Plumbing and Drainage

Designing safe and sustainable systems

Presented by:
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Part 3 of 3 | Plumbing and drainage design | Webinar series

What we'll cover

Webinar 1

Plumbing & Drainage Foundations

Webinar 2

Foul Water Fundamentals

Webinar 3

Safe & Sustainable Water Supply

- Water supply systems
- Stormwater systems
- Water re-use

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Good design improves life

Quick quiz

Where should a relief drain, discharge to?

A visible position

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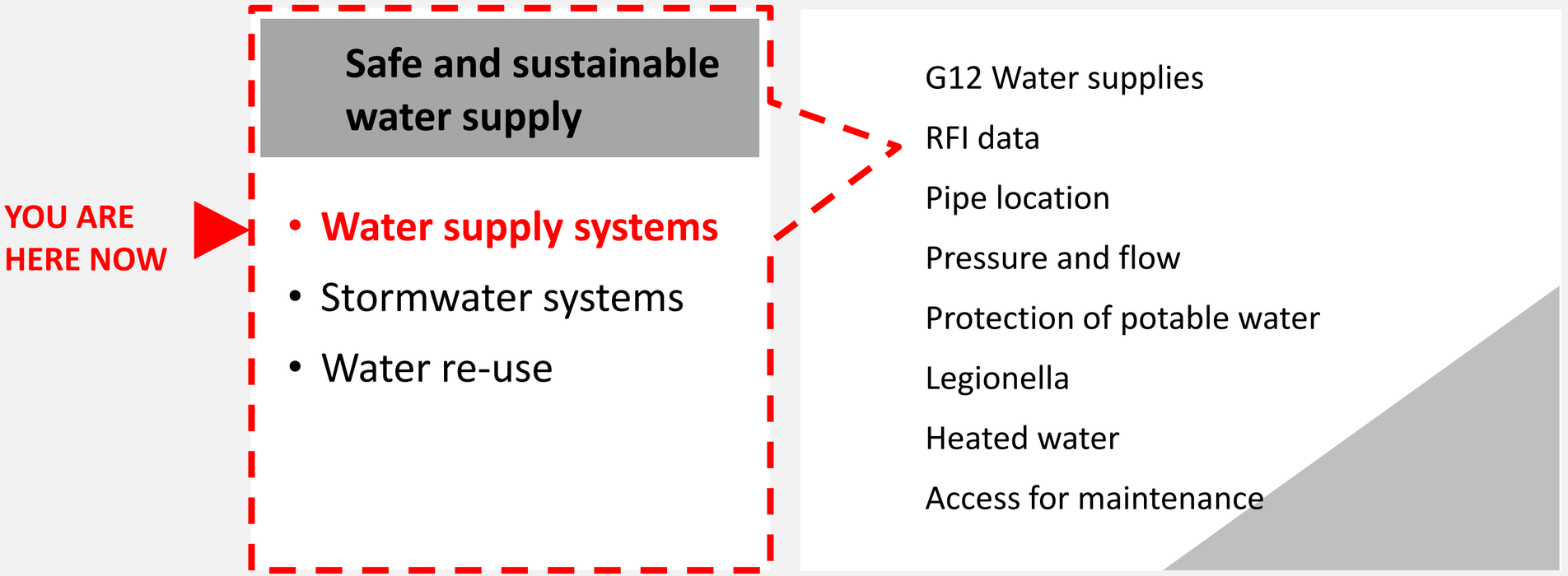
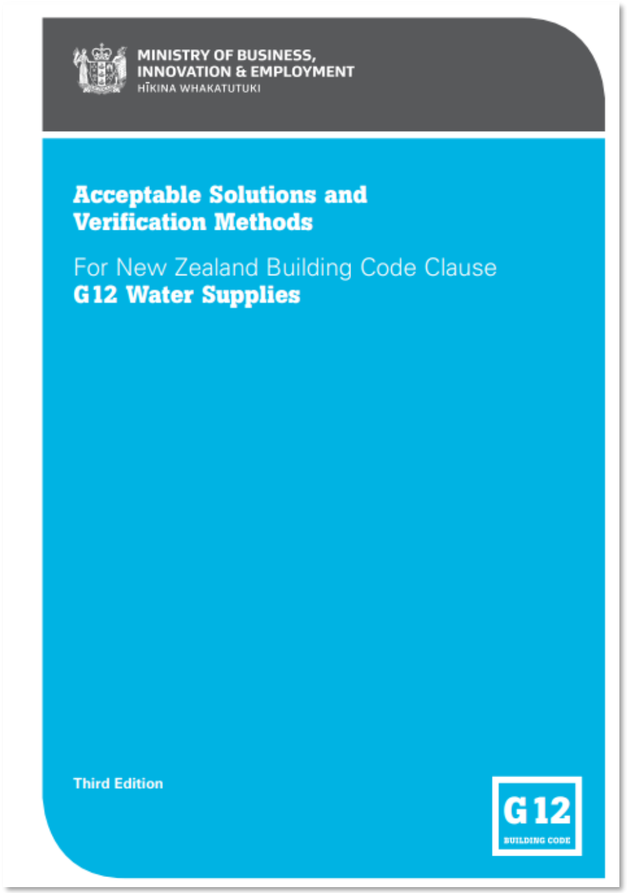
Water supply systems



Acceptable solutions

- G12/AS1 – below-ground and above-ground water supply systems
- G12/AS2 – solar water heaters
- G12/AS3 – AS/NZS 3500 part 1 & 4



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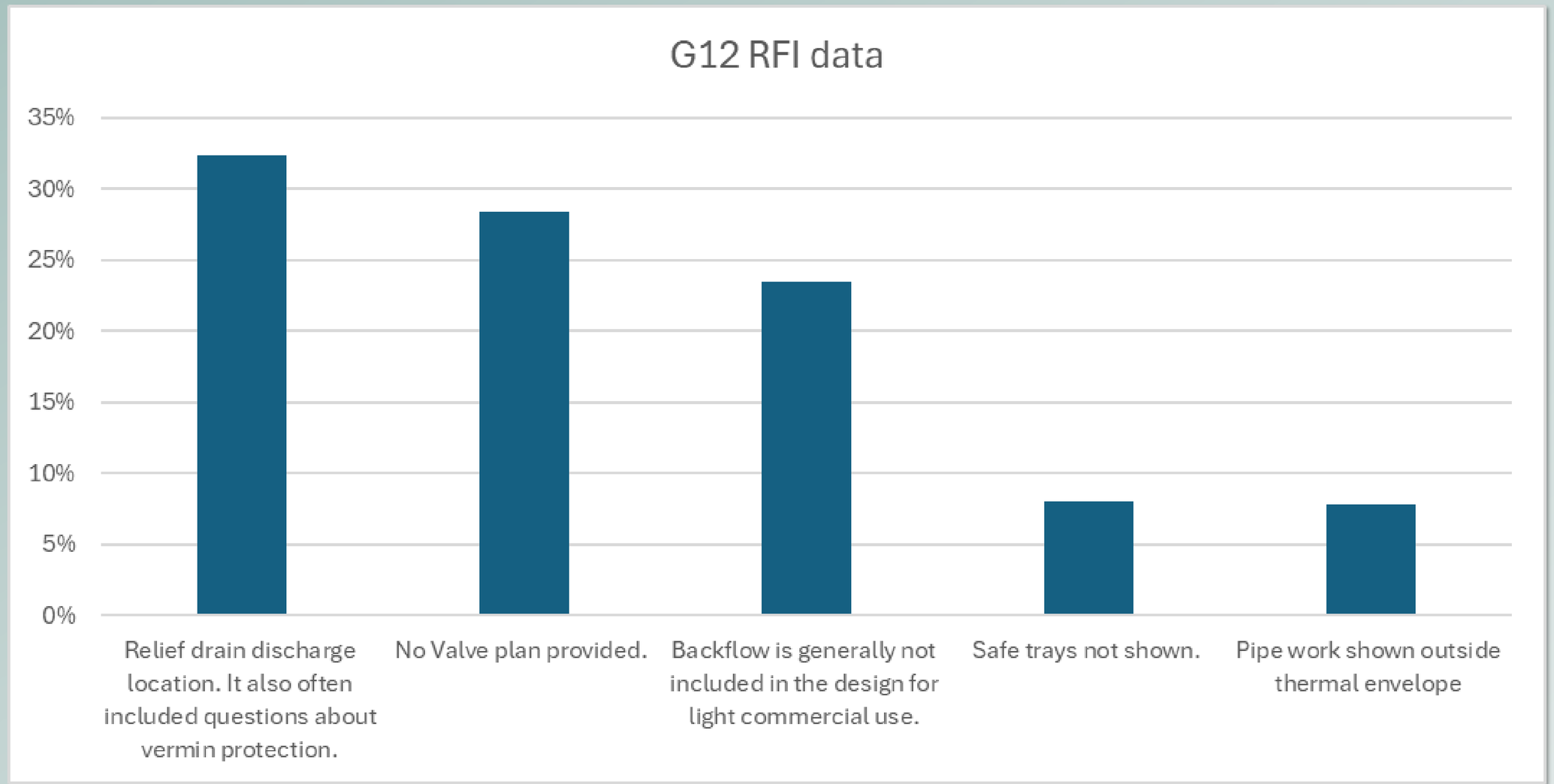
Request for Information data



Pipe location

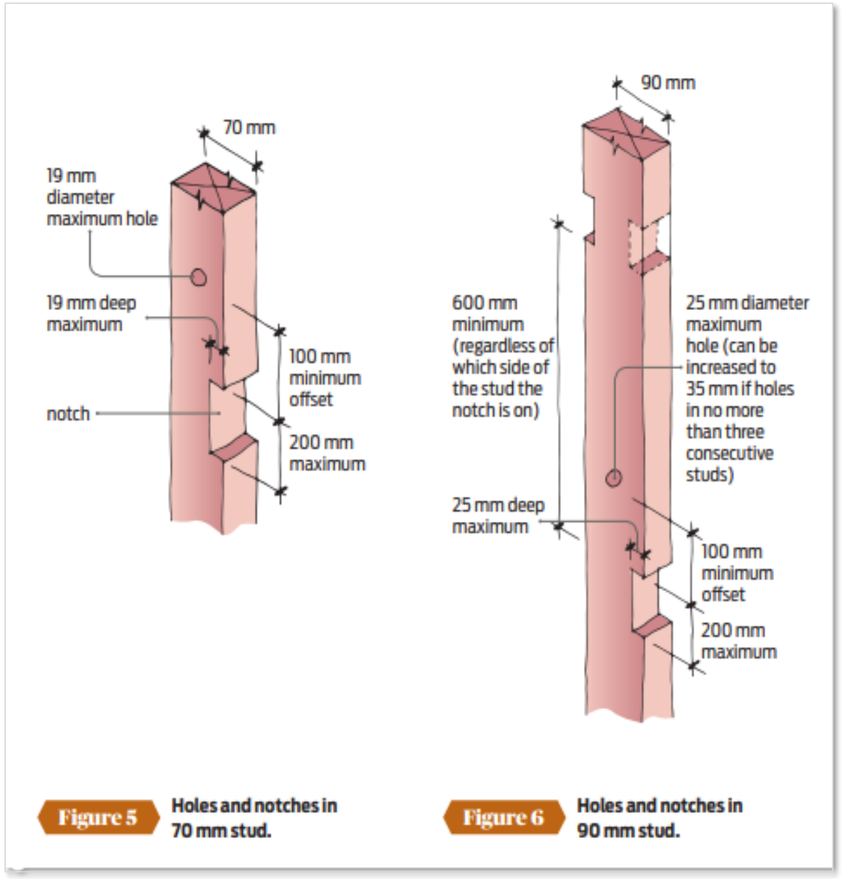


Figure 5 Holes and notches in 70 mm stud.

Figure 6 Holes and notches in 90 mm stud.

Pressure and flow requirements

Table 39. Acceptable flow rates to fixtures (G12/AS1).

Sanitary fixture	Flow rate and temperature (l/s and °C)	How measured
Bath	0.3 @ 45°C	Mix hot and cold water to achieve 45°C
Sink	0.2 (hot) and 0.2 (cold)	Flow rates required at hot and cold taps but not simultaneously
Laundry tub	0.2 (hot) and 0.2 (cold)	Flow rates required at hot and cold taps but not simultaneously
Basin	0.1 @ 45°C	Mix hot and cold water to achieve 45°C
Shower	0.1 @ 42°C	Mix hot and cold water to achieve 42°C

Notes: The flow rates shall be capable of being delivered simultaneously to the kitchen sink and one other fixture. The temperatures given in this table are to assist with ensuring acceptable flow rates are achieved when hot and cold water are mixed. For maximum hot water temperatures, see section 10.1 and G12/AS1 6.14.1.

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Pressure and flow requirements

Table D.1 — Preferred sizes of pipe for non-circulatory typical single-storey household installations

Feed	Minimum internal diameters of pipe, mm			
	Water heater operating pressure, kPa			
	< 85	85 – 170	> 170	
			Storage	Instantaneous
From heater to first branch	15.0	12.5	12.5	15.0
A branch to kitchen sink or washbasin	10.0	10.0	10.0	10.0
A branch to kitchen sink and laundry	10.0	10.0	10.0	10.0
A branch to bathroom and one other room	15.0	12.5	10.0	10.0
A branch to bathroom only, all pipe in bathroom	12.5	10.0	10.0	10.0

NOTE The above are recommended sizes only. Individual installations may require larger piping to give the flow rates detailed in Table 10.3.2.

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Pressure and flow – velocity

Table 4: **Tempering Valve or Thermostatic Mixing Valve and Nominal Pipe Diameters**
Paragraphs 5.4.1 and 6.12.1

	Low pressure (i.e. header tank supply or low pressure)	Low pressure unvented (valve vented) and open vented	Mains pressure
Pressure of water at Tempering Valve or Thermostatic Mixing Valve (kPa)	20 – 30	30 – 120	over 300
Metres head (m)	2 – 3	>3 – 12	over 30
Minimum Tempering Valve or Thermostatic Mixing Valve size	25 mm	20 mm	15 mm
Pipes to Tempering Valve or Thermostatic Mixing Valve	25 mm (see **Note 3**)	20 mm	20 mm (15 mm optional) (see **Note 1**)
Pipes to shower	20 mm	20 mm (see **Note 4**)	20 mm (see **Note 5**) (15 mm optional) (see **Note 1**)
Pipes to sink/laundry (see **Note 2**)	20 mm	20 mm	15 mm
Pipes to bath (see **Note 2**)	20 mm	20 mm	15 mm
Pipes to basins (see **Note 2**)	15 mm	15 mm	10 mm

Notes:

1. If supplied by separate pipe from *storage water heater* to a single outlet.
2. This table is based on maximum pipe lengths of 20 metres.
3. 2 m maximum length from *water heater* outlet to tempering valve or thermostatic mixing valve
4. 15 mm if dedicated line to shower.
5. 10 mm if dedicated line to shower.
6. Pipe sizes in this table have been calculated to deliver water simultaneously to the kitchen sink and one other *fixture*.

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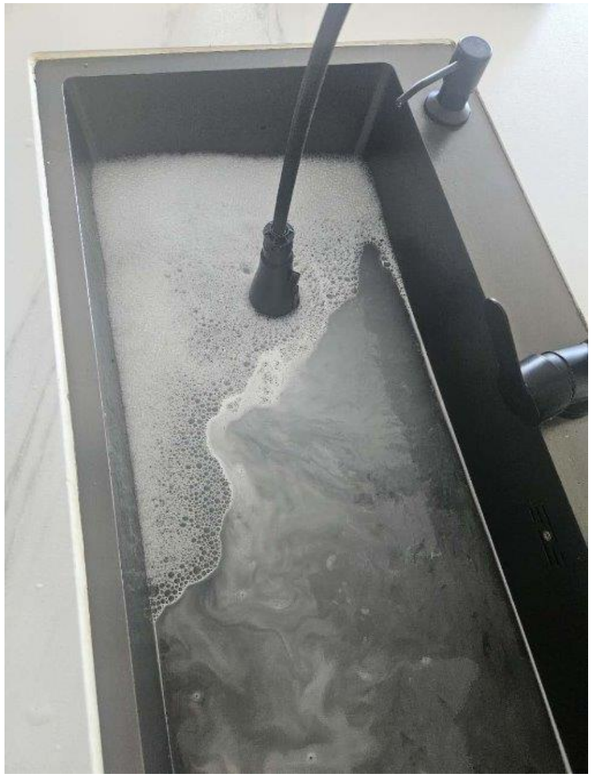
Protection of potable water



Protection of potable water – backflow

Table 40. Backflow prevention devices must be appropriate to the level of hazard.

	Low hazard	Medium hazard	High hazard	Back siphonage	Back pressure
Hose vacuum breakers (Figure 223)	•			•	
Atmospheric vacuum breakers (Figure 224)	•	•	•	•	
Pressure vacuum breakers (Figure 225)	•	•	•	•	
Double check valve assemblies (Figure 226)	•	•		•	•
Reduced pressure zone devices (Figure 227)	•	•	•	•	•
Break tanks (Figure 222)	•	•	•	•	
Air gaps (Figure 221)	•	•	•	•	•

For selection of backflow protection, refer to G12/AS1.

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Protection of potable – containment

FIGURE 3.1: Example of containment backflow protection

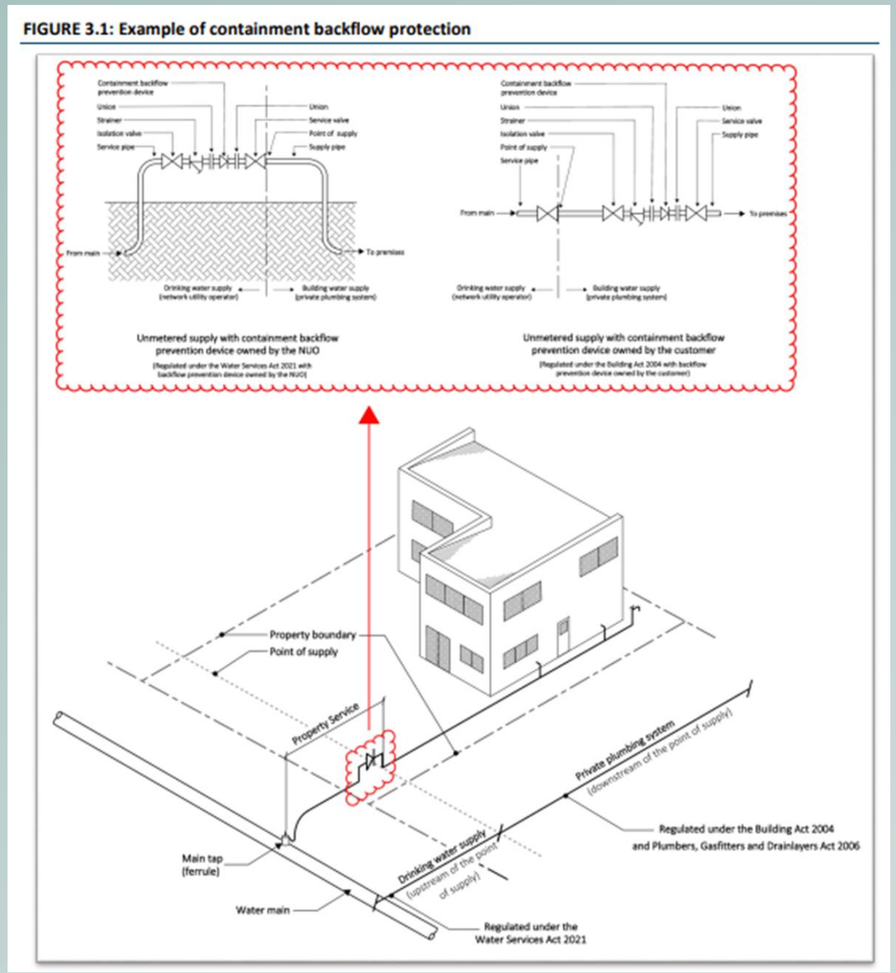

Table 2A: Containment Backflow Protection
Paragraph 3.5.1

High Hazard Premises	Backflow Protection
Abattoirs	Air gap or Reduced pressure zone device
Vehicle and plant washing facilities	Air gap or Reduced pressure zone device
Chemical laboratories	Air gap or Reduced pressure zone device
Chemical plants	Air gap or Reduced pressure zone device
Commercial and industrial premises using, processing or manufacturing toxic chemicals	Air gap or Reduced pressure zone device
Hospitals, laboratories, dental surgeries, mortuaries and veterinary clinics	Air gap or Reduced pressure zone device
Petroleum processing plants, storage plants and service stations	Air gap or Reduced pressure zone device
Piers, docks, marinas and other waterfront facilities	Air gap or Reduced pressure zone device
Premises containing soil waste dump points, including stock truck effluent disposal sites	Air gap or Reduced pressure zone device
Sewage treatment plants and sewage lift stations	Air gap or Reduced pressure zone device
Tertiary and secondary education facilities with laboratories	Air gap or Reduced pressure zone device
Medium Hazard Premises	**Backflow Protection**
Caravan parks with no soil waste dump points	Air gap or Double check valve
Food and beverage processing plants	Air gap or Double check valve
Premises with fire-fighting water services	Air gap or Double check valve
Premises with an alternative water supply	Air gap or Double check valve
Public swimming pools	Air gap or Double check valve

Notes:

1. The premises listed above are not an exhaustive list. Where there is doubt, *containment backflow protection* shall be selected to match highest *cross connection* hazard identified within the property by making comparison to the hazard descriptions in Paragraphs 3.3.1, 3.3.2 and 3.3.3.
2. *Air gaps* must not be installed in a *toxic environment*.
3. This table does not apply to premises contain only *household units*.

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Legionella

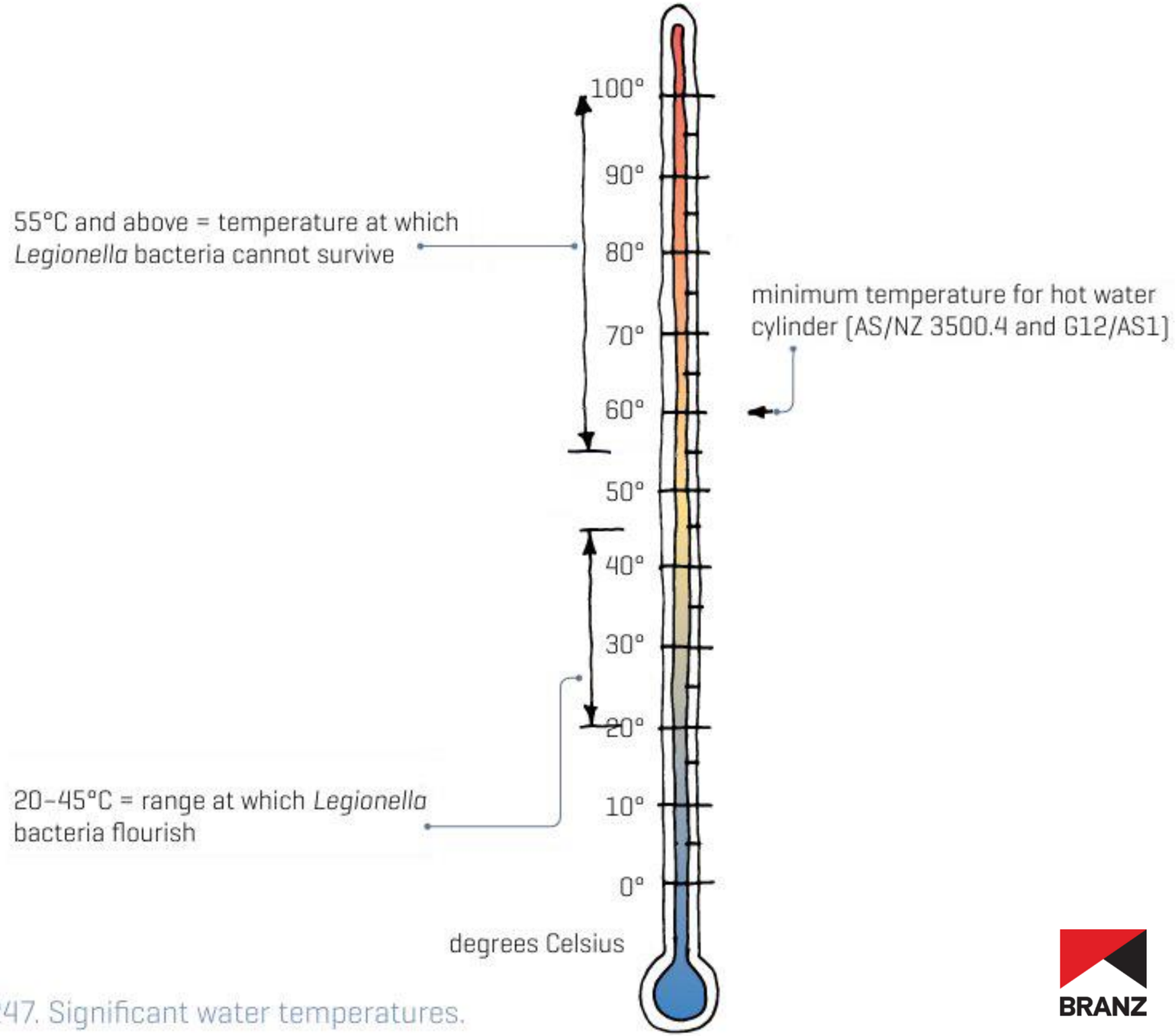

Figure 247. Significant water temperatures.

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Heated water – Temperature

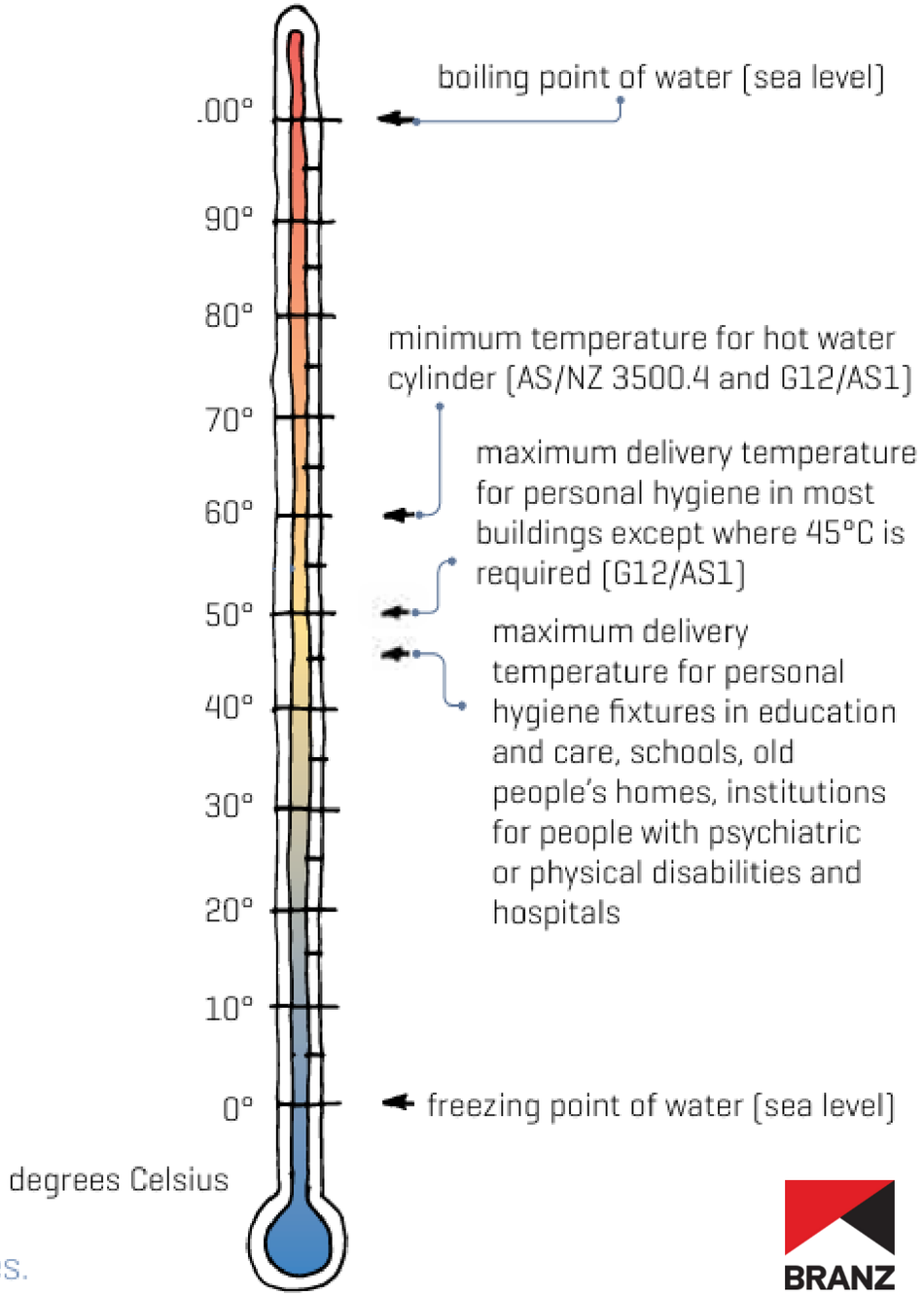
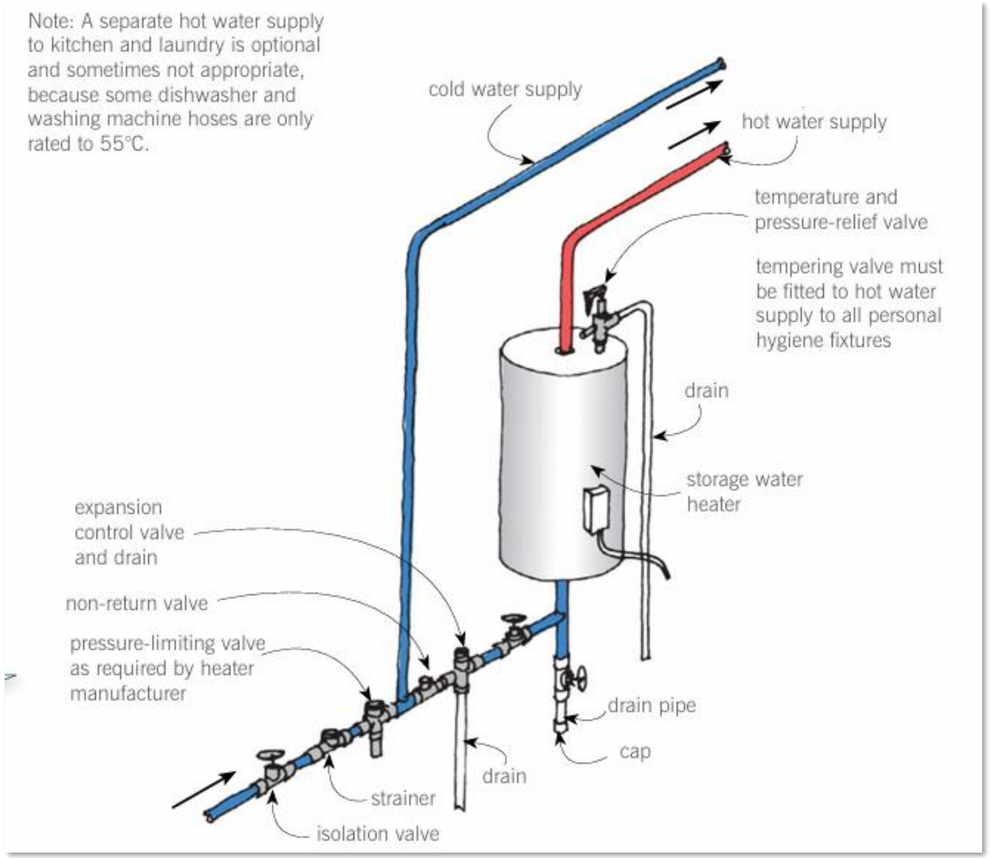
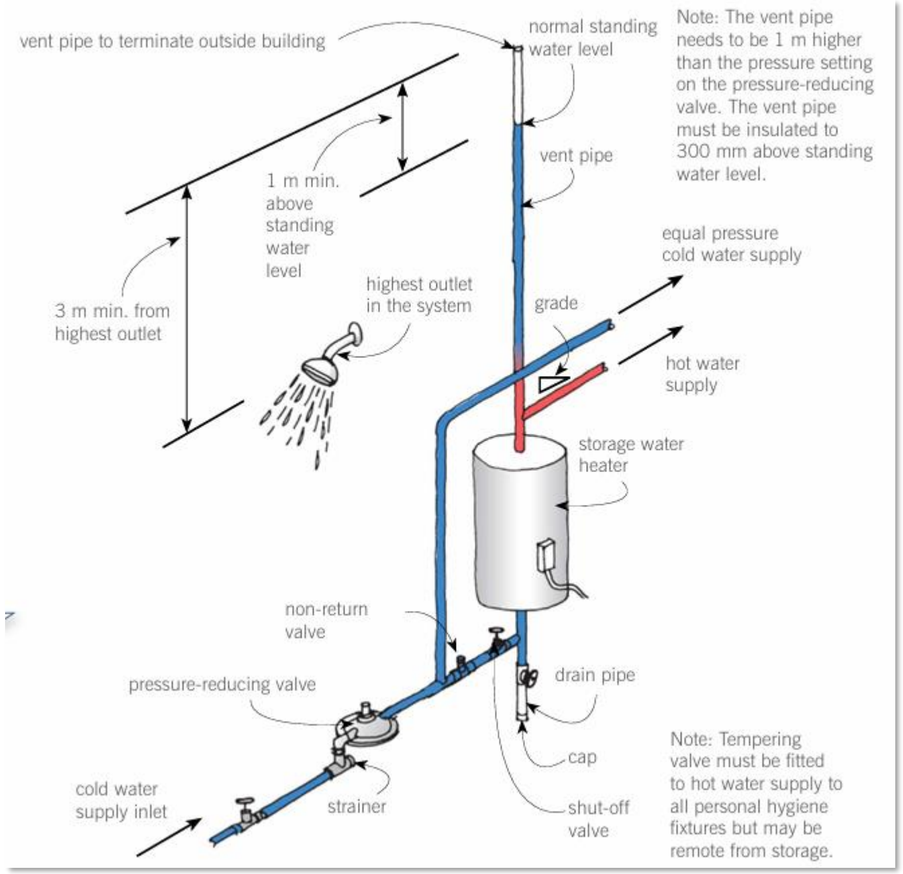


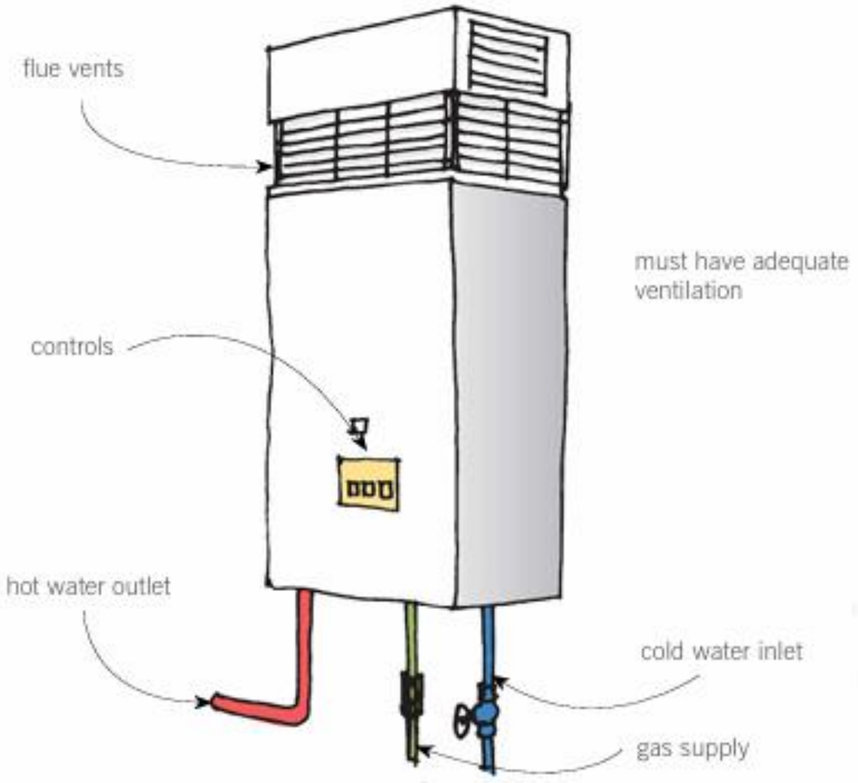
Figure 247. Significant water temperatures.

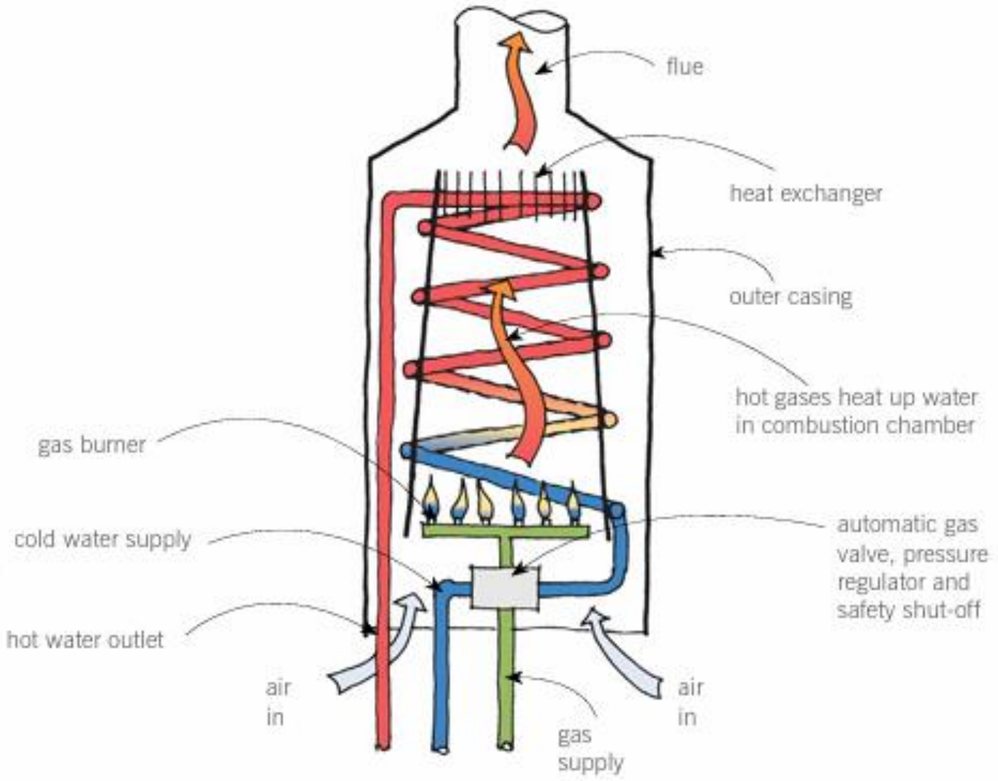
Heated water – HWC's



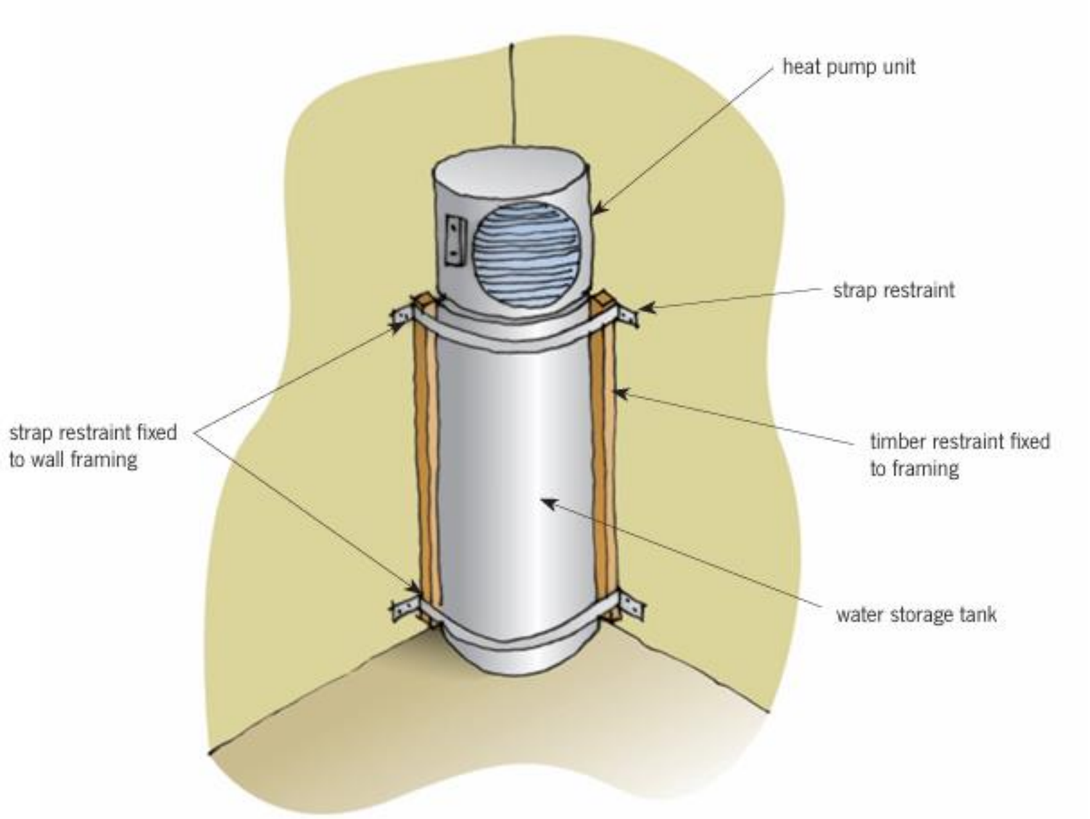


Heated water – continuous flow water heaters





Heated water – energy saving



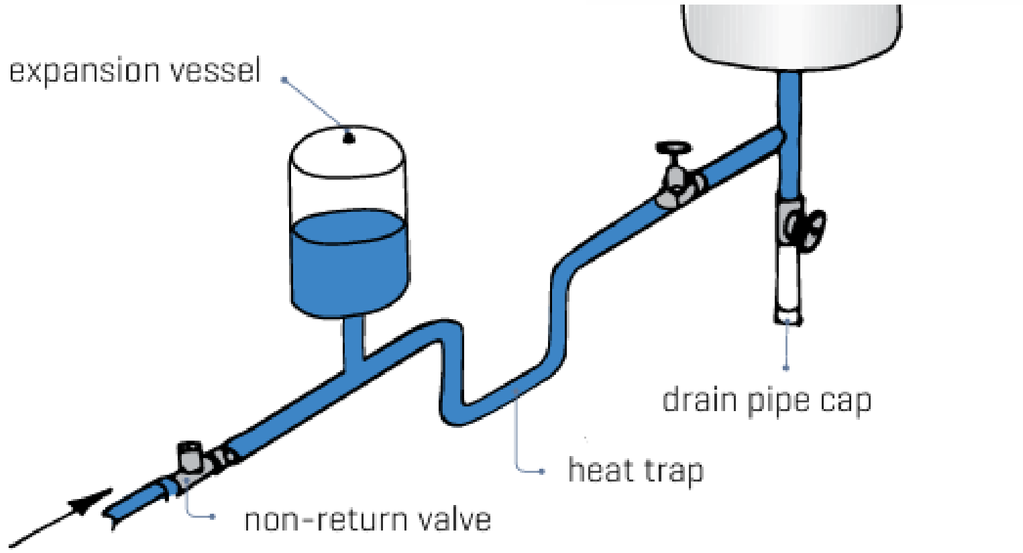


Figure 264b. Typical expansion vessel.

Heated water – energy saving

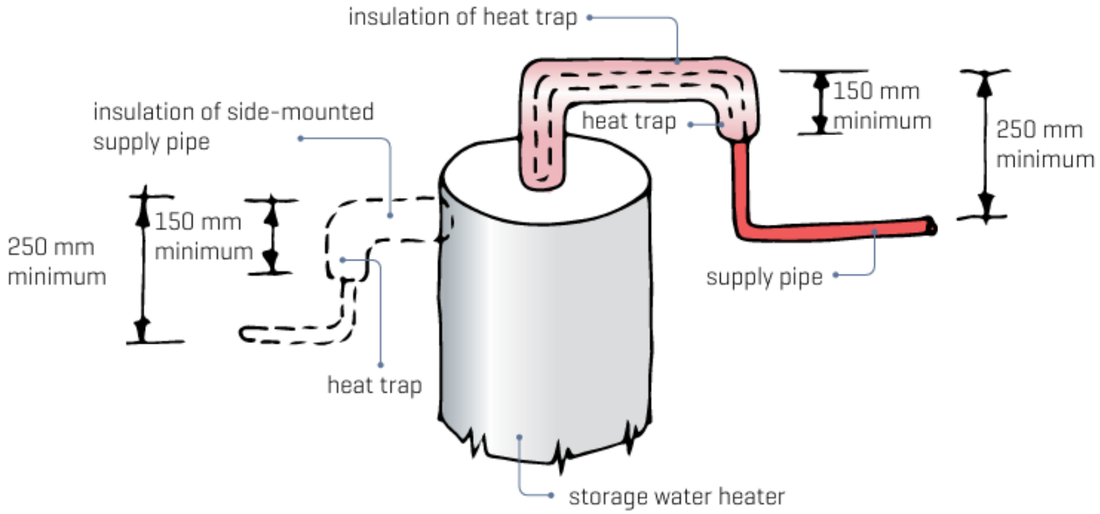


Figure 270. Insulation of hot water distribution pipes where a heat trap is formed.

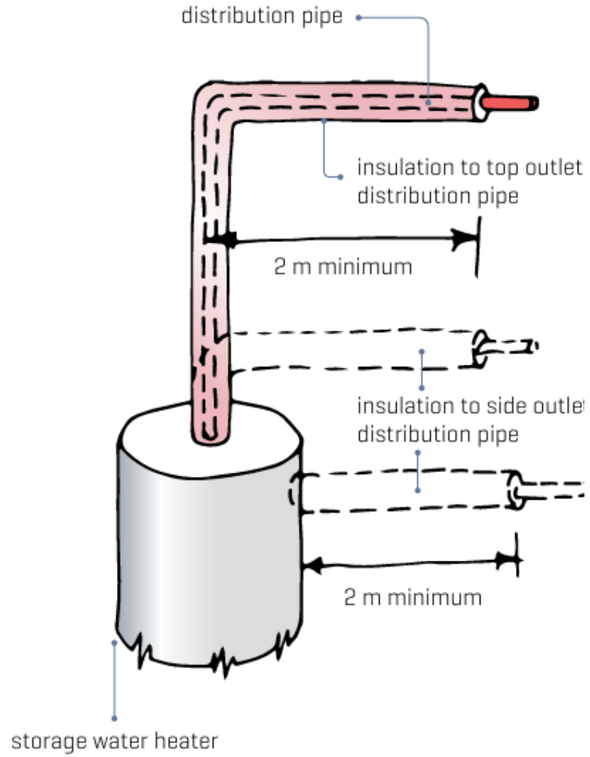


Figure 269. Insulation of hot water distribution pipes – alternatively, a heat trap may be installed (see Figure 270).

Access for maintenance

Quick quiz

What is the most forgotten item from E1 Surface water?

Sumps

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Stormwater systems

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Safe and sustainable water supply

- Water supply systems
- **Stormwater systems**
- Water re-use

E1 Surface water
RFI data
Stormwater neutrality
Sizing stormwater drains
E1/AS 1 Gradients
E1/AS1 Bubble-up Chamber
Cover
Proximity to a foundation
Access for maintenance
Sumps

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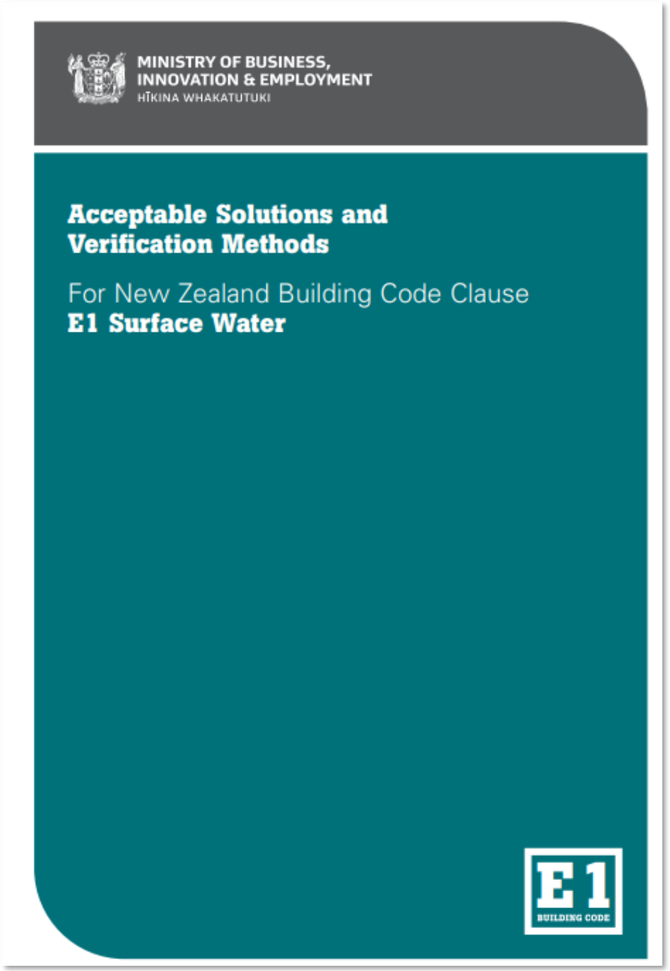
E1 *Surface water*

- E1/VM1 – Sizing drains
- E1/AS1 – Catchment area of less than 0.25 ha
- E1/AS2 – AS/NZS 3500.3 with modifications



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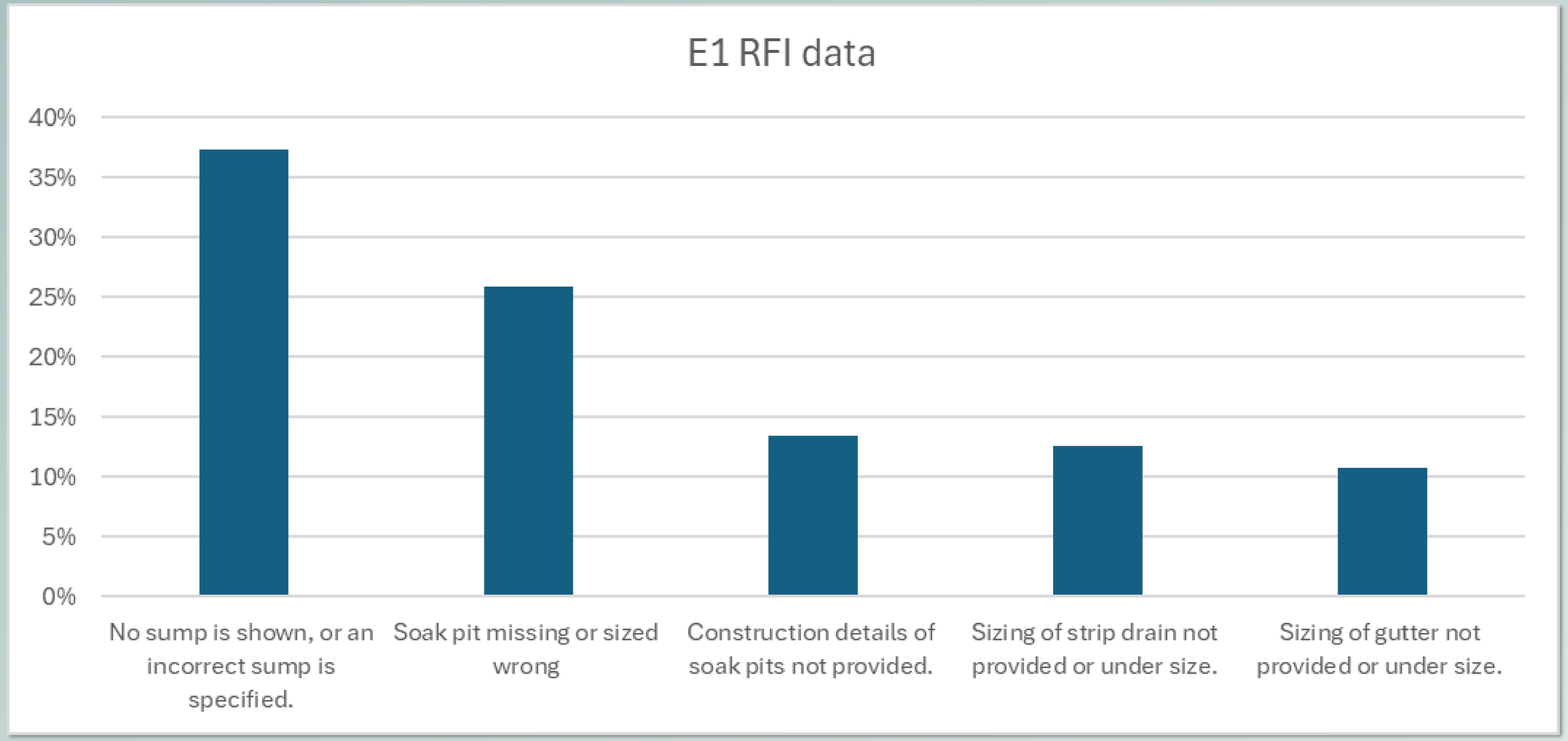

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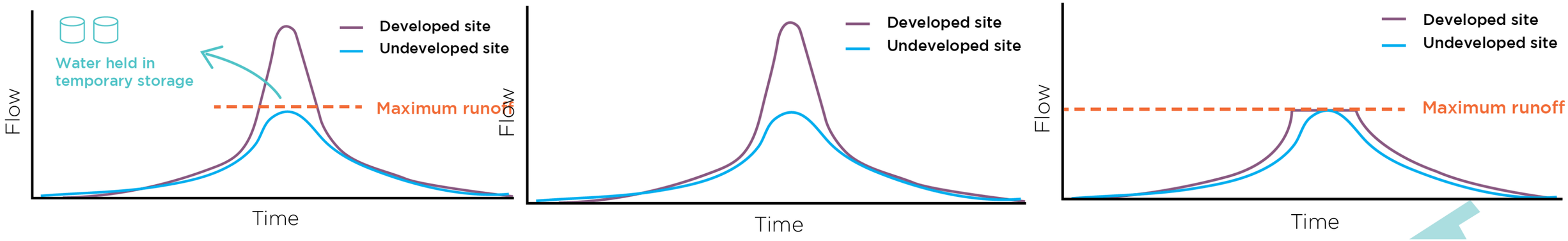
Stormwater neutrality



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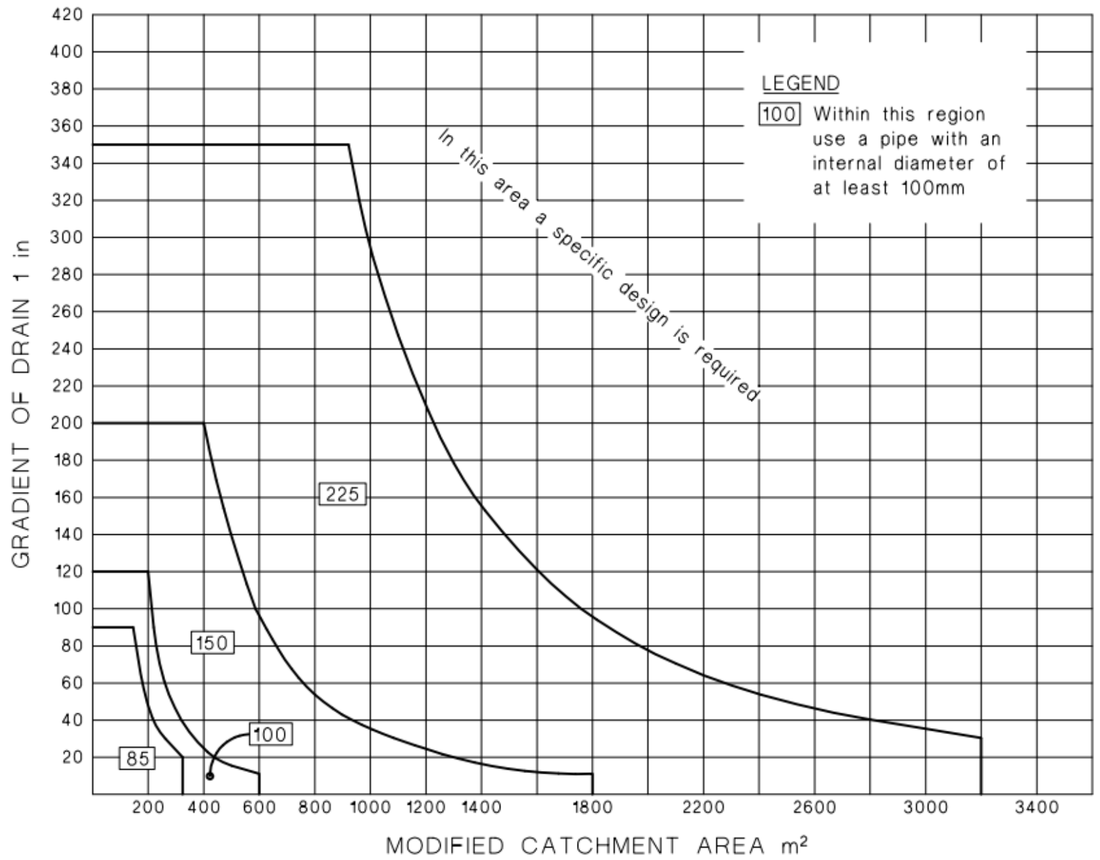
Sizing Stormwater drains

Formula:

Modified catchment area = 0.01 x A x I

A = Surface area
I = Rainfall intensity

Figure 3: **Sizing of Surface Water Drains**
Paragraphs 3.2.2 and 3.2.3



Sizing Stormwater drains

Example:

A house in Wellington has:

- a roof plan area of 250 m^2
- a concrete driveway of 90 m^2
- a paved patio of 50 m^2.

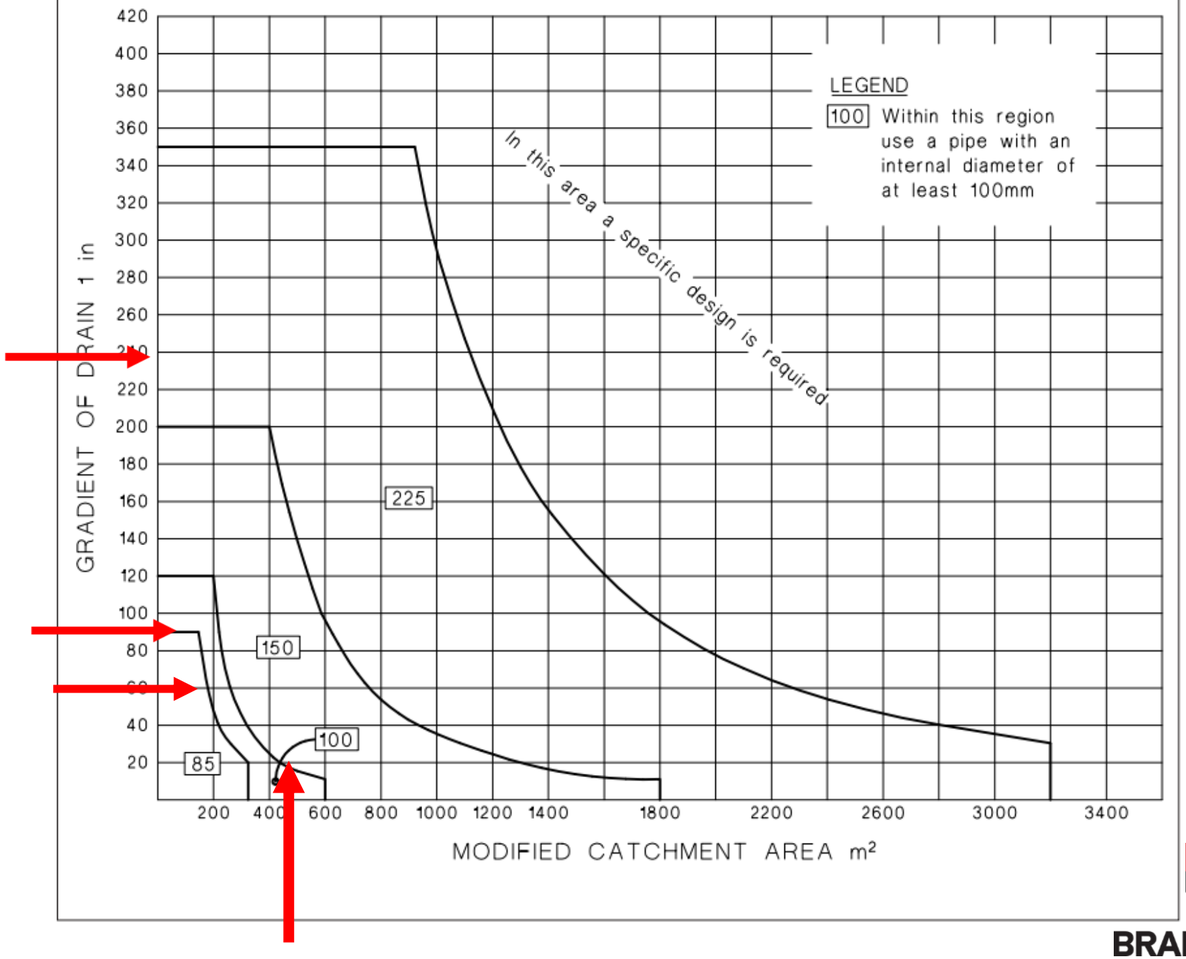
Area A = 250 + 90 + 50 = 390 m^2.

Rainfall intensity for Wellington is 70 mm/hr.

Modified catchment area = 0.01 x 390 x 70 = 273.

- 85 mm ID drain at a minimum gradient of 1:30
- 100 mm ID drain at a minimum gradient of 1:60
- 150 mm ID drain at a minimum gradient of 1:200.

Figure 3: **Sizing of Surface Water Drains**
Paragraphs 3.2.2 and 3.2.3



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E1/AS1 gradients

Table 2: Minimum Gradients
Paragraph 3.4.1

Drain internal diameter	Minimum gradient
85 mm	1 in 90
100 mm	1 in 120
150 mm	1 in 200
225 mm	1 in 350

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E1/AS1 bubble-up chamber

Figure 6: **Bubble-up Chamber**
Paragraph 3.4.2

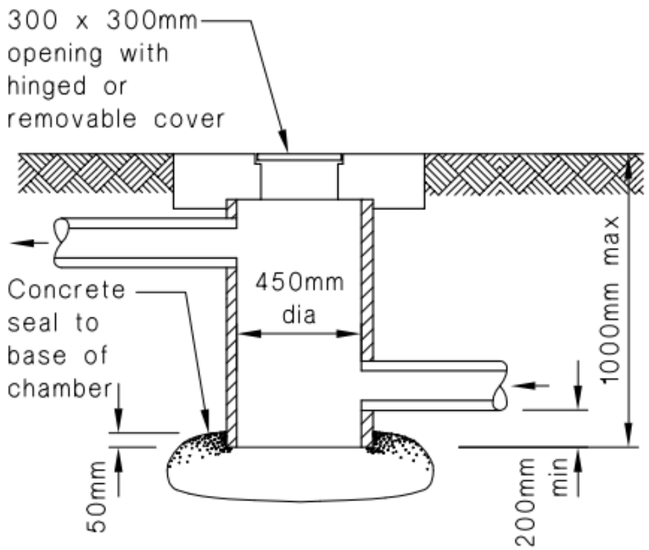
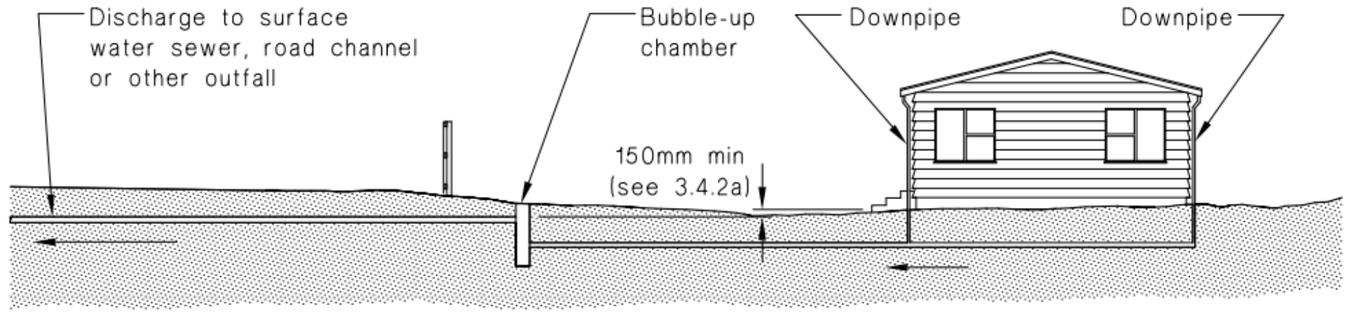


Figure 7: **Longitudinal Section of Bubble-up Chamber System**
Paragraph 3.4.2



SECTION

Cover

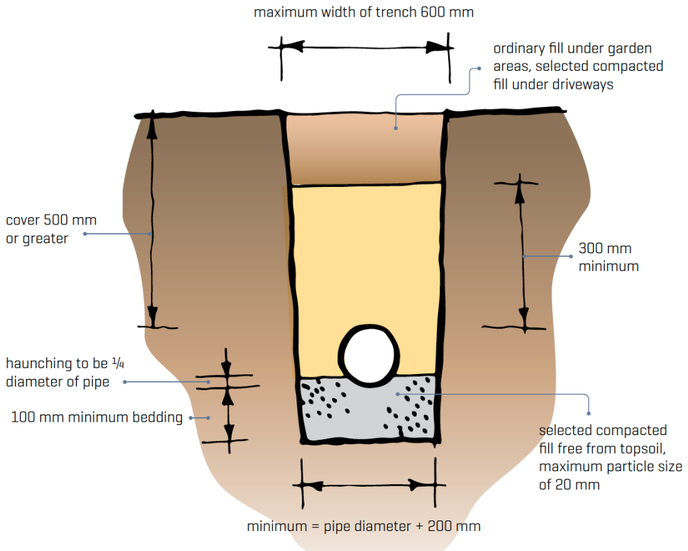


Figure 167. Bedding and backfilling where cover over drain is 500 mm or greater.

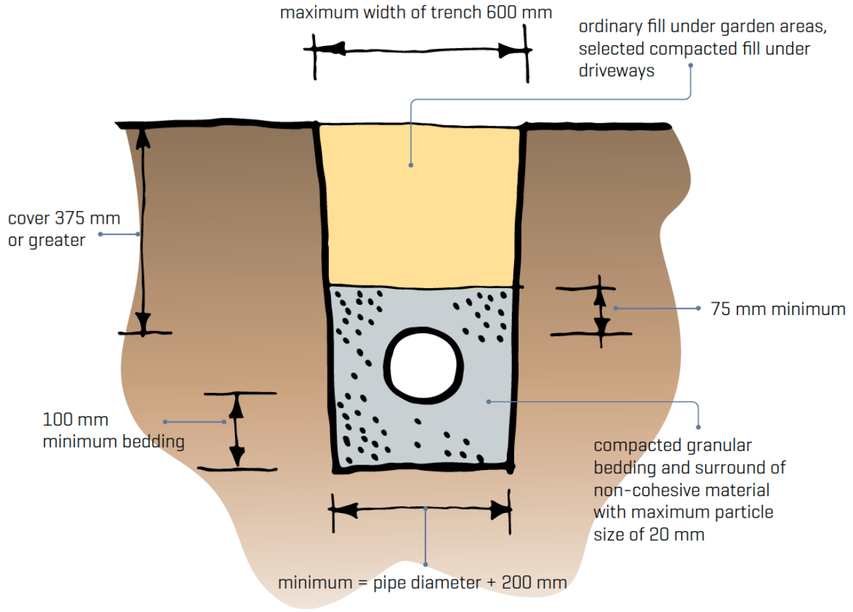


Figure 168. Bedding and backfilling where cover over drain is 375 mm or greater.

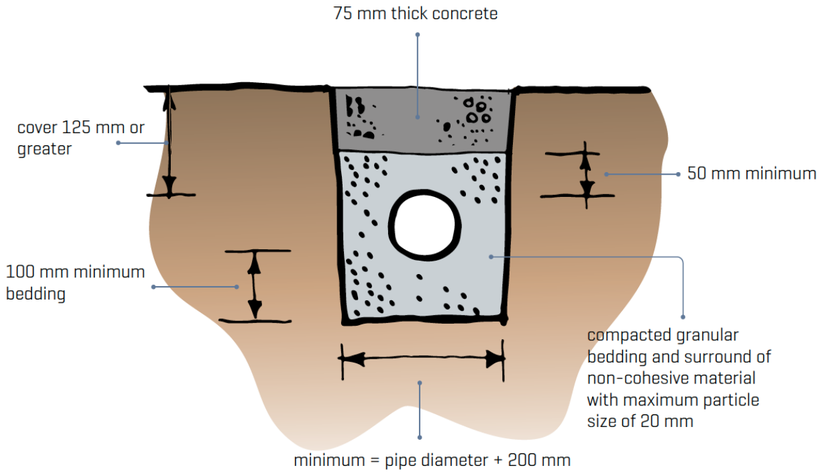


Figure 169. Bedding and backfilling where cover over drain is 125 mm or greater.

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Proximity to a foundation E1/AS1

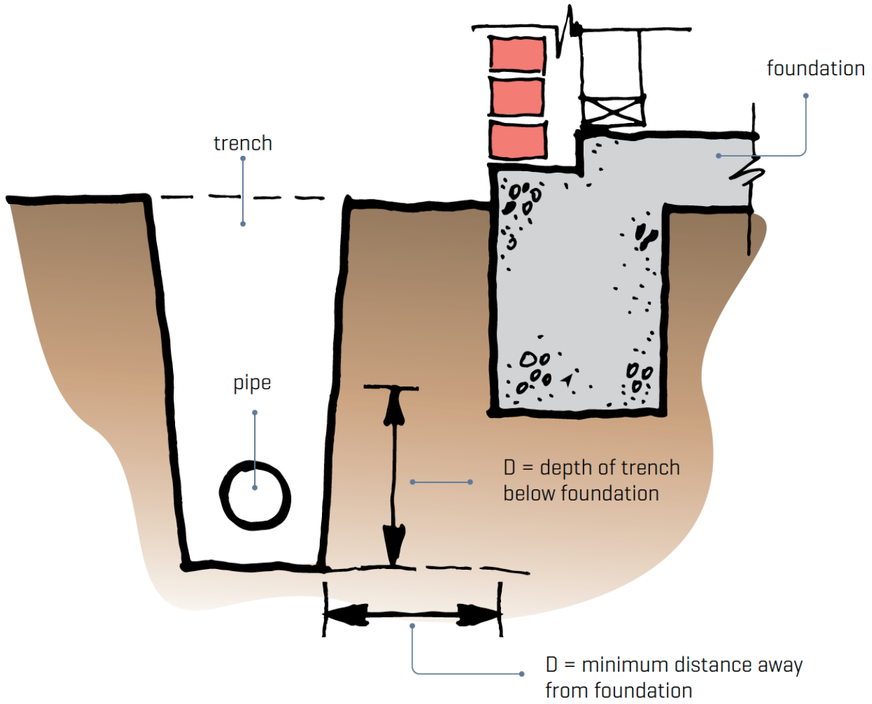

Figure 170. Relationship between trench depth and foundation for trenches remaining open for no longer than 48 hours.

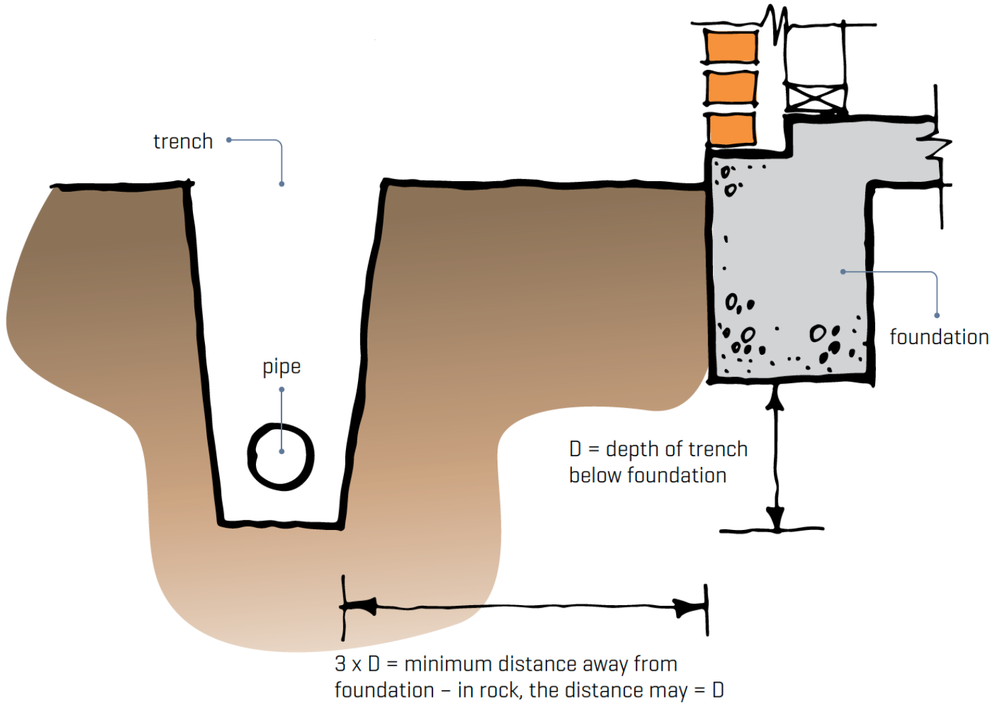

Figure 171. Relationship between trench depth and foundation for trenches remaining open for longer than 48 hours.

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E1/AS1 Access for maintenance/access openings

Sumps

Type 1 = 4500/l = m2

Type 2 = 40,000/l = m2

I = rainfall intensity

Figure 8: Type-one Surface Water Sump
Paragraph 3.6.2

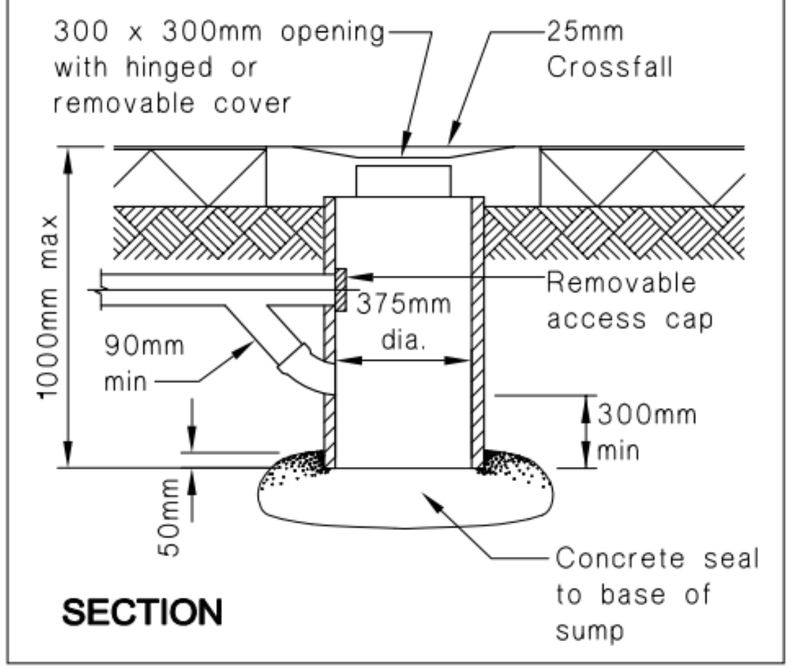
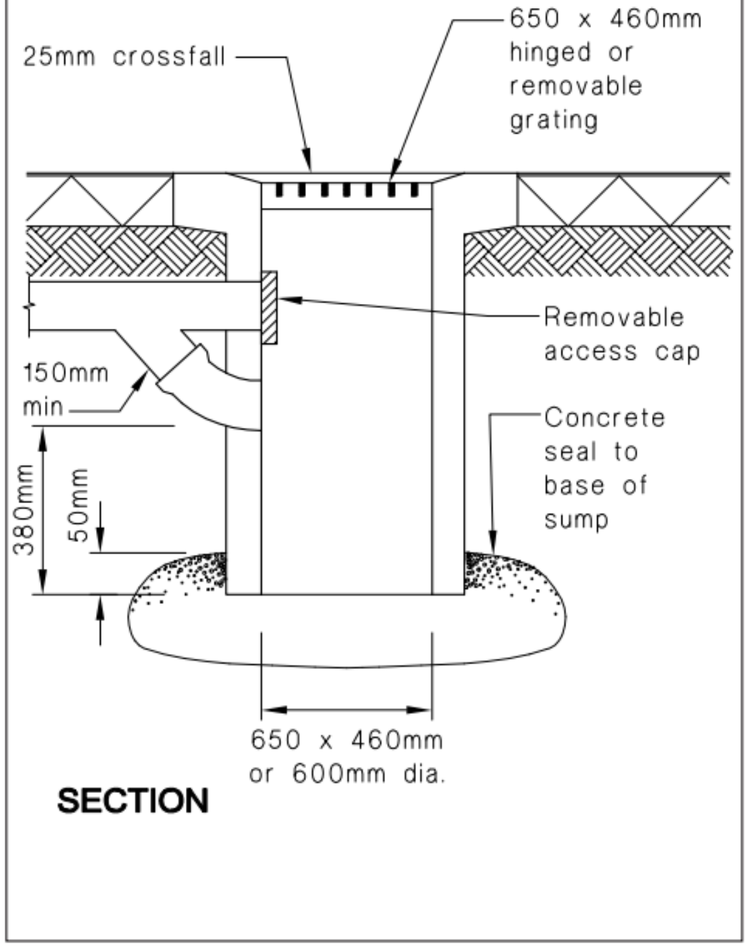


Figure 9: Type-two Surface Water Sump
Paragraph 3.6.2



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Sumps – sizing

Example:

Surface area = 50 m2
Rainfall intensity = 109 mm/hr

4500 ÷ 109 = 41.28 m2

Table A: **Rainfall Intensities**
10 minute duration rainfall intensities for various locations in New Zealand

Location	Latitude degrees	Longitude degrees	10% AEP intensity mm/hr	2% AEP intensity mm/hr
NORTHLAND				
Taipa Bay-Mangōnui	-35	173.5	86	117
Awanui	-35.05	173.25	85	116
Kaeo	-35.1	173.78	91	123
Kaitaia	-35.11	173.26	86	117
Ahipara	-35.17	173.17	86	116
Kerikeri	-35.23	173.95	101	135
Russell	-35.27	174.12	109	147
Paihia	-35.29	174.09	110	148
Ōkaihau	-35.32	173.77	97	130
Ōhaeawai	-35.35	173.88	99	132

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Quick quiz

What fixtures in a building can be supplied by non-potable water?

Washing machine, toilet flushing, hose tap/irrigation

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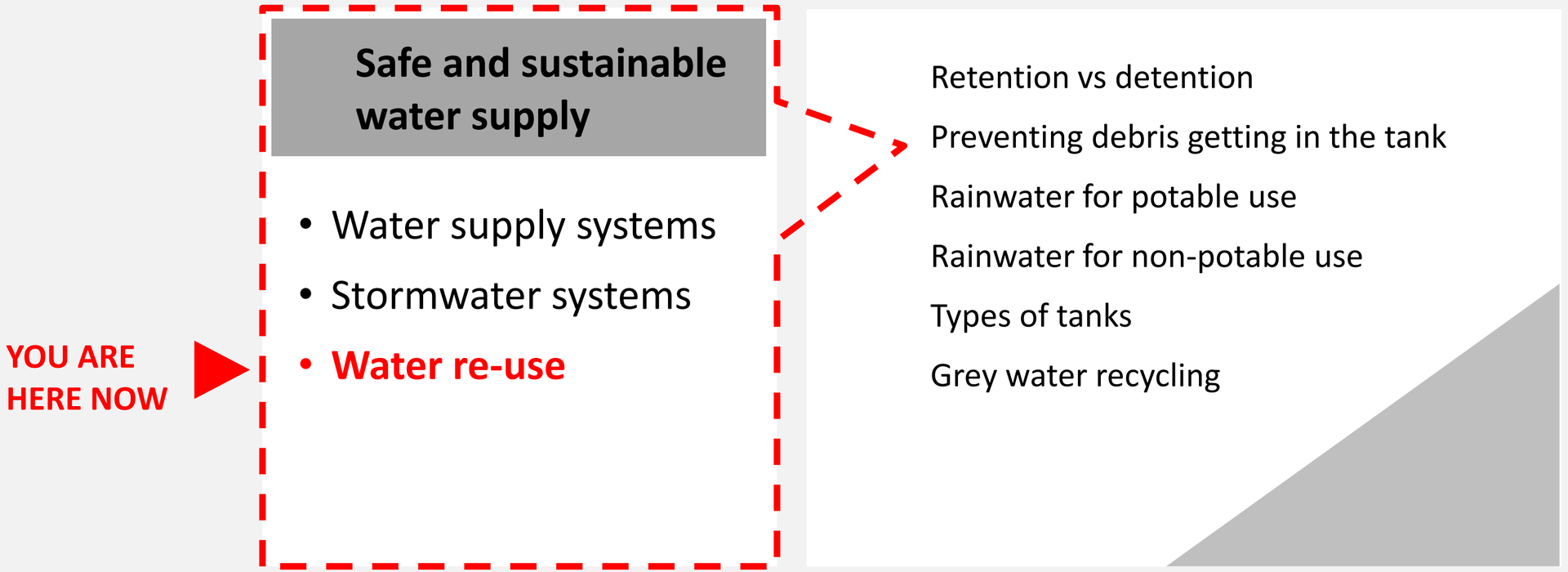
Water re-use



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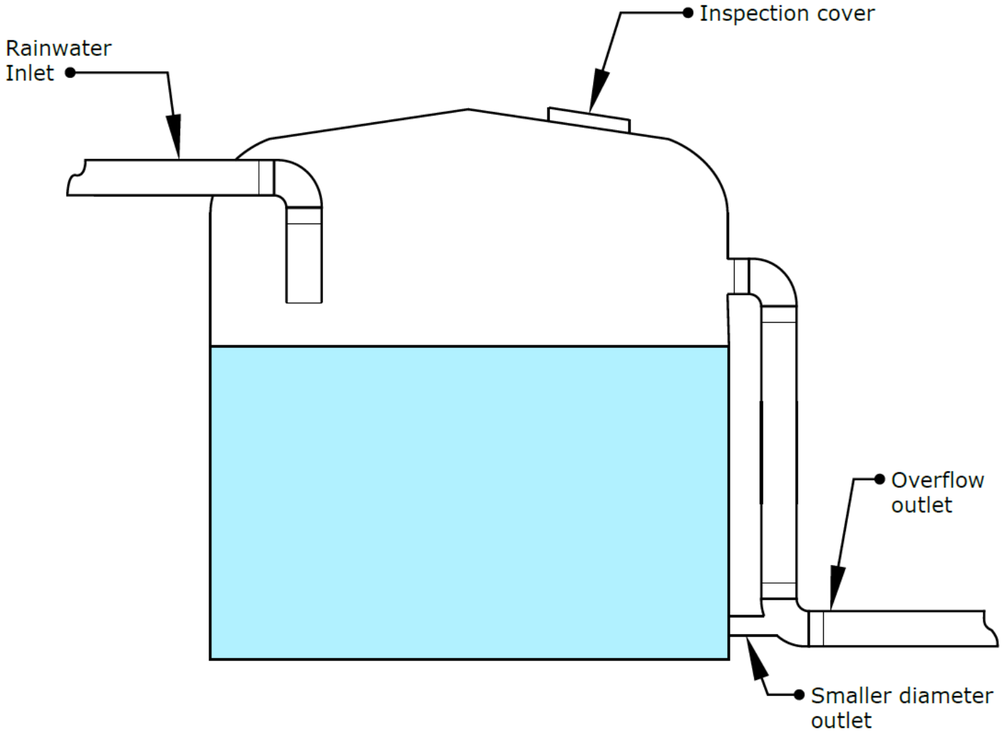
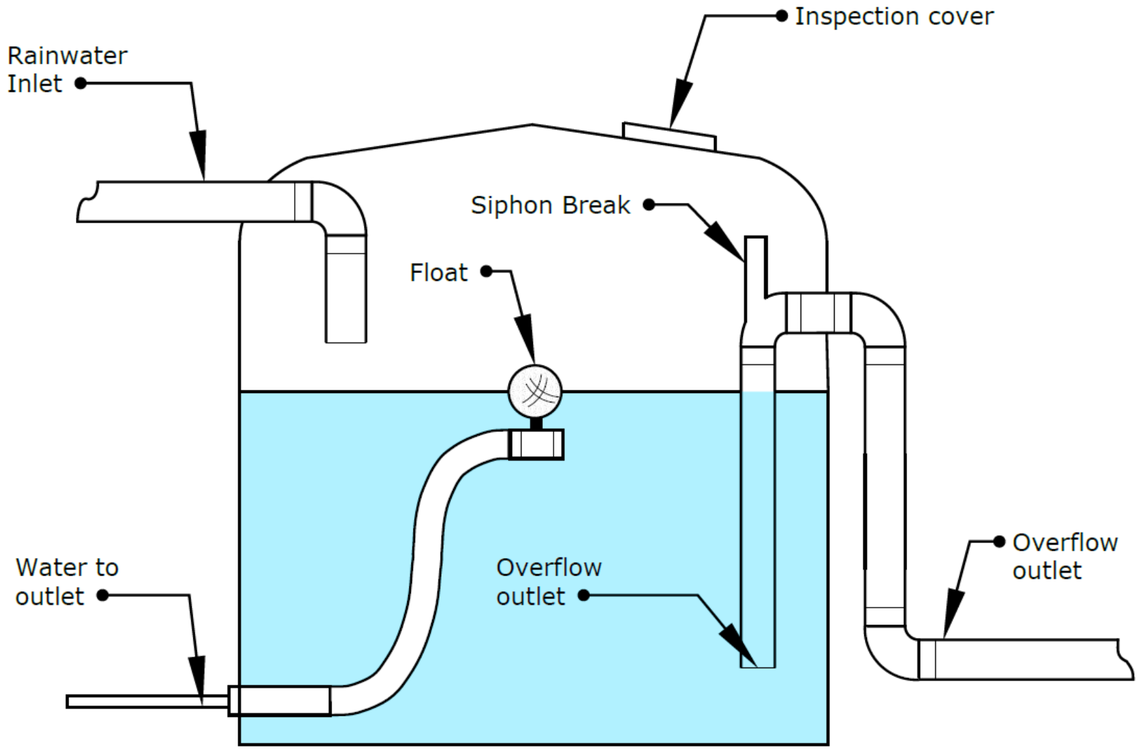
Retention vs detention





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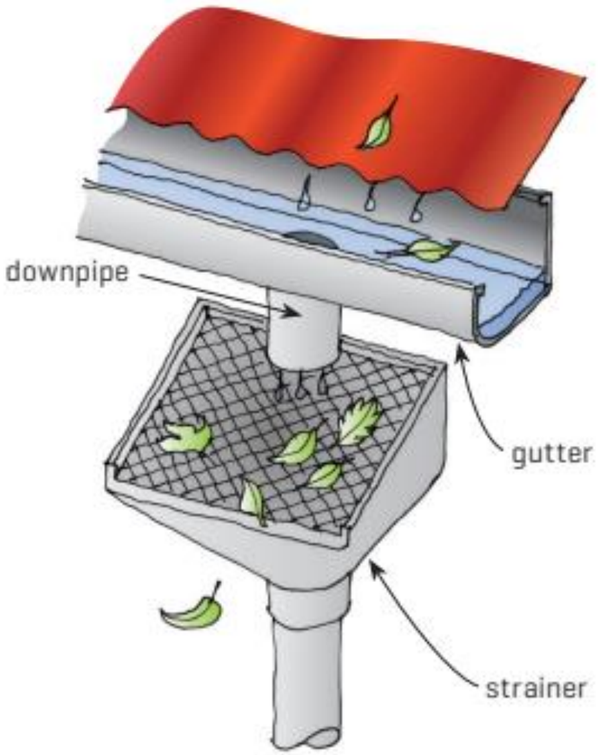
Preventing debris getting in the tank



Rainwater for potable use

Rainwater for non-potable use

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Types of tanks

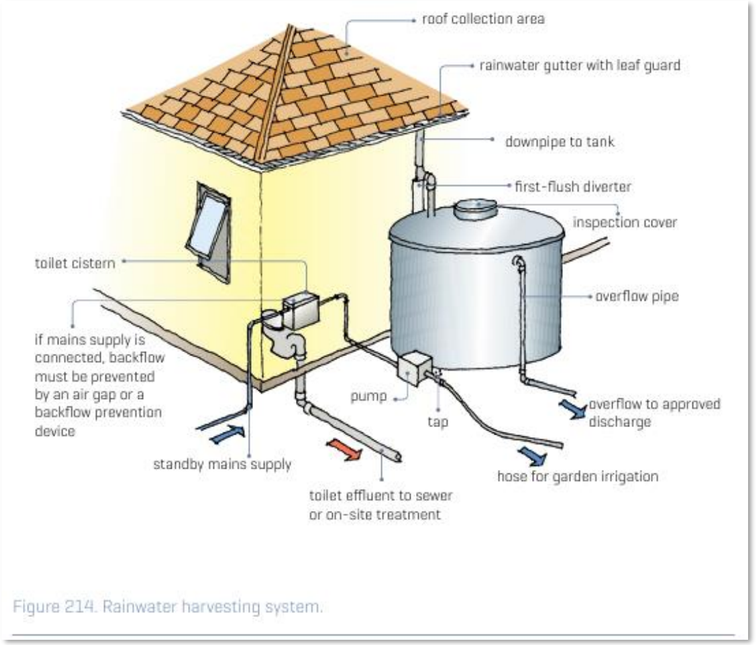
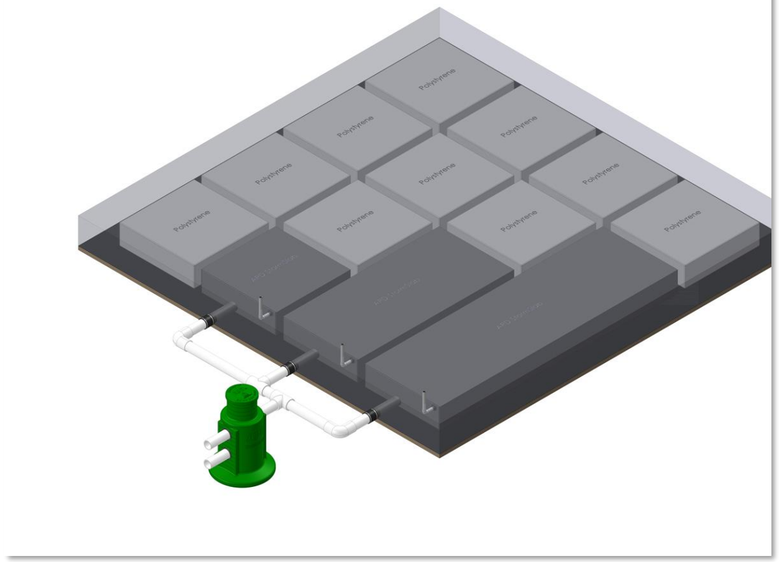


Figure 214. Rainwater harvesting system.



Grey water recycling

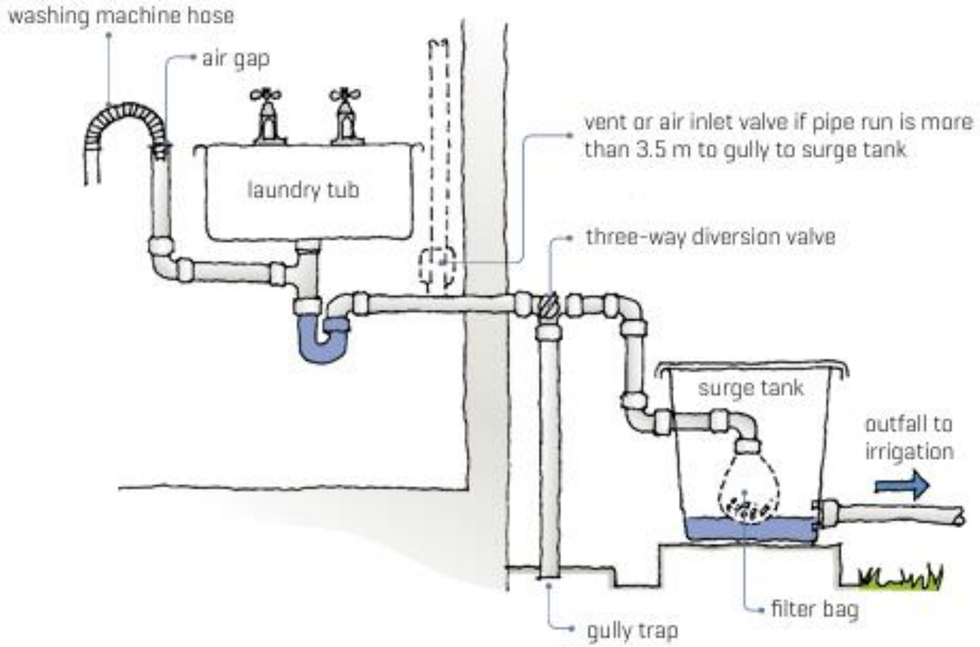


Figure 158. Gravity-fed greywater system.

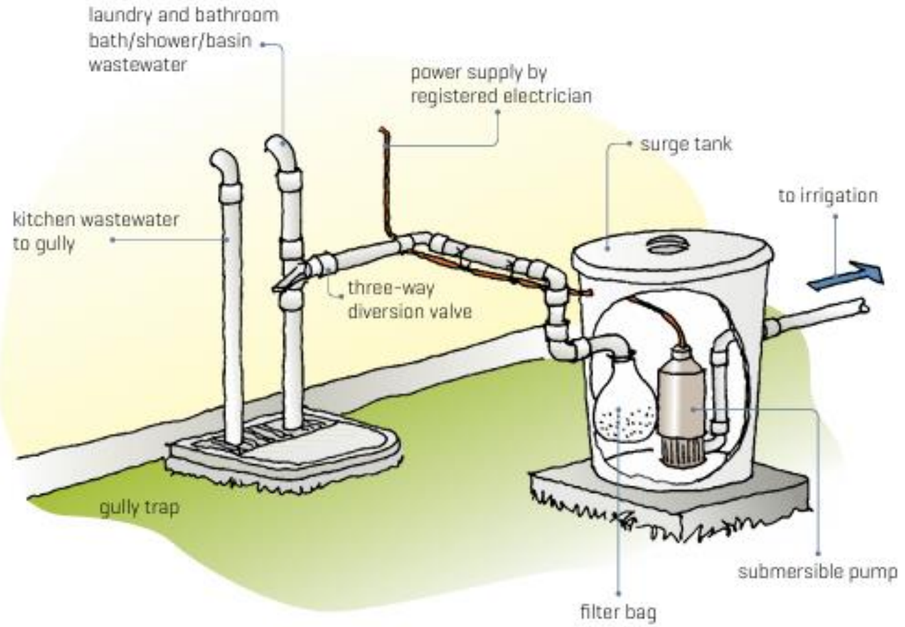


Figure 159. Pumped greywater system.

Changes recap

CLAUSE	SECTION	UPDATE DETAILS	PURPOSE/IMPLICATIONS
G12 (Water Supplies)	**General Water Safety**	New standards for reducing lead content in plumbing products.	Aims to ensure safer drinking water by minimizing lead exposure risks.
	Backflow Prevention	Mandated containment backflow protection, addressing cross-connection hazards.	Protects potable water supply by preventing contamination from reverse flows in water systems.
	System Components	Specific requirements for water supply systems components like pipeline identification and temperature control and expansion vessels	Improves system transparency and safety by regulating temperature and identifying potable pipelines.
G13 (Foul Water)	**Sanitary Plumbing Standards**	Updating citation to AS/NZS 3500 Part 2 (2021), detailing new requirements for drainage and junction installation.	Reduces blockage risks and supports the use of wate-efficient fixtures in foul water systems.
	Waste Disposal Efficiency	Adjustments to disposal methods to support hygienic wastewater management.	Enhances waste disposal efficiency, minimizing odour and accumulation of offensive matter.