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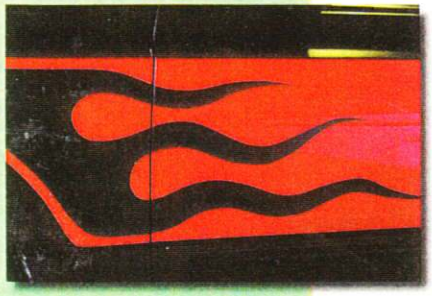

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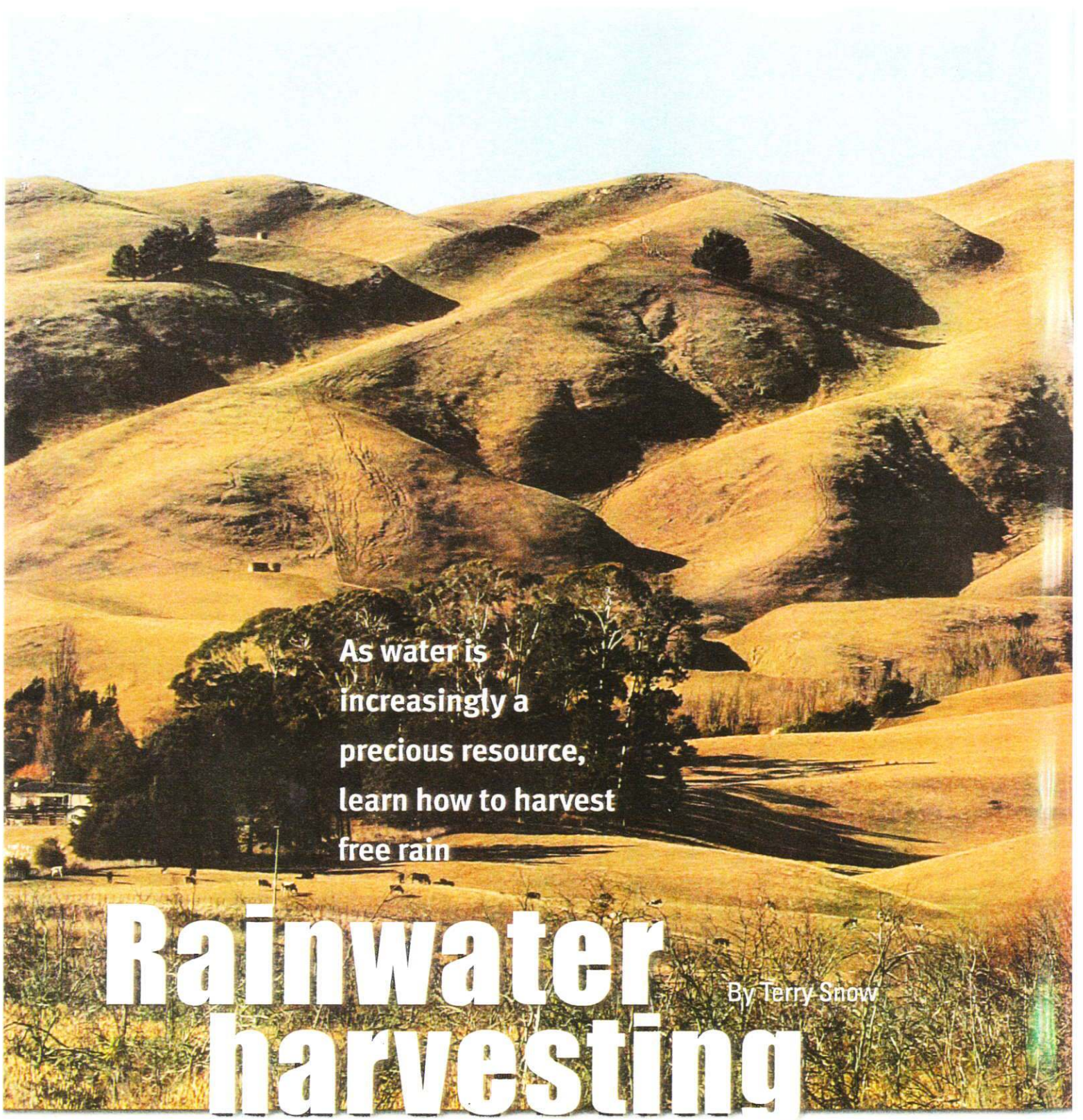


As water is increasingly a precious resource, learn how to harvest free rain

Rainwater harvesting

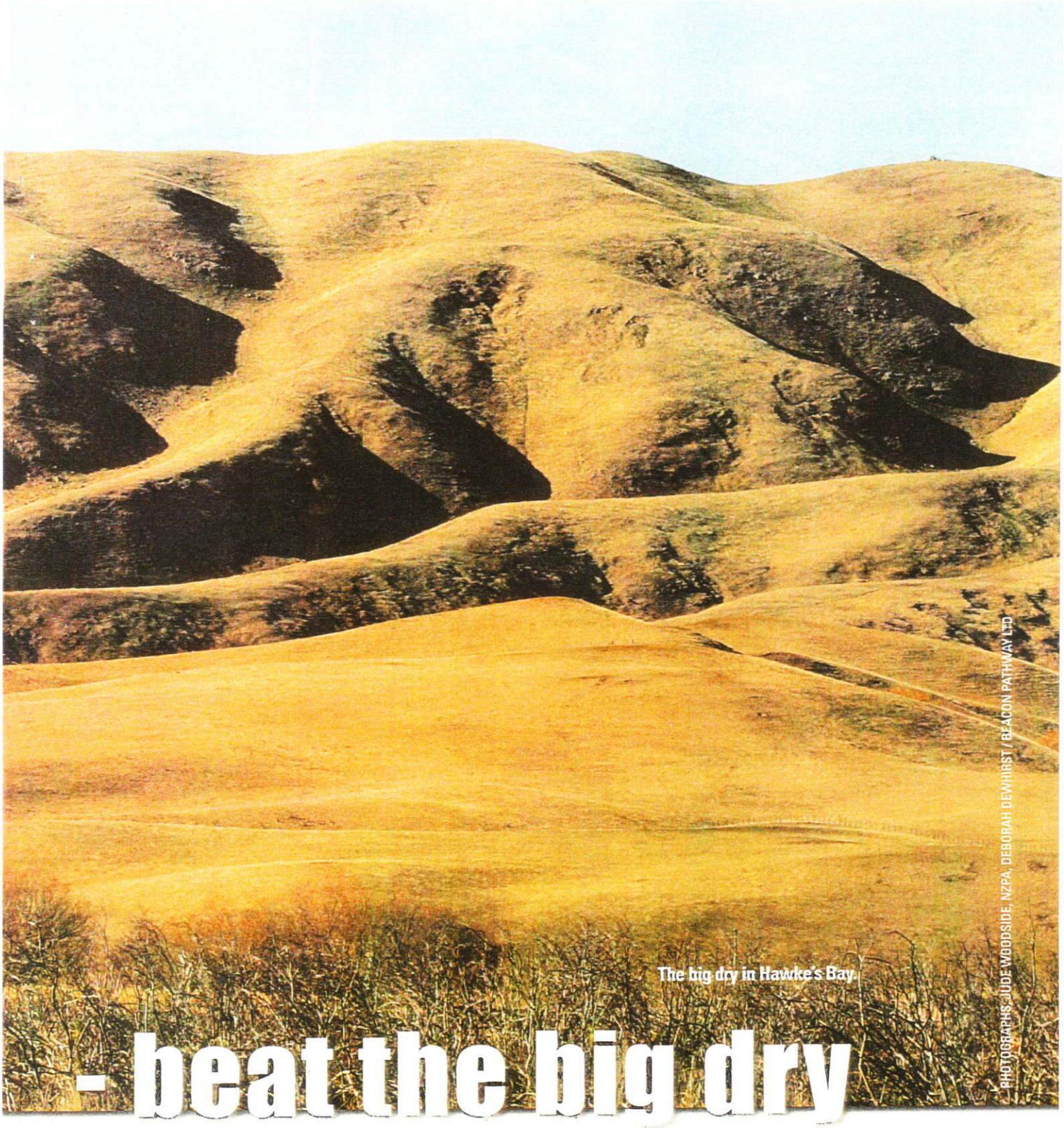
By Terry Snow

Summer drought conditions remind us that water as a vital resource can suddenly be scarce. City hosing restrictions for gardens are just the start. Farms suffering with parched pasture and struggling stock are a sign of worsening conditions. But it's not only here and now. Water world-wide in the future is going to be one of the most sought after commodities, not only in times of low rainfall.

The NIWA 2005 report "Changes in drought risk with climate change" says drought risk in New Zealand is expected to increase during this century in all areas. By the 2080s, severe droughts are projected to occur more than four times as often in in inland and northern parts of Otago; eastern parts of Canterbury and Marlborough; parts of the Wairarapa; parts of Hawke's Bay; parts of the Bay of Plenty; and parts of Northland, in Coromandel and most of Gisborne."

The report should be taken as a guide rather than a categorical set of predictions, says NIWA.

Councils and other organisations concerned about water supply are now producing policies and pamphlets that usually begin with the philosophy, "For many centuries, people collected rainwater for drinking, washing, gardens and farms, with no help from treatment plants and distribution systems. Today, as water shortages loom,



The big dry in Hawke's Bay.

PHOTOGRAPHS: JUDE WOODSIDE, NZPA, DEBORAH DEWHIRST / BEACON PATHWAY LTD

– beat the big dry

people are again turning to private rainwater collection."

Some 460,000 New Zealanders use tank water for home supply but increasingly urban home-owners on town supply are being encouraged to install rainwater tanks.

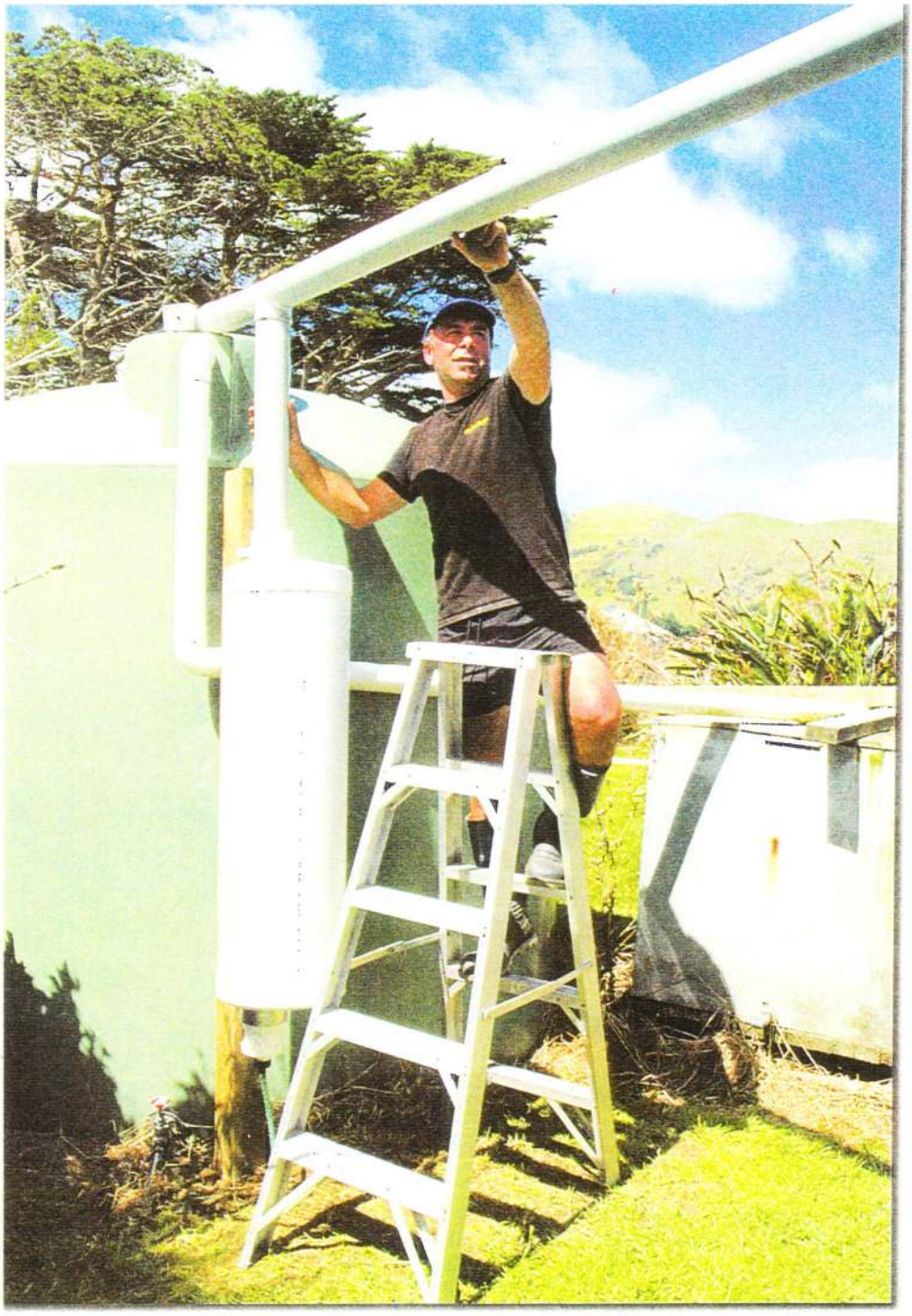
Rebates

Councils as diverse as Rodney District, Waitakere City and North Shore City are offering tank rebates of $500 for the installation of rainwater tanks. The rebates are limited but will reinforce the idea that New Zealand has had a sharp reminder this summer of the fragility of our water supply.

Waitakere City, needing to reduce water demand by 25 percent by 2025 or it will have to buy expensive new infrastructure such as another dam, makes the sharp point that we drink only five percent (1/ 20th) of home water yet are

THE RAIN IN VAIN

Waitakere City buys 13 billion litres of drinking-quality water from Watercare to distribute to the community each year. At the same time, the council estimates, average total rainfall in the city – free for those who want to save it in tanks – is about 150 billion litres.



Rainwater harvesting system.

paying for the other 95 percent to be treated to the highest drinking standards to flush the toilet, take a shower or do the laundry.

By working with suppliers of rain tanks and associated products, the council says it is making it easier for ratepayers to collect their own water to use at home for drinking and non-drinking, so reducing the home water bill and demands on mains water supply, wastewater and stormwater systems.

Monitoring of the water use in the Waitakere NOW home, a two-year eco-friendly experiment in a purpose-built house, showed rainwater harvesting and low-flow plumbing fixtures reduced water use by the two adults and two boys to 40 percent less reticulated water than comparable households in Waitakere City, and 66 percent less water than the average consumption for the Auckland region.

The North Shore City Council estimates in its area that 65 percent of household water is used for non-potable needs (non-drinking water for toilet and bathroom, for example). The council estimates amount of rainfall you can collect (depending on roof area and rainfall) is around 180,000 litres a year or an average of 500 litres a day for a 150 square-metre roof where there is an average annual 1200mm rainfall. Typically, 80 to 90 percent of this volume is collected, with 10 to 20 percent lost through evaporation and spillage.

Free

The amount of free water from rain suggests attempts to corral this abundance for future use is common sense. Rainwater tanks now come in many guises (see Panel, Water tanks). For this project to encourage rainwater harvesting, we look principally at the systems that ensure your rainwater is collected safely and that the systems of collection are most useful.

According to David Oliver, the business development manager dedicated to rainwater and stormwater for Marley, major supplier of plastic rainwater, drainage and plumbing materials, the most important component is the first flush diverter.

This is a system that diverts the first run-off of rain from the roof to a pipe or cylinder from where it drains. This prevents the first run of contaminated water and rubbish from entering your water tank. The first flush diverter is complemented by mesh filters and other leaf and rubbish preventers in the spouting and the rainhead or expansion joint which is a catching sump at the top of a downpipe. A picture of

NZ POST

In its Waikato Mail Centre, NZ Post has installed rainwater tanks as a water conservation measure for supplying the building. The first flush diverter required is nearly 500 litres. Some 840 square metres or 15 percent of total roof area is used to collect rainwater in three tanks adding up to 75,000 litres. This is estimated to cover all annual toilet flushing requirements of 750 cubic metres of water while a total of 990 cubic metres of rainwater is potentially collectable, weather permitting.

a sump that has not been cleaned out shows the amount of dirt and rubbish that can come off the roof. Says Oliver, The first flush diverter keeps out bugs from the roof, spray, pollen, e coli – "the first flush diverter cleans up hugely." He says researchers at Wellington's Massey University rainwater research station are amazed at the *e coli* count that the first flush diverter picks up.

The project

The first step is to calculate the amount of water that needs to be diverted in the first flush (see Panel, First flush calculations). There are two options – first flush in a downpipe from the gutter, or in a free-standing cylinder, attached to a post, preferably by the tank.

Then a rainhead that's a leaf eater should be installed. This needs to be placed as high as possible under the roof overhang. The mesh in the leaf eater is less than 1mm or at 1mm to stop mosquitoes and insects getting through in the water to the tank. There's a second wider mesh on top to catch leaves. The mouth of the expansion joint is wide to catch a dump of rain in a sudden rainfall.

The downpipe example here uses 90mm PVC to get more than five litres as a first flush diversion. The

Mesh leaf eater on rainhead or expansion outlet.

Gunge collects in unprotected gutter rainhead.

FIRST FLUSH CALCULATIONS

To calculate the safe amount of water to divert from the roof, Marley recommends the roof area x pollution factor = litres to divert. The pollution factor has been worked out as low = 0.5, high pollution = 2.0. If you estimate average pollution, pick a middle figure, e.g. 1.25.

For example, a house with a 118 sq metre roof area in a low pollution region would require 118 x 0.5 = 59 litres diverted. From the table, you can assess the length of pipe to be used for the first flush diverter. In this case, a 300mm cylinder for 59 litres would be 850mm in length. This assumes a dry system – all the water is cleared from the pipes after the rain. If you have a wet system that holds water in the downpipe (often buried) after the rain has finished, you need to allow for that volume as well, due to the fact that the next time it rains, before you can divert the First Flush off the roof, you will get the water from the wet area

Volumes of Pipes

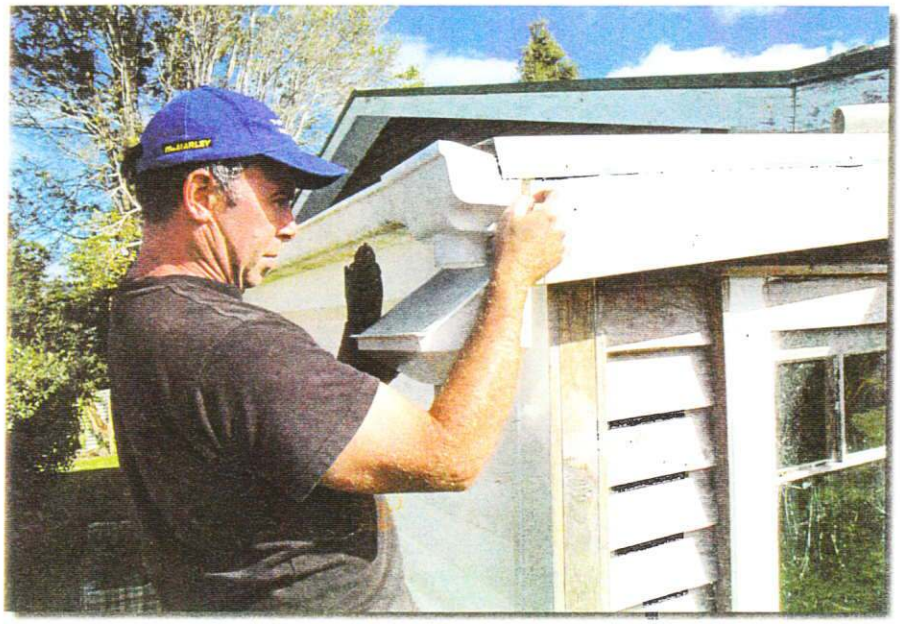
Diameter	Litres
1 metre of 300mm	70
1 metre of 100mm	8.5
1 metre of 90mm	5.75
1 metre of 80mm	4.4
1 metre of 65mm	3.3

grey material, which is industrial strength regrind plastic, can be painted to suit. An 80mm PVC pipe is standard in New Zealand. Adapters enable 80-90mm connections.

A normal house would have 600mm eaves so it's possible to use a couple of elbows to bring the downpipe close to the wall where you can put the bracket on. Cut bits of pipes to fit elbows and any extensions necessary for the brackets. Glue up after dry fitting.

The first flush diverter downpipe has a seat at the top against which a floating ball is pushed by the first run of water down the pipe. Once the ball blocks the top of the downpipe, the water from the spouting

NOW house tank saved water.



Put rainhead as high as possible.

flows past and on to the rainwater tank.

The water trapped in the downpipe then drips out over the course of several hours through the filter and washer in the drip system at the base of the downpipe. A similar system operates in the bigger 300mm cylinder. As water falls into the cylinder from the downpipe, the ball floats up to the sloped cap and then jams against the valve seat in the top cap. Water then continue to flows across the top of the cylinder into the tank.

The first flush diverter can be buried or put at a low point of the system (on a sloping section) but then you have to ensure it's draining and there's no water left (to make it dry). Any tank water left in the system after summer can be smelly and encourage organisms.

Key aspect

A key aspect of installing the diverter cylinder near the tank is to ensure there is enough fall from the eaves to the tank – a 2° fall is a good rule of thumb. The first flush diverter on the post that is concreted in could have a fence round it and the tank for a better look, although the diverter can be set by the house with a bracket.

The 300m diameter cylinder as a first flush diverter can hold 80 litres per metre but this is not as much as you think when the water is pouring in. Install the first flush diverter on the post first before connecting the pipe above

To cut the 300mm PVC cylinder to size, use a fine tooth saw then bevel the edge with a grinder. The cylinder is made with a bevelled edge. This ensures that you don't push the solvent cement out when you join pieces or put the cap on. The bevel helps you to slide on the caps which are a tight fit. Even if it leaks, the job of the first flush diverter is to let the water out.

Put solvent cement on the cylinder edge and then on the cap edge before fitting the cap. The solvent cement is not a glue, it's a cement – it melts the PVC. Because the first flush diverter is on a post, the ends will line up with each other.

Garden, car

The kit includes a double filter with a coarse stainless steel mesh and a washer – the 2mm hole in the washer takes a few hours to empty everything out. The water from the first flush diverter can be set up for a hose to drain and used for the garden, saved in a rain barrel for a dry time or to wash the car. The water comes out clear although it is not potable.

When you install the first flush diverter cylinder on a post, make sure the bottom bracket leaves room for the tap at the bottom – say 250mm or so. Otherwise experience will have to reveal that you can install the cylinder too low.

Make sure you have the tail of the bracket up otherwise you will have trouble getting the cap on and off as it will bump against the post and bracket.

The first flush diverter takes a few hours to empty but you are not likely to get more rubbish on the

roof in that time. If you want to empty it quickly it is possible to unscrew the filler. However, as the system is self-maintaining.

Overflow

An important part of rainwater collection is the overflow control. There's a clever vacuum-action "pump" that has no moving parts and operates automatically. This is just a set of pipes. A pipe with a serrated end so that it's not flush, sits vertically on the bottom of the tank among the rubbish that drifts down to the bottom of the water in the anaerobic zone. A bend at the top of this pipe is led out through the wall of the tank to an overflow pipe. The bend of the pipe in the tank has a hole in it, an antisiphon – a crucial control element.

When the tank fills up, there's only one way for the water to get out – it has to enter through the bottom of the siphon pipe, not from the top where overflow often drains the good water. When the water gets up over the hole at the top, it starts to siphon dramatically through the bottom of the pipe. Through a 90mm diameter pipe there can be quite a flood. When the water level in the whole tank at the top drops below the hole in the siphon

Fix elbows for downpipe first flush diverter,

Drainage washer for bottom of first flush diverter.

pipe, that breaks the cycle and stops the siphon. It needs the hole or it doesn't stop siphoning and can empty the tank in minutes.

There was the case of a rural gentleman who knew how everything worked and had some ordinary pipe that he could use – it had no antisiphon hole in it, so once the water started siphoning out of the tank, the whole lot poured out in a few minutes without stopping. There was no hole to break the pressure and stop the action

Floating out-take

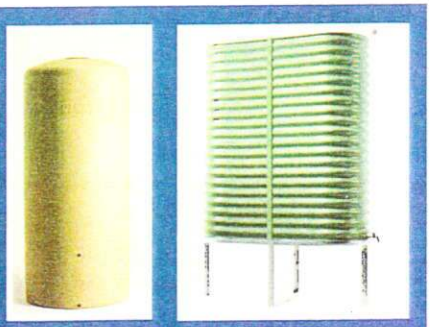
David Oliver says that Marley suggest a floating out-take because it's better to use the water at the top of the tank.

Most councils do not recommend that rainwater used direct from the tank is potable. However, the system of cleaning up water with the first flush diverter, mesh filters, gutter cleaners and finally filters in the house, lead to the conclusion of Rodney District Council where about half of the properties

TANKS

The tradition of concrete tanks in areas where houses have no piped supply or rural corrugated iron tanks without a lid – floating possums and rat carcases have been known – have been outstripped by the many-coloured modern shapes available today. The common materials are concrete, galvanised steel and polyethylene. They can be round, oblong, oval, fat or slim, tall or flat. There's even a tough bladder-style flexible "tank" resting flat in a soft stretcher and suitable for under the house or deck. A series of bladders can be linked for a capacity of up to 30,000 litres. The tall, oblong tank panels can be bracketed along your fence

line (these are 220-litre capacity) and connected like modules for greater capacity. They can also be painted to match your backyard colour scheme. The slimmest corrugated polyethylene tanks, long and



oval, are only 190mm wide and can hold up to 3000 litres.

Tanks that will be buried usually need to be of concrete and require building consent. Specialist tanks companies are now finding major chains selling small (600-litre) plastic rainwater tanks as the trend catches on.

Plastic filter inside first flush diverter.

Drip filter screws on,.

in Rodney are on water tanks. "The Ministry of Health recommends using the public supply for drinking water purposes (including cleaning teeth, washing hands, bathing, showering, food preparation and cooking). However, there are many situations where a public supply is not available, and rainwater tanks are the most practical solution," says the council.

There's a story of a South Island architect who tested his own home tank water and compared it with the town supply – the result was that the tank supply was healthier.

DRY RUN

Advice from the Kapiti District Council warns about not taking your rainwater tank supply for granted. It may run dry. An average flow from a hose that is pump-fed is 10-20 litres a minute or 600-1200 litres per hour. So a 5000 litre tank would last only 16 hours or four to eight days if used for two hours a day. Experienced gardeners use their tank water as first aid only on plants showing signs of distress.

Rainwater future

Rain water collected from roofs will figure increasingly in New Zealand's future, says New Zealand's leading expert on roof water research. Roof water researcher Stan Abbott, director of the Roof Water Research Centre at Massey University' Wellington campus, told Massey News that the use of alternative water sources such as roof-collected rainwater is definitely part of the solution to diminishing water resources.

The Massey News reported that currently the 400,000 or one in te New Zealanders who rely on roof water for drinking mostly live in rural areas, beaches and offshore islands. The trend towards coastal living and lifestyle blocks will increase that percentage closer to that of rural Australia, where three million people rely on roof water as their sole source of water.

In Australia, which has been plagued by worsening droughts, there is huge demand for roof-collected rainwater, Mr Abbott says.

"Rainwater is becoming an important supplement to mains water supplies in urban areas. Authorities are encouraging more Australians to use rainwater, and in the past 18 months 147,000 rainwater tanks have been installed in Queensland alone.

"In some parts of Australia building consents for renovations or new houses are issued only if rainwater tanks are installed."

Health risks

Although the microbiological quality of rainwater collected in tanks will generally be poorer than that of many public mains water supplies, the health risks associated with contaminated roof-collected rainwater consumption are not well defined or quantified, Mr Abbott says.

In the fact, the Ministry of Health