DRINKING WATER SUPPLY

WATER NETWORKS INSTALLATION GUIDELINE

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Glossary

Abbreviation /Terminology	Description
AC	Asbestos Cement
AV	Air Valve
CLS	Cement (Mortar) Lined Steel
CI	Cast Iron
COP	Code of Practice
DI	Ductile Iron
DMA	District metered area
DN	Diameter Nominal
ESF	Engineering Standards Framework
GRP	Glass reinforced plastic
ISO	International Oragnisation for Standardisation
KPa	Kilopascals
MPa	Megapascals
O.D.	Outside diameter
PE	Polyethylene
PIPA	Plastics Industry Pipe Association
PV	Peat Valve
RPZ	Reduced Pressure Zone
RS gate valve	Resilient seated gate valve
RTO	Registered Training Organisation (offering the relevant welding unit standard qualifications)
SV	Sluice Valve
WS	Water Supply

1. Scope and general

1.1 Introduction

Watercare's water distribution network (pipelines up to and including 250mm internal diameter) spans across the Auckland region, providing daily water to residents and businesses for consumption, recreational and industrial use. The integrity of these assets is paramount to ensure a consistent and acceptable level of service to customers.

Installing and maintaining these assets by applying good practice and quality assurance helps achieve the expected service life and reduces unforeseen failures.

1.2 Purpose

This document provides guidance on what is considered best practice for installation of local network watermains. It draws a practical comparison between standard drawings and physical installations to:

- Help contractors, designers and inspectors understand the applicable options when installing watermains.
- Provides examples to help designers and contractors get a visual representation of what is considered good and acceptable practice.
- Provide references to other applicable standards including Watercare's Material Supply Standard which lists acceptable materials / products.
- Identify acceptable materials and installation configurations.
- Clarify acceptable practices for supplementary works (e.g. corrosion protection wrapping)

1.3 Materials

1.3.1 Material standards

Materials shall include all components, or products used to complete the works.

All materials necessary for the work shall be supplied in accordance with Watercare's Material Supply Standard. Materials shall be new and suitable for their intended purpose and performance requirements.

Where machinery and equipment are used for installing assets, these shall be in a good, maintained condition and safe for use.

1.4 Referenced standards

This guideline must be read in conjunction with the latest Watercare, national and international standards listed below.

1.4.1 Watercare standards

- COP-01: Code of Practice for Water Supply
- ESF-500-FOR-101 (DW02): Code of Practice for land development and subdivision – water drawing set
- CG – General civil construction standard
- ESF-600-STD-701: General mechanical construction standard
- ESF-500-STD-604: Material supply standard
- ESF-600-STD-103 (COP-04): Code of Practice for disinfection of water systems
- ESF-900-GDN-101: Guidance Note - Anchoring pipelines
- ESF-900-GDN-103: Guidance Note – Water network EPDM gasket material
- ESF-600-GDN-702: Guidance Note – Steel bolted flanged joint assemblies

1.4.2 Other relevant standards

- AS/NZS 4020: Testing of products for use in contact with drinking water
- AS/NZS4129: Polyethylene (PE) Fittings for Pressure Applications
- AS/NZS4130: Polyethylene (PE) Pipes for Pressure Applications
- AS/NZS2566.2: Buried Flexible Pipe: Installation
- AS/NZS 2033: Design and installation of polyolefin pipe systems
- ISO 13953: Polyethylene (PE) Pipes and Fitting Determination of the tensile strength and failure of test pieces for Butt – Fuse Welding
- ISO 13954: Peel Decohesion test for Polyethylene (PE) Electron Fusion Assemblies
- PIPA-POP001: Electrofusion jointing of PE pipes and fittings for pressure applications
- PIPA-POP001A: Guide to electrofusion assembly and welding
- PIPA-POP003: Plastic Pipe and Fittings – Butt Fusion Jointing procedure for Polyethylene (PE) Pipe and Fittings used in the construction of gas and water distribution systems.
- PIPA-POP005: Packaging, handling and storage of polyethylene pipes and fittings
- PIPA-POP007: Flanged joints for polyethylene (PE) pipe
- PIPA-POP014: Assessment of polyethylene welds

1.4.3 Regulations

- Health and Safety at Work Act 2015
- Water Services (Drinking Water Standards for New Zealand) Regulations 2022

2. Installation

The section on new installations covers assemblies relating to Watercare standard drawings ESF-500-FOR-101 (DW02): Code of Practice for land development and subdivision – water drawing set. These drawings reflect the principles discussed in COP-01: Code of Practice for Water Supply as well as proven construction methods.

2.1 Pipe materials

Pipe materials should be compatible when transitioning between material types and fittings. The design engineer should confirm the necessary details during design. Table 1 lists acceptable pipe materials and considerations when planning for network watermain installations.

***Table 1**: Acceptable pipe materials for watermains up to and including 250mm internal diameter.*

Pipe material	Where used	Standard	Section in Material Supply Standard
Polyethylene (PE)	Standard pipeline installations where minimum cover is achieved	AS/NZS 4130	13.1.6 Polyethylene (PE) pipe including fabricated bends and tees
Polyethylene fittings (PE)	Standard pipeline installations where minimum cover is achieved	AS/NZS 4129	13.1.7 Polyethylene (PE) fittings other than fabricated bends and tees
Ductile Iron (DI)	Pipe bends, reducers, in potentially contaminated ground where PE is not suitable (e.g. near petrol stations), or reduced cover conditions (by approval only)	AS/NZS 2280	13.1.12 Ductile iron pipe and pipe fittings
Cement lined steel	Pipe bridges or reduced cover conditions (by approval only)	AS 1579/ AS 1281	13.1.9 Spiral welded steel pipe

2.1.1 Storing materials on site

Storing and handling materials on site shall be to the manufacturer's recommendations. It is also important that all pipes are capped to prevent any contamination, animals or insects entering pipes.

Refer to the following links for handling and installation requirements of various pipe materials:

- Polyethylene pipes: PIPA-POP005: Packaging, handling and storage of polyethylene pipes and fittings
- Ductile iron pipes: https://www.saint-gobain-pam.co.uk/pipes-fittings-installation-guide
- Cement mortar lines steel (CLS): https://www.steelmains.com/h_i_manual (*requires registration*)

***Figure 1**: Example of materials stored on-site with appropriate capping.*

2.1.2 Pipe sizing

It is important that pipe and fitting sizes are selected correctly to ensure compatibility and alignment when transition between different pipe material types (especially in brown field sites).

The pipe sizing chart in Table 2 provides a breakdown of the different sizes (outside diameters), materials and standards. This can be used to select appropriate methods of joining pipe materials depending on the installation.

***Table 2**: Pipe sizing chart for materials.*

Pipe Information			**Pipe nominal bore** **Note dimensions listed in the table are outside diameter (O.D.) to compare compatibility for joining**										
Material	**Designation**	**Standard**	**50**	**65**	**80**	**100**	**125**	**150**	**175**	**200**	**225**	**250**	**300**
PE	SDR13.6 / PN12.5	AS/NZS 4130	63	75	90	110	140	160	200	250		280	355
	SDR11 / PN16	AS/NZS 4130	63	75	90	125	140	180	200	225		315	355
Ductile Iron (DI)	Class K9 or K12	AS/NZS 2280			96	122		177		232	259	286	345
	International	ISO 2531	66	82	98	118	144	170		222		274	326
CLS	International	AS 1579				114		168		219		273	324
CLS	Previous standard	NZS 4442				122		177		232		286	345
PVC	Imperial (Blue / Series2)	AS 1477				122		177		232	259	286	345
	Metric (White / Series 1)	AS 1477	60	75	89	114	140	160	200	225	250	280	315
Asbestos Cement (AC)	Class AB	AS 1711			96	122		177		232	259	286	345
	Class CD	AS 1711			96	122		177		232	259	286	345
Cast Iron	Class B	AS 1724-2				122		177		232	259	286	334
	Class C	AS 1544			96	122	149	177	203	232	259	286	345
Galvanised steel	GWI	AS 1074	60	76	89	114	140	165					
Reinforced concrete	Class 2 - 12	AS 4058						197			279		362
Copper		AS 3688	51	64	76	102	127	152		203	229		
GRP		AS 1413				122		177		232	259	286	345

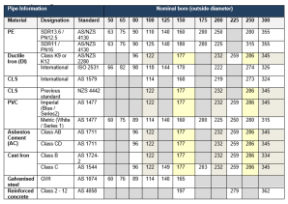
From the table above it is notable that the outside diameters of the following pipe materials are equally sized (highlighted):

- Ductile Iron (DI)
- CLS (NZS 4442)
- PVC series 2
- Asbestos Cement (AC)
- Cast Iron (CI)
- GRP

2.1.3 Measuring pipe size

Where the outside diameter of the pipe is unknown, one of the methods in Table 3 can be used to determine the size.

***Table 3**: Methods of measuring pipe size*

Method	Requirements	Example
Using a pipe sizing chart	Confirm Manufacturing standard and material	
Use callipers to measure the outside diameter	Callipers and excavation around pipe or at least to the spring line	
Use measuring tape to measure the circumference and divide by 3.14 (π) to get diameter	Tape and excavation around pipe	

2.1.4 General notes

a) Where flanges are used, the flange pattern shall conform with AS/NZS 4087.

b) Where threaded fittings are used, *plumbers' hemp* shall be used *for metallic fittings* and *thread tape* for *plastic fittings.* This shall be wound around threaded ends to secure and seal the fitting.

c) Where ductile iron fittings are used for bends, thrust support shall be included as per the relevant drawings. Appropriate polyethylene sleeving shall be installed around these fittings.

d) Reducers are generally only used where a watermain is reduced down from a size larger than 100mm diameter. Where reducing from 100mm diameter to smaller sizes, blank flanges which are drilled and threaded can be used.

e) **It is important that the minimum cover and installation depth is met.** This is not only to account for traffic loading or third-party damage to pipes, but also importantly, to mitigate the effects of seasonal ground movement. Shallow installations are more likely to be affected by ground movement and temperature fluctuations, resulting in the displacement (heaving) of soil which can cause leaking joints and pipe failures.

2.2 Gasket material

All gaskets used on local water networks shall be **solid blue EPDM**, complaint with AS/NZS 4020. NO reinforced or natural rubber gaskets shall be used.

Refer to Watercare's Material Supply Standard for a list of approved suppliers.

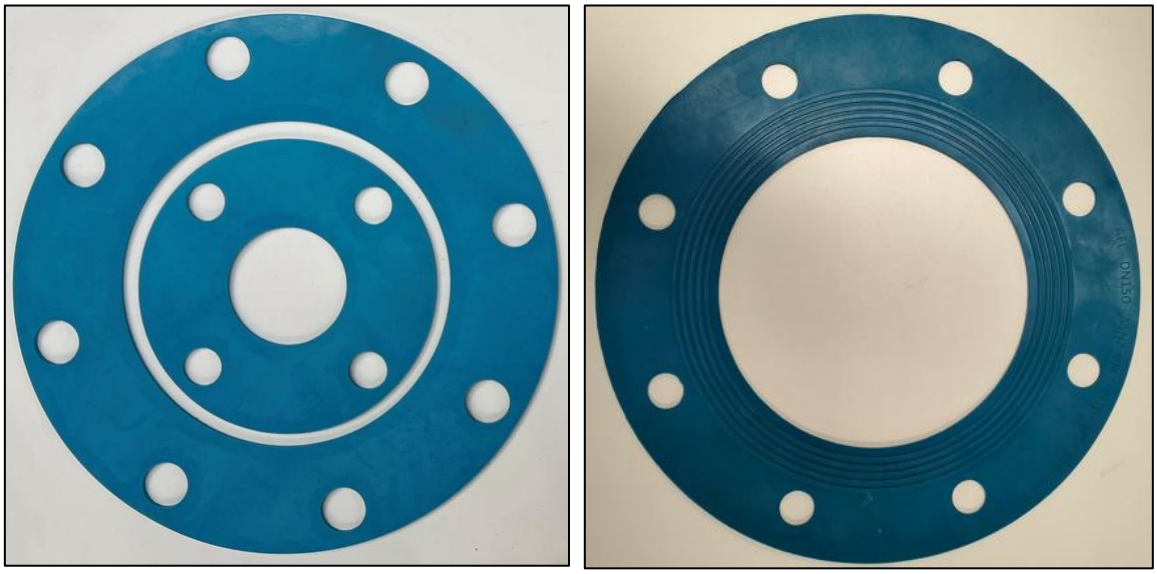


***Figure 2**: Examples of acceptable solid blue EPDM gaskets.*

2.3 Bolt torque values

The following torque values are based on raised face AS/NZS 4087 flange patterns for local water networks

***Table 4**: Bolt torque values for steel -to-steel or DI to steel flanged assemblies*

Pipe DN	No. Bolts	Bolt Size (mm)	Target Torque "T" (Nm)
100	4	16	48
150	8	16	48
200	8	16	48
250	8	20	94
300	12	20	94
350	12	24	163

***Table 5:** Bolt torque values for PE stub flange adaptor to joined to non-PE flanges (steel or DI)*

PE Pipe DN	Target Torque "T" (Nm) Bolt Grade 4.6	Target Torque "T" (Nm) Bolt Grade: A4-50
110	36	47
160	32	42
200	50	66
225	45	60
250	86	115
315	74	98

Table 6: *Bolt torque values for PE stub flange adaptor to PE stub flange adaptor*

PE Pipe DN	**Target Torque "T" (Nm)** Bolt Grade 4.6	**Target Torque "T" (Nm)** Bolt Grade: A4-50
110	38	51
160	33	43
200	50	67
225	46	61
250	87	116
315	74	99
355	121	161

Note: The use of threaded rod in lieu of bolts is **NOT** allowed

2.4 Bolt lubrication

Bolts will typically be supplied with an oily residue, **this is not considered sufficient** lubrication for assembly and additional lubrication shall be applied to fasteners and adjoining bearing surfaces.

Flange fastener and bearing surface lubricants selected for use in drinking and non-drinking water applications shall comply with AS/NZS 4020

A high-quality solid type lubricant such as molybdenum disulphide (Molykote 1000 or Loctite 771), or NCH Thread-Eze Ultra shall be used for bolts.

Note: It is important that all bolts are well lubricated to achieve the necessary seal on gaskets. Bolts that lack lubrication requires more torque to overcome the frictional resistance of the threads, resulting in lower stress being applied on the gasket for a set torque value. **Not lubricating bolts properly at these torque values can result in leaking joints.**

Table 7*: Lubricant application to bolts*

Insufficient lubricant applied	**Lubricant applied correctly**
 ✗	 ✓

2.5 Bolt tightening sequence

Bolt tightening sequence shall be in a cross-pattern (star pattern) to ensure the load is applied evenly to seat the gasket (see Figure 3 example).

Step 1: Hand tighten the assembly to between 15 Nm and 30 Nm (but not exceeding 20% of the target torque "T" value). This ensure that the flanges are fitted up snug and uniformly against the gasket.

Step 2: Tighten to 20% - 30% of the target torque "T", while monitoring the flange gap around the circumference of the assembly. Ensure that that the gap is kept continuously uniform. Adjust appropriately if required.

Step 3: Tighten to 50% - 70% of the target torque "T", while monitoring the flange gap around the circumference of the assembly. Ensure that that the gap is kept continuously uniform. Adjust appropriately if required.

Step 4: Tighten to 100% of the target torque "T", while monitoring the flange gap around the circumference of the assembly. Ensure that that the gap is kept continuously uniform. Adjust appropriately if required.

Step 5: Continue tightening the bolts, but in a circular clockwise pattern until no further rotation occurs at 100% target torque.

Step 6: Wait 4-hours following the final torquing (Step 5) and repeat Step 5 to account for any short-term creep relaxation or embedment losses. This may also be required following pressure testing where the test pressure is higher than the operating pressure.

Note: Where polyethylene (PE) flanged joints are installed, the bolts shall be re-torqued after 12-24 hours of the initial installation to account for short term relaxation of the PE stub flange.

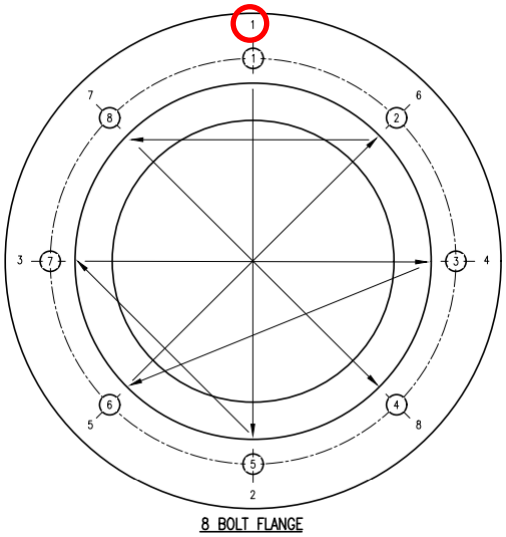


***Figure 3**: Example of bolt tightening sequence – Outside number indicate tightening sequence.*

2.6 Welding qualifications

2.6.1 Polyethylene pipe welding qualifications

All contractors performing welding works on polyethylene pipelines shall successfully complete the Unit Standard training specified in AS/NZS 2033. This includes:

- Unit Standard 31532: Demonstrate knowledge of fusion jointing of polyethylene pipes for water networks.
- Unit Standard 31524: Carry out butt fusion jointing on polyethylene pipes for water networks
- Unit Standard 31525: Carry out electrofusion jointing on polyethylene pipes for water networks

The welding supervisor on site should be a trained and experienced welder, i.e., a person trained by a *Registered Training Organisation* (RTO) and be able to provide objective evidence of at least 3 years relevant experience. This experience should include welding pipe of similar or larger sizes to those in the current project.

Note: As a minimum, welding qualifications shall be renewed every three (3) years.

2.6.2 Steel pipe welding qualifications

All contractors performing welding works on steel pipelines shall hold current qualifications conforming to one of the following standards:

- AS/NZS 3992
- AS/NZS ISO 9606.1
- ASME IX

Refer to Watercare's General Mechanical Construction Standard for testing and inspection requirements.

2.7 Assembly configurations

The assembly configurations discussed under this Section cover those which have been standardised by Watercare. This Section includes reference to the applicable drawings, visual examples of acceptable installations, and a breakdown of the various components forming part of the assembly.

2.7.1 Typical watermain intersection layout (WS 3)

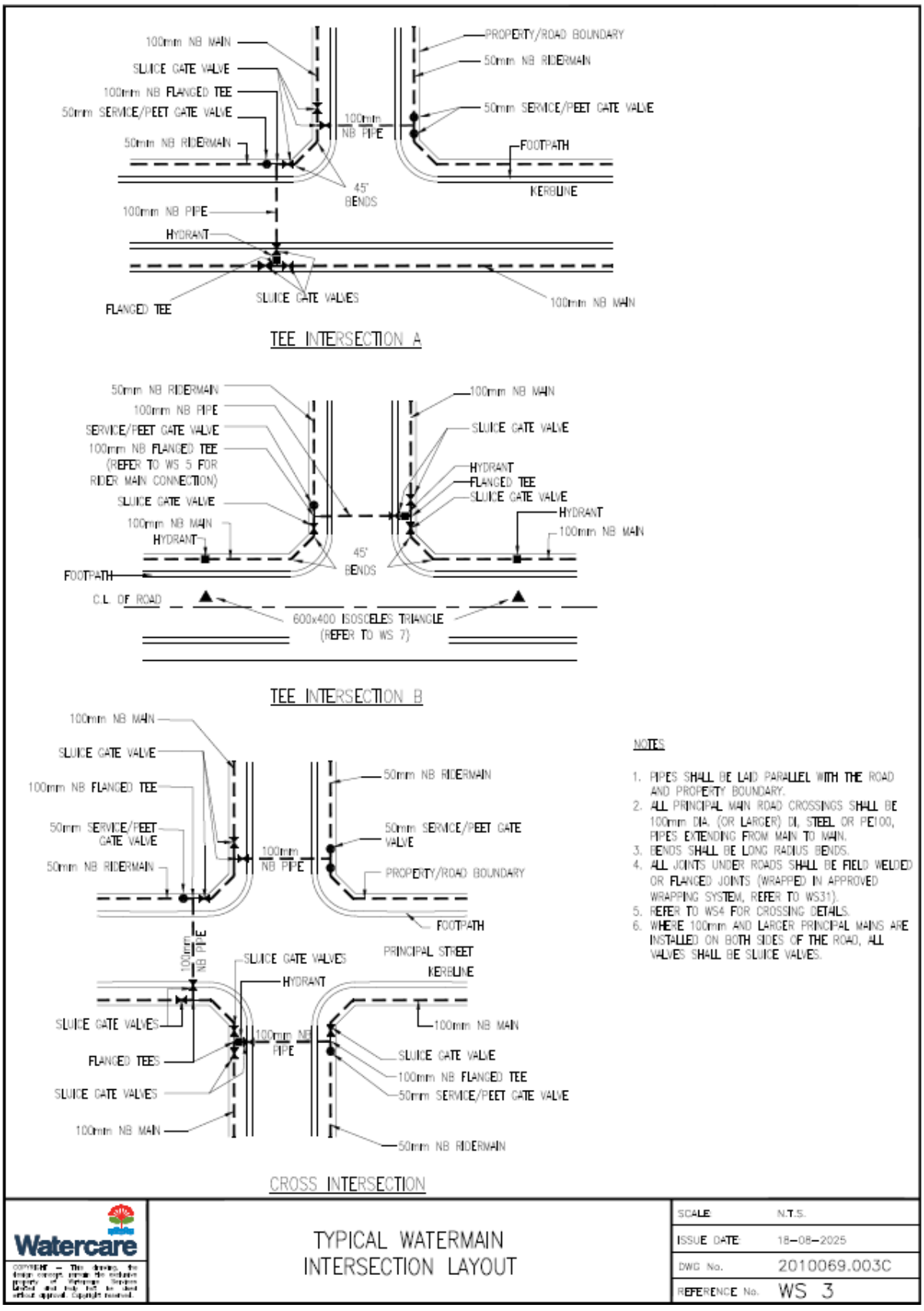
Water reticulation across intersections requires careful planning. The configuration of valves and hydrants at corners and crossings need to allow for:

a) Isolation that minimizes disruption to the water network.
b) Isolation that allows road crossings to be maintained, with minimal disruption to the upstream or downstream network.
c) Hydrants that allow for flushing of the lines during maintenance or flow/ pressure monitoring – these can be installed with the valve configuration prior to crossing (refer Figure 5).
d) Hydrants spaced to service the surrounding properties within the limits specified in SNZ PAS 4509.

Figure 4: *Examples of isolation valves installed on the principal water main at a road crossing.*

Figure 5: *Examples of isolation valves including a hydrant installed at a road crossing to accommodate flushing the line.*

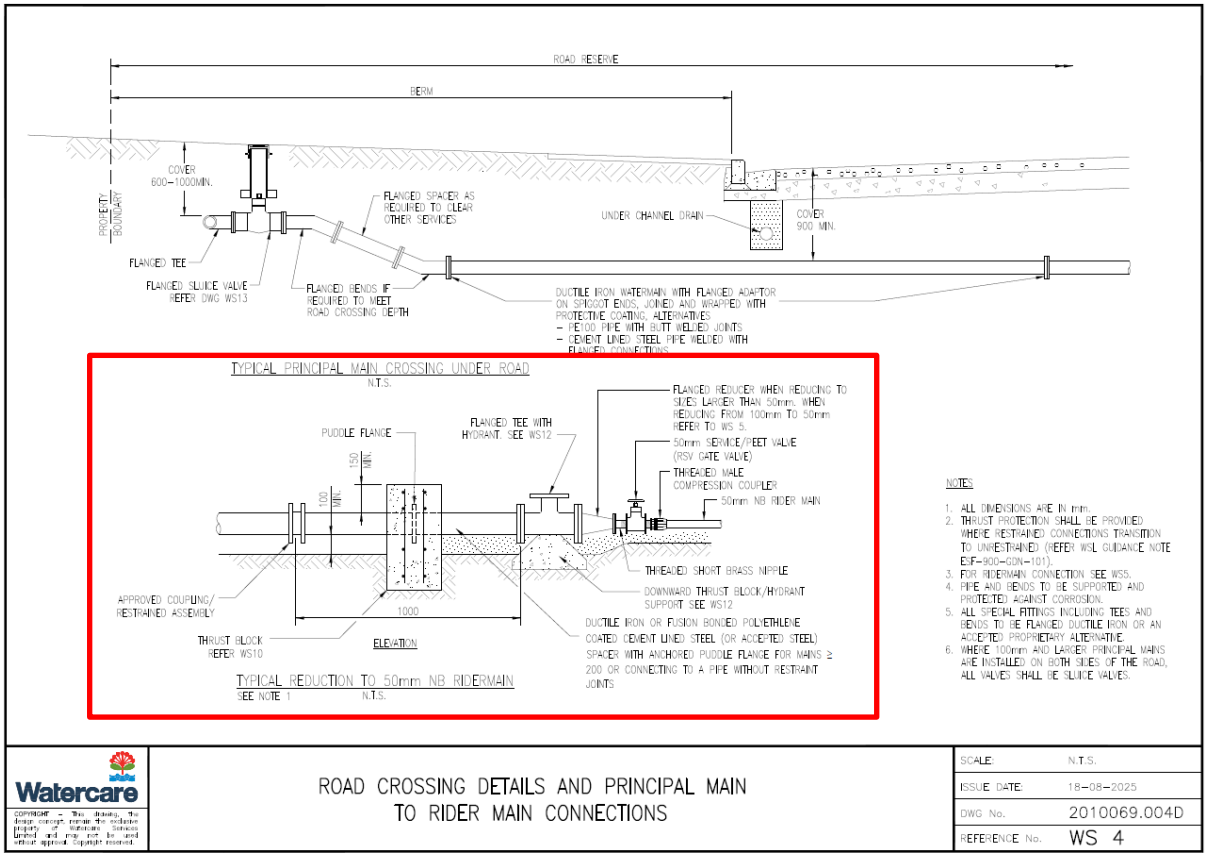
2.7.1.1 Watercare drawing reference – WS 3



2.7.2 Principal main to rider main connection (WS 4)

Principal water mains can be reduced to rider mains where localised supply is required for a limited number of properties. For larger principal watermains (greater than DN100), a reducer is first required to step the pipe size down to a DN100 before transitioning to the rider main - normally sized at 50mm bore (63mm PE).

2.7.2.1 Watercare drawing reference – WS 4



2.7.2.2 Material / components required

No.	1	2	3	4	5	6	7	8	9
Description	Ductile iron tee	Dress set (gasket & bolts)	Ductile iron reducer	Dress set (gasket & bolts)	Blank flange	Threaded short	Service gate valve	Compression coupler	PE pipe
Illustration									
Watercare Material Supply Standard Section	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.1.12	N/A	13.2.1	13.1.7	13.1.6
Manufacturing standard	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts)	AS/NZS 2280	DZR brass	AS/NZS 2638.2	AS/NZS 4129	AS/NZS 4130

2.7.2.3 *Installed example*

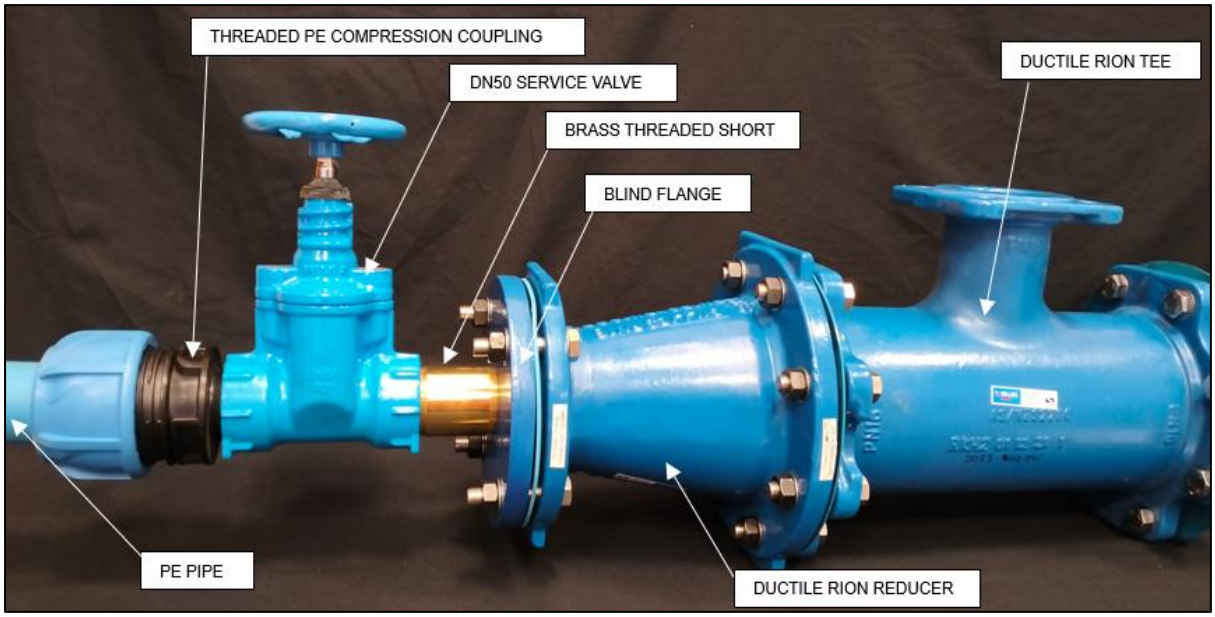


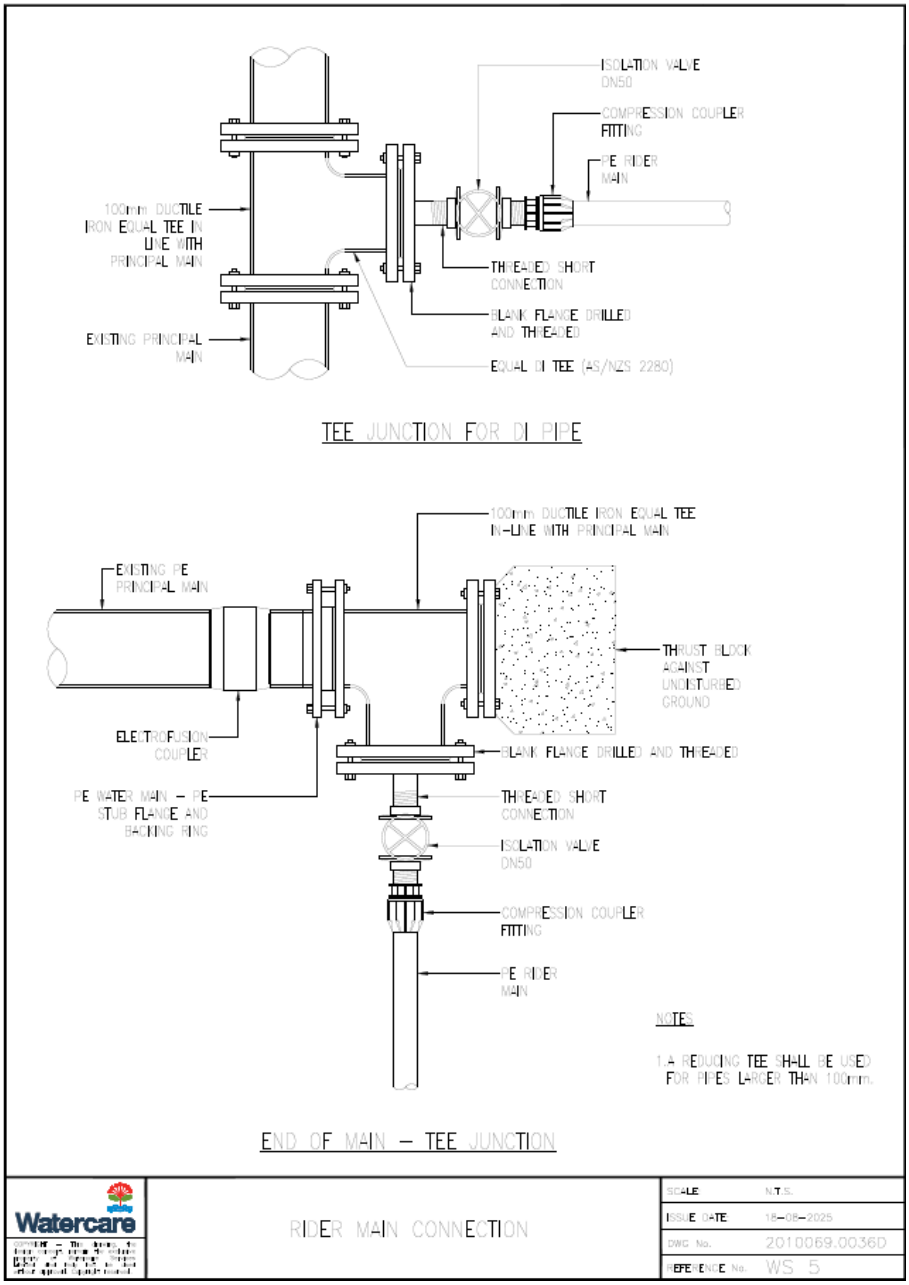
***Figure 6**: Assembled example of Watercare reference drawing WS 4.*

2.7.3 Rider main connection (WS 5)

Where rider mains are installed to serve smaller isolated groups of dwellings and is reduced directly off a 100mm diameter principal water main, a drilled and threaded blank flange is used to reduce down to 50mm diameter. These should never be used for road crossing or where hydrants are installed.

Note: Minimum diameter for a road crossing is 100mm nominal bore.

2.7.3.1 Watercare drawing (WS 5)



2.7.3.2 Material / components required

No.	1	2	3	4	5	6	7
Description	Ductile iron tee	Dress set (gasket & bolts)	Blank flange	Threaded short	Service gate valve	Compression coupler	PE pipe
Illustration							
Watercare Material Supply Standard Section	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.1.12	N/A	13.2.1	13.1.7	13.1.6
Manufacturing standard	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2280	DZR brass	AS/NZS 2638.2	AS/NZS 4129	AS/NZS 4130

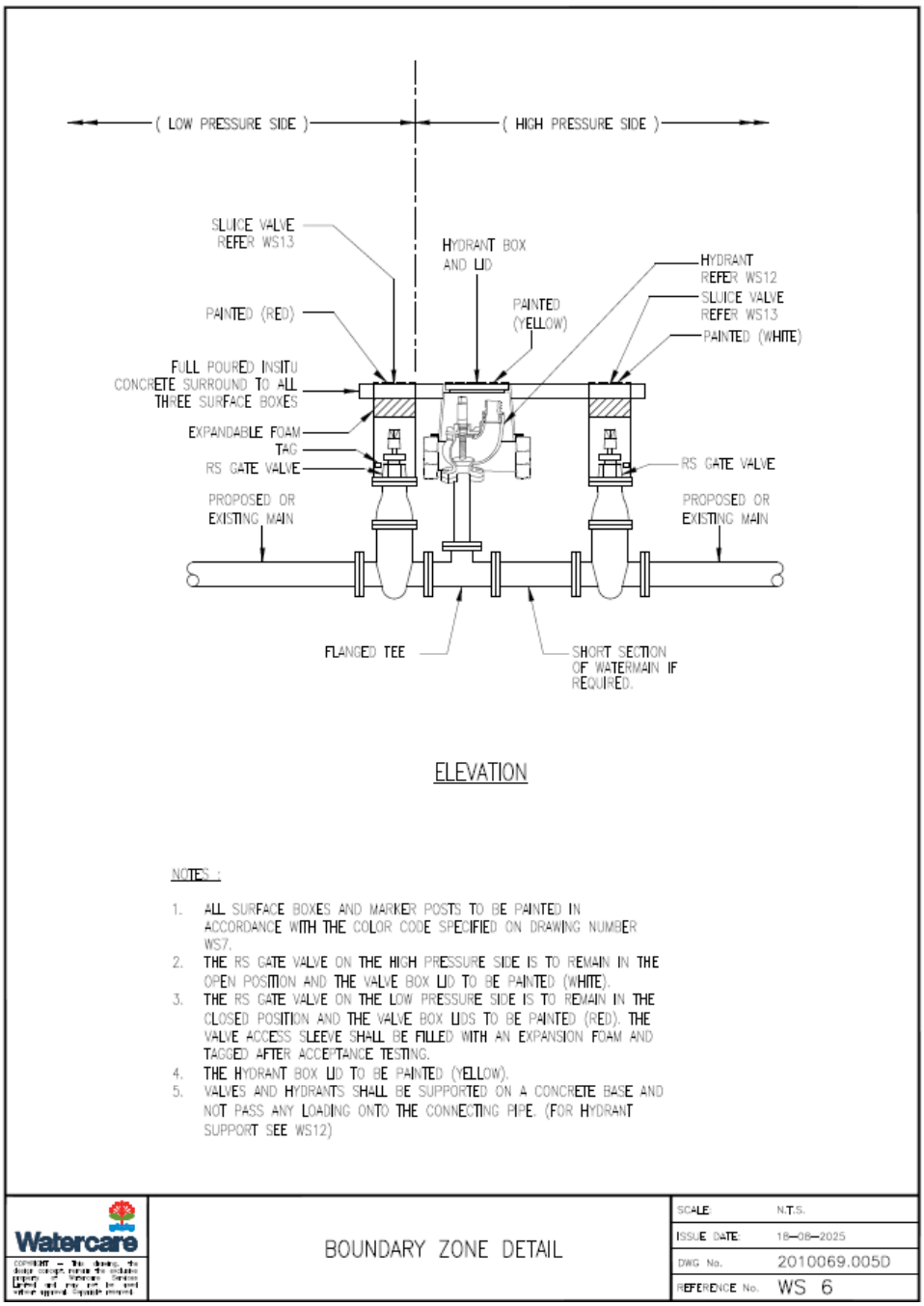
2.7.3.3 Installed example

***Figure 7**: Installed example of a DN50 rider main connection from a 100mm principal main.*

2.7.4 Boundary zone valve

Boundary zone valves are normally installed near pressure reducing valves (PRV's) and flow meters measuring consumption in a district metered area (DMA) or "zone". These allows for the isolation of DMAs, maintenance and to detect leaks and monitor pressure.

2.7.4.1 Watercare drawing (WS 6)



2.7.4.2 *Material / components required*

Refer to the section listed below for applicable materials and components:

- 2.7.5: Valve and hydrant markings (WS 7)
- 2.7.6: Thrust block installation (WS 8 & 9) (if required)
- 2.7.7: Flange connection detail (WS 11)
- 2.7.8: Hydrant installation (WS 12)
- 2.7.9: Sluice valve (WS 13)

2.7.4.3 *Installed example*

***Figure 8**: Example of installed zone valves and valve tag.*

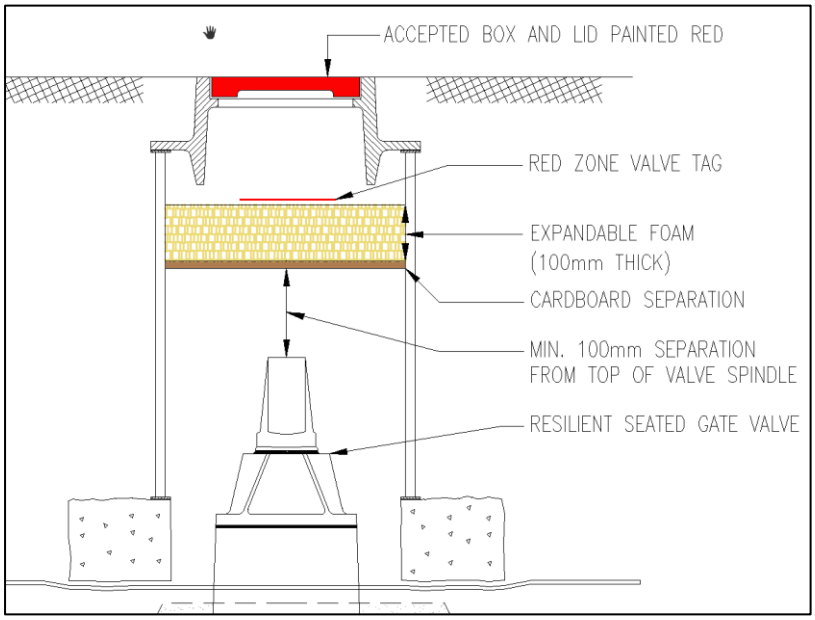
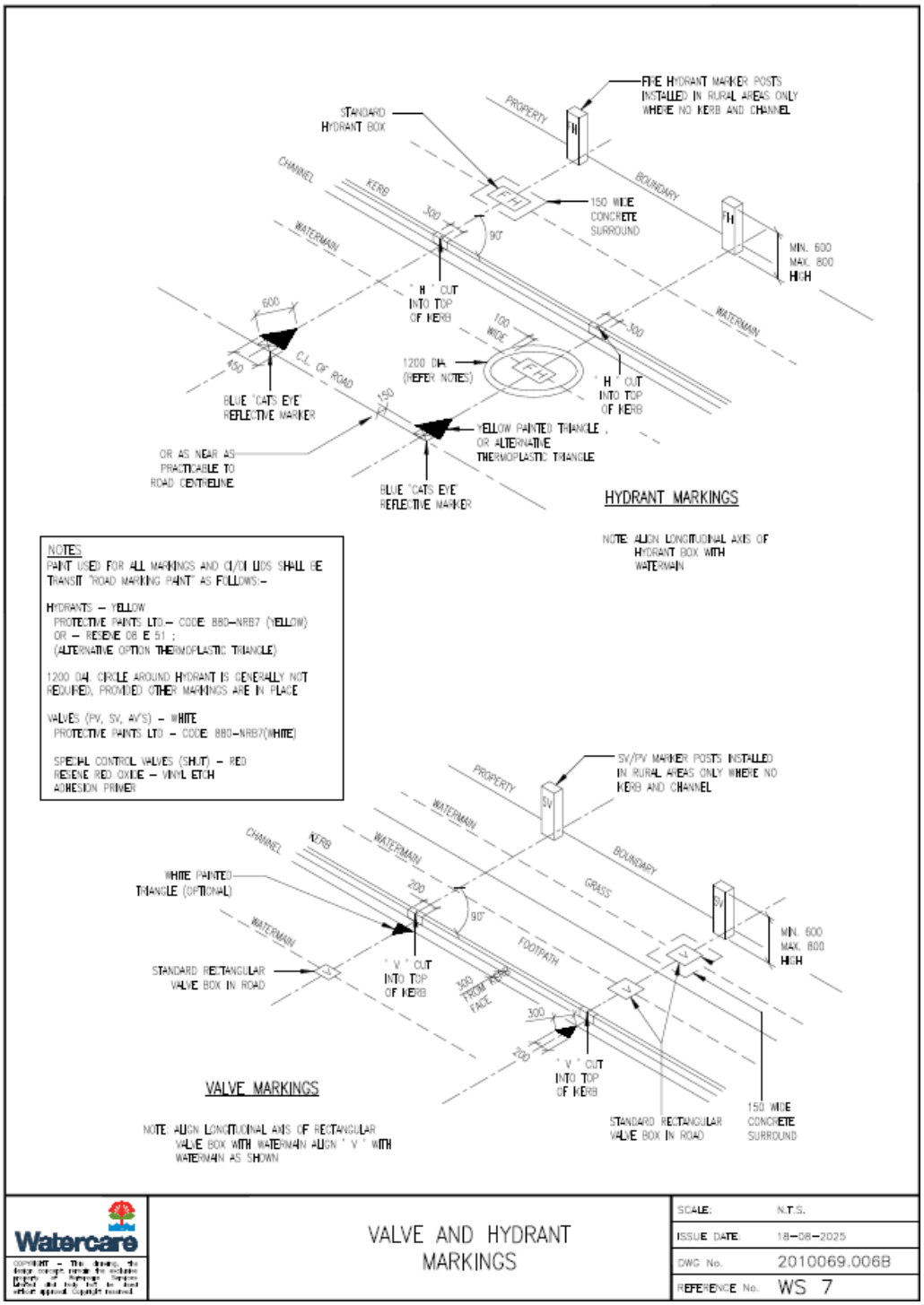


***Figure 9**: Schematic of zone valve installation including cardboard separation and expandable foam.*

2.7.5 Valve and hydrant markings

Valve and hydrant markings are used for identification. This allows operational staff to locate and inspect or isolate valves when work is required. For hydrants it is important that fire and emergency services easily locate these valves in the event of fires. Installing and maintaining these markings is important when detecting these assets.

2.7.5.1 Watercare drawing reference - WS 7



2.7.5.2 *Material / components required*

***Table 8**: Examples of installed valves and hydrants showing the applicable road markings.*

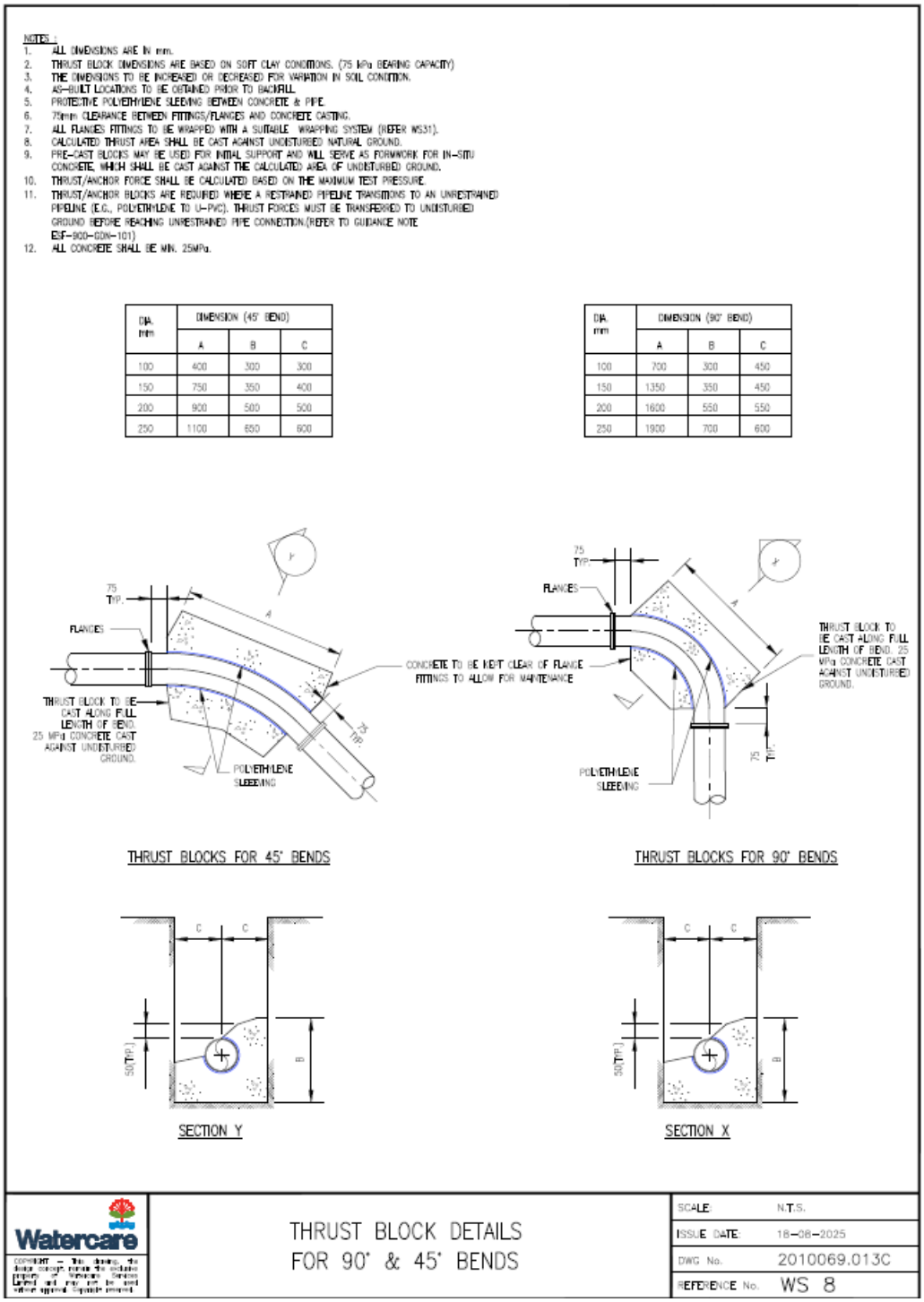
Fixture	Requirement	Specification	Example
Valve CI/DI lids and road markings	• Service/Peet, Sluice or Air valve lids to be painted white. • Triangle to be painted on road (200mm x 300mm) • "V" to be cut into top of kerb and 200mm wide painted across kerb section	Protective paints ltd. – Code: 880-NRB7 (White)	 
Valve boundary zone CI/DI lids and road markings	• Lids to be painted red. • Triangle to be painted on road (200mm x 300mm) • "V" to be cut into top of kerb and 200mm wide painted across kerb section	Resene red oxide – vinyl etch	
Hydrant CI/DI lids and road markings	• Lids to be painted yellow. • Triangle to be painted on road (450mm x 600mm) • "H" to be cut into top of kerb and 300mm wide painted across kerb section • **Note**: 1200mm Dia. circle is generally not required around hydrant in the road, provided the other markings have been allowed for.	Protective paints ltd. – Code: 880-NRB7 (Yellow); or Resene 08 E 51	

***Note**: "V" s should not be cut into aesthetic or natural stone kerbing*

2.7.6 Thrust block installation

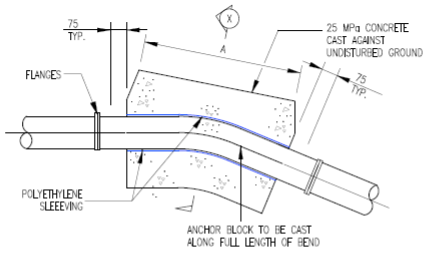
Thrust blocks need to be installed where pipes or fittings are subject to forces which can result in dislodged joints, pipe pull-out failures. The design engineer needs to assess the requirement for thrust protection based on a number of factors including pipe material, joint type, transitions to different materials, the weight of the backfill material, and more. Refer to ESF-900-GDN-101: Guidance Note - Anchoring pipelines.

2.7.6.1 Watercare drawing (WS 8, WS 9 and WS 10)

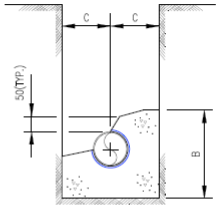


NOTES :
1. REFER TO NOTES IN WS8.

DIA mm	DIMENSION		
	A	B	C
100	300	250	300
150	400	350	400
200	500	500	500
250	600	600	600

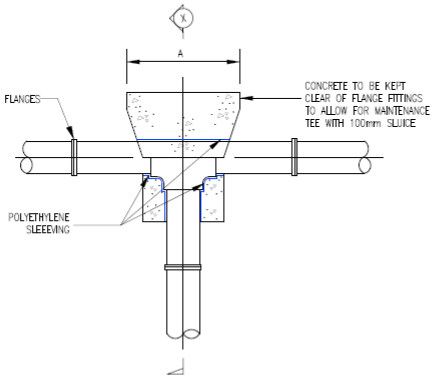


THRUST BLOCKS FOR 22½° & 11¼° BENDS

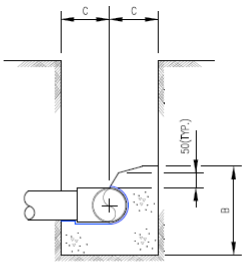


SECTION X

DIA mm	DIMENSION		
	A	B	C
100	500	350	450
150	900	400	450
200	1200	550	550
250	1400	700	600



THRUST BLOCKS TEE JUNCTION & END CAPS

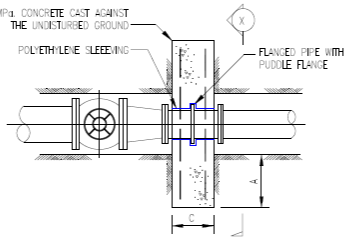


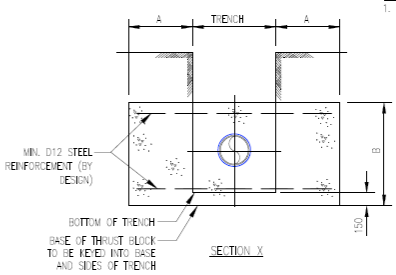
SECTION Y

Watercare	THRUST BLOCK DETAILS FOR 22½° & 11¼° BENDS AND TEE JUNCTION	SCALE: N.T.S. ISSUE DATE: 18–08–2025 DWG No. 2010069.014C REFERENCE No. WS 9

NOTES :
1. REFER TO NOTES ON WS8.

REDUCER mm	REDUCERS		
	A	B	C
100–150	300	350	300
100–200	600	400	300
150–200	300	500	300
150–250	600	550	300
200–250	300	600	300
200–300	600	700	300



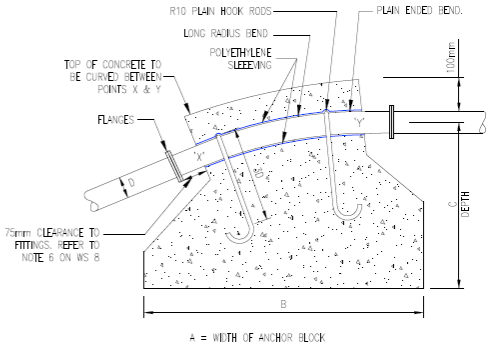


THRUST BLOCKS AT REDUCERS

PIPE DIA	VERTICAL BENDS–45°		
	A	B	C
100mm	600	900	700
150mm	900	1100	900
200mm	1200	1400	900
250mm	1200	1800	1100

PIPE DIA	VERTICAL BENDS–22.5°		
	A	B	C
100mm	600	600	600
150mm	600	900	800
200mm	800	1100	900
250mm	1000	1300	1000

PIPE DIA	VERTICAL BENDS–11.25°		
	A	B	C
100mm	500	500	500
150mm	600	700	600
200mm	600	900	800
250mm	700	1100	800



ANCHOR BLOCKS AT BENDS IN VERTICAL PLANE

VERTICAL SECTION

Watercare	THRUST BLOCK DETAILS REDUCERS AND VERTICAL BENDS	SCALE: N.T.S. ISSUE DATE: 18–08–2025 DWG No. 2010069.015C REFERENCE No. WS 10

2.7.6.2 General considerations and preparation

Precast kerb blocks may be used as formwork and temporary support; however, the final thrust block shall be cast against the bearing (undisturbed) surface.

***Figure 10**: Example of kerb blocks being used for temporary support before casting in-situ concrete.*

Always ensure that the pipework is not in direct contact with the concrete of a thrust block. This can be achieved by **wrapping a polyethylene sleeve around the pipe / fitting**, creating an offset (slip layer) between the pipe / fitting and concrete. This prevents bonding with the concrete, allowing for slight movement without causing stress on the pipe / fitting.

***Figure 11**: Example showing PE sleeving around the pipe.*

Where a bearing surface is required for in-line thrust protection, the required bearing area against the undisturbed ground surface is beyond trench, i.e. it should be keyed into the trench wall and floor to achieve the total bearing area.

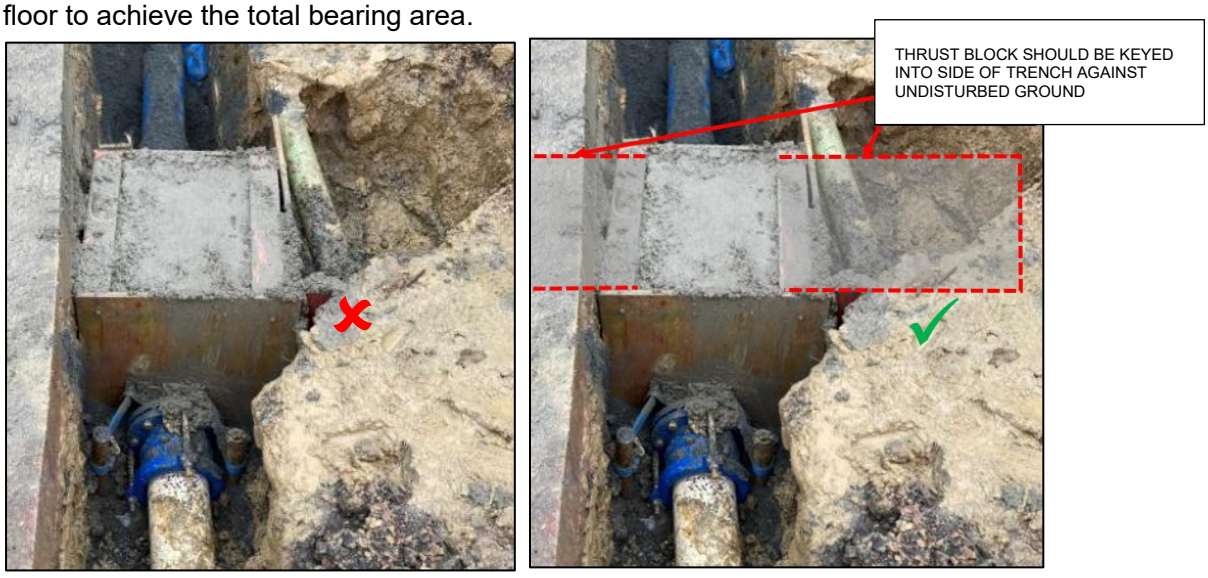


***Figure 12**: Example of incorrect installation, where concrete does not extend beyond the trench wall.*

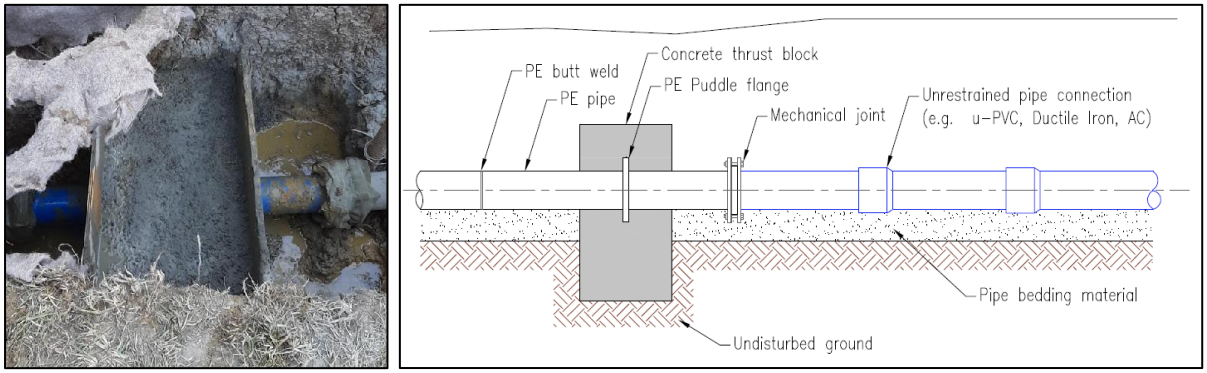


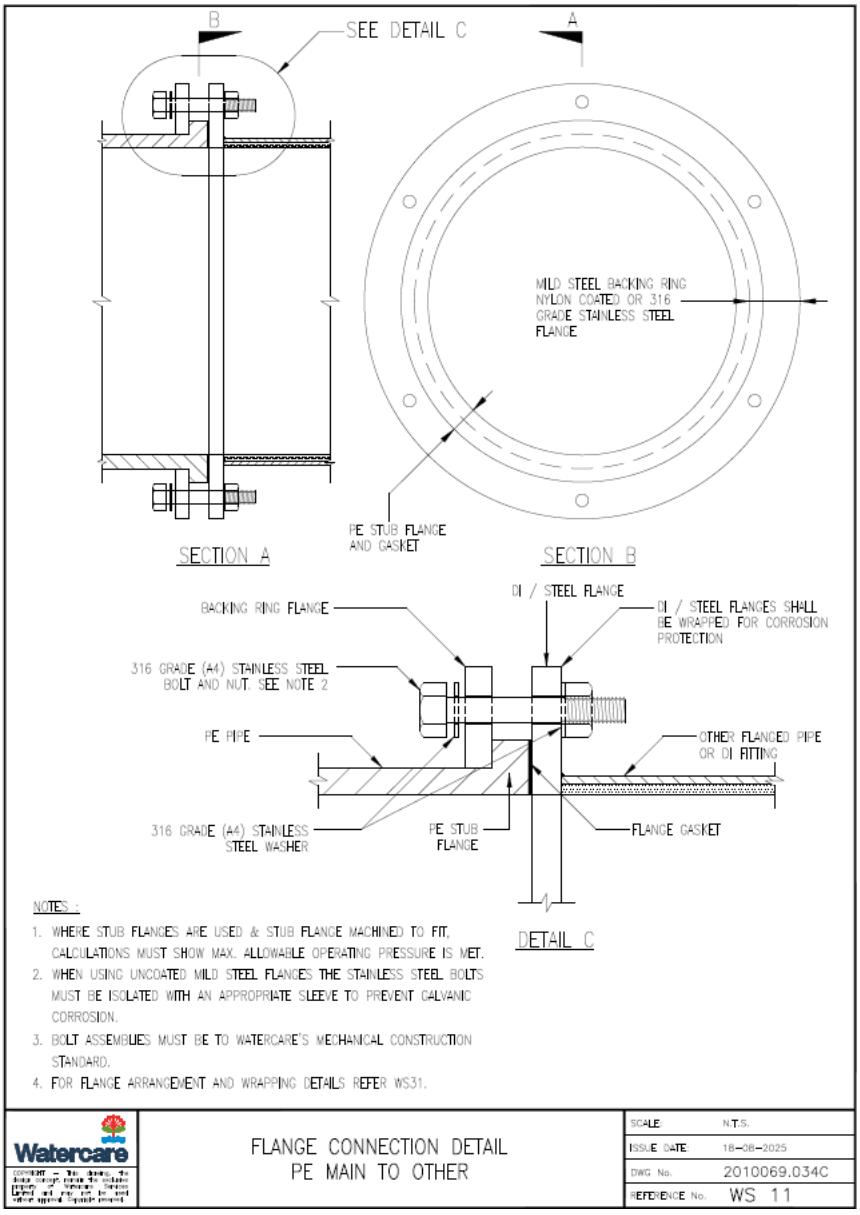
***Figure 13**: Example of thrust block keyed into the bottom and sides of the trench where PE pipe transitions to unrestrained pipe. Note that the thrust block should be cast away from dismantlable mechanical joint.*

2.7.7 Flange connection detail (WS 11)

Transitions between PE pipe and ductile iron fittings or steel flanges are achieved by using PE stub flanges with backing rings. The stub flange should normally be butt welded to the PE pipe to complete a fully ductile connection. Alternatively, electrofusion (EF) welds can be used where it is demonstrated by the Contractor that butt welds cannot be carried out.

Note: Slim flanges (reduced spigot flange adaptor) may be used to accommodate mismatched flange drilling pattern. Examples include stepping down in size from the PE watermain to suit the flange pattern & size of the valve / hydrant, e.g. DN250 PE pipe, DN250 Slim flange, connected to a DN200 valve / DN 200 Tee (for hydrant connection)

2.7.7.1 Watercare drawing



2.7.7.2 *Material / components required*

No.	1	2	3	4	5
Description	Ductile iron flanged fitting	Dress set (gasket & bolts)	PE Stub flange (or slim flange)	Backing ring	PE pipe (welded to stub flange)
Illustration					
Watercare Material Supply Standard Section	13.1.11 (General) 13.2.1 (Valves) 13.2.9 (Hydrants)	13.7 (gaskets) 13.5 (bolts)	13.1.6	N/A	13.1.6
Manufacturing standard	AS 1831 AS/NZS 2638.2 (Valves) NZS 4522 (Hydrants) AS/NZS 4087 (Flange)	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	ISO 9624 / AS/NZS 4129	Stainless steel 316 or Nylon coated mild steel	AS/NZS 4130

2.7.7.3 *Installed example*

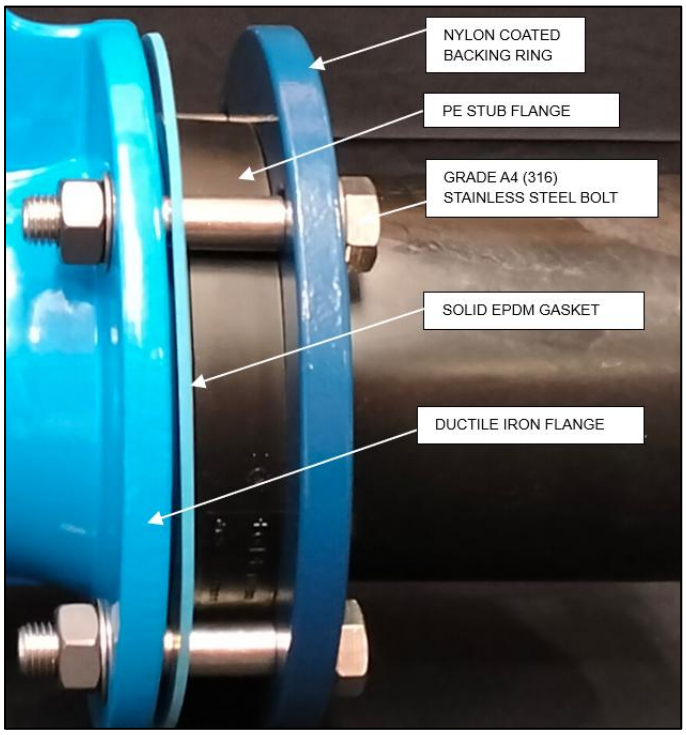


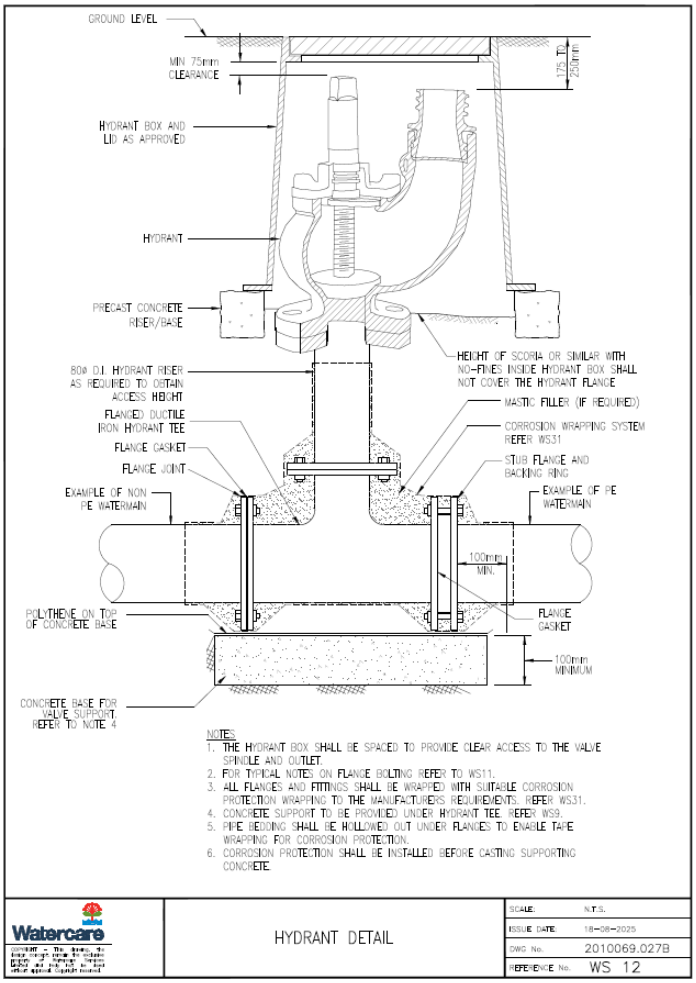
***Figure 14**: Example of assembled PE stub flange connection with backing ring, connecting to a ductile iron fitting.*

Note: Designers and Contractors should also refer to PIPA POP 007: Flanged Joints for Polyethylene (PE) Pipe for guidance on the assembly of PE stub flanged connections.

2.7.8 Hydrant installation (WS 12)

Hydrants are primarily installed for fire protection but also act as scour or flushing points for Watercare. This allows cleaning of the line if required, as well as testing the line to assess the available flow in the network.

2.7.8.1 Watercare drawing



2.7.8.2 Material / components required

No.	1	2	3	4	5	6	7	8
Description	PE pipe (welded to stub flange)	Butt weld or EF Coupler	Backing ring	PE Stub flange (or slim flange)	Dress set (gasket & bolts)	Hydrant tee	Dress set (gasket & bolts)	Hydrant
Illustration								
Watercare Material Supply Standard Section	13.1.6	13.1.7	N/A	13.1.6	13.7 (gaskets) 13.5 (bolts)	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.2.9
Manufacturing standard	AS/NZS 4130	AS/NZS 4129	Stainless steel 316 or Nylon coated mild steel	ISO 9624 / AS/NZS 4129	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	NZS 4522

2.7.8.3 Installed example

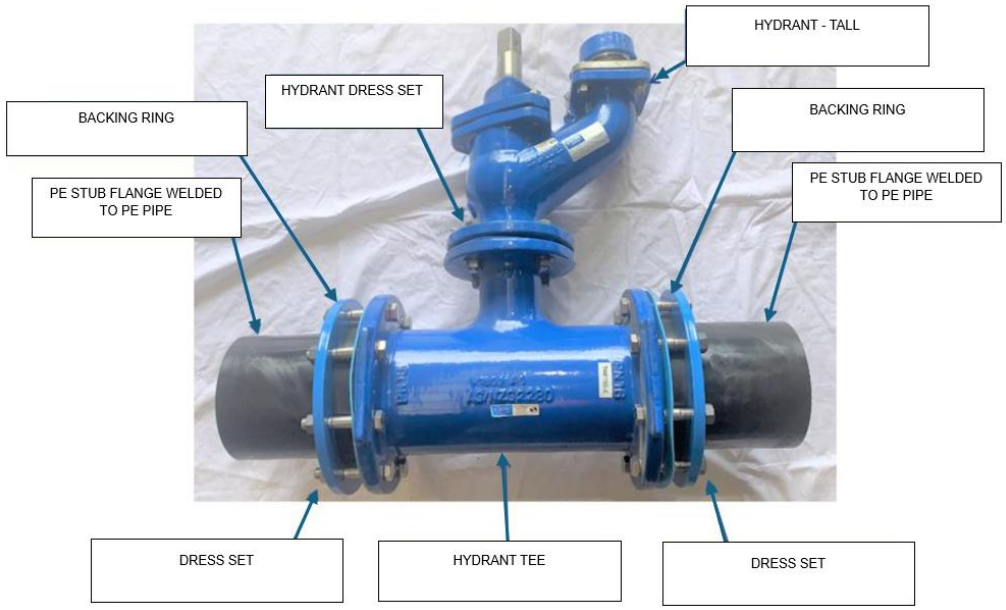


***Figure 15**: Example of assembled hydrant to a PE pipe (without riser).*

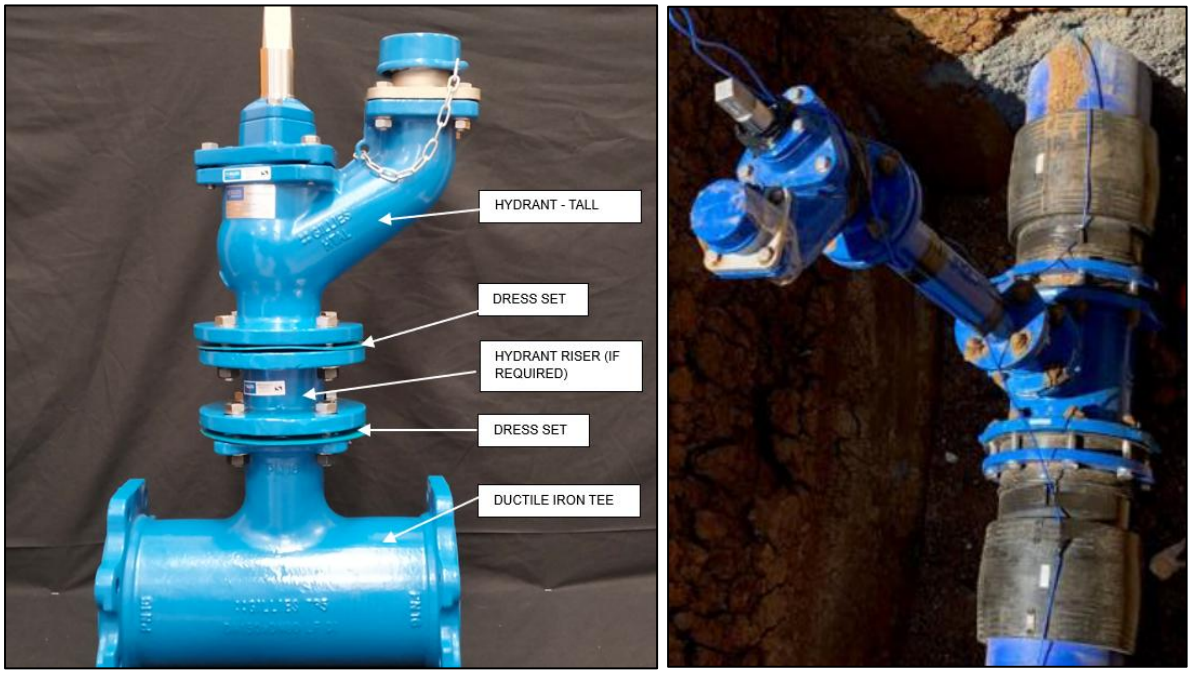
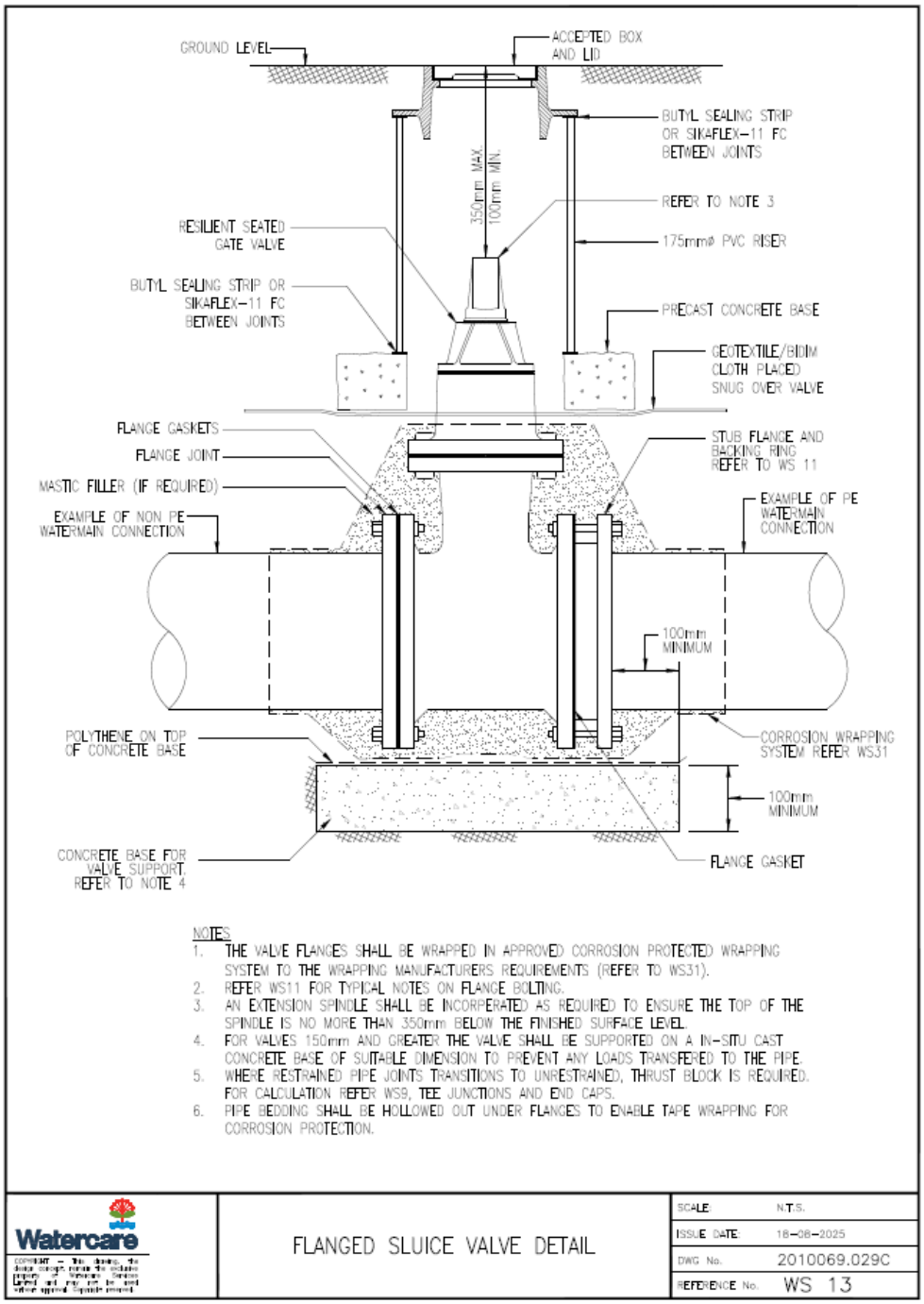


***Figure 16**: Alternative examples of hydrants with ductile iron risers to achieve the necessary height in proximity to the ground level for access.*

2.7.9 Sluice valve (WS 13)

Sluice or gate valves are installed primarily on principal watermains to isolate the network. It allows sections of the network to be maintained or repaired without affecting extended lengths of pipelines, minimising the amount of disruption to property owners.

2.7.9.1 Watercare drawing(s)



2.7.9.2 Material / components required

No.	1	2	3	4	5	6
Description	PE pipe (welded to stub flange)	Butt weld or EF Coupler	Backing ring	PE Stub flange (or slim flange)	Dress set (gasket & bolts)	Gate valve
Illustration						
Watercare Material Supply Standard Section	13.1.6	13.1.7	N/A	13.1.6	13.7 (gaskets) 13.5 (bolts)	13.1.11 (General) 13.2.1 (Valves)
Manufacturing standard	AS/NZS 4130	AS/NZS 4129	Stainless steel 316 or Nylon coated mild steel	ISO 9624 / AS/NZS 4129	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS 1831 AS/NZS 2638.2 (Valves) AS/NZS 4087 (Flange)

2.7.9.3 Installed example

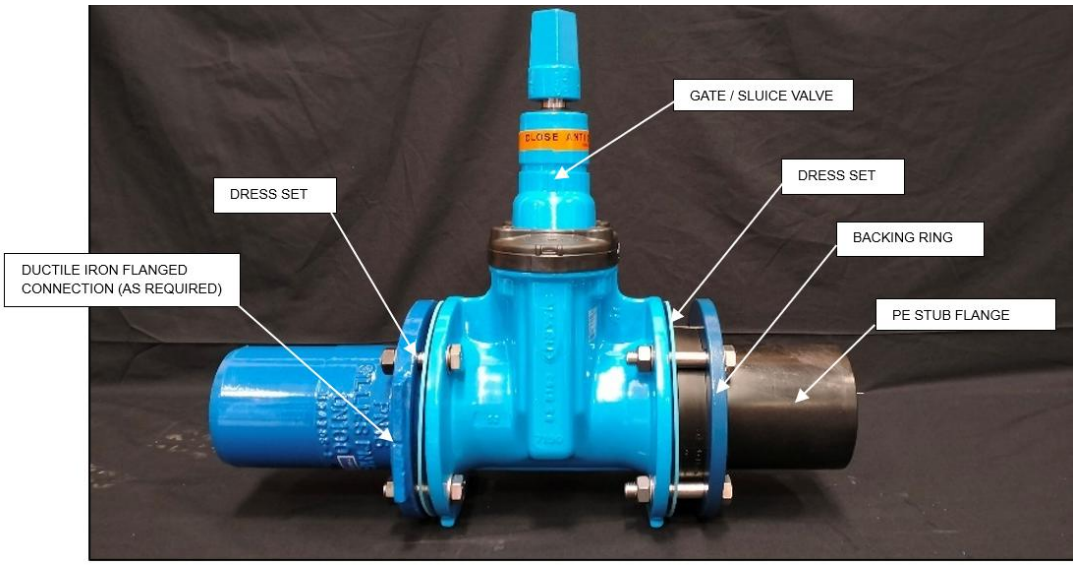


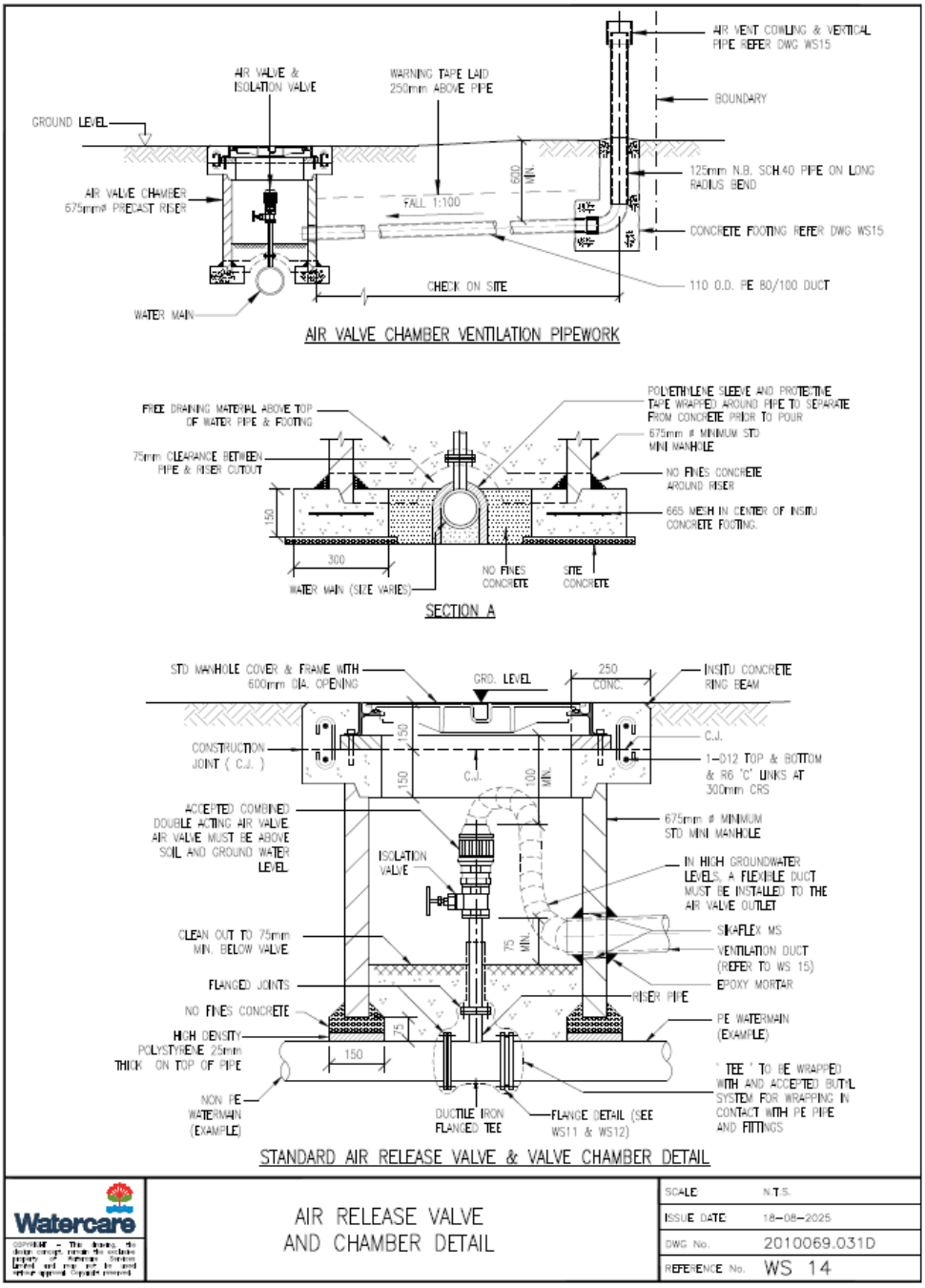
***Figure 17**: Example of assembled sluice (gate) valve connecting to either PE or ductile iron pipework.*

***Figure 18**: Installed sluice (gate) valves prior to reinstatement.*

2.7.10 Air release valve and chamber detail

Air release valves are installed to remove trapped air from the network. When air is present in the network it can result in pressure surges, inaccurate flow measurement and reduced efficiency. For the local reticulation network, private property plumbing fixtures like taps essentially serve as “air valves”, allowing any trapped air to be extracted once these are opened. For this reason, very few air valves are required to be installed on the local network, unless watermains are installed for an extended distance without any service connections (or at localised high points).

2.7.10.1 Watercare drawing (WS 14)



2.7.10.2 Material / components required

No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Description	PE pipe (welded to stub flange)	Butt weld or EF Coupler	Backing ring	PE Stub flange (or slim flange)	Dress set (gasket & bolts)	Ductile iron tee	Dress set (gasket & bolts)	Riser pipe (optional)	Dress set (gasket & bolts)	Blank flange	Threaded short	Gate valve	Air valve (water)
Illustration													
Watercare Material Supply Standard Section	13.1.6	13.1.7	N/A	13.1.6	13.7 (gaskets) 13.5 (bolts)	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.1.12	N/A	13.2.1	13.2.8
Manufacturing standard	AS/NZS 4130	AS/NZS 4129	Stainless steel 316 or Nylon coated mild steel	ISO 9624 / AS/NZS 4129	AS 1646 (gaskets) AS 1111.1 (bolts)	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts)	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts)	AS/NZS 2280	DZR brass	AS/NZS 2638.2	AS 4956

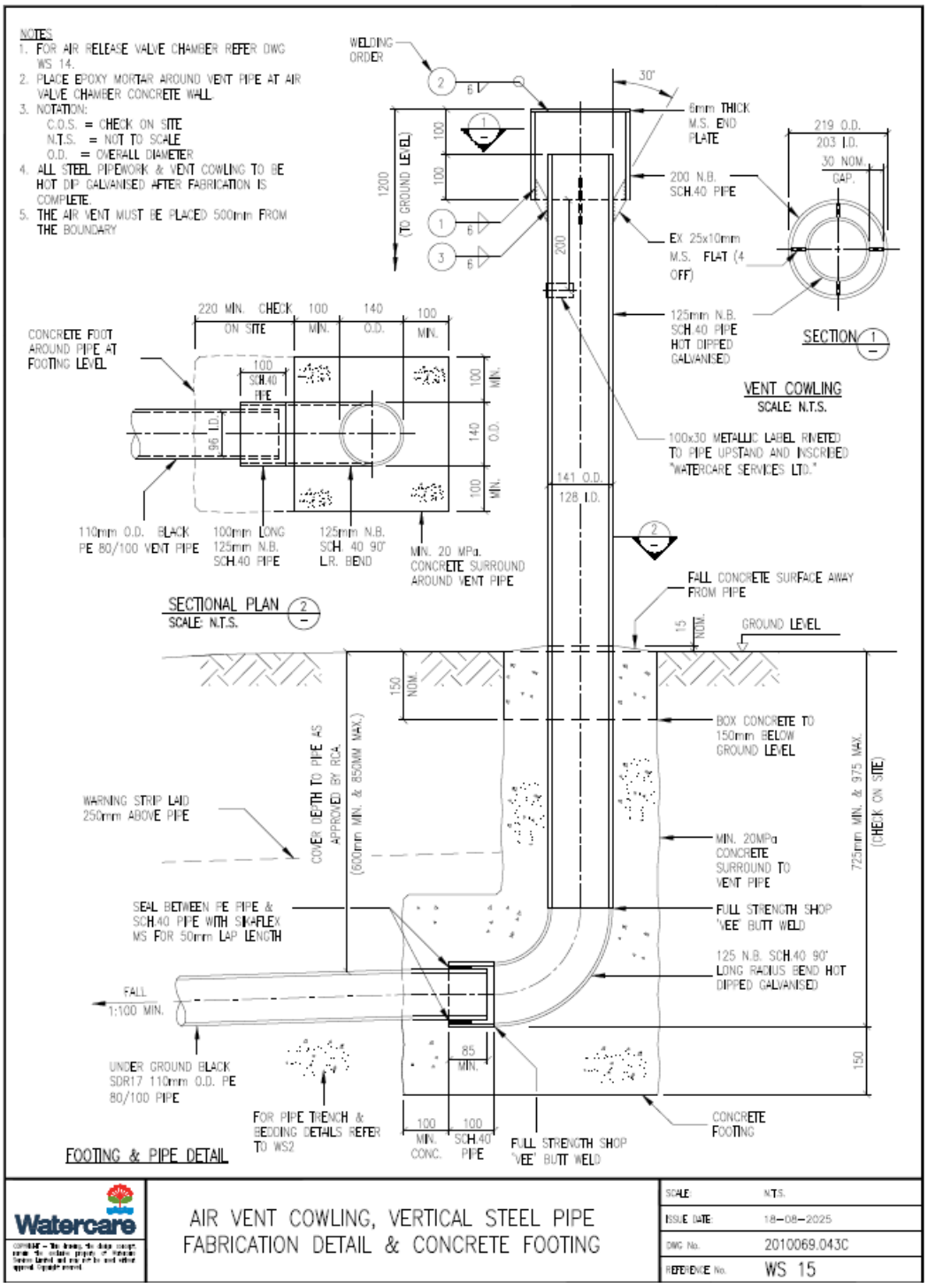
2.7.10.3 Installed example

***Figure 19**: Example of assembled air valve including a riser (if required).*

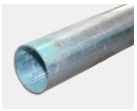
2.7.11 Air vent cowling, vertical steel pipe

Air vents are used to guide the air collected inside of an air valve chamber and discharge it to the atmosphere.

2.7.11.1 Watercare drawing (WS 15)



2.7.11.2 Material / components required

No.	1	2	3	4
Description	PE pipe	Joint sealant (Sikaflex MS)	Schedule 40 hot dipped galvanised pipe (125mm)	Cowling and end plate
Illustration				
Watercare Material Supply Standard Section	13.1.6		N/A	N/A
Manufacturing standard	AS/NZS 5065 or AS/NZS 4130	ISO 11600	AS/NZS 4792 Schedule 40	Manufactured to drawing

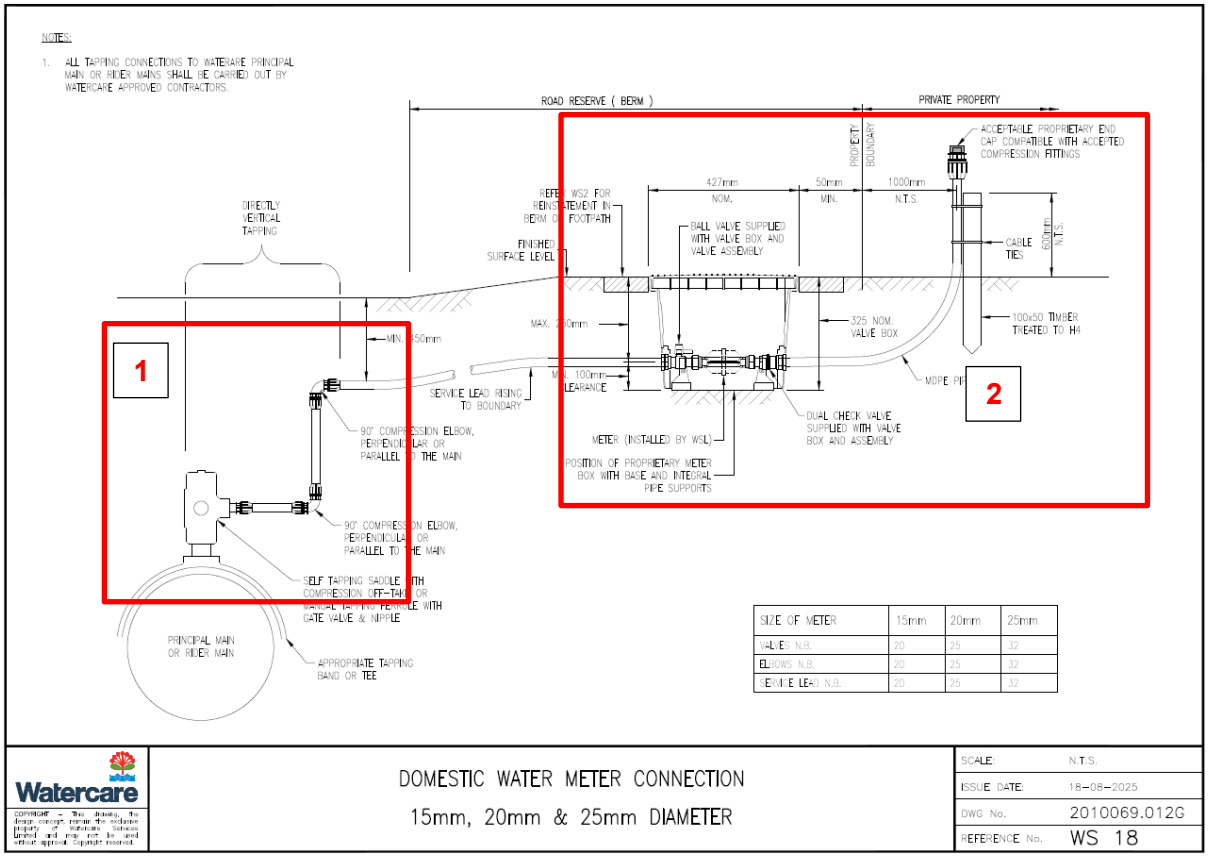
2.7.11.3 Installed example

***Figure 20**: Installed air vent, from air valve chamber.*

2.7.12 Domestic water meter connection

Domestic water meters are used to measure the water consumption of individual dwellings.

2.7.12.1 Watercare drawing (WS 18)



2.7.12.2 Material / components required

1) Tapping band, compression couplers and gate valve

No.	1	2	3	4	5	6	7
Description	Tapping band	Compression fitting	PE pipe	Compression elbow	PE pipe	Compression elbow	PE pipe
Illustration							
Watercare Material Supply Standard Section	13.3.6 13.1.7 (PE)	13.1.7 (PE)	13.1.6	13.1.7 (PE)	13.1.6	13.1.7 (PE)	13.1.6
Manufacturing standard	AS/NZS 4793 AS/NZS 4129 (PE)	AS/NZS 4129	AS/NZS 4130	AS/NZS 4129	AS/NZS 4130	AS/NZS 4129	AS/NZS 4130

2) Domestic meter

No.	1	2	3	4	5	6	7
Description	Meter box	PE pipe	Ball valve	Water meter	Dual check valve (b)	PE pipe	Compression end cap
Illustration							
Watercare Material Supply Standard Section	13.8.2	13.1.6	15.1 13.2.10	13.12.3	15.1 13.2.14	13.1.6	13.1.7 (PE)
Manufacturing standard	AS 3996 AS/NZS 4586	AS/NZS 4130	Ball valve AS/NZS 4796 Gate valves AS 1628 (a)	Multiple including OIML R49-1	AS/NZS 2845	AS/NZS 4130	AS/NZS 4129

(a) Gate valve may be used for existing like for like replacement (maintenance)

(b) Note: Dual check valve can be integrated with ball valve

2.7.12.3 Installed example

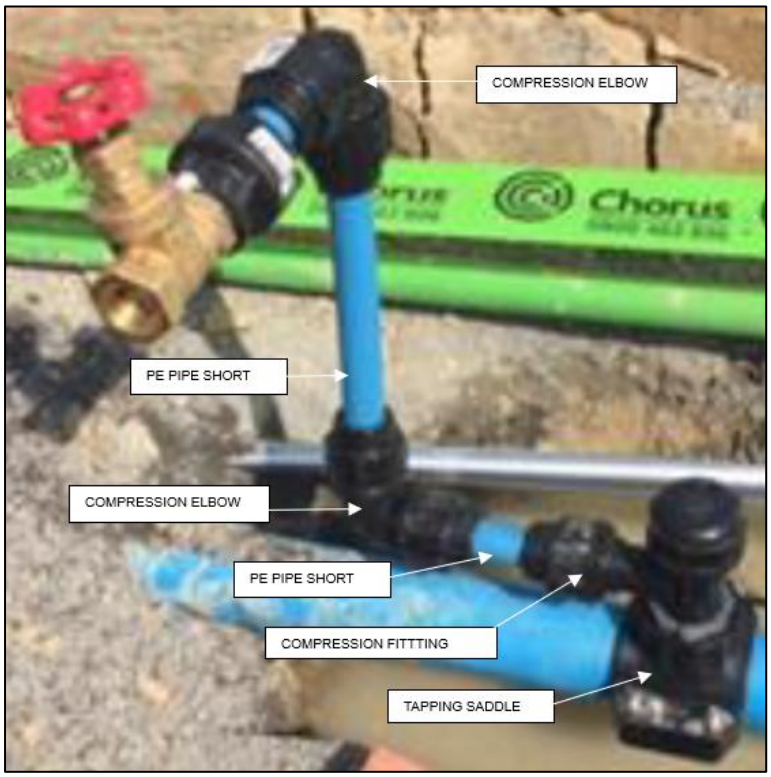


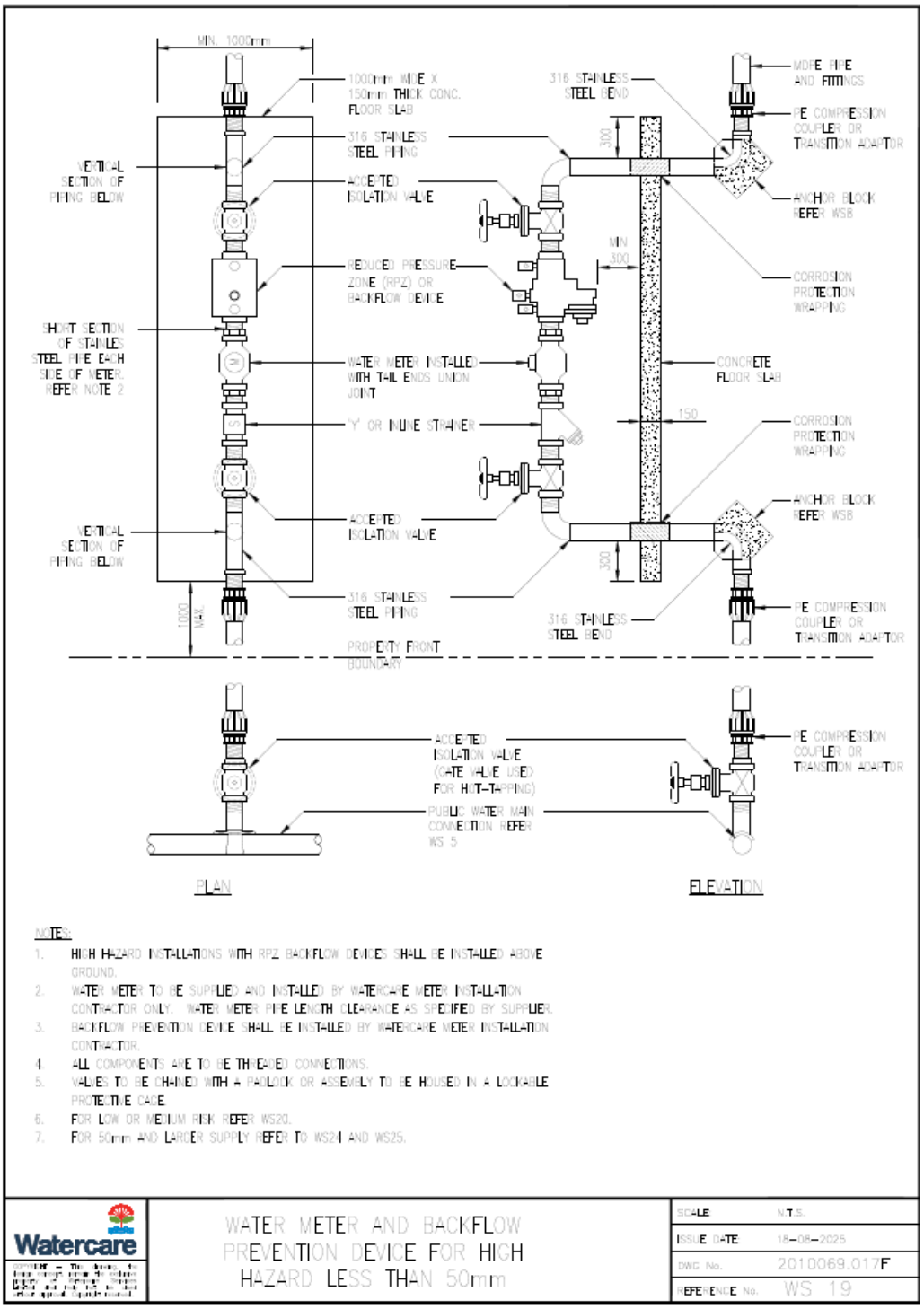
***Figure 21**: 1) Installation of a tapping band, compression couplers and gate valve.*

***Figure 22**: 2) Installed single domestic water meter.*

2.7.13 Water meter and backflow prevention device for high hazard less than 50mm (WS19)

Reduced pressure zone (RPZ) backflow prevention devices are used in high-risk areas, preventing contaminants entering the network. These devices **MUST** be installed **aboveground**, as they can cause flooding in the event of malfunction or a blockage. These devices are testable.

2.7.13.1 Watercare drawing (WS 19)



2.7.13.2 Material / components required

No.	1	2	3	4	5	6	7	8	9
Description	Stainless steel pipe	Stainless steel bends	Isolation valve	Strainer	Water meter	RPZ backflow device	Isolation valve	Stainless steel bends	Stainless steel pipe
Illustration									
Watercare Material Supply Standard Section	13.1.10	13.1.10	13.2.10 & 13.2.11	14	13.12.3	13.2.14	13.2.10 & 13.2.11	13.1.10	13.1.10
Manufacturing standard	AS 5200.053 AS 3688	AS 5200.053 AS 3688	AS 1628 BS EN 1983	DR/DZR brass	Multiple including OIML R49-1	AS/NZS 2845	AS 1628 BS EN 1983	AS 5200.053 AS 3688	AS 5200.053 AS 3688

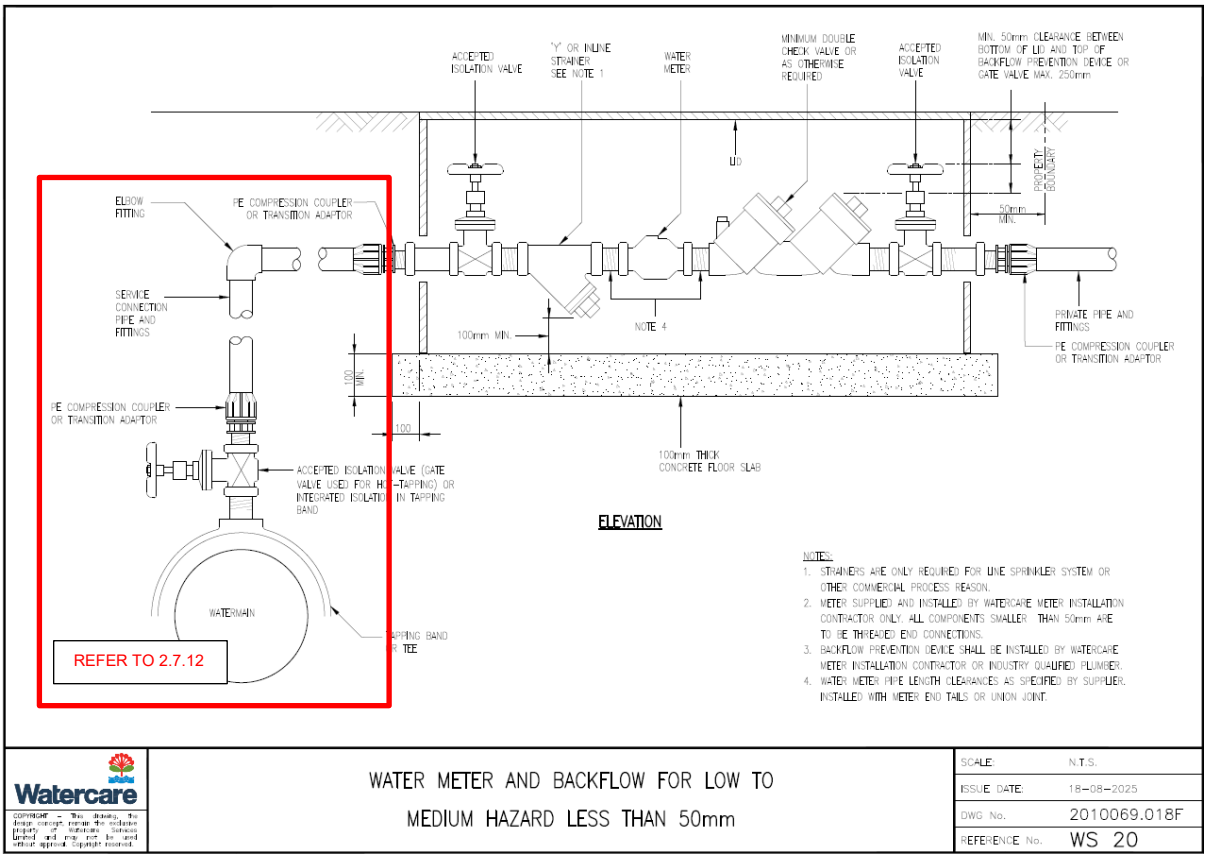
2.7.13.3 Installed example

***Figure 23**: Installed backflow prevention device for a high-hazard location.*

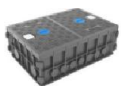
2.7.14 Water meter and backflow prevention device for medium hazard less than 50mm (WS20)

Backflow devices for medium hazard locations should as a minimum include a double check valve, as these can be tested to confirm functionality. These can be installed in an in-ground chamber (large meter box). Should an RPZ be preferred, it **MUST** be installed aboveground.

2.7.14.1 Watercare drawing (WS 19)



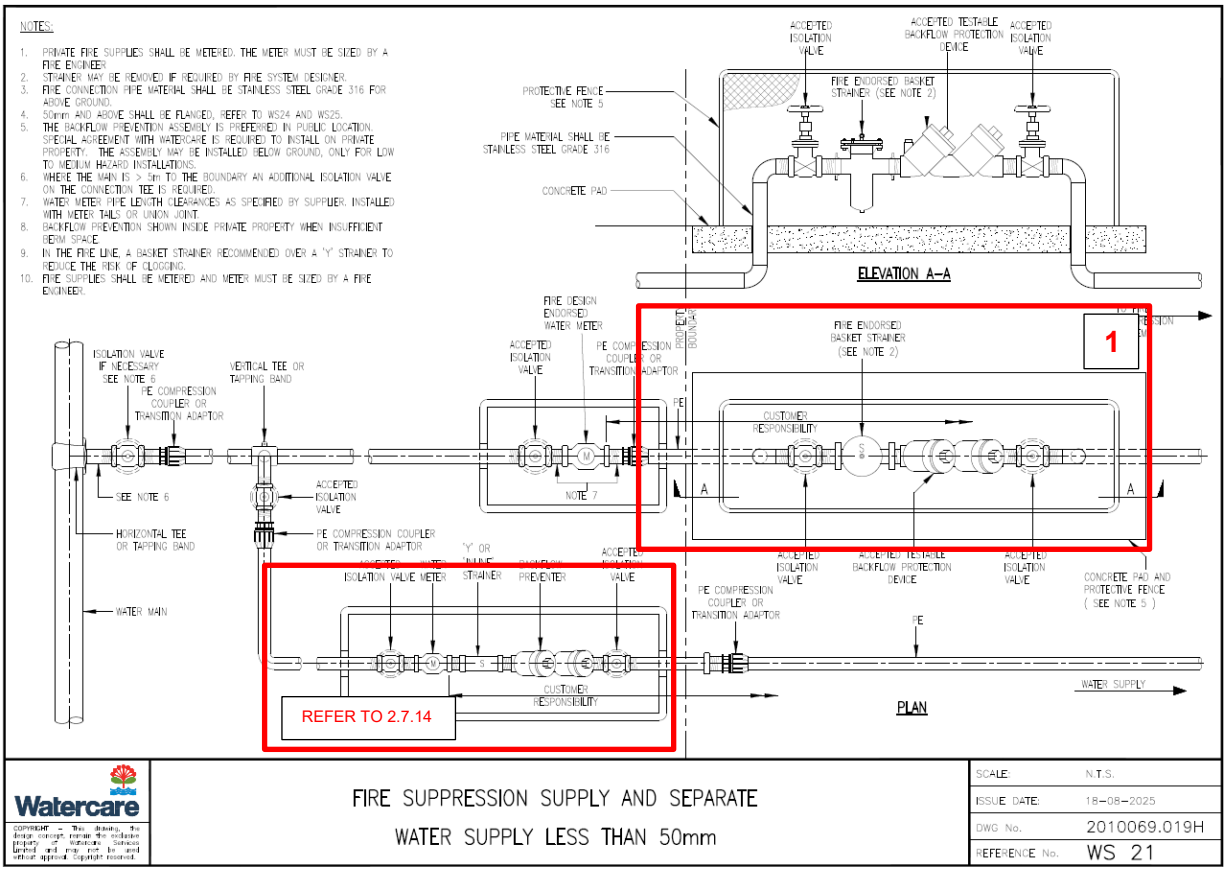
2.7.14.2 Material / components required

No.	1	2	3	4	5	6	7	8
Description	Meter box	Isolation valve	Strainer	Water meter	Double check valve	Isolation valve	Compression coupler	PE pipe
Illustration								
Watercare Material Supply Standard Section	13.8.2	13.2.10	14	13.12.3	13.2.14	13.2.10	13.1.7	13.1.6
Manufacturing standard	AS 3996 AS/NZS 4586	AS1628	DR/DZR brass	Multiple including OIML R49-1	AS/NZS 2845	AS1628	AS/NZS 4129	AS/NZS 4130

2.7.15 Fire supply and separate water supply less than 50mm (WS21)

Installations less than 50mm are generally introduced where lower demands are required for water and fire supply. These follow similar detail to other installations; however, fire endorsed basket strainers are specified (where required) for fire supply systems. Basket strainers mitigate reduced flow rates in the event of a blockage when compared to in-line or y-strainers.

2.7.15.1 Watercare drawing (WS 21)



2.7.15.2 Material / components required

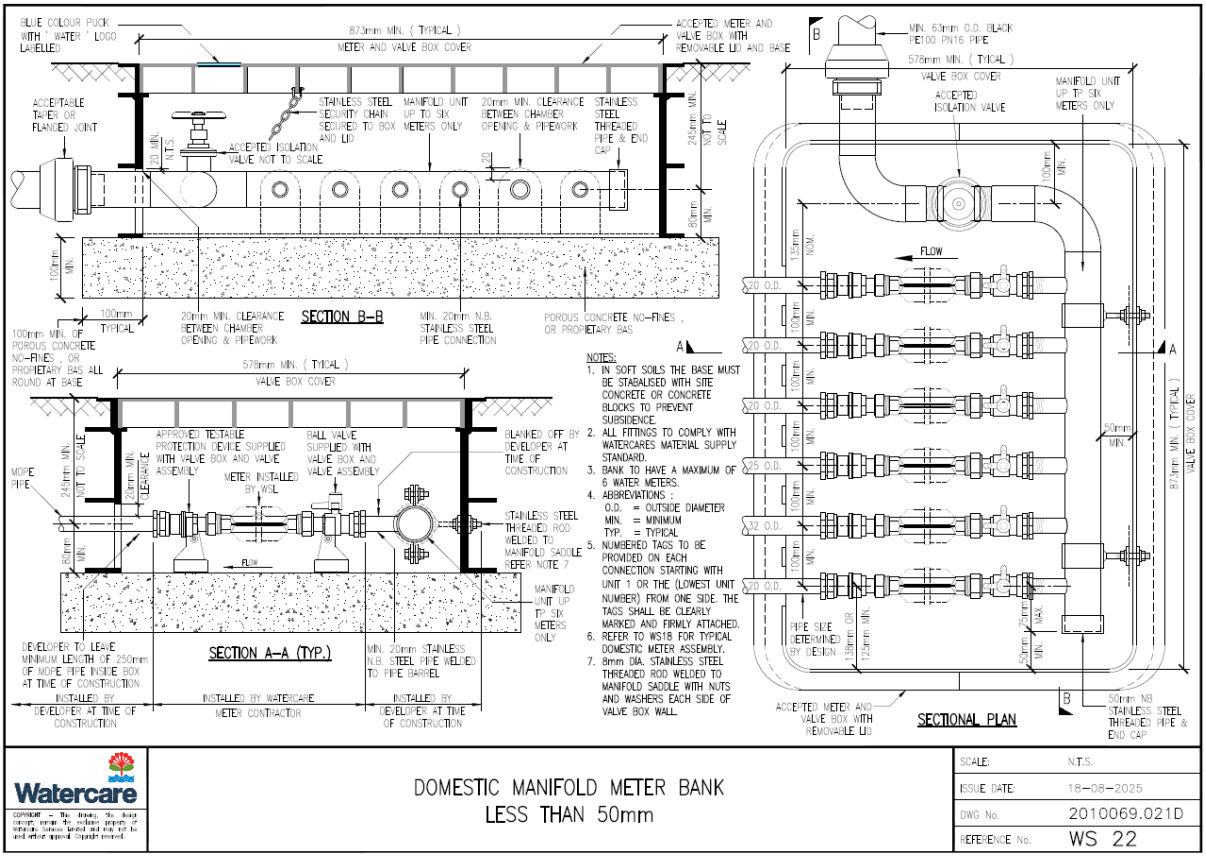
1) Fire suppression supply

No.	1	2	3	4	5	6	7	8	9
Description	Stainless steel pipe	Stainless steel bends	Isolation valve	Strainer	Water meter	Testable backflow device	Isolation valve	Stainless steel bends	Stainless steel pipe
Illustration									
Watercare Material Supply Standard Section	13.1.10	13.1.10	13.2.10 & 13.2.11	14	13.12.3	13.2.14	13.2.10 & 13.2.11	13.1.10	13.1.10
Manufacturing standard	AS 5200.053 AS 3688	AS 5200.053 AS 3688	AS 1628 BS EN 1983	To be specified	Multiple including OIML R49-1	AS/NZS 2845	AS 1628 BS EN 1983	AS 5200.053 AS 3688	AS 5200.053 AS 3688

2.7.16 Domestic manifold meter bank less than 50mm (WS22)

Domestic water meters are used to measure the water consumption of multiple (up to six) individual dwellings.

2.7.16.1 Watercare drawing (WS 22)



2.7.16.2 Material / components required

No.	1	2	3	4	5	6	7	8
Description	Meter box	Stainless steel manifold	Isolation valve	Ball valve	Water meter	Dual check valve	Compression fitting	PE pipe
Illustration								
Watercare Material Supply Standard Section	13.8.2	14	13.2.10	15.1	13.12.3	15.1 13.2.14	13.1.7 (PE)	13.1.6
Manufacturing standard	AS 3996 AS/NZS 4586	ASTM A312 - 316 Stainless Steel	AS1628	AS/NZS 4796	Multiple including OIML R49-1	AS/NZS 2845	AS/NZS 4129	AS/NZS 4130

2.7.16.3 Installed example

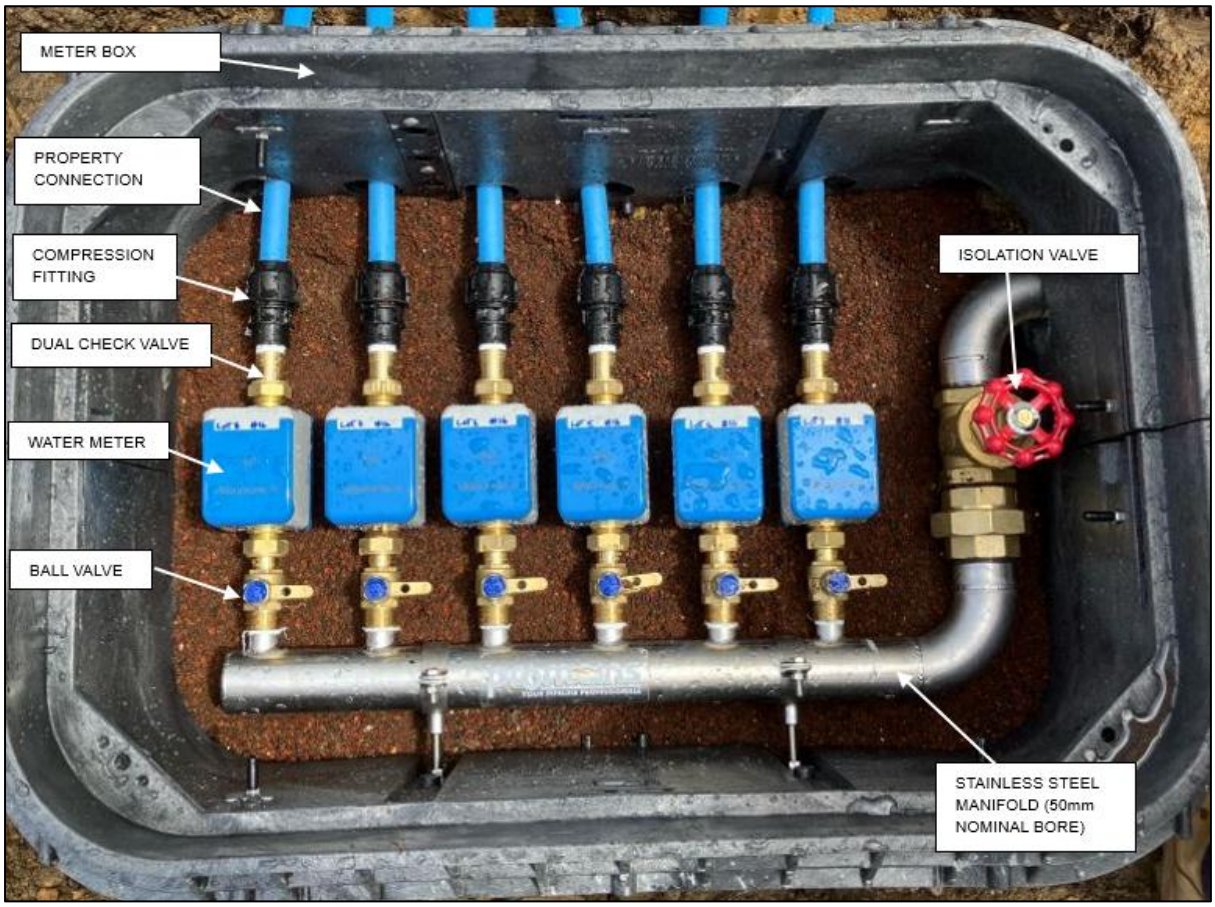
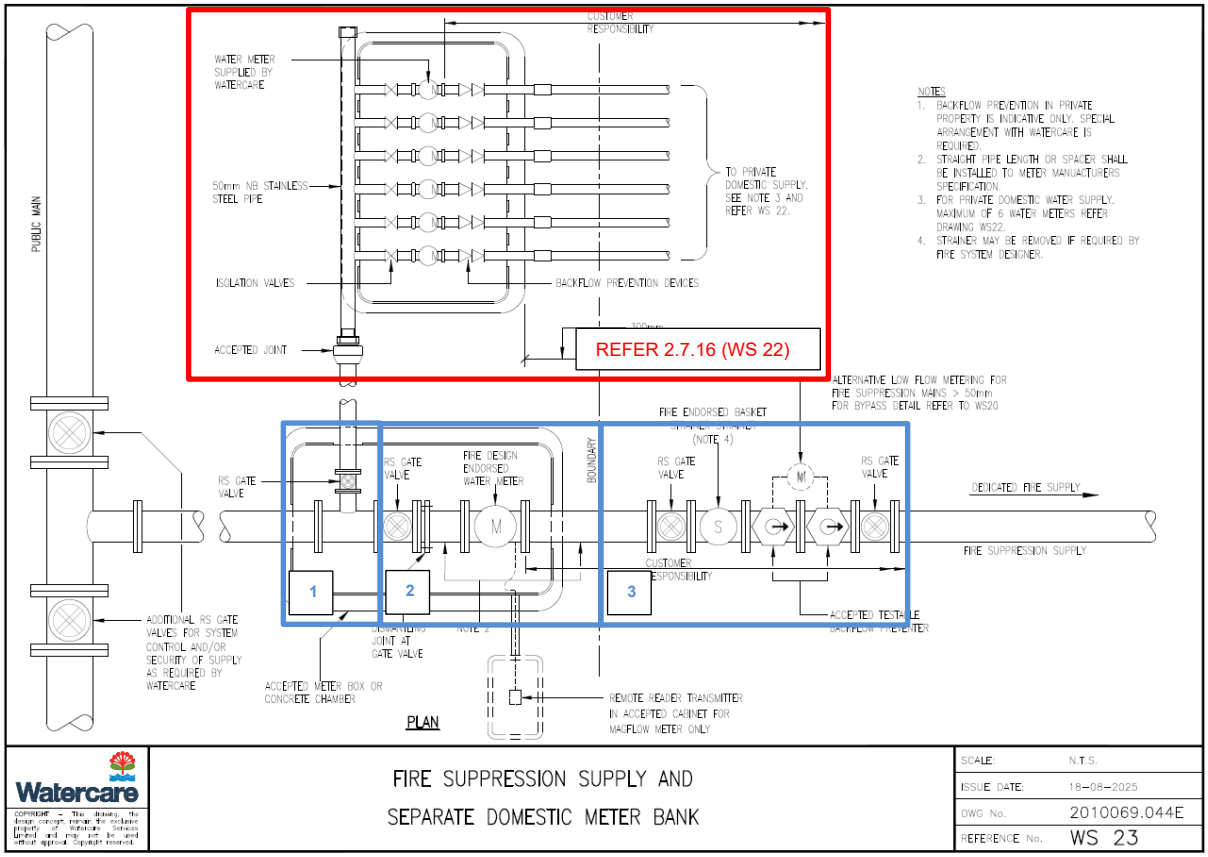


***Figure 24**: Example of installed meter bank*

2.7.17 Fire suppression supply and separate domestic meter bank (WS 23)

Installed where a development has a domestic meter bank with multiple meters and requires a separate fire suppression water pipeline to meet the necessary fire protection requirements for the building(s).

2.7.17.1 Watercare drawing (WS 23)



2.7.17.2 Material / components required

1) Offtake to separate domestic meter bank

No.	1	2	3	4	5	6	7
Description	Ductile iron tee	Dress set (gasket & bolts)	Blank flange	Threaded short	Service gate valve	Compression coupler	PE pipe
Illustration							
Watercare Material Supply Standard Section	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.1.12	N/A	13.2.1	13.1.7	13.1.6
Manufacturing standard	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2280	DZR brass	AS/NZS 2638.2	AS/NZS 4129	AS/NZS 4130

2) Fire suppression supply in meter box

No.	1	2	3	4	5	6	7	8	9
Description	Meter box	Ductile iron tee	Dress set (gasket & bolts)	Resilient seated gate valve	Dress set (gasket & bolts)	Dismantling joint	Dress set (gasket & bolts)	Water meter	Dress set (gasket & bolts)
Illustration									
Watercare Material Supply Standard Section	13.8.2	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.2.1	13.7 (gaskets) 13.5 (bolts)	13.3.2	13.7 (gaskets) 13.5 (bolts)	13.12.3	13.7 (gaskets) 13.5 (bolts)
Manufacturing standard	AS 3996 AS/NZS 4586	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2638.2	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS 1831 EN 12842 EN14525	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	OIML R49-1	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)

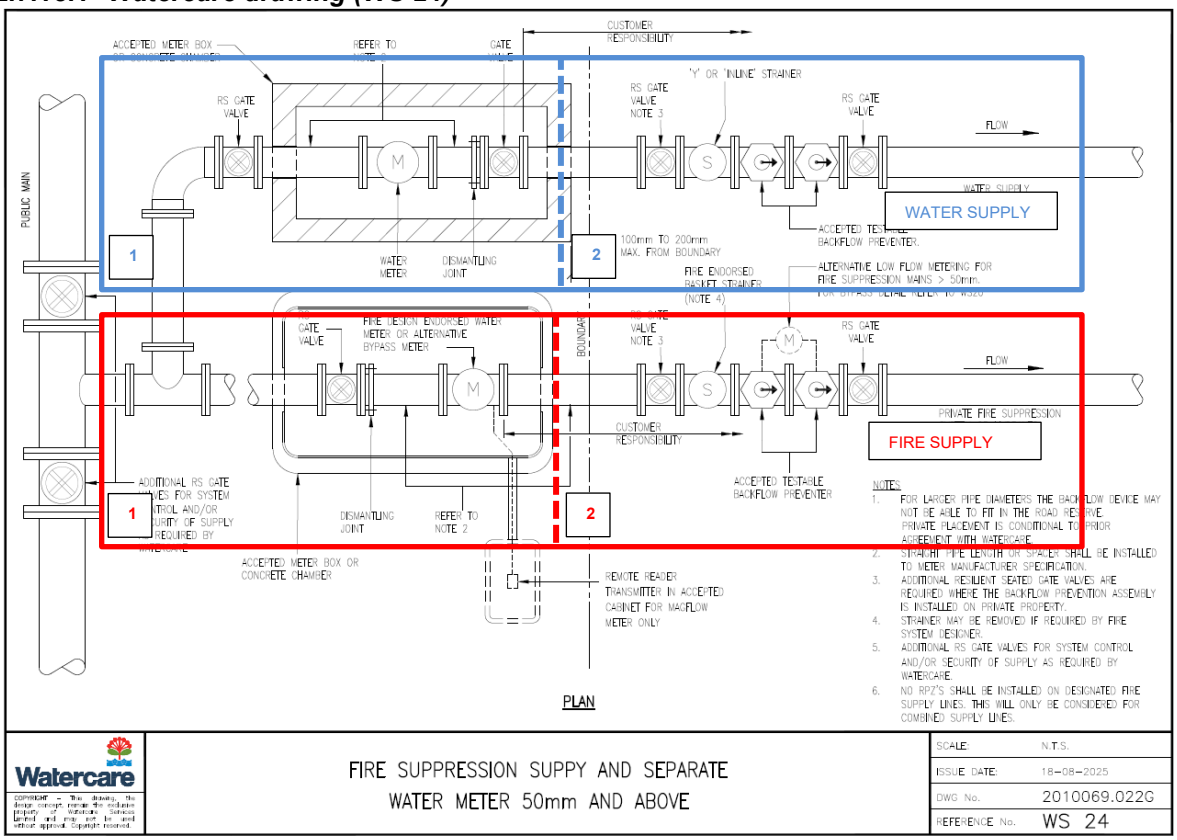
3) Valve and backflow configuration

No.	1	2	3	4	5	6	7	8	9
Description	Ductile iron pipe spool	Dress set (gasket & bolts)	Resilient seated gate valve	Dress set (gasket & bolts)	Basket strainer	Dress set (gasket & bolts)	Backflow device	Dress set (gasket & bolts)	Resilient seated gate valve
Illustration									
Watercare Material Supply Standard Section	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.2.1	13.7 (gaskets) 13.5 (bolts)	14	13.7 (gaskets) 13.5 (bolts)	13.2.14	13.7 (gaskets) 13.5 (bolts)	13.2.1
Manufacturing standard	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2638.2	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	To be specified	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2845	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2638.2

2.7.18 Fire suppression supply and separate water meter 50mm and above (WS 24)

These connections provides both water supply and a separate fire supply line for larger developments, commercial or industrial properties. A separate fire supply line is provided to measure each supply line independently and also mitigate the risk of pressure dropping in the event of fire.

2.7.18.1 Watercare drawing (WS 24)



2.7.18.2 Material / components required

Water supply

1) Water meter and box

No.	1	2	3	4	5	6	7	8	9	10	11	12
Description	Ductile iron bend	Dress set (gasket & bolts)	Resilient seated gate valve	Dress set (gasket & bolts)	Ductile iron pipe spool	Dress set (gasket & bolts)	Water meter	Dress set (gasket & bolts)	Dismant-ling joint	Dress set (gasket & bolts)	Resilient seated gate valve	Dress set (gasket & bolts)
Illustration												
Watercare Material Supply Standard Section	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.2.1	13.7 (gaskets) 13.5 (bolts)	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.12.3	13.7 (gaskets) 13.5 (bolts)	13.3.2	13.7 (gaskets) 13.5 (bolts)	13.2.1	13.7 (gaskets) 13.5 (bolts)
Manufacturing standard	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2638.2	AS 1646 (gaskets) AS 1111.1 (bolts) 1112.3 (nuts)	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts) 1112.3 (nuts)	OIML R49-1	AS 1646 (gaskets) AS 1111.1 (bolts) 1112.3 (nuts)	AS 1831 EN 12842 EN14525	AS 1646 (gaskets) AS 1111.1 (bolts) 1112.3 (nuts)	AS/NZS 2638.2	AS 1646 (gaskets) AS 1111.1 (bolts) 1112.3 (nuts)

2) Valve and backflow configuration

No.	1	2	3	4	5	6	7	8	9
Description	Ductile iron pipe spool	Dress set (gasket & bolts)	Resilient seated gate valve	Dress set (gasket & bolts)	Strainer	Dress set (gasket & bolts)	Backflow device	Dress set (gasket & bolts)	Resilient seated gate valve
Illustration									
Watercare Material Supply Standard Section	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.2.1	13.7 (gaskets) 13.5 (bolts)	14	13.7 (gaskets) 13.5 (bolts)	13.2.14	13.7 (gaskets) 13.5 (bolts)	13.2.1
Manufacturing standard	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2638.2	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	Ductile iron to comply with AS 1831	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2845	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2638.2

Fire supply

1) Water meter and box

No.	1	2	3	4	5	6	7	8	9	10	11
Description	Meter box	Ductile iron tee	Dress set (gasket & bolts)	Ductile iron pipe spool	Dress set (gasket & bolts)	Resilient seated gate valve	Dress set (gasket & bolts)	Water meter	Dress set (gasket & bolts)	Dismant-ling joint	Dress set (gasket & bolts)
Illustration											
Watercare Material Supply Standard Section	13.8.2	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.2.1	13.7 (gaskets) 13.5 (bolts)	13.12.3	13.7 (gaskets) 13.5 (bolts)	13.3.2	13.7 (gaskets) 13.5 (bolts)
Manufacturing standard	AS 3996 AS/NZS 4586	AS/NZ S 2280	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZ S 2280	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2638.2	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	OIML R49-1	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS 1831 EN 12842 EN 14525	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)

2) Valve and backflow configuration

No.	1	2	3	4	5	6	7	8	9
Description	Ductile iron pipe spool	Dress set (gasket & bolts)	Resilient seated gate valve	Dress set (gasket & bolts)	Basket strainer	Dress set (gasket & bolts)	Backflow device	Dress set (gasket & bolts)	Resilient seated gate valve
Illustration									
Watercare Material Supply Standard Section	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.2.1	13.7 (gaskets) 13.5 (bolts)	14	13.7 (gaskets) 13.5 (bolts)	13.2.14	13.7 (gaskets) 13.5 (bolts)	13.2.1
Manufacturing standard	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2638.2	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	To be specified	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2845	AS 1646 (gaskets) AS 1111.1 (bolts)	AS/NZS 2638.2

2.7.18.3 Installed example

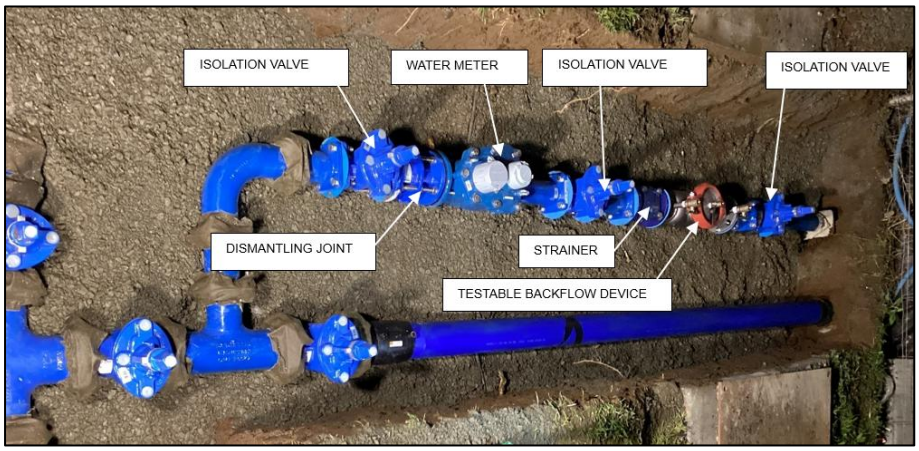


***Figure 25**: Example of installed water supply line for WS 24.*

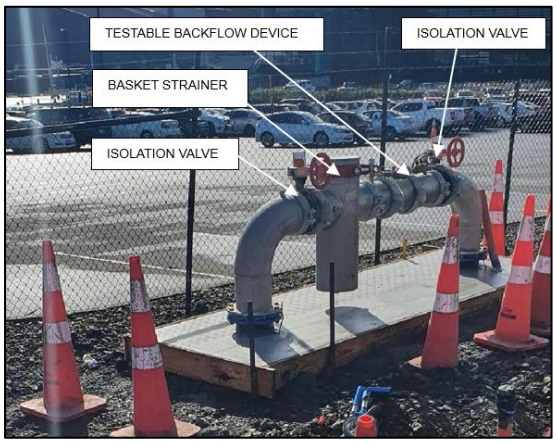
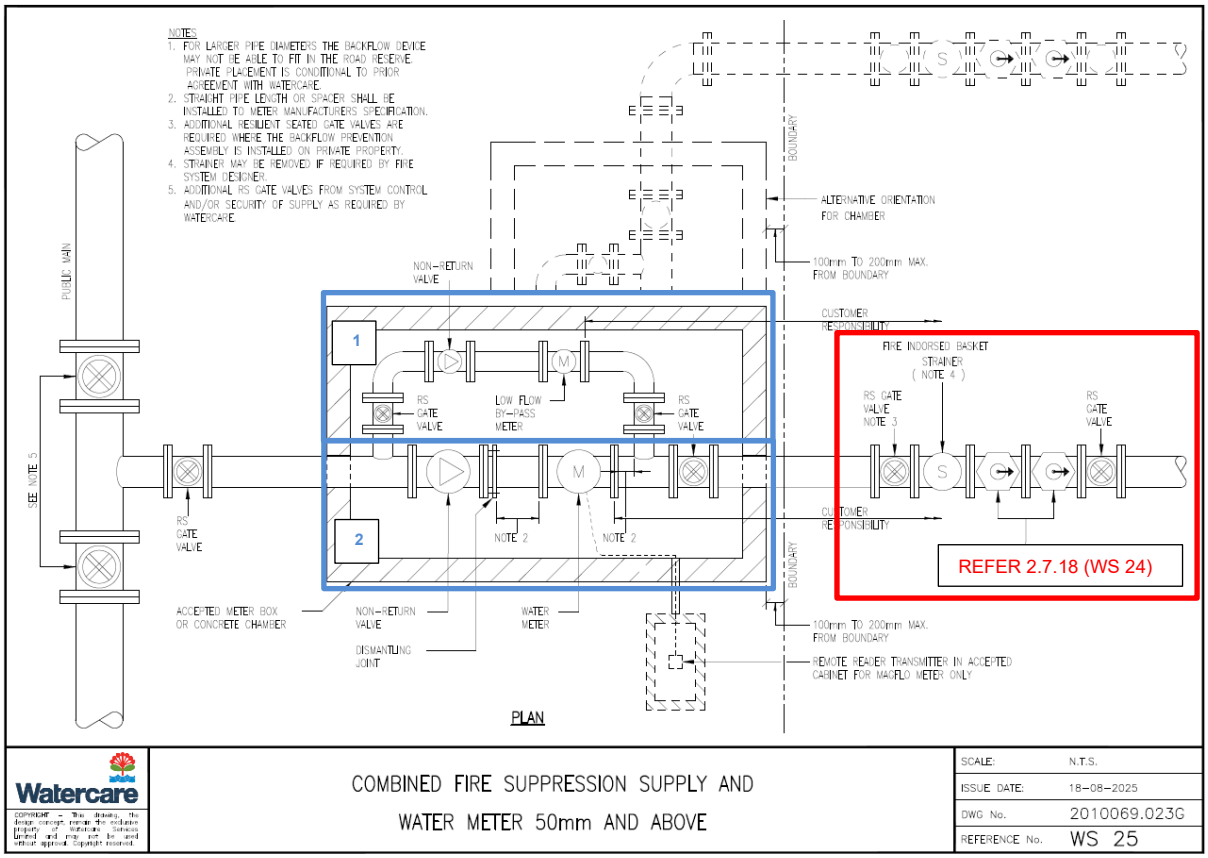


***Figure 26**: Example of a testable backflow device and endorsed basket strainer (RPZ aboveground).*

2.7.19 Combined fire suppression supply and water meter 50mm and above (WS 25)

Installed for free standing developments (single property owner) where low and high flows are expected between normal operation and water demand during fire supply.

2.7.19.1 Watercare drawing (WS 25)



2.7.19.2 Material / components required

1) Bypass configuration

No.	1	2	3	4	5	6	7	8	9	10	11
Description	Blank flange	Isolation valve	90-degree compression elbow	PE pipe	Dual check valve or ball valve with integrated check valve	Water meter	Compression fitting	PE pipe	90-degree compression elbow	Isolation valve	Blank flange
Illustration											
Watercare Material Supply Standard Section	13.1.12	13.2.10	13.1.7	13.1.6	15.1 13.2.10	13.12.3	13.1.7 (PE)	13.1.6	13.1.7	13.2.10	13.1.12
Manufacturing standard	AS/NZS 2280	AS1628	AS/NZS 4129	AS/NZS 4130	AS/NZS 2845 Ball valve AS/NZS 4796	Multiple including OIML R49-1	AS/NZS 4129	AS/NZS 4130	AS/NZS 4129	AS1628	AS/NZS 2280

2) Water meter and box

No.	1	2	3	4	5	6	7	8	9	10	11	12
Description	Meter box	Ductile iron tee	Dress set (gasket & bolts)	Non-return valve	Dress set (gasket & bolts)	Dismant-ling joint	Dress set (gasket & bolts)	Water meter	Dress set (gasket & bolts)	Ductile iron tee	Dress set (gasket & bolts)	Resilient seated gate valve
Illustration												
Watercare Material Supply Standard Section	13.8.2	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.2.12	13.7 (gaskets) 13.5 (bolts)	13.3.2	13.7 (gaskets) 13.5 (bolts)	13.12.3	13.7 (gaskets) 13.5 (bolts)	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.2.1
Manufacturing standard	AS 3996 AS/NZS 4586	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS 4794	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS 1831 EN 12842 EN 14525	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	OIML R49-1	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2638.2

2.7.19.3 Installed example

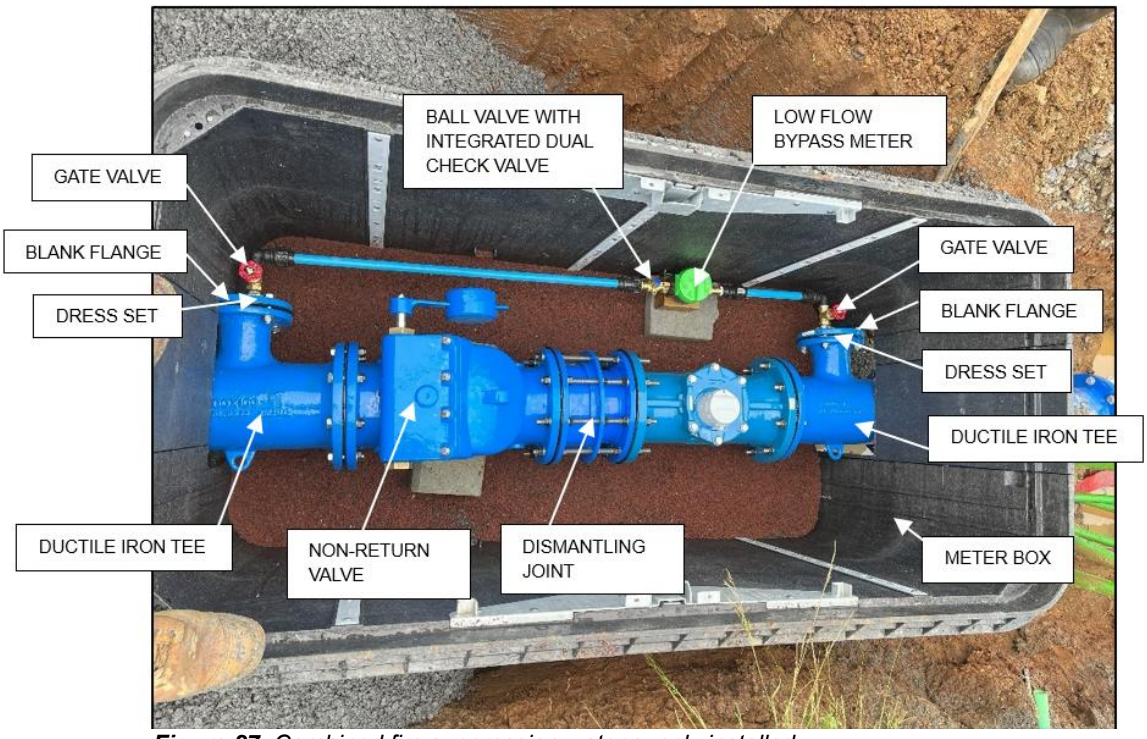
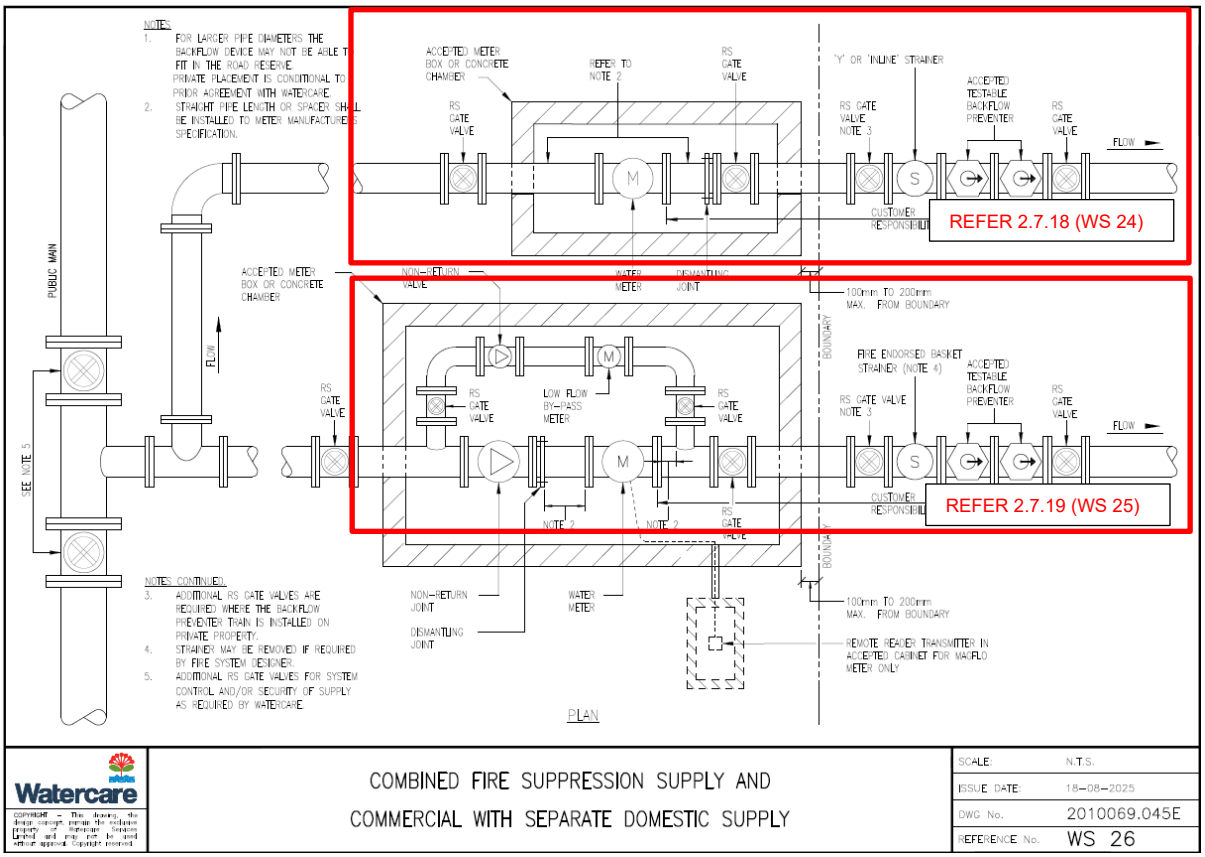


***Figure 27**: Combined fire suppression water supply installed.*

2.7.20 Combined fire suppression supply and commercial with separate domestic supply (WS 26)

In addition to WS 25, there is also a requirement for a domestic water supply.

2.7.20.1 Watercare drawing (WS 26)

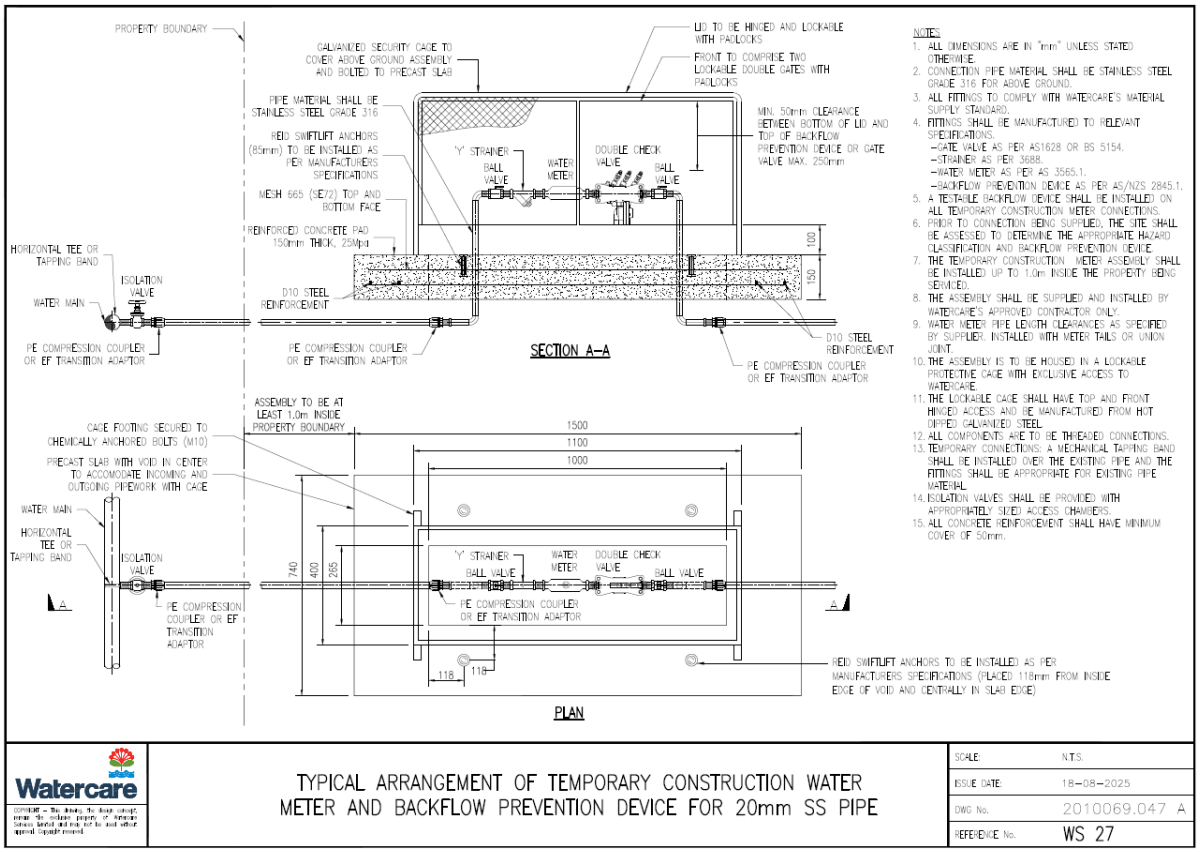


2.7.21 Typical arrangement of temporary construction water meter and backflow prevention device for 20mm SS pipe (WS 27)

Temporary construction water meters are installed at sites to supply water for consumption and the works to be carried out. Depending on the size of the site and supply required a 20mm or 50mm connection can be made available by Watercare.

Note: Temporary construction meters can only be installed and removed by Watercare's approved contractor. Standpipe connections to hydrants are **NOT ALLOWED**.

2.7.21.1 Watercare drawing (WS 27



2.7.21.2 Material / components required

No.	1	2	3	4	5	6	7	8	9
Description	Stainless steel (or DZR brass) pipe	Stainless steel (or DZR brass) bends	Isolation valve	Strainer	Water meter	Double check valve (minimum)	Isolation valve	Stainless steel (or DZR brass) bends	Stainless steel (or DZR brass) pipe
Illustration									
Watercare Material Supply Standard Section	13.1.10	13.1.10	13.2.10 & 13.2.11	14	13.12.3	13.2.14	13.2.10 & 13.2.11	13.1.10	13.1.10
Manufacturing standard	AS 5200.053 AS 3688	AS 5200.053 AS 3688	AS 1628 BS EN 1983	DR/DZR brass	Multiple including OIML R49-1	AS/NZS 2845	AS 1628 BS EN 1983	AS 5200.053 AS 3688	AS 5200.053 AS 3688

2.7.21.3 Installed example

***Figure 28**: Installed 20mm diameter temporary construction water meter.*

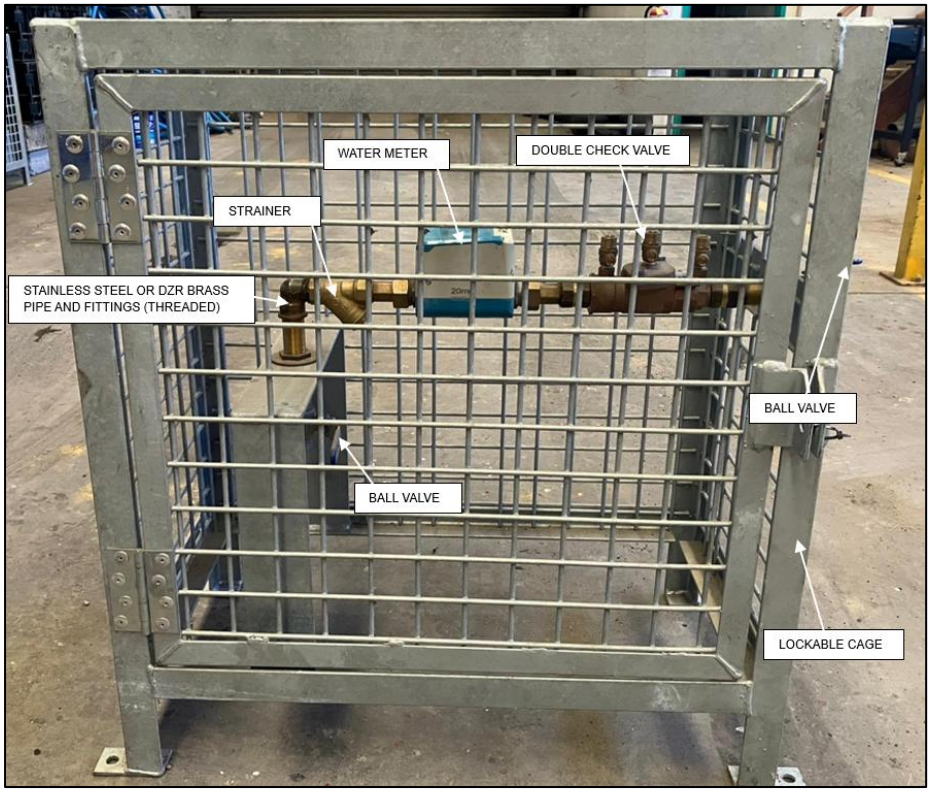
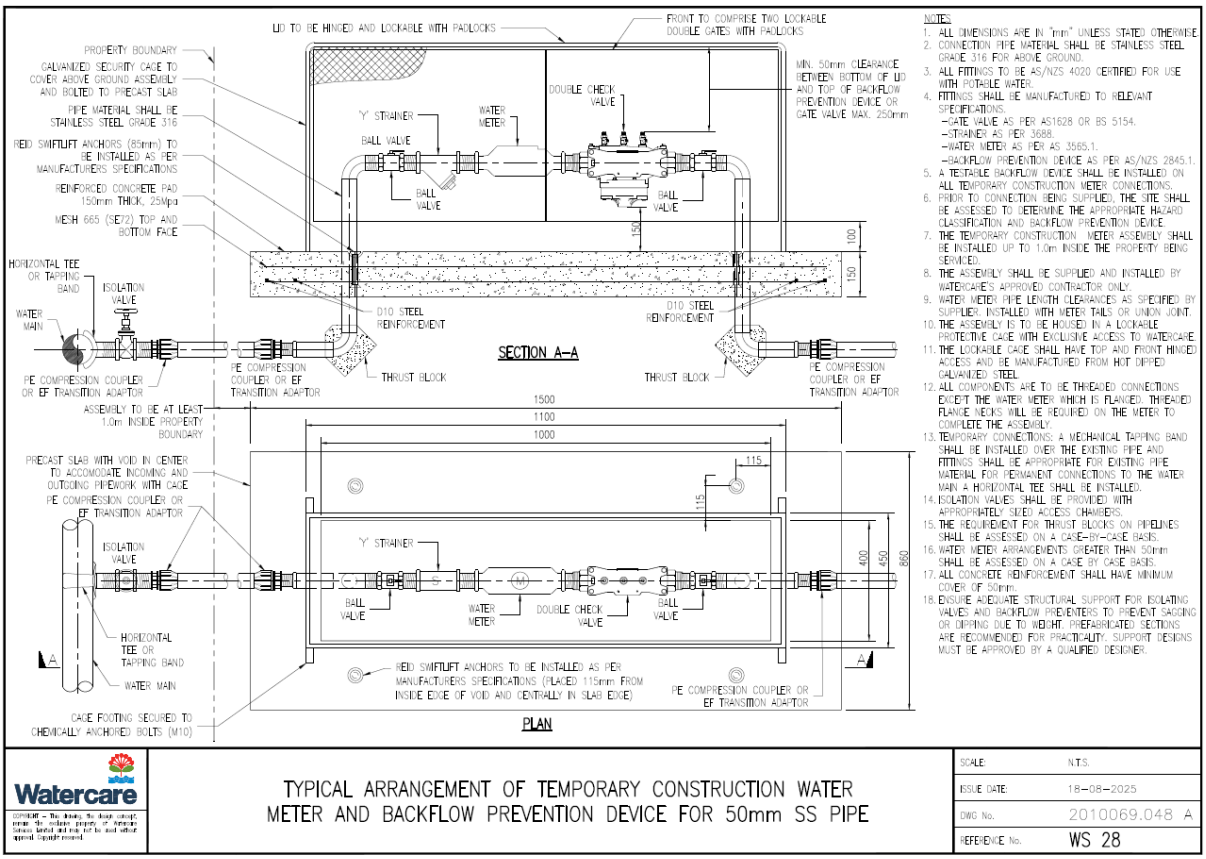


***Figure 29**: Assembled 20mm diameter temporary construction water meter.*

2.7.22 Typical arrangement of temporary construction water meter and backflow prevention device for 50mm SS pipe (WS 28)

For function, see Section 2.7.21.

2.7.22.1 Watercare drawing (WS 28)



2.7.22.2 Material / components required

No.	1	2	3	4	5	6	7	8	9	10	11
Description	Stainless steel (or DZR brass) pipe	Stainless steel (or DZR brass) bends	Isolation valve	Strainer	Blank flange	Water meter	Blank flange	Double check valve (minimum)	Isolation valve	Stainless steel (or DZR brass) bends	Stainless steel (or DZR brass) pipe
Illustration											
Watercare Material Supply Standard Section	13.1.10	13.1.10	13.2.10 & 13.2.11	14	13.1.12	13.12.3	13.1.12	13.2.14	13.2.10 & 13.2.11	13.1.10	13.1.10
Manufacturing standard	AS 5200.053 AS 3688	AS 5200.053 AS 3688	AS 1628 BS EN 1983	DR/DZR brass	AS/NZS 2280 or Stainless steel 316	Multiple including OIML R49-1	AS/NZS 2280 or Stainless steel 316	AS/NZS 2845	AS 1628 BS EN 1983	AS 5200.053 AS 3688	AS 5200.053 AS 3688

2.7.22.3 *Installed example*

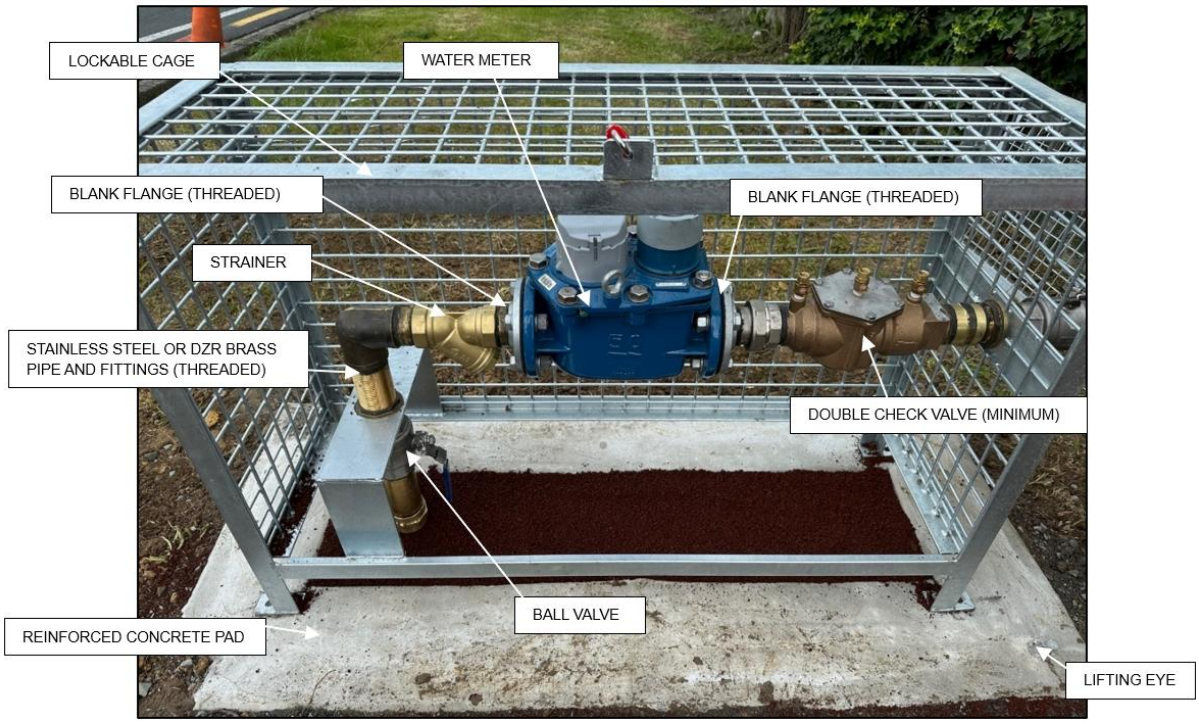
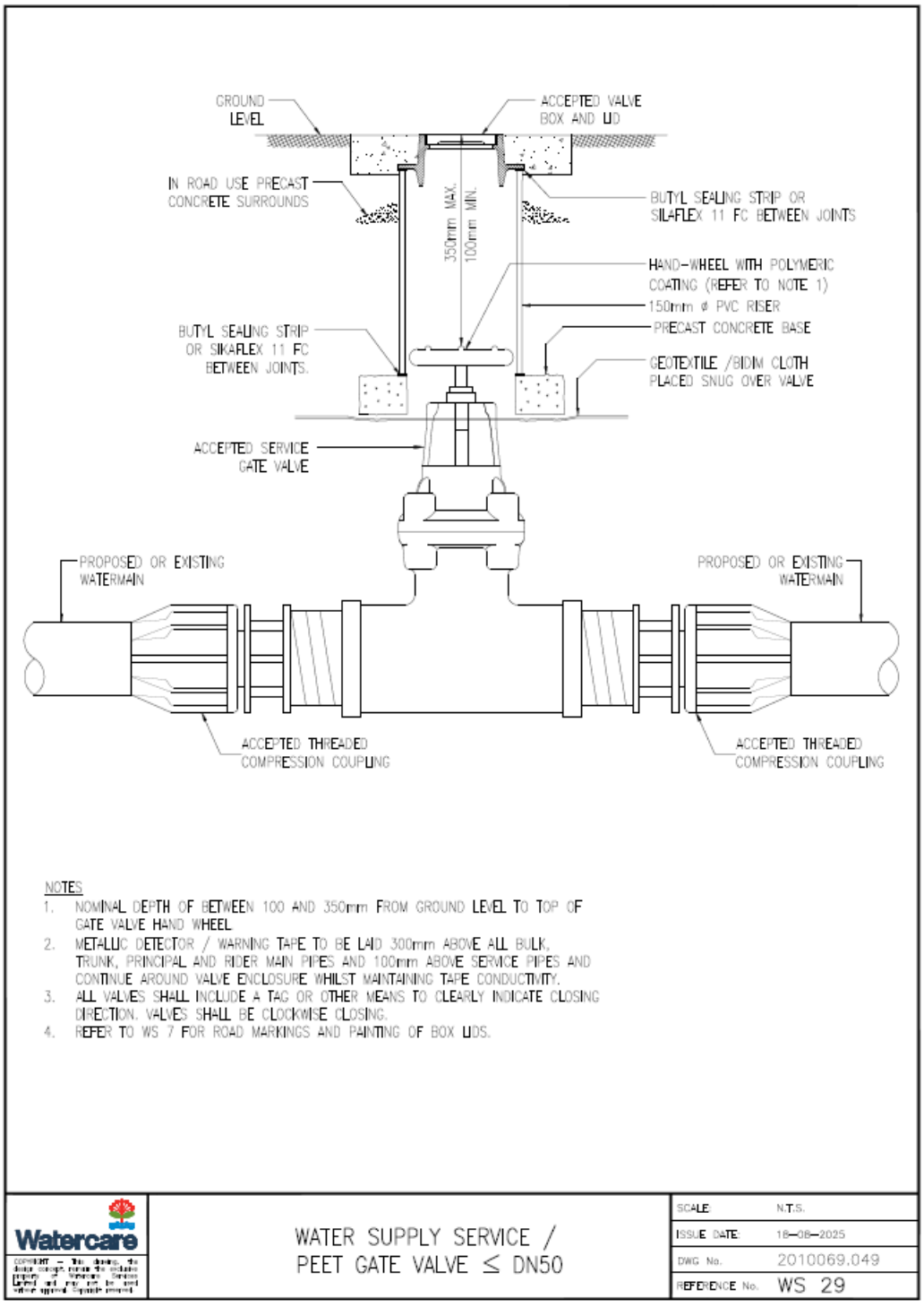


***Figure 30**: Installed 50mm diameter temporary construction water meter.*

2.7.23 Water supply service / peet gate valve ≤ 50mm (WS 29)

Service valves located on rider mains are normally DN50 threaded valves. These allow isolation of rider mains to minimise disruption (pressure loss) to the principal network, should any maintenance or repair work be required on rider mains.

2.7.23.1 Watercare drawing (WS 29)



2.7.23.2 Material / components required

No.	1	2	3	4	5
Description	PE pipe	Compression coupler	Service gate valve	Compression coupler	PE pipe
Illustration					
Watercare Material Supply Standard Section	13.1.6	13.1.7	13.2.1	13.1.7	13.1.6
Manufacturing standard	AS/NZS 4130	AS/NZS 4129	AS/NZS 2638.2	AS/NZS 4129	AS/NZS 4130

2.7.23.3 Assembled example

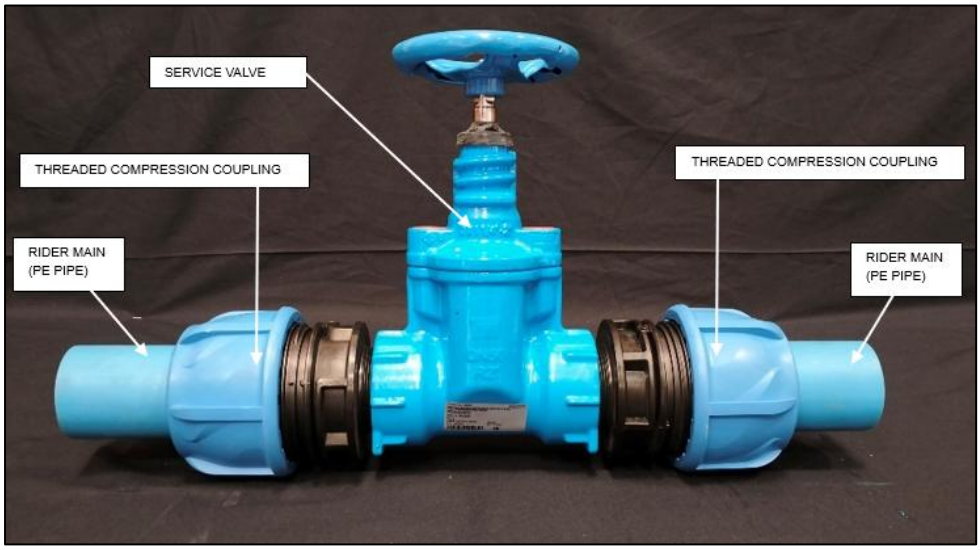
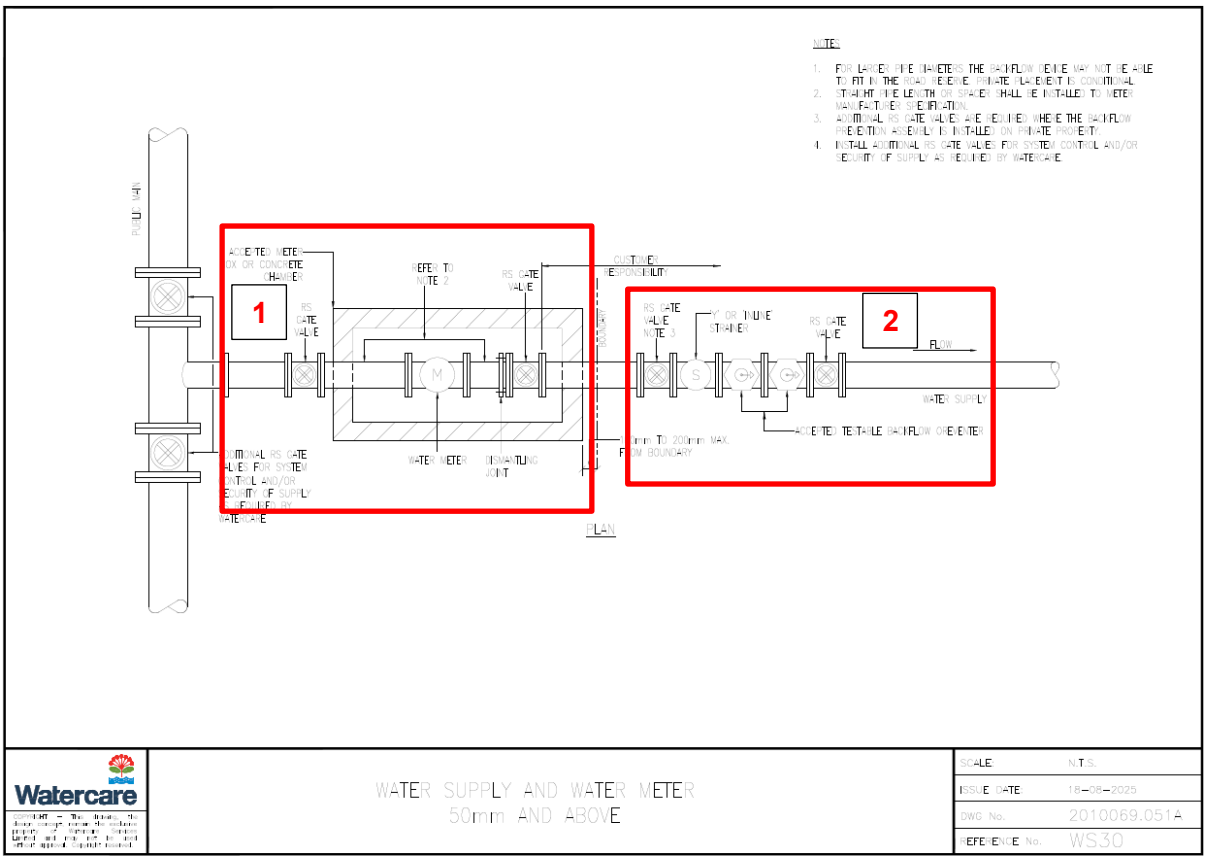


***Figure 31**: Example of an assembled service valve*

2.7.24 Water supply and water meter 50mmΦ and above (WS31)

These larger diameter meters serve big developments (bulk meter), commercial or industrial properties, where a greater water supply is required.

2.7.24.1 Watercare drawing (WS 31)



2.7.24.2 Material / components required

1) Water meter and box

No.	1	2	3	4	5	6	7	8
Description	Ductile iron tee	Dress set (gasket & bolts)	Resilient seated gate valve	Dress set (gasket & bolts)	Meter box	Water meter	Dismantling joint	Resilient seated gate valve
Illustration								
Watercare Material Supply Standard Section	13.1.11 & 13.1.12	13.7 (gaskets) 13.5 (bolts)	13.2.1	13.7 (gaskets) 13.5 (bolts)	13.8.2	13.12.3	13.3.2	13.2.1
Manufacturing standard	AS/NZS 2280	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS/NZS 2638.2	AS 1646 (gaskets) AS 1111.1 (bolts) AS 1112.3 (nuts)	AS 3996 AS/NZS 4586	OIML R49-1	AS 1831 EN 12842 EN 14525	AS/NZS 2638.2

2) Valve and backflow configuration

No.	1	2	3	4	5	6	7
Description	Resilient seated gate valve	Dress set (gasket & bolts)	Strainer	Dress set (gasket & bolts)	Backflow device	Dress set (gasket & bolts)	Resilient seated gate valve
Illustration							
Watercare Material Supply Standard Section	13.2.1	13.7 (gaskets) 13.5 (bolts)	14	13.7 (gaskets) 13.5 (bolts)	13.2.14	13.7 (gaskets) 13.5 (bolts)	13.2.1
Manufacturing standard	AS/NZS 2638.2	AS 1646 (gaskets) AS 1111.1 (bolts)	Ductile iron to comply with AS 1831	AS 1646 (gaskets) AS 1111.1 (bolts)	AS/NZS 2845	AS 1646 (gaskets) AS 1111.1 (bolts)	AS/NZS 2638.2

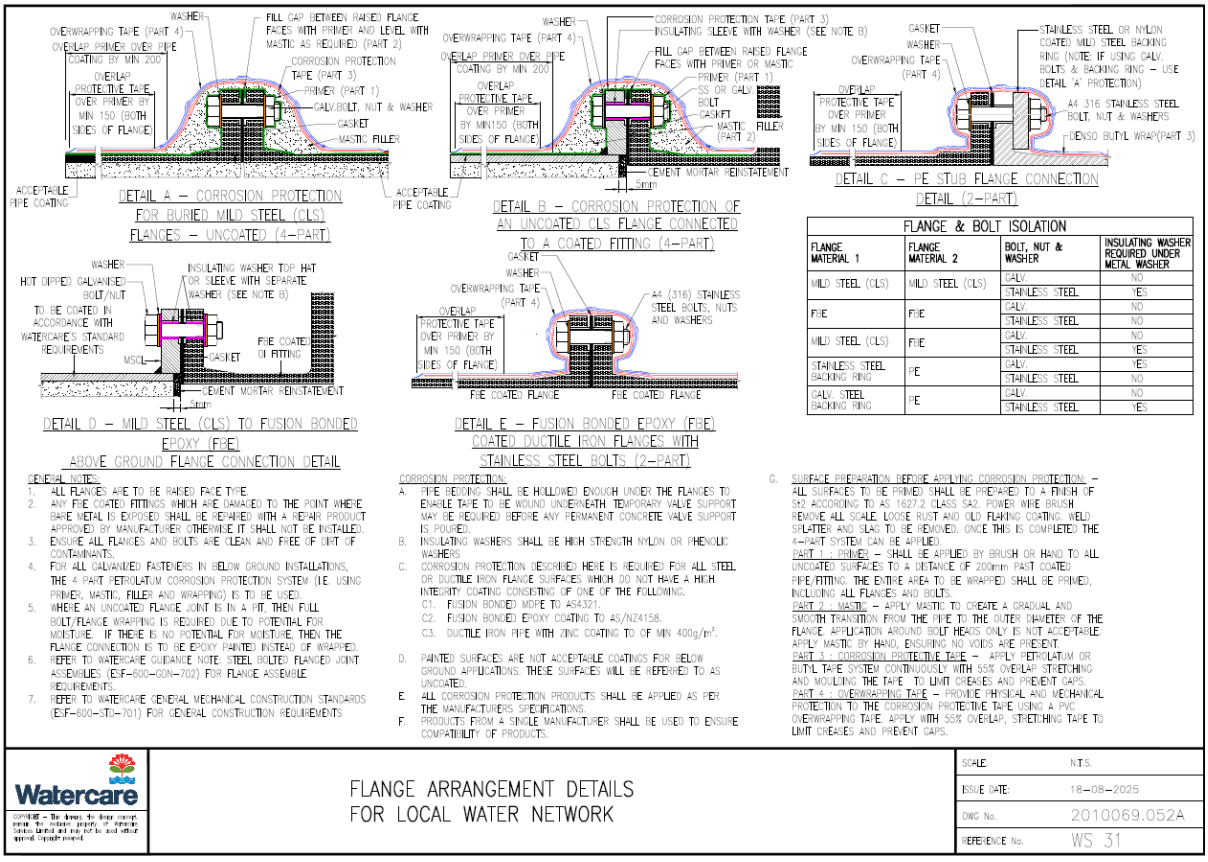
2.7.24.3 Installed example

For installed example, see Section 2.7.18.

2.7.25 Corrosion protection wrapping (WS31)

Wrapping systems are used to protect steel (including bolts and nuts) or uncoated fittings against corrosion. It is used to preserve these external components against in-ground (buried) conditions.

2.7.25.1 Watercare drawing (WS 31)



2.7.25.2 Material / components required

No.	1	2	3	4
Description	Primer	Mastic	Corrosion protection tape	Over wrap (PVC)
Illustration				
Watercare Material Supply Standard Section	13.10.1	13.10.1	13.10.1	13.10.1
Manufacturing standard	N/A	N/A	N/A	N/A

2.7.25.3 Installed example

***Figure 32**: Application of primer (Part1)*

***Figure 33**: Application of mastic (Part2)*

***Figure 34**: Application of corrosion protection tape (Part3)*

***Figure 35**: Application of overwrap PVC tape (Part4)*

3. Asset protection

3.1 Tracer wires

The ability to detect services is crucial in preventing damage to existing services. Most newly installed water network pipelines are polyethylene, although other materials are also used from time to time depending on site conditions. Polyethylene or other plastic materials such as PVC-U are non-conductive, suggesting that service detection devices wont easily locate these pipelines. For this reason, tracer wires are required where non-metallic pipes are installed.

a) A suitable trace wire system from the Material Supply Standard shall be selected, including the proprietary splicing and test point fittings.
b) Tracer wire shall be secured to the pipe at three metre intervals.
c) When placing a tapping band on the pipe, ensure that the tracer wire is not placed between the pipe and tapping band and provide adequate slack over the fitting. The wire shall be protected from excavation works.
d) With exception of approved spliced connections, the tracer wire shall be continuous from between valve chambers or connection/trace points.
e) No breaks or cuts are permitted.
f) Spliced or repaired connections to the tracer wire shall be made using proprietary splice fittings.
g) The tracer wire shall be secured to the outside of the valve sleeve and brought up to the valve box to a point 100mm below the surface and an additional 500mm of slack in such a manner as not to interfere with the working of the valve or damage the wire.
h) The main line tracer wire shall follow hydrant laterals up to and back from the hydrant and then continue along the watermain.
i) The testing for functionality will only be undertaken after confirmation that the installation has been completed.
j) Trace wire installations shall be verified during testing using typical low frequency (512Hz) line tracing equipment. This shall be witnessed by the Contractor and Watercare's representative prior to acceptance.
k) A test certificate shall be supplied to Watercare on the outcome of the test.

The following products and methods are not acceptable:

- Uninsulated trace wire
- Trace wire insulations other than HDPE
- Non locking, friction fit, twist on or taped connectors
- Brass or copper ground rods
- Wire connections utilizing taping or spray-on waterproofing
- Looped wire or continuous wire installations, that has multiple wires laid side-by-side or in close proximity to one another
- Trace wire wrapped around the pipeline
- Brass fittings with trace wire connection lugs
- Wire terminations within the roadway, i.e. in valve boxes, cleanouts, manholes, etc.
- Connecting trace wire to existing conductive utilities

Additionally, pipe installed by open trenched methods shall have an applicable **blue warning tape** e.g. “CAUTION – WATER MAIN BELOW” or an approved equivalent of minimum 100mm width located at 500mm above the pipe.

4. Testing of pipelines

Pressure testing of water pipelines shall be carried out in accordance with AS/NZS 2566.2 & AS/NZS 2033.

- Constant pressure test (water loss method) can be used for pipes of all sizes and different materials – Refer to Appendix M4 and M5 of AS/NZS 2566.2.
- Pressure rebound test method can be used **for PE** pipe systems **up to DN 355**.
- Test lengths should not exceed 1000m.
- Pressure testing of pipeline shall not be carried out against closed valves.
- Test pressure shall be 1.25 times the maximum working pressure or maximum 1.25 times the pressure rating of the pipe (the test pressure **shall NOT exceed 1.25 times the pipe’s pressure rating**)
- Leave all bolted or flanged joints exposed to allow for re-tensioning after testing.

Useful links:

- Watercare’s General Civil Construction Standard
- https://www.iplex.co.nz/assets/Uploads/Poly-Pete-How-I-Field-Test-PE-Pressure-Pipelines.pdf
- https://www.watersandfarr.co.nz/wp-content/uploads/Testing.pdf
- https://pipa.com.au/wp-content/uploads/2020/08/TN005-Notes-on-Hydrostatic-Field-Pressure-Testing-of-PE-Pipes.pdf

Note: The links above provide supplementary information only and does not supersede the AS/NZS 2566.2 and 2033 standards.

5. Disinfection

All pipelines and fittings must be disinfected before going into service. This allows the line to be flushed and cleaned, ensuring no contaminants are present. The Contractor shall follow Watercare’s Code of Practice for Disinfection of Water Systems.

Appendix A – Example inspection and test plan (ITP)

The example inspection and test plan provide the basis for quality assurance requirements of standard pipeline installations. Each step requires an action which may involve a hold point, witnessing or monitoring the work. These actions are defined as follows:

Hold point (H)

- **Definition**: A mandatory inspection point beyond which work **cannot proceed without formal approval**.
- **Who is involved**: Usually Watercare's representative or an approved inspector.
- **Action required**: Work must stop until the hold point is released, typically after a successful inspection or test.
- **Example**: Pressure testing of a pipeline before backfilling.

Witness Point (W)

- **Definition**: An inspection point where Watercare's inspector has the **right to witness** the activity, but **work may proceed if they are not present**.
- **Who is involved**: Watercare or third-party (construction monitoring) inspector is notified in advance.
- **Action required**: The contractor proceeds with the activity if the witness party does not attend within the agreed timeframe.
- **Example**: Compaction testing.

Monitor Point (M)

- **Definition**: An inspection or test that is **recorded and documented**, but **no Watercare representative or third-party attendance is required**.
- **Who is involved**: Typically performed and recorded by the contractor or internal QA/QC team.
- **Action required**: Results are submitted for review; no interruption to work.
- **Example**: Materials stored on site or erosion and sediment control.

No:	Inspection / Test Point / Action	ACTION (Hold, Monitor, Witness)	Detail	Frequency / Timing	Inspection / Test Method submission, visual inspection, testing, measure, review	Conformance Criteria	Records	Initials	MSQA Initials (Grey if not required)	Date(s)
PRE-CONSTRUCTION										
1	Construction drawings and specifications from Designer(s)	H	Construction drawings and specifications from Client/ Engineer	Pre-construction	Document Review	Engineering Plan Approval (EPA) - This should include approved Erosion and Sediment Control Plan (ESCP) (if required)	Drawing Transmittal			
2	Ensure Resource Consent(s) are obtained (if required)	W	Check that all relevant Resource Consent(s) have been obtained	Pre-construction	Document Review	Detail Consent Conditions in the relevant Management Plan(s).	Construction Management Plan			
3	Pre-construction meeting	H	Prior to commencing works, a pre-start meeting to be held with Watercare engineer / inspector to confirm work scope etc	Pre-construction	Document Review	All stakeholders to be present	Meeting Minutes			
4	Pre-works Inspection (Pre-condition survey)	W	Contractor to arrange a joint inspection of the relevant areas, within and outside the working areas, with Watercare, Engineer, and relevant landowners/ occupiers	Pre-construction	Visual Inspection	Confirmation in writing from all parties that the record is a true representation of the inspection (Important for record keeping and comparison at final reinstatement works)	Time stamped photos with location			
5	Pre-construction meeting with arborist (if required)	H	Prior to any tree works, a pre-start meeting to be held on site with arborist	Pre-construction	Document Review	Arrange one off pre-start meeting with arborist.	Arborist Report			
6	Permits	H	Obtain all necessary permits to enable works	As required	Document Review	Weekly Excavation Permit, Confined Space Entry, Excavation Checklist, any stand overs as required by Service Providers	Signed documents			
7	Site induction and safety	H	Site induction JSA Site specific safety plan and emergency procedures	Pre-construction	Document Review	Staff to sign following induction and review safety plans	Signed records			
8	Erosion and Sediment Controls	M	Monitor effectiveness of the ESCP Controls throughout the construction process	Ongoing	Visual Inspection	Compliance with CMP and Auckland Council COP (GD05)	Photos			
9	Tree owner approval (if required)	H	Obtain all necessary approvals to enable works	Pre-construction	Document Review	Documented tree owner approval from asset owner	Signed records			
10	Trees	M	Trees within vicinity of works to be fenced and protected	Pre-construction	Visual Inspection	Trees fenced and no storage or stockpiling of materials within drip line of trees	Photos			
11	Obtain utility / services plans and records	M	Before u dig Plans provided by utilities As-built records	Pre-construction	Visual Inspection	Source all available records of existing services / structures that may be located around the alignment of the works (or may be influenced by the works - e.g. structures)	Records			

No:	Inspection / Test Point / Action	ACTION (Hold, Monitor, Witness)	Detail	Frequency / Timing	Inspection / Test Method submission, visual inspection, testing, measure, review	Conformance Criteria	Records	Initials	MSQA Initials (Grey if not required)	Date(s)
12	Site mark-out	M	Set out of existing services on-site using marker spray	Pre-construction	Visual Inspection	All services set out prior to location (pot-holing / hydro-excavation)	Photos			
13	Survey Setout	H	Setout pipe alignment, bends location and inverts as required by design	Pre-construction	Survey receipt / amended plans	Locate property boundaries, Design Drawings and contract specs	Survey receipt	**N/A**		
14	Locate existing services by non-destructive excavation methods no closer than 500mm	H	Ensure all services conflicting with the line of trench has been exposed by hydro excavation (hydrovac) or hand digging	Pre-construction	Potholing	All conflicts have been located. New services and/or conflicts to be advised to Project Manager. As-built all services	As-built Drawings Doc. Review	**N/A**		
15	Materials on site - correctly stockpiled and / or secured	W	Material stored on site as per Supplier's requirements **Note: all pipes stored on site should be capped to prevent contamination**	Pre-construction	Visual Inspection	Material Certificates to be supplied Contract Specs	Product dockets Site Diary Product Name / Supplier			
16	Pipes to be checked	W	Check pipe upon arrival	Pre-construction	Visual Inspection	No visual damage, eccentricity and dimensions to: AS/NZS 4130 - PE Pipe AS/NZS 2280 - Ductile Iron Pipe AS 1579 / ISO 559 - CLS Pipe	Photos			
17	Welders' qualifications, training, competency etc to be checked	W	Welders to be trained, certified and competent to undertake work	Pre-construction	Document Review / Filed	**PE Pipes**: Welder holds NZQA recognised qualification - Unit Standards 31532, 31524 & 31525 as well as a Welding Accreditation Card. Experience to be in pipe size and type. **Steel Pipes**: ISO 9606 / AS/NZS 3992 / ASME Experience to be in pipe size and type.	Documents			

No:	Inspection / Test Point / Action	ACTION (Hold, Monitor, Witness)	Detail	Frequency / Timing	Inspection / Test Method submission, visual inspection, testing, measure, review	Conformance Criteria	Records	Initials	MSQA Initials (Grey if not required)	Date(s)
18	Welding machine calibration to be checked	W	Welding machine / equipment must be calibrated	Pre-construction	Document Review	Calibration of equipment within the last 12 months. The Contractor shall provide a calibration certificate for each machine prior to pre-construction welds. Welding machinery should generally be serviced twice a year (and more often if they are used heavily). The contractor shall provide evidence of service records for the machinery to be used during the welding process. **Specific to PE Welding** Butt welding equipment shall conform to ISO 12176-1: Plastics pipes and fittings – Equipment for fusion jointing polyethylene systems. Part 1: Butt fusion - **NOTE: No Manual Equipment allowed** Electrofusion control boxes shall conform to ISO 12176-2: Plastic pipes and fittings – Equipment for fusion jointing polyethylene systems. Part 2: Electrofusion. The electrofusion control box shall be an automatic bar code scanner machine.	Documents			
19	Pre-Qualifying Weld Tests	H	Destruction test weld completed. One weld per welder, per machine, per pipe	Pre-construction	Test	All welds ductile. NATA/IANZ accredited laboratory testing to ISO 13953/4/6,	Report			
20	Electrofusion Destructive Testing	H	Strip Bend Test	Pre-construction	Test	A longitudinal specimen is cut axially through the joint and undergoes a side bend test as described by ISO 21751	Report			
21	Power leads	W	Certified by electrician	3 monthly tagging	Visual Inspection	No visual damage, must be tagged	Photos			
CONSTRUCTION										
22	Pipe storage (Refer to item above - this would be relevant to materials received during construction - PE, DI, Steel (CLS)	M	Pipe to be stored as per manufacturer's recommendations	Ongoing	Visual Inspection	Pipe ends capped, stacked safely, less than 3m high, pipe ends clear.	Photos			

No:	Inspection / Test Point / Action	ACTION (Hold, Monitor, Witness)	Detail	Frequency / Timing	Inspection / Test Method submission, visual inspection, testing, measure, review	Conformance Criteria	Records	Initials	MSQA Initials (Grey if not required)	Date(s)
23	Pipe Inspection	W	Pipe branding- Pipe Material, Size, Pressure Rating, SDR details (PE pipes).	Ongoing	Visual Inspection	Check that details on drawings aligns with pipe material details Prior to installation inspection to check the pipes and pipe coatings are free from damage PE pipes - No scratches more than 10% of the pipe thickness. - Out of roundness at pipe end does not exceed 5% of pipe wall thickness	Photos			
24	Pipe Installation QA sheet	W	QA check sheet for each pipe string	Ongoing	Checklist	Pipe laid to correct line, level and grade; bedding, backfill and compaction, reinstatement (This should be captured at 10m chainage intervals) - signed off by supervisor **Note: Compaction testing is only relevant to open trench installations**	Documents			
25	Pipelaying accuracy - Drilling/ open cut	W	Within 30mm of both line and level	Ongoing	Survey	Construction Drawings	As-built			
26	Trench Bedding and Preparation	W	Use SAP7 / Certified GAP7 fines	Ongoing	Visual inspection	Bedding depth per design	Photos			
27	Pipe Laying	W	Pipes laid to design alignment, restrained / thrust protection installed where required	Ongoing	Visual Inspection	Pipes laid to correct alignment Sleeve placement around pipes / fittings installed in concrete Adequate cover and clearance from other services	Photos			
28	Data logging of welds	M	All welds logged and recorded	Ongoing	Review	Watercare General Civil Construction Standard Watercare General Mechanical Construction Standard	Documents			
29	Tent / welding shelter	M	Welding shelter established as required	Ongoing	Visual Inspection	Tent must cover all sides.	Photos			
30	Pipe ends sealed during welding	W	Pipe ends sealed while welding carried out	Ongoing	Visual Inspection	Watercare General Civil Construction Standard Watercare General Mechanical Construction Standard	Photos			
31	Welding area	M	Clean working space, no mud or standing water on trench floor	Ongoing	Visual Inspection	Area must be kept clean	Photos			
32	Butt weld parameters	H	Calculated by pipe size and type	Ongoing	Review	Tolerances to POP003	Documents			
33	Heater plate readings	W	Heater plate readings to be recorded for each weld	Ongoing	Measure	Tolerances to POP003 Daily Heater Plate Temperature QA check sheet	Documents			

No:	Inspection / Test Point / Action	ACTION (Hold, Monitor, Witness)	Detail	Frequency / Timing	Inspection / Test Method submission, visual inspection, testing, measure, review	Conformance Criteria	Records	Initials	MSQA Initials (Grey if not required)	Date(s)
34	EF Pipe surface preparation	W	Mechanical peeling tool used to prep pipe Witness marks to be clearly marked to minimise internal gap.	Ongoing	Measure	>0.2mm <0.5mm material removed	Document/Photos			
35	Weld beads	W	Welder's certification number must be stamped on the bead of each butt weld.	Ongoing	Measure	Tolerances to POP003 Bead shape and appearance - Visual Bead Testing - external bead itself can be removed and tested by twisting or bending the removed bead to provide non-destructive assessment of weld integrity. No de-beading required	Photos			
36	Construction weld test	H	PE Pipes: Welds must be ductile. NATA / IANZ accredited laboratory test to ISO 13953/4/6 Steel pipes: Non-destructive testing (NDT)	Testing 5% (1 in 20), or a minimum of 2 welds shall be removed and tested (contract must allow for this) Steel Pipes - Refer to Watercare's General Mechanical Construction Standard	Submission	PE Pipes: NATA / IANZ accredited laboratory test to ISO 13953/4/6 Steel Pipes: Refer to Watercare's General Mechanical Construction Standard	Report		Engineer's Representative	
37	Joint Assembly - DI	M	Lubrication, lock placement, sleeve placement where in contact with concrete	Each joint	Visual inspection	joint fully inserted with lock rings and sleeves in place	Photos			
38	Mechanical Fittings - Flanges	M	AS/NZS 4087 Raised face flanges to be used.	Every mechanical fitting and flanged connection	Inspect/ Measure	Correct size, pattern and class as per specification and IFC drawings Flange faces shall be free of paint unless otherwise specified (some applications may require the factory paint to remain, such as for wastewater), grease, oil or any other foreign material.	Documents			
	Gasket	M	Solid blue EPDM, complaint with AS/NZS 4020. NO reinforced or natural rubber gaskets shall be used. Refer to Section 13.7 of Watercare's **Material Supply Standard** for a list of acceptable suppliers.	All Flanged fittings	Visual Inspection	Gaskets shall be procured from an accepted supplier and be blue in colour with AS/NZS 4020 certification. Gaskets shall be stored flat in a relaxed state. No other material may be placed on top of stored gaskets, and they shall be protected from sunlight and chemicals. Gaskets shall be inspected for any defects such as bulges, protruding reinforcing or any other markings. The inner diameter of the gasket shall be larger than the inner diameter of the connecting flanges and be the correct size for the flange and bolt holes.	Bolting QA sheet			

No:	Inspection / Test Point / Action	ACTION (Hold, Monitor, Witness)	Detail	Frequency / Timing	Inspection / Test Method submission, visual inspection, testing, measure, review	Conformance Criteria	Records	Initials	MSQA Initials (Grey if not required)	Date(s)
	Jointing Assembly	M	**Step 1**: Hand tighten the assembly to between 15 Nm and 30 Nm (but not exceeding 20% of the target torque "T" value). This ensure that the flanges are fitted up snug and uniformly against the gasket. **Step 2**: Tighten to 20% - 30% of the target torque "T", while monitoring the flange gap around the circumference of the assembly. Ensure that that the gap is kept continuously uniform. Adjust appropriately if required. **Step 3**: Tighten to 50% - 70% of the target torque "T", while monitoring the flange gap around the circumference of the assembly. Ensure that that the gap is kept continuously uniform. Adjust appropriately if required. **Step 4**: Tighten to 100% of the target torque "T", while monitoring the flange gap around the circumference of the assembly. Ensure that that the gap is kept continuously uniform. Adjust appropriately if required. **Step 5**: Continue tightening the bolts, but in a circular clockwise pattern until no further rotation occurs at 100% target torque. **Step 6**: Wait 4-hours following the final torquing (Step 5) and repeat Step 5 to account for any short-term creep relaxation or embedment losses. This may also be required following pressure testing where the test pressure is higher than the operating pressure. **Note: Where polyethylene (PE) flanged joints are installed, the bolts shall be re-torqued after 12-24 hours of the initial installation to account for short term relaxation of the PE stub flange.**	All Flanged fittings	Review	Refer to Watercare's General Mechanical Construction Standard	Bolting QA sheet			
	Fasteners - Bolts /Nuts/Washers	M	Refer to Watercare's General Mechanical Construction Standard. Bolts are correct length and grade for the application. Bolts are correct length and grade for the application. Washers are correct diameter and thickness. Bolt threads are cleaned and well lubricated with an accepted lubricant. The nut must be able to be screwed by hand onto the bolt for the full thread length and but must not be loose on the bolt thread.	All Flanged fittings	Review	Refer to Watercare's General Mechanical Construction Standard A high-quality solid type lubricant such as molybdenum disulphide (Molykote 1000 or Loctite 771), or NCH Thread-Eze Ultra shall be used for bolts	Bolting QA sheet			
39	Tracer wire installed (for PE / Plastic pipes)	W	Installed accepted tracer wire along the pipe	Ongoing	Visual Inspection	Tracer wire shall be secured to the pipe at three metre intervals. Refer to Watercare's General Civil Construction Standard	Photos			

No:	Inspection / Test Point / Action	ACTION (Hold, Monitor, Witness)	Detail	Frequency / Timing	Inspection / Test Method submission, visual inspection, testing, measure, review	Conformance Criteria	Records	Initials	MSQA Initials (Grey if not required)	Date(s)
40	Warning tape installed - any pipe laid by trenching	W	Install accepted warning tape	Ongoing	Visual Inspection	Warning tape shall be blue for water (AS/NZ 2648) Installed 500mm above pipeline Minimum width 100mm Strip should read "CAUTION WATER MAIN BELOW)	Photos			
41	Pipe surround clegg test	W	Clegg Hammer to confirm 90% MDD	Min.2 tests on each layer of backfill per 10m	Test	Refer to Watercare's General Civil Construction Standard Watercare Standard Drawing Set ESF-500-FOR-101 (DW02)	Report			
42	GAP65 compaction test	W	Clegg Hammer to confirm 95% MDD	Min. 2 tests on each layer of backfill per 10m	Test	Refer to Watercare's General Civil Construction Standard Watercare Standard Drawing Set ESF-500-FOR-101 (DW02)	Report			
43	TNZM4 AP40 compaction test	W	Nuclear Density Meter (NDM)	Road surface Every 10m	Test	NDM >98% of Lab Aggregate MDD (WSL Specs/Auckland Transport)	Report		Engineer's Representative	
44	TNZM4 AP40 Benkelman Beam Test	W	Beam Test	Road surface Every 10m	Test	<1mm deflection (WSL Specs/Auckland Transport)	Report	**N/A**	Engineer's Representative	
45	Compaction test locations	M	Locational records	Ongoing	Review	Records chainage of test locations of QA sheets	Report	**N/A**		
46	Pipe penetrations through structures	W	Protective wrapping installed at structures	Ongoing	Measure	150mm of wrapping tape past structures	Photos			
47	CCTV inspection to be completed	H	Perform CCTV Inspection and review for defects (requirements for coiled pipes shall be agreed with Watercare)	Post-construction	Visual Inspection	No damage or blockage in the line	CCTV Footage	**N/A**	Engineer's Representative	
48	Pressure test methodology	H	Testing Plan to be submitted to the Engineer	Two weeks pre-test	Document Review	Methodology accepted by the Engineer	WI		Engineer's Representative	
49	Pressure test gauge calibrated	W	Ensure the pressure gauges are calibrated and comply with WSL standards	Pre-Test	Document Review	Gauge calibrated	Calibration documents			
50	Pressure test trial done	W	Carry out a pressure test trial to ensure that the test has passed	Pre-Test	Test	Notify Engineer once trial has passed - 24 hours' notice required	Test Sheet			

No:	Inspection / Test Point / Action	ACTION (Hold, Monitor, Witness)	Detail	Frequency / Timing	Inspection / Test Method submission, visual inspection, testing, measure, review	Conformance Criteria	Records	Initials	MSQA Initials (Grey if not required)	Date(s)
51	Pressure test with Engineer done and signed off	H	Pressure test to be completed, passed and signed off by the Engineer	Post-construction	Pressure Test	Pressure Test sheet to be forwarded to Engineer	Test Sheet		Engineer's Representative	
52	Chlorination test completed and approved	H	Independent Tester to carry out chlorination test on line	Post-construction	Chlorination Test	Chlorination Test sheet to be forwarded to Engineer Refer to Watercare's Code of Practice for Disinfection of Water Systems: ESF-600-STD-103 (COP-04)	Test Sheet		Engineer's Representative	
53	No chlorinated water shall be discharged into stormwater network unless maximum residual of 0.02 mg/l	H	Water must be de-chlorinated before it is discharged into stormwater system	Post-test	Visual Inspection	Refer to Watercare's Code of Practice for Disinfection of Water Systems: ESF-600-STD-103 (COP-04)	QA Sheet			
54	Reinstatement	W	Site reinstatement to match prior condition (refer pre-condition survey) Topsoil replacement	Post-construction	Visual Inspection	For respective areas where topsoil was removed - 100mm depth, clear of stones and debris, 90% grass cover Watercare Standard Drawing Set ESF-500-FOR-101 (DW02)	Photos			
55	Reinstatement	W	Footpath	Post-construction	Visual Inspection	For respective areas where footpath was removed - 100mm depth. Extent of reinstatement and Surface Finish agreed with AT with AT corridor manager Watercare Standard Drawing Set ESF-500-FOR-101 (DW02)	Photos			
56	Reinstatement	W	Driveway	Post-construction	Visual Inspection	For respective areas where driveway was removed - 150mm depth. Extent of reinstatement and Surface Finish agreed with AT with AT corridor manager Watercare Standard Drawing Set ESF-500-FOR-101 (DW02)	Photos			
57	Reinstatement	W	Carriageway	Post-construction	Visual Inspection + Clegg Test results	For respective areas where carriageway was removed. Extent of reinstatement and surface finish agreed with AT corridor manager	Photos, Clegg Test results			
58	AT inspection - Final walkover with corridor manager	W	All Reinstatement	Post-construction	Visual Inspection	All reinstatement as per the AT standard	Signed A9 form			
59	As-Builts	W	Pipeline to be as-built surveyed at 20 metre intervals and at each change in direction, and at pits	Submitted monthly	Survey	Refer to Watercare's Standard for producing CAD and Geospatial Drawings (ESF-500-STD-502)	As-built drawings/ Red line Mark up			
60	Asset Creation Sheet	M	All pipes, valves, hydrants, fittings need to be As-builted and the serial numbers / equipment details needs to be recorded along with their address and details i.e. - Size, Flange pattern, closing direction	All pipes, fittings, Valves, Hydrants	Inspection /Record	Refer to Watercare's Asset creating /Data capturing requirements	Asset Creation sheet			

No:	Inspection / Test Point / Action	ACTION (Hold, Monitor, Witness)	Detail	Frequency / Timing	Inspection / Test Method submission, visual inspection, testing, measure, review	Conformance Criteria	Records	Initials	MSQA Initials (Grey if not required)	Date(s)
61	Asset Acceptance (AA) Requirements	H	Watercare Engineer reviews document submittals and confirms that work carried out meets Watercare standards and that the installation if ready to connect to the network	Post-construction	Records submitted	CS3 & CS4 including supporting documentation i.e. construction monitoring reporting/site inspections as per applicable construction monitoring level Draft As-built Welding reports Pressure testing reports All supporting quality assurance information	Supporting documents		Engineer's Representative	
62	Certificate of Acceptance (COA)	H	Watercare Engineer reviews document submittals and confirms that work carried out meets Watercare requirements for final hand-over and issuing Certificate of Acceptance	Post-construction	Records submitted	EPA CS3 & CS4 including supporting documentation i.e. construction Completed Schedule of Assets Final certified As-builts (including CAD and PDF) CCTV footage	Supporting documents		Engineer's Representative	