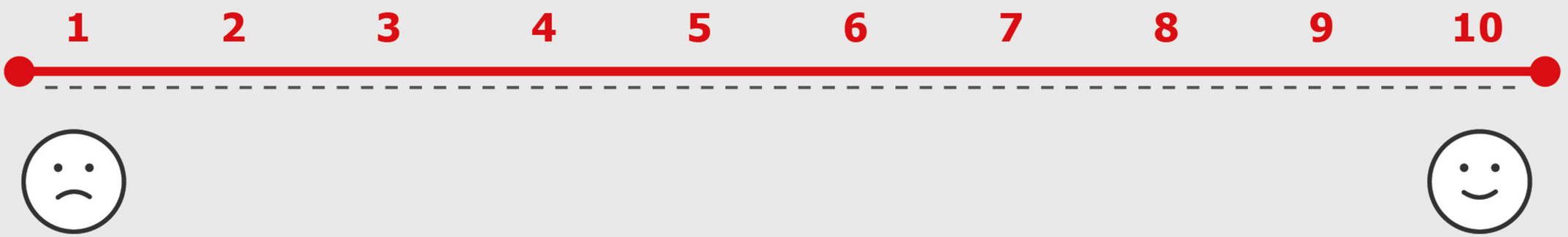
Plumbing and Drainage

Understanding Code changes and key design principles

Presenters:
Sam Wood, Shay Harrop and Bruce Klein

Part 1 of 3 | Plumbing and drainage design | Webinar series

How confident in plumbing and drainage design are you?



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Building Act 2004

14D Responsibilities of designer

(1) In subsection (2), **designer** means a person who prepares plans and specifications for building work or who gives advice on the compliance of building work with the building code.

(2) A designer is responsible for ensuring that the plans and specifications or the advice in question are sufficient to result in the building work complying with the building code, if the building work were properly completed in accordance with those plans and specifications or that advice.

Section 14D: inserted, on 13 March 2012, by section 10 of the Building Amendment Act 2012 (2012 No 23).

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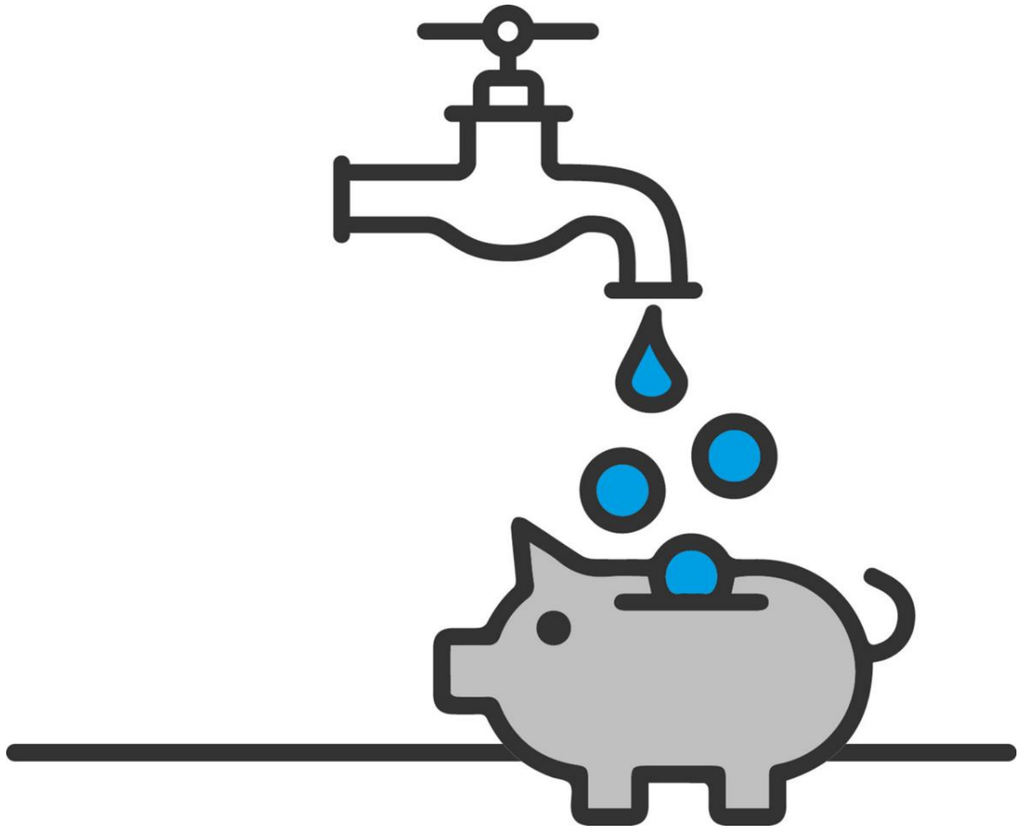
Good design saves money



What we'll cover

Webinar 1

Plumbing & Drainage Foundations

- Regulatory requirements
- Scope of P&D guide
- P&D fundamentals
- Key building code updates

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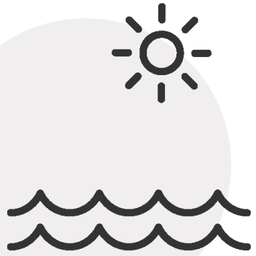
Webinar 2

Foul Water Fundamentals

Webinar 3

Safe & Sustainable Water Supply



Quick quiz

Acceptable Solution G13/AS1 applies to above-ground non-pressure sanitary plumbing for buildings having no more than how many floors?

3 floors

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Quick quiz

True or false: Acceptable Solutions must be followed to comply with the New Zealand Building Code.

Acceptable Solutions are deemed to comply with the New Zealand Building Code but are not the only way of complying.

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Regulatory requirements

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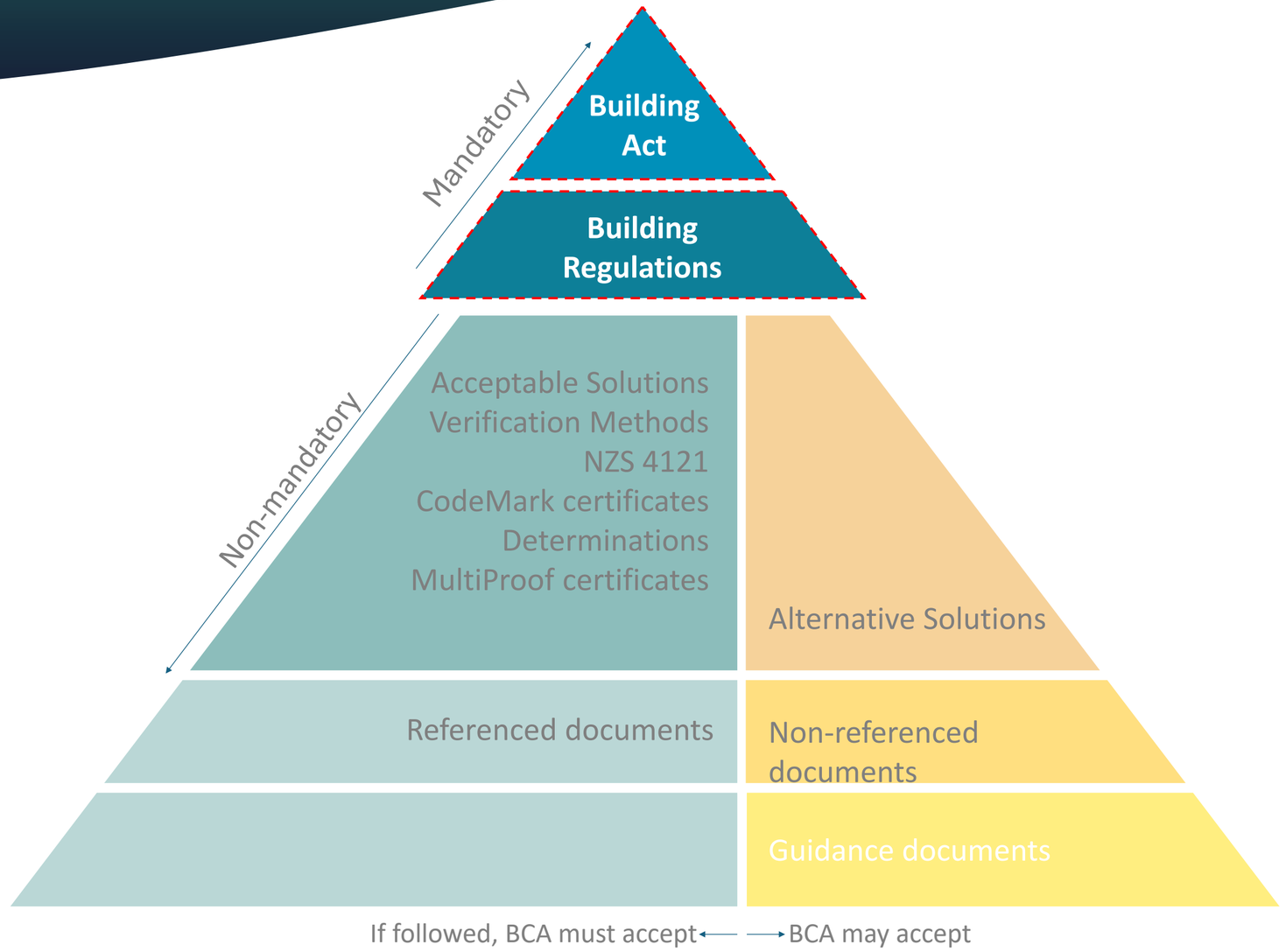
- **Regulatory requirements**
- Scope of P&D guide
- P&D fundamentals
- Key building code updates

We'll cover:

- Building code
- Acceptable Solutions
- BRANZ guide

How the Building Code works



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Building Code G13 *Foul water*

Clause G13—Foul water

Provisions	Limits on application
Objective	
G13.1 The objective of this provision is to:	
(a) safeguard people from illness due to infection or contamination resulting from personal hygiene activities, and	
(b) safeguard people from loss of *amenity* due to the presence of unpleasant odours or the accumulation of offensive matter resulting from *foul water* disposal.	
Functional requirement	
G13.2 *Buildings* in which *sanitary fixtures* and *sanitary appliances* using water-borne waste disposal are installed must be provided with—	
(a) an *adequate* plumbing and drainage system to carry *foul water* to appropriate outfalls; and	
(b) if no *sewer* is available, an *adequate* system for the storage, treatment, and disposal of *foul water*.	

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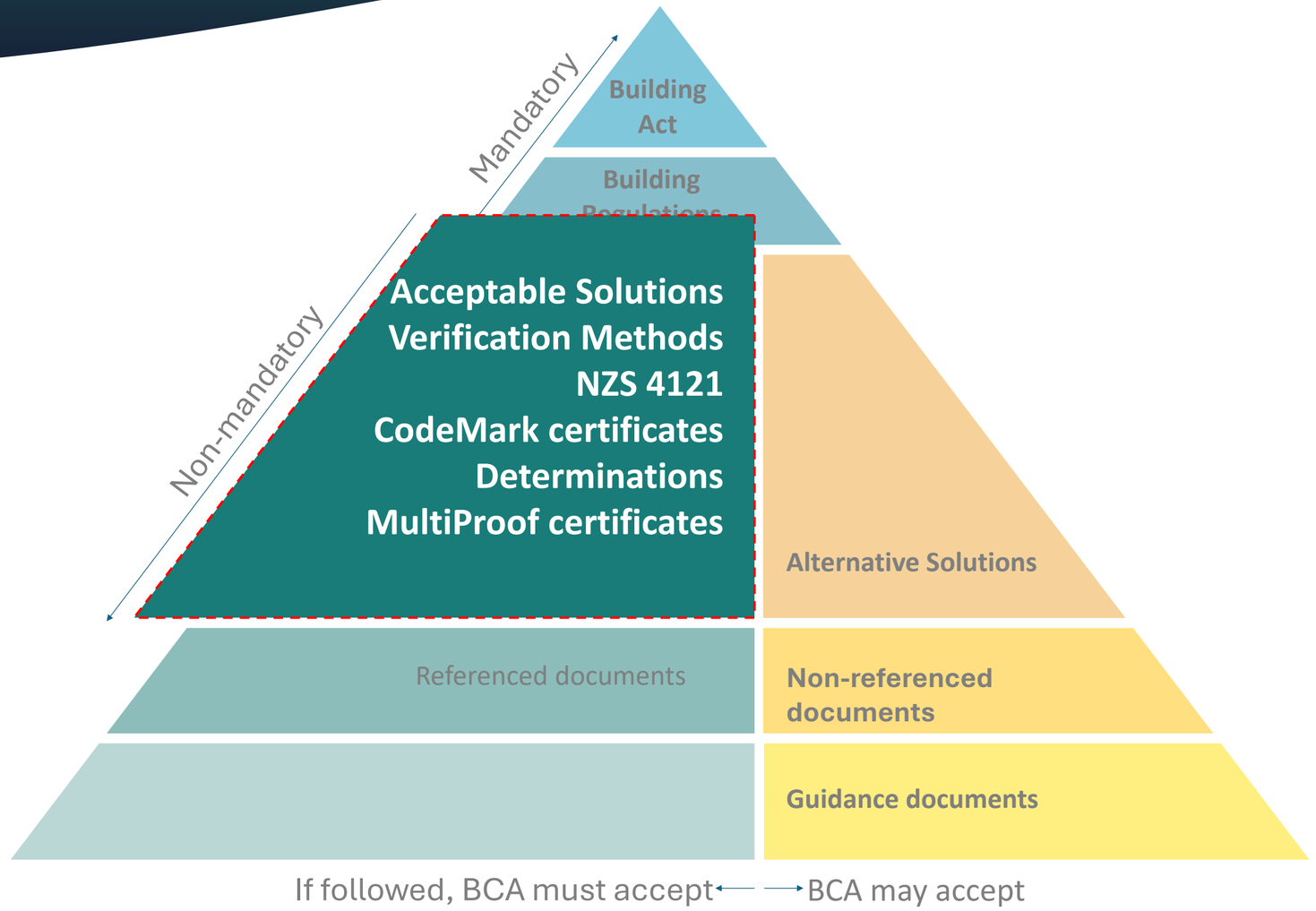
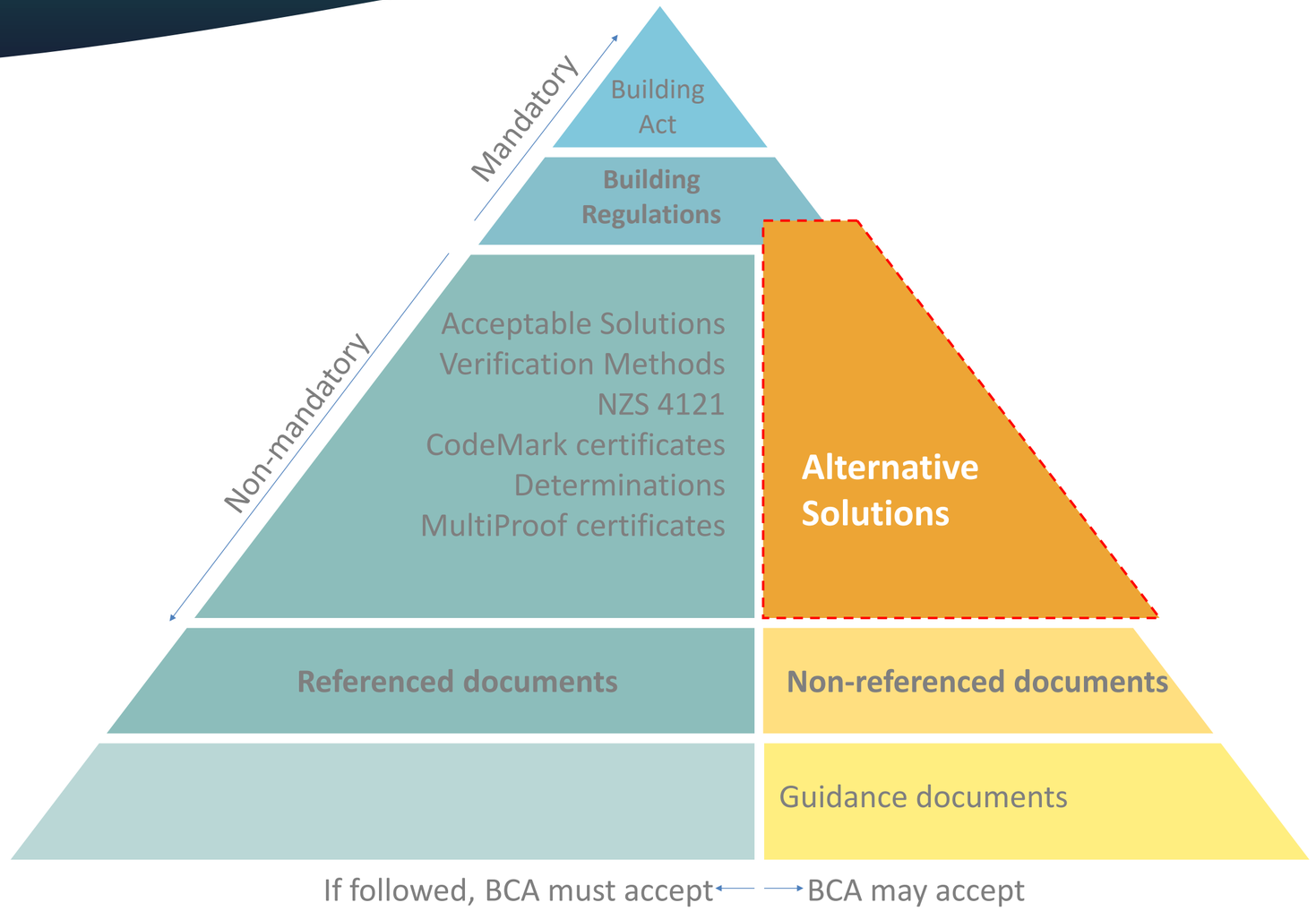
Must accept


Mandatory
Non-mandatory
Building Act
Building Regulations
Acceptable Solutions
Verification Methods
NZS 4121
CodeMark certificates
Determinations
MultiProof certificates
Alternative Solutions
Referenced documents
Non-referenced documents
Guidance documents
If followed, BCA must accept
BCA may accept

May accept


Mandatory
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Referenced documents
Non-referenced documents
Guidance documents
If followed, BCA must accept
BCA may accept

Scope of the P&D Guide

Webinar 1

Plumbing & Drainage Foundations

YOU ARE HERE NOW

- Regulatory requirements
- **Scope of P&D guide**
- P&D fundamentals
- Key building code updates

We'll cover:

How the Plumbing and Drainage Guide collates information on water supplies, foul water and stormwater.

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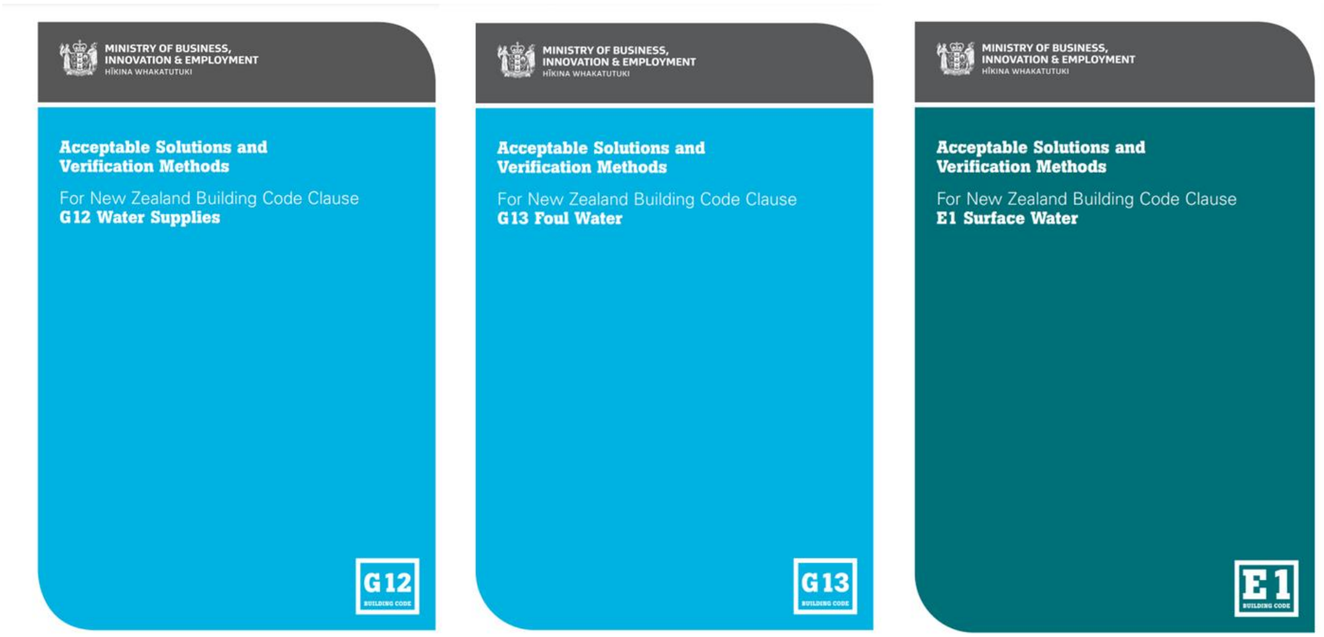
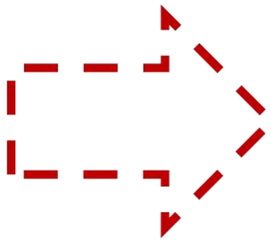
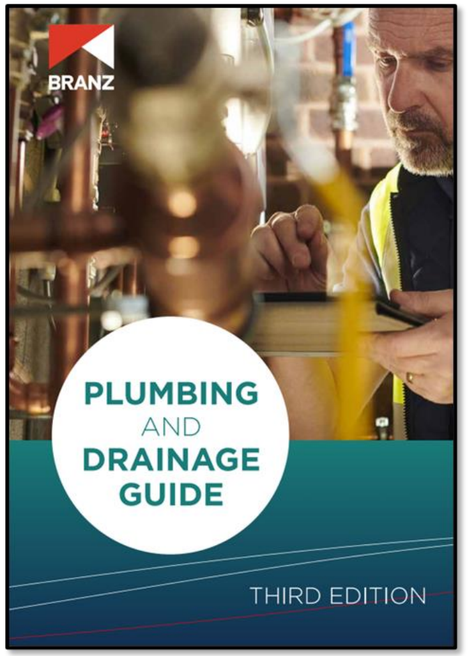
AS and the P&D Guide







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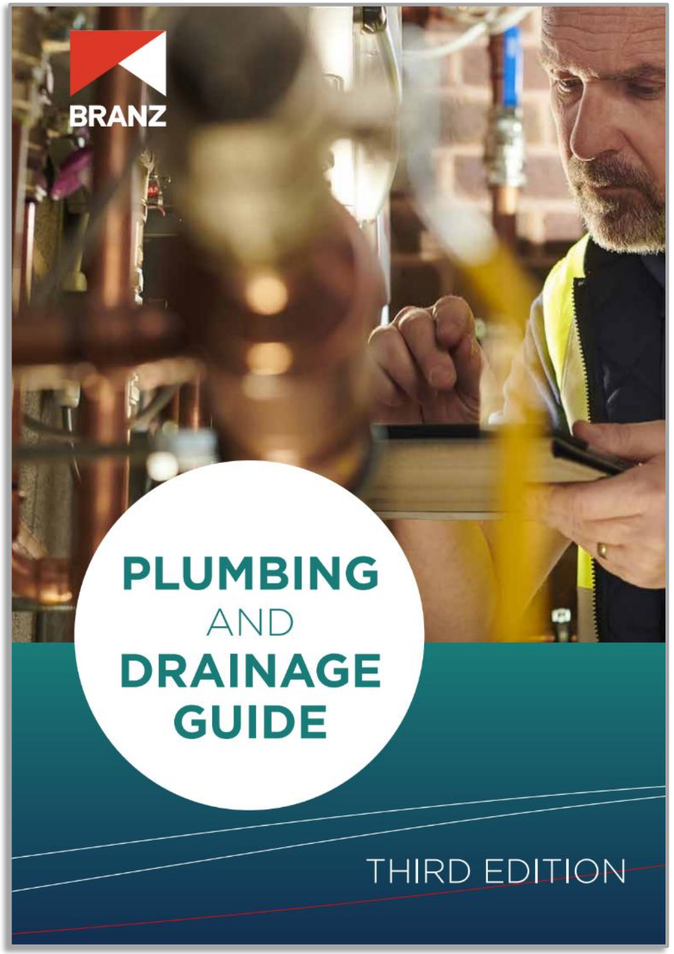
The P&D Guide

Contents

1. General principles of sanitary plumbing and drainage
2. Designing buildings to allow for plumbing
3. Guide to Acceptable Solution G13/AS1 Sanitary Plumbing
4. Guide to AS/NZS 3500.2 Sanitary Plumbing and Drainage
5. Guide to G13/AS2 Foul Water Drainage
6. Guide to AS/NZS 3500.2 below ground, gravity-flow or pumped foul water drainage
7. Surface water drainage
8. Rainwater collection and use
9. Water supply
10. Hot water installations
11. Multi-unit developments
12. Climate change



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Quick quiz

NZS 4305 says the hot water pipework volume from a water heater to a kitchen sink outlet shall be no more than what volume?

2 litres

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Quick quiz

In a water supply system, what is **backflow**?

The unplanned reversal of flow of water or mixtures of water and contaminants into the water supply system.

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Fundamental principles

Webinar 1

Plumbing & Drainage Foundations

- Regulatory requirements
- Scope of P&D guide
- **P&D fundamentals**
- Key building code updates

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We'll cover:

To understand P&D design, it's important to understand some fundamental principles behind it.

- Water supplies
- Thermal efficiency
- Foul water
- Material choice

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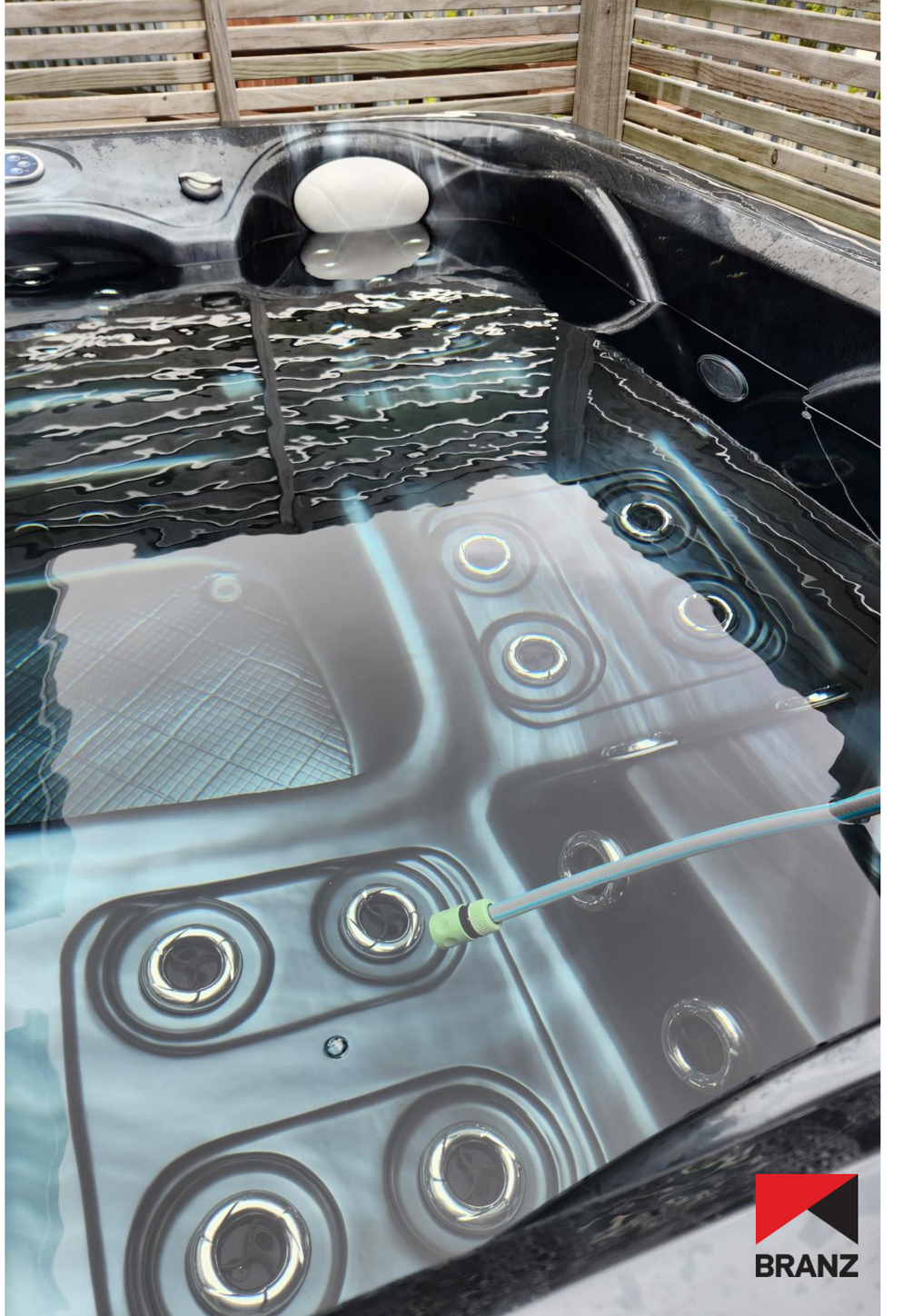
Pressure, flow and velocity

Pressure, flow and velocity

Risk of contamination

Cross connection



Backflow

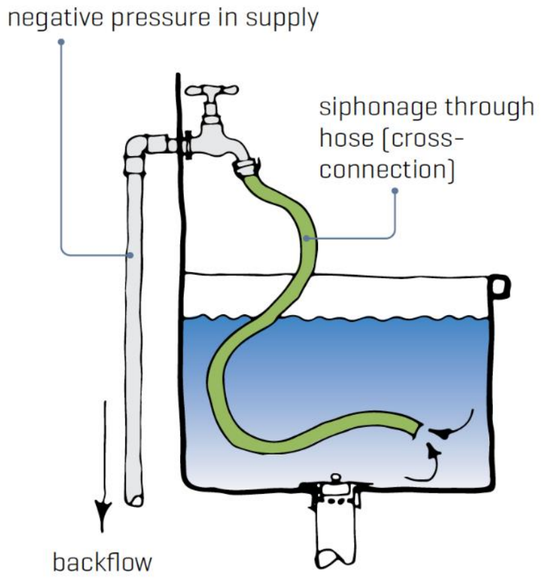


Figure 219. Back siphonage.

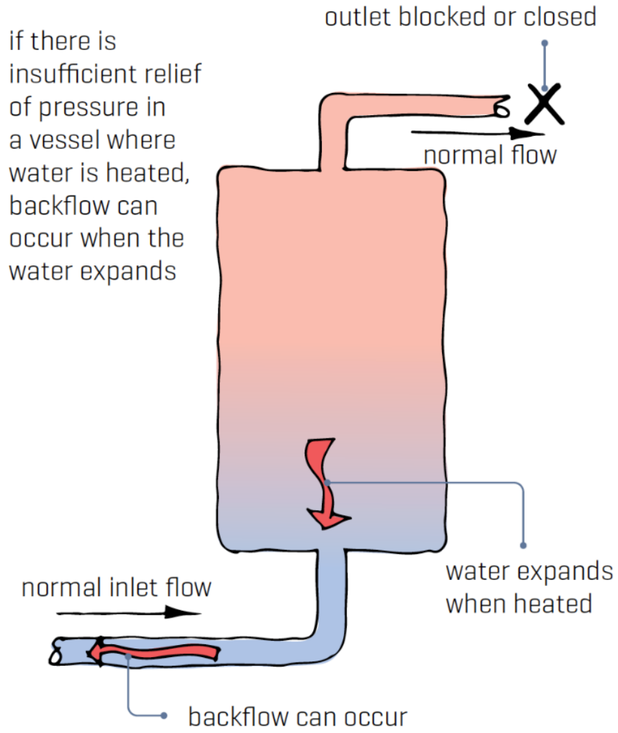
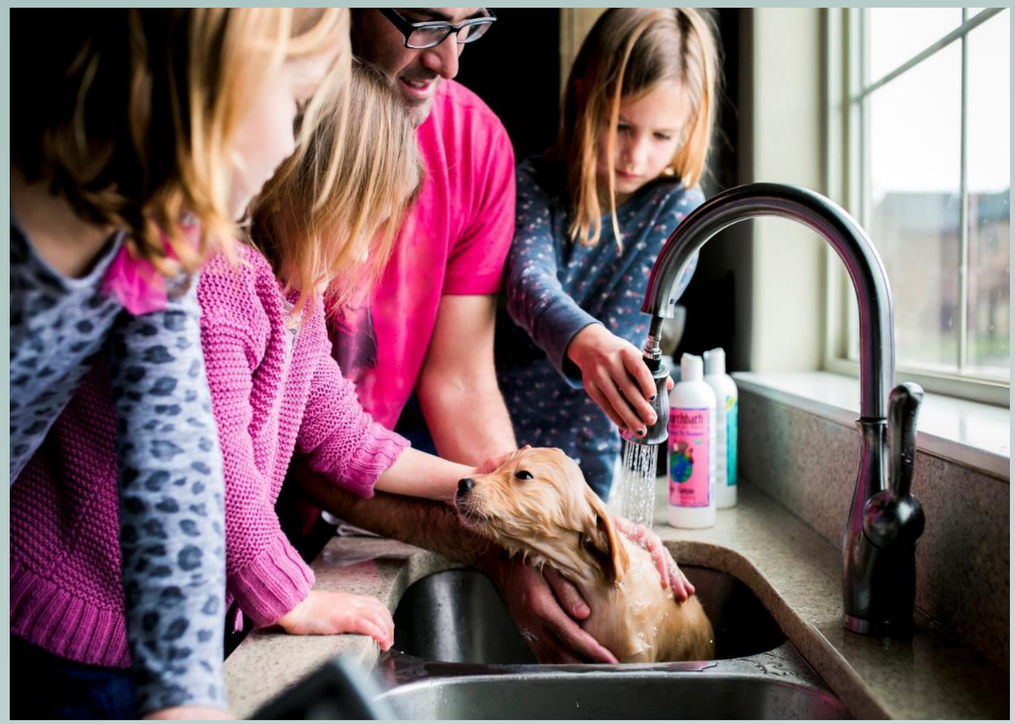


Figure 220. Principle of back pressure.

Backflow protection



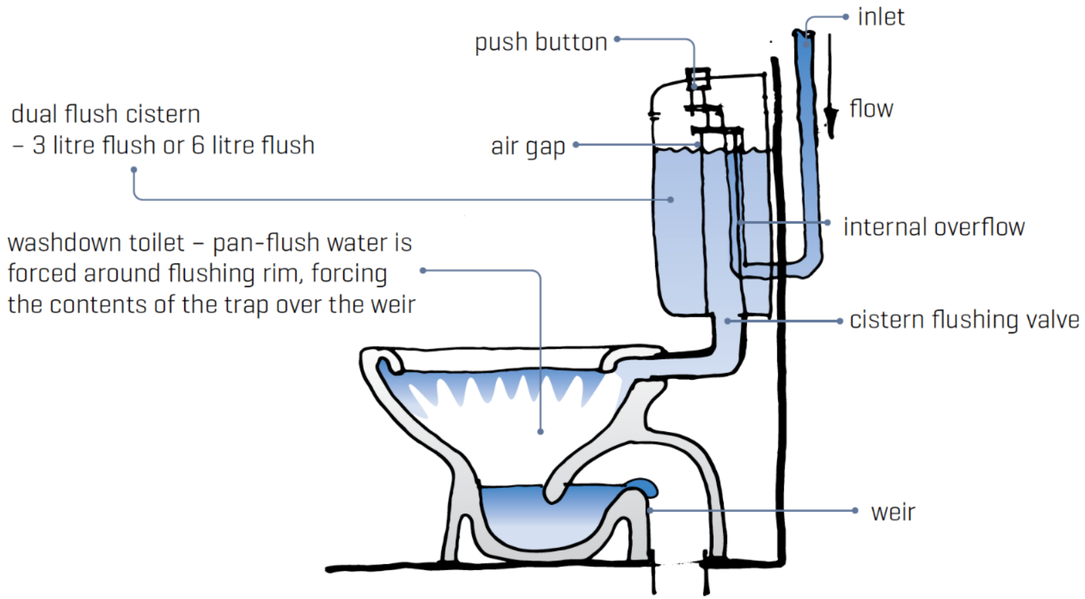
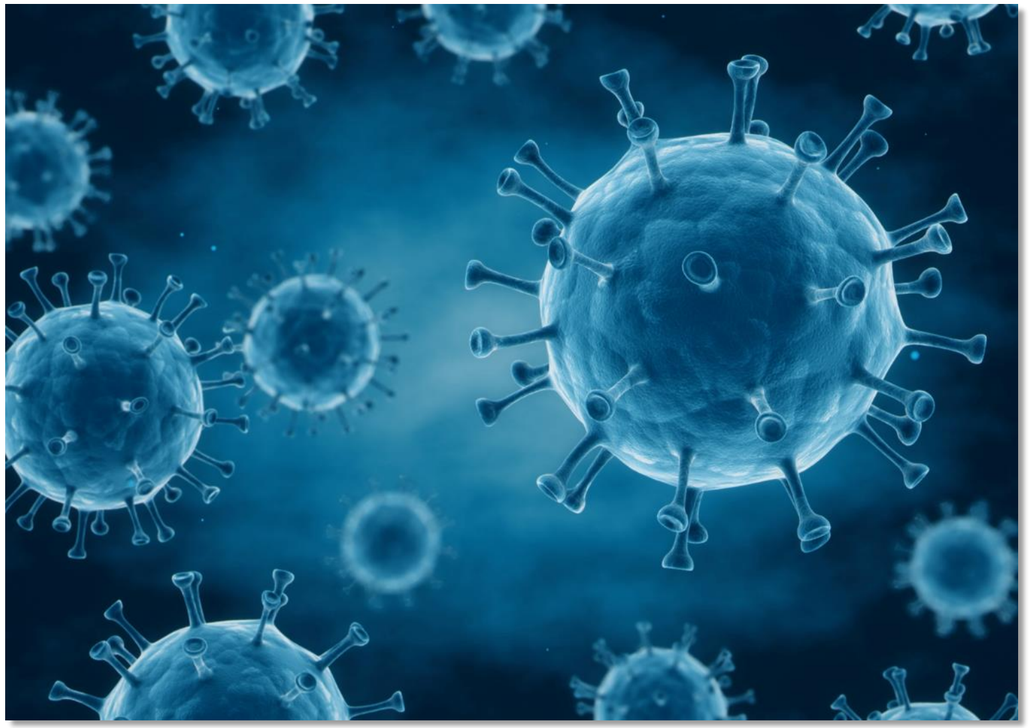


Figure 231. Principle of flushing cistern.

Legionella bacteria

- Health risks from water vapours
- Grows between 20°C and 45°C (optimal around 35–40°C)
- Hot water sterilisation
- Avoid stagnant water, e.g. dead legs



Thermal efficiency

Reasons for lack of thermal efficiency:

- Pipework volume
- Heat transfer
- High flow rates

Foul water

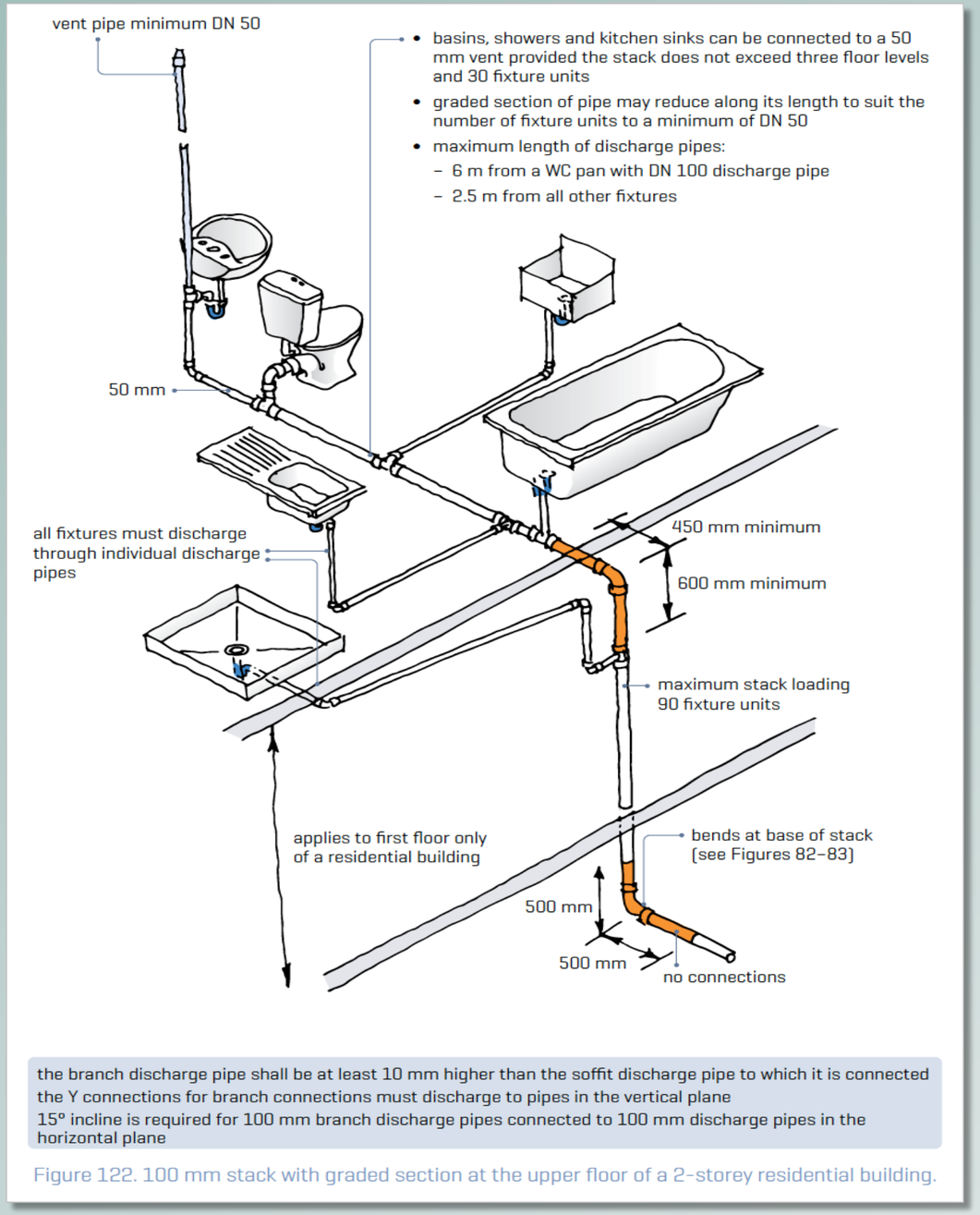


Figure 122. 100 mm stack with graded section at the upper floor of a 2-storey residential building.

Water seal

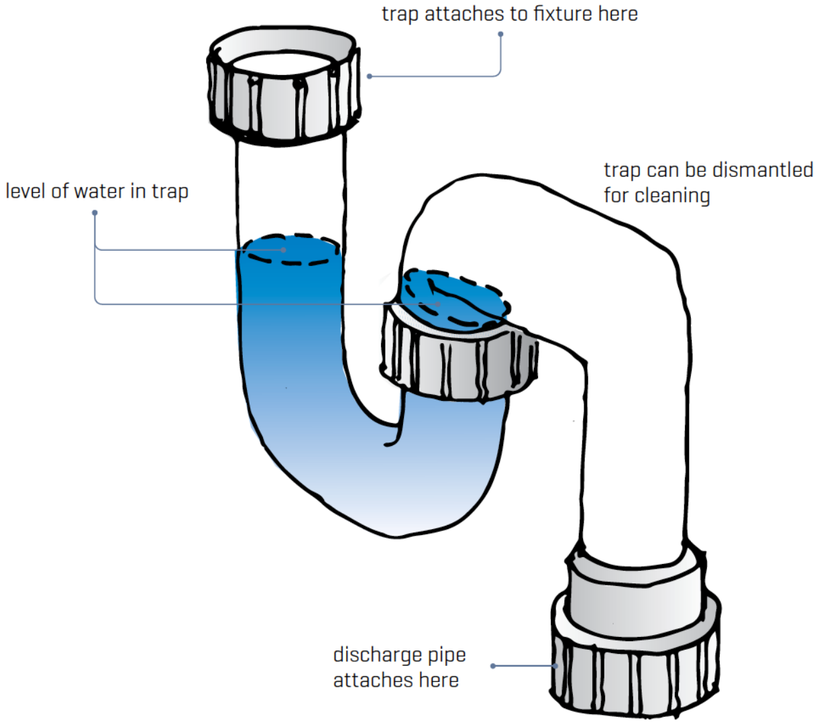


Figure 3. S trap for wastewater fixture.

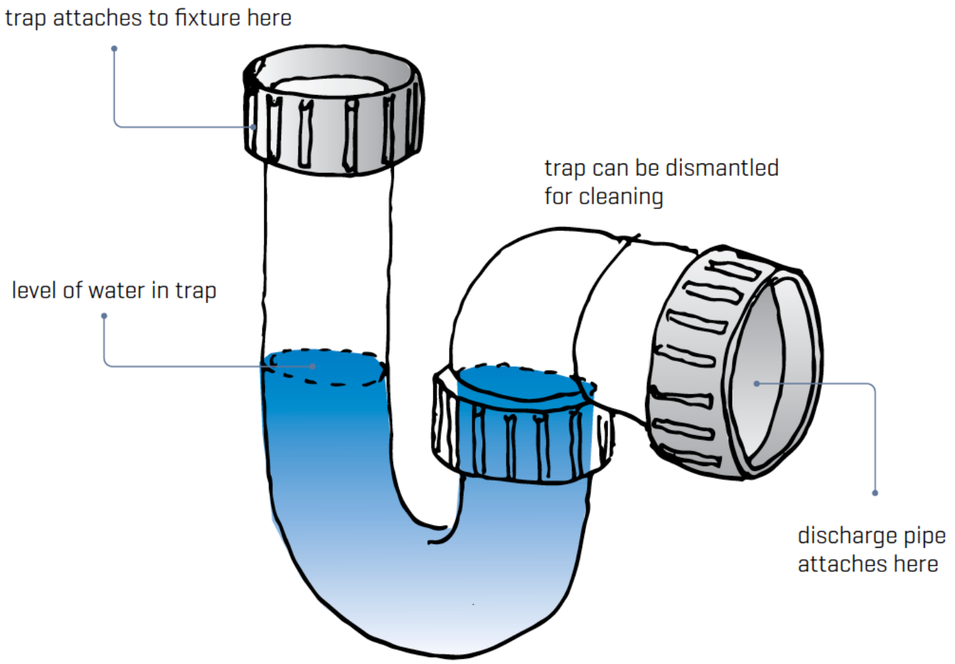


Figure 4. P trap for wastewater fixture.

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Gradient slopes

Table 9. Minimum single discharge pipe sizes, gradients and lengths for ground floor plumbing.

Fixture	Minimum size (DN)	Minimum gradient %	Ratio	Maximum unvented length of fixture discharge pipe (m)
Basin	40 32 NZ	2.5 5	1:40 1:20	2.5 2.5
Bidet	40 32 NZ	2.5 5	1:40 1:20	2.5 2.5
Drinking fountain	40	2.5	1:40	2.5
Cleaning sink	50	2.5	1:40	2.5
Urinal (single bowl)	50 32 NZ	2.5 5	1:40 1:20	2.5 2.5
Shower (single)	40	2.5	1:40	2.5
Sink (single or double)	50 40 NZ	2.5 2.5	1:40 1:40	2.5 2.5
Bath	40	2.5	1:40	2.5
Laundry tub	40	2.5	1:40	2.5
WC pan	80 100	1.65	1:60	2.5 6.0

Notes:

For floor waste gullies, see section 4.1.5. See Table 6 for fixture unit ratings. Refer to AS/NZS 3500.2:2021 Appendix B.

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Ventilation

Pipe size

Material choice

Quick quiz

At **55°C**, how many seconds does it take for hot water to scald burn (3rd degree) a child?

10 seconds

Quick quiz

A cold water expansion valve helps manage the thermal expansion of water within a hot water cylinder. How many litres of water do they discharge a day?

Around 4.5 litres per day – volumes vary depending on hot water use and the size of the cylinder.

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Updates

Webinar 1

Plumbing & Drainage Foundations

- Regulatory requirements
- Scope of P&D guide
- P&D fundamentals
- **Key building code updates**

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These changes are the latest in a series of continuous improvements that support P&D work.

The BRANZ P&D Guide has been updated to incorporate the changes.

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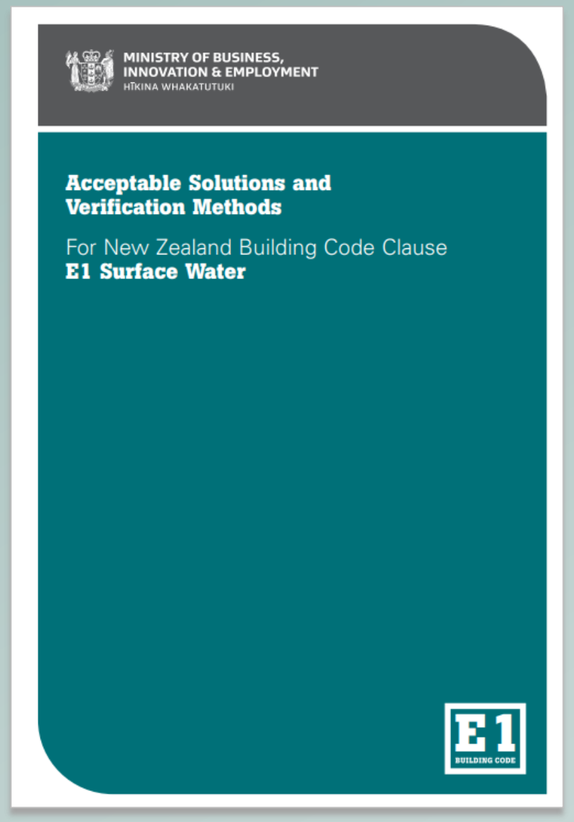
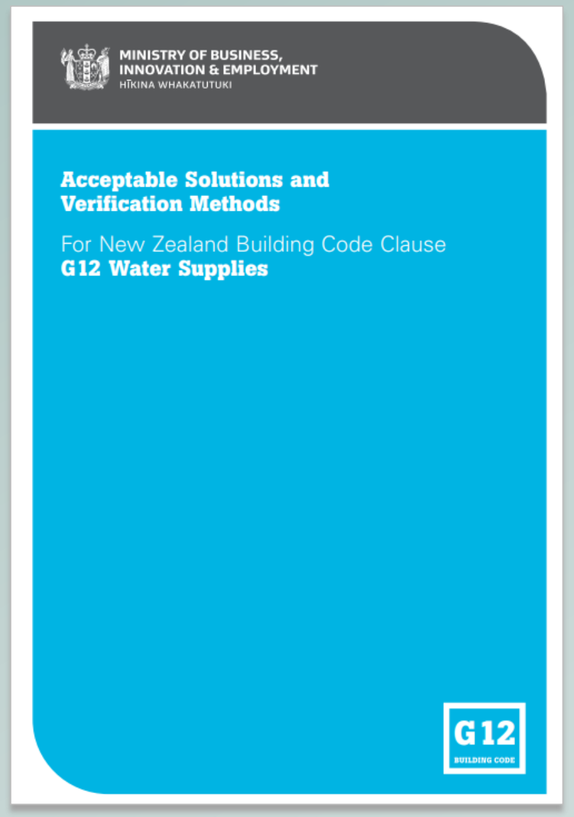
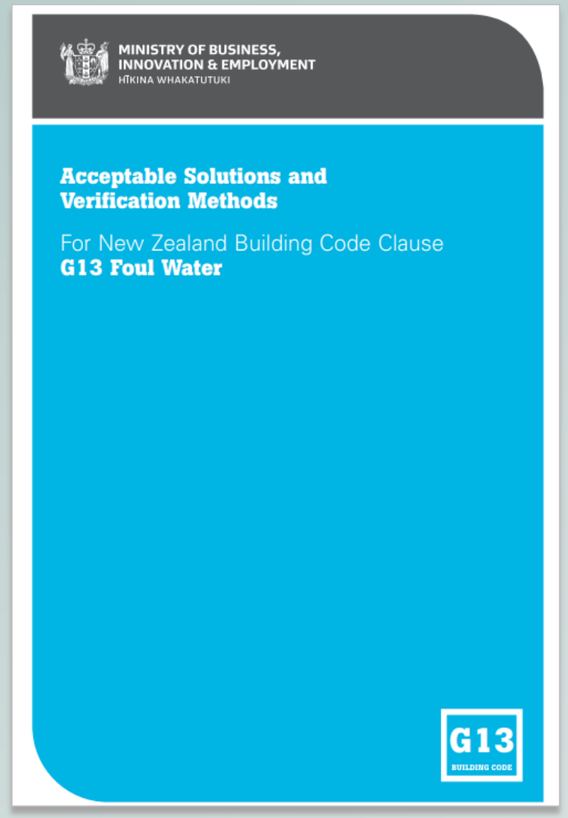
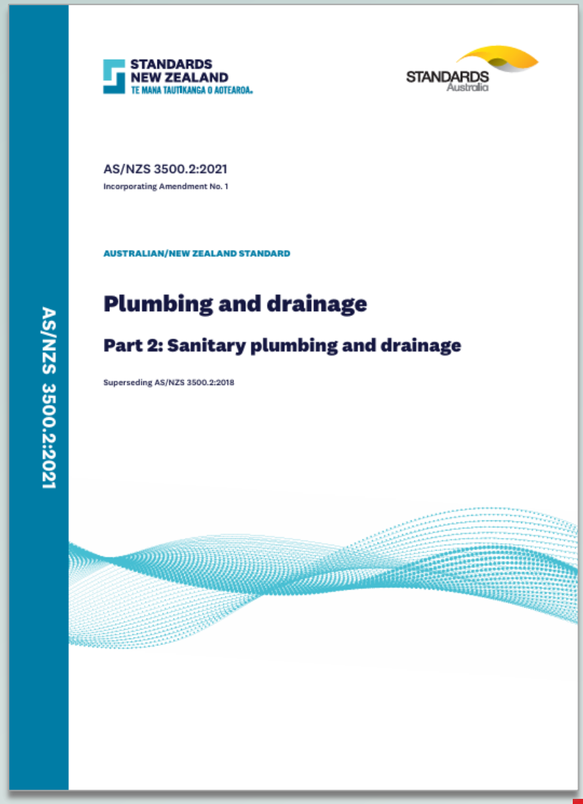
We’ll cover these updates









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Locating the updates

G12: Document History *(continued)*

	Date	Alterations	
Amendment 13	Effective from 2 November 2023 until 1 November 2024	pp. 2A-2B Document History, Status p. 5, 6 Contents pp. 7-10a References pp. 11-13 Definitions p. 15 G12/VM1 1.0, 1.0.1 p. 17 G12/AS1 1.0.1, 2.1.3, 2.2.1, 2.2.2, 2.2.3 p. 18 G12/AS1 Table 1, 3.3.1 p. 19 G12/AS1 3.3.2, 3.3.3 p. 19A G12/AS1 3.4.5, 3.4.6, 3.5, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.6, 3.6.1, 3.6.2 p. 19B G12/AS1 Table 2 p. 19C G12/AS1 Table 2A p. 20 G12/AS1 3.6.3, 3.6.4, 3.7, 3.7.1, Figure 1 p. 21 G12/AS1 3.7.2, 3.7.3, 3.7.4 p. 22 G12/AS1 Figure 2 p. 23 G12/AS1 3.8, 3.8.1, 3.8.2, 3.7.3 (deleted), 3.8.3, 4.3.1, 4.3.2, 4.3.3, 4.3.4 p. 24 G12/AS1 5.1.1, 5.2.2,5.2.8 p. 25 G12/AS1 5.3, 5.3.1, 5.3.2, 5.3.3 p. 26 G12/AS1 5.4, 5.4.1, Table 3, Table 4 p. 27 G12/AS1 5.4.2 (deleted), 5.5, 5.5.1, 5.5.2, 5.5.3, Figure 5, 6.1.2, 6.2.2	p. 28 G12/AS1 Table 5, p. 29 G12/AS1 6.3.3, Figure 7 p. 30 G12/AS1 Figures 8(a) and 8(b) p. 31 G12/AS1 Figure 11 p. 33 G12/AS1 6.6, 6.6.1, 6.6.2, 6.6.3, 6.6.5 p. 33A G12/AS1 6.6.7, 6.6.8, Table 7 p. 33B G12/AS1 6.7.2 p. 34 G12/AS1 Figure 12, 6.7.6, 6.7.7 p. 35 G12/AS1 Figure 13, 6.8.3 p. 36 G12/AS1 Figure 14, 6.11.5 (deleted), 6.13.1, 6.13.2 (deleted) p. 37 G12/AS1 Figure 15, 6.14.1, 6.14.2, Figure 16, 6.14.3 p. 38 G12/AS1 6.14.3, 6.14.4, 6.14.5, Table 8A, Table 8B p. 38A G12/AS1 Table 9 p. 39 G12/AS1 7.1.3, 7.3, 7.3.1, 7.4, 7.4.1,7.4.2, 7.4.3 p. 40 G12/AS1 7.5, 7.5.1, Table 10, 7.6, 7.6.1, 7.6.2, 7.7, 7.7.1 p. 41 G12/AS1 Figure 18, 8.0, 8.0.1 p. 53 G12/AS2 5.2.5, 5.2.6 p. 54 G12/AS2 Figure 6 p. 55 G12/AS2 5.3.3 p. 64a New Acceptable Solution G12/AS3 included pp. 65-68 Index
Amendment 14	Effective 2 November 2024	pp. 2A-2B Document History, Status p. 6 Contents p. 12 Definitions pp. 17-18 G12/AS1 2.1.3, 2.2.3	p. 20 G12/AS1 Figure 1 p. 36 G12/AS1 Figure 14 p. 38 G12/AS1 Table 8B p. 64a G12/AS3 1.0.2 p. 65 Index

Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

w) Bidets and douche seats

x) Handheld bidet hoses and WC trigger sprays

y) Connections for portable and mobile tankers

z) Healthcare waste disposal equipment

Amend 13 Nov 2023

Note: The examples given are not an exhaustive list. Where there is doubt comparison must be made to the hazard definitions.

3.3.2 Medium hazard

Any condition, device or practice which, in connection with the *potable water supply system*, has the potential to injure or endanger health.

COMMENT:
Medium hazard may include but not necessarily be limited to:

a) Auxiliary water supplies such as pumped and non-pumped fire sprinkler secondary water

Amend 13 Nov 2023

b) Connections for appliances, vehicles or equipment

c) Deionised water, reverse osmosis units and equipment cooling without chemicals

d) Fire sprinkler systems and *building* hydrant systems

e) Hose taps and fire hose reels associated with Medium hazard situations

Amend 13 Nov 2023

f) Irrigation systems with underground controllers

g) Irrigation without chemicals

h) Livestock water supply without added chemicals

i) Untreated water storage tanks

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j) Water for steam cleaning

k) Water for equipment cooling

l) Drink dispensers with carbonators (see Note 2)

m) Swimming pools, spas and fountains, other than those filled by a hose tap in conjunction with a *household unit*

n) Treated grey water

o) Air handling unit humidifiers without chemicals

Amend 13 Nov 2023

Notes:
1. The examples given are not an exhaustive list. Where here is doubt comparison must be made to the hazard definitions.
2. For carbonated drink dispensers, the pipework material installed downstream of the *backflow prevention device* should not be made of copper and not be affected by carbon dioxide gas.

Amend 13 Nov 2023

3.3.3 Low hazard

Any condition, device or practice which, in connection with the *potable water supply system*, would constitute a nuisance, by colour, odour or taste, but not injure or endanger health.

COMMENT:
Low hazard may include but not necessarily be limited to:

a) Drink dispensers (except carbonators)

b) Drinking fountains and bottle fillers

c) Hose taps, other than those associated with Medium hazard or High hazard situations

Amend 13 Nov 2023

Note: The examples given are not an exhaustive list. Where there is doubt comparison must be made to the hazard definitions.

3.4 Backflow protection

3.4.1 *Backflow* protection shall be provided where it is possible for water or *contaminants* to *backflow* into the *potable water supply system*.

COMMENT:
The protection of non-*potable water* used for personal hygiene is contained in Paragraph 4.1.

3.4.2 *Backflow* protection shall be determined by identifying the individual *cross connection* hazard(s) and *backflow* protection required. Water from each hazard shall be regarded as non-*potable* until an appropriate *backflow* protection is installed.

3.4.3 *Backflow* protection shall be achieved by:

a) An *air gap*, in accordance with Paragraph 3.5, or

b) A *backflow prevention device* selected in accordance with Paragraphs 3.4.4 and 3.4.5.

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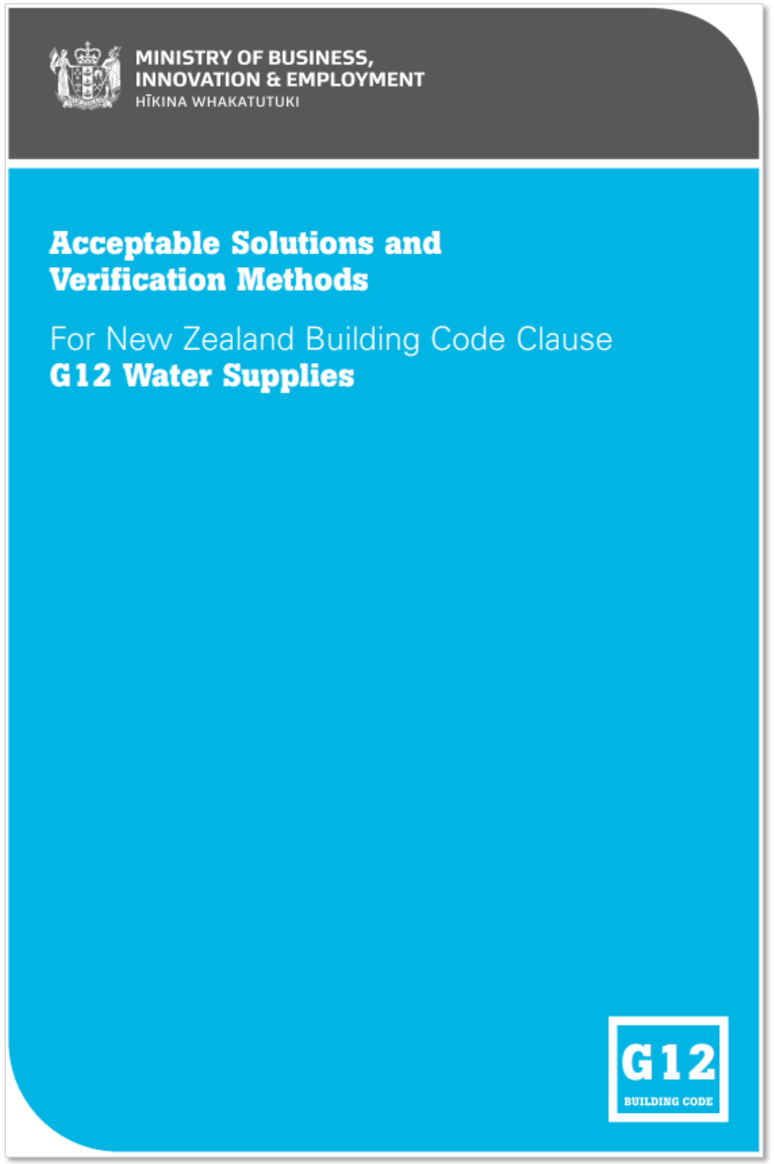
G12 *Water supplies* updates



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Hot water delivery temperature

Maximum allowable hot water delivery temperatures for new personal hygiene fixtures is reducing from 55°C to **50°C** for most buildings.

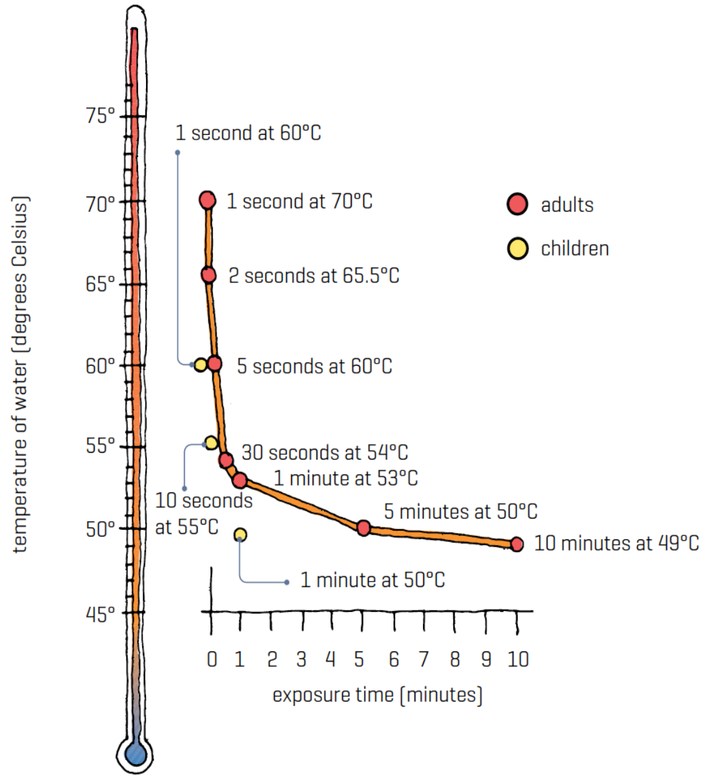

Figure 245. Time of exposure and water temperature at which full thickness skin scalds can occur.

Lead in plumbing products

- Maximum 0.25% lead content
- Applies to brass components in contact with drinking water
- Verified test report
- ‘Lead Free’ WaterMark is one way to identify products that comply
- 1 May 2026

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Cross-connection hazards

	**High hazard**	Any condition, device or practice that, in connection with the potable water supply system, has the potential to ***cause death***.
	**Medium hazard**	Any condition, device or practice that, in connection with the potable water supply system, has the potential to ***injure or endanger health***
	**Low hazard**	Any condition, device or practice that, in connection with the potable water supply system, would constitute a ***nuisance, by colour, odour or taste, but not injure or endanger health.***

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High cross-connection hazard

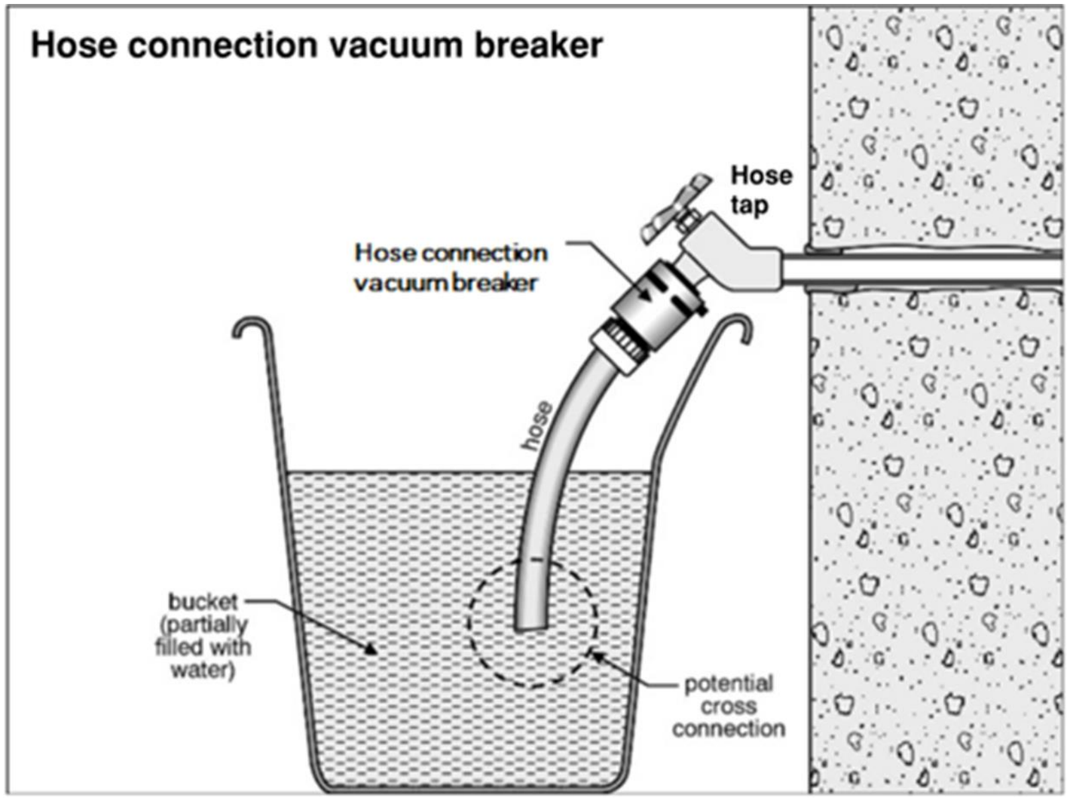
- Bidets and douche seats
- Handheld bidet hoses and trigger sprays
- Connections to mobile and portable tankers
- Healthcare waste disposal equipment
- Hose taps associated with ‘soil waste dump points’

Medium cross-connection hazard

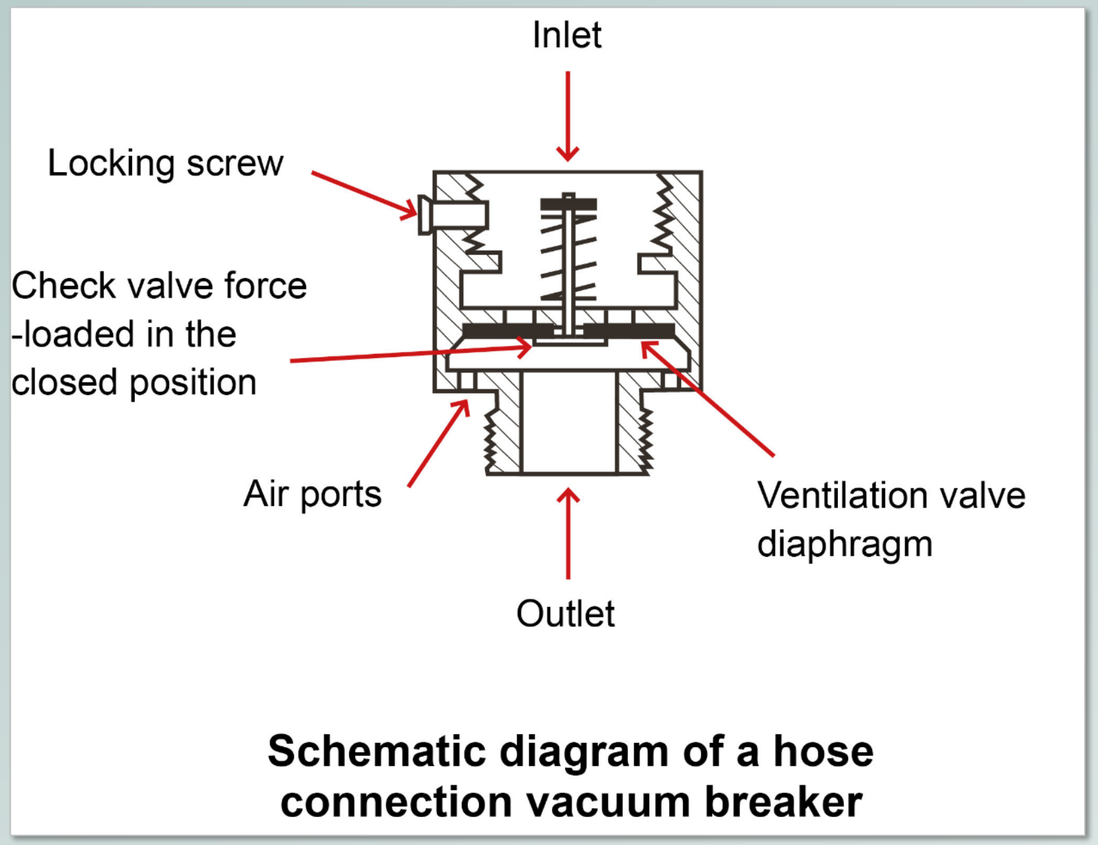
- Treated greywater
- Air handling unit humidifiers without chemicals
- Exemption to medium hazard example of swimming pools, spas and fountains filled by a hose tap
- Note about carbonated drink dispensers that pipework downstream of the backflow prevention device should not be made of copper

Low cross-connection hazard

- Drinking fountain bottle fillers
- Hose taps (other than those associated with medium or high hazard situations)



Hose connection vacuum breaker



Schematic diagram of a hose connection vacuum breaker

Containment backflow protection

FIGURE 3.1: Example of containment backflow protection

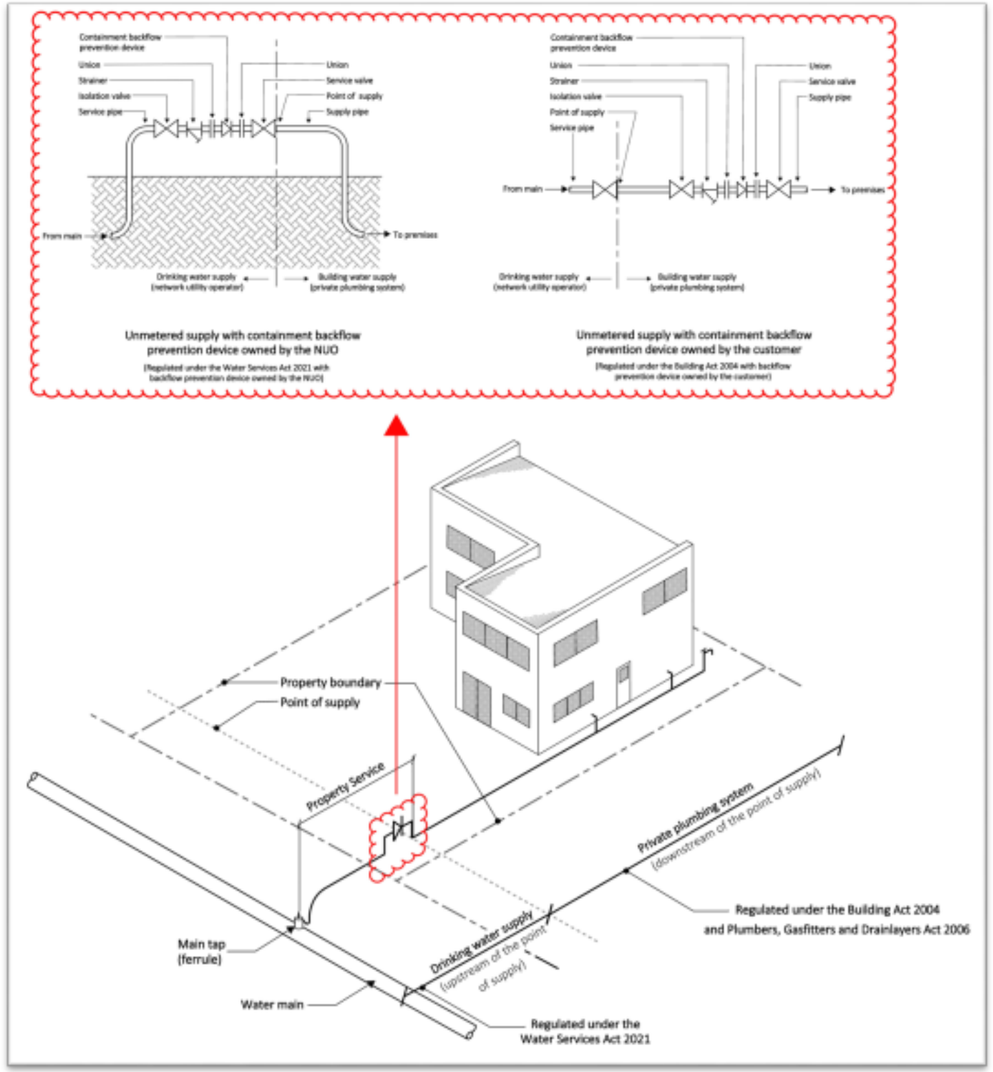


Table 2A: Containment Backflow Protection
Paragraph 3.5.1

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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Identification of pipework

- Removing the requirement for potable pipework to be made identifiable in household units that also contain non-potable pipework
- Alternative methods to lilac
- Clarifying marking requirements
- Provisions for below-ground non-potable water pipework

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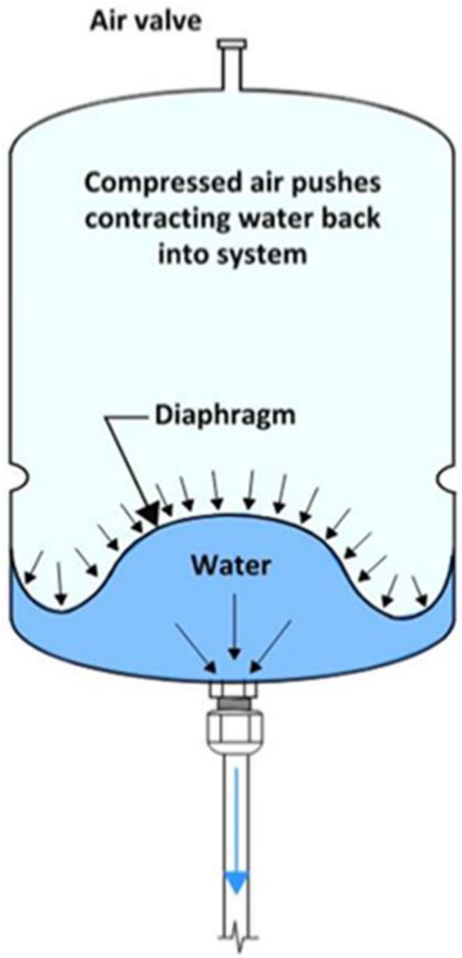
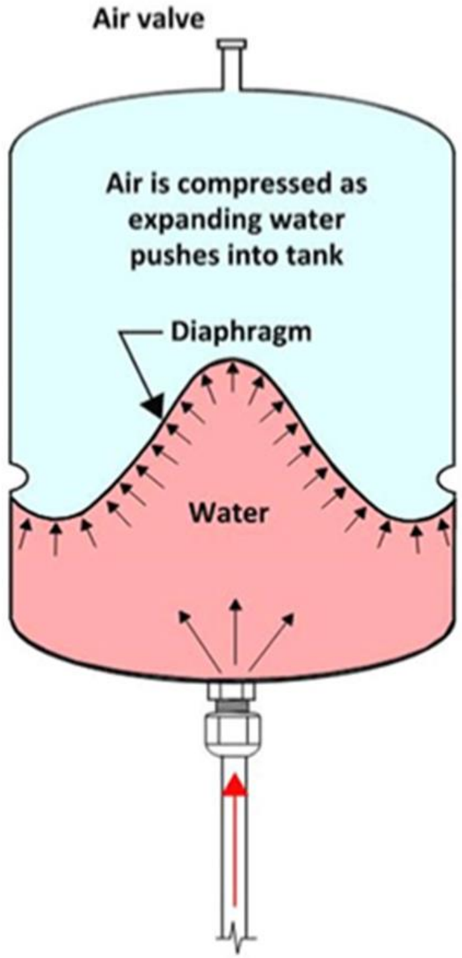
Expansion vessels



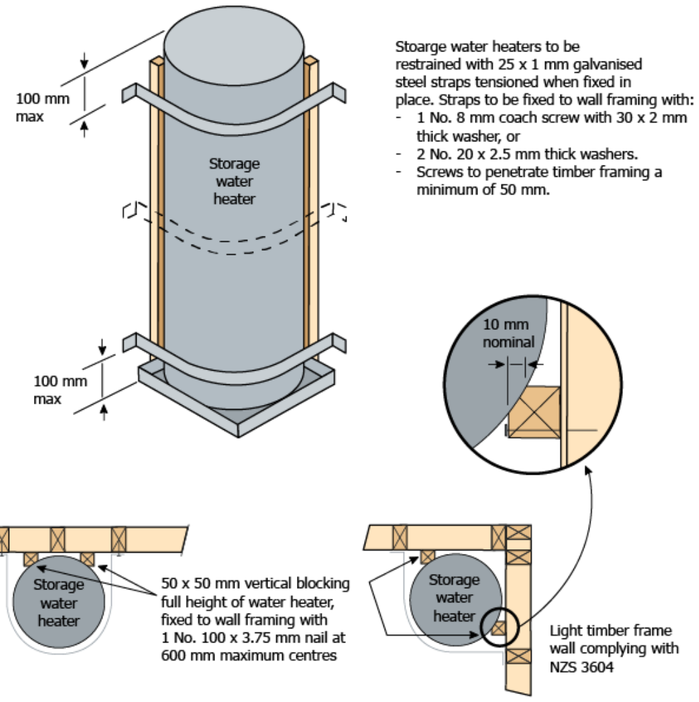


Expansion vessels

Table 45. Minimum expansion vessel capacity.

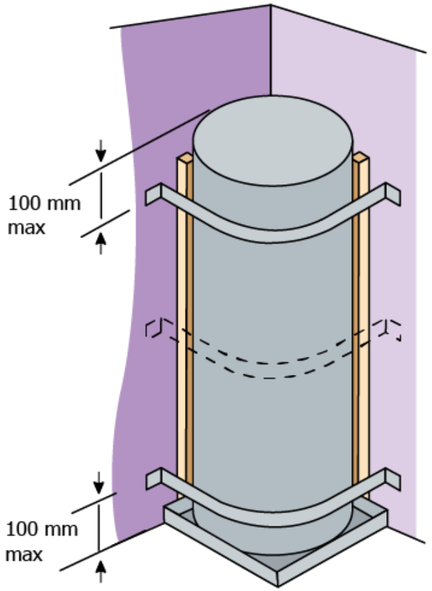
Storage water heater volume (litres)	Storage water heater thermostat setting (°C)							
	60	65	70	75	80	85	90	95
135	8	9	11	12	14	15	17	19
180	11	13	15	17	19	21	23	25
250	16	18	20	23	26	29	32	35
300	19	21	24	28	31	34	39	42

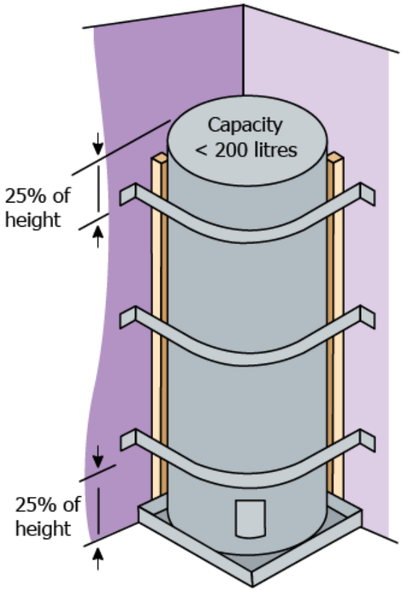
Seismic restraints

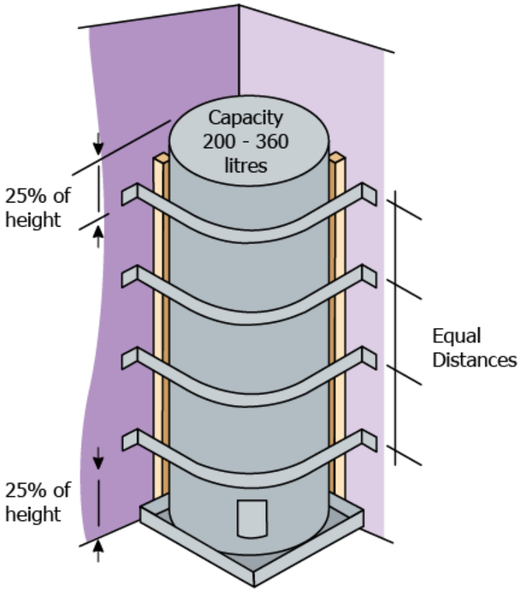


Stoarge water heaters to be restrained with 25 x 1 mm galvanised steel straps tensioned when fixed in place. Straps to be fixed to wall framing with:

- 1 No. 8 mm coach screw with 30 x 2 mm thick washer, or
- 2 No. 20 x 2.5 mm thick washers.
- Screws to penetrate timber framing a minimum of 50 mm.







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Water supply system components

- Water pressure:
  - 30 kPa minimum
  - 500 kPa maximum
- UV resistant insulation
- Cover for buried water pipes
- Unintentional heating of cold water
- Sensor taps in accessible bathrooms
- Relief valve drain locations

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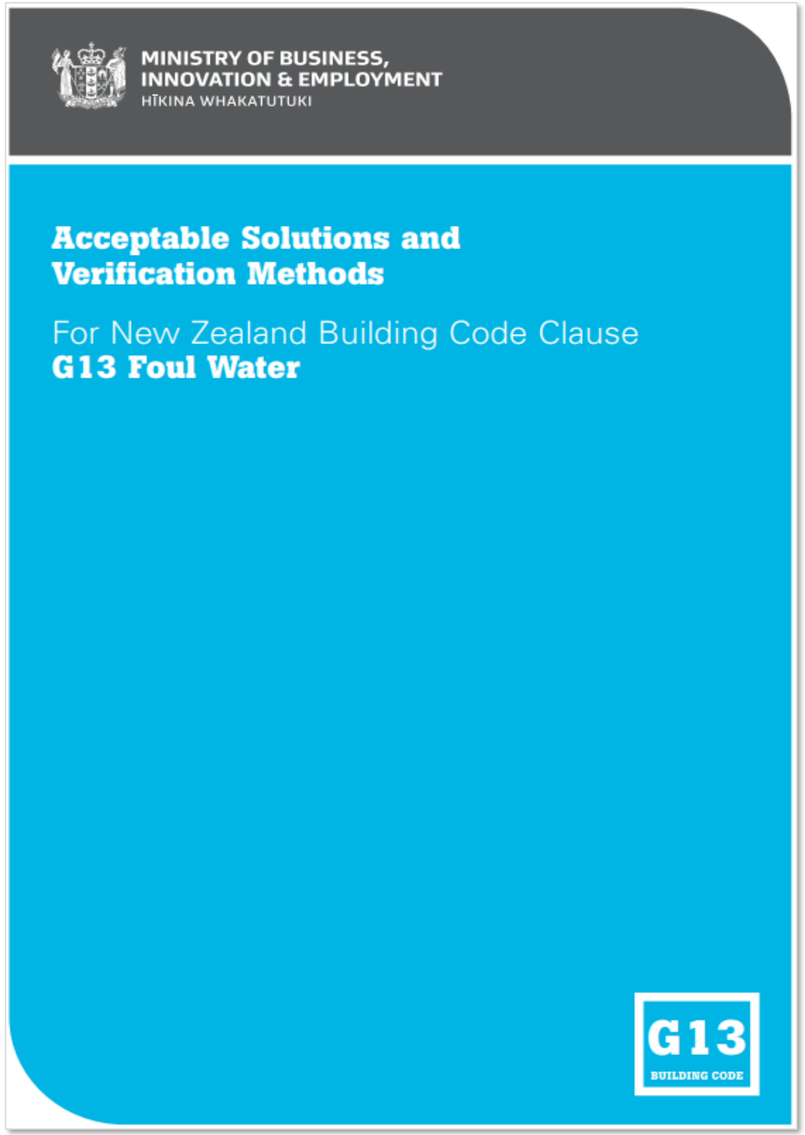
G13 *Foul water*



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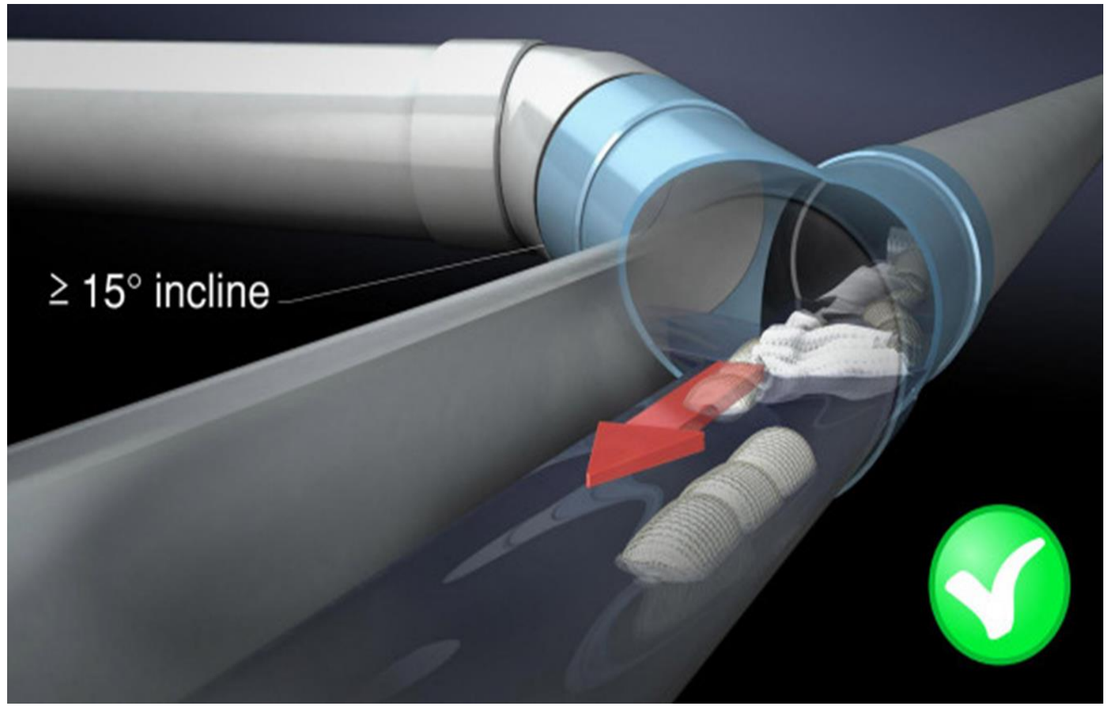
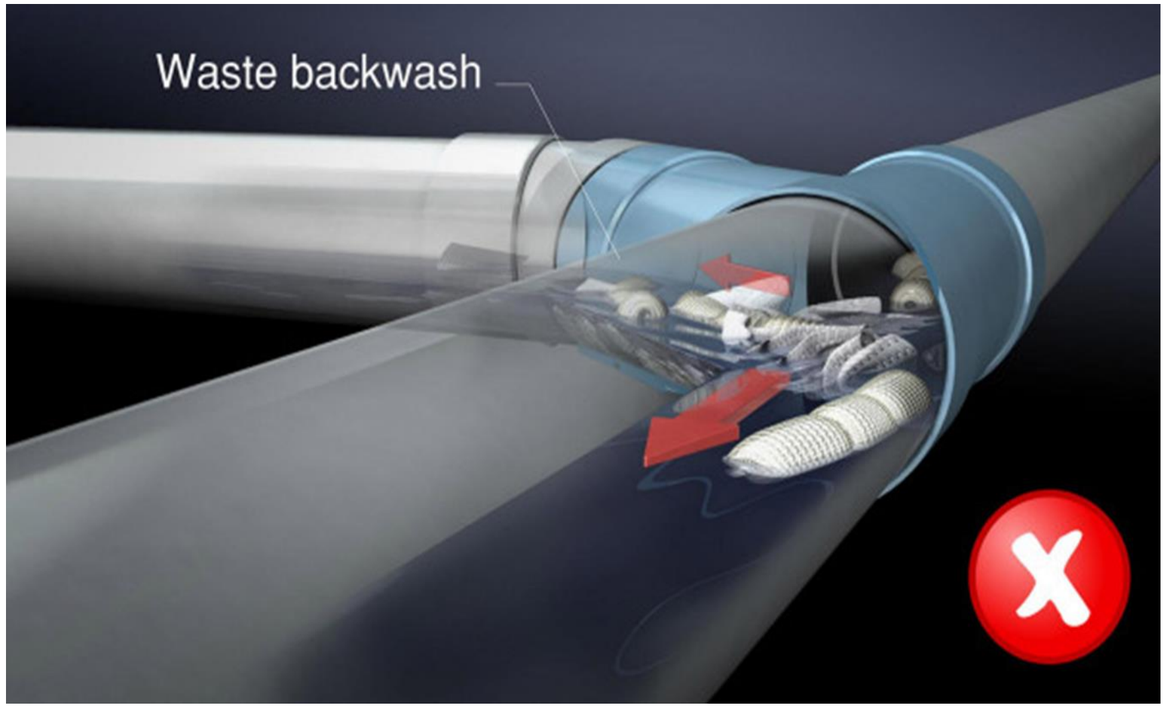
Junctions on grade

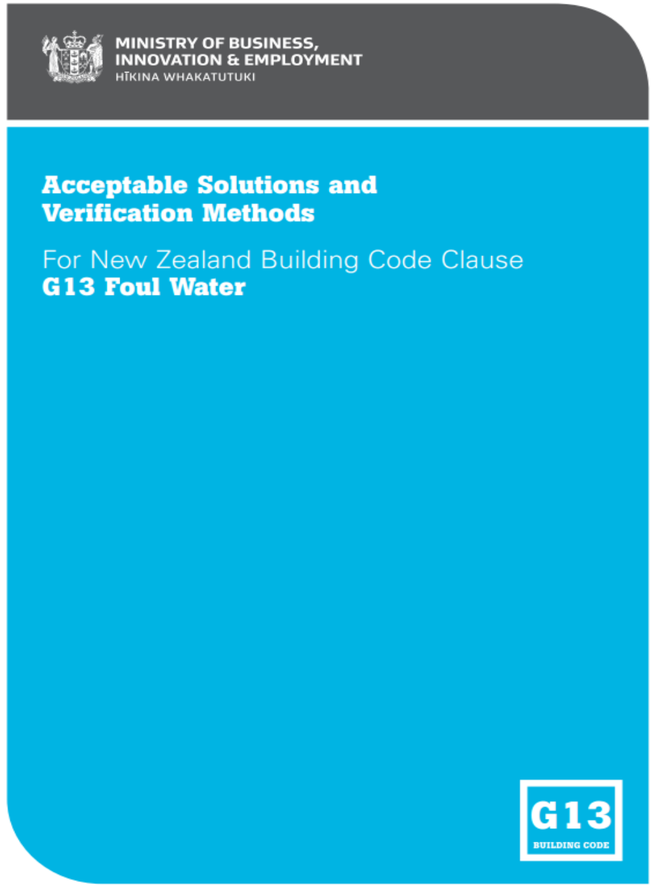


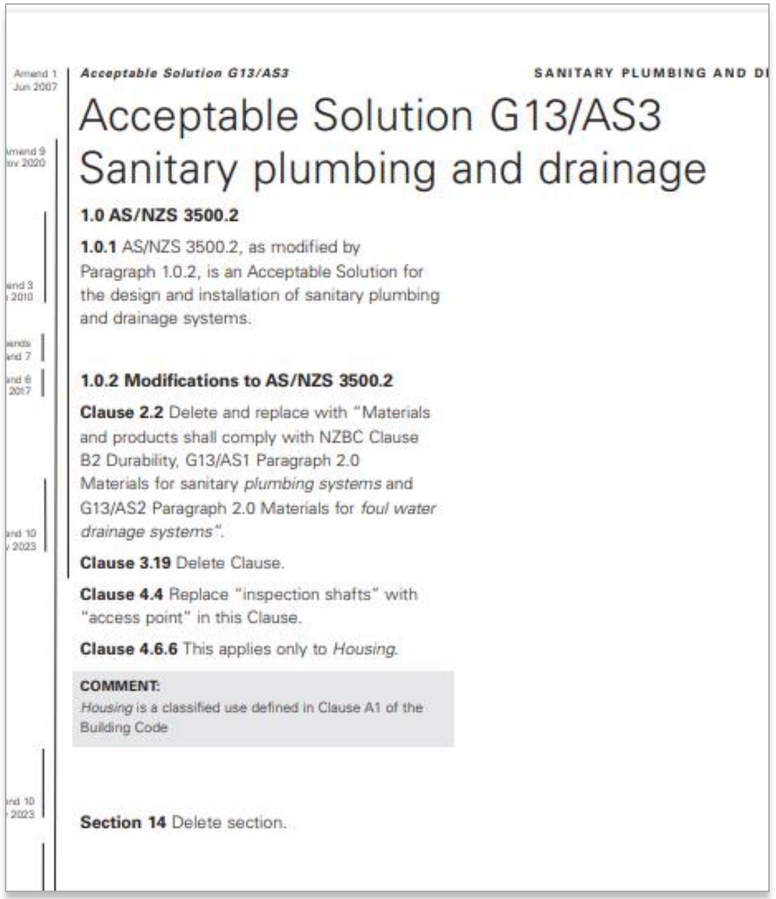


Gully dish height

G13/AS3 modifications

G13/AS3 references AS/NZS 3500 Part 2. However, it also has five modifications to the standard, which is significantly reduced in number due to the updates being addressed within AS/NZS 3500 Part 2.





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AS/NZS 3500:2021 Parts 1–4

Referenced as an Acceptable solution for complying with E1, G12 and G13

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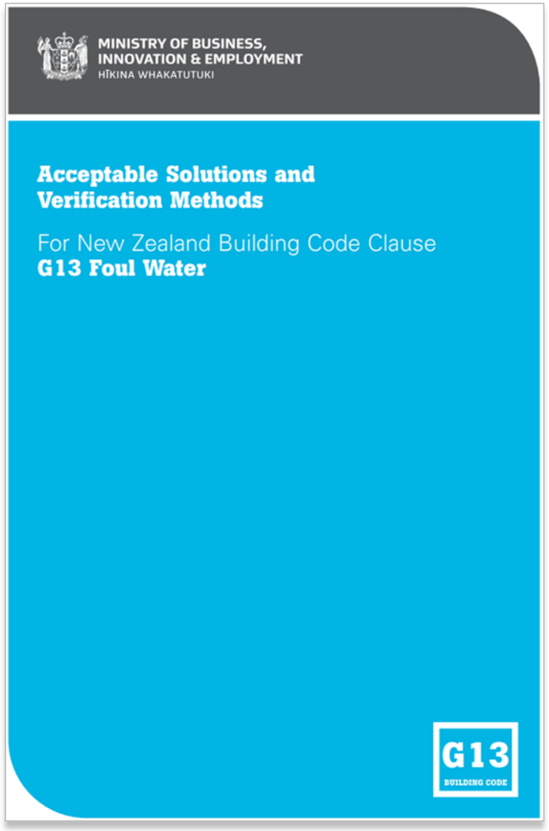
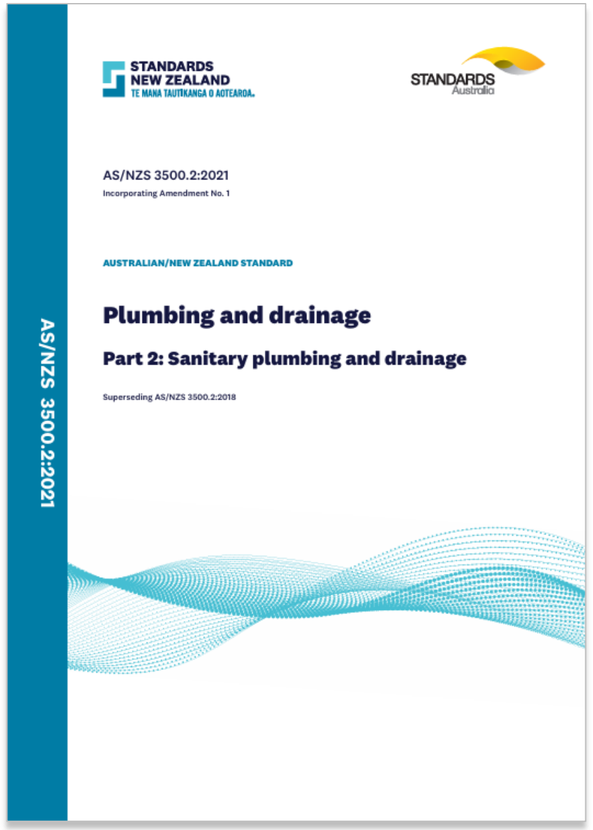
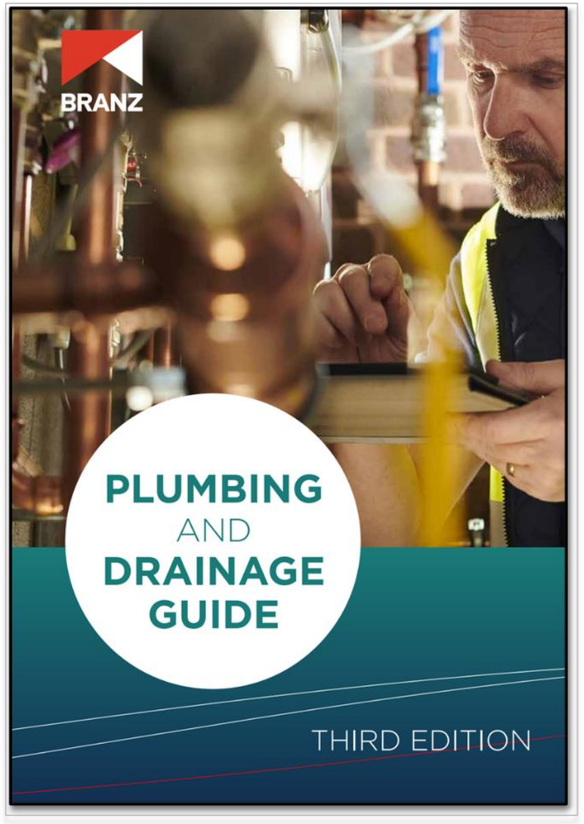
AS/NZS 3500:2021 Parts 1–4

Referenced as an Acceptable solution for complying with E1, G12 and G13







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Water services in metal framework

Services in metal framework:

- Affects Parts 1 and 4
- Use manufactured holes
- Max 32 mm where there are no holes
- Restriction on location of holes
- Protect pipes from direct contact with metal framing

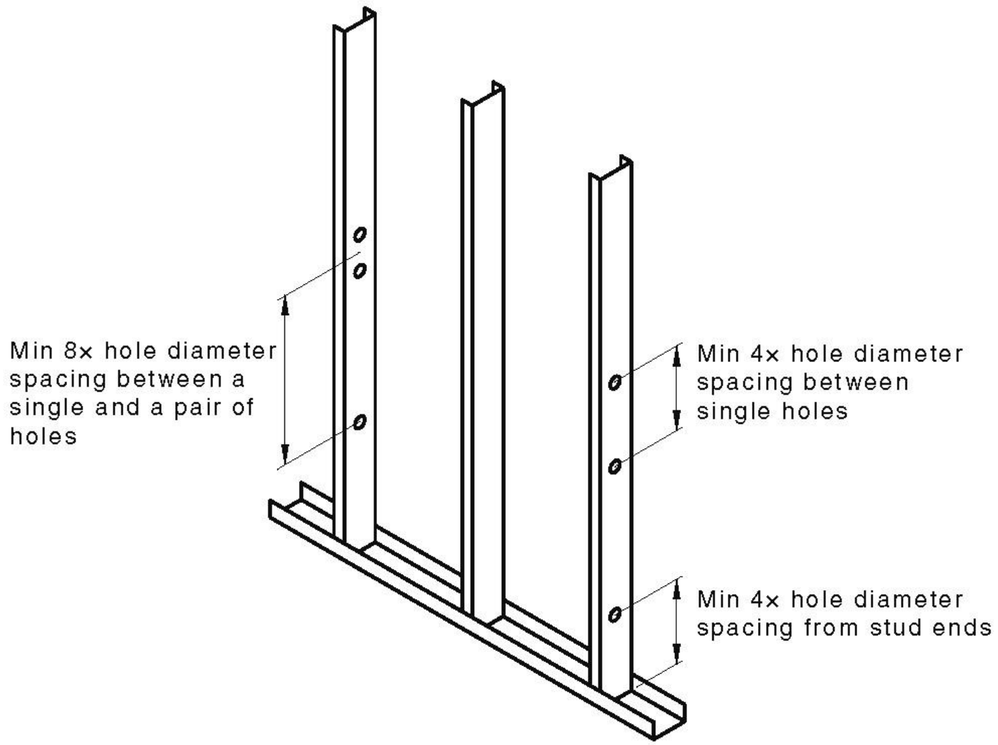


Figure 4.6.1.1(C) — Hole spacing in metal wall framework

Clearance to above-ground electrical wires

Reducing the clearance from water pipes to above-ground electrical wiring to **25 mm.**

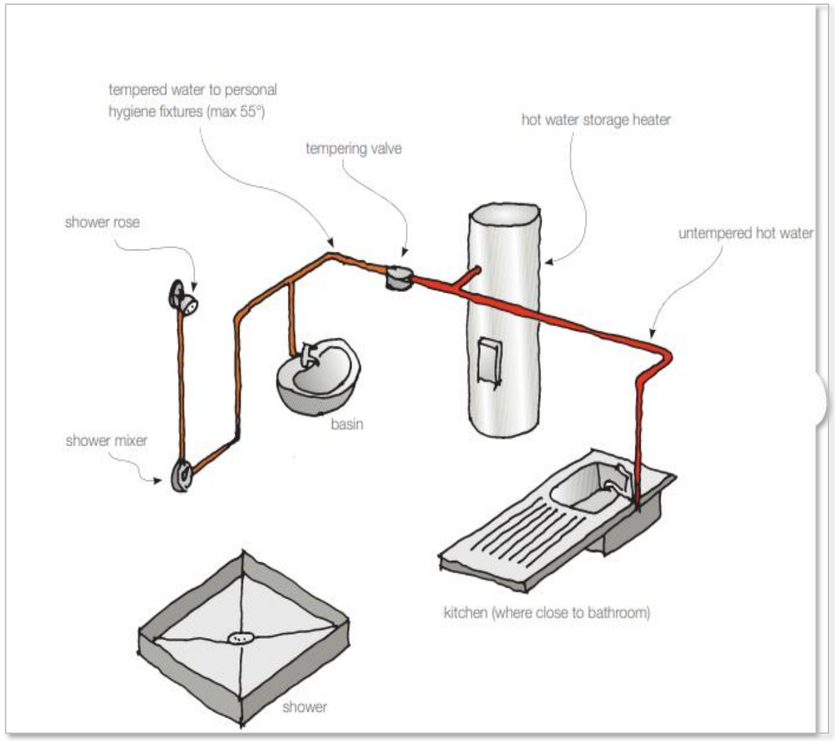
Identification of pipework

- Affects AS/NZS 3500 Parts 1–4 updated
- Removed reference to NZS 5807 from mandatory to informative
- Added more detail in standards
- Key change to spacing –from every 8 m to 6 m

15-degree inclined junction on grade

Heated water circulatory systems

- AS/NZS 3500.4:2021
- Metered branches must be accessible
- Limit dead legs to 2 litres
- Appendix Q



Updated data on rainfall intensity

Wet-well materials

AS/NZS 3500.2 clause 12.5.2 note on plastics to allow for prefabricated wet-wells.

Next webinars

Webinar 1

Plumbing & Drainage Foundations

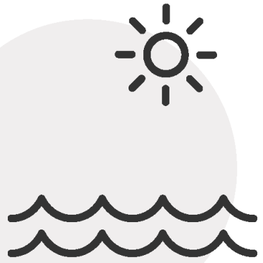
- Regulatory requirements
- Scope of P&D guide
- P&D fundamentals
- Key building code updates

Webinar 2

Foul Water Fundamentals

Webinar 3

Safe & Sustainable Water Supply



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