the number of tanks and orifice size needed.
2. Runoff from no less than 80% of all new roof areas must be diverted to, and attenuated by the tanks.
3. You must have a leaf litter/debris diverter (or equivalent product) between your roof gutter and downpipes(s), or on the downpipe to your tanks.
4. A silt trap must be installed at the inlet to the tanks. This will reduce sediment build up within the tanks and allow for easy maintenance.
5. Overflow from the tanks should discharge via an appropriate and visible overland flow path to an acceptable outfall or public system. The overflow pipe must not be connected to the main stormwater system. This is to provide a visible indicator if your primary outlet is blocked.
6. This solution is acceptable for developments of 1 – 10 residential buildings. It may be considered as part of a wider solution to managing stormwater runoff in developments greater than 10 buildings, though full hydrological analyses of the development will be necessary. This is to ensure that stormwater detention devices are appropriately sized for the specific conditions of the local area and will consider the total impervious area within the development such as driveways, roads and footpaths.
7. The tanks must be installed in accordance with the manufacturer's specifications.
8. The orifice sizes specified in Table 2-1 have been calculated to ensure that stormwater discharges to the stormwater network at pre-development flow rates. As such, they must be adhered to. Any variation will mean that your solution does not fall within Approved Solution #2.
9. The outlet of the tanks must be free of backwater effects during a flood event and therefore must be at an elevation above the 100 year flood level at the point of connection to the public stormwater network. Please consult Wellington Water for details of the elevation of the stormwater network outside your property.

Approved Solution #2 – Stormwater Tanks





Modular storage tanks do not address increased runoff from sealed surfaces on your property. When you are developing your property we'd love you to consider this and minimise sealed surfaces where possible.

Wind and Seismic Restraint

As the tanks are located underground, or underneath structures such as decks, wind and seismic restraints are not required. Modular tanks are considered to be less prone to damage from these events than free standing tanks.

Table 2-1: Sizing your modular tank system

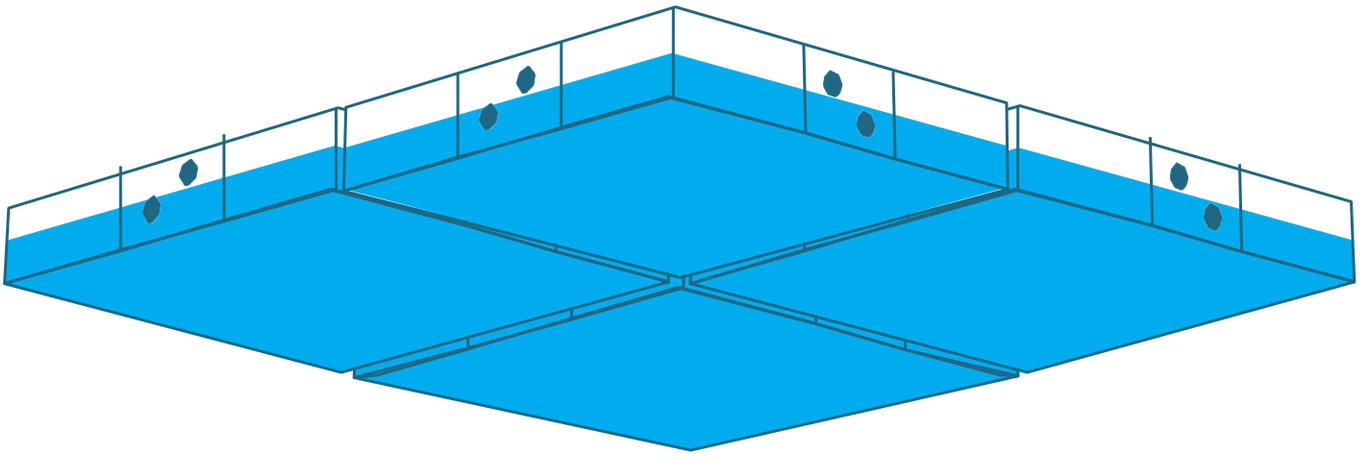
House roof area	Number of tanks needed	Orifice size
0 – 100 m^2	7	35 mm
101 – 150 m^2	12	41 mm
151 – 200 m^2	15	48 mm
201 – 250 m^2	18	54 mm
251 – 300 m^2	21	60 mm
301 – 350 m^2	25	64 mm

Emergency water supply

Additional tanks can be added to provide water retention for emergency water supply. Any tanks used for retention should be installed in such a way that the emergency water does not discharge to the stormwater network, and is regularly flushed. Please consult the manufacturer on the best way to achieve this for your set up. It is important that any tanks for emergency water supply are installed additional to the number of tanks required in Table 2-1.

We are all encouraged to store 20 litres of water per person per day for seven days. That is 140 litres for one person or 560 litres for a family of four. Two 350 litre modular tanks meet this requirement.

Following this seven day period community stations will be established to provide a centralised source of drinking water as it may take more than 100 days before the water supply network is repaired. Your tanks should have enough water to meet your immediate requirements. Your tanks will be topped up after every rainfall event, so in an emergency they may save you a trip or two to your community station.



Tanks Setup

If you decide to install modular storage tanks as your stormwater solution, the following considerations are standard set up requirements.

Have a flat and level site, free from rocks, stones or anything else that might damage the base of the tanks. You'll also want the site to be well compacted.

Ensure the overflow capacity equals or exceeds the inflow capacity (from your downpipes).

If you're adding tanks to use for emergency water supply then avoid any lead, chromium or cadmium products in any of your roof materials, soldering, flashings paint or any other part of your roof. Uncoated metal roofs can also pose a problem. Your roof should be painted with product suitable for drinking water supply.

You must install a leaf litter/debris diverter to divert debris away from your tanks, to prevent blockages.

A screen should be installed over your emergency overflow outlet/silt trap to reduce the likelihood of debris entering the silt trap and tanks.

The tanks must be installed by an approved installer

Maintenance

Your tanks will require some maintenance to prevent blockages and to ensure the water is clean. Please refer to the manufacturer's specific maintenance instructions. For optimal performance and clean useable water, it is likely that you'll be required to:

Clean your roof of animal droppings, pollen, ash and other organic matter. It is recommended you inspect your roof six-monthly, though depending on your location this may need to be done more frequently.

Remove leaf litter and debris from your gutters regularly. It is recommended you inspect your gutters every six months, though if you have lots of trees around your property you will need to do this more frequently. You may want to consider trimming back any overhanging vegetation or installing gutter-guards.

Wash out leaf litter/ debris diverters every few months. This should only take 10 minutes.

Inspect and maintain any mesh screens and filters annually. Likewise inspect and repair any seals, pipes and valves annually.

The silt trap should be inspected annually and vacuumed out when needed (usually no more than once every 10 years).

The tank installation and its function as an attenuation device will be recorded on the council property file. Altering the tanks from its intended use may result in a fine or restoration of its intended function.

03

Approved Solution #3

Approved Solution #3

Approved Solution #3 requires the diversion and attenuation of roof runoff into 250L modular storage tanks.

We advise that for Approved Solution #3 the number of tanks, minimum number of downpipes and the required orifice size at the outlet is based on the house roof area, and must be in accordance with the table below:

House roof m2	No of tanks	Orifice size	Minimum no of downpipes
Up to 100	11	38	2
101-150	17	44	3
151-200	21	54	4
201-250	29	58	5
251-300	34	68	5
301-350	40	73	6

The nine basic requirements and limitations are the same as listed for Wellington Water's Approved Solution #2 (350L modular tanks), which are:

1. This solution is only applicable to lot sizes where the total impervious area is less than 350 m2. Tanks can be used for larger sites; however modelling will need to be undertaken to determine the number of tanks and orifice size needed.
2. Runoff from no less than 80% of all new roof areas must be diverted to, and attenuated by the tanks.
3. You must have a leaf litter/debris diverter (or equivalent product) between your roof gutter and downpipes(s), or on the down pipe to your tanks.
   A silt trap must be installed at the inlet to the tanks. This will reduce sediment build up within the tanks and allow for easy maintenance.
4. Overflow from the tanks should discharge via an appropriate and visible overland flow path to an acceptable outfall or public system. The overflow pipe must not be connected to the main storm water system. This is to provide a visible indicator if your primary outlet is blocked.
5. This solution is acceptable for developments of 1 – 10 residential buildings.
6. It may be considered as part of a wider solution to managing storm water runoff in developments greater than 10 buildings, though full hydrological analyses of the development will be necessary. This is to ensure that storm water detention devices are appropriately sized for the specific conditions of the local area and will consider the total impervious area within the development such as driveways, roads and footpaths.
7. The tanks must be installed in accordance with the manufacturer's specifications.
8. The orifice sizes specified in Table 2-1 have been calculated to ensure that storm water discharges to the storm water network at pre-development flow rates. As such, they must be adhered to. Any variation will mean that your solution does not fall within Approved Solution #2.
9. The outlet of the tanks must be free of backwater effects during a flood event and therefore must be at an elevation above the 100-year flood level at the point of connection to the public storm water network. Please consult Wellington Water for details of the elevation of the storm water network outside your property.

Additional considerations for tank setup are also the same as for Wellington Water's Approved Solution #2. This approval is conditional on the following:

- Wellington Water retains the right to revoke or revise approval at any time.

Wellington Water

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