Watercare
An Auckland Council Organisation

Water and Wastewater Code of Practice for Land Development and Subdivision

Version: 1.5
Version date: May 2015

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Schedule of Amendments

Version No	Nature of amendment	Authorised by	Date
Draft 1.0	Initial document for internal consultation	J Hodges	11/02/2011
Draft 2.2	Amended from feedback for external consultation	J Hodges	12/04/2011
Version 1.0	Amended after external consultation	M Lind	15/06/2011
Version 1.1	General re-formatting for website release	M Lind	30/06/2011
Version 1.2	Text expanded, errors corrected, more linked docs	M Lind	06/12/2011
Version 1.3	Text and linked docs updated, more linked docs	M Lind	16/11/2012
Version 1.4	Detailed updates to specifications and drawings	J de Villiers	08/12/2014
Version 1.5	Amended drawings and content	Chief Executive	28/05/2015

CoP Units review tracking **Review date**

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Watercare Services Limited

Water and Wastewater Code of Practice

for Land Development and Subdivision

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Introduction

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Foreword

A significant proportion of all new infrastructure is created by land development and subdivision projects. As a community, we need ***to deliver infrastructure of good quality and consistent practices***. This is why NZS 4404:2010 aims to encourage good urban design and remove road blocks to liveability and economic development in communities.

This Code of Practice (CoP) has been developed to guide and govern subdivisional, development and re-development standards in the water and wastewater areas of the Auckland region. It is applicable within the territory of the Auckland Council, where these utility services are provided by or are to be vested in or connected to assets owned by Watercare Services Limited (Watercare). The CoP is based substantially on NZS 4404:2010 Land Development and Subdivision Infrastructure and various parts have been reproduced in this CoP pursuant to Licence 000805 granted to Watercare by Standards New Zealand.

To assist practitioners used to NZS 4404 in discerning changes and identifying differences between the base publication and this CoP, the formatting of this document will follow the convention that unaltered text quoted from NZS 4404 will be reproduced in Ariel font, while added parts or changed text will be presented in Bold Italic font as this present text.

NZS 4404 is a national standard and as such it has been developed to accommodate local variations to suit different conditions and circumstances. Accordingly there are numerous inserts, further material and additional standard drawings that were added to incorporate Watercare's local requirements, many of which have been embedded in the local industry for some time. Nevertheless, these are also identified by the different formatting, as departures from the national document.

Watercare's functions relate to the provision of water and wastewater services, so only the parts of the Standard dealing with these activities ('Section 5 Wastewater' and 'Section 6 Water Supply') have been addressed in detail. However, it was also found to be necessary to include edited versions of 'Section 1 General Requirements and Procedures' and 'Section 8 Network Utility Services' for their general application, Appendices A (Acceptable Pipe and Fitting Materials), B (Standard Construction Drawings), C (Field Testing of Pipelines), and make references to parts of Section 2 Earthworks and Geotechnical Requirements. The clause numbering of the original Standard has been retained to facilitate cross-referencing, although the sequence of sections has been changed.

As part of its responsibilities for delivering wastewater services Watercare is responsible for combined wastewater and stormwater sewers in older parts of the original Auckland City Council area. Reference shall be made to the relevant Auckland Council stormwater infrastructure design standards when working in the combined sewer areas to ensure all applicable requirements are met.

This CoP derived from NZS 4404:2010 is applicable to greenfield, infill, and brownfield redevelopment projects***, including individual private property development and redevelopment***. ***It*** provides developers a Standard for the design and construction of subdivision infrastructure. It can be used on its own as a means to comply with ***certain requirements of the*** Resource Management Act (RMA) consent conditions. It is not an urban design policy, guide, or method of masterplanning.

Outcome Statement

This ***CoP*** provides owners, developers, and their professional advisors with standards for the design and construction of ***water and wastewater infrastructure within the broader context of*** land development and subdivision. NZS 4404:2010 ***and this CoP*** encourage sustainable development and modern design that emphasises liveability and environmental quality. It will also provide as much consistency as possible on land development and subdivision infrastructure while still allowing flexibility for local variations to suit local circumstances, ***innovation and creativity.***

Preamble

Watercare is a Council Controlled Organisation (CCO) of the Auckland Council with specific legislative rights and obligations set out in the Local Government (Auckland Council) Act 2009 No 32 and the Local Government (Auckland Transitional Provisions) Act 2010 No 37. It is responsible for the bulk and retail water and wastewater services throughout the Auckland region, except the area franchised to Veolia Water in the previous Papakura District Council area.

The applicable legislation, this CoP and other documents, regional plans and wastewater by-laws are intended to ensure:

- ***That water is used efficiently and wastage is minimised to the greatest extent practicable***
- ***Wastewater networks, including new and existing private connections to these networks allow the minimum practicable seepage into and out of the networks***
- ***Illegal entry of roof water, overland flow and other stormwater is prevented***
- ***Overflows from the networks during both dry and wet weather are minimised as far as practicable***
- ***Waste materials entering the networks are controlled to avoid or minimise adverse effects on physical assets, wastewater treatment processes and the environment***
- ***Watercare's and other publicly owned assets are not damaged and future access is not compromised by the actions of third parties***

Developing, setting and monitoring subdivisional and development standards for greenfield (expansion), brownfield (urban renewal) or other development (e.g. intensification) is an important part of ensuring the above requirements are met.

Sub-divisional, development and redevelopment proposals are approved and authorised by the Auckland Council. Watercare's contribution to this process is the examination and approval of the design, construction and commissioning of elements of water and wastewater infrastructure, which are to be part of or connected to Watercare's networks. This includes works on private property, where developments proposing changed land use or intensification may result in a significant alteration to the local demand pattern.

Figure 1 – Document Hierarchy depicts some of the relationships between these influences.

Figure 2 shows the examination and approval process for water supply and wastewater installations.

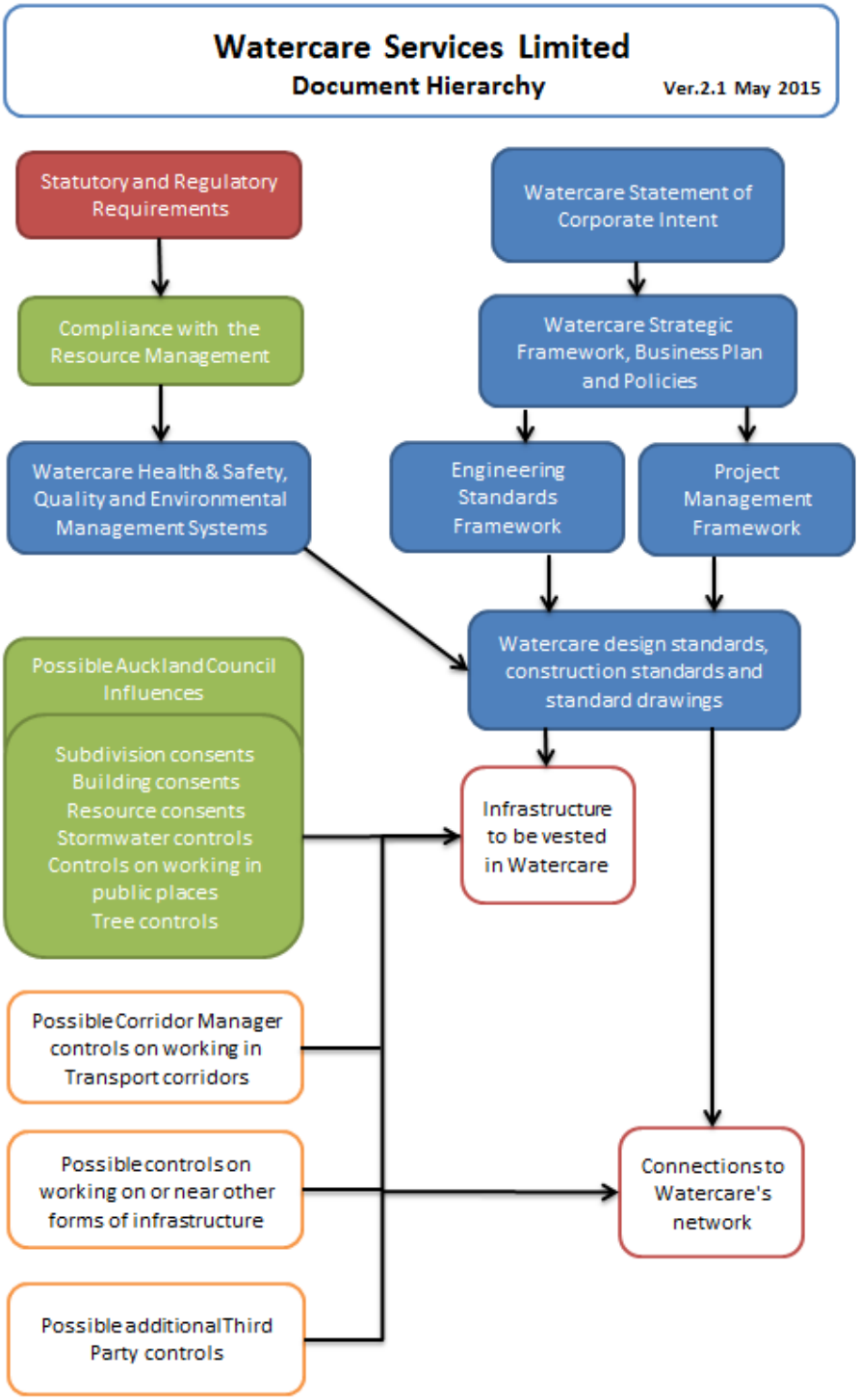

Figure 1: Document Hierarchy

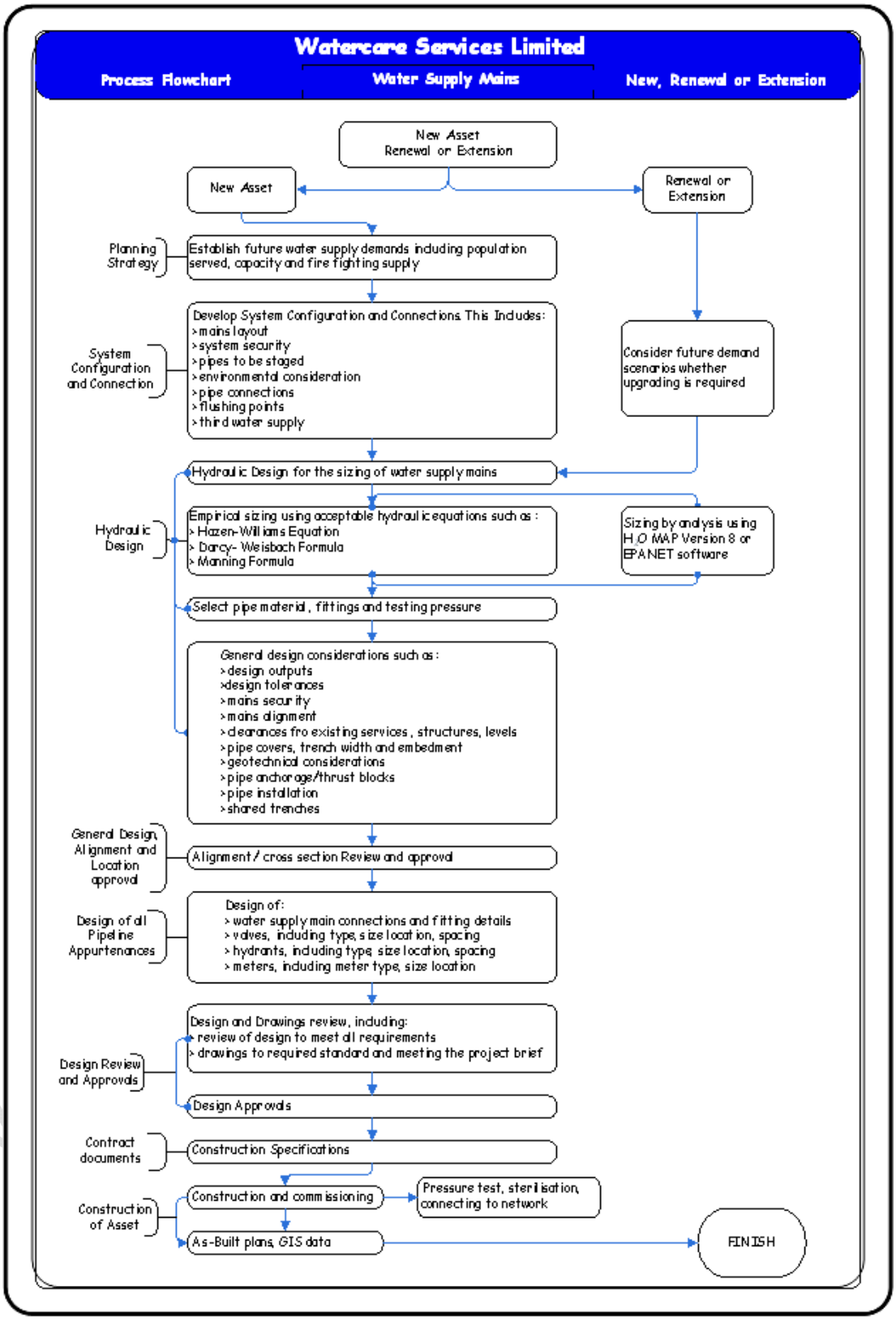

Figure 2 – Water Supply General Processes

New Zealand Legislation

The provisions of this ***Code of Practice (CoP)*** shall be read subject to the provisions of regional and district plans and to any applicable statutes, regulations, bylaws, and any subsequent amendments, including (but not limited to):

Building Act 2004, Building Regulations, and New Zealand Building Code (NZBC) 1992

Civil Defence Emergency Management Act 2002

Conservation Act 1987

Government Roading Powers Act 1989

Health and Safety in Employment Act 1992

Health (Drinking Water) Amendment Act 2007

Historic Places Act 1993

Infrastructure (Amendments Relating to Utilities Access) Act 2010

Land Transfer Act 1952

Local Government Act 1974 and Local Government Act 2002

Reserves Act 1977

Resource Management Act 1991***, including all applicable regional and territorial planning documents and by-laws***

Local Government (Auckland Council) Act 2009

Local Government (Auckland Transitional Provisions) Act 2010

Utilities Access Act 2010, ***National CoP for Utility Operators' Access to Transport Corridors (November 2011)***

Referenced Documents

All standards listed shall be the most current version or its superseded document where the standards may be updated or replaced from the latest version of this CoP.

Reference is made in this document to the following:

NEW ZEALAND STANDARDS

NZS 1170 Structural design actions

Part 5 Earthquake actions – New Zealand

Part 5 Supp 1 Earthquake actions – New Zealand – Commentary

NZS 4219 Seismic performance of engineering systems in buildings

NZS 3109 Concrete construction

NZS 3114 Specification for concrete surface finishes

NZS 3116 Concrete segmental and flagstone paving

NZS 4402 Methods of testing soils for civil engineering purposes

Part 6 Soil strength tests

~~NZS 4405:1986 Helical lock-seam corrugated steel pipes~~ ***AS/NZS 2041.4 Helically formed sinusoidal pipes***

~~NZS 4406:1986 Helical lock-seam corrugated steel pipes – Design and installation~~ ***(Withdrawn)***

NZS 4442 Welded steel pipes and fittings for water, sewage and medium pressure gas

NZS/AS 1657 Fixed platforms, walkways, stairways and ladders. Design, construction and installation

~~NZS/BS 750:1984 Specification for underground fire hydrants and surface box frames and covers~~ ***NZS 45220 Underground fire hydrants***

SNZ PAS 4509 New Zealand Fire Service fire fighting water supplies code of practice

JOINT AUSTRALIAN/NEW ZEALAND STANDARDS

AS/NZS 1260 PVC-U pipes and fittings for drain, waste and vent application

AS/NZS 1477 PVC pipes and fittings for pressure applications

AS/NZS 2032 Installation of PVC pipe systems

AS/NZS 2033 Installation of polyethylene pipe systems

~~AS/NZS 2041:1998 Buried corrugated metal structures~~ ***AS/NZS 2041 Buried corrugated metal structures***

Part 1 Design Methods

Part 2 Installation

Part 6 Bolted plate structures

AS/NZS 2280 Ductile iron pipes and fittings

AS/NZS 2566 Buried flexible pipelines

Part 1 Structural design

Part 1 Supp 1 Structural design – Commentary

Part 2 Installation

AS/NZS 3500 Plumbing and drainage

Part 1 Water services

AS/NZS 3518 Acrylonitrile butadiene styrene (ABS) compounds, pipes and fittings for pressure applications

AS/NZS 3690 Installation of ABS pipe systems

AS/NZS 3725 Design for installation of buried concrete pipes

AS/NZS 3879 Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS pipes and fittings

AS/NZS 4020 Testing of products for use in contact with drinking water

AS/NZS 4058 Precast concrete pipes (pressure and non-pressure)

AS/NZS 4129 Fittings for polyethylene (PE) pipes for pressure applications

AS/NZS 4130 Polyethylene (PE) pipes for pressure applications

AS/NZS 413 Polyethylene (PE) compounds for pressure pipes and fittings

AS/NZS 4158 Thermal-bonded polymeric coatings on valves and fittings for water industry purposes

AS/NZS 4331.2 Metallic flanges - Cast iron flanges

AS/NZS 4441 Oriented PVC (PVC-O) pipes for pressure applications

AS/NZS 4765 Modified PVC (PVC-M) pipes for pressure applications

AS/NZS 4793 Mechanical tapping bands for waterworks purposes

AS/NZS 4998 Bolted unrestrained mechanical couplings for waterworks purposes

AS/NZS 5065 Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications

AS/NZS 3000 Electrical installation

AS/NZS 3000 SET Wiring rules and companions set

AS/NZS 1768 Lighting protection

AS/NZS 3017 Electrical installations – Verification guidelines

AS/NZS 1359 Rotating electrical machines

Part 3 Methods for determining losses and efficiencies

Part 5 General requirements- Three phase cage induction motors – High efficiency and minimum energy performance standards requirements

AS/NZS 3439 Low voltage switchgear and control gear assemblies

Part 1 Type tested and partially type tested assemblies

Part 3 Particular requirements for low-voltage switchgear and control gear assemblies intended to be installed in places where unskilled persons have access for their use – Distribution boards

AS/NZS 3191 Electrical flexible cords

AS/NZS 5000 Electric cables

Part 1 Polymeric insulated – For working voltages up to and including 0.6/1 kV

Part 2 Polymeric insulated – For working voltages up to and including 450/750V

Part 3 Polymeric insulated – Multicore control cables

AS/NZS 3008.1.2 Electrical installations – selection of cables up to and including 0.6/1 kV

AUSTRALIAN STANDARDS

AS 1579 Arc-welded steel pipes and fittings for water and waste-water

AS 1741 Vitrified clay pipes and fittings with flexible joints – Sewer quality

AS 2200 Design charts for water supply and sewerage

AS 2638 Gate valves for waterworks purposes

Part 2 Resilient seated

AS 2700 Colour Standards for general purposes

AS 3571 Plastics piping systems – Glass-reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin

Part 1 Pressure and non-pressure drainage and sewerage

Part 2 Pressure and non-pressure water supply

AS 3681 Application of polyethylene sleeving for ductile iron piping

AS 3996 Access covers and grates

BRITISH STANDARDS

BS EN 295 Vitrified clay pipes and fittings and pipe joints for drains and sewers

Part 1 Requirements

Part 2 Quality control and sampling

Part 3 Test methods

Part 4 Requirements for special fittings, adaptors and compatible accessories

Part 6 Requirements for vitrified clay manholes

Part 7 Requirements for vitrified clay pipes and joints for pipe jacking

Part 10 Performance requirements

BS EN 805 Water supply – Requirements for systems and components outside buildings

OTHER PUBLICATIONS

GENERAL

Ministry for the Environment. *New Zealand urban design protocol.* Wellington: Ministry for the Environment, 2005.

EARTHWORKS AND GEOTECHNICAL REQUIREMENTS

BRANZ. BRANZ Study Report 004, *Assessment of slope stability at building sites*. BRANZ and Worley Consultants Ltd, 1987.

Cook, D, Pickens, G A, and MacDonald, G. *'The role of peer review'*, Report by Crawford S A. NZ Geomechanics News (Dec 1995).

Crawford, S A, and Millar, P J. *'The design of permanent slopes for residential building development',* EQC Research Project 95/183, NZ Geomechanics News (June 1998).

New Zealand Geotechnical Society Inc. *Field description of soil and rock*. New Zealand Geotechnical Society Inc, 2005.

New Zealand Geotechnical Society Inc. *'Geotechnical issues in land development'*. Proceedings of New Zealand Geotechnical Society Symposium, Hamilton, 1996.

WASTEWATER AND WATER SUPPLY

Auckland Regional Council:

Technical Publication No. 124 (TP124) *Low impact design manual for the Auckland region,* 2000.

Technical Report 2008-20 *Application of low impact design to brownfield sites* (in preparation)

Technical Report 2009-83 *Integration of low impact design, urban design and urban form principles* (in preparation)

Australasian Society for Trenchless Technology (ASTT). *Guidelines for horizontal directional drilling, pipe bursting, microtunnelling and pipe jacking.* Greenwood, Western Australia: ASTT, 2009.

Janson, Lars-Eric. *Plastics pipes for water supply and sewage disposal.* 2003.

Lamont, P. *'Metrication: Hydraulic data and formulae.'* Water Services Volume 81, numbers 972/3/4 (Reprinted by Kent Meters Ltd, UK)

Ministry for the Environment.

Coastal hazards and climate change – A guidance manual for local government in New Zealand. Wellington: Ministry for the Environment, 2008.

Preparing for climate change – A guide for local government in New Zealand. Wellington: Ministry for the Environment, 2008.

Preparing for coastal change – A guide for local government in New Zealand. Wellington: Ministry for the Environment, 2009.

Preparing for future flooding – A guide for local government in New Zealand. Wellington: Ministry for the Environment, 2010.

Tools for estimating the effects of climate change on flood flow – A guidance manual for local government in New Zealand. Wellington: Ministry for the Environment, 2010.

Ministry of Health. *Drinking-water standards for New Zealand 2005 (Revised 2008).* Wellington: Ministry of Health, 2008.

Najafi, M. Trenchless technology – *Pipeline and utility design, construction, and renewal*. McGraw-Hill, 2005.

New Zealand Water and Wastes Association (Water New Zealand). *New Zealand pipe inspection manual.* Wellington: New Zealand Water and Wastes Association, 2006.

Stein, D. *Trenchless technology for installation of cables and pipelines*. Germany: Stein & Partner, 2005.

Uni-Bell. *Handbook of PVC pipe*. 4th ed. Dallas: Uni-Bell PVC Pipe Association, 2001.

~~Water Services Association of Australia (WSAA):~~

~~WSA 02-2002 Sewerage Code of Australia – 1999 and 2002~~

~~WSA 03-2002 Water Supply Code of Australia – 1999 and 2002~~

~~WSA 04-2005 Sewage Pumping Station Code of Australia – 2005~~

~~WSA 06-2008 Vacuum Sewerage Code of Australia – 2008~~

~~WSA 07-2007 Pressure Sewerage Code of Australia – 2007~~

Watercare Services Ltd Standards for design, construction, standard drawings and materials supply

NETWORK UTILITY SERVICES

Department of Labour. Guide for safety with underground services. Wellington: Department of Labour, 2002.

New Zealand Transport Agency. Bridge manual. (SP/M/022) 2nd ed. Wellington: NZTA, 2003.

TEMPORARY TRAFFIC MANAGEMENT

Code of Practice for Temporary Traffic Management (CPTTM)

AT-ACC-Guidelines-Temporary Traffic Management (Auckland Transport)

Related Documents

When interpreting this CoP it may be helpful to refer to other documents, including but not limited to:

GENERAL

Land Information New Zealand. New Zealand geodetic datum 2000 (NZGD2000)

Ministry for the Environment. Climate change effects and impacts assessment – A guidance manual for local government. 2nd ed. Wellington: Ministry for the Environment, 2008.

EARTHWORKS AND GEOTECHNICAL REQUIREMENTS

Auckland Regional Council. Technical Publication No. 90 (TP90) Erosion and sediment control: guidelines for land disturbing activities in the Auckland Region. Auckland: Auckland Regional Council, 1999.

Fraser Thomas Ltd (B J Brown, P R Goldsmith, J P M Shorten, L Henderson) BRANZ Study Report 120, Soil expansivity in the Auckland region. Judgeford: BRANZ, 2003.

Ministry for the Environment. Planning for development of land on or close to active faults – A guideline to assist resource management planners in New Zealand. Wellington: Ministry for the Environment, 2004.

Sanders, W, and Glassey, P. (Compilers). Guidelines for assessing planning policy and consent requirements for landslide prone land, GNS Science Miscellaneous Series 7. Lower Hutt: Institute of Geological and Nuclear Sciences Limited, 2007.

SNZ HB 44 Subdivision for people and the environment. Wellington: Standards New Zealand.

WASTEWATER AND WATER SUPPLY

Puddephatt, J, and Heslop, V. Guidance on an integrated process – Designing, operating and maintaining low impact urban design and development devices. Landcare Research, July 2008.

Sustainable urban drainage systems (SUDS) design manuals for countries in the United Kingdom

Water sensitive urban design (WSUD) manuals from various Australian states and cities

WEBSITES

Auckland Council www.aucklandcouncil.govt.nz

Auckland Transport https://at.govt.nz/

Ministry for the Environment http://www.mfe.govt.nz

New Zealand Historic Places Trust http://www.historic.org.nz

New Zealand Legislation http://www.legislation.govt.nz

New Zealand Transport Agency http://www.nzta.govt.nz/

Plastics Industry Pipe Association of Australia: http://www.pipa.com.au

Latest Revisions

Watercare recognises the requirement to update and/or amend this CoP from time to time, so the users of this ***document*** should ensure that their copies of the ***CoP and the*** above-mentioned New Zealand Standards are the latest revisions. Amendments to referenced New Zealand and Joint Australian/New Zealand Standards can be found on http://www.standards.co.nz

Review of standards

Suggestions for improvement of this ***CoP*** will be welcomed. They should be sent to the ***Principal Engineer - Standards, Watercare Services Limited, Private Bag 92521, Wellesley Street, AUCKLAND 1141.***

Precedence of documents

Legislative and statutory requirements take precedence over all other documents.

Watercare standards take precedence in the event of conflict with other documents, except with the written approval of Watercare.

Watercare Services Limited
Water and Wastewater Code of Practice for Land Development and Subdivision
(Based on Section 1 of NZS 4404: 2010)

1 GENERAL REQUIREMENTS AND PROCEDURES

Contents

1.1 Scope

This ***Code of Practice (CoP)*** is applicable to greenfield, infill development, ***and*** brownfield redevelopment projects ***including individual private property development and redevelopment***. ***It*** also serves as a basis for technical compliance for the ***water and wastewater local network components of*** subdivision and development of land where these activities are subject to the Resource Management Act.

Sections 1 ***and 8*** of this ***CoP*** concern matters of general application and general requirements to be observed. ***Subsequent Sections*** of this ***CoP state requirements to be met and*** provide good practice guidelines on particular types of infrastructure to be provided. ***Attention is drawn to the need to construct to Auckland Council Stormwater Infrastructure design Standards where works are in areas served by combined wastewater and stormwater services.***

1.1.1 Overall design approach to be followed

All new assets forming part of or connecting to Watercare's water supply and wastewater systems must be designed to be consistent with and form part of Watercare's overall network management programmes. The infrastructure design standards for networks with pipe sizes up to 250mm for water, up to 300mm for wastewater and small wastewater pump stations up to 12.5 l/s are included in the CoP. For any other design outside of the scope of the CoP specific design criteria is available in the Engineering Standards Framework (ESF) and requires separate approvals and level of input from Watercare.

Designs are required to:

a) ***Meet the criteria set out in the Foreword to this CoP***

b) Comply with the relevant Watercare Standards obtainable from Watercare

c) Comply with the relevant Watercare Standard Drawings and Details Listed in Appendix B.

d) Satisfy the requirements of all relevant Regional, National and International Standards and Codes of Practice, generally as listed in this CoP or other relevant Watercare Standards.

The relevant forms included in Appendix F shall be used to support applications for all approvals from Watercare.

1.1.2 Specific matters to be addressed

All designs shall include appropriate consideration of and provision for the following:

a) ***Geotechnical conditions***

b) Geothermal conditions

c) Low impact design opportunities to minimise community infrastructure requirements, including water efficient designs and the control of wastes at source

1.1.3 Overall design objectives

All designs (and associated works) are required to comply with the following, as appropriate.

a) ***All applicable legislation***

b) Auckland Council and Auckland Transport requirements relating to working in roads, footpaths and berms

c) NZ Transport Agency requirements relating to works on state highway road reserve, including motorway corridors

d) All other applicable New Zealand Standards and Codes of Practice, unless alternative requirements are included in the Manual

e) All relevant statutory planning documents and, where appropriate, anticipated future statutory planning requirements

f) All relevant Auckland Council policies, for example relating to stormwater in areas served by combined sewers

g) Watercare Engineering Standards Framework

h) Watercare's Standard Network Operation and Maintenance Procedures

i) All relevant resource consents held by Watercare. Watercare will advise affected parties of any consent requirements that could affect their works.

1.1.4 Third Party consents that could bind Watercare

Any party constructing works that will connect to or form part of Watercare's networks, and where legally binding consents under the Resource Management Act or other legislation are required for the works, which could place future obligation on Watercare, is strongly advised to consult Watercare before the consent conditions are finalised. Watercare may elect to decline applications to connect or to accept the vesting of assets in the event that conditions are unacceptable to Watercare.

1.2 Interpretation

1.2.1 General

1.2.1.1

The full titles of referenced documents cited in this ***CoP*** are given in the list of referenced documents.

1.2.1.2

The word 'shall' refers to practices which are mandatory for compliance with the ***CoP***. The words 'should' or 'may' indicate a recommended practice.

1.2.1.3

Clauses prefixed by 'C' and printed in italic type are intended as comments on the corresponding mandatory clauses. They are not to be taken as the only or complete interpretation of the corresponding clause. The ***CoP*** can be complied with if the comment is ignored.

1.2.1.4

The terms 'informative' and 'normative' have been used in this CoP to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance. Informative provisions do not form part of the mandatory requirements of this **CoP**.

1.2.1.5

Schedules containing information to be provided in certificates or as-built plans are hyperlinked at the end of sections to which they relate. Each schedule is copyright waived, meaning it may be copied for use in accordance with the **CoP**.

1.2.2 Definitions

For the purpose of this ***CoP***, the following definitions shall apply:

Annual exceedance probability (AEP)	The probability of exceedance of a given occurrence, generally a storm, in a period of 1 year (1% AEP is equivalent to a 1 in 100-year storm)
Carriageway	That part of a road consisting of the movement lane, sealed shoulder, and includes parking and loading areas when provided within the road
Combined sewer	***A drainage network that collects wastewater and stormwater in a single pipe system.***
Corridor manager	Has the meaning given to it by the Utilities Access Act 2010
Developer	An individual or organisation having the financial responsibility for the development project. Developer includes the owner
Developer's	The person, appointed by the developer, who shall be

professional advisor	responsible for: (a) The investigation, design and obtaining of approvals for construction; (b) Contract administration and supervision of construction; (c) Certification upon completion of construction
District Zone	***Smallest operational unit of network. Zones bounded by meters, pressure reducing valves, pressure sustaining valves, closed isolation valves, non-return valves, or physical gaps.***
Drinking water	As defined in the Health (Drinking Water) Amendment Act
Dwelling unit	Any building or group of buildings, or part thereof used, or intended to be used principally for residential purposes and occupied, or intended to be occupied by not more than one household
Earthworks	Any alteration to the contours, including the excavation and backfilling or recompaction of existing natural ground and the stripping of vegetation and topsoil
Efficient use of water	***Practices that minimise water use and wastage and which include low flow shower heads, dual flush toilets, water efficient washing machines and dishwashers, drip irrigation and the like, as well as the use of non-potable water sources***
Footpath	So much of any road or other area as is laid out or constructed by authority of the ***Auckland Council or Auckland Transport*** primarily for pedestrians; and may include the edging, kerbing, and channelling of the road
Freeboard	A provision for flood level design estimate imprecision, construction tolerances, and natural phenomena (such as waves, debris, aggradations, channel transition, and bend effects) not explicitly included in the calculations
Geoprofessional	A chartered professional engineer (CPEng) or an engineering geologist with recognised qualifications and experience in geotechnical engineering, and experience related to land development
Ground	Describes the material in the vicinity of the surface of the earth whether soil or rock
Independent qualified person (IQP)	A specialist approved by ***Watercare*** and having the appropriate skills and qualification to carry out specific procedures
Local authority	As defined in the Local Government Act 2002, and includes territorial authorities and regional councils
Low impact design	An approach to land development and stormwater management that recognises the value of natural systems in order to mitigate environmental impacts and enhance local amenity and ecological values
Movement lane	That part of the formed and sealed road that serves the link function in a road. It may have a shared use for other activities such as walking, cycling, parking, and play
Network utility operator	Has the same meaning given to it by section (s.) 166 of the Resource Management Act
Owner	In relation to any land or interest in land, includes an owner of the land, whether beneficially or as trustee, and their agent or attorney, and a mortgagee acting in exercise of power of sale; and also includes the Crown, the Public

	Trustee, and any person, TA, board, or other body or authority however designated, constituted, or appointed, having power to dispose of the land or interest in land by way of sale
Potable water	As defined in the Health (Drinking Water) Amendment Act
Point of supply	***A 'point of supply' is the point where Watercare's network connects with a private network. At this point, the responsibility for ownership and maintenance of assets and equipment transfers from Watercare to the customer.***
Private road	Any roadway, place, or arcade laid out within a district on private land by the owner of that land intended for the use of the public generally and has the same meaning given to it by s. 315 of the Local Government Act 1974
Private way	Any way or passage over private land within a district, the right to use which is confined or intended to be confined to certain persons or classes of persons, and which is not thrown open or intended to be open to the use of the public generally and includes any shared access or right of way and has the same meaning given to it by s. 315 of the Local Government Act 1974
Road	Has the same meaning given to it by s. 315 of the Local Government Act 1974
Secondary flow	The estimated surface water run-off in excess of the primary flow. In most cases this flow will be managed in an overland flowpath or ponding area that is protected by public ownership or easement
Separate sewers	***Distinct and separate drainage systems for wastewater and stormwater (cf; Combined sewer)***
Stormwater	Rainwater that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, channels, or pipes into a defined surface water channel, open watercourse, or a constructed infiltration facility
Street	Has the same meaning as 'road' as defined by s. 315 of the Local Government Act 1974
Supply zone	***One or more District Zones, usually interdependent in some way e.g. sharing a common source, grouped for zone management plan convenience***
Surface water run-off	All naturally occurring water, other than subsurface water, which results from rainfall on the site or water flowing onto the site, including that flowing from a drain, stream, or river
Survey plan	A survey plan under s. 2 of the Resource Management Act
Territorial authority	A territorial authority (TA) defined in the Local Government Act 2002
Third Pipe System	***Community scale options for the use or re-use of water resources not supplied by Watercare including rainwater catchment, used water, groundwater and onsite treatment systems.***
Wāhi tapu	Means a place sacred to Māori in the traditional, spiritual, religious, ritual, or mythological sense
Wastewater	Water that has been used and contains unwanted dissolved or suspended substances from communities, including

homes, businesses, and industries

1.2.3 Abbreviations

The following abbreviations are used in this ***CoP:***

ABS acrylonitrile butadiene styrene
AEP annual exceedance probability
AV air valve
°C degrees Celsius
CBD central business district
CBR California bearing ratio
CCTV closed circuit television
CLS (SCL) concrete lined steel (steel concrete lined)
DI ductile iron
DN nominal diameter under the pipe manufacturing standard
du dwelling unit
FAC free available chlorine
FL flange
FSL finished surface level
GL ground level
g/m^3 grams per cubic metre
GRP glass reinforced plastic
H head (in metres)
h hour
ha hectare
HDD horizontal directional drilling
IQP independent qualified person
km kilometre
km/h kilometres per hour
kPa kilopascal
L litre(s)
LA local authority
LID low impact design
m metre
MDD maximum dry density
MH manhole or maintenance hole
min minute(s)
MPa ***mega Pascal***
MS maintenance shaft
m/s metres per second
m^3/s cubic metres per second
mm millimetres
NES National Environmental Standard
NIWA National Institute of Water and Atmospheric Research
NPS National Policy Statement
NZBC New Zealand Building Code

NZHPT New Zealand Historic Places Trust

NZTA New Zealand Transport Agency

OSH Occupational Safety and Health

p person

PE polyethylene

PE 80B polyethylene with minimum required strength (MRS) of 8 MPa as defined in AS/NZS 4130 and AS/NZS 4131

PE 100 polyethylene with MRS of 10 MPa as defined in AS/NZS 4130 and AS/NZS 4131

PF peaking factor

PIPA Plastics Industry Pipe Association of Australia Ltd

PN nominal pressure class (maximum rated operating pressure)

PP polypropylene

PRV pressure reducing valve

PVC polyvinyl chloride

PVC-U unplasticised polyvinyl chloride

PVC-M modified polyvinyl chloride

PVC-O orientated polyvinyl chloride

RMA Resource Management Act

RRJ rubber ring joint

s. section

Soc socket

STP specified test pressure

TA territorial authority

TMS terminal maintenance shaft

UV ultraviolet

VC vitrified clay

vpd vehicles per day

1.3 Context

This ***CoP*** is relevant to Acts such as the Resource Management Act ***(RMA)***, Building Act, Historic Places Act and other legislation. The purpose of NZS 4404:2010 ***and of this CoP*** is to provide ***minimum*** standards for the implementation of well-designed land development and subdivision infrastructure projects that have obtained the necessary resource consents under the RMA, and comply with other legislation. ***Watercare*** will require compliance with this ***CoP*** to ensure that the sustainability, urban design, and environmental impact objectives of land development and subdivision projects are carried through to completion. The interrelationship between this ***CoP*** and these Acts is outlined below.

The requirements of the CoP are intended to assist Watercare to ensure it is able to meet its obligations under the RMA and other legislation. Certain requirements may be included by law, but regardless of whether this is the case, Watercare will not approve connections to its networks or accept vesting of new infrastructure in Watercare, unless the requirements of the CoP are met or written dispensation is provided. Attention is drawn to section 1.1.4 of this CoP.

The ***CoP*** also provides best practice land development and subdivision infrastructure techniques in low impact design, climate change, and urban design.

1.3.1 Resource Management Act

The Resource Management Act 1991 (RMA) is the principal statute under which the development and subdivision of land is controlled.

Regional and district plans prepared under the RMA are the key resource management instruments that councils implement to achieve sustainable management of natural and physical resources, which is the overarching purpose of the RMA.

A national policy statement (NPS) and national environmental standard (NES) may also apply to a proposed development in addition to regional and district planning documents. However NPS and NES only apply once they are finalised and gazetted whereas regional and district plan provisions may apply to consent applications as soon as they are notified.

C1.3.1
Over time, central government may develop other NPS and NES which may affect decision-making by councils on land development and subdivision, including national policy on freshwater management, sea level rise, and flood risk. The Ministry for the Environment's website should be referred to for any relevant NPS and NES.

The protection of historic heritage from inappropriate subdivision, use, and development is a matter of national importance under s. 6(f) of the RMA. The RMA's definition of historic heritage includes: historic sites, structures, places, and areas; archaeological sites; sites of significance to Māori including wāhi tapu; and surroundings associated with the natural and physical resources. Therefore regional/district plans should be reviewed to ascertain whether any development proposal affects historic heritage. Most plans have a historic heritage schedule, which lists the item protected, its location, and its sensitivity. A precautionary approach should be taken prior to any land development and subdivision infrastructure affecting historic heritage, with the council consulted at the earliest stage (see 1.3.2).

Where applications for resource consents may affects sites of significance to Māori, consultation with the appropriate tangata whenua groups should occur prior to finalising plans or submitting applications for resource consent in order to give effect to Part II of the RMA.

1.3.2 Historic Places Act

In addition to the RMA, the Historic Places Act regulates the modification of archaeological sites on all land and provides for substantial penalties for unauthorised destruction, damage, or modification of these sites.

The Act makes it unlawful for any person to destroy, damage, or modify the whole or any part of an archaeological site registered with the New Zealand Historic Places Trust (NZHPT), without the prior authority of the NZHPT. This is the case regardless of whether:

(a) The site is registered or recorded by the council in planning documents;

(b) The land on which the site is located is designated;

(c) The activity is permitted under the district or regional plan; or

(d) A resource or building consent has been granted.

Therefore approval from the NZHPT is required if a site registered with the NZHPT is affected, in addition to any council approval that may be required.

Furthermore, if the site is known to be associated with pre-1900 human activity, or there is reasonable cause to suspect such an association, the developer should consult with the NZHPT prior to undertaking any earthworks or ground disturbance.

1.3.3 Building Act

The Building Act provides a national framework for building control to ensure that buildings are safe and sanitary and have suitable means of escape from fire. The Building Regulations made under the Act provide the mandatory requirements for building control in the form of the New Zealand Building Code. The Building Code contains the objective, functional requirements, and performance criteria that building works shall achieve.

Where the development of land and subdivision infrastructure involves the creation of structures with associated site works, including specific aspects of stormwater management and the interaction of buildings, fences, and walls with stormwater flows,

the requirements of the Building Act shall be observed. Nothing in this CoP shall detract from the requirements of the Building Act or the Building Code.

It is an important requirement of this CoP that gully traps are sited and maintained to preclude, the entry of stormwater to separate wastewater networks, either by way of overland flowpath or illegal connection.

C1.3.3

Systems owned or operated by a network utility operator for the purpose of reticulation are not included in the definition of building under the Building Act.

1.3.4 Other legislation

The Reserves Act, Conservation Act, and other Acts may also require consideration when undertaking land development and subdivision infrastructure. Covenants (a legal restriction or agreement recorded on the title of a property that is a matter of private contract) may also require consideration. For example, a Queen Elizabeth II Act Open Space Covenant is a legally binding protection document agreed between a landowner and the QEII National Trust.

There is an inherent obligation on all parties connecting to or constructing works that will form part of Watercare's networks to avoid any action that will, or may result in Watercare breaching its obligations under any legislation.

1.4 Low impact design

Low impact design (LID) is both a design approach and a range of structural techniques that can be applied to urban development and stormwater management. As a design approach, LID provides an opportunity to identify and recognise natural features and integrate these into the design of development layouts in order to minimise environmental impacts or enhance natural features. The integration of natural processes in the design stage of a development can result in more attractive, multifunctional landscapes with greater social, environmental, cultural, and transport outcomes.

Low impact design solutions that use natural processes and add value to urban environments are the preferred approach.

LID shall be considered in all areas served by combined wastewater and stormwater sewers and as otherwise required by the Auckland Council Stormwater Infrastructure Design Standards.

1.5 Climate change

Climate change is likely to increase the magnitude of some hazards, therefore it is important to incorporate risk management in the design of infrastructure supporting new developments to maintain the same level of service throughout the design lifetime. The design of infrastructure for land development and subdivision needs to provide for the impact of sea level rise and the increased frequency of extreme weather events.

C1.5

Amendments to the Resource Management Act, the Local Government Act 2002, and the Building Act require councils to have particular regard to the effects of climate change when making decisions under these Acts.

In coastal areas, the proposed 'New Zealand coastal policy statement' (policy 52) requires councils to consider the location of any new subdivisions in the context of avoiding or reducing potential coastal hazards.

The government is considering the development of a number of other national policy instruments which may affect decision-making by local authorities, including a 'National environmental standard on sea level rise' and a 'National policy statement on flood risk'. These would not take effect until they are gazetted.

1.6 Urban design protocol

The New Zealand urban design protocol seeks to ensure that the design of buildings, places, spaces, and networks that make up our towns and cities, work for all of us, both now and in the future. NZS 4404 ***and this CoP*** include recommended best practices that support urban design protocol initiatives. The New Zealand urban design protocol identifies seven essential design qualities for good urban design:

(a) Context: seeing that buildings, places, and spaces are part of the whole town or city;

(b) Character: reflecting and enhancing the distinctive character, heritage, and identity of our urban environment;

(c) Choice: ensuring diversity and choice for people;

(d) Connections: enhancing how different networks link together for people;

(e) Creativity: encouraging innovative and imaginative solutions;

(f) Custodianship: ensuring design is environmentally sustainable, safe, and healthy;

(g) Collaboration: communicating and sharing knowledge across sectors, professions, and with communities.

The New Zealand urban design protocol has been the primary influence on the urban layouts that are encouraged in ***NZS 4404 and supported in this CoP to the extent appropriate***.

1.7 Requirements for design and construction

1.7.1 Investigation and design

All investigation, calculations, design, supervision, and certification of the infrastructure outlined in this ***CoP*** shall be carried out by or under the control of persons who:

(a) Are experienced in the respective fields;

(b) Hold appropriate membership in the respective professional bodies or are recognised by ***Watercare*** as having proven experience;

(c) Have appropriate professional indemnity insurance and public liability insurance.

The provisions of this ***CoP*** do not reduce the responsibility of those professionals to exercise their judgement and devise appropriate solutions for the particular circumstances of each development.

1.7.2 Construction

All construction carried out in any development shall be done by persons who:

(a) Have the appropriate experience in the relevant areas;

(b) Have the appropriate equipment;

(c) Have the appropriate public liability insurance;

(d) Meet the requirements of the Health and Safety in Employment Act.

Watercare reserves the right to decline to accept connection to or authorise works that affect its networks where construction does not meet the requirements of section 1.7.2.

1.8 Approval of design and construction

1.8.1 Documents to be submitted for design approval

1.8.1.1

Prior to, or as a condition of, granting a resource consent for subdivision or development of land, or as otherwise required by a district or regional plan, or as otherwise considered necessary by ***the Auckland Council*** when considering applications to construct infrastructure, the council ***and/or Watercare*** may require documents to be submitted including the following:

(a) Design and construction documentation including drawings, specifications, and calculations for the following:

(i) Earthworks and geotechnical requirements

(ii) Wastewater

(iii) Water supply

(iv) Network utility services;

(b) A geo-professional's report on the suitability of the land for subdivision or development;

(c) Other reports as considered necessary by the Council ***or Watercare*** in the circumstances of the proposed infrastructure in order to meet the requirements of this ***CoP***;

(d) A design certificate in the form of the certificate in Schedule 1A.

1.8.2 Drawings

1.8.2.1 General

Design drawings shall be prepared in accordance with the ***Watercare's*** practices.

Except where otherwise notified, the requirements are as set out in this section and in sections ***5*** to ***6*** of this ***CoP***. Drawings ***submitted through Auckland Council*** shall be approved by ***Watercare.*** All drawings shall be provided in a form required by ***Watercare as set out in Watercare's "Standards and Procedures for the Production and Registration of AutoCAD Drawings".***

Drawings shall be to adequate detail to clearly illustrate the proposals and enable assessment of compliance with this ***CoP*** and enable accurate construction.

1.8.2.2 Composition of drawings

Design drawings generally include the following:

(a) A locality plan giving the overall layout and location ***together with a site plan and drawing index;***

(b) Detailed plans, longitudinal sections, cross sections, and diagrams of the proposed developments;

(c) Special details where the standard drawings are not sufficient;

(d) A north point and level datum ***as required for As-Built information in Appendix F***, the scale or scales used ***suitable for an A3 output***, the date of preparation and the date of any amendments, the designer's name, a unique ***drawing*** number ***and issue identifier***.

1.8.2.3 Scale

The scale for plans is generally 1:500 but other ***approved*** scales may be used to suit the level of detail on the plans. Special details shall be to ***approved*** scales appropriate for clarity ***at A3 size reproduction.***

Watercare may require other specific scales to be used.

1.8.2.4 Content of drawings

The following information when relevant shall be shown on the design drawings:

(a) The extent of the construction showing existing and proposed roads, and the relationship with adjacent construction, services, or property;

(b) Significant existing vegetation to be removed and any special or protected trees, areas of heritage significance, and existing water bodies that may be affected by the construction;

(c) The extent of earthworks, including earthworks on proposed reserves, existing and proposed contours, areas of cut and fill, batter slopes, subsoil drainage, and silt control measures both temporary and permanent;

(d) The design of proposed roads (and their connections with existing roads), including longitudinal and cross section plans, horizontal and vertical geometry and levels, typical cross sections, details of proposed pavement surface, kerbing, swales, berms, footpaths, cycle paths, tree planting, road marking and signals, and all other proposed road furniture;

(e) The horizontal and vertical location and alignment, lengths, sizes, materials, minimum cover, position relative to other services of all proposed water and wastewater systems and service connections, valves, hydrants, manholes, bends,

tees, meters and backflow devices, and services that may be reconnected or plugged, and any proposed overland stormwater flow path;

(f) Details and location of mechanically restrained portions of pipelines, pipeline bridges, pumping stations, reservoirs, intake and outlet structures and the location of surface obstructions, hazards, or other features that may be affected by the construction;

(g) For water mains, the nominal static pressure head at the point of connection and at the lowest point; design pressure and maximum design pressure;

(h) Details and location of existing and proposed telecommunications, electricity and gas supply, and street lighting layout, including proposed underground and above ground junction boxes, transformers and similar equipment. This information is typically provided by the service authorities once other design drawings are finalised and approved.

1.8.2.5 Recording of infrastructure – As-built information

Watercare will require the design drawings to be in a certain format ***(both electronic and hard copy),*** suitable for later addition of as-built information and inclusion in ***Watercare's GIS database***. In particular, electronic plans ***and GIS data*** will be required ***together with Survey.out and .dxf files, as well as the removal of construction notes, references to removed/demolished items, etc. prior to the lodging of final plans.***

1.8.3 Design basis for documents submitted for approval

1.8.3.1 Standard design basis

Proposals submitted on a standard design basis shall conform to this ***CoP***.

1.8.3.2 Alternative design basis

Proposals submitted on an alternative design basis may differ from this ***CoP*** and shall apply specifically to a particular proposal. ***Watercare's*** approval of an alternative design does not confer approval in general to any design criteria, construction technique or material forming part of the alternative design.

An explanation of the design basis or construction method is to be submitted, for approval in principle. It will be considered on its merits and should be approved provided that the design results in infrastructural development equivalent or superior in performance to that complying with this ***CoP and does not involve undue operation, maintenance or renewal obligations for Watercare.***

Alternative designs provide flexibility to meet the circumstances and requirements peculiar to the site, or as a means of encouraging innovative design, or to meet the principle of life-cycle costing.

1.8.3.3 Life-cycle costing

Life-cycle costing shall be used to consider options within a proposal or a proposal as a whole. In undertaking a life-cycle costing, consideration shall be given to the initial costs borne by the developer and the maintenance and replacement costs borne by ***Watercare*** at some future date. A reasonable balance shall be maintained between these short-term and long-term costs.

Watercare will not accept design or works that minimise the construction costs to the extent that disproportionately high operation and maintenance costs will be incurred.

1.8.4 Approval of design

1.8.4.1

When it is satisfied that the design meets the requirements of this ***CoP and any further provisions of Watercare***, or in the case of an alternative design, that the design satisfies the requirements of 1.8.3.2, ***Watercare*** shall notify the owner that the design has been approved and endorse the plans, specifications, and other documents accordingly. For the purpose of this approval ***Watercare*** may require the owner to make amendments to any plans, specifications, and other documentation and to submit

further or other reports. In considering project design and giving its approval, ***Watercare*** shall act without undue delay.

1.8.4.2 Approval before commencing construction

Construction shall not commence on site unless and until:

(a) Resource consents have been issued, except when no such consents are required; and

(b) ***Watercare*** has approved any other consents and the drawings, specifications, and calculations for the specific infrastructure that is required in accordance with 1.8.4.1.

C1.8.4.2

S. 116 of the Resource Management Act sets out when a resource consent commences. Generally this will be when any appeals against the grant of the consent have been disposed of. Where any appeals are unresolved, approval to commence work will need to be obtained from the Environment Court.

1.8.5 Notification of contracts and phases of construction

1.8.5.1

The developer shall notify ***Watercare***, in writing, of the names and addresses of contractors to whom it is proposed to award the contracts, and the nature of the construction in each case.

1.8.5.2

Unless ***Watercare*** requires otherwise, the developer shall notify ***Watercare*** when the following phases of construction are reached and such other phases as ***Watercare*** may determine to enable inspection to be carried out:

(a) Commencement of construction;

(b) Prior to concrete construction ***for structures and MHs***;

(c) Water and wastewater reticulation prior to backfilling;

(d) Water and wastewater reticulation ***prior to*** pressure testing;

(e) Disinfection of water mains;

(f) Prior to backfilling un-metered connections

At least 24-hours' notice shall be given by the developer. Inspection shall be carried out within 24 hours of notification if possible. Further construction phases shall not proceed until inspection has been made.

C1.8.5.2

Watercare *may require the appointment of a 'developer's professional advisor' or 'independent qualified person (IQP)' in which case this requirement will be performed by that person.*

1.8.6 Supervision of construction

The level of supervision undertaken in connection with any construction shall be agreed between ***Watercare*** and the developer, or, if appointed, the developer's professional advisor or the IQP as the case may be, and shall be appropriate to the circumstances considering the size and importance of the project, the complexity of the construction, and the experience and demonstrated skill in quality management of the person undertaking the construction.

Watercare will require as a minimum that the person in charge of the construction works is qualified at Level 3 or higher of an appropriate NZQA qualification.

Watercare will require completion certification for construction and supervision be submitted to it on completion. Such certification may be required from the contractors undertaking the construction, or the developer, or the developer's professional advisor (if any). The certificates shall be in the form given in ***Items 3, 4 and 5 in Appendix F.***

C1.8.6

An appropriate level of supervision is to be selected by reference to the Construction Monitoring Services information published by the Institution of Professional Engineers of New Zealand (IPENZ) and the Association of Consulting Engineers New Zealand (ACENZ).

1.8.7 Connecting to existing services

1.8.7.1

Connection of water and wastewater services to existing systems will be carried out by an approved contractor at the cost of the developer.

C1.8.7.1

*There is a prescribed process for organising and managing the water or wastewater shutdowns that may be necessary with the commissioning of some projects. It can be found **via these hyperlinked Items 13 and 14 in Appendix F.***
This is to be followed in all instances requiring a shutdown. The application must be lodged well in advance to provide adequate time for some of the complex planning that may be involved.

1.8.7.2

The developer shall give Watercare 5 working days' notice for approval to connect to existing services. New services shall be tested and completion documentation submitted to Watercare prior to connection approval being granted.

1.8.8 Testing

Any infrastructure required to be tested by the developer shall be pre-tested and proved satisfactory by the developer before test by ***Watercare*** is requested.

1.8.9 Maintenance

The developer shall maintain the infrastructure until it is formally taken over by ***Watercare*** or to a date specified in a bond or consent condition for completion of uncompleted infrastructure. The developer shall not be responsible for damage caused by other activities ***outside the developer's direct control*** such as building construction or for fair wear and tear or vandalism caused by public use of the roads that have been taken over by ***the Auckland Council, Auckland Transport or Watercare.***

1.8.10 Completion documentation

On completion of all subdivision and land development infrastructure, the developer shall provide ***Watercare*** with the following:

(a) The geotechnical reports and as-built plans required by 2.6 of this ***CoP***;

(b) As-built plans of all water and wastewater infrastructure showing the information set out in ***Item 1, Appendix F.*** As-built plans will be required as electronic data ***in accordance with the relevant sections of the Watercare "Standards and Procedures for Production and Registration of AutoCAD Drawings", which is linked as Item 17 in Appendix F in this CoP.***

(c) Evidence that all testing required by this ***CoP*** has been carried out and that the test results comply with the requirements of this ***CoP***;

(d) Evidence that reticulation and plant to be taken over by ***Watercare*** have been installed to their standards and will be taken over, operated and maintained by ***Watercare***;

(e) Completion certificates as per ***Items 3 and 5 in Appendix F.***

(f) Certification by a suitably qualified person where they have recommended a specific design and construction has been undertaken in accordance with that recommendation. The certification shall state that the suitably qualified person

supervised the construction and it has been completed in accordance with the recommended design principles;

(g) Other documentation required by ***Watercare*** including, but not limited to, operation and maintenance manuals, and warranties for new facilities involving electrical or mechanical plant and asset valuations for all infrastructures to be taken over by ***Watercare;***

(h) A detailed Schedule of Assets, including costs, for capitalising vested Water and Wastewater Assets shall be provided on Watercare template.

1.8.11 Approval of uncompleted work

Watercare will not consider the deferral of completion of any water or wastewater work. All work is to be completed, As-Built information and any O & M manuals provided and a bond will not be accepted against uncompleted work.

1.9 Bonds and charges

1.9.1 Uncompleted works

As already stated under 1.8.11, Watercare will not consider the deferral of completion of any water or wastewater work. All work is to be completed, As-Built information and any O & M manuals provided and a bond will not be accepted against uncompleted work.

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Water and Wastewater Code of Practice for Land Development and Subdivision

(Based on Section 8 of NZS 4404: 2010)

8 NETWORK UTILITY SERVICES

(Section 8 of NZS 4404 is out of sequence here, but is included at this point because of its general applicability to network utility services, which together with the preceding Section 1 set the framework for the Wastewater and Water sections following.)

Contents

8 NETWORK UTILITY SERVICES

(Section 8 of NZS 4404 is out of sequence here, but is included at this point because of its general applicability to network utility services, which together with the preceding Section 1 set the framework for the Wastewater and Water sections following.)

8.1 Scope

This section sets out requirements for the provision of stormwater, wastewater, and water supply systems, power, telecommunications and gas, and their locations in the road. The scope of these provisions applies to both future and existing roads and applies equally to all network utility services.

Note – Network utility services in roads are subject to the Utilities Access Act 2010 and the Infrastructure (Amendments Relating to Utilities Access) Act 2010.

8.2 General

8.2.1 Legislation

Referenced legislation and documents are listed in the Referenced Documents section of this Standard.

8.2.2 Definitions

For the purpose of section 8 the following definitions shall apply:

Code Means the national code of practice approved in accordance with the Utilities Access Act 2010

Corridor manager Has the same meaning given to it by the Utilities Access Act 2010 (see below)

("corridor manager means,—

(a) in relation to a road (as defined in section 315(1) of the Local Government Act 1974, and which includes State highways and Government roads), the local authority or other person that has jurisdiction over the road:

(b) in relation to a motorway (as defined in section 2(1) of the Government Roading Powers Act 1989), the New Zealand Transport Agency:

(c) in relation to railway land, the licensed access provider who controls access to the land")

8.2.3 Context

The developer is required to make all arrangements with the appropriate network utility operators for the supply and installation of stormwater, wastewater, water supply, and electric power and to the extent applicable for the provision of telecommunication and gas reticulation.

The developer shall provide satisfactory evidence to ***Auckland Council*** that the network utility operators are prepared to reticulate the subdivision and that agreement on the financial arrangements for the installation of each supply has been reached. The following applies to each utility:

(a) Stormwater, wastewater, and water supply. Where water supply and wastewater pipes, and stormwater systems are in the road reserve, they shall be installed at the time of road construction to the requirements of ***the Corridor Manager*** and ***Watercare*** for water pipes, and wastewater pipes and the ***Auckland Council*** for stormwater systems;

(b) Electric power. The supply of electric power will generally be by means of an underground system. Ducts shall be installed at the time of road construction to the requirements of the electrical supply authority and ***the Corridor Manager***. Where the developer is intending to provide electric power other than by underground

system, the developer shall provide alternative supply arrangements for approval of the ***Auckland Council***;

(c) Telecommunications. Arrangements shall be made with the telecommunication supplier for the reticulation of telecommunication facilities. Where only part of this reticulation is being supplied initially the arrangements shall include the requisite space being maintained for the installation of the remainder of the reticulation at a later date. Ducts will be supplied to the subdividing developer at the time of road construction for installation in the carriageway formation to the requirements of the telecommunications supplier and ***the Corridor Manager***;

(d) Gas. Where an existing gas supply is available or likely to be available to serve a subdivision, the developer may make appropriate arrangements with the gas supply authority and ***the Corridor Manager*** and at the time of road construction, install such ducts/pipes as may be required.

The developer shall follow the requirements of the ***CoP*** to the extent that they apply to the utility installation for the development.

8.3 Design

8.3.1 Plans

Copies of the plans of the development/subdivision shall be forwarded by the developer to all of the affected network utility operators at an early date to facilitate the design of the reticulation.

C8.3.1

It is important that all of the affected network utility operators are advised by the developer of any amendments to the development plan. Information when available on the type of dwellings and likelihood of more than one dwelling on any lot will be valuable for design purposes.

8.3.1.1

In preparing the engineering plans consideration shall be given to the requirements of the network utility operators and ***the Corridor Manager*** for:

(a) Minimum cover to cables and pipes;

(b) The network utility operator's desired position for the cable and piping within the road berm as agreed with ***the Corridor Manager***;

(c) The minimum separation distances between power or telecommunication cables, and gas or water mains;

(d) The width of berm which shall be clear of other services and obstructions to enable efficient cable-laying operations.

C8.3.1.1

*Reference should be made to each network utility operator and **the Corridor Manager** for their specific requirements. Refer to the **National Code of Practice approved under the Utilities Access Act,** for further information.*

8.3.2 Utilities above ground

Utilities should preferably be sited within the road berm or on land which will legally become part of the road but which is set back outside the normal road line. Alternatively separate lots (public utility reserves) or easements over **private property may be used. If there are any concerns raised about the safety** of above ground structures, the risk should be assessed in accordance with the requirements of the ***CoP*** and any significant risks mitigated.

8.4 Construction

8.4.1 Underground cabling

Underground cable laying shall be achieved by the most appropriate method considering the nature of subsoil and potential damage to infrastructures and shall be to the approval of Auckland Transport.

C8.4.1

The trenchless method is preferred in existing urban areas for underground cabling. Refer to the National Code of Practice for further information.

8.4.2 Materials

Materials and sizes of ducts and pipes shall comply with the requirements of the network utility operators and the colours should be in accordance with the Department of Labour's *Guide for safety with underground services.*

8.4.3 Conversion to underground on existing roads

Where a proposed subdivision fronts on to an existing road, the conversion of overhead reticulation to underground will in some instances be desirable. Agreement on the feasibility and benefit shall first be agreed between the network utility operator and the Auckland Council.

8.4.4 Commercial and industrial subdivisions

The servicing requirements for commercial and industrial areas are often indeterminate. Close liaison between the developer and the network utility operator is advisable, particularly immediately before cabling is installed so that changes can be incorporated to accommodate extra sites or the requirements of a particular industry.

8.4.5 Location of services

8.4.5.1 Position in the road

Position and depth shall be agreed with the appropriate network utility operator and the Corridor Manager in accordance with the provisions of the Code.

8.4.5.2 Recording of underground services

Auckland Council shall maintain a procedure for recording the location of their underground services on plans which are readily available to the public at the offices of the ***Auckland Council***. It is unlikely that ***Auckland Council*** will be able to provide a service for utility services other than those for which it is immediately responsible. This will be stormwater. Other authorities or network utility operators are required to maintain similar records of the existence and detailed location of their services for ready reference.

8.4.5.3 Accuracy and tolerance

It is essential that all services be laid to predictable lines if there is to be a reasonable opportunity of laying new services in existing systems. In addition to specifying the location of any service in the road berm, there should also be a tolerance which shall on no account be exceeded without proper measurement and recording on the detailed record plan. Tolerance of ±***150*** mm in the horizontal and ±***50*** mm in the vertical is a practicable requirement.

8.4.6 Trenches

8.4.6.1

When new subdivision construction is undertaken the backfilling and compaction of trenches to a state of stability consistent with the future of the surface shall be carried out in accordance with the Code and to the satisfaction of ***the Corridor Manager.***

8.4.6.2

Where underground services are laid after the initial construction of the subdivision or where they are extended from an existing area into a new one, special attention shall be given to the opening and reinstatement of trenches in accordance with the ***CoP*** and to the satisfaction of ***the Corridor Manager.***

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(Based on Section 6 of NZS 4404: 2010)

6 WATER SUPPLY

6 WATER SUPPLY

6.1 Scope

This section sets out requirements for the design and construction of drinking water supply systems. It covers the design of the localised reticulation system. ***The scope of water networks under this Code of Practice (CoP) is limited to pipe sizes of up to and including DN250 and excludes pumping station details. The requirements for pumping stations, the electrical controls and telemetry shall be reviewed with Watercare in the first instance. Requirements for a*** larger distribution network, ***reservoirs or treatment facilities are not covered by this CoP and needs to be supplemented with other Watercare standards.***

Water reticulation design is generally described in 'performance based' terms combined with 'deemed to comply' solutions. The designer is responsible for all aspects of the water system design, excepting those aspects nominated and provided to the designer by ***Watercare.***

If the scope of the development is large ***or the developer proposes a new*** water source, treatment or reservoirs, ***Watercare should be consulted at the earliest possible opportunity***.

Detailed plans and design calculations (where appropriate) shall be submitted to ***Watercare***. In addition the requirements outlined in section 1 of this ***CoP*** shall be met.

For any proposal involving third pipe systems for non-potable supply, early discussions with Watercare are recommended.

6.2 General requirements

6.2.1 Objectives

The objectives are to ensure that the water reticulation system is functional, the required quality and quantity of water is supplied to all customers within ***Watercare's*** designated water supply area.

The design shall ensure an acceptable water supply for each property including fire flows, by providing either:

(a) A watermain allowing an appropriate point of supply to each property; or

(b) A service connection from the main for each property. ***The water meter for each property must be installed by Watercare. Application for new water meters can be made to Watercare's Connections Team, Connections@water.co.nz.***

In principle the water system shall provide:

(c) ***Compliance with Watercare's*** policies, customer contract, ***design standards*** and contracts;

(d) The hydraulic adequacy of the system;

(e) The ability of the water system to maintain acceptable water quality;

(f) The structural strength of water system components to resist applied loads;

(g) The requirements of SNZ PAS 4509;

(h) ***Compliance with*** environmental requirements;

(i) ***Consideration to*** the environmental and community ***effects*** of the works;

(j) The 'fit-for-purpose' service life for the system ***as specified in this CoP***;

(k) Optimising the 'whole-of-life' cost;

(l) Each component's resistance to internal and external corrosion or degradation;

(m) Compatibility with Watercare's Networks Operating and Maintenance Procedures;

(n) Compatibility with Watercare's long term management strategy and plan (to be sought from Watercare Planning) for the overall supply zone; and

(o) Ensure Health and Safety requirements are met in design, construction and disinfection stages of a project.

6.2.1.A Safety of people

New chamber shall be fitted with an accepted stainless steel safety grille supported by the chamber lid frame.
The grille does not require to be locked in place separately. Other access points to Watercare's network may also require a form of fall restraint. Please contact Watercare's Health and Safety Manager for further information.

6.2.2 Referenced documents and relevant guidelines

Relevant legislation is listed in the Referenced Documents section of this ***CoP.***

Water designs shall incorporate all the special requirements of ***Watercare*** and shall be in accordance with the most appropriate standards, codes, ***technical policies*** and guidelines including those set out in Referenced Documents, the Civil Defence Emergency Management Act 2002, and *Drinking-water Standards for New Zealand 2005* (Revised 2008). Related Documents list additional material that may be useful.

All drawings shall comply with Watercare drawing standards. Refer Watercare CAD Manual: "Standards and procedures for the upload and registration of AutoCAD drawings", document number 7363.

6.3 Design

6.3.1 Design life

All water supply systems shall be designed and constructed for an asset life of at least 100 years. Some components such as pumps, metering, control valves, and control equipment may require earlier renovation or replacement.

6.3.2 Structure plan

Watercare and/or the Auckland Council may provide a structure plan setting out certain information to be used in design, such as ***population to be served,*** flows, sizing, upstream controls, ***roading,*** recommended pipe ***route*** layout, or particular requirements of ***Watercare and the Auckland Council.*** Where a structure plan is not provided, the designer shall determine this information by investigation using this ***CoP*** and engineering principles ***and by discussion with Watercare as necessary.***

6.3.3 Future development

Where further subdivision, adjacent to the one under consideration, is provided for in the district or regional plan, ***Watercare will*** require water supply infrastructure to cater for future development.

6.3.3A Contaminated sites

Contaminated sites should be avoided. Where a contaminated site has been confirmed as contaminated and cannot be avoided, written approval to proceed shall be obtained from the Auckland Council. The following issues shall be addressed in the request for approval:

- ***The nature of the contamination;***
- ***Compliance with statutory requirements;***
- ***Options to de-contaminate the area;***
- ***Selection of appropriate pipe materials, coatings and jointing techniques to maintain water quality;***
- ***Selection of pipeline materials to achieve the required life expectancy of the watermain;***
- ***Safety of construction and maintenance personnel; and***
- ***Special watermain maintenance considerations.***

Watermains and connections in the immediate vicinity of petrol stations shall not be constructed of PE or PVC material. Ductile Iron (and copper for connections) or an alternative material approved by Watercare shall be used.

6.3.4 System design

Watermains shall be designed with sufficient capacity to cater for all existing and predicted development within the area to be served and to meet the requirements of SNZ PAS 4509.

The water demand allowance in the subdivision design shall include provision for:

(a) Population targets;

(b) The area to be serviced; or

(c) Individual properties proposed by the developer.

Adjustment may be required to cater for the known performance (demand-based flows) of the existing parts of the water system.

6.3.5 Design criteria

6.3.5.1 Hydraulic design

The diameter, material type(s), and ***pressure*** class of the water main shall be selected to ensure that:

(a) The main has sufficient capacity to meet peak demands while maintaining minimum pressure;

(b) All consumers connected to the main receive at all times an adequate water supply ***flow*** and pressure;

(c) The appropriate firefighting flows and pressures can be achieved; ***and;***

(d) PE and CLS pipe design shall consider the nominal bore (NB) for design purposes where nominal diameter (DN) is referred to in this document.

6.3.5.1A Hydrant flow tests

A properly designed hydrant flow test can provide information about the current capacity of the water supply system to the area where the development is proposed and the capability of the hydrant asset to deliver required flows. This information is essential to support the capacity assessment process regardless of the fire-fighting requirement of a building.

For the design of all commercial, industrial and large residential developments (>10 lots)and/or as Watercare deems required actual hydrant flow tests shall be carried out by an approved person at peak hour, with pressure recorded at the nearest public hydrant, and the next available hydrant flowing in a fully open position.

The design of hydrant flow test shall not extract flow from hydrants beyond that specified by Watercare fire-flow targets. Refer 6.3.11.

All hydrant flow tests require Watercare approval through the access approval process prior to conducting in the field. Watercare may require the hydrant flow test to be observed in the field by an approved independent observer to audit the readings. If at any point in time during a hydrant flow test, the observed pressure drops to or below 100kPa, the hydrant flow test shall be terminated immediately. The hydrant flow test shall also follow a procedure to ensure safety, prevent dirty water incidents, and discharge of excessive amount of chlorinated water into the environment.

It should be noted that only hydrants painted yellow in the field can be used for hydrant flow tests. Some areas have zone isolations that are painted red and are not to be used. Do NOT open transmission flushing points which can appear in the field as hydrants painted blue.

6.3.5.2 Network analysis

Where required by ***Watercare***, a network analysis of the system shall be undertaken to ensure adequate water supply is available to all consumers connected to the system for all defined modes of operation. The analysis shall include all elements within the system***, including current and future development stages in a multi-staged development site,*** and ***the analysis*** shall address all demand periods including peak demand, low demand

flows, and fire flows. ***The network analysis shall be provided in a report detailing assumptions, analysis, and proposed water supply design.***

6.3.5.3 Peak flows

Occupancy rates for properties shall be as stated in Chapter 5 section 5.3.5.1, unless project-specific rates have been determined.

Water demands vary on a regional basis depending on a variety of climatic conditions and consumer use patterns. ***Watercare*** will provide historically-based demand information appropriate for design. Where peak demands are required for the design of a distribution system, the value shall be calculated from the following formulae:

Peak Day Demand (over a 12-month period) = Average Day Demand x PF

Unless specified otherwise by ***Watercare***:

(a) PF = 1.5 for populations over 10,000;

(b) PF = 2 for populations below 2,000.

(c) Interpolated between 1.5 and 2 for populations between 10,000 and 2,000

Peak Hourly Demand = Average Hourly Demand (on peak day) x PF (over a 24-hour period)

Unless specified otherwise by ***Watercare***:

(a) PF = 2 for populations over 10,000;

(b) PF = 5 for populations below 2,000.

(c) Interpolated between 2 and 5 for populations between 10,000 and 2,000

6.3.5.4 Head losses

The head loss through ***the local network*** pipes and fittings at the design flow rate shall be less than:

(a) 5 m/km for DN ≤150;

(b) 3 m/km for DN ***>150***.

Head loss can be calculated using one of a number of standard hydraulic formulae. ***Watercare's preference is for the use of the Hazen-Williams formula.***

6.3.5.4.1 Hydraulic roughness values

The hydraulic roughness values considered in the analysis shall take account of the pipe material proposed, all fittings and other secondary head losses, and the expected increase in roughness over the life of the pipe.

Watercare's preference is the use ***of the Hazen-Williams*** formula and coefficients ***given in Table 6.1. Other acceptable formulae and coefficient are given in the same table.***

Table 6.1 – Hydraulic roughness values

Material	**Colebrook-White coefficient k** (mm)	**Manning roughness coefficient** (n)	***Hazen Williams Coefficient (C)***
PE	0.003 – 0.015	0.008 – 0.009	***140***
Ductile iron ***concrete*** lined	0.01 – 0.06	0.006 – 0.011	***110-140***
Mild steel ***concrete*** lined	0.01 – 0.06	0.006 – 0.011	***130-140***
GRP	0.003 – 0.015	0.008 – 0.009	***140***
NOTE – The values show a range of roughness coefficients. *These* represents the expected value ***ranges for*** clean, new pipes laid straight ***to*** typical maximum expected for ***aged pipes***. It cannot be an absolute maximum, as the factors detailed in AS 2200 can lead to even higher roughness values in some circumstances. Recommendations on the appropriate roughness coefficient for a particular fluid may be obtained from the pipe supplier. Refer also to AS 2200 table 2 and notes.			

6.3.5.5 Minimum flows

The minimum flow shall be the greater of: (a) 25 L/min ***at the customer meter***; (b) ***Hydrant*** fire flow ***targets set by Watercare***; (c) flow required by sprinkler systems.

6.3.5.6 Minimum water demand

The minimum peak domestic demand shall be specified by ***Watercare***, or:

(a) Daily consumption of 250 L/p/day;

(b) Peaking factor of up to 5;

(c) Firefighting demands as specified in SNZ PAS 4509;

(d) The network ***shall*** be designed to maintain appropriate nominated pressures for both peak demand (average daily demand in L/s x peaking factor) and firefighting demand scenarios. These figures should be applied to mains of 100 mm diameter or greater. Mains less than 100 mm in diameter can be sized using the multiple dwellings provisions of AS/NZS 3500.1 table 3.2.

Design flows for hospitals, schools and other similar public developments shall be confirmed with Watercare.

6.3.5.7 Sizing of mains

Tables 6.2 and 6.3 may be used as a guide for sizing mains.

Table 6.2 – Empirical guide for principal main sizing

Nominal diameter of main DN	**Capacity of main (single direction feed only)**			
	Residential (lots)	**Rural Residential** (lots)	**General/light industrial** (ha)	**High usage industrial** (ha)
100	40	10	–	–
150	160	125	23	–
200	400	290	52	10
225	550	370	66	18
250	650	470	84	24

Table 6.3 – Empirical guide for sizing rider mains

DN 50 Rider mains		
Pressure	**Maximum number of dwelling units**	
	One end supply	**Two end supply**
High > 600 kPa	20	40
Medium 400 – 600 kPa	15	30
Low < 400 kPa	7	15

6.3.5.8 Water district zones

All areas will have ***limits of*** acceptable ***site ground elevation and/or*** pressure requirements in a ***water district*** zone ***due to hydraulic grade (HGL) constraints***. In some cases ***the installation of a pressure reducing valve to create a pressure reduced zone or the installation of a pump station to create a pressure boosted*** zone may be ***considered*** to control the pressure delivered to an area. In these cases the designer shall consult with ***Watercare*** to confirm ***if the proposal is acceptable for long term operations***.

6.3.5.9 *Watermain hydraulic design input and output*

Inputs to the design process include:

(a) ***Hydraulic grades (HGL) at point of connection to existing Watercare network***;

(b) ***Water demand (low, average, peak) in l/s, and diurnal profile;***

(c) Proposed land use and water use activities;

(d) Hydraulic loss functions;

(e) Watercare fire flow targets for the proposed site;

(f) An understanding of the general operating philosophy and design constraints of the water district zone the proposed development is connecting to; and

(g) Elevation assumptions at proposed water meter locations.

The outputs of water main hydraulic design shall include:

(***h***) Size of ***watermains (nominal diameter)***;

(***i***) Maximum, ***average*** and minimum design pressure ***at each of the water meter locations***;

(***j***) The pressure class/rating of pipeline system components;

(***k***) Surge analysis results;

(***l***) ***Pipe headloss (m/km) and velocity (m/s) compliance with low, average, peak demand and firefighting demand scenarios***;

(***m***) Specification of the maximum ***and minimum*** allowable operating pressure;

(***n***) Flow and pressure compliance with ***low, average,*** peak demand and firefighting demand scenarios; ***and***

(o) Reticulation layout that provides security of supply to end users.

6.3.5.10 Design pressure

The design pressures are the limiting pressures for operation of a ***water supply*** system including any allowance for variation of usage in the future.

The minimum design pressure is either the minimum pressure defined by ***Watercare*** or some higher pressure selected to control (minimise) the range of pressures experienced over the normal diurnal variation in the system.

Unless otherwise specified by ***Watercare***, the design pressure shall be between 250kPa and 800kPa (25 m to 80 m).

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A design pressure of 250 kPa to 800 kPa is set at the water meter. Specific consideration should be given for multi-storeyed buildings or areas of significant contours.

6.3.5.10.1 Operating pressure/working pressure

The operating pressure shall not exceed the re-rated pressure class/rating or the operating pressure limit of the pipeline components at that location.

6.3.6 Water quality

A number of factors in a network can adversely affect the quality of the water in the system. The network design shall ensure that the water quality at each property complies with the *Drinking-water Standards for New Zealand 2005* (Revised 2008). The requirement to protect water supplies from the risk of backflow is stated in the Health (Drinking Water) Amendment Acts 69ZZZ and this shall be adhered to.

6.3.6.1 Materials

All parts of the water supply system in contact with drinking water shall be designed using components and materials that comply with AS/NZS 4020.

A minimum pressure rating of PN12.5 shall be used for all pipe material and PN16 for all components, unless otherwise agreed with Watercare. The pressure rating of each component is to be provided to Watercare with the as-built details.

6.3.6.2 Prevention of backflow

Drinking water supply systems shall be designed and equipped to prevent backflow. The location and operation of hydrants, air valves, and scours shall ensure no external water enters the system through negative pressure from normal operation.

Watercare's requirements for the prevention of backflow may be viewed Appendix H.

6.3.6.3 Water age

Drinking water supply systems shall be designed to minimise water age to ensure no unacceptable deterioration of water quality. This shall include:

(a) Mains with dead ends ***(or termination points – see 6.3.17)*** should be avoided by the provision of looped watermains. Particular care shall be taken at the boundaries between supply zones where dead ends shall be ***avoided or*** minimised ***whilst maintaining existing district zone boundaries;***

(b) Mains for short runs shall be reduced in size or looped, for example no-exit roads (see figure 6.6);

6.3.7 Flow velocities

In practice it is desirable to avoid unduly high or low flow velocities. Pipelines shall be designed for ***normal*** flow velocities ***at peak periods*** within the range of 0.5 to 2.0 m/s. In special circumstances, velocities of up to 3.0 m/s may be acceptable.

For pumping mains an economic appraisal may be required to determine the most economical diameter of pumping main to minimise the combined capital and discounted pumping cost. The resulting velocity will normally lie in the range 0.8 m/s to 3.0 m/s. ***All pump station design considerations should be consulted with Watercare in the first instance.***

The following factors shall be considered in determining flow velocity:

(a) ***Avoid*** stagnation;

(b) ***Minimise*** turbidity (large fluctuations in flow rates can dislodge the biological slime or stir up settled solids in pipelines);

(c) Pressure;

(d) Surge;

(e) Pumping facilities;

(f) Pressure reducing devices;

(g) Pipe lining materials.

6.3.7.1 Surge analysis

A surge analysis shall be undertaken for any pipeline within a pumped system or system containing automated valves. The source of any significant pressure surges or high-pressure areas shall be identified and remedial measures to minimise pressure surges designed and specified.

6.3.8 System layout

6.3.8.1 General

Watermains ***shall be*** located in the road ***reserve***. The location shall be specified by the ***Auckland Council or Watercare***, within the road ***reserve*** or space allocation nominated by the ***Corridor Manager.*** Where approved by the ***Auckland Council or Watercare,*** watermains may be located in a public reserve, and in this case easements shall be required.

Watermains should:

(a) Be aligned parallel to property boundaries;

(b) Should not traverse steep gradients; and

(c) Should be located to maintain adequate clearance from structures and other infrastructure. ***Refer section 6.3.9***

6.3.8.2 *Principal and Rider mains* layout

For residential areas, a principal water main of not less than nominal diameter (DN) 100, fitted with fire hydrants, shall be laid on one side of all public roads in every residential development. A rider main ***of not less than nominal diameter (DN) 50*** shall be laid along the road frontage of all lots not fronted by the principal main. A ***minimum DN 50*** rider main shall also be provided for service connections where the principal main is ***DN 300*** or larger. The principal mains serving commercial and industrial areas shall be at least DN 150 laid on both sides of the road. This requirement may be relaxed in short no-exit roads as long as adequate firefighting coverage is available. ***To facilitate future development, watermains shall be laid across the full road frontage of the site at the developer's expense.***

6.3.8.3 Mains layout

In determining the general layout of mains, the following factors shall be considered:

(a) Main location to allow easy access for repairs and maintenance;

(b) Whether system security, maintenance of water quality, and ability to clean mains meet operational requirements;

(c) Location of valves for shut-off areas and zone boundaries (see 6.3.14);

(d) Avoidance of dead ends by use of looped mains or rider mains;

(e) Provision of dual or alternate feeds to minimise service risk;

(f) Consider material type and evidence of engineering evaluation, i.e. location to fuel stations; and

(g) Compatibility with Watercares's long term management strategy and plan for the overall district zone

6.3.8.4 Watermains in private property

Watermains shall only be installed in the public road reserve. Watermains in private property, right of ways (ROW), private roads, etc. will not be permitted.

6.3.8.5 Types of system configuration

Network layouts shall be established in accordance with ***Watercare's*** practice. Interconnected ring systems should be provided when feasible.

6.3.8.6 Watermains near trees

Locating watermains within the root zone of trees should be avoided if possible. Where this is not practicable, careful attention to pipe material selection is necessary to minimise risk of pipe failure due to root growth.

6.3.8.7 Shared trenching

Where shared trenching is approved ***in accordance with the Utilities Access Act*** by ***Watercare, the Auckland Council, the Corridor Manager*** and utility service owners, a detailed design shall be submitted for approval by those parties and shall include:

(a) Relative location of services (horizontal and vertical) in the trench;

(b) Clearances from other services;

(c) Pipe support and trench fill material specifications;

(d) Embedment and trench fill compactions;

(e) Trench markings;

(f) Services' location from property boundaries;

(g) Any limitations on future maintenance; and

(h) Special anchoring requirements, such as for bends and tees.

Where approved by ***the parties listed above***, shared trenching may also be used for property service connections.

6.3.8.8 Rider mains and duplicate mains

A rider main shall be laid along the road frontage of all lots not fronted by a principal main.

Duplicate mains are required to provide adequate fire protection in the following cases:

(a) Arterial roads or roads with a central dividing island;

(b) Roads with split elevation;

(c) Roads with rail or tram lines;

(d) Urban centres;

(e) Parallel to large distribution mains that are not available for service connections;

(f) Commercial and industrial areas nominated by the ***Auckland Council***;

(g) Where required by SNZ PAS 4509.

6.3.8.9 Crossings

Water main crossings of roads, railway lines, and underground services shall, as far as practicable, be at right angles. ***Ducting and additional protection of the crossing service is subject to the affected authority's requirements. In any event the minimum water main crossing shall be sized at DN100.*** Mains should be located and designed to minimise maintenance and crossing restoration. ***Watercare*** may require extra mechanical protection for the pipes or different pipe materials to minimise the need for future maintenance.

6.3.8.10 Crossings of waterways or reserves

All crossings of waterways or reserves shall be specific designs to suit ***Watercare's*** requirements.

Crossings shall ***be sized minimum DN100 and***, as far as practicable, be at right angles to the waterway or reserve. Reference should be made to ***Watercare*** to establish whether it prefers elevated crossings or below waterway invert crossings. When the pipeline is placed under the invert level of a waterway it may require mechanical protection by concrete encasement or steel or other acceptable pipe duct. Different pipeline materials may need to be used for the crossing.

6.3.8.11 Location marking of valves and hydrants

The location marking of valves and fire hydrants shall be to SNZ PAS 4509 and ***Appendix B*** drawing WS8.

6.3.8.12 Location of watermains on bridges

The owner or controlling authority for any bridge must give approval for any watermain design where the proposed watermain is to be attached to or be mounted under a bridge. Specific design will be required. Refer section 6.3.8.9

6.3.9 Clearances

6.3.9.1 Clearance from underground services

Where a ***watermain*** is designed in a road the clearances of the pipe ***from other services shall comply with Watercare's specific requirements***.

For ***all*** trenching and trenchless technology installation, clearance from other service utility assets shall not be less than the minimum vertical and horizontal clearances shown in Table 6.4.

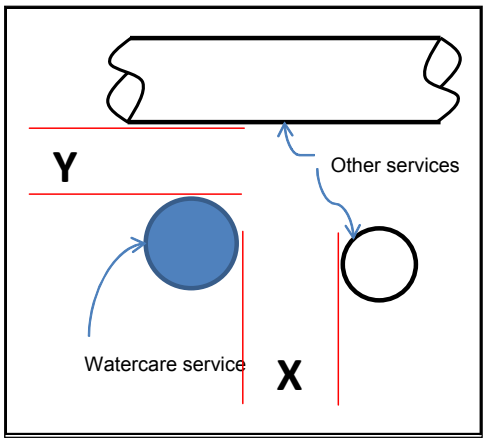


Figure 6.1 Service clearance measurements

Table 6.4 – Clearances between watermains and underground services [6]

Utility (Existing service)	**Minimum horizontal clearance** (mm) ***(Fig. 6.1 'X')***		**Minimum vertical clearance**[1] (mm) ***(Fig 6.1 'Y')***
	New main size		
	DN <250	**DN 250**	
Watermains DN ≥ 750	***Location of new services to be negotiated with Watercare***		
Watermains ***750*** > DN ≥375	600	600	500
Watermains DN <375	300[2]	600	150
Gas mains	300[2]	600	150
Telecommunications conduits and cables	300[2]	600	150
Electricity conduits and cables	500	1000	225
Wastewater ***and Storm water*** pipes	1000/600[4]	1000/600[4]	500[3]
Kerbs	150	600[5]	150 (where possible)

NOTE –

All clearances are measured as the inside open spacing between the external walls of services.

(1) Vertical clearances apply when watermains cross another utility service, except in the case of wastewater when a vertical separation shall always be maintained, even when the main and wastewater pipe are parallel. The main should always be located above the wastewater pipe to minimise the possibility of backflow contamination in the event of a main break.

(2) Clearances can be further reduced to 150 mm for distances up to 2 m when passing installations such as poles, pits, and small structures, providing the structure is not destabilised in the process.

(3) Watermains should always cross over wastewater and stormwater drains.

(4) When the wastewater or storm water pipe is at the minimum vertical clearance below the water main (500 mm), maintain a minimum horizontal clearance of 1000 mm. This minimum horizontal clearance can be progressively reduced to 600 mm as the vertical clearance is increased to 750 mm.

(5) Clearance from kerb and channel shall be measured from the nearest edge of the concrete. For watermains ≤375 clearances can be progressively reduced until the minimum of 150 mm is reached for mains DN ≤200.

(6) Where a main crosses other services, it shall cross at an angle as near as possible to 90°.

6.3.9.2 Clearance from structures

Pipes adjacent to existing buildings and structures shall be located clear of the 'zone of influence' of the building foundations. If this is not possible, a specific design shall be undertaken to cover the following:

(a) Protection of the pipeline;

(b) Long term maintenance access for the pipeline;

(c) Protection of the existing structure or building;

(d) Consideration to building overhangs and clearances. Also refer Chapter 5 and drawing WW53; and

(e) Building over watermains is not permitted.

The protection shall be specified by the designer for evaluation and acceptance by ***Watercare***.

Sufficient clearance for laying and access for maintenance is also required. Table 6.5 may be used as a guide for minimum clearances for mains laid in public streets.

Table 6.5 – Minimum clearance from structures

Pipe diameter DN	**Clearance to wall or building** (mm)
<100	600
100 – 150	1000
200 – 250	1500

For the process to build close to Watercare's networks please refer to the Works Over page under 'Development and Connections' on the Watercare website.

6.3.9.3 Clearance from high voltage transmission facilities

Watermains constructed from metallic materials shall generally not be located close to high voltage transmission lines and other facilities. Special design shall be undertaken if it is necessary to locate such mains close to such facilities.

C6.3.9.3

For any situation where a metallic pipeline is located in proximity of electrical transmission lines, particular attention is drawn to AS/NZS 4853 Electrical hazards on metallic pipelines. Similarly, A Guide to Power System Earthing Practice published by the Electrical Engineers Association is a useful reference (www.eea.co.nz)

6.3.9.4 Deviation of mains around structures

Deviation of a pipeline around an obstruction can be achieved by deflection of the pipeline at joints, to the angular deflection limits stated by the pipe joint manufacturer and with suitably restrained fitting bends. Permitted angular deflection varies with pipe material, pipe wall thickness, pipe PN class, joint type, design and geometry. Some joint types are specifically designed to accommodate angular deflection. PVC and PE pipes may also be curved along the pipe barrel, between joints, to a radius of curvature not less than that stated by the pipe manufacturer.

6.3.10 Pipe selection

The selection of the appropriate pipe material, sizes, and ***pressure*** classes shall be based on system demands.

6.3.10.1 Standard pipe sizes

The principal main shall be standardised as DN 100, 150, 200, 250 nominal diameters only. When larger pipes are required the exact diameter will be determined by ***Watercare***.

6.3.10.2 Minimum pipe sizes

Minimum pipe diameters shall be as follows, where DN is the nominal pipe diameter:

(a) DN 50 for rider mains in residential zones;
(b) DN 100 for ***principal mains in*** residential zones;
(c) DN 150 for industrial or commercial zones; ***and***
(d) DN100 minimum for road, railway and reserve crossings.

Watercare may also specify minimum pipe diameters for other identified areas such as CBDs and high density residential zones.

6.3.10.3 Pipe PN class (pressure rating)

Pipe PN class is selected on the basis of the design pressure (head) calculated for the various sections of the reticulation network. This may be varied by specific operational requirements specified by ***Watercare***. ***The minimum pipe pressure rating shall be PN12.5***

6.3.10.3.1 Design pressure

The design pressure (head) for the mains to be installed shall be based on the following:

Design pressure, (m) = Maximum Supply Pressure, (m above the level datum used for the ground level)
+ Surge Allowance, (m) (see 6.3.7.1)
– Lowest Ground Level (GL) of the proposed main, (m above datum).

The design pressure (m head) shall be used for:

(a) Selection of pipe materials and classes;
(b) Selection of pipe fitting types and classes.

6.3.10.3.2 Minimum pipe PN

The minimum ***pressure rating for pipe shall be PN12.5*** and ***for*** fittings ***PN16 on*** water reticulation mains (see **Appendix A** for list of pressure pipe and fittings Standards). Designers shall verify ***Watercare's*** minimum requirement before specifying the required pipe PN.

6.3.10.3.3 Nominated pipe PN

In some cases Watercare may nominate a pipe PN (such as PN ***16***) for pressure pipes and fittings to standardise on a limited number of pipe PNs, or to allow future operational flexibility within the system. Where this is the case, the design pressure used as the basis for system design shall not exceed ***Watercare's*** specified operating pressure limit associated with the ***nominated*** pipe PN.

6.3.10.3.4 Pumped mains

Wherever pumping mains are considered the requirements shall be reviewed with Watercare in the first instance. Pump station design for water reticulation systems is excluded from this CoP.

For watermains in pumped systems, a detailed surge analysis shall be conducted unless otherwise directed by ***Watercare*** to ensure:

(a) The appropriate surge pressure is included in the calculated design head;
(b) Surge control devices are included in the system design, where identified by the detailed analysis, to protect the network or control pressure fluctuations in the supply to customers, or both.

6.3.10.4 Pipe materials

For acceptable pipe materials and Standards see **Appendix A**.

C6.3.10.4

If, for any reason, the developer proposes the use of steel watermains, early discussions with Watercare are required to agree on aspects of the proposal, such as the provision of cathodic protection.

6.3.11 Fire flow

The water reticulation system shall be designed to comply with SNZ PAS 4509.

The water reticulation shall be designed to comply with Watercare fire flow target zoning. Any shortfall between the fireflow as specified according to the targets and fire flow required by the proposed development is the responsibility of the site owner to provide alternative fire protection services, at the cost of the site owner.

6.3.11.1 Fire protection services

Many commercial and industrial developments require installation of special fire protection services. While it is the responsibility of the site owner to provide these fire services, the developer shall design the water reticulation system ***with consideration*** to the required demands, where these are known in advance. ***The site owner shall ensure that if any special fire protection services require supply of water from Watercare's reticulation, the design shall include the protection of existing Watercare assets and consider the existing and future available pressure and flow during normal operations.***

As development continues in a zone or as required by Watercare to manage the water supply system, the pressure and flow is likely to reduce. The design shall also make allowance for a future upgrade at the site owner's cost when the system operating pressure and flow changes in the future to other conditions within Watercare's level of service criteria - refer 6.3.5.10.

6.3.12 Structural design

6.3.12.1 General

For installation conditions beyond those shown on the drawings, the pipeline installation***, including non-pipeline elements such as pump station chambers, etc.,*** shall be specifically designed to resist structural failure. The design shall be in accordance with AS/NZS 2566.1 including the structural design commentary AS/NZS 2566.1 Supplement 1 ***and NZS 1170.5 including Supplement 1***. Details of the final design requirements shall be shown on the drawings.

Pipe bridge design shall be subject to specific structural design of the pipe and supports for empty and full static loads, any dynamic loads and full seismic provisions.

6.3.12.2 Seismic design

All pipes and structures shall be designed with adequate flexibility and special provisions to minimise risk of damage during earthquake. Historical experience in New Zealand earthquake events suggests that suitable pipe options, in seismically active areas, may include rubber ring joint PVC pipes PE pipes***, or steel pipe***. Specially designed flexible joints shall be provided at all junctions between pipes and rigid structures (such as reservoirs, pump stations, bridges, and buildings) in natural or made ground.

C6.3.12.2

Good reference material for consideration is the American Lifelines Alliance Seismic Guidelines for Water Pipes.

6.3.12.3 Structural consideration

Pipelines shall be designed to withstand all the forces and load combinations to which they may be exposed including internal forces, external forces, temperature effects, settlement, and combined stresses. The watermain design shall include the selection of the pipeline

material, the pipe ***pressure*** class, and selection of appropriate bedding material to suit site conditions.

6.3.12.4 Internal forces

Pipelines shall be designed for the range of expected pressures, including transient conditions (surge and fatigue) and maximum static head conditions. In the case of transient conditions the amplitude and frequency shall be estimated. The allowance for surge included in the maximum design pressure shall not be less than 200 kPa. Transfer and distribution mains subject to negative pressure shall be designed to withstand a transient pressure of at least 80 kPa below atmospheric pressure. A surge safety factor of 2 may be applied to the normal operating pressure to estimate the surge pressure in lieu of a detailed surge analysis.

6.3.12.5 External forces

The external forces to be taken into account shall include:

(a) Trench fill loadings (vertical and horizontal forces due to earth loadings);

(b) Surcharge;

(c) Groundwater***, including the potential for floatation;***

(d) Dead weight of the pipe and the contained water;

(e) Other forces arising during installation;

(f) Traffic loads;

(g) Temperature (expansion/contraction).

The consequences of external forces on local supports of pipelines shall also be considered.

6.3.12.6 Geotechnical investigations

The designer ***shall*** take into account any geotechnical requirements determined ***during the investigations for the development***. ***All geotechnical log reports shall be uploaded to the Auckland Geotechnical Database:*** ***https://agd.projectorbit.com*** where required, standard special foundation conditions shall be referenced on the drawings.

Special design requirements may apply in any area susceptible to land instability or soil liquefaction. A regional map showing such areas is available in section 6.7.

Note: Information provided on the map is indicative only, based on the best available material at the time it was produced. Geo-professionals are to satisfy themselves of the correctness of the information and apply current knowledge and their skills when meeting any such special requirements on a proposal.

6.3.12.7 Pipe selection for special conditions

Pipeline materials and jointing systems shall be selected and specified to ensure:

(a) Structural adequacy considering ground conditions and water temperature;

(b) Water quality, considering ***the chemical concentration and temperature of the water, the influence of applied stresses and*** lining material;

(c) Compatibility with aggressive or contaminated ground ***(consider HAIL sites)***;

(d) Suitability for the geotechnical conditions;

(e) Compliance with ***Watercare's*** requirements.

6.3.12.8 Above-ground watermains

The design of above-ground watermains shall include the design of pipeline supports, maintenance and access requirements, control of unbalanced thrusts ***and pipe thermal movements***, and shall address exposure conditions, such as corrosion protection, UV protection, freezing of watermains, and temperature de-rating.

In such situations the pipe materials, support, and restraint for the pipes and fittings shall be detailed on the drawings.

Pipe bridge design shall be subject to specific structural design of the pipe and supports for empty and full static loads, any dynamic loads and full seismic provisions. No wooden support will be accepted and provision shall be made for access and clearances to maintain the pipe and structures. Unauthorised bridge access shall be prevented with an adequate fencing structure and where required appropriate on-bridge railing for fall protection.

6.3.12.9 Trenchless technology

Trenchless technology ***shall*** be used as appropriate for alignments passing through or under:

(a) Environmentally sensitive areas;

(b) Built-up or congested areas to minimise disruption and reinstatement;

(c) Railway and road crossings;

(d) Significant vegetation;

(e) Vehicle crossings.

Pressure pipes used for trenchless installation shall have suitable mechanically restrained joints, specifically designed for trenchless application, which may include integral restraint seal systems, or heat fusion welded joints.

For information on trenchless installation methods see ***Chapter 5 section*** 5.3.6.8 ***and refer to Watercare for the appropriate installation standards, obtainable as a separate document.***

C6.3.12.9

*Further information on trenchless technologies may be found in 'Trenchless technology for installation of cables and pipelines' (Stein, **2004**), 'Trenchless technology – Pipeline and utility design, construction, and renewal' (Najafi, **2005**), and 'Guidelines for horizontal directional drilling, pipe bursting, micro-tunnelling and pipe jacking' (Australasian Society for Trenchless Technology, **2009**).*

6.3.12.10 Embedment

6.3.12.10.1 Minimum pipe cover

Pipeline cover shall be designed with depth to the top of the pipe measured to the final surface level:

(***a) In berms a minimum cover of 600mm up to a maximum of 1000mm;***

(b) In carriageways a minimum 900mm up to a maximum of 1200mm; or

(c) As otherwise agreed or required by Watercare and the Corridor Manager.

6.3.12.10.2 Minimum trench width

Pipe trench width design considerations shall be based on the minimum side clearances detailed in ***Appendix B*** Code of Practice for Working in the Road WS2.

6.3.12.11 Pipeline restraint

Anchorage shall be provided at bends, tees, reducers, valves, and dead ends where necessary.

C6.3.12.11

*In-line valves, especially those DN 100 or larger, should be anchored to ensure stability under operational conditions. See **Appendix B** drawings WS15 through to WS17.*

6.3.12.11.1 Thrust blocks

The design of thrust blocks shall be based on the maximum test pressure ***and be considered at all Tees, dead ends and reducers***.

Thrust blocks shall be designed to resist the total unbalanced thrust and transmit all loads to the adjacent ground. Calculation of the unbalanced thrust shall be based on the maximum design pressure, or as otherwise specified by ***Watercare***.

Restraint joint systems, specifically designed to resist the total unbalanced thrust, and support all thrust load, may be used ***for watermains up to 250 mm DN***, instead of thrust blocks. These may include mechanical restraint coupling joints, or integral restraint seal systems.

Typical contact areas for selected soil conditions and pipe sizes are shown in ***Appendix B*** drawings WS15 through to WS17.

Thrust blocks for temporary infrastructure shall be designed to the requirements for permanent thrust blocks.

6.3.12.11.2 Anchor blocks

Anchor blocks are designed to prevent movement of pipe bends in a vertical direction. They consist of sufficient mass concrete to prevent pipe movement (see ***Appendix B*** drawings WS15 through to WS17).

6.3.12.11.3 Restrained joint watermains

Commercially available mechanically restrained jointing systems may be used to avoid the need for thrust and anchor blocks subject to the approval of ***Watercare***. However in some situations ***Watercare*** may still require the use of thrust and anchor blocks.

Refer to Watercare for specific pipe material installation standards.
Watermains with restrained joints shall be indicated using a specific warning tape.

6.3.13 Reservoirs and pumping stations

Where reservoirs or pumping stations are required, reference shall be made to ***Watercare*** for its specific requirements.

6.3.14 Valves

This section shall be read in conjunction with Watercare's valve supply and installation specifications.

6.3.14.1 General

Valves are used to ***isolate mains from each other for operational and maintenance purposes***.

Valves shall be provided:

(***a***) ***Either side of crossings for motorways***, arterial roads, and railway and tram crossings;
(***b***) Adjacent to street intersections (for ease of location);
(***c***) In the ***footpath***, clear of ***carriageway***, where possible.
(d) Within 50 m of a bridge abutment, where distribution mains pass through motorway or arterial road bridge.

Watercare should be consulted to establish the local requirement for connection type (***typically flanged***), as well as any other issues such as valve anchoring requirements.

Valves and valve box lids shall be suitably marked and painted as follows:

(a) Hydrants – yellow
(b) Isolation valves (typically open) – white
(c) District zone valves (typically shut) – red

Refer to drawing WS8 for markings and marker post position requirements.

6.3.14.2 Siting of valves

The siting of valves shall take a holistic view of the existing infrastructure and proposed additions. General principles to be considered shall include:

a) Valves shall be sited to provide the control (such as flow, pressure, isolation, and diversion) required by ***Watercare***;
b) Ready access to valves to enable their safe operation. Account shall be taken of traffic and other site peculiarities;
c) Minimisation of inconvenience to the public by avoiding clustering of surface fittings in the footpath at intersections;
d) Optimisation of the number and location of valves to meet ***Watercare's*** operation and maintenance requirements, safe working, and to minimise the effect of a shutdown on ***Watercare***'s customers. ***Refer drawing WS5***

6.3.14.3 Gate valves *and Sluice valves*

Sluice valves shall be approved resilient seated gate valves with anti-clockwise rotation of the input spindle for closure, ***with a false dolly attached. Sluice valves are installed on principal mains***

Peet valves shall be approved resilient seated gate valves with clockwise ***rotation of the input spindle for closure. The spindle shall have a corrosion protected metallic hand wheel. Peet valves are installed on rider mains.***

Toby valves (gunmetal gate valves) shall be clockwise closing with corrosion protected hand wheel. ***Toby valves are installed on domestic service connections***

Buried valves shall be operated from above ground and shall be designed to facilitate the use of a standard key and bar. An extension spindle shall be incorporated as necessary to ensure the top of the spindle is ***reachable within 500mm but not be less than 100mm from the finished surface level.*** In-line valves shall be the same diameter as the reticulation main.

6.3.14.3.1 Valve spacing criteria

The number of property service connections in a shut-off area shall be in accordance with table 6.6. When assessing property service numbers, unit title and strata title properties such as apartment buildings and multi-unit developments shall be counted as multiple connections. All connections having an alternative supply may be excluded when assessing property service numbers. The overriding maximum spacing between in-line valves shall be in accordance with table 6.6.

Table 6.6 – Valve spacing criteria

Watermain size DN	**Number of property service connections (nominal)**	**Maximum spacing** (m)
≤150	***50***	300*
>150 and ≤ 250	***50***	***500***
* In rural areas, the maximum spacing is 500 m.		

6.3.14.3.2 Branch mains

Stop valves shall be located on branch mains adjacent to the through water main. The type of joint to be used ***shall be flange to flange. (see Fig. 6.2)***

Where a road crossing is necessary immediately after the tee branch and there is no space available adjacent to the tee, a stop valve shall be installed on the opposite side of the road.

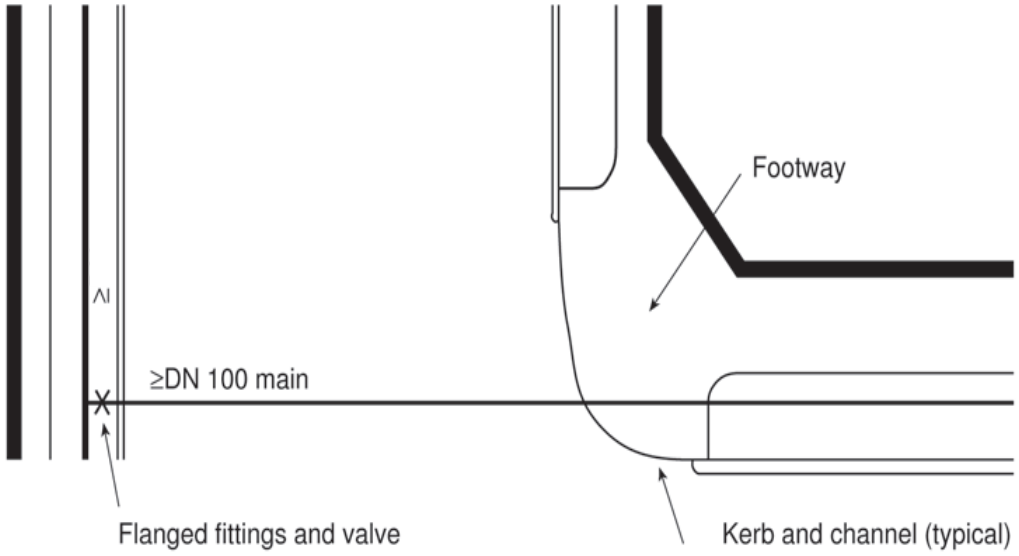


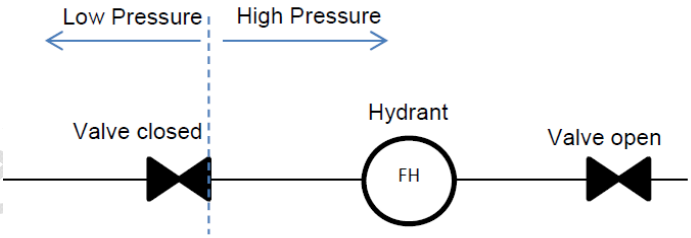
Figure 6.2 – Branch valve adjacent to main

6.3.14.3.3 *District* zone valves

District zone ***boundary*** valves and hydrants shall be installed as follows (see figure 6.3):

Valves in a paired configuration with a standard fire hydrant located between them. Installation in this manner permits the valves to be checked for leakage. The valve on the low pressure side of the pair will normally be closed in order for the fire hydrant to be used for firefighting purposes with the supply from the higher pressure zone;

District zone dividing valves on rider mains shall be subject to specific design.



Note –

(1) Refer drawing WS7 for detail

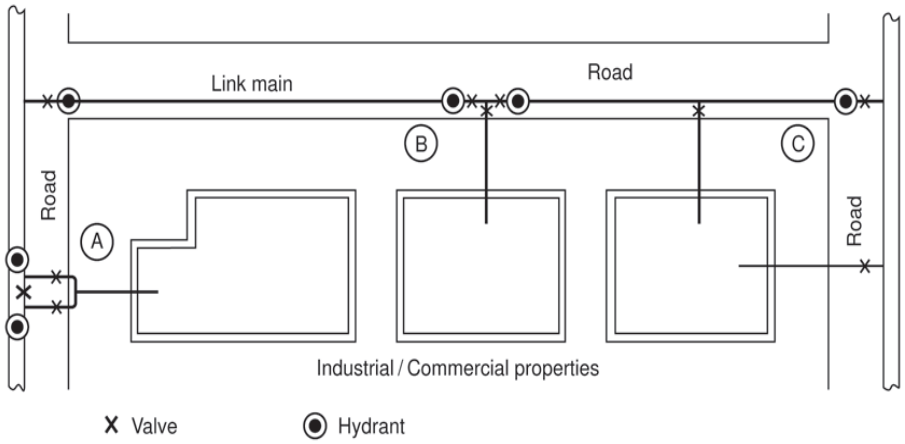
(2) The closed valve box shall be foamed to prevent accidental operation and the lid painted red. Kerb marking shall also be red to indicate the normally closed valve.

Figure 6.3 – Valve and hydrant combination for *district* zone dividing valves. Refer drawing WS7

6.3.14.3.4 Secure service connections

Additional stop valves may be provided at a service connection to a customer requiring a greater security of supply such as hospitals and large industrial or commercial

developments. Figure 6.4 illustrates typical arrangements to facilitate partial isolation of the main while maintaining supply to the customer.



NOTE

Notes –

(1) Example A – feed from two directions off a large diameter water main. The arrangement is more complicated than Example B, but is justified by the cost of an additional large diameter stop valve which would be required if using Example B.

(2) Example B – feed from two directions off a smaller diameter main. This is a simpler arrangement than Example A, but requires two valves on the main.

(3) Example C – feed from two separate mains.

Figure 6.4 – Secure connection

6.3.14.4 Butterfly valves

Butterfly valves shall only be used with the approval of ***Watercare***.

C6.3.14.4

Butterfly valves are not normally used in reticulation mains as they hinder swabbing operations, and the quick closing action can induce high surge pressures.

6.3.14.5 Pressure reducing valves

Pressure reducing valves (PRV) are outside the scope of this CoP Refer to ***Watercare for requirements and specification.***

C6.3.14.5

A PRV is used to reduce the pressure to a desired lower pressure downstream of the valve. The PRV works automatically to maintain the desired downstream pressure.

6.3.14.6 Air valves

6.3.14.6.1 Installation design criteria

Investigation into the need for air valves (AVs) shall be made for all high points on mains, particularly at points more than 2 m higher than the lower end of the section of water main and particularly if the main has a steep downward slope on the downstream side.

Where the hydraulic head is less than 10 m, special consideration shall be given to the type of AV to prevent water leakage from the valve. AVs shall be installed with an isolating valve to permit servicing or replacement without having to shut down the main.

Combination AVs, that is (dual) AVs incorporating an AV (large orifice) and an air release valve (small orifice) in a single unit, are generally the preferred type for distribution and transfer mains, and where required on reticulation mains.

The nominal size of the large orifice of air valves shall be DN 80 for installation on mains. This size has an exhaust capacity of approximately 0.3 m^3/s. ***For watermains up to DN250 hydrants are the preferred operational valve for air scouring***

C6.3.14.6.1

Watermains with only a few service connections or a configuration that leads to air accumulation may require combination air valves to automatically remove accumulated air that may otherwise cause operational problems in the water system.

The configuration of the distribution network for both the change in elevation and the slope of the water main govern the number and location of air valves required.

6.3.14.6.2 Air valves location

Air valves shall not be located in major roadways or in areas subject to flooding ***or in areas of high ground water without specific design to prevent backflow contamination of supply***. When required, air valves shall be located:

(a) At summits (***significant*** high points);

(b) At intervals of not more than 800 m on long horizontal, ascending, and descending sectors;

(***c***) On the downstream side of PRVs;

(***d***) On the downhill side of major isolating valves;

(***e***) At blank ends.

Where the air valve is in a valve chamber, the design shall ensure adequate venting for effective operation and drainage to prevent backflow contamination.

6.3.14.7 Scours and pump-out branches

Scours and pump-out branches ***on significant mains are*** provided in the distribution network for maintenance purposes. They are designed to allow draining of water from the mains by gravity or use of a mobile pump. Hydrants ***are preferred*** for flushing and draining on watermains DN <250. ***Scour layouts need to be approved by Watercare.***

Scours and pump-out branches shall incorporate appropriate measures to prevent back siphonage into the water supply system.

There shall be adequate drainage facilities to receive the flow resulting from flushing and draining operations.

Scours shall:

(a) Drain the watermain by gravity or have provision for pump-out within a period of 1 hour, or both;

(b) Have a diffuser fitted at the discharge point if there is a likelihood of environmental or asset damage; and

(c) Not be subject to inundation.

(d) Scour valve boxes shall be painted red.

6.3.14.7.1 Scour sizes

Scours shall be sized in accordance with Table 6.7.

Table 6.7 – Minimum scour size

Main size DN	**Scour size** DN
DN ≤200	80
200< DN ≤300	100

6.3.14.7.2 Scour locations

Scours shall be located at:

(a) Low points at the ends of watermains; and

(b) Low points between in-line stop valves. Scours shall drain to a point where the discharge is readily visible to prevent the scour valve inadvertently being left open.

Typical discharge locations include:

(c) An approved pit that is to be pumped out each time the scour is operated (called a pump scour);

(d) A kerb and channel;

(e) An open-grated street drainage sump;

(f) A natural water course (with energy dissipater);

Scours shall not:

(g) Cause damage when operated;

(h) Discharge to closed stormwater structures;

(i) Discharge across roadways;

(j) Discharge directly to waterways, unless in compliance with the appropriate consent requirements.

6.3.15 Hydrants

6.3.15.1 General

Hydrants are installed on reticulation mains for firefighting ***and*** operational purposes. Operational purposes include mains flushing, chlorination, to allow the escape of air during charging, and the release of water during dewatering of the water main, where air valves and scours are not installed.

The marking of hydrant shall be in accordance with the requirements in Appendix G and drawing WS8.

6.3.15.2 Hydrants for firefighting

The spacing of hydrants for fire fighting shall be in accordance with SNZ PAS 4509.

For road safety reasons, hydrants on state highways shall be placed outside of the NZTA roadside clearance zone and preferably within 2m of the road reserve boundary.

6.3.15.3 Hydrant installation

Fire hydrants shall not be fitted to reticulation mains DN <100 or to ***transmission*** mains without the prior written approval of ***Watercare***.

6.3.15.4 Hydrants for reticulation system operational requirements

Additional to fire fighting requirements, hydrants shall be provided at:

(a) High points on reticulation mains to release air during charging, to allow air to enter the main when dewatering, and for manual release of any build-up of air, as required, where automatic combination AVs are not installed;

(b) Localised low points on watermains to drain the water main where scours are not installed.

Adequate drainage facilities shall be provided to receive the hydrant flows from dewatering and flushing operations.

C6.3.15.4

AVs are not normally required on reticulation mains in residential areas where the configuration of mains and service connections will usually eliminate small amounts of air accumulated during operation; hydrants should be placed as close as possible to stop valves to facilitate maintenance activities such as cleaning of watermains.

6.3.15.5 Hydrants at ends of mains

If a scour is not provided, a hydrant shall be installed as close as possible to the end of every main DN ≥100.

C6.3.15.5

Apart from the fire fighting function, a hydrant also allows the section of dead end main to be flushed regularly to ensure acceptable on-going water quality. This is particularly important in new subdivisions where only a small number of properties may be connected initially and where the main has been laid in a larger than required size with the expectation that it will be extended at a future date.

6.3.16 Connections

6.3.16.1 Connection of new mains to existing mains

In specifying connection detail the designer shall consider:

(a) Pipe materials, especially potential for corrosion;
(b) Relative depth of mains;
(c) Standard fittings;
(d) Pipe restraint and anchorage;
(e) Limitations on shutting down major mains to enable connections; and
(f) Existing cathodic protection systems.

Connections from the end of an existing main shall be designed to address any differing requirements for the pipes being connected, particularly restraint, spigot/socket joint limitations, and corrosion protection. The designer shall consider the potential for insufficiently restrained/ anchored stop valves near the connection.

All connections shall have a branch connection isolation valve. Hot tapping of watermains shall not be completed without Watercare's approval.

All connections to the existing reticulation shall be made by a contractor approved ***by Watercare and in accordance with Watercare's processes. Should a bulk supply point (BSP) be required refer to Watercare for approval and specific design requirements.***

6.3.16.2 Property service connections

There shall be one service connection per dwelling unless otherwise approved by Watercare. Watercare's point of supply is clarified under section 6.6.

Property service connections shall ***not be less than 20mm NB or as otherwise approved*** by ***Watercare***.

The method of connection (including tapping) is dependent on both the reticulation main and service connection pipe materials. The method adopted shall conform to:

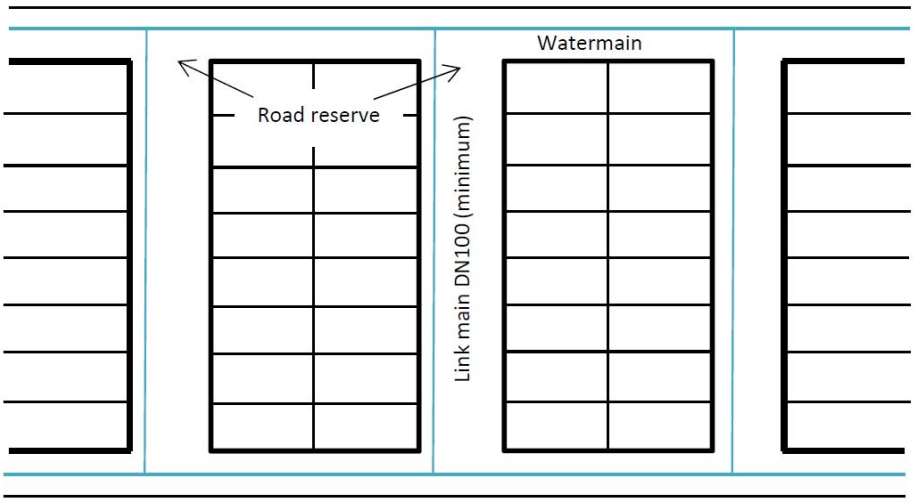
(a) ***Appendix B*** drawing WS18 through to WS25;

(b) The requirements of ***Watercare***.

The position of the property connection toby valve, meter, and backflow device shall conform to the requirements of ***Watercare***.

6.3.17 Termination points

Termination points or dead ends should be avoided to prevent poor water quality. Alternative configurations such as a continuous network, link mains, looped mains, and the use of reticulation mains smaller than DN 100, particularly in no-exit roads, should be considered (see figures 6.6 and 6.7).



Note – Rider mains are not shown

Figure 6.6 – Elimination of termination points

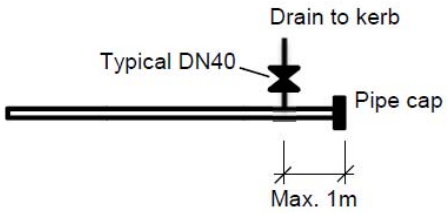
NOTE – Rider mains are not shown.

Figure 6.7 – Looped principal mains

6.3.17.1 Permanent ends of watermains

Rider mains, DN <100, may be used to supply the furthest properties beyond the water main. The DN 100 main shall be laid to a point where all properties are provided with the fire protection required by SNZ PAS 4509.

A method of flushing shall be provided at the end of the rider main and water main, which shall be suitably anchored. ***Refer figure 6.8 below for example of a flushing point on a rider main.***



Note – The gate vale shall be in a normally closed position in a red painted valve box and kerb marking.

Figure 6.8 permanent end flushing point for rider mains

6.3.17.2 Temporary ends of watermains

Watermains shall be laid to within 1 m of the boundary of a subdivision where the main is to be extended in the future.

Temporary dead-end mains shall terminate with a hydrant followed by a gate valve. The valve and hydrant shall be suitably anchored so that the future extension can be carried out without the need to disrupt services to existing customers.

Where a development is staged mains shall be constructed to terminate approximately 2 m beyond the finished road construction to ensure that future construction does not cause disruption to finished installations.

6.4 Approval of proposed infrastructure

6.4.1 Approval process

Water supply infrastructure ***including all private connections*** requires approval from ***Watercare and where the works fall within state highway road reserve, also require prior approval from NZTA.***

6.4.2 Information to be provided

Design drawings compatible with the ***Auckland Council's*** concept plan and the design parameters included in this ***CoP*** shall be provided to ***Watercare*** for approval. ***A Design report to demonstrate that*** Designers ***have ensured*** the following aspects have been considered and where appropriate included in the design:

(a) The size (or sizes) of pipework throughout the proposed reticulation system ***supported by modelling or calculations***;

(b) Selection of appropriate pipeline material type/s and class;

(c) Mains layouts and alignments including:

(i) Route selection
(ii) Topographical and environmental aspects
(iii) Easements
(iv) Foundation and geotechnical aspects
(v) Clearances, shared trenching requirements
(vi) Provision for future extensions;

(d) Hydraulic adequacy including:

(i) Compliance with the required maximum and minimum operating (working) pressure
(ii) Acceptable flow velocities ***and head loss***,
(iii) Compliance with the estimated water demand ***(low, average and peak)***, including firefighting; and

(iv) Compatibility with Watercare management strategy and plan for the water district zone

(e) Property service connection locations and sizes;

(f) Types and locations of appurtenances, including:

(i) Stop valves

(ii) Pressure reducing valves (PRVs)

(iii) Hydrants and fire services

(iv) Scours and pump-out branches and

(v) Termination details;

(g) Locations and details of thrust blocks and anchors; see ***Appendix B*** drawings WS15 through to WS17;

(h) Preparation of final design drawings, plans (and specifications if applicable);

(i) Design assumptions and exclusions; and

(j) Hydrant flow test results, along with the access approval issued by Watercare for the specific hydrant flow test.

6.5 Construction

A pre-construction meeting shall be organised with Watercare prior to the commencement of construction. Construction work shall comply with Watercare's construction standards and be demonstrated to comply with all the quality assurance requirements of these standards. As-built requirements shall comply with Watercare standards AI-06 or AI-01 as appropriate.

6.5.1 Excavation

Excavation of existing carriageways shall conform to the ***Auckland Transport's*** road opening procedures. Excavation in existing carriageways shall be carried out in a safe manner with the minimum disruption to traffic and pedestrians.

All works within the road reserve shall comply with the relevant code of practice for temporary traffic management.

6.5.2 Embedment

Pipes and fittings shall be surrounded with ***Gap 7*** bedding material ***150mm above (maximum 300mm above) and below pipe, width to diameter plus 300mm either side***. ***Refer drawing WS2.***

6.5.2A Trenching

Where a pipeline is to be constructed through areas with unsuitable foundations such material shall be removed and replaced with other approved material or alternatively, other methods of construction shall be carried out to the approval of Watercare to provide an adequate foundation and side support if required for the pipeline.

6.5.3 Backfilling and reinstatement

6.5.3.1 Carriageways

Backfilling shall be in accordance with the requirements of the ***Auckland Council and where the works are in the road reserve, they shall comply with the Auckland Transport Code of Practice Part 12 and 16 and the National Code of Practice for Utilities' Access to the Transport Corridors.***

As a minimum, pipe trenches within a carriageway shall be backfilled using an approved hardfill placed immediately above the pipe embedment and compacted in layers not exceeding 200 mm in loose depth.

6.5.3.2 Berms

Pipe trenches under grass berms and footpaths shall be backfilled in accordance with the ***Auckland Transport Code of Practice*** and ***in accordance with the National Code of Practice for Utilities' Access to the Transport Corridors.***

6.5.3.3 Detector tape

Open trenching – backfill shall be placed to 100 mm below existing ground level. At this point, where required by the council, the contractor shall provide and lay metallic 'detector' tape coloured blue, stipulating 'Danger – Water Main Below' (or similar).

6.5.3.4 Tracer wire

Accepted tracer wire shall be installed with all non-metallic pipes to allow detection. The wire shall be strapped to the pipe wall by means of a minimum of two complete wraps of heavy duty adhesive tape, at a maximum of 3.0 m intervals. The wire shall have some slack to allow for bends in laying and for future installation of tapping saddles***, which must be placed under the tracing wire***.

The tracer wire shall run continuously between valves and hydrants. At each valve or hydrant the wire shall be ducted to surface level through a length of polyethylene pipe ending immediately below the lid, The tracer wire shall be long enough to extend 600 mm minimum above ground level when uncoiled. The excess length shall be neatly coiled in the valve or hydrant box.

The tracer wire shall be tested for continuity between surface boxes using an electronically generated tone and detector probe or alternative approved method.

A more detailed description and photos is available in Appendix I

6.5.4 Pressure testing of watermains

Before a new water main is connected to the existing reticulation, a successful pressure test shall be completed. The system test pressure is applied to test the integrity of construction of the pipeline system. The system test pressure generally exceeds the actual design pressure of the system (maximum 1.25 times the maximum rated operating pressure of the lowest rated component in the system). See ***Appendix C*** for the appropriate testing procedure.

6.5.5 Disinfection of watermains

Disinfection of the watermains shall be carried out following successful pressure testing and backfilling as specified in ***Appendix D***. The disinfection solution shall be collected and disposed of in an appropriate manner.

6.5.6 Discharge of testing water

Discharge of testing or chlorinated water from pipelines may require resource consent from the ***Auckland Council***.

6.5.7 Water sampling

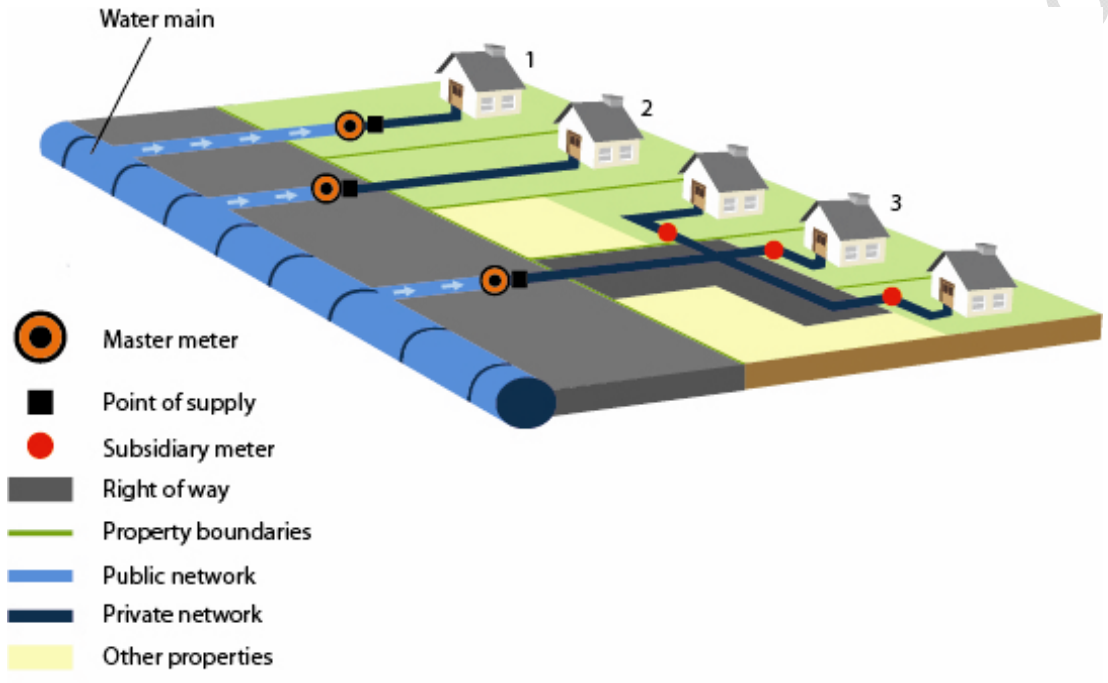
Watercare may require water samples to be taken for water quality compliance purposes.

6.6 Point of supply—water

The *point of supply* for water is based on the location of the *master meter*, regardless of where the *master meter* is in relation to the property boundary.

The *point of supply* is the outlet of the last fitting of the *master meter*, which is usually a 'downstream isolation valve'.

All equipment and fittings upstream of this point are owned by Watercare and are considered part of the *Watercare network*.

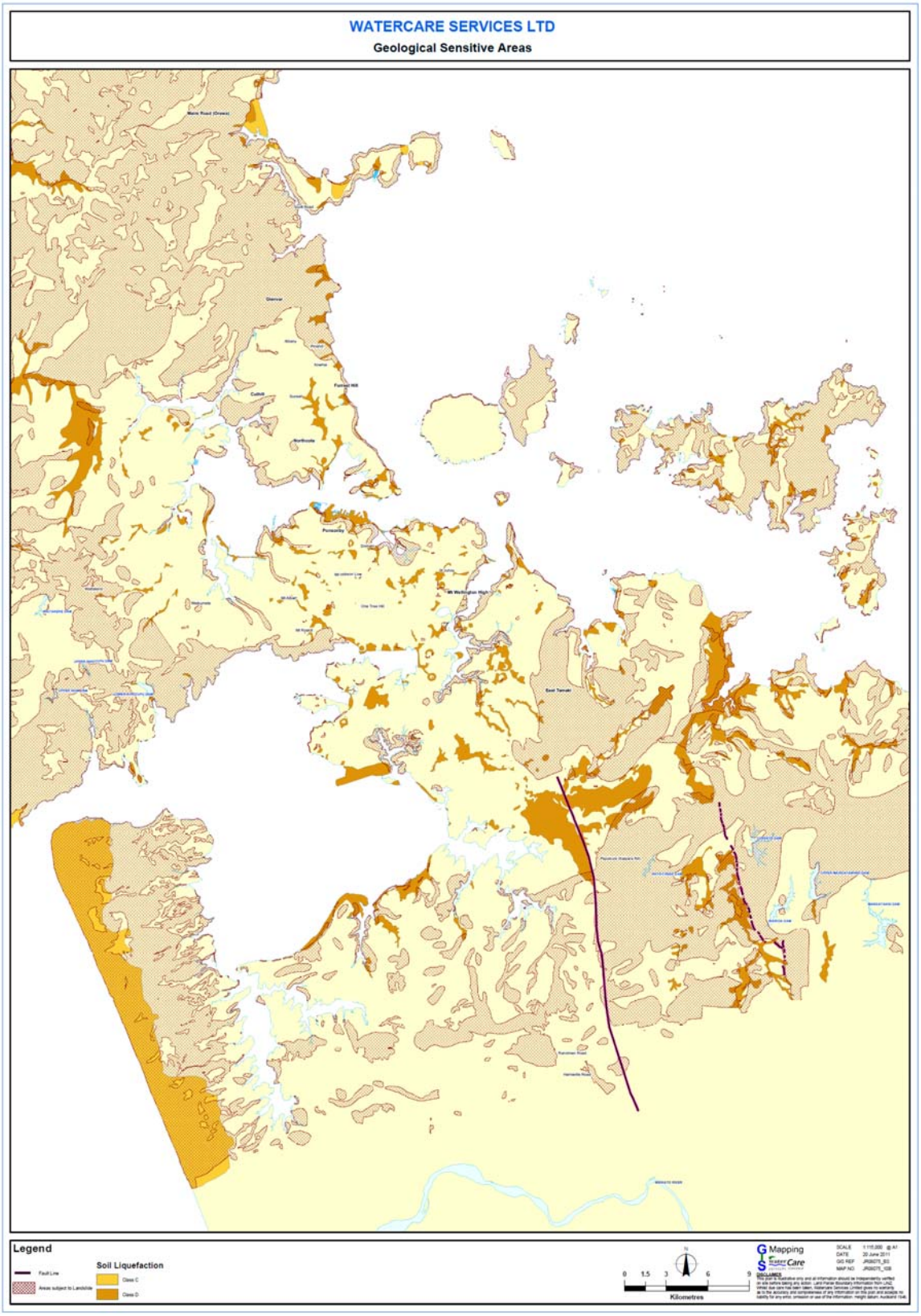


1. Master meter inside boundary. The point of supply is the outlet of the last fitting of the master meter (not to be used for new constructions).

2. Master meter outside boundary. The point of supply is the outlet of the last fitting of the master meter.

3. Subsidiary meter and master meter in a right of way. The point of supply is the outlet of the last fitting of the master meter. (Body corporates or equivalent only)

6.7 Geological Sensitive Areas



Appendix A: Acceptable pipe and fitting materials

Table A1 and table A2 on the following pages ***provides general*** information on acceptable pipe and fitting materials. ***Some of the*** information is sourced with permission from the Water Services Association of Australia, ***which is modified and supplemented by material from Watercare***. ***Refer to Watercare accepted materials list and material standards on specific material types – These tables are to be used as a guideline only.***

Table A1 – Acceptable pipe materials and Standards

Pipe materials	Standard applicable	Wastewater (Pressure sewer / rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
PVC-U	AS/NZS 1260 (Solid wall Class SN 16 or as required by Watercare)	-	✓	-	Gravity applications only. Well established methods of repair. Suitable for aggressive groundwater, anaerobic and tidal zones. Can be used for trenchless installations with suitable load resistant joints
PVC-O	AS/NZS 4441 (Series 1 or Series 2, as required by Watercare)	✓	-	✓	Improved fracture toughness compared to PVC-U. Improved fatigue resistance compared to PVC-U and PVC-M. NOTE – Use only DI fittings in pumped mains to achieve full fatigue resistance. Has increased hydraulic capacity compared with PVC-U and PVC-M. Suitable for aggressive groundwater, anaerobic conditions and tidal zones. Specific design for dynamic stresses (fatigue) required for pressure applications.
PVC-U	AS/NZS 1477 (PN 12 or PN 16, as required by Watercare)	✓	-	✓	Well established methods of repair. Alternative installation techniques possible, e.g. slip lining. Suitable for aggressive groundwater, anaerobic conditions and tidal zones. Can be used for trenchless installation with suitable end load resisting joints. Specific design for dynamic stresses (fatigue) required for pressure applications.

Table A1 – Acceptable pipe materials and Standards (continued)

Pipe materials	Standard applicable	Wastewater (Pressure sewer / rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
PVC-M	AS/NZS 4765 (Class SN as required by Watercare	✓	-	✓	Improved fracture toughness compared to PVC-U. Has increased hydraulic capacity compared with PVC-U. Inferior fatigue resistance compared to PVC-U and PVC-O. Suitable for aggressive groundwater, anaerobic and tidal zones. Specific design for dynamic stresses (fatigue) required for pressure applications.
PE	AS/NZS 4130 AS/NZS 4131 (PE 80B SDR 11 or PE 100 SDR 13.6 or as required by Watercare)	✓	-	✓	Generally for pressure applications. Can be easily curved to eliminate the need for bends. Alternative installation techniques, e.g. pipe cracking, directional drilling and slip lining. Can be welded to form an end load resistant system. Compression couplings and end load resistant fittings are available in smaller diameters. Pipe longitudinal flexibility accommodates large differential ground settlement. Fusion jointing requires skilled installers and special equipment. Retrospective installation of fittings / repair complicated. Specific design for dynamic stresses (fatigue) required for pressure sewer applications. ≤ DN 125 are available in long coiled lengths for fewer joints. Suitable for aggressive groundwater, anaerobic and tidal zones. Suitable for ground with high subsidence potential, e.g. fill or mining areas.
NOTE: All PE pipes ≤ 63 mm OD are to be PE 80B.					

Table A1 – Acceptable pipe materials and Standards (continued)

Pipe materials	Standard applicable	Wastewater (Pressure sewer / rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
PE	AS/NZS 5065 (Stiffness Class SN 16, SDR 17, or as required by Watercare)	-	✓	-	Only for gravity applications. Can be easily curved. Alternative installation techniques possible, e.g. pipe cracking and slip lining. Can be welded to form an end load resistant system. Fusion jointing requires skilled installers and special equipment. Retrospective installation of fittings / repair complicated. Smaller diameters available in long coiled lengths for fewer joints. Suitable for aggressive groundwater, anaerobic and tidal zones.
PP	AS/NZS 5065 (Stiffness Class SN 16, as required by Watercare)		✓	-	Only for gravity applications.
GRP	AS 3571.1	✓	✓	-	Alternative installation techniques possible, e.g. slip lining. UV resistant (special product). Custom made fittings can be manufactured. Suitable for use without additional corrosion protection in areas where stray electrical currents occur. Low impact resistance and ease of damage to thermosetting resin makes GRP susceptible to damage during transportation and installation in above ground installations, from vandalism or when damaged as a consequence of nearby excavation. Suitable for aggressive groundwater, anaerobic and tidal zones.

Table A1 – Acceptable pipe materials and Standards (continued)

Pipe materials	Standard applicable	Wastewater (Pressure sewer / rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
GRP	AS 3571.2	-	-	✓	Alternative installation techniques possible, e.g. slip lining. UV resistant (special product). Custom made fittings can be manufactured. Suitable for use without additional corrosion protection in areas where stray electrical currents occur. Low impact resistance and ease of damage to thermosetting resin makes GRP susceptible to damage during transportation and installation in above ground installations, from vandalism or when damaged as a consequence of nearby excavation. Suitable for aggressive groundwater, anaerobic and tidal zones.
VC	BS EN 295		✓	-	Gravity applications only Has benefits for particularly aggressive industrial wastes. Not recommended for active seismic (earthquake) zones or unstable ground.
RRJRC (Rubber ring jointed reinforced concrete)	AS/NZS 4058	-	✓	-	Requires protection from hydrogen sulphide attack in sewer applications by plastic lining or selection of appropriate cement additives.

Table A1 – Acceptable pipe materials and Standards (continued)

Pipe materials	Standard applicable	Wastewater (Pressure sewer / rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
CLS (SCL)	NZS 4442 AS 1579 (Cement mortar lined welded steel, minimum thickness 4.8 mm)	✓	-	✓	Cement mortar lined, PE coating below ground or heavy duty coating above ground. High mechanical strength and toughness. Available in long lengths. RRJ welded joints are available. Custom made, specially configured steel fittings can be made to order. Can be welded to form a system that will resist end load and joint permeation. UV resistant / vandal proof / impact resistant (where PE coated). Cathodic protection (CP) can be applied to electrically continuous pipelines to provide enhanced corrosion protection. PE lined and coated – RRJ. As above for CLS (SCL). Suitable for conveying soft water. Corrosion resistant under all conditions. <u>General notes:</u> Standard Portland cement is not resistant to H_2S attack at any high points or discharge points in the main. High alumina cement has improved resistance. Welded joints require skilled installers and special equipment. Welded joints require reinstatement of protection system on site. Special design required for welded installations parallel and adjacent to high voltage (> 66kV) transmission lines. Cathodic protection requires regular monitoring and maintenance. Seal coating may be required over cement mortar linings when conveying soft water or in low flow extremities of reticulation mains, to prevent potentially high pH. Suitable for high load applications, such as railway crossings and major roads. Large diameters are available. Suitable for aerial or suspended pipeline applications.

Table A1 – Acceptable pipe materials and Standards (continued)

Pipe materials	Standard applicable	Wastewater (Pressure sewer / rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
DI	AS/NZS 2280 AS 3681 (Ductile iron pipe – K9 or PN 35)	✓	-	✓	Fatigue analysis not normally required (pressure sewer application). High mechanical strength and toughness. Ease of jointing. UV resistant / vandal proof / impact resistant. Well established methods of repair. Suitable for high pressure and above ground pipelines. Restrained joint systems available. Sufficient ring stiffness not to rely on side support for structural adequacy for the usual water supply installation depths. Elevated pH may occur when conveying soft water or in low flow extremities of reticulation mains. PE sleeving is required and must be carefully applied and repaired when damaged. Standard Portland cement mortar is not resistant to H_2S attack at any high points or discharge points in the main. High alumina cement has improved resistance. Not suitable for aggressive ground water, anaerobic conditions or tidal zones.
ABS	AS/NZS 3518 AS/NZS 3690 AS/NZS 3879	✓	-	✓	Specific design for dynamic stresses (fatigue) required for pressure sewer applications.
PVC-U	AS/NZS 1260	-	✓	-	Gravity applications only.

Table A2 – Acceptable fitting materials and Standards

Fitting materials	Standard applicable	Wastewater (Pressure sewer / rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
PE	AS/NZS 4129	✓	✓	✓	PE pressure fittings, including mechanical compression, butt fusion or electrofusion, as approved by Watercare.
Access covers and grates	AS 3996	-	✓	-	
Ductile iron	AS/NZS 2280	✓	-	✓	Generally for pressure applications. Shall be coated with a polymeric coating, applied in accordance with AS/NZS 4158.
Ductile iron unrestrained mechanical couplings	AS/NZS 4998	✓	-	✓	Generally for pressure applications. Shall be coated with a polymeric coating, applied in accordance with AS/NZS 4158.
Metallic tapping bands (No plastic bands accepted)	AS/NZS 4793	✓	-	✓	Generally for pressure applications. Tapping bands used on flexible pipes shall be AS/NZS 4793 Type F – that is 'full circle design'. LG2 gunmetal tapping bands preferred for all applications. Ductile iron tapping bands shall be coated with polymeric coating, applied in accordance with AS/NZS 4158.
Fire hydrants	NZS 4522	-	-	✓	
Resilient seated gate valves	AS 2638.2	✓	-	✓	Generally pressure applications.
PE	AS/NZS 5065 (Stiffness Class SN16, or as required by Watercare)	-	✓	-	Gravity application only.
PP	AS/NZS 5065 (Stiffness Class SN16, or as required by Watercare)	-	✓	-	Gravity applications only.

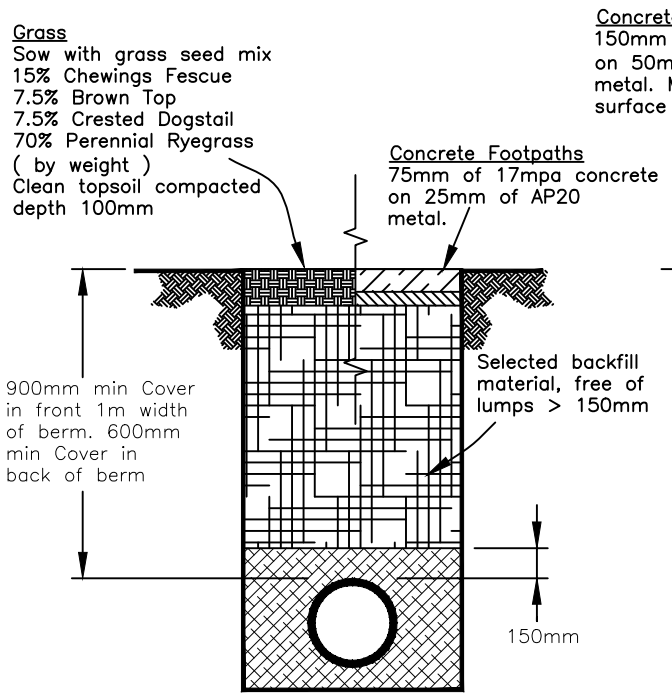
Appendix B: Standard Construction Drawings

WASTEWATER NETWORKS

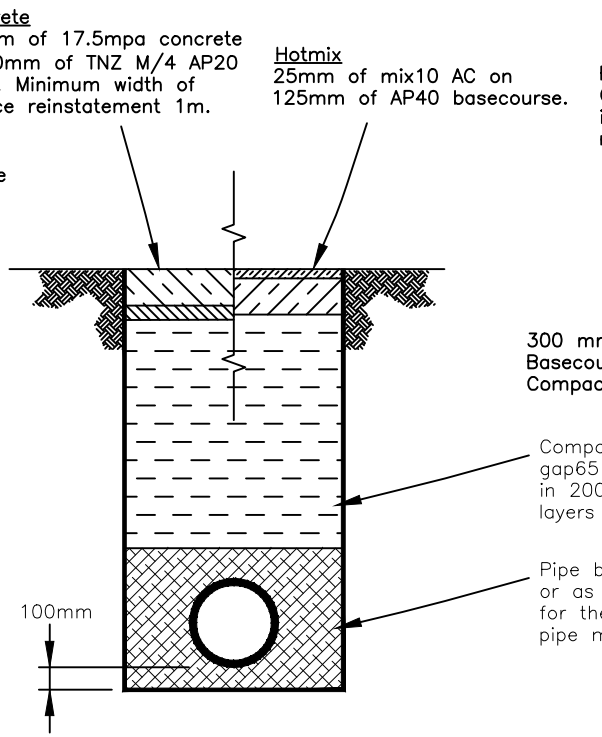
No.	Title	Revision
WW2	Trench Reinstatement and Bedding Details	Apr 2015
WW3	General Construction Notes	Apr 2015
WW4	Drainage Plan Format for Design	Sep 2013
WW7	Bedding Details	Apr 2015
WW12	Shallow Manhole Details 675mm Nominal Diameter	Apr 2015
WW13	Manhole up to 1.8m Deep to Outlet Invert	Apr 2015
WW15	Precast Manhole and Precast Base	Apr 2015
WW16	Precast Manhole Base	Apr 2015
WW24	Internal Manhole Drop Pipe	Apr 2015
WW30	Step Rung for Standard Precast Manhole	Sep 2013
WW34	Standard Manhole HDPE Sliding Joint	Nov 2014
WW35	Manhole Throat and Cover Details	Nov 2014
WW37	600mm Diameter Heavy Duty Manhole Cover and Frame	Sep 2013
WW40	Typical Manhole Access Details	Apr 2015
WW45	100mm Saddle Connections to Public Sewers, >225mm Diameter	Nov 2014
WW46	Minimum Requirements for Private Connections (Floor level to soffit of sewer)	Nov 2014
WW47	Typical Service Connections to PVC/VC/Concrete Wastewater Sewers	Dec 2014
WW50	Public rising Main Outlet to Gravity	Sep 2013
WW52	Rising Main Connection Private	Sep 2013
WW53	Pipe and Manhole Construction Clearance	May 2015
WW54	Building Close to or Over Public drains	Sep 2013
WW58	Anchor and Anti-Scour Block	Sep 2013
WW60	Guideline for Building Close to or Over Transmission (Trunk) Sewer	Apr 2015
WW61	Flange Connection Detail PE Pipe to Other	Nov 2014
WW62	Anchor Block Details Reducers and Vertical Bends	Nov 2014
WW63	Standard Manhole Restraint PE Joint	Nov 2014

WATER NETWORKS

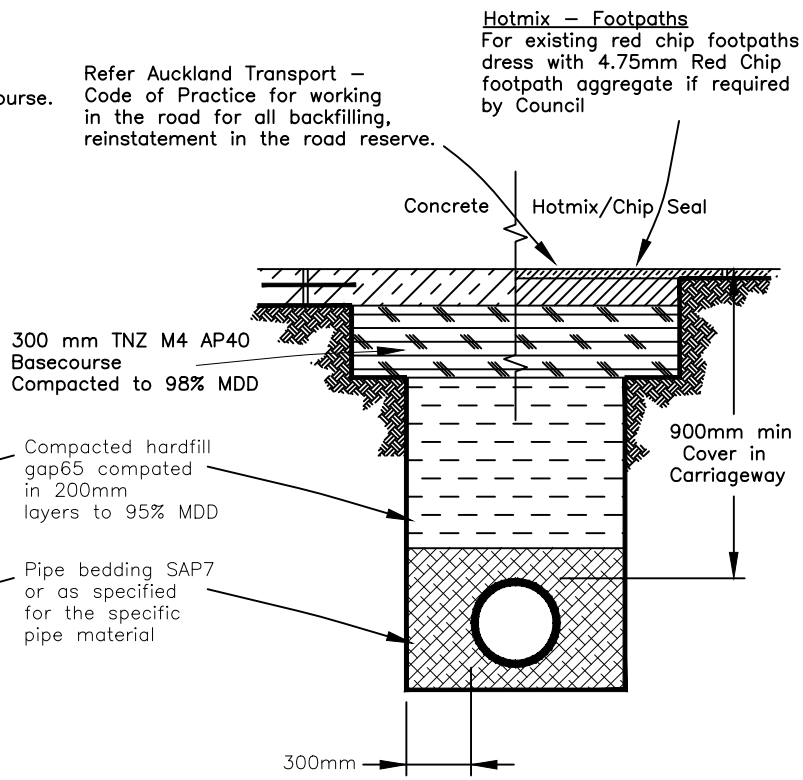
No	Title	Revision
WS2	Trench Reinstatement and Bedding Details	Apr 2015
WS3	General Construction Notes	Apr 2015
WS5	Typical Watermain Intersection Details	Nov 2014
WS6	Road Crossing Details and Principal Main to Rider Main Connections	Nov 2014
WS7	Boundary Zone Details	Nov 2014
WS8	Valve and Hydrant Markings	Nov 2014
WS9	HDPE Water Mater Box and Lid	Nov 2014
WS10	Cast Iron Water Mater Box and Lid	Sep 2013
WS13	Lot Service Connection Detail	Apr 2015
WS14	Water Meter Connection Detail (By Watercare Contractor Only)	Apr 2015
WS15	Anchor Block Details for 90^{o} and 45^{o} CI/DI Bends	Nov 2014
WS16	Anchor Block Details for 22 $1/2^{o}$ and 11 $1/4^{o}$ CI/DI Bends	Nov 2014
WS17	Anchor Block Details for Reducers and Vertical Bends	Nov 2014
WS18	Unmetered Fire System Connection Only	Apr 2015
WS19	Water Meter with Backflow Prevention Device (High Hazard)	Apr 2015
WS20	Water Meter with Backflow Prevention Device (Low to Medium Hazard)	Apr 2015
WS21	Fire System Connection and Water Mater <50mm Diameter	Apr 2015
WS23	Water Meter Bank	Sep 2013
WS24	Fire System Connection and Water Meter 50mm Diameter and Above	Nov 2014
WS25	Combined Fire Supply and Water Meter 50mm Diameter and Above	Nov 2014
WS29	Hydrant Details	Sep 2013
WS31	Flanged Sluice Valve Detail	Nov 2014
WS33	Standard Air Release Valve and Chamber Detail	Dec 2014
WS37	Flange Connection Detail PE Main to Other	Nov 2014
WS39	Rider Main Connection	Nov 2014
WS44	Cast Iron Hydrant Box and Lid	Sep 2013
WS45	Cast Iron Valve Box and Lid	Sep 2013
WS47	Wooden Meter Box with Hinged Lid	Sep 2013
WS48	Air vent cowling vertical steel pipe fabrication detail and concrete footing	Dec 2014



GRASS AREA & FOOTPATH (not in Road reserve) REINSTATEMENT



DRIVEWAY REINSTATEMENT (Not in Road Reserve)



FOOTPATH/VEHICLE CROSSING, CARRIAGEWAY REINSTATEMENT

NOTES

1. All trench reinstatement within the road reserve shall comply with the Auckland Transport "Code of Practice for Working in the Road" These are typicl expectations for reinstatements. Contractors need to confirm with Auckland Transport.
2. All backfill is to be compacted in 200mm, layers to obtain maximum density, as per standard specifications.
3. Where concrete or other stabilized layers exist in the roadway, the trench shall be reinstated with similar material or as directed by the roading engineer.
4. Minimum cover in carriageway for watermains 900mm. 900mm cover in front 1m of berm and Minimum 600mm in the back of berm.
5. Fill shall be clean, Non–contaminated material. Recycled material is not acceptable.
6. Pipe bedding shall be compacted to AS/NZS 2566.2 clause 5.6.3 for compaction control.
7. Alternative embedment details by specific design for pipe at steep grades, inadequate trench foundation and erosion is not covered by this drawing.

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Watercare

TYPICAL TRENCH REINSTATEMENT AND BEDDING DETAILS FOR WATER SUPPLY

SCALE:	N.T.S.
ISSUE DATE:	14–04–2015
DWG No.	2010069.001B
REFERENCE No.	WS 2

GENERAL CONSTRUCTION NOTES

STANDARDS RELATING TO WORKS

All works are to be carried out to the requirements of the Health & Safety Act 1992

All works is to be carried out will be of the highest tradesman like standard.

MANUFACTURERS SPECIFICATIONS

All materials to be used and installed as per Manufacturers Specifications.

CONCRETE

All on-site concrete to be 17.5 Mpa unless otherwise stated.

WELDING & FIXINGS

All steelwork to be workshop fabricated , No on-site welding.

All steelwork to be Hot-Dip Galvanised to AS/NZS 46809

All metal nuts , bolts & washers to be Stainless steel 316 unless otherwise stated. A Nickel anti-seize free of copper , lead , sulphides , chlorides and carbons (graphite) shall be used on bolts.

REINFORCING STEEL

All steel to be ' deformed ' mild steel unless otherwise specified.

All steel to be placed central with minimum 60mm minimum cover for principal steel and 50mm elsewhere.

All radius required to be cold formed.

WORKS REQUIRING EPOXY

Any Stainless Steel fixings that are epoxied in place are required to be supplied from the manufacturer ' NOT OILED '.

All Metal fixings and or Stainless Steel to be epoxied will use EPCON C6 epoxy or similar , to Engineers recommendations.

PROTECTIVE WRAPPING

All fittings & valves (Non Plastic) to be wrapped with Denso Petrolatum system, as per the suppliers instructions ; Primer ; Densyl mastic for profiling ; Tape & protective membrane (Polythene).

For PE pipe application, a Butyl System shall be used ; (Densolen System) without primer on the PE surface. Alternatively Polyken 930 may be used.

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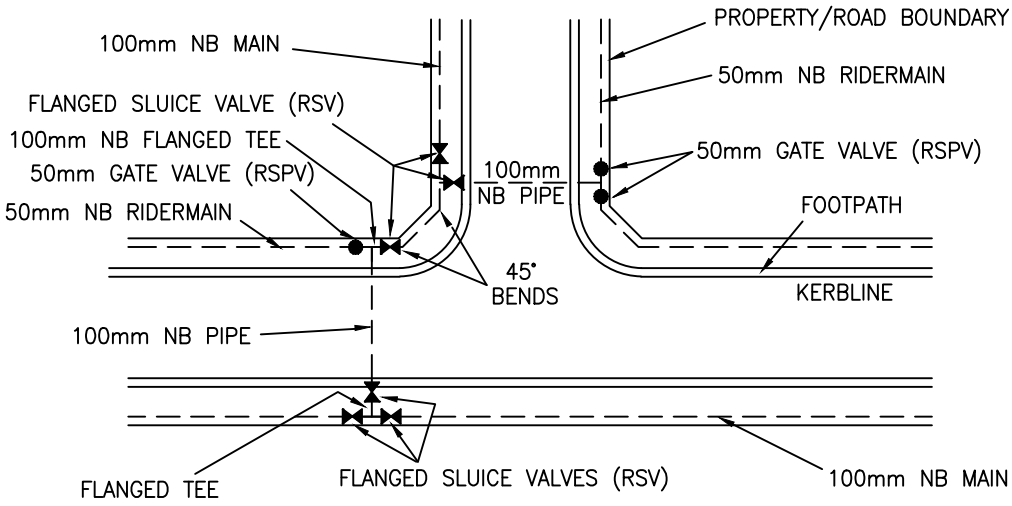
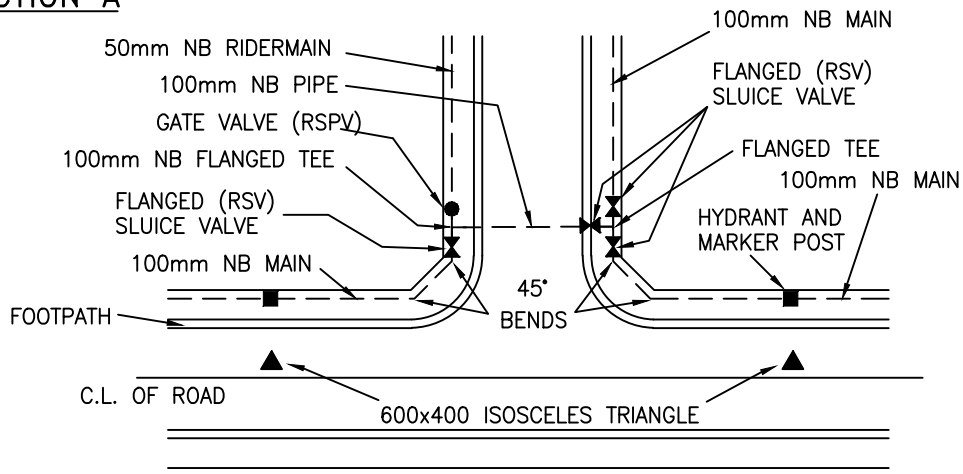
Watercare

GENERAL CONSTRUCTION NOTES

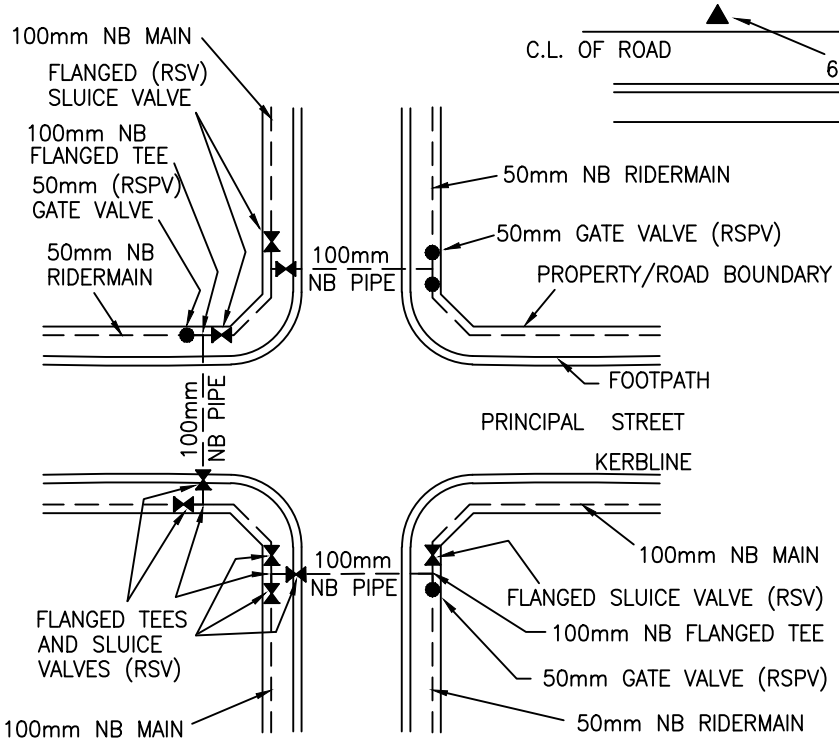
SCALE:	N.T.S.
ISSUE DATE:	14-04-2015
DWG No.	2010069.002B
REFERENCE No.	WS 3



TEE INTERSECTION A



TEE INTERSECTION B



CROSS INTERSECTION

NOTES

1. ALL PIPES SHALL BE LAID WITHIN 1400mm OF BOUNDARY WHERE PRACTICABLE.
2. ALL PRINCIPAL MAIN ROAD CROSSINGS SHALL BE 100mm DIA. (OR LARGER) DI, STEEL OR PE80, PIPES EXTENDING FROM MAIN TO MAIN.
3. BENDS ARE TO BE LONG RADIUS BENDS OR FLANGED BENDS.
4. ALL JOINTS UNDER ROADS TO BE EITHER FIELD WELDED OR FLANGED JOINTS (WRAPPED IN APPROVED WRAPPING SYSTEM).
5. THESE DETAILS APPLY TO 100mm NB AND 150mm NB PRINCIPAL MAINS. LARGER DIAMETER MAINS SHALL GENERALLY PASS STRAIGHT THROUGH INTERSECTIONS.
6. ALL 50 mm VALVES AND LARGER SHALL BE RESILIENT SEAT TYPE
7. GENERALLY, THERE SHALL BE A MINIMUM OF 5 VALVES ASSOCIATED WITH EACH ROAD CROSSING.

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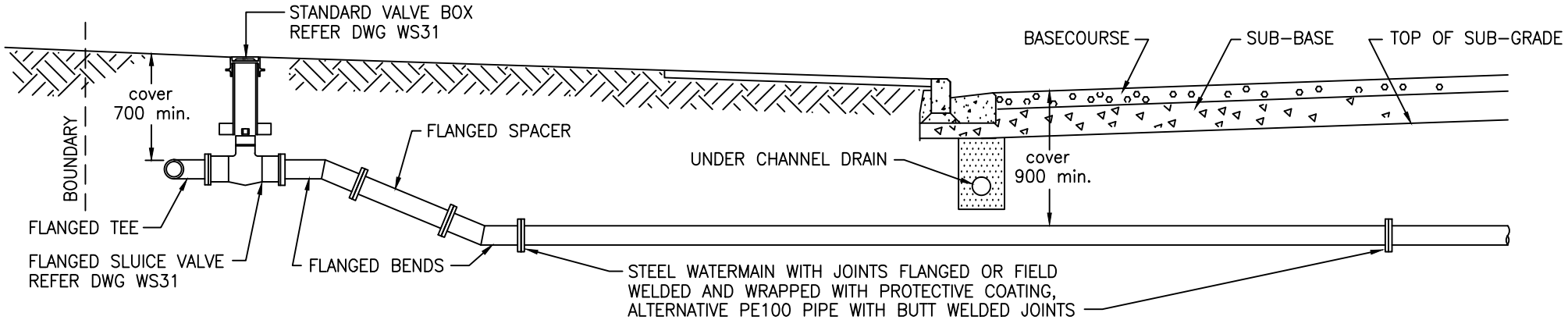
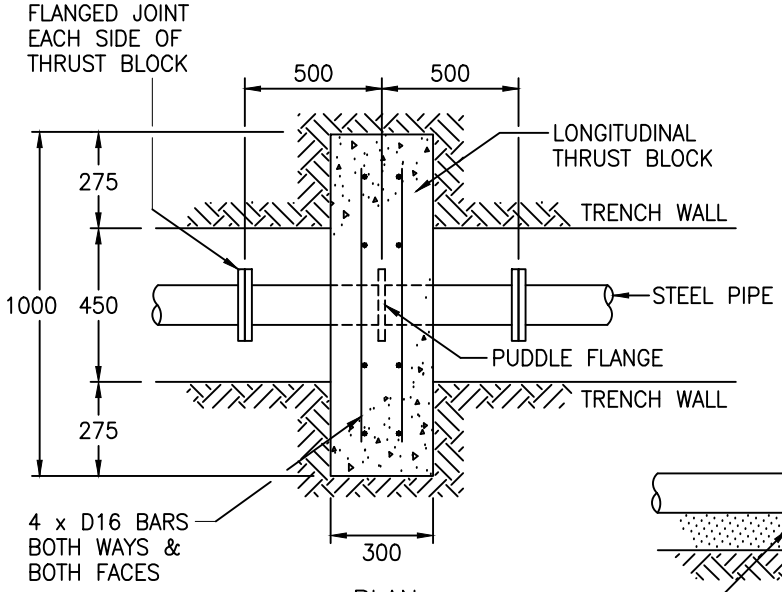
Watercare

TYPICAL WATERMAIN INTERSECTION DETAILS

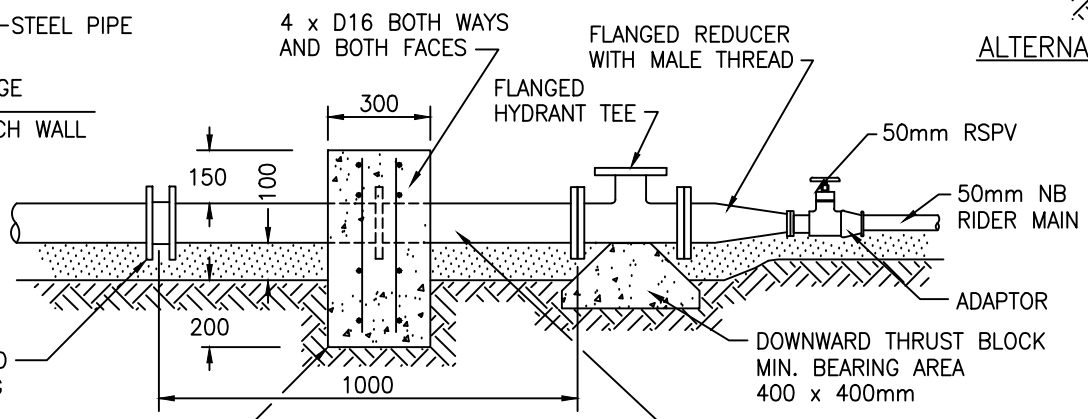
SCALE:	N.T.S.
ISSUE DATE:	25–11–2014
DWG No.	2010069.003A
REFERENCE No.	WS 5



TYPICAL PRINCIPAL MAIN CROSSING UNDER ROAD
N.T.S.



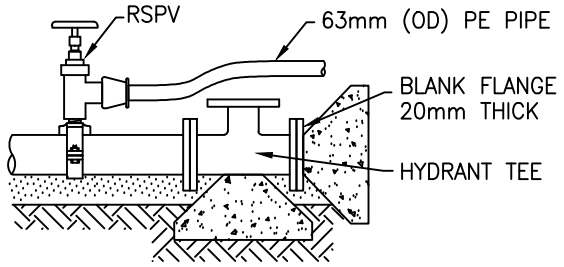
PLAN



ELEVATION

NOTE: SPECIAL DESIGN IF NOMINAL DIAMETER OF MAIN PIPE >150mm NB.

TYPICAL REDUCTION TO 50mm NB RIDERMAIN
N.T.S.



ALTERNATIVE TO FLANGED REDUCER
N.T.S.

NOTES

1. IF USING CONCRETE LINED STEEL, PIPE WALL THICKNESS SHALL BE 4.80mm UNDER CARRIAGEWAYS.
2. PIPE AND BENDS TO BE WRAPPED AS SPECIFIED.
3. ALL SPECIAL FITTINGS INCLUDING TEES AND BENDS TO BE FLANGED DUCTILE IRON.
4. ALL FLANGED SPACERS OR SPOOLS TO BE DUCTILE IRON OR EPOXY COATED STEEL.

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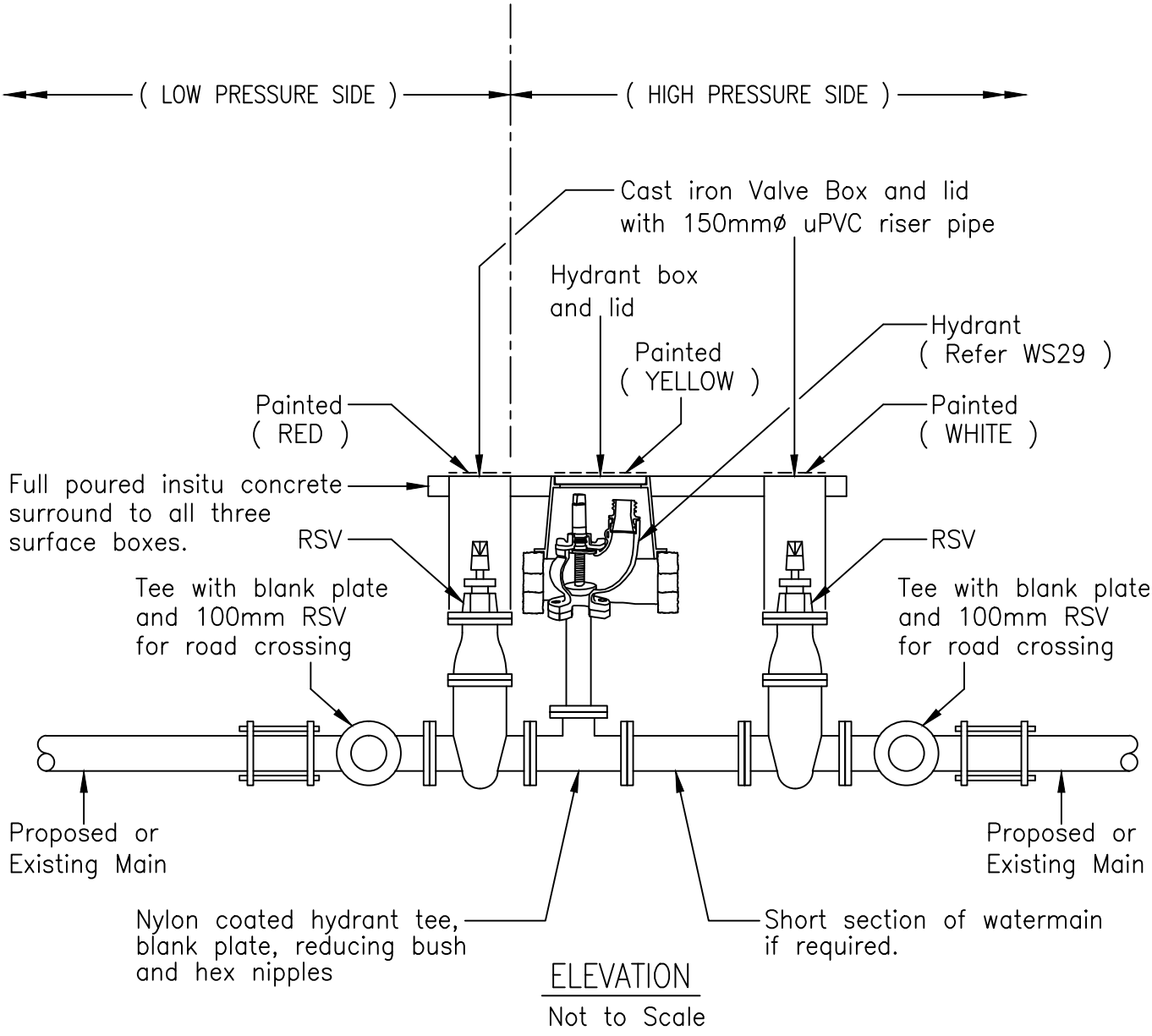
Watercare

ROAD CROSSING DETAILS AND PRINCIPAL MAIN TO RIDER MAIN CONNECTIONS

SCALE:	N.T.S.
ISSUE DATE:	25-11-2014
DWG No.	2010069.004A
REFERENCE No.	WS 6



ELEVATION

Not to Scale

NOTES :

1. All surface boxes and marker posts to be painted in accordance with the color code specified on drawing number WS 8.

2. The RSV gate valve on the high pressure side is to remain in the open position and the valve box lid to be painted (WHITE).

3. The RSV gate valve on the low pressure side is to remain in the closed position and the valve box lids to be painted (RED).

4. The Hydrant box lid to be painted (YELLOW).

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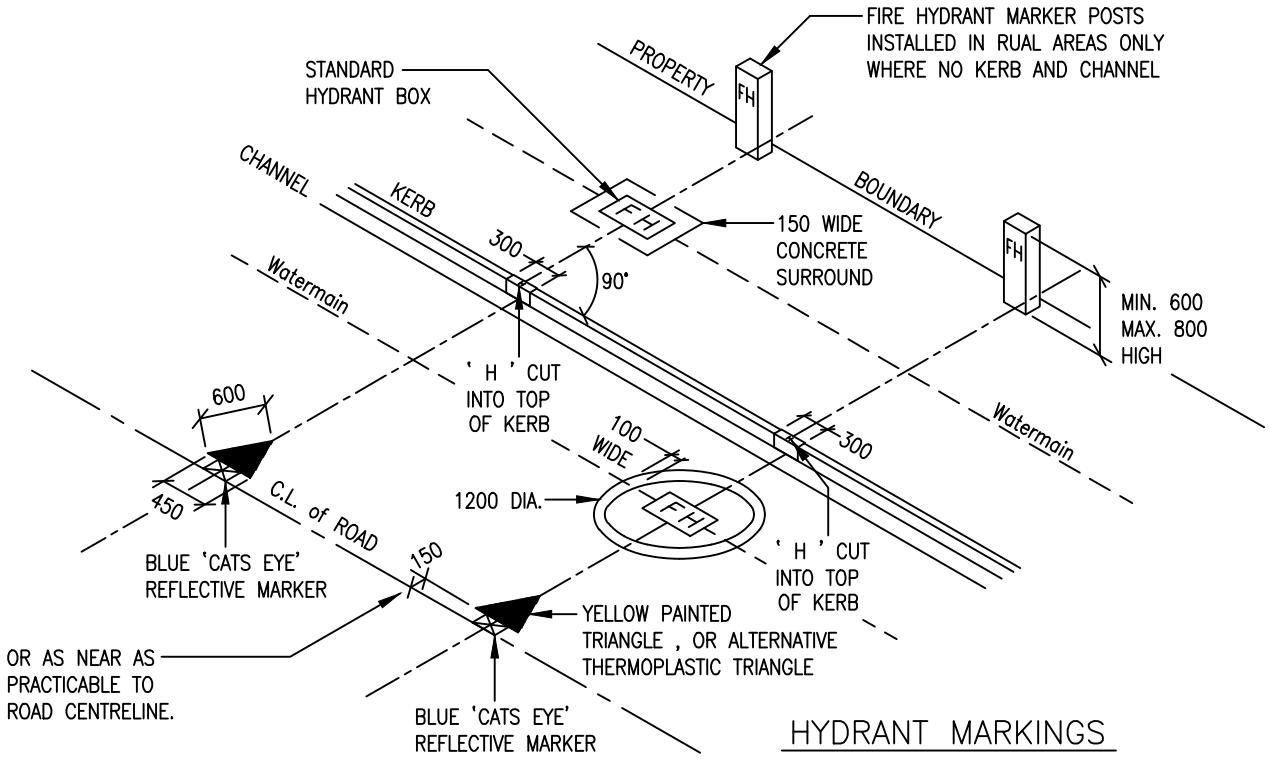
BOUNDARY ZONE DETAIL

SCALE:	N.T.S.
ISSUE DATE:	25–11–2014
DWG No.	2010069.005A
REFERENCE No.	WS 7



HYDRANT MARKINGS

N.T.S.

NOTE: ALIGN LONGITUDINAL AXIS OF HYDRANT BOX WITH WATERMAIN

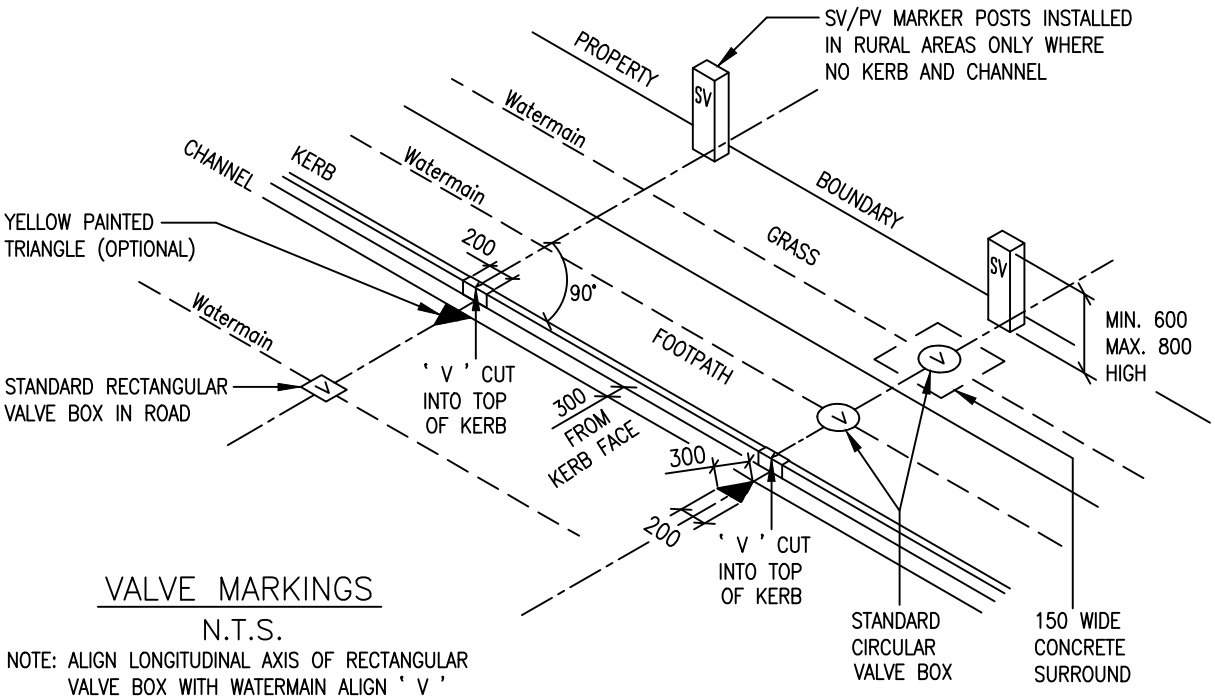
NOTES

PAINT USED FOR ALL MARKINGS AND CI/DI LIDS SHALL BE TRANSIT "ROAD MARKING PAINT" AS FOLLOWS:–

HYDRANTS – YELLOW
PROTECTIVE PAINTS LTD.– IJAY CODE: 880–403
OR – RESENE M7–W ;
(ALTERNATIVE OPTION THERMOPLASTIC TRIANGLE)

VALVES (PV, SV, AV"s) – WHITE

SPECIAL CONTROL VALVES (SHUT) – RED
RESENE RED OXIDE – VINYL ETCH
ADHESION PRIMER



VALVE MARKINGS

N.T.S.

NOTE: ALIGN LONGITUDINAL AXIS OF RECTANGULAR VALVE BOX WITH WATERMAIN ALIGN ' V ' WITH WATERMAIN AS SHOWN

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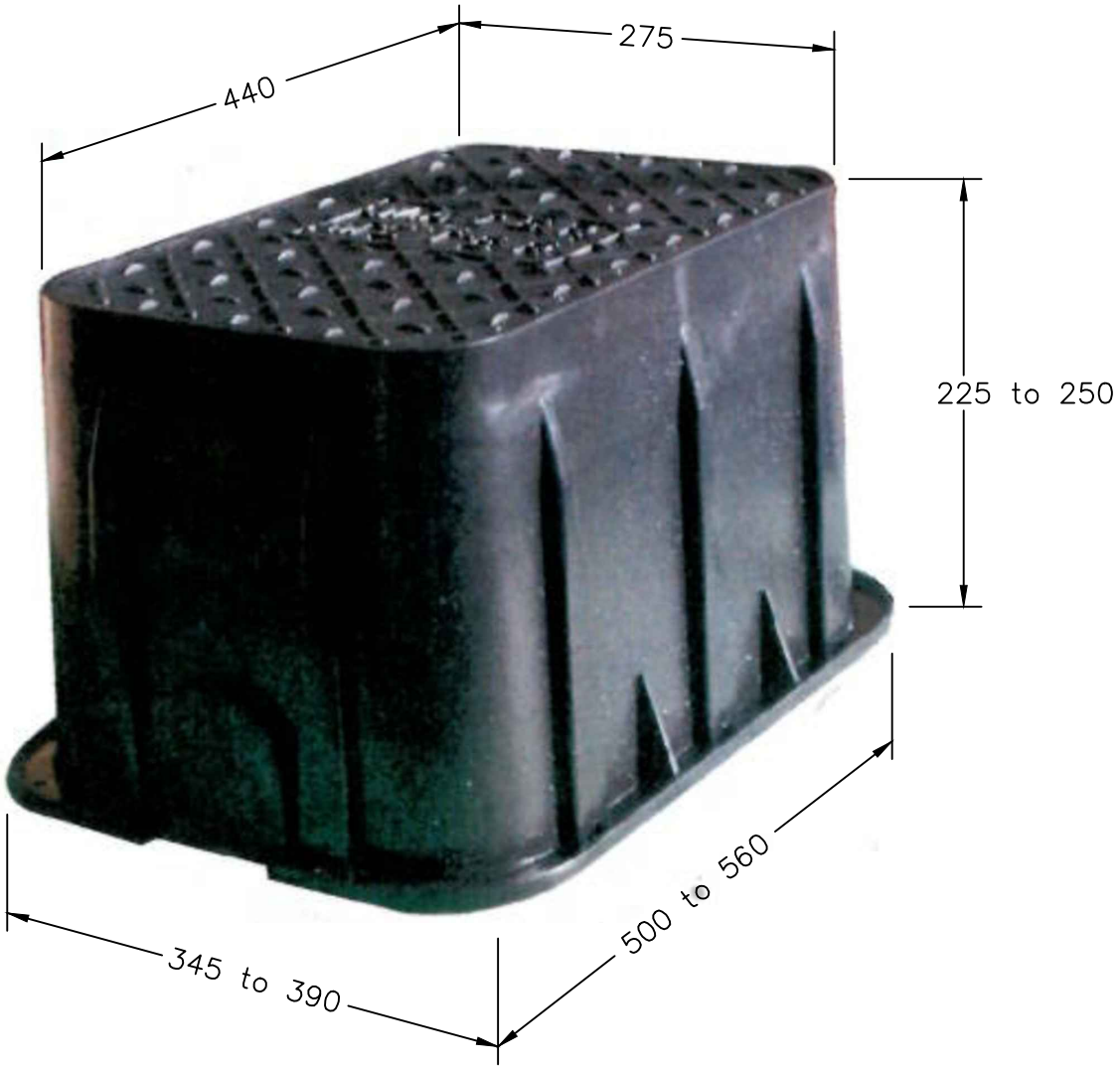
Watercare

VALVE AND HYDRANT MARKINGS

SCALE:	N.T.S.
ISSUE DATE:	25–11–2014
DWG No.	2010069.006A
REFERENCE No.	WS 8



Water Meter Box

Notes:–

1. Water meter box to be marked "WATER METER" on a black cover.
2. Cover to comply with slip resistance standard AS/NZS 3661.1.
3. Cover to be secured to box with stainless steel flexible wire or galvanised chain with stainless steel nuts & bolts.
4. All boxes to be indelibly marked with manufacturer's name/brand on underside of cover.
5. Box to have metal detection strips/rods.

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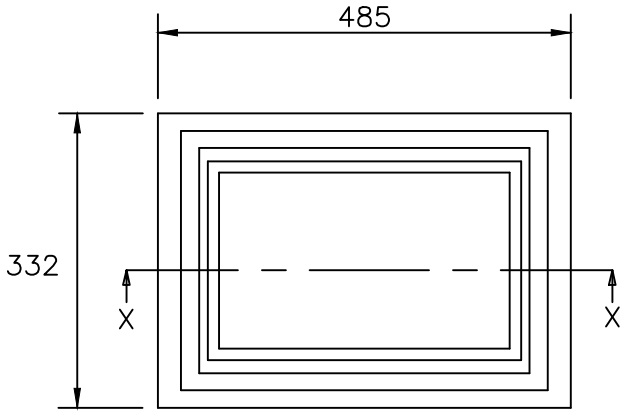
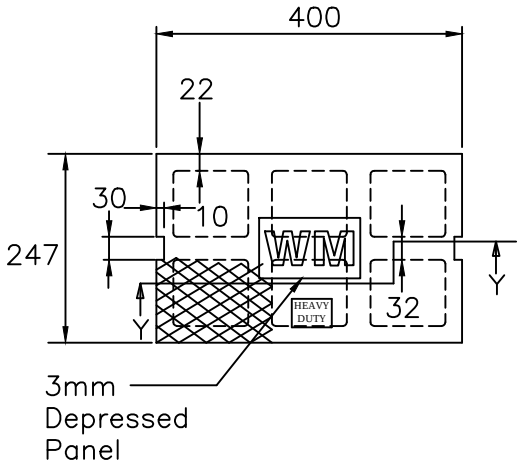
HDPE WATER METER BOX & LID

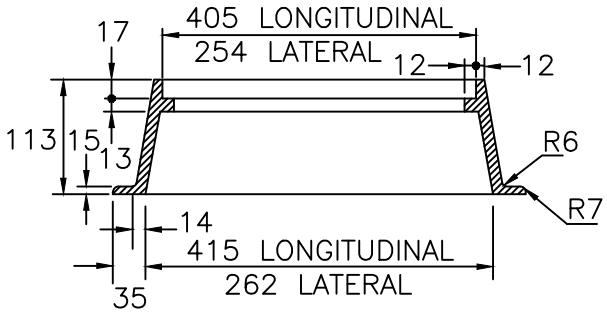
SCALE:	N.T.S.
ISSUE DATE:	25–11–2014
DWG No.	2010069.007A
REFERENCE No.	WS 9



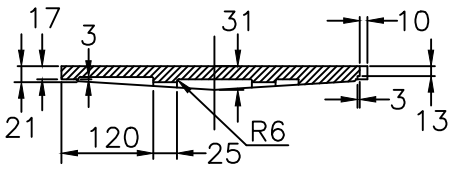
FRAME PLAN



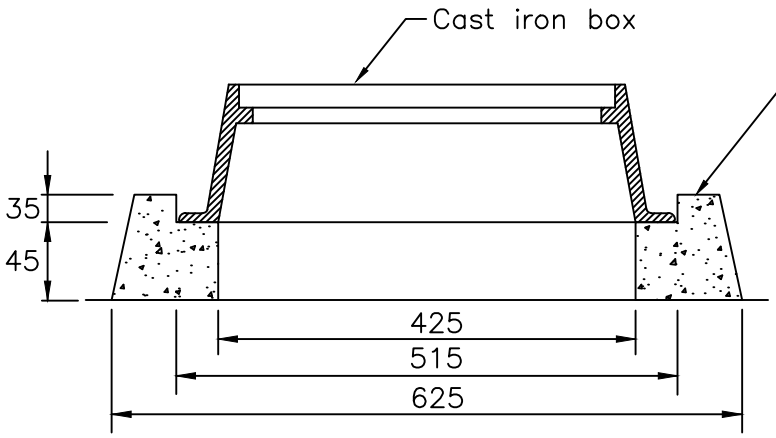
LID PLAN



SECTION X–X



SECTION Y–Y



INSTALLATION DETAIL

Notes:

1. All cast iron to be made to AS 1830 grade H229 with finish of black bituminous paint.
2. Lid to show in depressed panel the letters 'WM' in raised lettering as shown.

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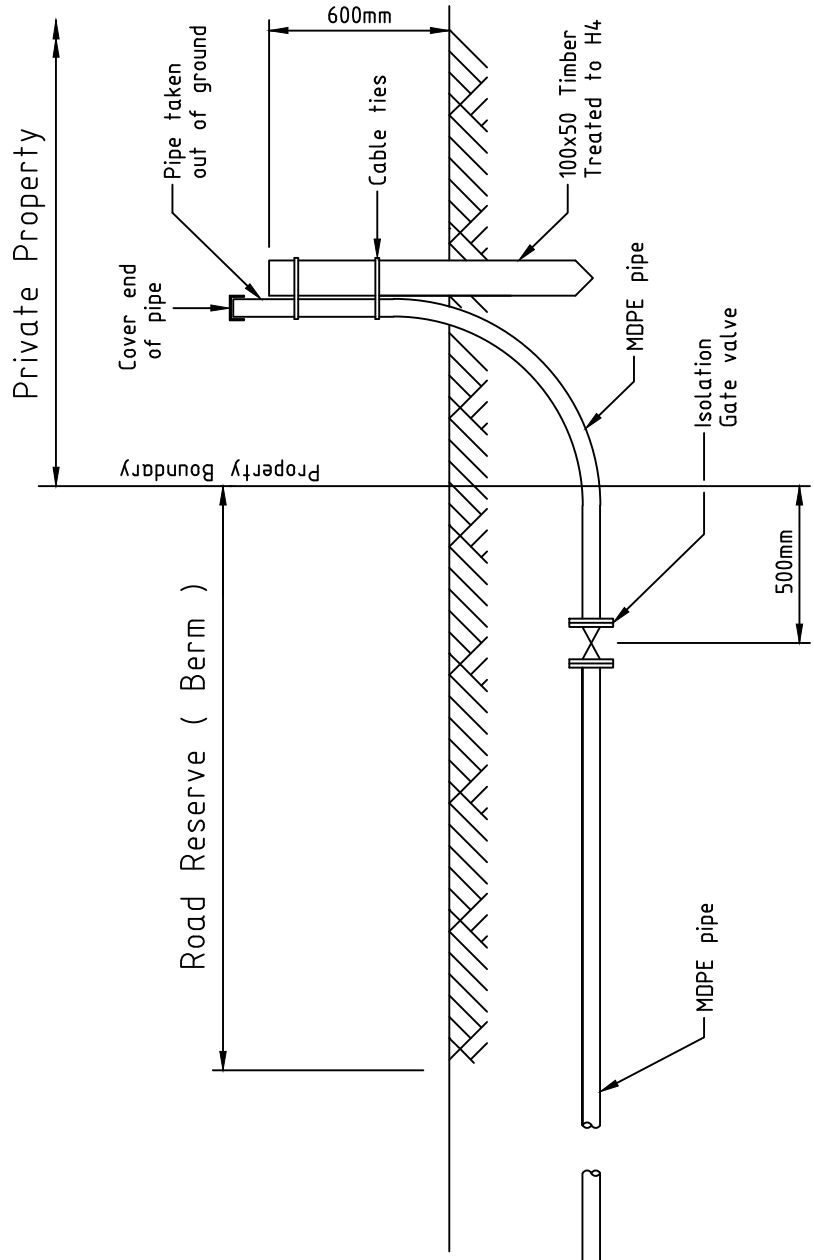
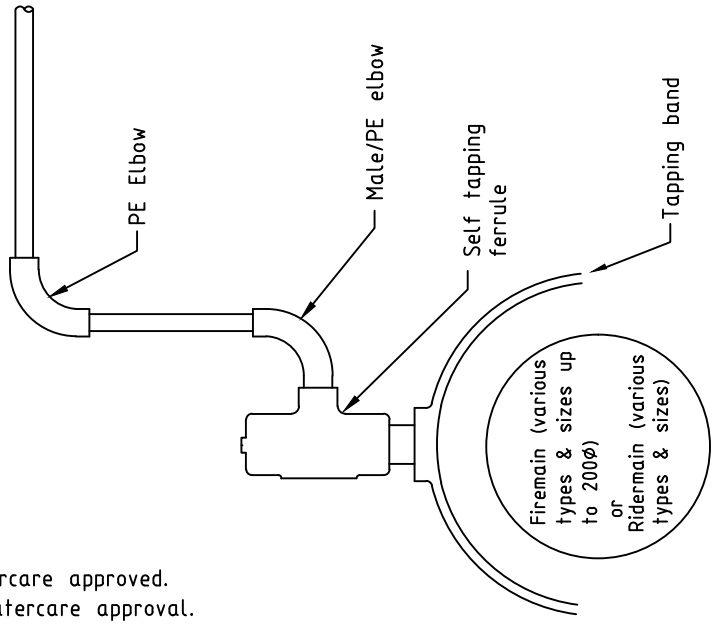
CAST IRON WATER METER BOX & LID

(TO BE USED IN CONCRETE AND PAVED AREAS ONLY)

SCALE:	N.T.S.
ISSUE DATE:	20–9–2013
DWG No.	2010069.008
REFERENCE No.	WS 10



Size of Meter	15mm	20mm	25mm
Male/ PE elbow OD	25	25	32
PE elbow OD	25	25	32
MDPE pipe & PE fittings OD	25	25	32



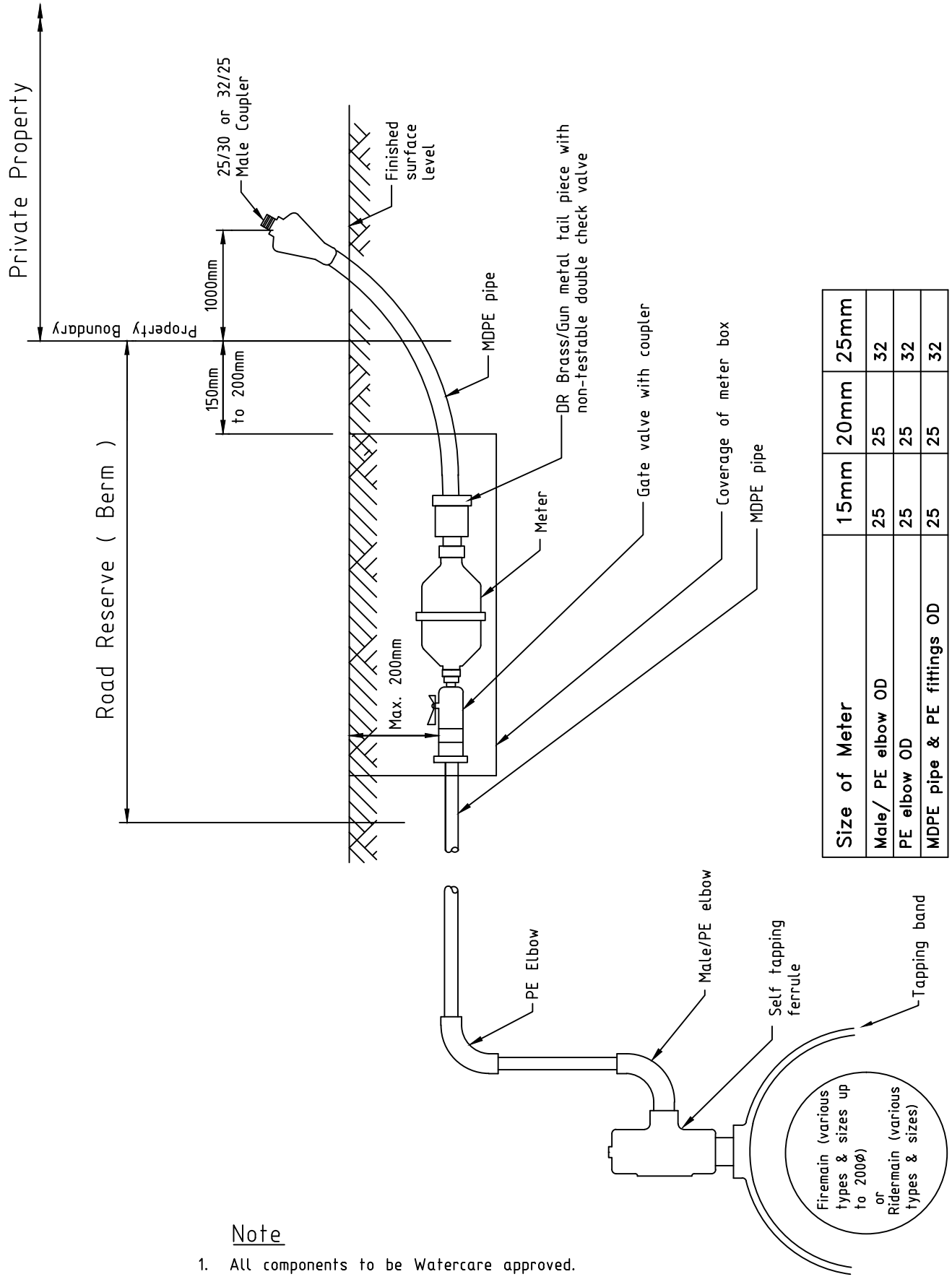
Note

1. All components to be Watercare approved.
2. Meters are installed on Watercare approval. See drawing WW14

L:\---\ EGCADFI \ 2015 \ WATER & WASTEWATER NETWORK STD DWGS \ 2010069.011B .DWG

LOT SERVICE CONNECTION DETAIL

SCALE:	N.T.S.
ISSUE DATE:	14–04–2015
DWG No.	2010069.011B
REFERENCE No.	WS 13



Size of Meter	15mm	20mm	25mm
Male/ PE elbow OD	25	25	32
PE elbow OD	25	25	32
MDPE pipe & PE fittings OD	25	25	32

Note

1. All components to be Watercare approved.

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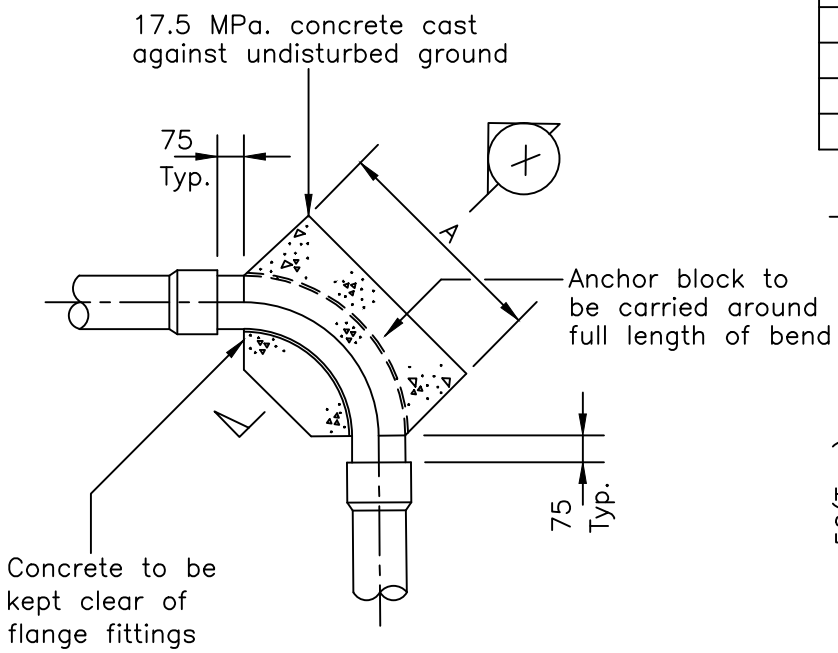
WATER METER CONNECTION DETAIL
15mm. 20mm & 25mm DIAMETER
(BY WATERCARE CONTRACTOR ONLY)

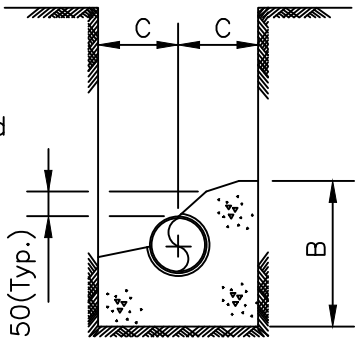
SCALE:	N.T.S.
ISSUE DATE:	14–04–2015
DWG No.	2010069.012A
REFERENCE No.	WS 14

Notes :

1. Thrust block dimensions for firm soil conditions.
2. The dimensions to be increased or decreased for variation in soil conditions.
3. Allowable bearing stress used – 100KPa.
4. Internal pipe test pressure up to 1400KPa.
5. As built locations to be obtained prior to backfill.
6. Protective membrane (Polythene) between concrete & pipe.
7. 75mm clearance between fittings/flanges and concrete casting.
8. All fittings to be Denso wrapped to the product specification. (Butyl system for Plastic pipes)

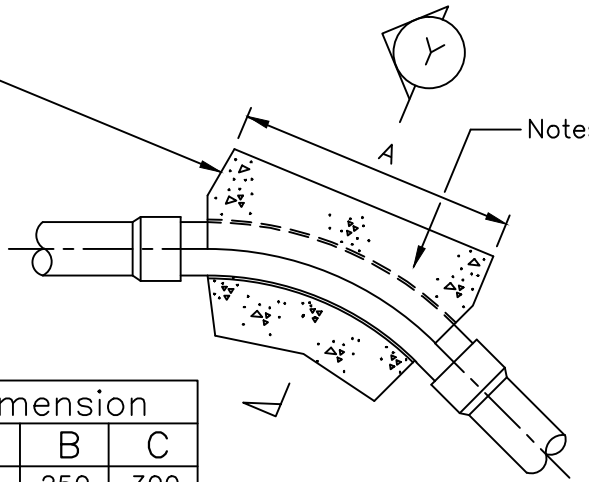
Dia. mm	Dimension		
	A	B	C
100	670	250	450
150	1250	300	450
200	1500	450	550
250	1750	600	600

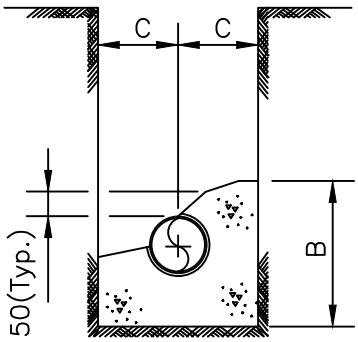




SECTION X

ANCHOR BLOCKS FOR 90° BENDS





SECTION Y

Dia. mm	Dimension		
	A	B	C
100	360	250	300
150	680	300	400
200	800	450	500
250	1000	600	600

ANCHOR BLOCKS FOR 45° BENDS

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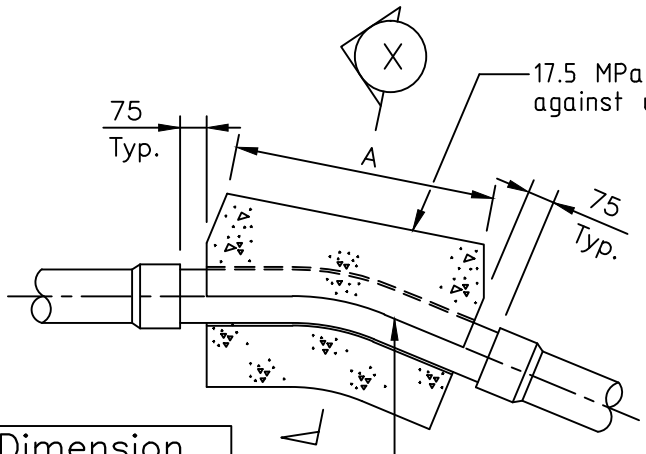
Watercare

ANCHOR BLOCK DETAILS FOR 90° & 45° BENDS

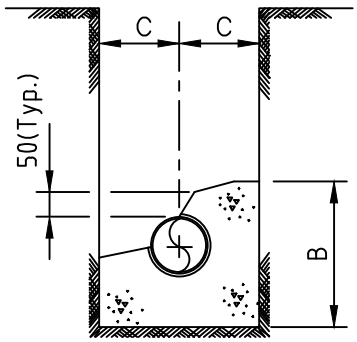
SCALE:	N.T.S.
ISSUE DATE:	25–11–2014
DWG No.	2010069.013A
REFERENCE No.	WS 15

Notes :

1. Thrust block dimensions for firm soil conditions.
2. The dimensions to be increased or decreased for variation in soil conditions.
3. Allowable bearing stress used - 100KPa.
4. Internal pipe test pressure up to 1400KPa.
5. As built locations to be obtained prior to backfill.
6. Protective membrane (Polythene) between concrete & pipe.
7. 75mm clearance between fittings/flanges and concrete casting.
8. All fittings to be Denso wrapped to the product specification. (Butyl system for Plastic pipes)

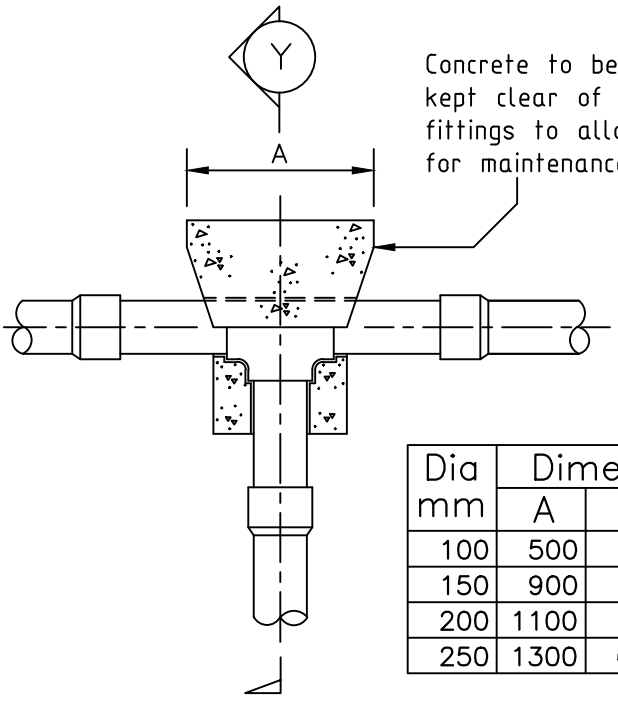


Dia mm	Dimension		
	A	B	C
100	300	250	300
150	400	300	400
200	500	450	500
250	600	600	600

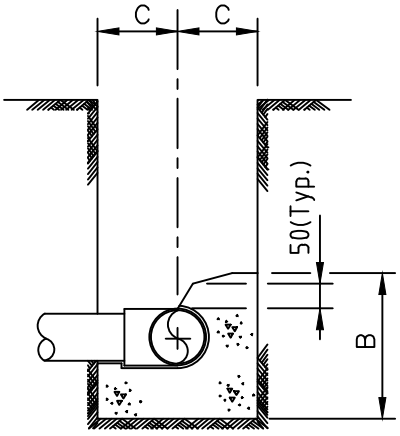


SECTION X

ANCHOR BLOCKS FOR 22½° & 11¼° BENDS



Dia mm	Dimension		
	A	B	C
100	500	250	450
150	900	300	450
200	1100	450	550
250	1300	600	600



SECTION Y

ANCHOR BLOCKS TEE JUNCTION & END CAPS

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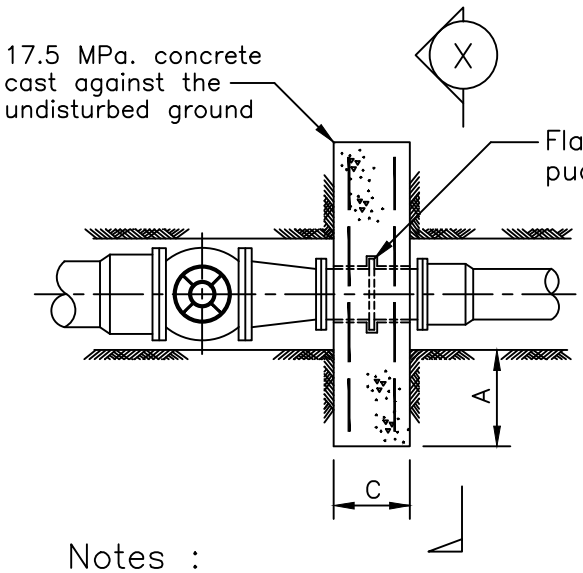
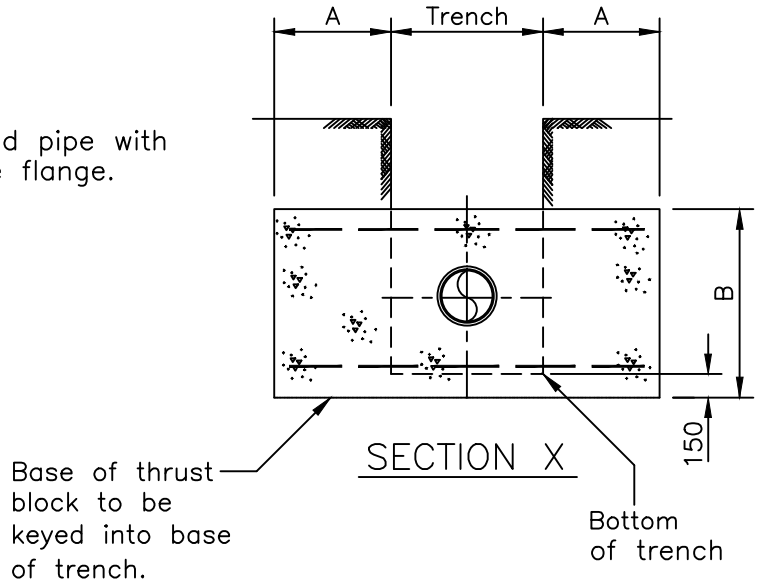
Watercare

ANCHOR BLOCK DETAILS FOR 22½° & 11¼° BENDS AND TEE JUNCTION

SCALE:	N.T.S.
ISSUE DATE:	25–11–2014
DWG No.	2010069.014A
REFERENCE No.	WS 16





Notes :

1. Concrete thrust block dimensions for firm soil conditions.
2. The dimensions to be increased or decreased for variation in soil conditions.
3. Allowable bearing stress used - 100KPa.
4. Internal pipe test pressure up to 1400KPa.
5. As built locations to be obtained prior to backfill.
6. Protective membrane (Polythene) between concrete and pipe.
7. 75mm clearance between fittings/flanges and concrete casting.
8. All fittings to be Denso wrapped to the product specification. (Butyl system for Plastic pipes)

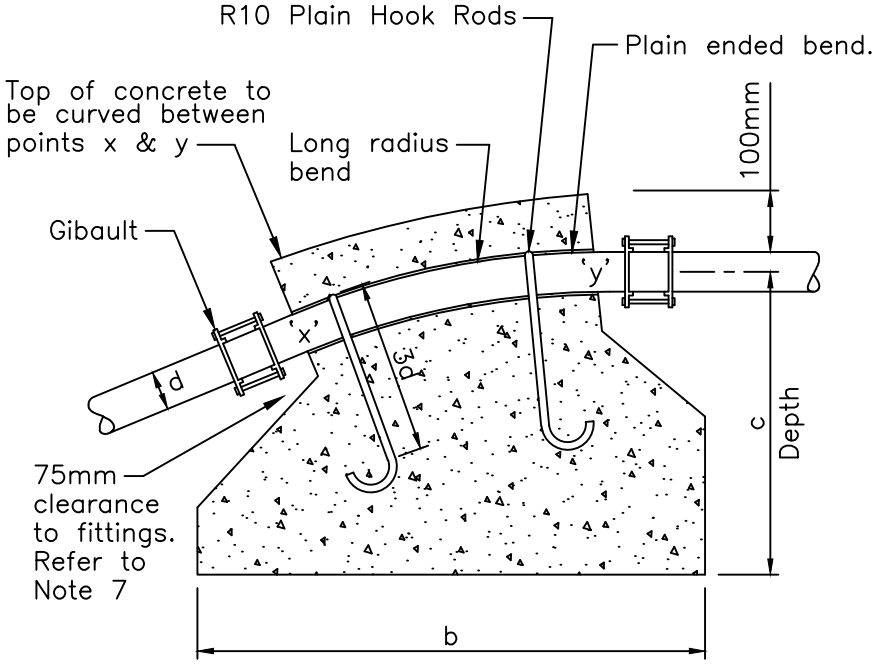
Reducer mm	Reducers		
	A	B	C
100–150	250	350	300
100–200	500	350	300
150–200	250	500	300
150–250	500	500	300
200–250	250	600	300
200–300	400	700	300

ANCHOR BLOCKS AT REDUCERS

Pipe Dia	Vertical Bends–45°		
	a	b	c
100mm	600	800	700
150mm	800	1000	800
200mm	1000	1200	800
250mm	1000	1600	1000

Pipe Dia	Vertical Bends–22.5°		
	a	b	c
100mm	500	500	500
150mm	500	800	800
200mm	700	1000	800
250mm	800	1200	900

Pipe Dia	Vertical Bends–11.25°		
	a	b	c
100mm	400	500	500
150mm	500	600	600
200mm	500	800	800
250mm	700	1000	800



a = Width of Anchor Block

VERTICAL SECTION

ANCHOR BLOCKS AT BENDS IN VERTICAL PLANE

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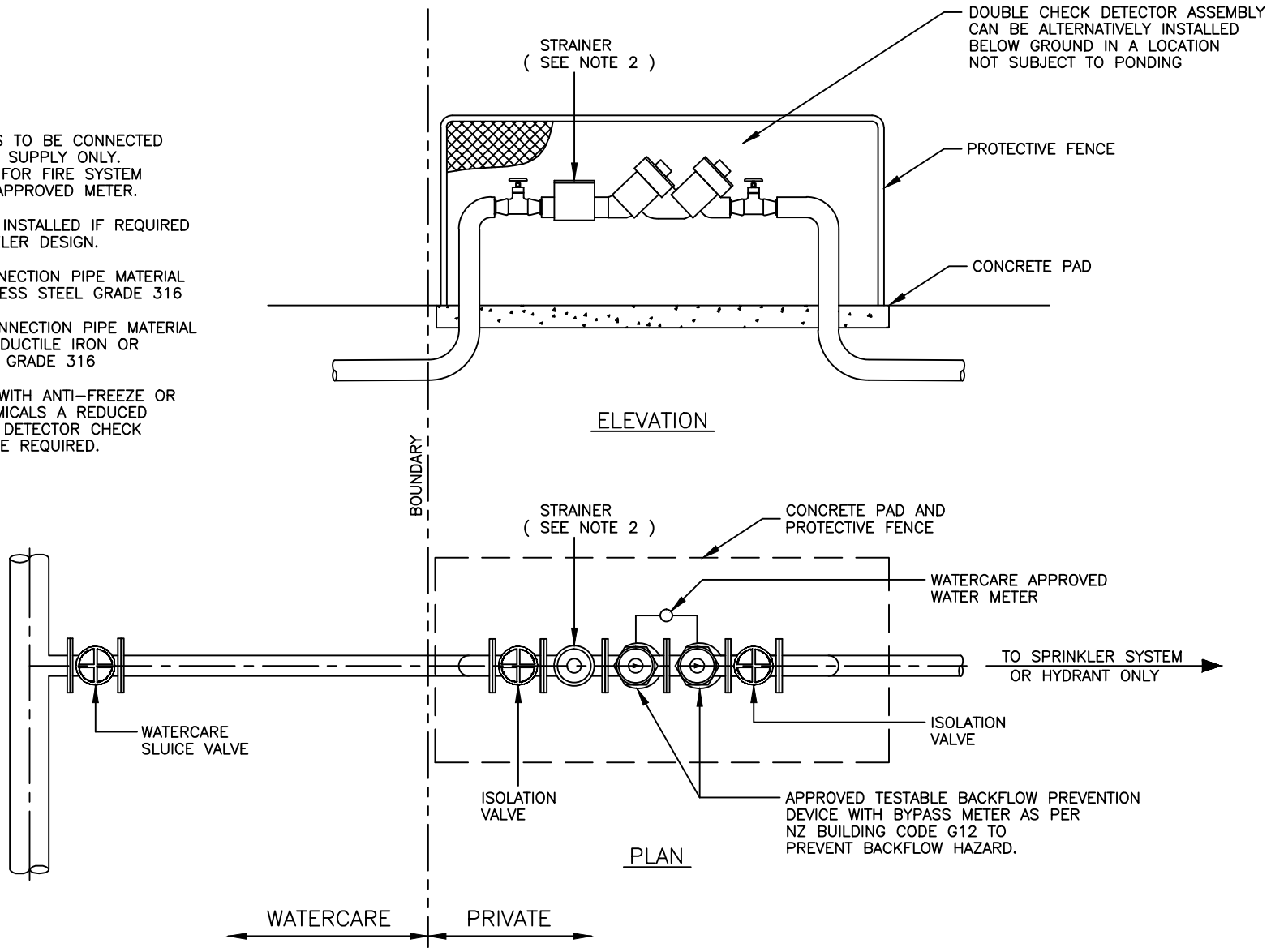
ANCHOR BLOCK DETAILS
REDUCERS AND VERTICAL BENDS

SCALE:	N.T.S.
ISSUE DATE:	25–11–2014
DWG No.	2010069.015A
REFERENCE No.	WS 17

NOTE:

1. FIRE HOSE REELS TO BE CONNECTED TO THE METERED SUPPLY ONLY. REFER TO WS21 FOR FIRE SYSTEM WITH STANDARD APPROVED METER.
2. STRAINER TO BE INSTALLED IF REQUIRED FOR FIRE SPRINKLER DESIGN.
3. 50mm FIRE CONNECTION PIPE MATERIAL SHALL BE STAINLESS STEEL GRADE 316
4. >50mm LINE CONNECTION PIPE MATERIAL MAY BE COATED DUCTILE IRON OR STAINLESS STEEL GRADE 316
5. FOR FIRE LINES WITH ANTI-FREEZE OR HAZARDOUS CHEMICALS A REDUCED PRESSURE ZONE DETECTOR CHECK ASSEMBLY MAY BE REQUIRED.



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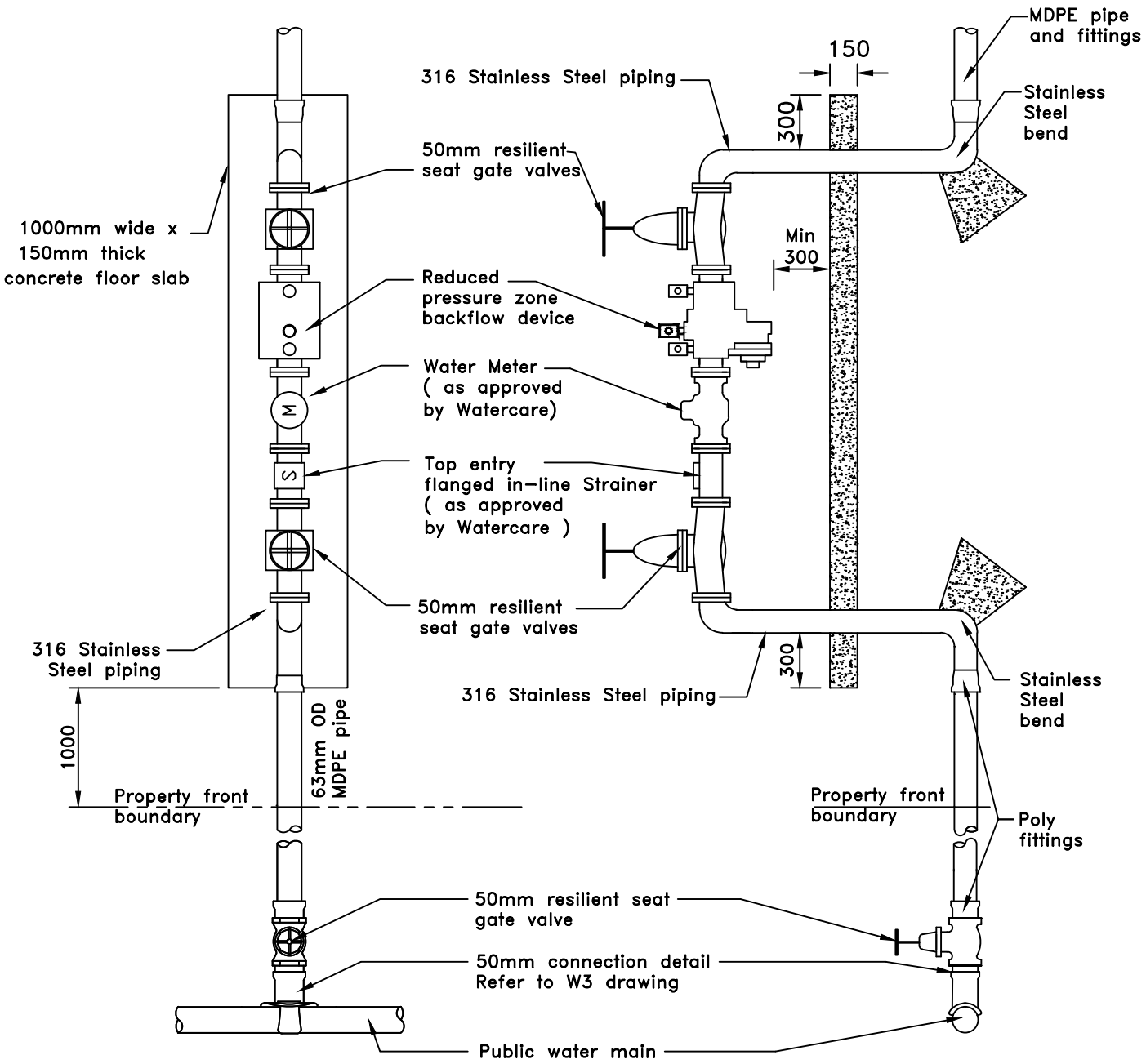
Watercare

UNMETERED FIRE SYSTEM CONNECTION ONLY

SCALE:	N.T.S.
ISSUE DATE:	14-04-2015
DWG No.	2010069.016B
REFERENCE No.	WS 18



Notes:

1. All components to be Watercare approved.
2. Water Meter to be Supplied and installed by Watercare meter installation contractor only.
3. Backflow prevention device shall be installed by Watercare meter installation contractor or a Registered Plumber.
4. All components to be flanged connections.
5. Valves to be chained with a padlock or assembly to be housed in a lockable protective cage.
6. Water meter pipe length clearances as specified by Supplier.

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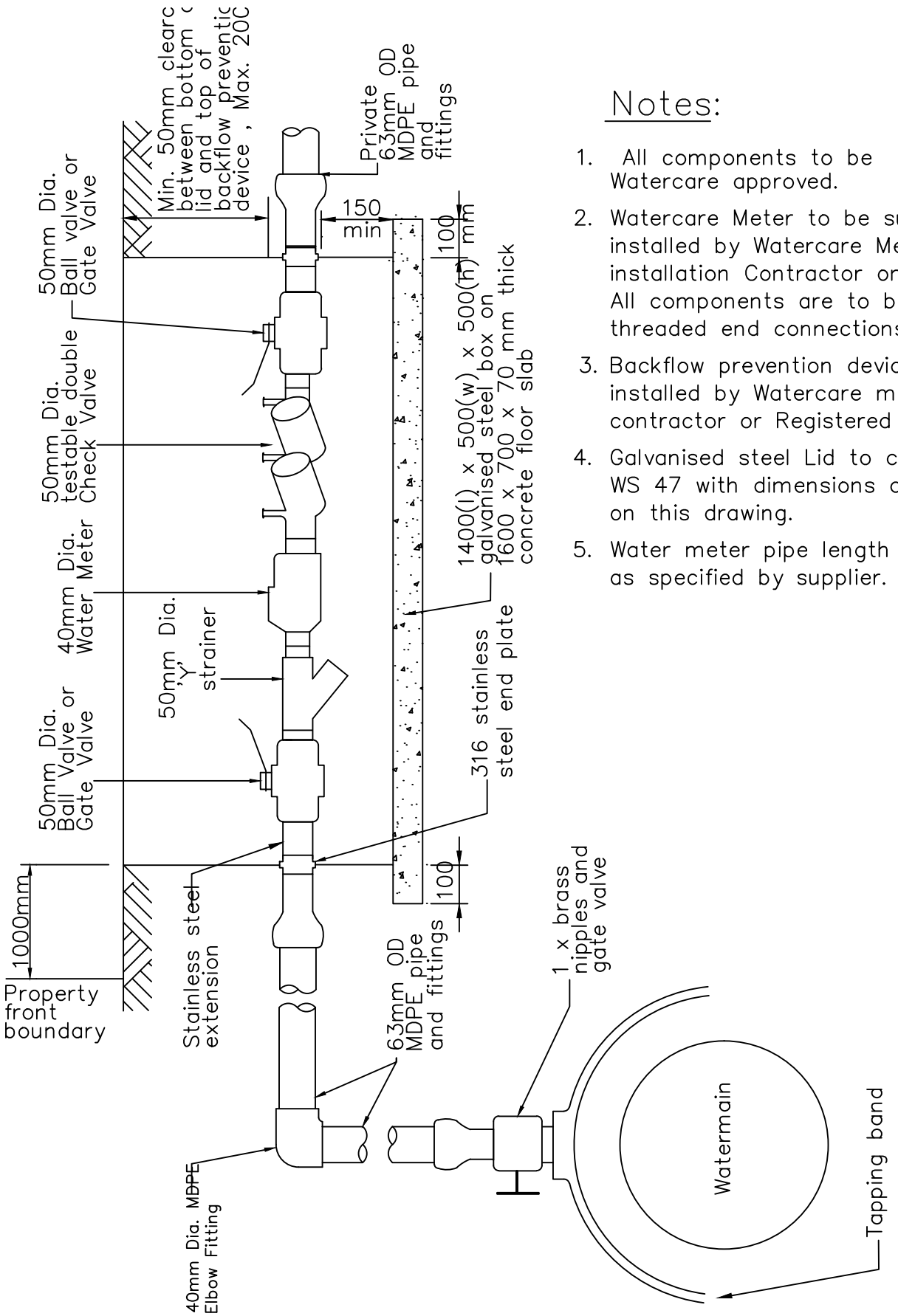
Watercare

WATER METER WITH BACKFLOW PREVENTION DEVICE (HIGH HAZARD) 50mm RPZ

SCALE:	N.T.S.
ISSUE DATE:	14-04-2014
DWG No.	2010069.017A
REFERENCE No.	WS 19



Notes:

1. All components to be Watercare approved.
2. Watercare Meter to be supplied an installed by Watercare Meter installation Contractor only. All components are to be threaded end connections.
3. Backflow prevention device shall be installed by Watercare meter instal contractor or Registered Plumber.
4. Galvanised steel Lid to conform to WS 47 with dimensions as shown on this drawing.
5. Water meter pipe length clearance: as specified by supplier.

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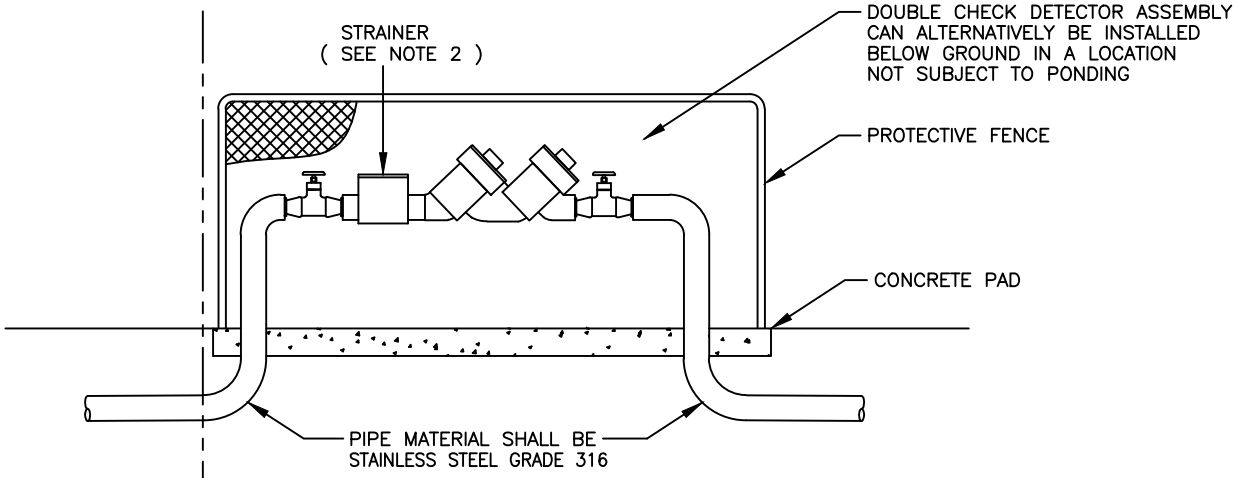
Watercare

WATER METER WITH BACKFLOW PREVENTION DEVICE (LOW TO MEDIUM HAZARD) 40mm TO 50mm DIAMETER

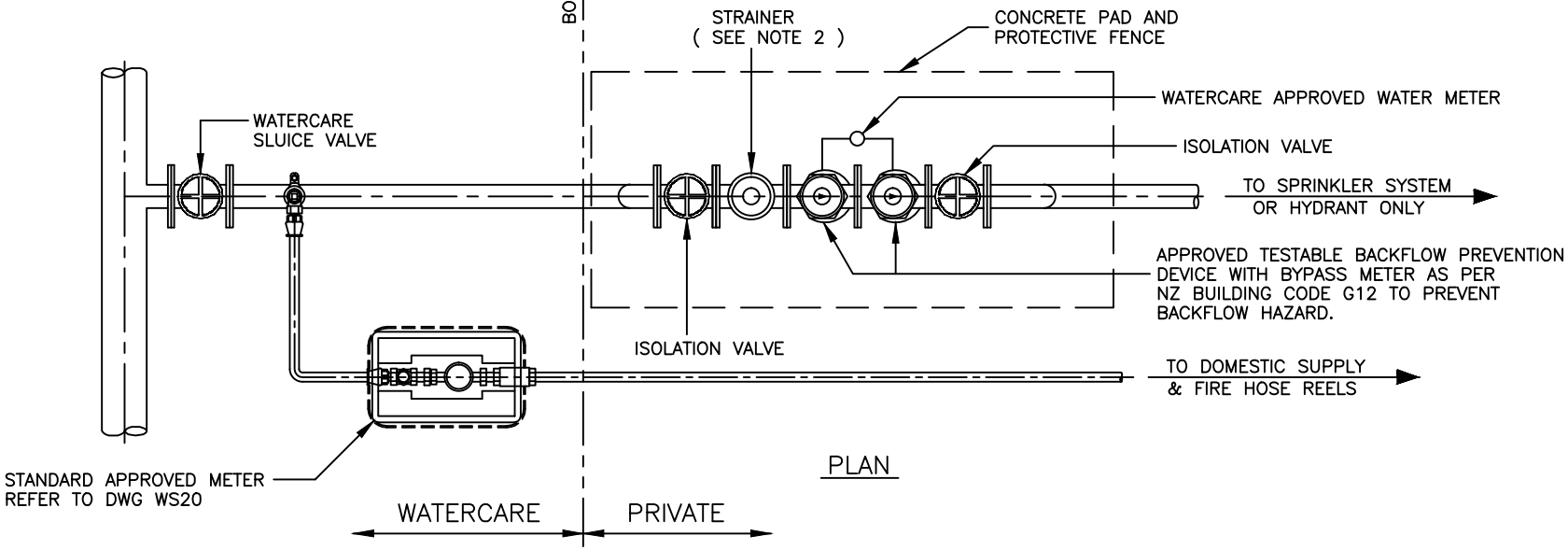
SCALE:	N.T.S.
ISSUE DATE:	14–04–2015
DWG No.	2010069.018A
REFERENCE No.	WS 20

NOTE:

1. FIRE HOSE REELS TO BE CONNECTED TO THE METERED SUPPLY.
2. STRAINER TO BE INSTALLED IF REQUIRED FOR FIRE SPRINKLER DESIGN.
3. 50mm FIRE CONNECTION PIPE MATERIAL SHALL BE STAINLESS STEEL GRADE 316
4. >50mm LINE CONNECTION PIPE MATERIAL MAY BE COATED DUCTILE IRON OR STAINLESS STEEL GRADE 316



ELEVATION



PLAN

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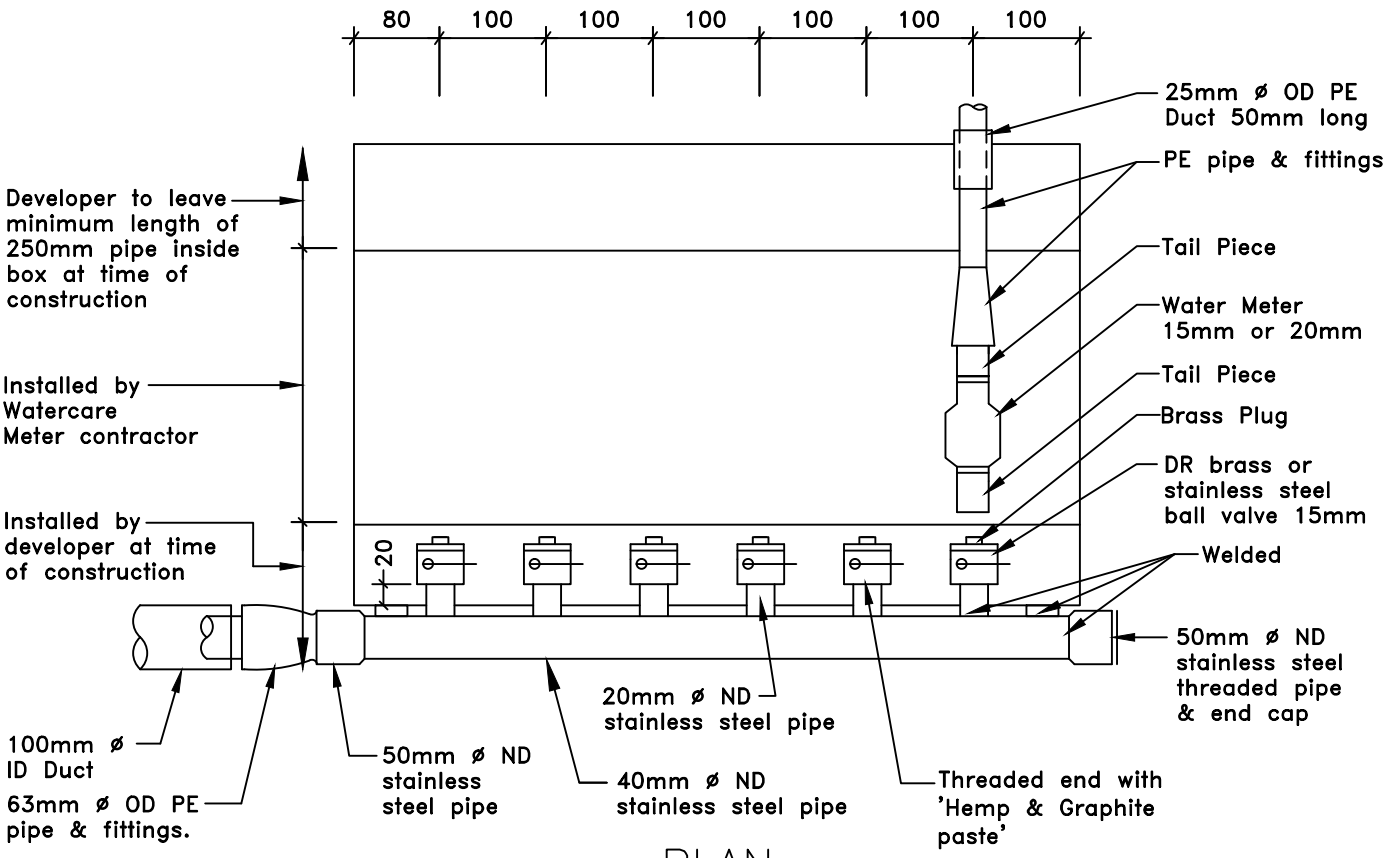
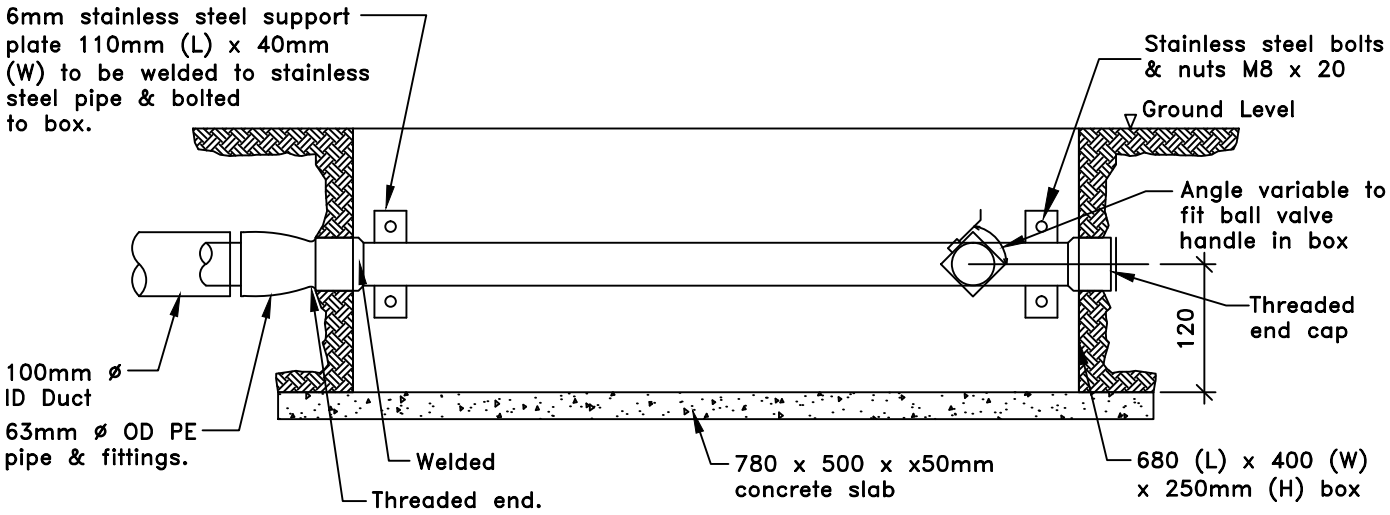
Watercare

FIRE SYSTEM CONNECTION AND WATER METER < 50mmØ

SCALE:	N.T.S.
ISSUE DATE:	14–04–2015
DWG No.	2010069.019B
REFERENCE No.	WS 21



PLAN



ELEVATION

Notes:

1. All fittings to be to Watercare Services Limited engineering Standards.
2. Each meter bank to have minimum of 6 meters. Box length is variable depending on the number of meters – 680mm for 6 meters, 780mm for 7 meters and so forth, whereas box width and height are unchanged.
3. The width of box may be modified to accommodate pressure reducing valves if required.
4. The numbered tags to be provided on each connection starting with unit 1 (or the lowest unit number) from one side. The tags shall be clearly marked firmly attached.

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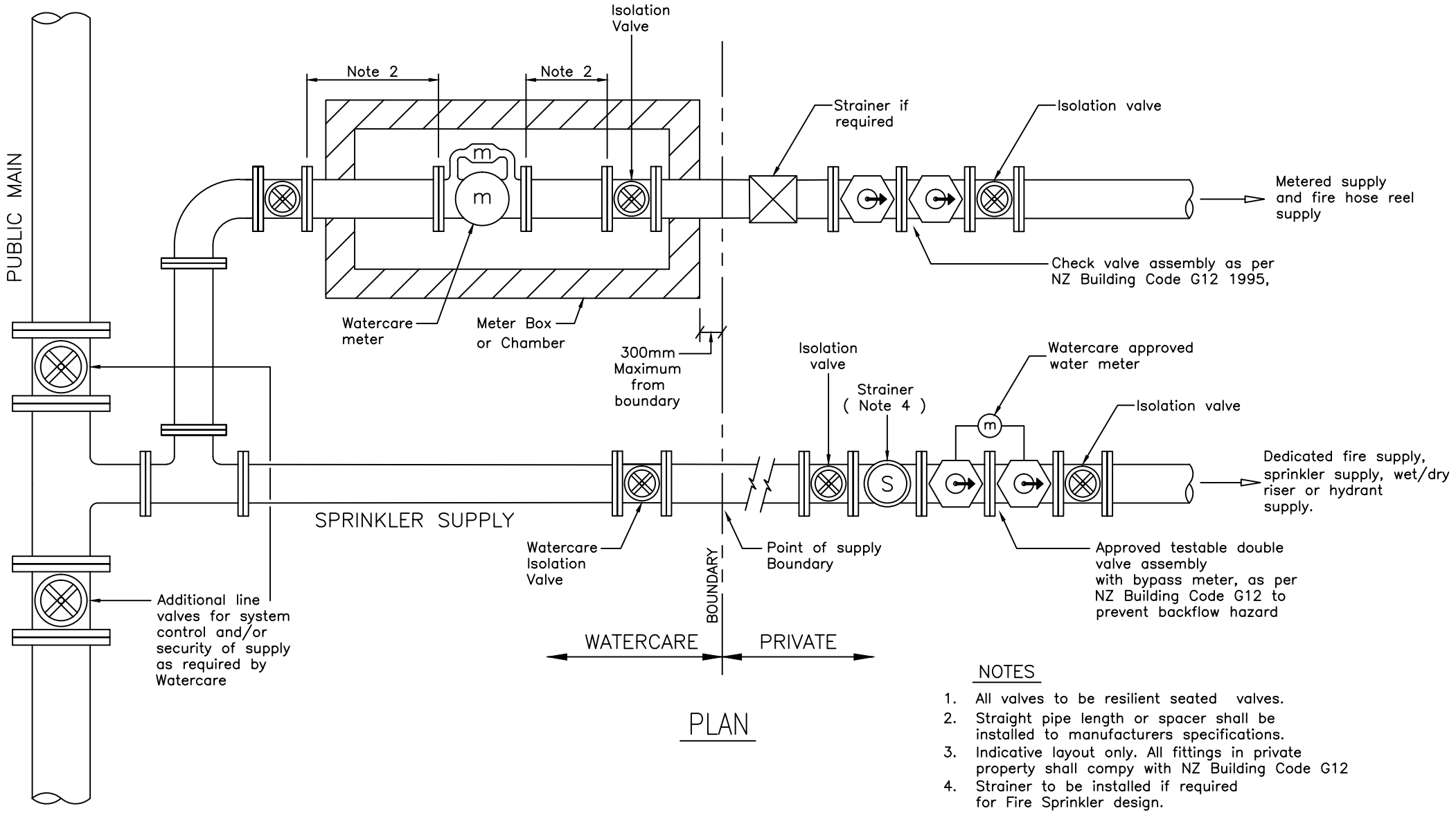
WATER METER BANK

SCALE:	N.T.S.
ISSUE DATE:	20–9–2013
DWG No.	2010069.021
REFERENCE No.	WS 23



PLAN

NOTES

1. All valves to be resilient seated valves.
2. Straight pipe length or spacer shall be installed to manufacturers specifications.
3. Indicative layout only. All fittings in private property shall compy with NZ Building Code G12
4. Strainer to be installed if required for Fire Sprinkler design.
5. Pipe material may be coated Ductile Iron or Stainless Steel Grade 316 or similar approved.

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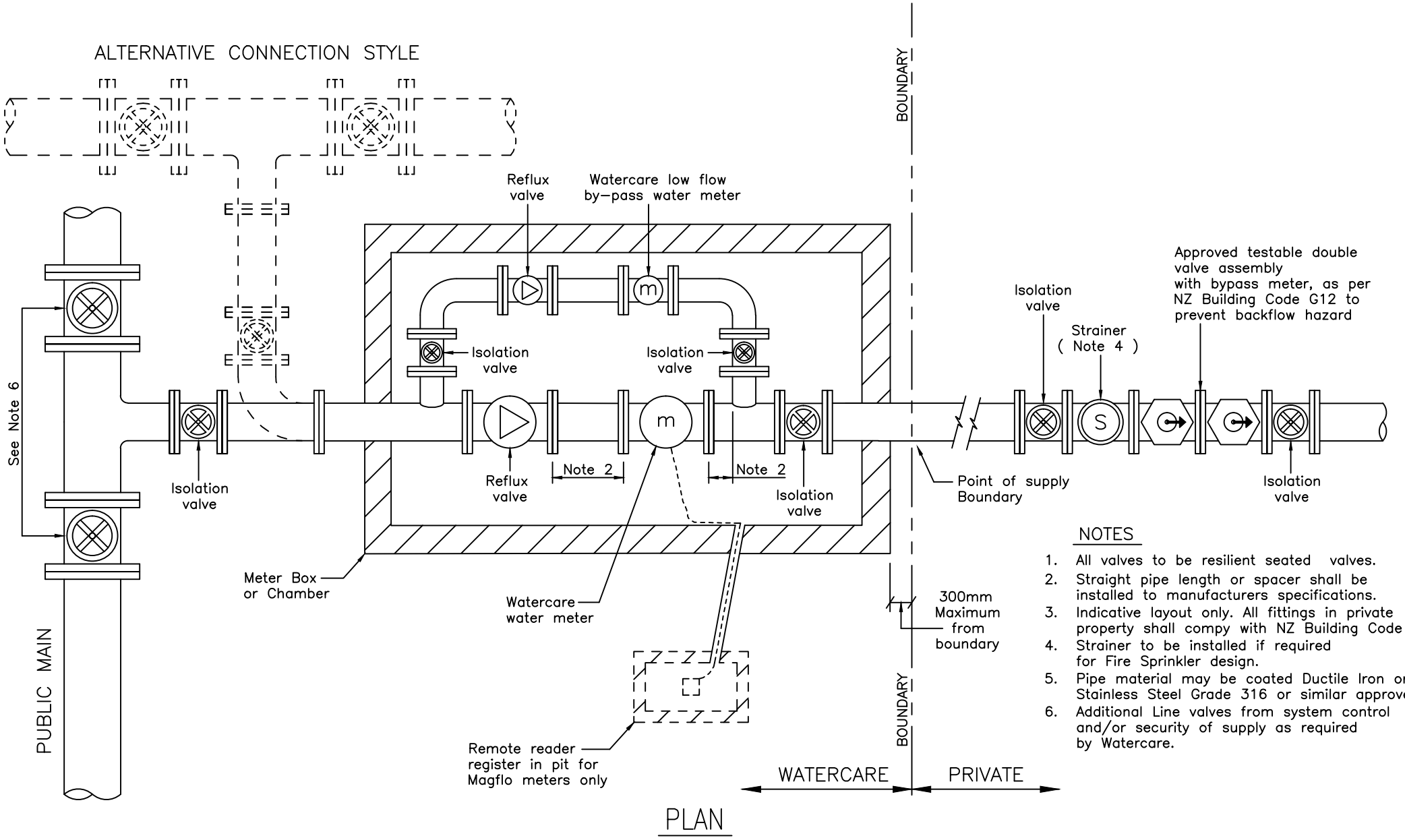
Watercare

FIRE SYSTEM CONNECTION AND WATER METER 50mmø AND ABOVE

SCALE:	N.T.S.
ISSUE DATE:	25–11–2014
DWG No.	2010069.022A
REFERENCE No.	WS 24



PLAN

NOTES

1. All valves to be resilient seated valves.
2. Straight pipe length or spacer shall be installed to manufacturers specifications.
3. Indicative layout only. All fittings in private property shall compy with NZ Building Code G12
4. Strainer to be installed if required for Fire Sprinkler design.
5. Pipe material may be coated Ductile Iron or Stainless Steel Grade 316 or similar approved.
6. Additional Line valves from system control and/or security of supply as required by Watercare.

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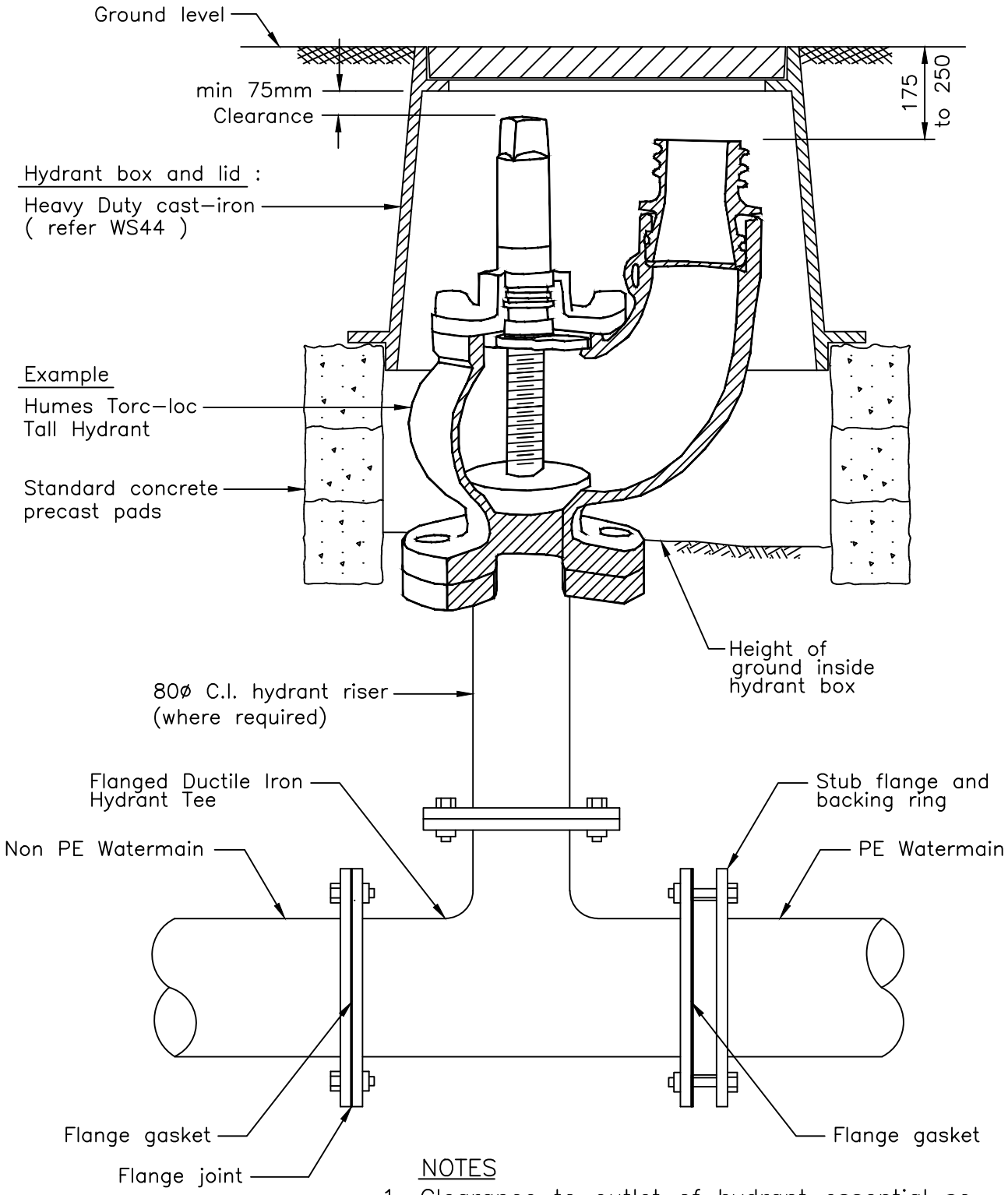
Watercare

COMBINED FIRE SYSTEM AND WATER METER 50mmø AND ABOVE (WITH LOW FLOW BY-PASS WATER METER)

SCALE:	N.T.S.
ISSUE DATE:	25-11-2014
DWG No.	2010069.023A
REFERENCE No.	WS 25



NOTES

1. Clearance to outlet of hydrant essential so that automatic pressure recorder can also be fitted.
2. Hydrant tee, riser, fire hydrant shall be fully polymeric coated.
3. All flanges and fittings shall be Denso wrapped and taped to manufacturers specifications.
4. All nuts & bolts to be Denso–Taped and Molybond coated and shall be grade 316 stainless steel.

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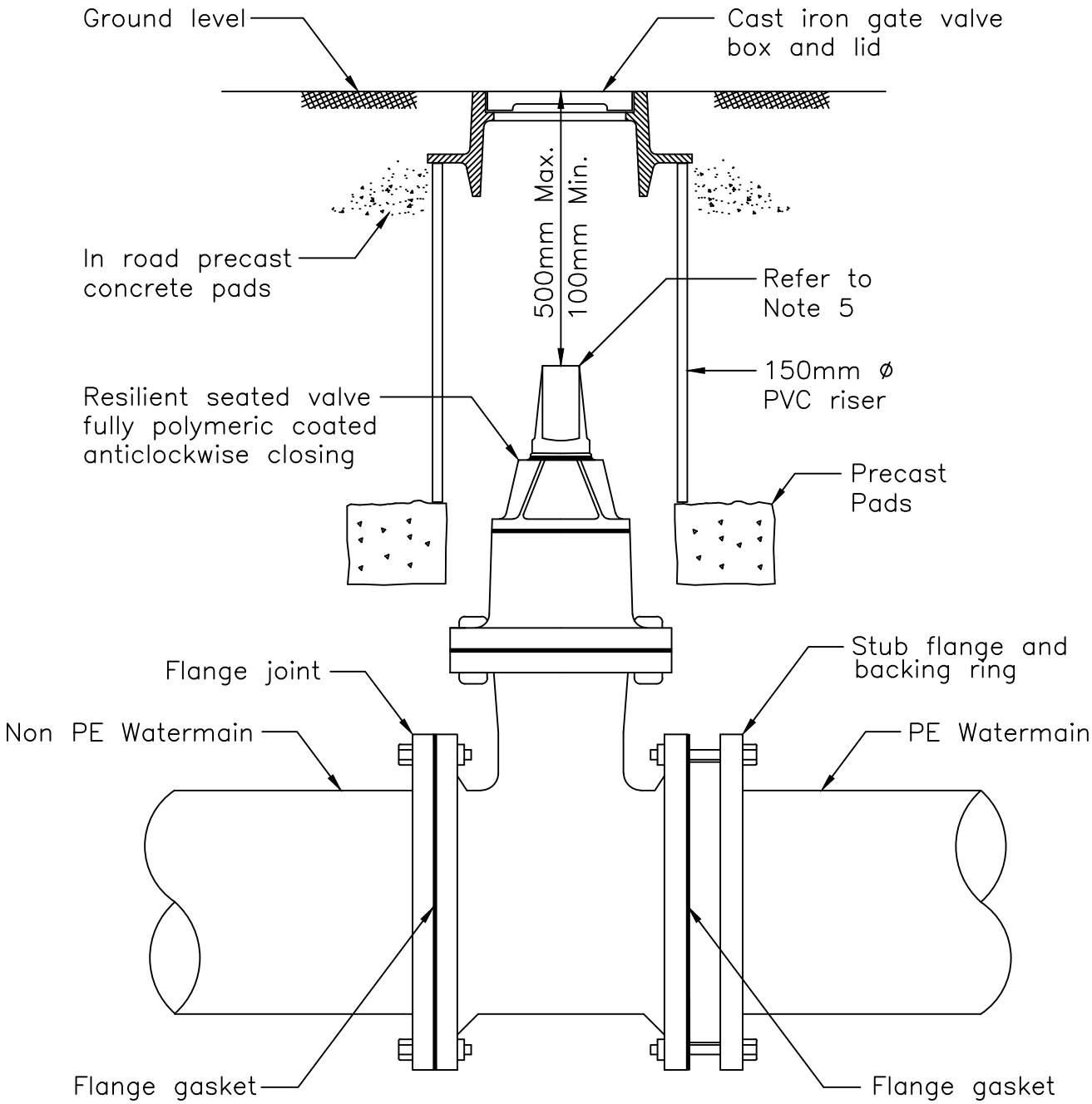
Watercare

HYDRANT DETAIL

SCALE:	N.T.S.
ISSUE DATE:	20–9–2013
DWG No.	2010069.027
REFERENCE No.	WS 29



NOTES

1. Plastic valve covers/boxes not permitted.
2. C.I. gate valve boxes to be used on existing valves only. Square C.I. valve boxes on all new mains.
3. Flanges are to be 'Greensleeved' Polyethylene or Denso wrapped and taped.
4. All nuts and bolts to be Denso–taped and Molybond coated and shall be grade 316 stainless steel.
5. An extension spindle shall be incorperated as required to ensure the top of the spindle is no more than 350mm below the finished surface level.

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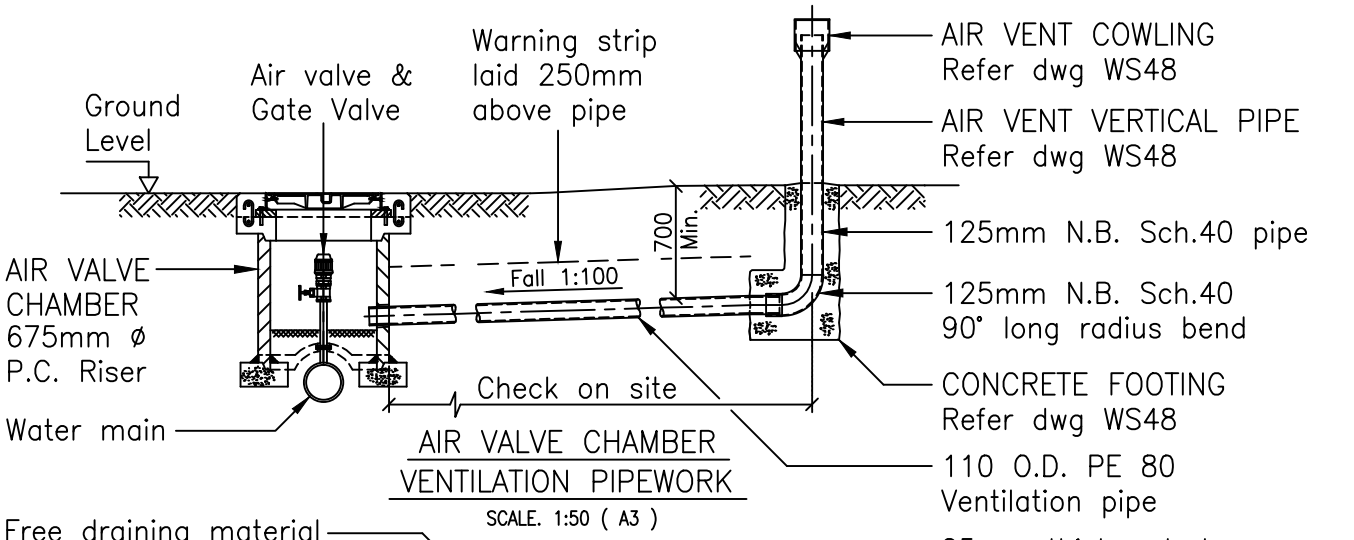
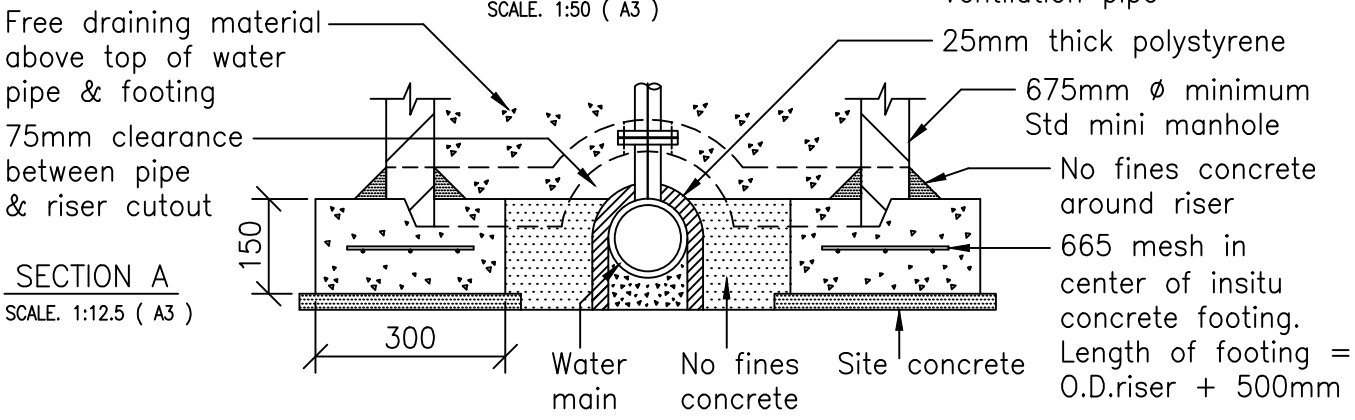
FLANGED SLUICE VALVE DETAIL

SCALE:	N.T.S.
ISSUE DATE:	25–11–2014
DWG No.	2010069.029A
REFERENCE No.	WS 31



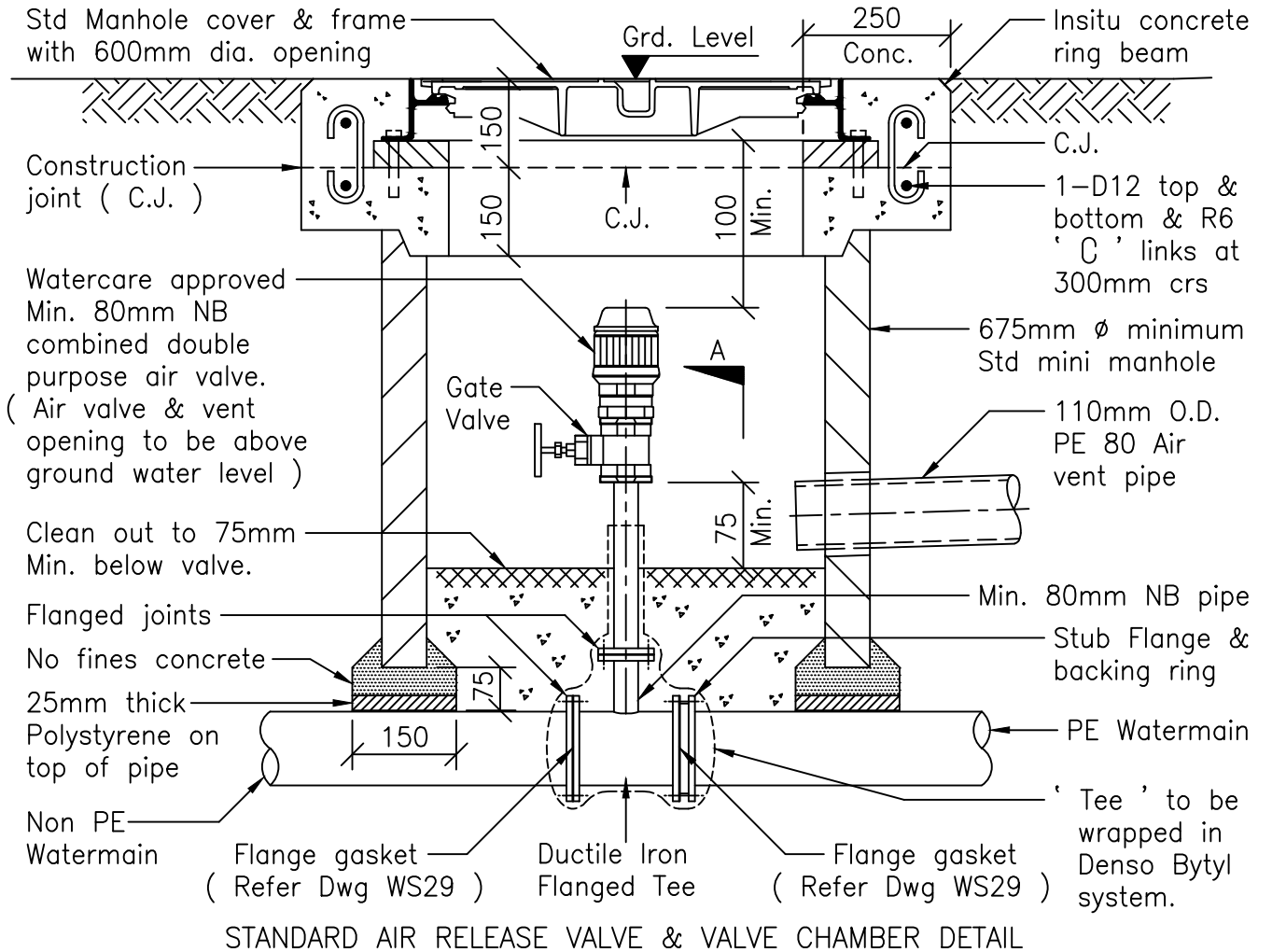
AIR VALVE CHAMBER VENTILATION PIPEWORK

SCALE. 1:50 (A3)



SECTION A

SCALE. 1:12.5 (A3)



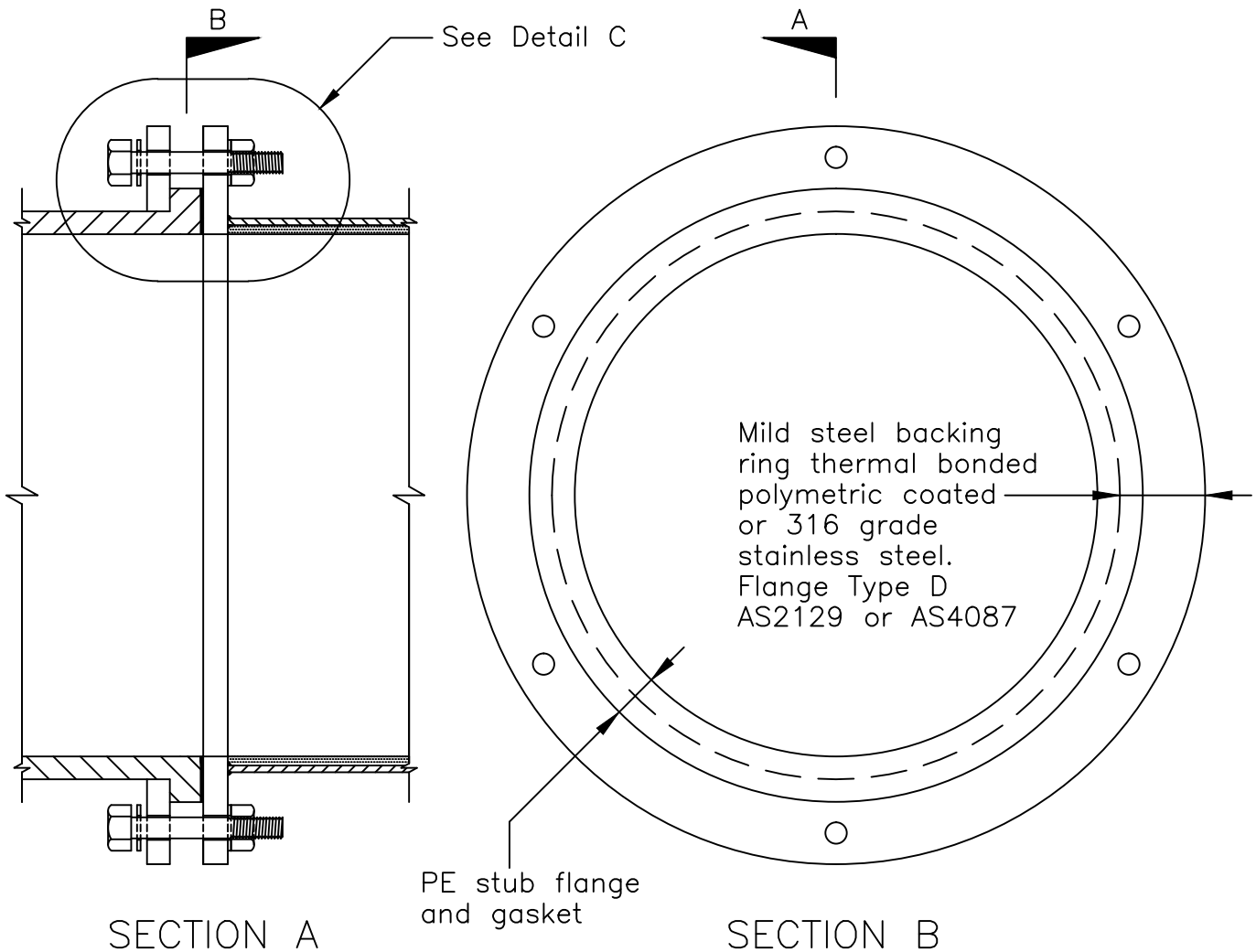
STANDARD AIR RELEASE VALVE & VALVE CHAMBER DETAIL

SCALE. 1:12.5 (A3)

L:\---\ EGCADFI \ 2013 \ WATER & WASTEWATER NETWORK STD DWGS \ 2010069.031A .DWG

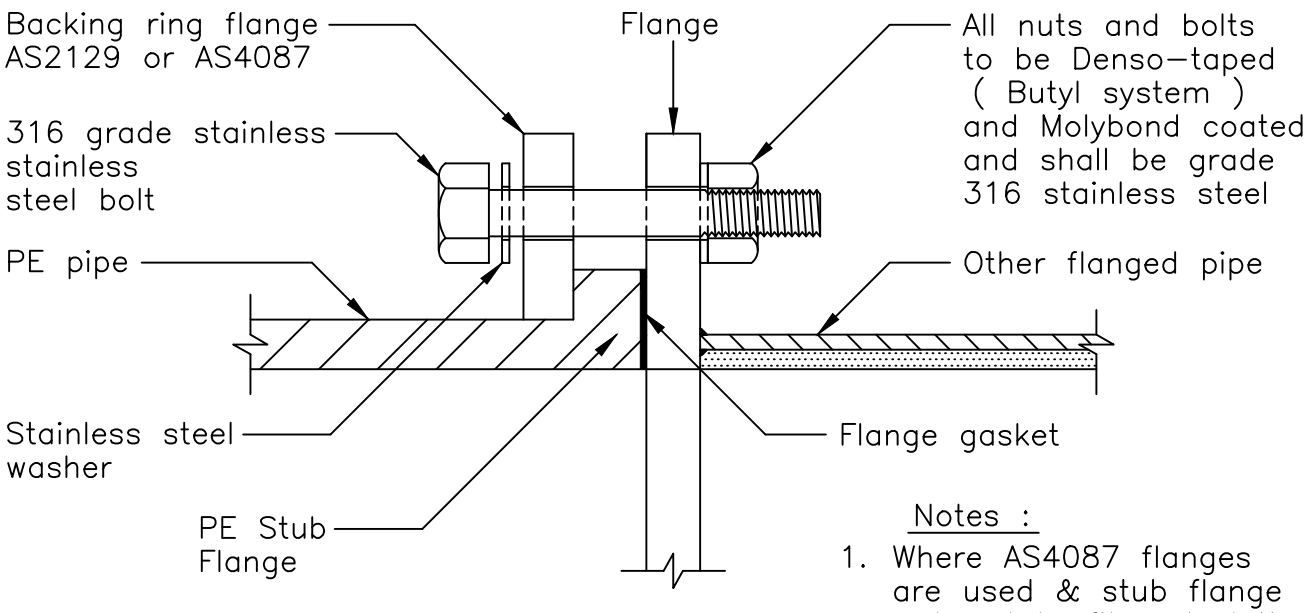
AIR RELEASE VALVE AND CHAMBER DETAIL

SCALE:	N.T.S.
ISSUE DATE:	04–12–2014
DWG No.	2010069.031A
REFERENCE No.	WS 33



SECTION A

SECTION B



DETAIL C

Notes :

1. Where AS4087 flanges are used & stub flange reduced to fit, calculations should show Max. allowable operating pressure is met.
2. Use BSEN1092 flanges where connections are to transmision mains. (Typical)

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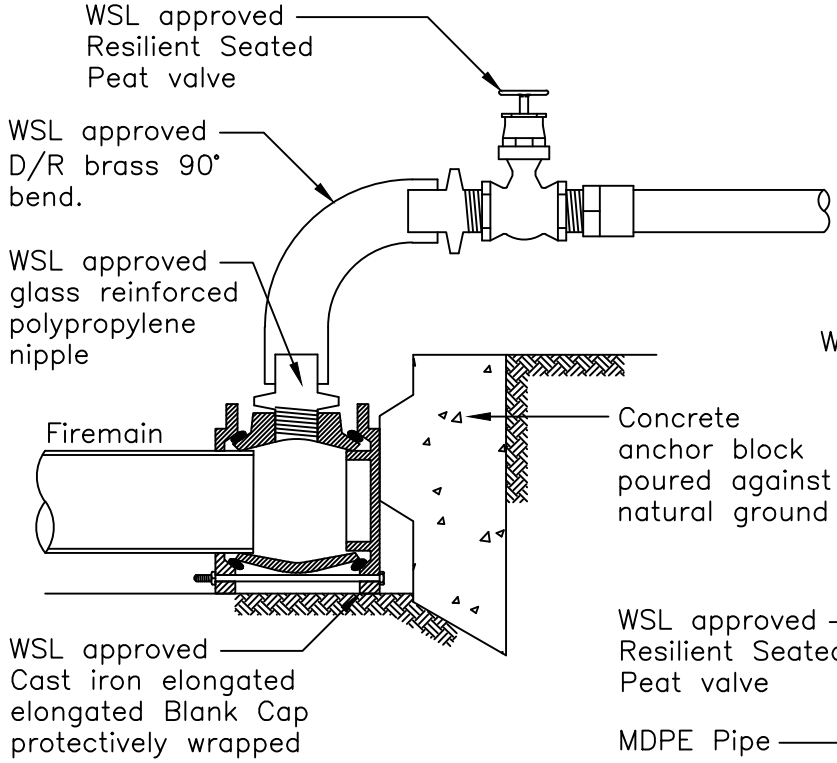
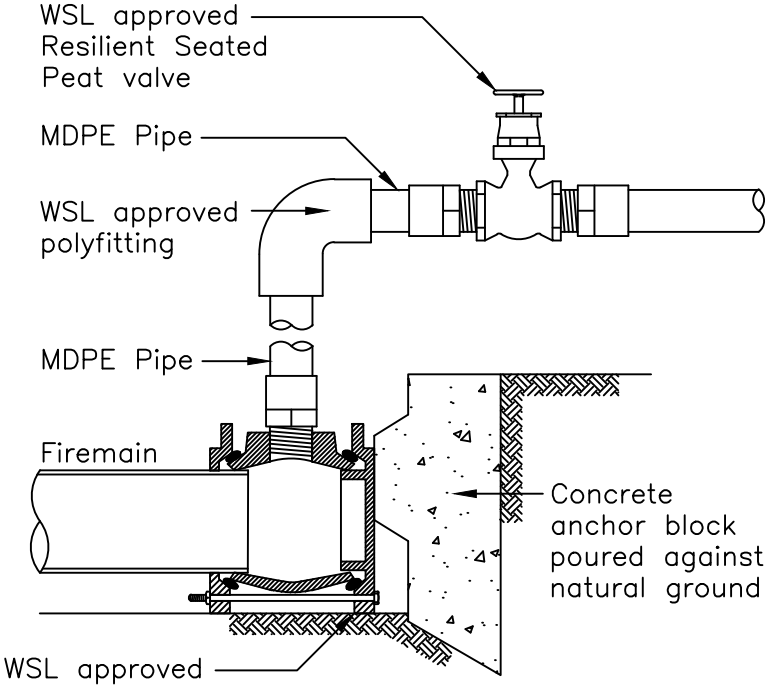
FLANGE CONNECTION DETAIL PE MAIN TO OTHER

SCALE:	N.T.S.
ISSUE DATE:	25–11–2014
DWG No.	2010069.034A
REFERENCE No.	WS37

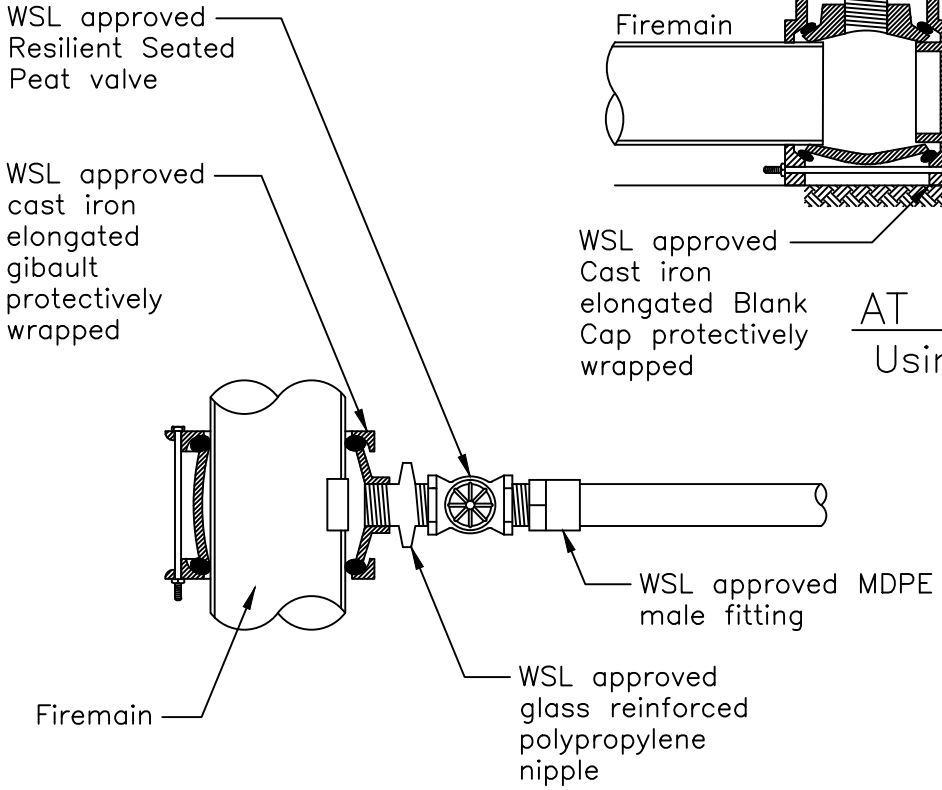


AT END OF MAIN
Using Brass 90° Bend

Notation
WSL = Watercare Services Ltd



AT END OF MAIN
Using MDPE elbow



AT TEE JUNCTION

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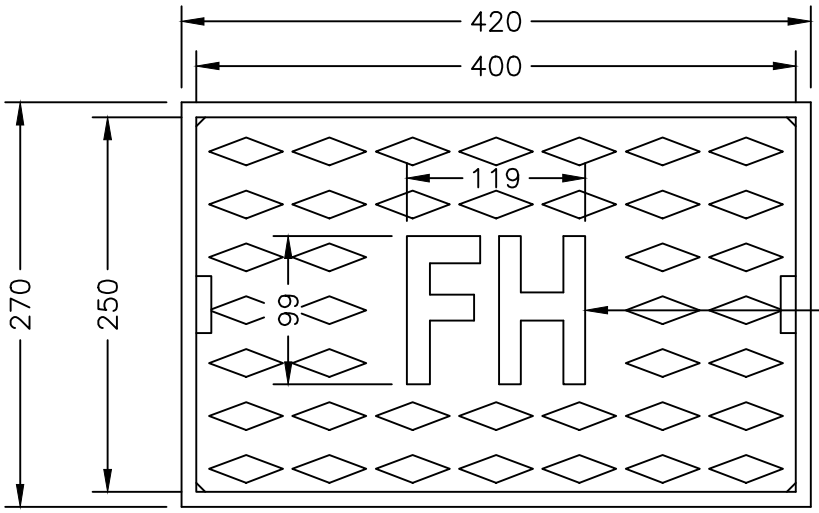
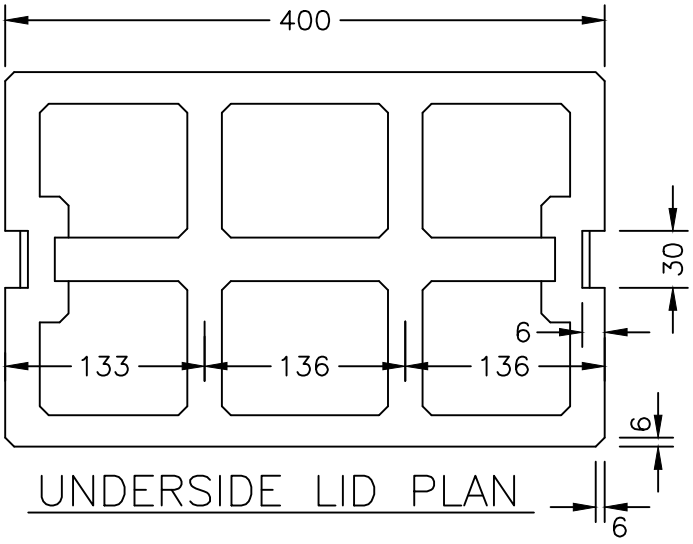
RIDER MAIN CONNECTION

SCALE:	N.T.S.
ISSUE DATE:	25–11–2014
DWG No.	2010069.036A
REFERENCE No.	WS 39

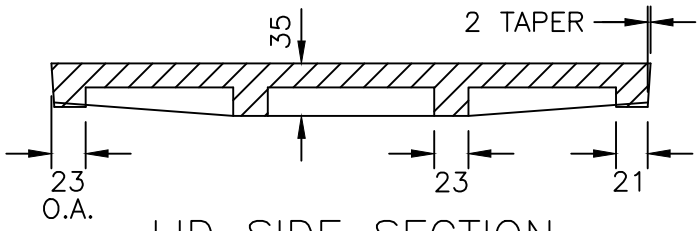


LID PLAN

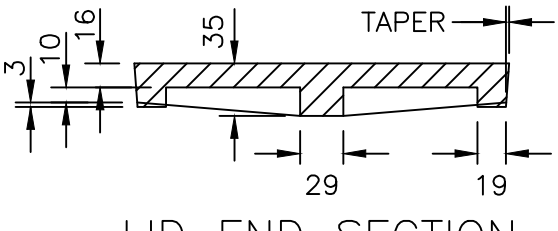
Note:
All castings to be made to BS 4622:1983



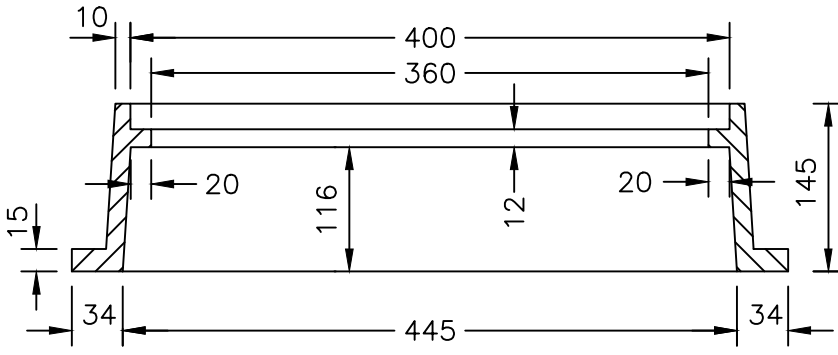
UNDERSIDE LID PLAN



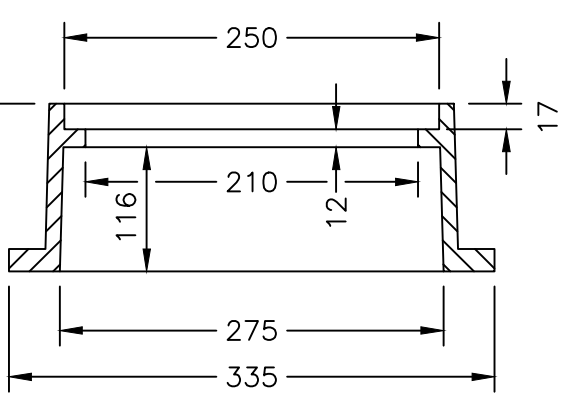
LID SIDE SECTION



LID END SECTION



BOX SIDE SECTION



BOX END SECTION

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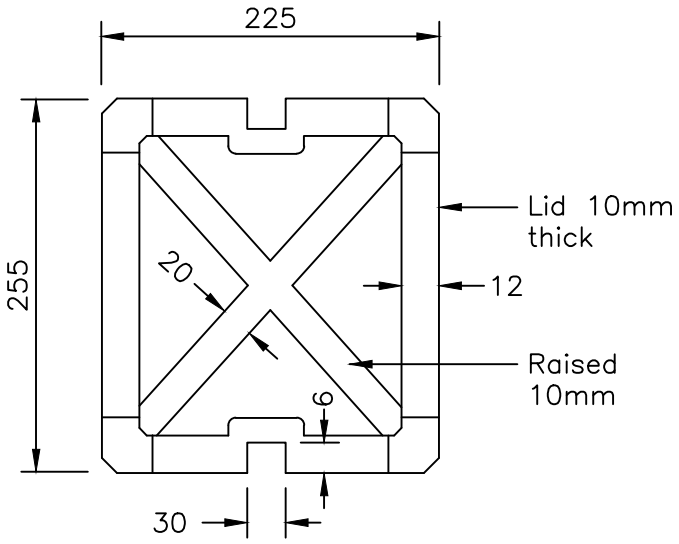
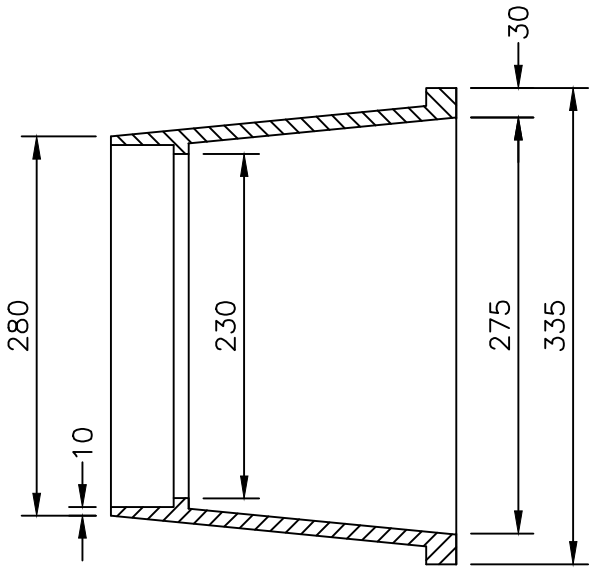
CAST IRON HYDRANT BOX & LID

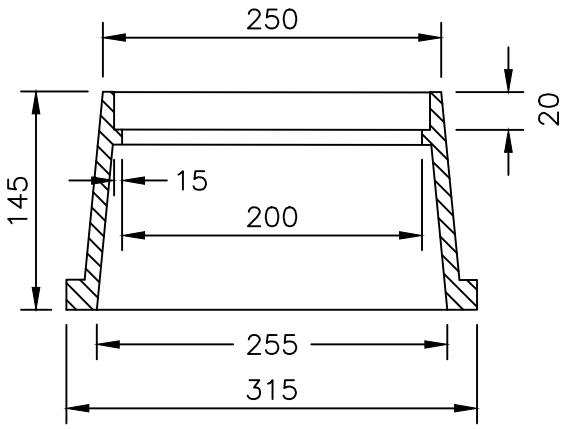
SCALE:	N.T.S.
ISSUE DATE:	20–9–2013
DWG No.	2010069.039
REFERENCE No.	WS 44



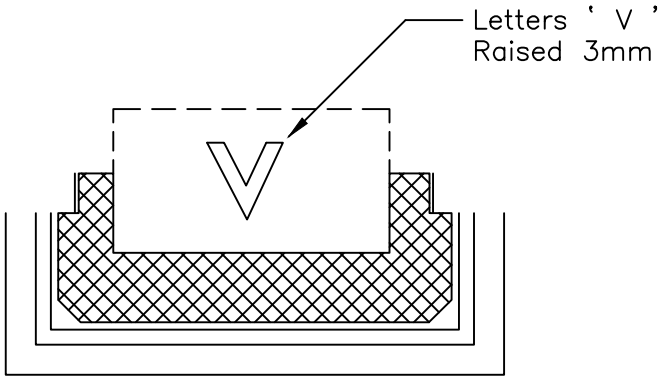
UNDERSIDE LID PLAN



BOX SIDE UP



BOX END SECTION



HALF PLAN

Note:

All castings to be made to BS 4622:1983

L:\---\ EGCADFI \ 2013 \ WATER & WASTEWATER NETWORK STD DWGS \ 2010069.040 .DWG

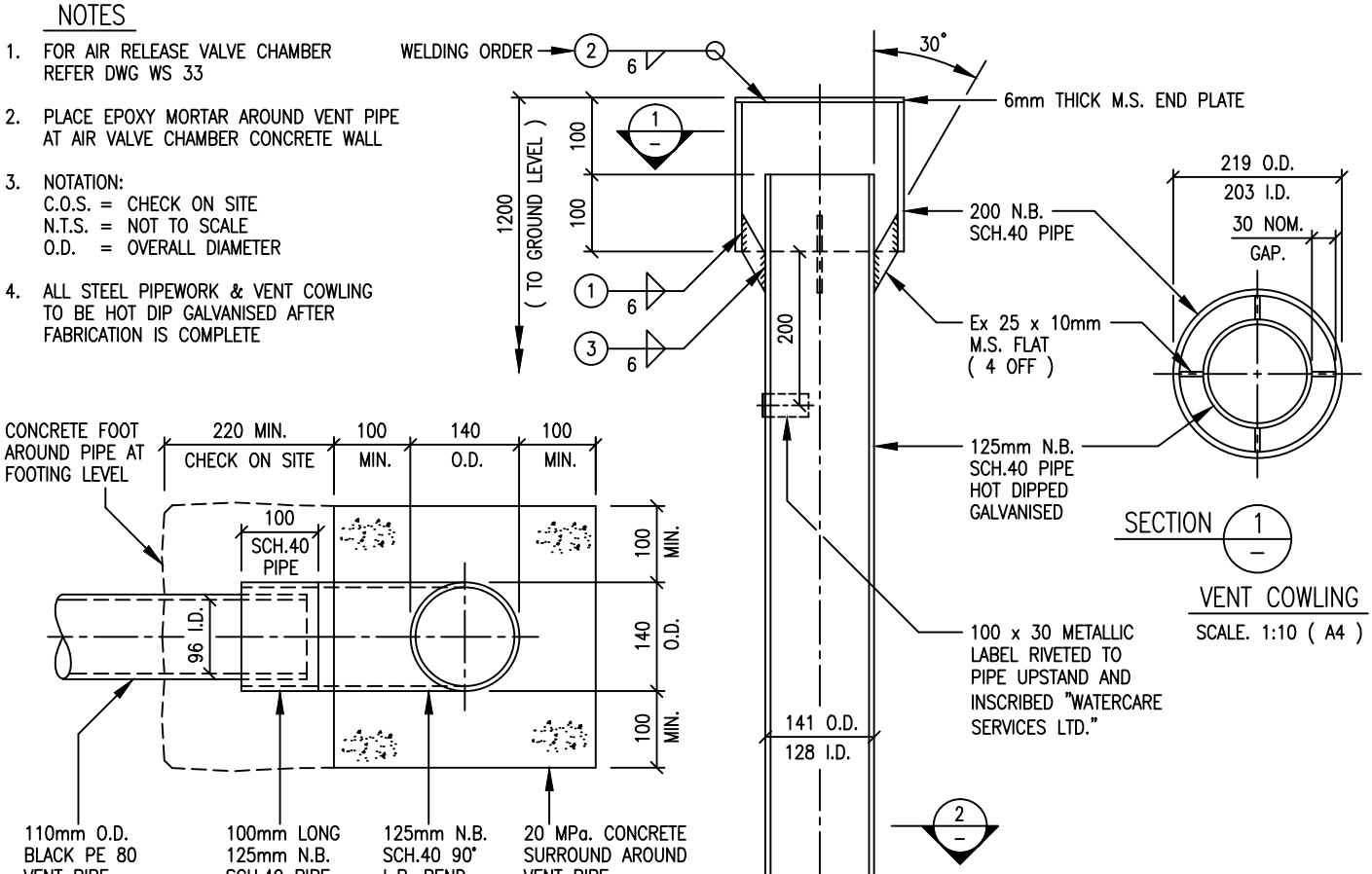
Watercare

CAST IRON VALVE BOX & LID

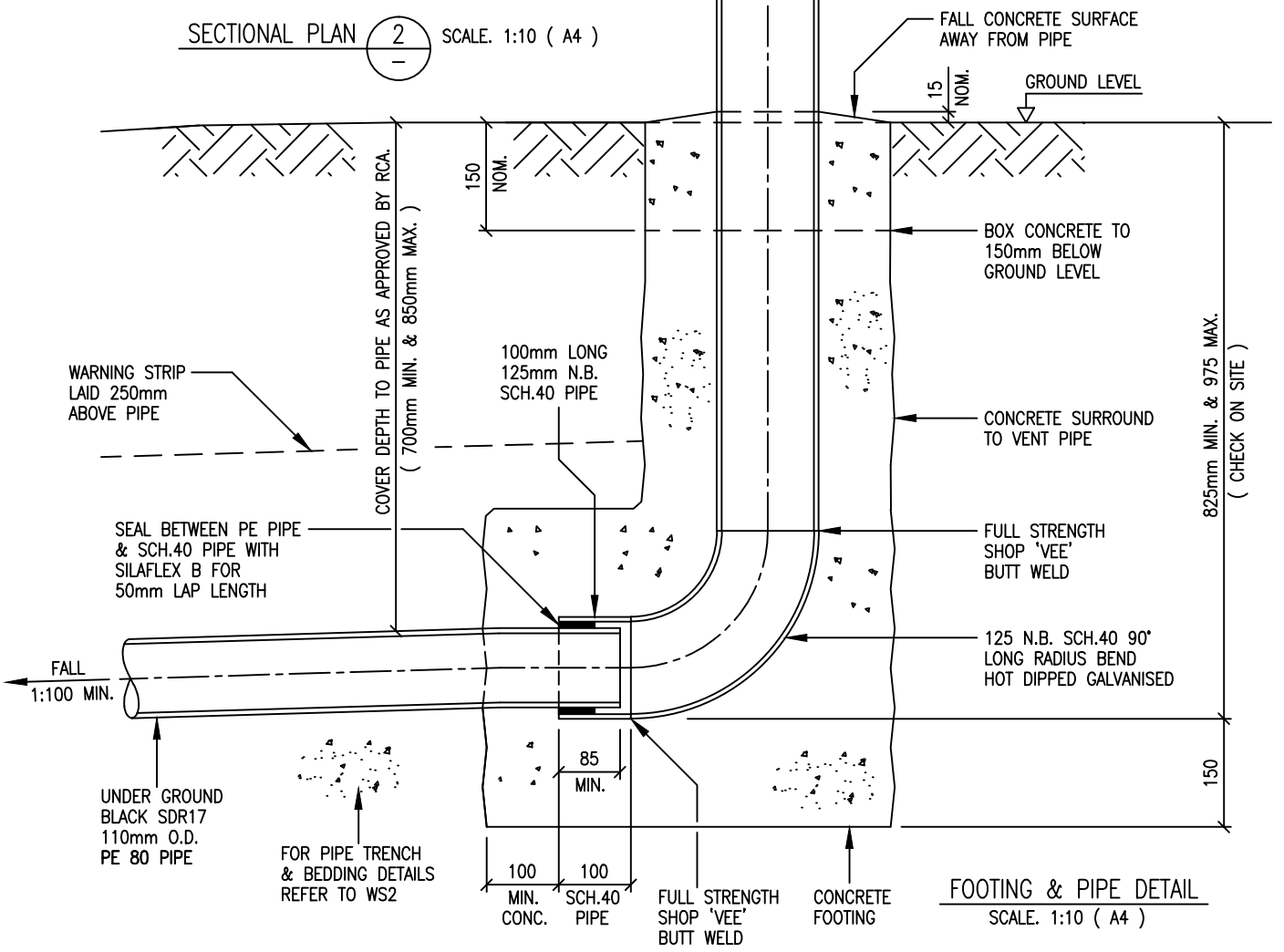
SCALE:	N.T.S.
ISSUE DATE:	20–9–2013
DWG No.	2010069.040
REFERENCE No.	WS 45

NOTES

1. FOR AIR RELEASE VALVE CHAMBER REFER DWG WS 33
2. PLACE EPOXY MORTAR AROUND VENT PIPE AT AIR VALVE CHAMBER CONCRETE WALL
3. NOTATION:
   C.O.S. = CHECK ON SITE
   N.T.S. = NOT TO SCALE
   O.D. = OVERALL DIAMETER
4. ALL STEEL PIPEWORK & VENT COWLING TO BE HOT DIP GALVANISED AFTER FABRICATION IS COMPLETE



SECTIONAL PLAN 2 SCALE. 1:10 (A4)



FOOTING & PIPE DETAIL SCALE. 1:10 (A4)

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Watercare

AIR VENT COWLING, VERTICAL STEEL PIPE FABRICATION DETAIL & CONCRETE FOOTING

SCALE:	1:10 (A4)
ISSUE DATE:	10-12-2014
DWG No.	2010069.043
REFERENCE No.	WS 48

Appendix C: Field testing of Pipelines *and Manholes*

Table of Contents

1 Scope

This appendix specifies methods of test and their application to field testing of pipelines ***and manholes*** for the purpose of determining pipeline acceptability. Field testing includes leak or hydrostatic pressure testing, as appropriate, for pressure and non-pressure pipelines ***and manholes***.

1.1 Purpose of field testing

The purpose of field testing is to:

a) Reveal the occurrence of faults in the laying procedure, for example, joints incorrectly installed or damaged ***material***;

b) Reveal the occurrence of faults in the assembly procedure of components, for example, tapping bands, maintenance structures, frames, and covers;

c) In the case of pressure pipelines, determine that the pipeline will sustain a pressure greater than its design pressure without leakage;

d) In the case of non-pressure pipelines ***and manholes***, determine that the ***installation*** satisfies the requirements for infiltration and exfiltration; and

e) Test the installed structural integrity.

Field testing is not intended to supplement or replace the test requirements of product standards.

2 Pipeline testing

The type of test shall be selected according to the application of the system and the type of material being tested.

2.1 Non-pressure pipelines – Field leakage testing

Leakage testing is used to reveal locations of potential infiltration and exfiltration due to the inclusion of damaged pipes, seals, or incorrectly made joints in the pipeline at the completion of installation.

Leakage testing for acceptance of non-pressure pipelines shall be carried out by at least one of the following methods:

a) Low pressure air testing;

b) Hydrostatic testing

NOTE – Air tests provide qualitative data only, as air pressure losses cannot be related directly to water leakage rates.

For pipeline test sections installed below the water table, and for submarine pipelines, the test pressure used for the hydrostatic test, and for the air test, shall be increased to maintain the required differential between internal and external pressure.

A pipeline failing to meet the requirements of the air tests may be retested using the hydrostatic test method.

NOTE – Failure is still probable.

2.1.1 Low pressure air test

The test length shall be acceptable where the gauged pressure exceeds 18 kPa (or not more than 7 kPa less than the pressure at the start of the test) for the time interval shown in table C1 after the shut-off of the air supply.

Table 1 is based on an air test pressure of 25 kPa (in excess of any external hydrostatic pressure due to groundwater) and, on this basis, air volume losses shall not exceed the greater of:

a) A rate of 0.0009 m3/(min x m2) of pipe wall area; and

b) A rate of 0.056 m^3/min, which is regarded as the lowest detectable individual air leak.

Column 2 and column 3 of table 1 give the times and lengths up to which (b) prevails over (a).

NOTE – For safety reasons air test pressures in excess of 50 kPa should not be applied.

Table 1 – Low pressure air and vacuum tests – Minimum time intervals for 7 kPa pressure change in pipeline

DN	Minimum time (minutes)	Maximum length for minimum time to apply (metres)	Test length (metres)				
			50	100	150	200	250
			Minimum test duration (minutes)				
80	1.5	231	1.5	1.5	1.5	1.5	1.6
100	2	185	2	2	2	2	**3**
150	3	123	3	3	3	5	6
225	4	82	4	5	8	10	13
300	**6**	62	6	9	14	18	23
375	7	49	7	14	22	29	36
450	9	41	10	21	31	41	52
525	10	35	14	28	42	56	70
600	11	31	18	37	55	73	92
675	13	27	23	46	70	93	116
750	14	25	29	57	86	115	143
900	17	21	41	83	124	165	207
1000	28	12	51	102	153	204	255
1050	20	18.8	56	112	169	225	281
1200	23	15	73	147	220	294	367
1500	28	12	115	230	344	459	574

NOTE – The time interval may be reduced for a proportionate reduction in the allowable pressure drop. Where there is no detectable change in pressure after 1 hour of testing, the section under test shall be deemed acceptable. This table is based on the following equation: $T = 1.02DikLq$ where T = time for a 7 kPa pressure drop, in seconds Di = pipeline internal diameter, in metres q = allowable volume loss in cubic metre/minute/square metre taken as 0.0009 m3/min.m2 $k = 0.054DL$ but not less than 1 L = length of test section, in metres. Columns 2 and 3 have been calculated with $k = 1.0$. The appropriate air or vacuum test/pressure method for pipes larger than DN 750 should be established by reference to the specifier.

2.1.1.1 Low pressure air test procedure

The procedure shall be as follows:

a) Pump in air slowly until a pressure of 25 + 5−0 kPa is reached. Where the pipeline is below the water table this pressure shall be increased to achieve a differential pressure of 25 kPa. In no circumstances should the actual pressure exceed 50 kPa; NOTE – Rapid pressurisation may cause significant air temperature changes, which will affect the testing accuracy.
b) Maintain the pressure for at least 3.0 minutes;
c) Where no leaks are detected, shut off the air supply;
d) Where the pipeline fails the test, re-pressurise to 25 +5,−0 kPa and check for leaks by pouring a concentrated solution of soft soap and water over accessible joints and fittings;
e) Repair any defects, then repeat steps (a) to (c);

f) With the air supply shut off, monitor the pressure for the time intervals given in table 1.

The test length shall be acceptable where the pressure drops by 7 kPa, or less, over the required (tabulated) test period.

NOTE –

(1) The test length of pipeline should be restricted to pipeline sections between maintenance holes (the most convenient places for inserting test plugs or fixing temporary bulkheads). The method should not be used for test lengths in excess of 250 m and for pipe diameters larger than 1500 mm.

(2) The procedure for low pressure air testing of large diameter pipelines is potentially hazardous because of the very large forces to be resisted by temporary plugs or bulkheads and the serious consequences of accidental bulkhead blow-out. A relief valve, with a 50 kPa maximum setting, should be installed on all pressurising equipment.

2.1.2 Hydrostatic test

The test length shall be acceptable where the specified allowable make up water is not exceeded. Where not specified, the allowable make up water shall be 0.5 L/hour per metre length per metre diameter.

2.1.2.1 Hydrostatic test procedure

The procedure shall be as follows:

a) The test pressure shall be not less than 20 kPa, or 20 kPa above the groundwater pressure at the pipe soffit at its highest point, whichever is the greater, and not exceed 60 kPa at the lowest point of the section;

b) Steeply graded pipelines shall be tested in stages where the maximum pressure, as stated above, will be exceeded if the whole section is tested in one length;

c) The pressure shall be maintained for at least 2 hours by adding measured volumes of water where necessary;

d) Any visible leaks detected shall be repaired and the pipeline shall be retested.

2.2 Pressure pipelines – Field hydrostatic pressure testing

Hydrostatic pressure testing requires selecting an appropriate configuration of method, pressure, and length of test section.

Test parameters and details shall be determined with due consideration to the following:

a) Pipe material;

b) Pipe diameter;

c) Length of test section;

d) Duration of the test;

e) Magnitude of test pressure and rate of pressurisation;

f) Presence of air in the pipeline;

g) Time required for saturation of porous liners;

h) Potential movement of pipeline thrust restraints;

i) Design pressure for thrust and anchor supports;

j) Accuracy of test equipment;

k) Ambient temperature changes during testing;

l) Presence of leaks in equipment used for testing or equipment attachment points (such as sealing plugs);

m) Potential for leaks in the pipeline.

NOTE – It is advisable to begin testing early in the pipeline installation to confirm adequacy of laying procedures and, where appropriate, to increase the length tested progressively as experience is gained.

2.2.1 Selection of test pressure

The hydrostatic test pressure at any point in the pipeline shall be:

a) Not less than the design pressure; and

b) Not more than 25% above the rated pressure of any pipeline component.

NOTE – The design pressure is the maximum system pressure at a point in the pipeline, considering future developments, static pressure, dynamic pressure, and an allowance for short-term surge pressure (water hammer), as determined by analysis.

Compressed air testing shall not be permitted for pressure pipe.

2.2.2. Selecting test lengths

The pipeline length tested shall be either the whole, or a section (capable of being isolated), of the pipeline depending on the length and diameter, the availability of water, and the spacing between sectioning valves or blank ends.

The pipeline shall be divided into test sections such that:

a) The hydrostatic test pressure at any point in the pipeline is:

(i) ***Shall be 1.25 times the rated pressure and no more, but*** not less than the design pressure ***at the highest point where pipe is tested on a sloped installation***; and

(ii) Not more than 25% above the rated pressure of any pipeline component;

b) Test sections shall not exceed 1000m and shall be limited to pipe of the same material. Consideration shall be given to the pressure loading time at the maximum filling rate (see C2.2.3) in determining the test length; and

c) Water is available for the test together with facilities for its disposal, in accordance with regulatory requirements, after the test.

C2.2.2 b)

Watercare recommends that test sections be done as short as possible to reduce the efforts during fault finding should a test length fail to pass the test. Test lengths of 250m to 500m are typically considered as practical.

NOTE –

(1) Where long lengths are to be tested, radio or other electronic means of communication between test operatives, to coordinate test procedures and thus minimise the test duration, is desirable.

(2) Long test sections may incorporate a large number of mechanical (that is, flanged) joints, which should be checked for leakage. The longer the test section the harder it is to locate a leak, or discriminate between a leak and the other effects, such as the absorption of air into solution under pressure.

2.2.3 Pre-test procedures

The pre-test procedures are as follows:

a) All required temporary and permanent thrust blocks, or other pipeline thrust-resisting methods, including integral joint-restraint systems, shall be in place, and all concrete shall be adequately cured (normally a minimum of 7 days);

b) Blank flanges or caps shall be installed at the beginning and end of the test section. Testing shall not take place against closed valves. Mechanical ends

that are not end load resistant shall be temporarily strutted or anchored, to withstand the test pressures without movement;

NOTE – Temporary supports should not be removed until the pipeline has been depressurised. All test personnel should be informed of the loading limits on temporary fittings and supports.

c) Where practicable, all bolted joints shall be left exposed to allow for re-tensioning during or after testing;

d) Compacted embedment and fill material shall be placed to leave all joints, service connections and ball valves exposed wherever possible;

e) For PE pipelines, the pressurising time shall not exceed 45 minutes;

NOTE – The pressurising time affects the duration of the PE pipeline test.

f) The test equipment shall be placed in position and checked for satisfactory operation;

g) The pump shall be of adequate size to raise and maintain the test pressure;

NOTE – A pump that is too small may increase the test duration or where too large it may be difficult to control the pressure.

h) Two calibrated test gauges shall be used to cross check gauge accuracy;

(i) Slowly fill the test length of pipeline with water, preferably from the lowest point, ensuring air is vented at the high point valves. Allow a period, in the range of ***minimum*** 3 hours to 24 hours ***(preferred)***, for the temperature of the test length and the test water to stabilise and for dissolved air to exit the system. The recommended rate of filling shall be based on a flow velocity of 0.05 m/s, calculated from the following equation:

$$Q\text{f} \leq 12.5\pi D2$$

where

Qf = filling rate, in litres per second

D = pipe diameter, in metres

NOTE – The slow rate of 0.05 m/s avoids air entrainment when the filling water is cascading through downward gradients along the pipeline.

The period of stabilisation will depend on pipe dimensions, length, material, longitudinal profile, and air exit points. For cement-mortar lined pipe, the pipeline shall be filled at least 24 hours before the commencement of the test, to allow the lining to become saturated.

NOTE – A firm foam swab may be used ahead of the fill water to assist air removal especially where the pipeline undulates. Extract the swab at a high-point wash-out.

Typical pressure test equipment and location are shown in figures 1 and 2.

2.2.4 Post-test procedures

After testing, pipelines shall be depressurised slowly. All air venting facilities shall be open when emptying pipelines. The test water shall be drained to an approved waterway and all connection points shall be reinstated.

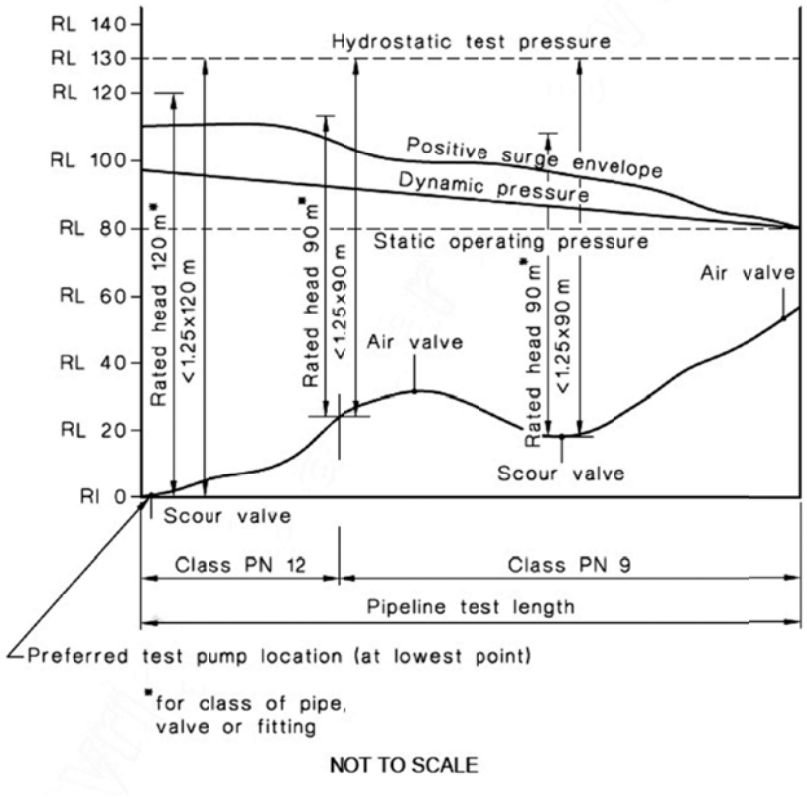


Figure 1 – Typical pressure pipeline under field hydrostatic test

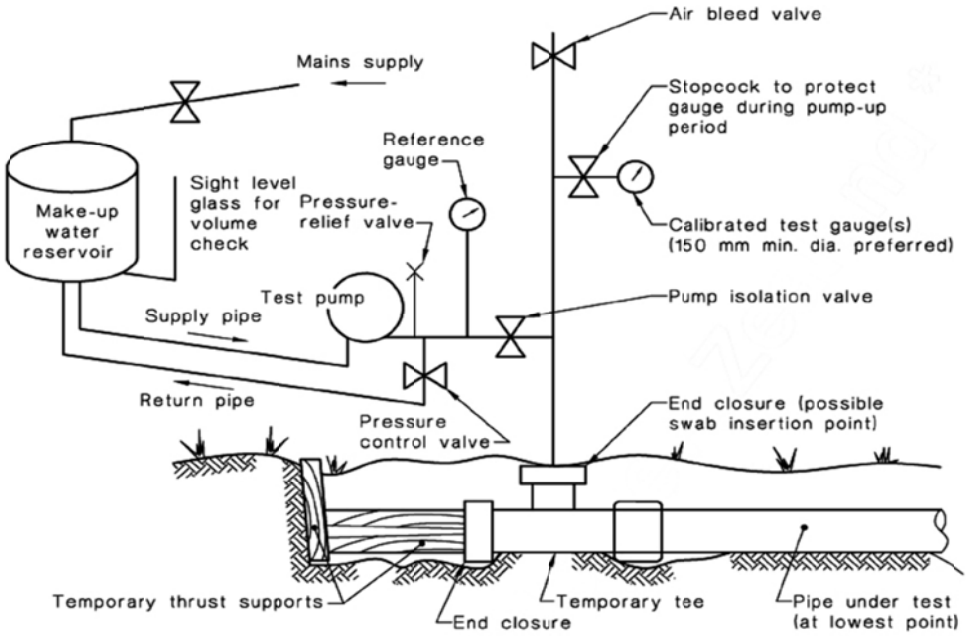


Figure 2 – Typical field pressure test equipment layout

2.2.5 Constant pressure test (water loss method) – PVC, DI, GRP, and steel pipelines

This test is applicable for PVC, DI, GRP, and steel pipelines.

2.2.5.1 Procedure

The procedure shall be as follows:

(a) Close all valves apart from the test pump input and pressurise the test length to the specified test pressure (STP) – (see 2.2.2);

(b) Apply and then maintain the test pressure by the addition of measured and recorded quantities of make-up water at regular intervals over a period, in the range of 1 hour to 12 hours;

(c) Where pressure measurements are not made at the lowest part of the test length, make an allowance for the static head, between the lowest point of the pipeline and the point of measurement,

The quantity of make-up water necessary to maintain the test pressure shall comply with the following equation:

$$Q \leq 0.14LDH$$

where

Q = allowable make-up water, in litres per hour

L = length of the test length, in kilometres

D = nominal diameter of the test length, in metres

H = average test head over length of pipeline under test, in metres

NOTE – The make-up water is not a leakage allowance, but is an allowance to cover the effects of the test head forcing small quantities of entrapped air into solution. Normally the test should last for a minimum of 2 hours and be concluded within 5 to 8 hours. The make-up water requirement should reduce with time as air goes into solution. Where, after 12 hours the make-up water still exceeds the allowable limit, testing should cease and the cause of loss investigated.

2.2.5.2 Acceptance

a) The test length shall be acceptable where there is no failure of any thrust block, pipe, fitting, joint, or any other pipeline component;

b) There is no physical leakage;

c) The quantity of make-up water necessary to maintain the test pressure complies with 2.2.5.1.

2.2.6 Pressure decay test for PE pipe larger than DN200 or longer than 250m

This test procedure is applicable to Polyethylene pipe of larger size and length or where larger water systems are being tested (up to 1000m).

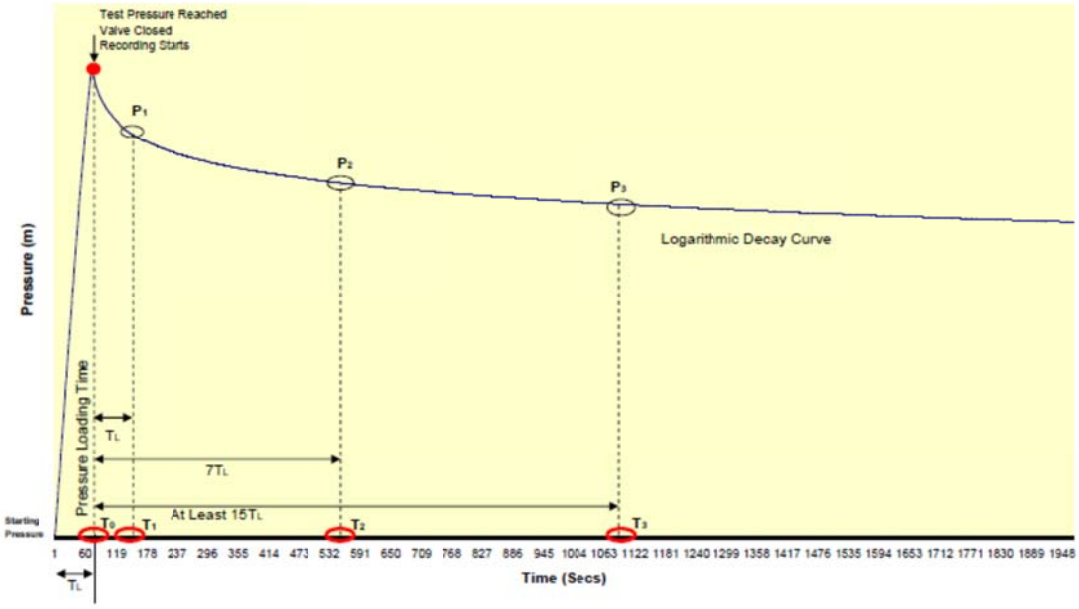
2.2.6.1 Procedure

The procedure shall be as follows:

(a) Close all valves apart from the test pump input and pressurise the test length to the specified test pressure (STP) – (see 3.2.3). The pressure loading time shall not exceed 45min;

(b) Once the STP is reached with satisfied conditions the pipe line is isolated and pressure allowed to naturally decay;

(c) Pressure decay over time in viscoelastic pipe is an exponential form and expressed in a calculated ratio as follows:



Take a first reading of pressure P1 at T1, where T1 is equal to the pressure loading time (TL).

- Take a second reading of pressure P2 at 7TL. Let this be T2.
- Take a third reading of pressure P3 at 15TL. Let this be T3.
- To allow for this stress relaxation behaviour of PE pipelines, calculate the corrected values of T1, T2 and T3.

- Calculate corrected T1: T1C = T1 + 0.4TL
- Calculate corrected T2: T2C = T2 + 0.4TL
- Calculate corrected T3: T3C = T3 + 0.4TL

(d) Calculate decay slope ratio (N) values

- Calculate N1:

$$N1 = \frac{\log P1 - \log p2}{\log t2C - \log t1C}$$

- Calculate N2:

$$N2 = \frac{\log P2 - \log P3}{\log t3C - \log t2C}$$

2.2.6.2 Acceptance

(a) For pipe with compacted backfill: N1 **and** N2 range within **0.04 to 0.05;** or
(b) For pipe without backfill or constraint: N1 **and** N2 range within **0.08 to 0.10**; and
(c) There is no physical leakage;
(d) No failure of any component, movement of permanent thrust block or temporary thrust restraint used for testing.
(e) Should the test fail, after the problem has been repaired the test shall be redone completely.

2.2.7 Pressure rebound *test for PE up to DN 200*.

This test is applicable to PE and ABS pressure pipelines up to ***typically 250m length or shorter as to allow rapid pressure reduction when bleeding the system for the rebound test.***

2.2.7.1 Pressure measurement rig

The test rig shall be a recently calibrated pressure transducer, data logger, and check pressure gauge that has a dial of at least 100 mm diameter and a pressure range that places the specified test pressure (STP) (see 2.2.1) in the range 35% to 70% of the gauge's full scale. The transducer and the check gauge shall read within ±5% of each other. If they do not agree within this tolerance, the equipment shall be recalibrated or replaced.

2.2.7.2 Procedure

a) Prepare the pipeline in accordance with 2.2.3 pre-test procedure;

b) Make sure that all air is expelled before commencing with the test and that no air is introduced into the section being tested;

c) Maintain the STP for 30 minutes by additional pumping as required.

d) Check for obvious leaks;

e) After 30 minutes at the test pressure, reduce this pressure rapidly by bleeding water from the system (<5min), to a nominal pressure of 2bar at the test gauge;

f) Close the control valve and isolate the test section;

g) Record pressure gauge readings at 5 minute intervals for 1 hour after isolation.

2.2.7.3 Acceptance

The test length shall be acceptable if:

a) There is no failure of any thrust block, pipe, and fitting, joint, or any other pipeline component;

b) There is no physical leakage;

c) The pressure rises ***and then*** remains static ***or slightly increases during*** the ***1 hour*** period.

d) ***This test may be reduced on approval from Watercare to 30min in the rebound phase where there is an operational need to bring the pipe into service quickly***.

e) If the pressure does not rise, or falls after an initial rise the test is a fail.

f) Should the test fail, after the problem has been repaired the test shall be redone completely.

2.2.8 Visual test for small pressure pipelines

This test is applicable for small pipelines of all materials (less than 20m in length), and pipelines where pipeline joints have been left exposed for the test operation (such as coiled pipe).

2.2.8.1 Procedure

The procedure shall be as follows:

a) The test pressure (see 2.2) shall be applied and the test section isolated by closing the high point air release valves and the pump feed valve;

b) The test section shall be visually inspected for leakage at all joints, especially bolted joints, all fittings, service connections, and ball valves;

c) Pressure gauges shall be checked to ensure that pressure has not fallen significantly indicating an undetected leak;
d) Any detected leak shall be repaired and the section shall be retested;
e) Where no leak is detected, high point air release valves shall be opened, the pipeline shall be depressurised to slowly drain the line into an approved waterway and all connection points shall be reinstated.

2.2.8.2 Acceptance

The test length shall be acceptable where:

a) There is no failure of any thrust block, pipe, fitting, joint, or any other pipeline component;
b) There is no physical leakage; and
c) There is no pressure loss indicative of a leak.
d) Should the test fail, after the problem has been repaired the test shall be redone completely.

3 Manhole (concrete) testing

The type of test shall be selected according to the performance requirement of the system, the type of installation methodology, ground conditions and Health and Safety risk factors associated with the installation. All manhole tests shall include 300mm of the connecting pipework with the lid fitted into place.

3.1 Hydrostatic testing of concrete manholes

This test may be used for manholes up to 3.5m depth and relies on obtaining a proper seal from the pipeline plugs to withstand the hydrostatic pressure. The limitation on this test is the un-uniform pressure distribution and the zero pressure at the top of the manhole will not sufficiently test the top seal of the lid. To test the top seal **this test shall be supplemented** with the visual check (smoke test) in section 3.4 or the low pressure air test as per section 2.1.1. The manhole shall be completely backfilled and interconnected pipework and manholes be vacated before starting the test.

3.1.1 Pre-test procedure

Ensure that there is no entry into the connecting trench or any connected manhole associated with the manhole being tested.

The manhole shall not be pressurised beyond the static pressure alone and the lid shall remain open.

3.1.2 Procedure

a) Seal openings using properly sized or inflatable plugs
b) Completely fill the manhole to the top of the lid frame with water
c) Allow the filled manhole to soak for minimum 4 hours
d) Top up any water loss to the top of the lid frame during the soak period
e) Measure the water loss over every 1 hour for 8 hours
f) Empty the manhole and allow standing for 1 hour before doing a visual inspection for groundwater infiltration.

3.1.3 Acceptance

a) The average quantity of make-up shall not be more than 0.3 litres per 1m diameter per 1m depth per hour.
b) The post-test visual inspection shall show no evidence of groundwater ingress through any joint.

3.2 Vacuum test

The vacuum test creates differential pressure between the inside and outside of the manhole. This test shall be completed with the manhole completely backfilled and the lid in place.

3.2.1 Procedure

a) Clean manhole thoroughly
b) Seal openings using properly sized or inflatable plugs
c) Connect seal plate to manhole opening
d) Draw vacuum of -254mmHg (or -338.6mbar) and isolate valves
e) Hold test time according to the manhole sizes as listed in the table below:

Depth (m)	Diameter (mm)								
	675	900	1050	1200	1350	1500	1800	2400	3000
	Time (s)								
<2	11	14	17	20	23	26	33	39	45
3	14	18	21	25	29	33	41	49	57
3.5	17	21	25	30	35	39	49	59	69
4.3	20	25	30	35	41	46	57	69	81
5	22	29	34	40	46	52	67	81	95
5.5	25	32	38	45	52	59	73	87	101
6	28	35	42	50	53	65	81	97	113
6.7	31	39	46	55	64	72	89	107	125
7.3	33	42	51	59	68	78	97	115	133
8	36	46	55	64	75	85	105	125	145
8.5	39	49	59	69	81	91	113	135	157
9	42	53	63	74	87	98	121	145	169
9.5	46	58	69	81	94	105	129	153	177
10	49	63	74	87	98	113	139	165	191

f) Release the vacuum and remove the test gear and plugs

3.2.2 Acceptance

a) For the duration of the test the vacuum did not drop below -228mmHg (or -304mbar).
b) There are no visible wet patches or “sweating” at any of the pipe penetrations, seals or riser joints.

3.3 Infiltration test

This test is completed by creating an external water column around the manhole to that will force groundwater through any leaking joints. This method is recommended where manholes are over 3.5m deep or can only be can be part tested using the hydrostatic testing method up to 3.5m depth. However the limitation on part testing to 3.5m is that the hydrostatic pressure shall be demonstrated to be higher than the groundwater pressure at the location of the joints being tested. The vacuum test procedure is preferred over this option.
This test does not confirm the lid seal and **shall be supplemented** with the visual check (smoke test) in section 3.4 or the low pressure air test as per section 2.1.1.

3.3.1 Procedure

a) Excavate or provide a moat of approximately 500mm around the circumference of the manhole and fill with water.
b) A 32mm PVC sleeve is provided adjacent to the manhole wall to 1 m below the hydrostatic test depth. The bottom 1m of the sleeve shall be perforated to allow groundwater to enter the sleeve.
c) The water in the moat is filled until the groundwater in the sleeve reaches the level of the water in the moat.

d) The groundwater level is maintained for eight (8) hours

3.3.2 Acceptance

There are no visible leaks, wet patches or “sweating” at any of the pipe penetrations, seals or riser joints.

3.4 Visual check (smoke test)

This test shall only be conducted on manholes where the joints and pipe penetrations being tested have not been backfilled over and are visible for inspection of forced smoke leaking through defective seals. The limitation of this test is to manholes that are not located within a 100 year flood plain level and is ideally suited for low risk shallow manholes.

3.4.1 Procedure

a) Seal openings using properly sized or inflatable plugs
b) Connect seal plate to opening of manhole lid with appropriate connection to introduce the smoke.
c) Introduce smoke into manhole being tested according to the manufacturer’s recommendation.
d) The smoke shall be introduced for a minimum of 5 minutes
e) Inspect joints for smoke leaks

3.4.2 Acceptance

There is no smoke leaking from any of the joints

4 Manhole (plastic/GRP material) testing

Manholes shall be tested twice:

1) Off-site as a single unit at the manufacturer’s facilities according to industry best practice for the material being used; and
2) On installation on site, fully backfilled and connected, and tested per the vacuum test described in section 3.2.

The material testing sheets shall be made available for record purposes’; having undergone Watercare’s pre-approval of the product being installed.

Code of Practice for Water Reticulation Disinfection

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Contents

1 Introduction

The bulk water supply to the Watercare network is chlorinated before it reaches the areas of local reticulation. Watercare monitors the water throughout the city on a daily basis to ensure a minimum residual level of chlorine is maintained. A minimum level of chlorine of 0.2 mg/l is required to act as a barrier to contamination and meet the requirements of the Drinking Water Standards of New Zealand (DWSNZ).

Watercare does not do additional chlorine dosing to the network supply. It is therefore imperative that any works carried out on the network follow the best practices as outlined in this Code of Practice in order to preserve the existing water quality and safeguard the water from contamination.

Failure to follow these identified best practices exposes the public water supply to a risk of contamination, both chemical and bacteriological.

2 Objectives

Water supply authorities are required by law to ensure that the water supply system is free from conditions that may be hazardous to public health.

The objectives of the Code of Practice are to:

1. Prevent contamination of the water supply system by defining the minimum requirements for the disinfection of new watermains

2. Prevent contamination of the water supply system by defining the minimum requirements for the disinfection of existing watermains and fittings following planned or reactive maintenance

3. Prevent contamination of the water supply system by defining required best practices for workers and materials that come in contact with water

4. Comply with regulatory requirements under:
    - Health (Drinking Water) Amendment Act 2007
        - Networks Water Safety plan
    - Drinking Water Standards for New Zealand 2005 (Revised 2008)
    - Draft Guidelines for Drinking Water Quality Management for New Zealand 2005
    - Resource Management Act 1991

5. Minimise demerit points under the requirements of:
    - Public Health Grading of Community Drinking Water Supplies 2003

2.1 Areas of Application

1. Installation of new mains and connections

2. Reticulation repairs/maintenance

3. Valve and hydrants inspections/repairs

4. Reticulation inspections involving cutting of live mains

5. Service connections and meters

6. Temporary supplies

This Code of Practice does not apply to the disinfection of water storage reservoirs.

2.2 Roles and Responsibilities

All water supply contractors must adhere to the Disinfection Code of Practice for all work on the Watercare water supply network.

Supervisors shall audit the disinfection practises to ensure the Code is being followed. Records must be kept of audit results.

Contractors shall be responsible for the annual medical clearance of their water reticulation workers. Contractors shall ensure on a daily basis that their water reticulation workers are in a medically fit condition for work. *Refer section 3.2 Water Reticulation Workers – Hygiene and Health.*

Any problems or transgressions from the outlined procedures must be reported to the Watercare Water Quality and Compliance Manager.

Any confirmed or suspected contamination to the water supply network must be escalated according to the Watercare Incident Management Plan, Water Quality Incident Response Plan and Public Health Risk Management Plans.

2.3 Reporting

Water supply workers shall report any gastrointestinal illness (vomiting, diarrhoea etc.) to their employer. *Refer section 3.2 Water Reticulation Workers – Hygiene and Health.*

All microbiological test results must be sent to the Watercare Water Quality and Compliance Analyst for assessment and/or approval.

2.4 Notification

Any bacteriological transgression identified as a result of testing after a repair will be investigated. A true transgression will be notified to the Auckland Drinking Water Assessor by the Watercare Water Quality and Compliance Analyst.

If *E.coli* contamination is higher than 10MPN/100ml Watercare may be required to issue a "Boil Water" notice to customers in the affected area.

2.5 Assessment of Level of Risk

Disinfection is a key element in preventing contamination of the water supply during maintenance but it cannot compensate for improper procedures and poor practices.

For all work carried out on the Water network including (but not limited to):

- Emergency or planned repairs on watermains
- Maintenance or replacement of fittings
- New service connections
- New main connections
- Disconnection of redundant mains

The Contractor shall assess the risk of contamination on a case by case basis using the procedure in *Section 8.1* and then follow the corresponding recommended disinfection procedures outlined in *Sections 8.2 - 8.4*.

The procedure for work and requirement for bacteriological testing depends upon the level of risk of contamination to the network.

3 Water Reticulation Workers

3.1 Qualifications

Water supply workers are expected to have completed the Level 3 National Certificate in Water Reticulation – Service Person Qualification. As a minimum the site supervisor or foreman shall hold this qualification and supervise all disinfection practises.

3.2 Hygiene and Health

The contractor and all subcontractors shall comply with the following requirements which relate to workers employed on the maintenance or repair of existing watermains and the construction of new watermains.

All contractors shall have current inoculations as specified by Watercare.

Maintenance workers on the water reticulation system must obtain medical clearance to attest that they are not carriers of any waterborne disease:

1. prior to employment on the water supply system, and on an annual basis thereafter

2. following any gastrointestinal illness (vomiting, diarrhoea etc)

3. following overseas travel to countries with endemic waterborne disease.

This clearance should be obtained from a licenced medical practitioner.

Until clearance is obtained workers shall be placed on work not directly involving the water supply network.

All contractors shall inform their workers of the need for a high standard of personal hygiene and the dangers of contamination. A high standard of personal hygiene shall be maintained by all people employed on the water supply network.

Water supply workers with running/septic skin infections or wounds shall not work on the water supply network unless the infection or wound is effectively dressed and in a location unlikely to be immersed.

The Watercare Water Quality and Compliance Analyst may, at any time where he or she believes a significant contamination risk exists, require water supply workers to produce a medical clearance against being carriers of potentially waterborne diseases including *Shigella, Salmonella, Campylobacter, Hepatitis A, Giardia* and *Cryptosporidium*.

Workers previously employed on stormwater or wastewater works (reticulation and treatment) shall not work on any water supply works until medical clearance as described above has been obtained and new or disinfected PPE provided for the worker(s).

4 Property and Equipment

4.1 Vehicles

Separate vehicles must be used for water reticulation and wastewater reticulation works.

A high standard of cleanliness shall be maintained in the interiors of all vehicles used for water reticulation works.

Vehicles must be equipped with sanitary wipes or antibacterial liquid for hand sanitation when working on site.

All fittings carried in vehicles must be boxed, capped or sealed with plastic wrapping. All pipes must be capped.

4.2 Stores

A high standard of cleanliness shall be maintained in the interior of all stores.

Water supply and wastewater equipment shall be stored separately.

All materials shall be stored and handled so as to minimise contact with foreign materials. Fittings shall be boxed, capped or sealed with plastic wrapping. All pipes shall be capped.

4.3 Tools and Equipment

Separate tools and equipment must be used for water reticulation and wastewater reticulation works.

All tools used in the construction or maintenance of the main and fittings **that come into contact with the treated water** must have been thoroughly disinfected and sprayed or rinsed in a 0.1% chlorine solution (1,000ppm) prior to use. Larger items of plant and equipment including excavators shall be steam cleaned before use on potable water jobs. Disinfected tools must not be placed directly on the ground prior to use.

4.4 Materials

All materials, including tools, used in the construction or maintenance of the main and fittings that come into contact with the treated water must have either:

1. Been sealed by the manufacturer under hygienic conditions and are not uncovered until immediately before use,

Or

2. Been thoroughly disinfected and sprayed or rinsed in a 0.1% chlorine solution (1,000ppm) prior to use. Disinfected items must not be placed directly on the ground prior to installation.

All materials used must conform to the Watercare Approved Materials List in the Water and Wastewater Code of Practice for Land Development and Subdivision.

A bactericidal lubricant is to be used on all rings and gaskets coming into contact with the reticulated water. The lubricant used should be compliant with *AS/NZS 4020:2005*.

4.5 Disinfection and Neutralising Chemicals

An 0.1% solution for disinfection of tools, equipment, fittings and materials to be used in connection with service work is one made up of 1 part chlorine solution (i.e. commercially available Sodium hypochlorite solution of 12-15% available chlorine) to 9 parts water and shall have a pH value of between 7 and 8. A freshly prepared solution shall be made available at least weekly and the old solution disposed of after dechlorination (refer Appendix C).

Chemical neutralising of chlorine solution (dechlorination) should only be carried out using the chemicals listed in Appendix D.

4.6 Standpipes

All standpipes used on fire hydrants other than those used for flow testing, must be fitted with a metred standpipe fitted with a non-return valve and connected to a section of hose pipe to direct the flow to the designated drainage/collection system.

4.7 Water Tankers for Emergency Supply of Potable Water

Any tanker used to provide emergency water supply for Watercare customers must be a tanker water carrier that only carries Class 1(a) water as defined by the Ministry of Health:

> *Class 1(a) is water taken from a reticulated supply that complies with the DWSNZ and is listed in the Register of Community Drinking water Supplies and Suppliers in New Zealand.*

Please note that water tanker suppliers engaged by Watercare directly or Watercare contractors must be currently registered on the Ministry of Health Register of Community Drinking-water Supplies and Suppliers under the Class 1(a) category. *Refer to the Ministry of Health website: www.moh.govt.nz/water*

4.8 Water Tankers for Super-chlorination

The preferred option for water chlorination tankers is a tanker supplier dedicated to carry only water from a source that complies with the Drinking Water Standards New Zealand 2005.

If such a supplier is not available then a truck and tanker may be used provided:

1. Assurance is given from the supplier that the tanker has not previously been carrying hazardous substances (Carrier log book to be inspected).

2. A visual inspection is done to ensure the truck and tanker is clean and free of any potential source of water contamination.

3. The tanker is cleaned and flushed thoroughly using potable water prior to filling.

4. That all openings and connections are protected from contamination during loading, transportation and delivery.

5. When the tanker is filled from the Watercare network a non-return valve must be fitted to the standpipe.

4.9 Bottled Water

All bottled water given to customers will be supplied by Watercare. It must have sealed caps and be stored as per supplier's instructions, out of direct sunlight, and not used beyond expiry date.

5 Work Practises

Good trade practices are to be applied at all times in main laying and maintenance/repair procedures.

In the event of a confirmed or suspected contamination of the reticulation the immediate area shall be isolated and the Watercare Water Quality and Compliance Manager contacted. This situation will be escalated as per the Watercare Incident Response Plan.

All connected valves that have been used to isolate reticulated water from a main being disinfected or a contaminated area shall be tagged and/or recorded by the site supervisor responsible for the disinfection and then signed off at re-commissioning.

5.1 Backflow Prevention Devices for Temporary Connections

All temporary connections of reticulated water to mains under construction and/or maintenance shall incorporate testable double check backflow devices to prevent contamination of the existing reticulation. This includes water being used for hydrostatic pressure testing, flushing and disinfection. See Figure 1 below for suggested temporary set up.

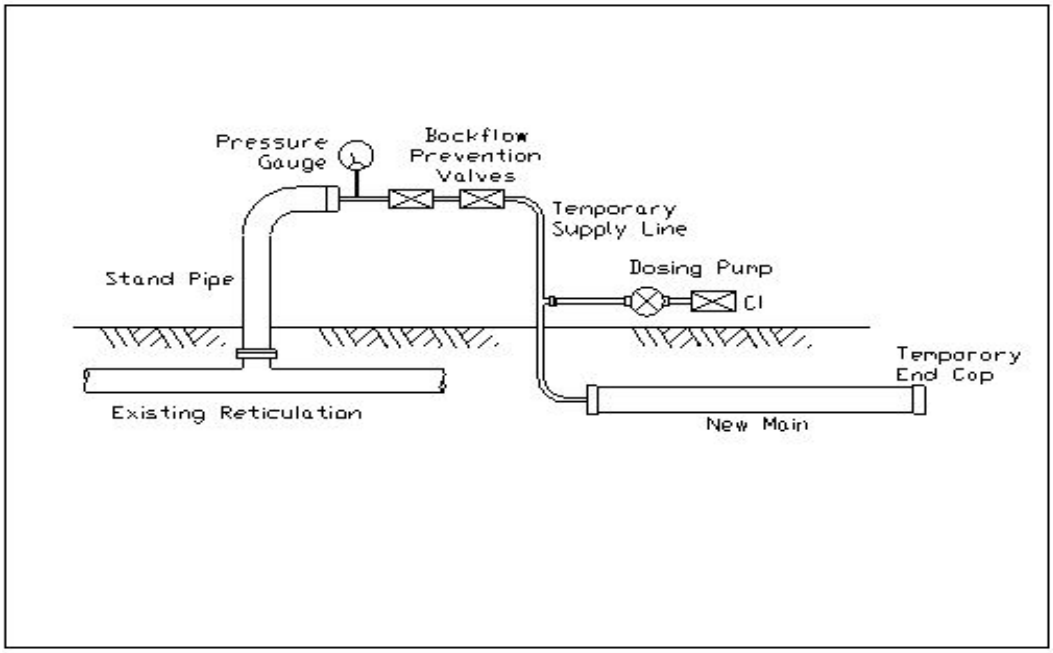

Figure 1: Suggested temporary flushing / dosing connection

For permanently installed backflow prevention devices refer to the NZ Water and Wastes Association – Backflow Prevention for Drinking Water Supplies – Code of Practice.

5.2 Air Scouring

During a programme of air scouring the contractor shall ensure:

1. A trial shutdown is completed and shutdown notifications given to ensure scouring operations do not adversely affect public health.

2. All valves to be operated and isolated must be operable to contain scour waters.

3. All service connections are to be isolated before air scouring (where possible).

4. All fittings used including the standpipes and sample taps must be disinfected with 0.1% chlorine solution prior to use.

5. The compressor pressure shall be set at 200 kPa less than the mains pressure to eliminate any risk of backflow.

6. All mains must be purged of scour waters following the air scouring to ensure mains are returned to service in a hygienic state.

7. Scour water shall be filtered through a 12 micron filter bag as per the Auckland Council requirements and discharged to the stormwater system.

8. Chlorine residual sampling must be undertaken post scouring to check that sufficient disinfection (minimum 0.2 mg/L of chlorine) is maintained before re-commissioning the scoured watermains.

6 Disinfection Procedures for New Network Watermains

Connection of new network watermains to the existing reticulation will not be permitted until all of the following requirements have been successfully completed (refer to Figure 6.1 in Appendix A).

For the disinfection procedures applicable to transmission watermains, reservoirs and fittings refer to Specification 291 in Appendix E.

6.1 Flushing

The main shall first be thoroughly flushed in sections through hydrants with sufficient velocity of water to remove all foreign matter. The volume of water used must be equivalent to at least three pipe volumes. The flow of water shall be from one direction at any time, and depending on the position of the flushing point(s), flushing may be required alternatively from opposite directions to ensure all of the water is completely flushed out of the main. Following successful flushing, the main shall be chlorinated.

6.2 Chlorination

Each section of new watermain, including all fittings and service connection pipes, shall be disinfected no more than 10 days before being put into service.

The preferred option is for the main to be drained completely, then slowly filled with potable water that has been pre-mixed with chlorine in a tanker. The water should be tested for chlorine concentration before use and should contain sufficient free available chlorine (FAC) to produce a uniform concentration of between 25-50 mg/litre in the main. The chlorinated water shall be introduced at the lowest point of the section of main to be disinfected to ensure no air is trapped. Chlorine levels shall be tested and recorded along the length of the main at a minimum of 150m intervals to ensure effective distribution of the chlorine.

If pre-mixed chlorinated water is not used the chlorine solution must be injected at a continuous rate to ensure a concentration of 25-50mg/litre is in contact with every part of the main *(Refer to Appendix C for chlorine dosage)*. This can be achieved by pumping in the chlorine solution or by using a chlorine injector while the main is being filled with water. Once the main is filled chlorine tests shall be carried out along the length of the main at 150m intervals to ensure effective distribution of the chlorine.

Under no circumstances will the use of hypochlorite powder, granules or tablets dumped into the pipe or hydrants be acceptable practice.

After 24 hours contact time the pH of the water shall be recorded. The effectiveness of hypochlorite as a disinfectant is greatly reduced above pH 8.0. A pH level greater than 9.0 will not be accepted as compliance with the disinfectant requirements and must be repeated using a solution with a pH less than 9.0.

After 24 hours the residual chlorine concentration must at least 20mg/L. If this requirement is not achieved, the chlorination procedure shall be repeated. If this requirement is achieved, the main and service connection pipes shall then be flushed until the chlorine concentration of the water is less than or equal to 1.0mg/litre (test required). Mains should again be flushed with water equivalent to three pipe volumes.

6.3 Disposal of Super-chlorinated Water

All water with a residual chlorine concentration greater than 1.0mg/litre shall be discharged to the sanitary sewer system. The rate of discharge to the sanitary sewer shall be limited to a maximum of 10 litres per second.

If chlorinated water cannot flow to the sanitary sewer system by gravity, then the water shall be pumped to the sanitary sewer system, or pumped into a tanker to be disposed into a conveniently-located sanitary sewer.

If the disposal of super-chlorinated water into the sanitary sewer system or a tanker is not achievable then the water must be de-chlorinated to a maximum residual of 0.2 mg/L before dumping to ground or a stormwater system. *Refer to Appendix D for de-chlorination procedure.*

Any discharge of highly chlorinated water onto the ground, into a watercourse, or into any stormwater system would contravene Section 15 of the Resource Management Act, and would be subject to maximum penalties of $200,000 fine and/or two years imprisonment.

Following discharge of the super-chlorinated water, the main shall be flushed with reticulation water for a minimum of three pipe volumes or until a chlorine concentration of less than 1.0mg/litre is achieved.

6.4 Sampling and Testing

Sampling and testing of water from new mains includes testing for chlorine, pH and bacteria (total coliforms and E.coli and HPC).

All chlorine, pH and bacteriological testing shall be done by accredited laboratories approved by Watercare. The contractor shall organise (including appropriate advance notice) and pay for the testing, and forward copies of the results to the network engineer for approval as soon as practicable after the tests are completed. Copies of the successful test result must also be sent to the Watercare project engineer.

Following a successful chlorination procedure and flushing, the main shall be charged with fresh mains water with a chlorine concentration of less than 1.0mg/litre. The water shall then be tested for the presence of *E.coli* at a minimum of two locations. One bacteriological test shall be carried out for every 300m of pipe disinfected including the extremity of any branches. The contractor must provide Watercare with a site plan showing the location of the new main as well as the sampling points.

The tests will take approximately 24 hours. A satisfactory result is *E.coli* <1MPN/100ml or an "*E.coli* Absent" result. If this requirement is not achieved, the disinfection procedure shall be repeated and a further bacteriological test done until a satisfactory result is achieved. A satisfactory pH result is pH 9.

If the newly chlorinated main has not been connected to the existing reticulation within 10 days, the main shall be retested for *E.coli* as per the initial testing. If any of the new samples fail the *E.coli* test the disinfection procedure must be repeated.

All sample results must be received before approval for the main to be hooked up can be given.

6.5 New Main Hook Up

The connection of a new main to existing reticulation may be treated as a medium risk (refer to Section 8.1 for Risk classification) situation provided sanitary construction procedures are followed ensuring no contamination of either the new or existing main by foreign material or groundwater.

New main hook-up procedure:

1. Excavate trench and dig sump under the section of the existing pipe to be removed to allow for the connection. The sump shall be of a depth at least 400mm.

2. Thoroughly clean and disinfect existing connecting pipework/fittings.

3. Any new fittings to be installed shall be kept clear of the sump and when unwrapped placed on a clean surface (e.g. impervious plastic sheet) until installed.

4. Reduce the pressure in the existing pipe through a hydrant or isolation valve.

5. Drain the existing pipe at the lowest point. If the lowest point is at the location of the new connection then drain into the sump ensuring the sump is dewatered by pump with the level of the water always remaining lower than any open pipework.

6. Empty the new main within the shutdown period, preferably immediately prior to the hook-up. If the main is to be drained into the sump, the sump must be dewatered by pump to avoid any entry into and contamination of the cut pipe.

7. Spray all surfaces of fittings, and wipe the interior of open ends of the new and existing watermains with 0.1% Chlorine solution (Refer to Section 4.5).

8. After completion of the work, the watermain must be flushed out through hydrants downstream of the new connection. The volume of water used must be equivalent to at least three pipe volumes.

7 Disinfection Procedures for Temporary Watermains

When a project requires the use of a temporary watermain, all temporary fittings shall be disinfected, *as per section 4.4,* prior to connection to the existing reticulation (refer to Figure 7.1 in Appendix A).

7.1 Flushing

The temporary watermain shall be flushed with a volume of water equivalent to three pipe volumes of the temporary supply and flushed through all practical outlets to remove any foreign materials that may have entered during storage. (*Refer to Appendix B for flushing volumes*).

7.2 Chlorination

The temporary watermain and fittings shall be disinfected with a chlorine dose of 100 mg/L for a minimum period of 30 minutes. After the 30 minute contact time the water within the temporary watermain shall be retested and the residual FAC must not have dropped by more than 20mg/L. Field tests will be acceptable as confirmation of this dose. Disposal of the super-chlorinated water shall be in accordance with the guidelines given under *Section 6.3: Disposal of Super-chlorinated Water.*

7.3 Post Chlorination Flushing

The watermain shall first be thoroughly flushed in sections from an independent water source with backflow prevention with sufficient velocity of water to remove all foreign matter. The volume of water used must be equivalent to at least three pipe volumes. The final flushing water shall be tested for residual chlorine levels and must be less than 1.0 mg/litre. If this has not been achieved flushing shall be continued until the residual is less than 1.0 mg/litre.

8 Disinfection Procedures for Emergency and Planned Repairs

8.1 Risk of Contamination

The procedure for work and requirement for bacteriological testing depends upon the level of risk of contamination to the network (refer to Figure 8.1 in Appendix A).

All high risk situations require bacteriological testing and must be escalated as an incident to the Watercare network manager. Bacteriological test results are required before the watermain is put back into service.

If any medium risk factors are present then bacteriological testing is required.

Low risk situations do not require bacteriological testing.

Table 1 provides a guideline to ascertain the level of risk and related procedure required. The most frequent risks are listed below however the contractor must assess every situation individually to identify any further risks and evaluate the risk category and associated disinfection procedure accordingly:

Table 1: Assessment of Level of Risk

Risk Description	***Level of Risk Required***	***E.coli Testing Required***
Confirmed or suspected contamination during repair or third party damage (sewage, chemical, hydrocarbons etc)	***High***	***Yes. Watercare Operations to immediately arrange sampling in the downstream network using B2P***
Pipe open and sump adequate i.e. level of drained water does not reach inlet of pipe	*Medium*	***Yes***
E.coli testing is **not** required for works while the watermain remains pressurised		
Pressure in watermain maintained during works e.g. under pressure tapping	*Low*	***No***

8.2 High Risk Situations

High risk situations are where confirmed or suspected contaminant (liquid or solid) material has made contact with the cut area of pipe or has entered the pipe or fitting, i.e. contamination has occurred via sewer, hydrocarbons, chemicals, or large amounts of ingress has occurred in the pipe.

The recommended procedure is:

1. Escalate this incident to the Watercare network manager.
2. Isolate the watermain to prevent further travel of the contaminated water.
3. Isolate all affected service connections.
4. If a service connection cannot be isolated the customer must be advised not to use water until the main has been recommissioned.
5. Tag and record all valves used to isolate.
6. Dig sump to at least 400mm beneath the affected area.
7. Drain the watermain through the cut section, pumping if required, to ensure the groundwater remains well below the invert of the open pipe.
8. Isolate and/or remove the contaminant.
9. Thoroughly clean exterior of pipe and fittings to be connected to prior to start of the repair.
10. Wipe the interior of the open ends of the existing pipe and the new pipe with a clean rag or foam plug soaked in 0.1% chlorine solution. Wipe or spray fittings prior to installation with 0.1% chlorine solution (refer to Section 4.5). Place disinfected materials onto a clean surface e.g. an impervious plastic sheet, not directly onto the ground.
11. Water used for flushing must be fed using a remote hydrant or water tanker; it must not be through a valve used to isolate the area.
12. The remote hydrant or tanker used for filling the contaminated pipe should be fitted with a non-return valve or non-return configuration piping to prevent backflow of super-chlorinated water into the reticulation.
13. After completion of the repair work the main shall be thoroughly flushed. The volume of water used must be equivalent to at least three pipe volumes. The main must be slowly charged from a remote hydrant or tanker while flushing from an open hydrant as close as possible to the opposite end.
14. To ensure effective distribution of the chlorine, the watermain should be charged using pre-chlorinated water to a level of 125 -150 mg/L. When the highly chlorinated water is detected at the flushing hydrant, close the charging valve. Sample should be taken and tested for Free Available Chlorine (this test will need to be carried out by Watercare approved Laboratory).
15. Leave the section isolated for 60 minutes.
16. For safe disposal of the super-chlorinated water the procedure given in the section 'Disinfection Procedure for New Mains' must be followed.
17. Flush the section as per the flushing guidelines (*Appendix B*).
18. Check that the chlorine concentration is in the range of 0.2 ≥1.0mg/L. Continue flushing if the chlorine concentration is outside this range.
19. After flushing, obtain a water sample for bacteriological testing downstream of the repair from a hydrant fitted with a tap or from a service connection that has been isolated from the customer's meter.

20. If in doubt of direction of flow, take a sample from both sides of the repair.
21. Customers' service connections are to remain closed until the results of the bacteriological testing is received by the Network Operations Manager.
22. The Network Operation Manager must approve the recommissioning of the watermain into service including the opening and flushing of the customers' service connections through their taps or meters until the chlorine concentration is in the range of 0.2 ≥1.0mg/L.
23. All tagged valves must be signed off and reinstated following completion of the work.
24. All actions taken during a High Risk situation must be recorded on the Water Quality Audit Form.

8.3 Medium Risk Situations

Medium risk situations are where the pressure in the pipe has been depressurised through a hydrant or isolation valve and then controlled by draining of the pipe into the trench excavation under the point where the pipe is cut.
The recommended procedure is:

1. Excavate while maintaining positive water pressure.
2. Reduce water level and inspect and clean pipe with 0.1% chlorine.
3. Visually inspect flushing water for contaminants and discolouration and repeat flushing if necessary.
4. Thoroughly clean exterior of pipe and fittings to be connected to.
5. After cutting pipe or disconnecting fittings, swab interior of the open ends of the pipe with a clean rag or foam plug soaked in 0.1% chlorine solution. Swab or spray all pieces of new pipe and fittings prior to installation with 0.1% chlorine solution as (*Refer Section 4.4*). Place disinfected materials onto a clean surface e.g. an impervious plastic sheet, not directly onto the ground.
6. After completion of the work, the main shall be thoroughly flushed through hydrants. The volume of water used must be equivalent to at least three pipe volumes.
7. After flushing, obtain a water sample for bacteriological testing downstream of the repair either from a customer's outside tap or from a hydrant fitted with a tap.
8. If in doubt of direction of flow, take a sample from both sides of the repair.
9. The watermain may be returned to service prior to the completion of bacteriological testing in order to minimise disruption to customers.
10. Open and flush the customers' service connections through their taps or meters until the chlorine concentration is in the range of 0.2-1.0mg/L.

8.4 Low Risk Situations

Low risk situations are where pressure in the watermain is maintained while carrying out work which involves cutting the live main (e.g. installing service connection, or a branch connection using live tapping techniques). This includes repairs using full circle clamps, sleeves etc.

The recommended procedure is:

1. Thoroughly clean exterior of pipe fittings to be worked on prior to start.
2. Spray all surfaces of fittings and exterior of the watermain with 0.1% Chlorine solution.
3. Carry out the repair or installation and return to service.

8.5 Bacteriological Sampling Procedure

For Medium Risk situations, the existing main may be returned to service prior to the completion of bacteriological sampling in order to minimise disruption to customers.

For high and medium risks sampling **must** be done by a Watercare approved Laboratory and sampled for: Chlorine Residual, pH, turbidity, *E.coli* , Total Coliforms and HPC.

Samples shall be obtained before the watermain is put back into service.

During working hours samples shall be delivered to the authorised laboratory within 2 hours of the sample being collected.

Samples obtained after hours shall be stored at the maintenance contractor's premises until the laboratory opens the following day. Samples must be kept refrigerated until tested and delivered to the Laboratory by 8am as *E.coli* must be analysed within 24 hours to be a valid test.

APPENDIX A: Disinfection Flow Charts

Disinfection Procedures for New Watermains

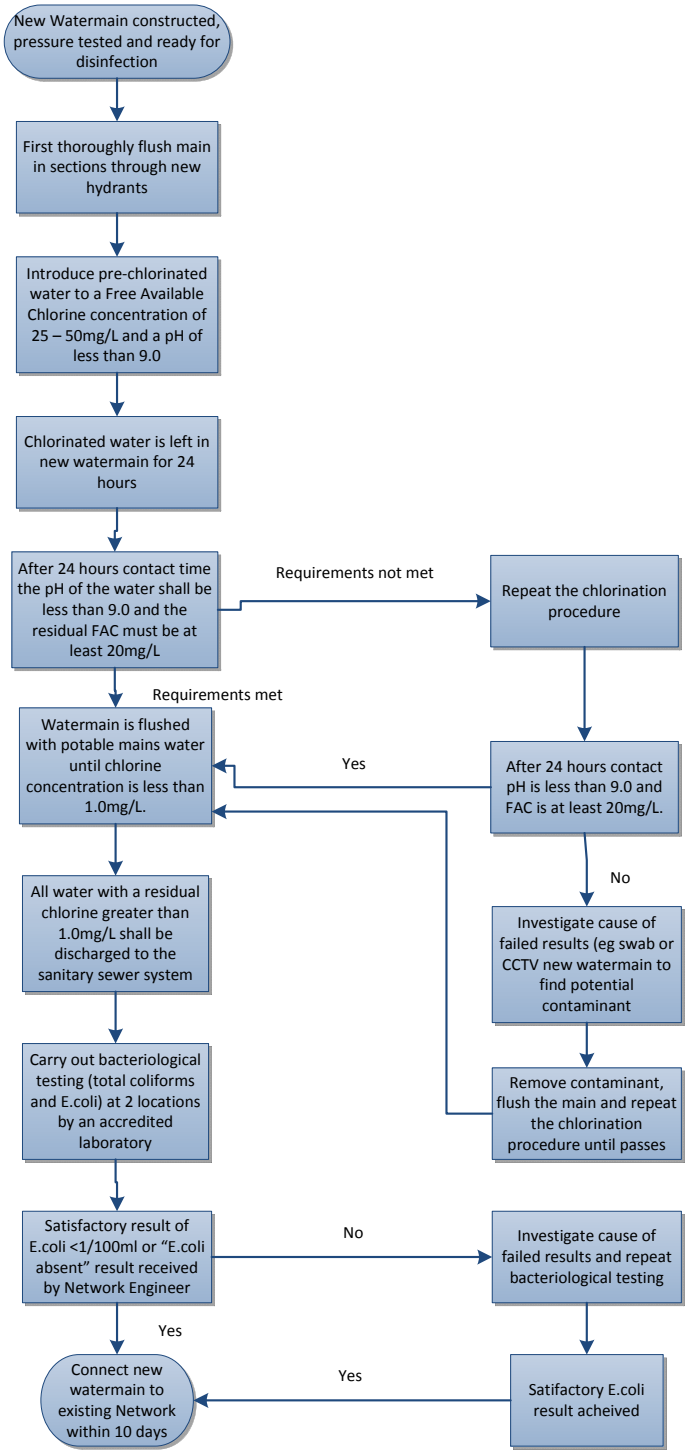

Figure 6.1

Disinfection Procedures for Temporary Watermains

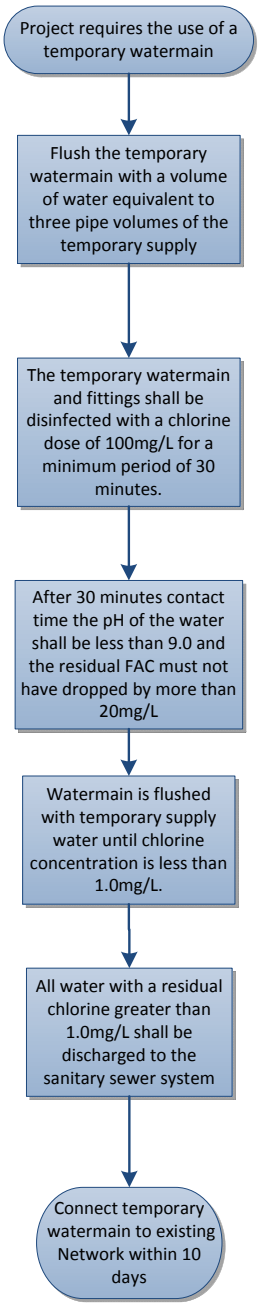

Figure 7.1

Disinfection Procedures for Emergency and Planned Repairs

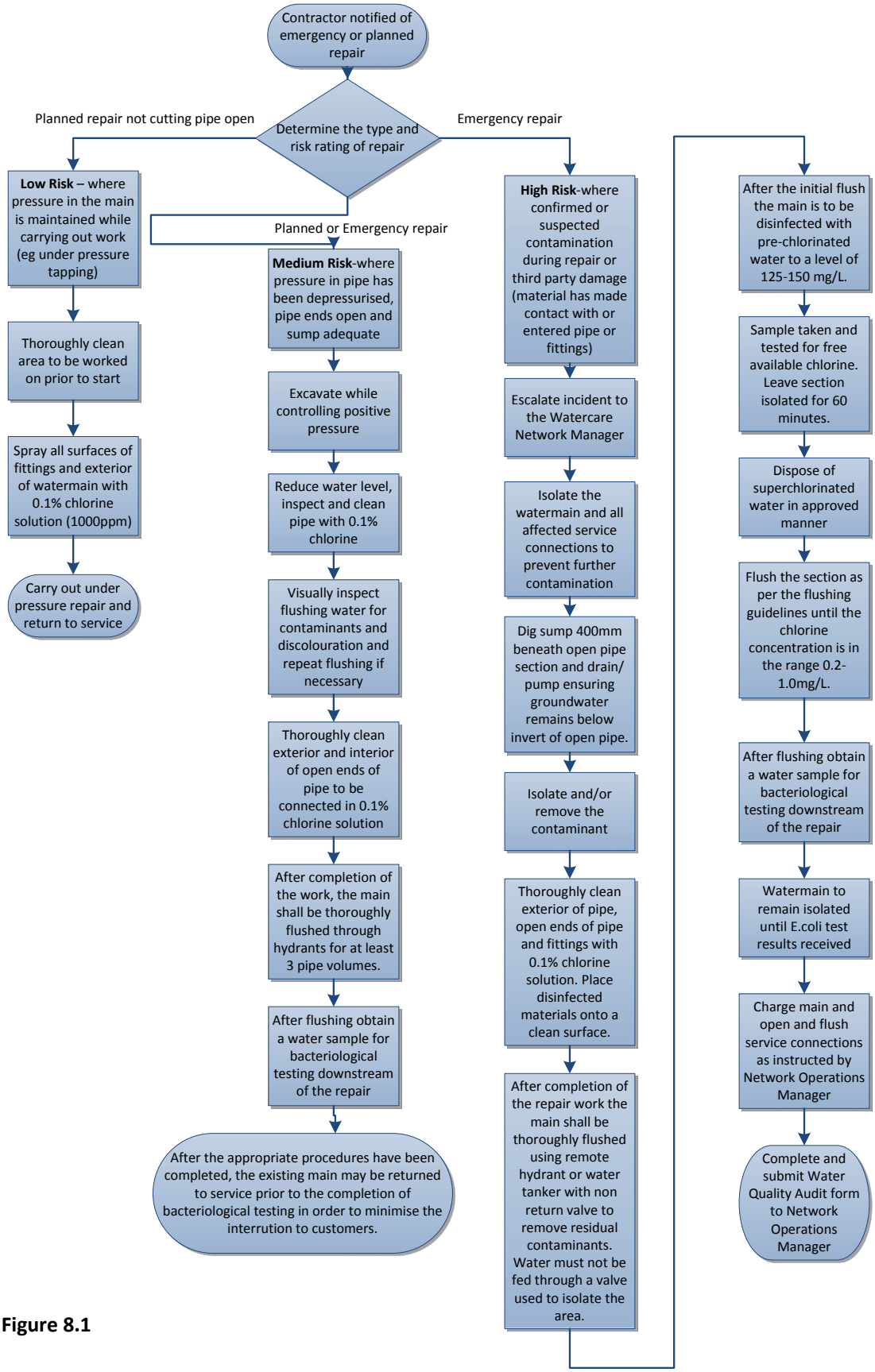

Figure 8.1

APPENDIX B: Flushing Guidelines

Flushing time guidelines in minutes for new works prior to disinfection

Table 2: Time in minutes to flush at 20 l/sec

Pipe Diameter (mm)	Number of hydrants to achieve flushing velocity*	Length of Pipe			
		50m	100m	200m	500m
50		5	5	5	5
75		5	5	5	8
100	1	5	5	5	15
150	3	5	6	5	11
200	4	5	5	6	15
300	9	5	5	6	15
600	35	5	5	7	15

*(assumes flow rate through 75mm hydrant of 20l/s)

Note *flushing rates of 5l/s and 10l/s can be used effectively on 50 and 75mm lines respectively.*

APPENDIX C: Chlorine Dosing

Amounts of Sodium hypochlorite shown in the Table 3 below are calculated to produce chlorine concentration of **25 mg/L** per 1m length of main:

Table 3: Chlorine Dosing

Pipe Diameter (mm)	Volume of water per 1m length of pipe (Litre)	Volume of 12% Sodium Hypochlorite (ml)	Volume of 15% Sodium Hypochlorite (ml)
50	1.96	0.41	0.33
75	4.41	0.93	0.74
100	7.85	1.64	1.31
150	17.67	3.69	2.95
200	31.41	6.55	5.24
250	49.08	10.23	8.18
300	70.68	14.73	11.78

Following completion of the repair, chlorine levels for disinfection can be tested by the maintenance crews using the field colorimetric indicator tests.

DPD Palintest for Chlorine levels 0 – 5.0mg/L
HR Palintest (Potassium Iodide) for Chlorine levels > 5.0mg/L

Note that improper or extended storage of the hypochlorite can cause a loss in available chlorine.

The maintenance contractor shall ensure that:

- Contractors have chemical handling training
- Vehicles have MSDS sheets
- Contractors have appropriate PPE

APPENDIX D: Neutralising Chlorine

At the end of the 24 hours contact time, the chlorine in the water in the new main must be neutralised before the water is discharged to the receiving environment (the street channel or stormwater system). There are two options that can be used to de-chlorinate the water:

1. Chemical Neutralisation; or
2. Chlorine Dissipation

1. CHEMICAL NEUTRALISATION

Chemical Neutralisation as a method to de-chlorinate water involves dosing to the water as it is being discharged from the main. The most effective and most commonly used chemical to achieve dechlorination is Sodium Thiosulphite though there are two other alternatives:

Table 4: Chlorine Neutralisation Chemicals

Name	Chemical Formula	Solubility
Sodium thiosulphite pentahydrate	$Na_2S_2O_3.5H_20$	200g/L
Anhydrous Sodium sulphite	Na_2SO_3	26.9g in 100g of water at 20ºC
Sodium Sulphite heptahydrate	$Na_2SO_3.7H_2O$	30g/100mL

Procedure:

1. To prepare 15% w/v solution of any of the above three chemicals, the following steps should be taken:

   Step 1. Fill the solution tank approximately 2/3 full with water
   Step 2. Add the required amount of the neutralising chemical into the tank as specified in Table 5 below
   Step 3. Mix the solution until the added chemical has dissolved
   Step 4. Add the remainder of water and mix
   Step 5. Stir periodically to avoid the solution stratifying

Table 5: Amounts of Chemicals Required for Chlorine Neutralisation

Solution Volume (L)	Sodium Thiosulphite (kg)	Anhydrous Sodium Sulphite (kg)	Sodium Sulphite Heptahydrate (kg)
100	15.2	15	30
200	30.3	30	60
300	45.5	45	90
400	61.0	60	120
500	76.0	75	150
600	91.3	90	180
700	106.2	105	210
800	121.2	120	240
900	136.0	135	270
1000	151.5	150	300

2. To add the neutralisation chemical to the super-chlorinated water, the following steps should be taken:

   Step 1. Calculate the flow rate required to add the neutralising chemical *(Refer to the formula given below)*
   Step 2. Use a calibrated dosing pump to achieve the calculated required flow rate by adjusting the speed or stroke setting of a calibration chart.
   Step 3. Verify successful neutralisation by testing for FAC (Free available chlorine). Note that the FAC of the discharged water must be zero or at least <1mg/L chlorine level

To Calculate Flow Rate:

The following formula shows the rate at which the prepared neutralising chemical needs to be added to the water as it is being discharged from the main:

$$\text{Flow (L/hr)} = \frac{\text{FAC (g/m}^3\text{)} \times 3 \times \text{draining flow rate of chlorinated water (L/min)} \times 60\text{min/hr}}{\text{\% Strength of the neutralising solution} \times 10{,}000}$$

Example:

The FAC of the super-chlorinated water to be neutralised is 20mg/L (i.e.20g/m3). The super-chlorinated water is being discharged from the main at a flow rate of 100 L/min. The required flow rate of the 15% neutralising chemical solution is:

$$\text{Flow} = \frac{20\ \text{g/m}^3 \times 3 \times 100\ \text{L/min} \times 60\ \text{min/hr}}{15\% \times 10{,}000}$$

$$= 2.4\ \text{L/hr}$$

2. CHLORINE DISSIPATION

This is an alternative method in dealing with the hyper chlorinated water which allows the chlorine to dissipate.

Capture the disinfected water on site prior to the discharge of the chlorinated water (e.g. in a tanker). It is suggested that the water is kept contained on site for a minimum of 2 days until the Free Available Chlorine concentration is reduced to the background level of <1 mg/L.

Disinfection of Transmission Watermains and Reservoirs

Refer to Watercare standard specification 'WS-05-Disinfection of Reservoirs and Pipelines'

Watercare Services Limited
Water and Wastewater Code of Practice for Land development and subdivision

Appendix F

Schedules and Forms

The forms listed below are updated from time to time and are available on the Watercare website http://www.watercare.co.nz by following the links under 'New Developments and Connections' to 'Business Forms' and 'Residential Forms' unless listed otherwise:

Engineering Approval Form for a Network Extension
When to use this form: for approval of a water and/or wastewater extension to Watercare's network.

Engineering Compliance Form for a Network Extension
When to use this form: for construction supervision and certification of water and/or wastewater assets to be constructed for a subdivision.

Pre-construction Meeting – Water System and Wastewater System
When to use this form: Complete this form during your pre-construction meeting, in consultation with the Watercare Inspector.

Non-domestic water and wastewater services application form
When to use this form: to apply for a new connection, to remove, relocate or separate an existing connection, to increase a connection size or to increase the demand on Watercare's network. Note: a supplementary form (below) should be completed for each additional meter associated with your application.

Supplementary form for water and wastewater services application
When to use this form: If there is more than one meter associated with your water and wastewater services application (see above form), complete one of these supplementary forms for each additional meter. This will ensure you don't have to repeat your property and contact details by filling in the original form each time.

Watercare approval of other activities application form
When to use this form: Complete this form to obtain Watercare's approval for other activities on Watercare's water and/or wastewater network.

Works over approval application form
When to use this form: to obtain Watercare's approval for a works over CCTV inspection of Watercare's wastewater network

Works over request for information form
When to use this form: for works in the vicinity of existing Watercare assets including water and wastewater pipes, connected manholes, structures, and rising and transmission mains

Inspection Application Form
When to use this form: if you are an 'approved contractor' applying for an inspection of connections/changes to Watercare's network.

Inspection Application Form
When to use this form: prior to a final inspection and test on the water/wastewater systems and before the council takes over works and assets being declared public watermains.

Water System shutdown Application
When to use this form: when applying to connect onto a Watercare water system
Where to find it: from Watercare new developments team.

Wastewater System Shutdown Application
When to use this form: when applying to connect onto a Watercare wastewater system
Where to find it: from Watercare new developments team.

Other business forms not listed specifically such as for payments are also available on the Watercare website, or alternatively through contacting the new developments team.

Specification for Marking of Fire Hydrants

The marking of fire hydrants was standardised in New Zealand with the introduction of *NZS 4501:1972: Code of practice for the location marking of fire hydrants.*

The standard is still current and its requirements have been incorporated in several related documents developed and published since, such as the *NZTA Manual of Traffic Signs and Markings – Part II: Markings*, and *SNZ PAS 4509:2008: New Zealand Fire Service firefighting water supplies code of practice.* (Appendix L deals with road marking.)

Accordingly, compliance with the following hydrant markings (extracted from the above listed documents) is required in the area serviced by Watercare's water networks, applying both to new developments and the existing network, where it is to be phased in with the cyclic maintenance work as re-painting falls due.

Hydrants on or adjacent to sealed roads:

1. Hydrant box lid shall be painted yellow with road marking paint complying with the requirements of NZTA M/07.
2. Isosceles triangle of solid colour, with 600 mm sides and 450 mm base, painted yellow with road marking paint complying with the requirements of NZTA M/07 or equivalent coloured thermoplastic road marking, on or near the centre of the carriageway, with the apex pointing towards the hydrant.
3. A sawcut **H**, 5 mm wide, 5 mm deep, cut into the kerb opposite the hydrant, with 300 mm of the kerb also marked with yellow paint.
4. 1.2 m outside diameter circle with a line width of 100 mm, painted yellow with road marking paint complying with the requirements of NZTA M/07 or equivalent coloured thermoplastic road marking, concentric around the hydrant box, mandatory in locations where there is a risk of vehicles parking over the hydrant (e.g. where the hydrant is within 2 m of the kerb or edge of the carriageway, or more if there is angle parking).

Hydrants on or adjacent to unsealed roads:

1. Hydrant box lid shall be painted yellow with road marking paint complying with the requirements of NZTA M/07

2. Marker Post complying with the dimensions for Type C edge marker posts specified in *NZTA Manual of Traffic Signs and Markings – Part II: Markings,* with the following changes: the two yellow reflectors must be replaced with two blue reflectors and these must be repeated on the reverse side of the post so it will be visible from both directions. The post must be located in the same manner as the standard edge marking posts in relation to the trafficable portion of the carriageway and in line with the fire hydrant.

Optional additional markings:

1. Blue raised reflective pavement markers (RRPM): these are optional additional markers recommended for locations where other markings may be difficult to see at night (e.g. low level of street lighting or curved road alignment). Any such RRPM installed shall be bi-directional and placed close to and on the fire hydrant side of the centre of the roadway, at, or near the base of the yellow triangle marked on the road. RRPMs are not mandatory.

2. Kerb marking (300 mm opposite the hydrant) in yellow for locations where the hydrant is in the road berm or footpath and the additional marking close to the carriageway is considered appropriate in helping to find the hydrant.

Specification for Water Metering & Backflow Prevention

Water meters serve a number of purposes:

- They are the basis for consumer charges
- They serve to delineate the boundary between the public water supply network and the private systems
- They are used to measure system losses (leakage)

This specification provides guidance in the design and installation of metered service connections and fire connections from the tapping band or tee on the watermain to point of supply (including meter & backflow device)

Definitions

Point of Supply (POS):

- the point at which ownership transfers from Watercare to the customer
- for metered connections Watercare is responsible for all fittings within the meter box, which shall be located as close to the property boundary as feasible, preferably in the road reserve
- for unmetered connections & fire supplies the POS is at the property boundary or boundary backflow

Note: some existing meters are located inside private property or on ROW easements. Watercare is only responsible for the water assets within and including the meter box.

Apartment meter – privately owned (usually by a Body Corporate) meter inside a property to measure consumption of a unit/strata title of a multi-storey or multiple tenancy building

Domestic supply – a supply which is primarily for household use

Commercial supply – properties where the primary purpose is for business activities

Residential – properties where the primary use is for residential occupancy

Mixed use – increasingly multi-storey residential properties have commercial tenancies in the ground floor; the highest risk activity will determine the level of backflow prevention required; meters shall be sized per the commercial criteria

Service connection - the section of underground water pipe between the Watercare watermain and the point of supply (usually the water meter).

Meter bank - a group of domestic sized water meters served by a single service connection, and connected via a fabricated manifold to the customer supply pipe (up to 5 meters per meter bank). Contained within a single meter box.

Policy - Requirements

- Watercare retails sole ownership of water meters at the point of supply, and is responsible for the ongoing maintenance and supply of associated fixtures and fittings. Applications for new water meters must be made to Watercare, New Connections team
- All new or redeveloped residential and non residential units, whether individually titled or not, must have individual water meters installed for each individually occupied unit or premise; unless the property is managed by a legal entity (i.e. body corporate) in which case a bulk meter at the boundary is adequate;

- Meters must be located in the road reserve within the pedestrian area (i.e. berm or footpath) on Watercare's side of the point of supply (out of any vehicle paths) and must be readily accessible at all times for reading and maintenance;
- Where it is not practical to install all the meters within the road reserve, Watercare may at its sole discretion, consent to separate meters being installed within the property. In this case:

    - Each meter must be readily accessible for reading, maintenance or replacement (boxes need to be sized appropriately)
    - Meters must not be located inside actual units/apartments or within ceiling cavities;
    - Integrated remote reading devices must be installed when a meter is located behind a door or gate (locked or unlocked), fence or within an area protected by security systems. The remote reading device must be easily accessible to a meter reader. Any remote reading device must approved by Watercare (Watercare uses ***Coronis Waveflo RF remotes***).
    - In addition to separate meters within the property, multi unit developments must also have a bulk meter located on Watercare's side of the point of supply.

- When an existing property requires individual water meters to be installed, a registered plumber's As-Built plan showing that each individually occupied unit has separate plumbing will be required by Watercare;
- Watercare may require a water meter to be installed on a fire prevention connection;
- Meters shall only be installed by Watercare's Approved Contractors in accordance with Watercare's standards.
- New meters shall not be installed in "Confined Spaces".

The meter-size for the development will be determined by Watercare. Demand flow requirements must be provided when the water connection is applied for.

Note: a customer may wish to attach logging or remote telemetry to a water meter to assess consumption patterns or manage resource use; where this is authorised by Watercare no liability will be taken if the meter is changed or Is unserviceable for any period of time; Watercare reserves the right to manage connections to its assets and may require that privately owned equipment is removed at any time.

Water Meters

- All water meters at the point of supply are owned by Watercare;
- All water meters shall be manufactured to AS 3565.1 Meters for Cold Potable Water – Volumetric & Turbine meters;
- All residential meters must be certified as conforming to ISO 4064/BS 5728 Class C, or any other performance standard approved by Watercare;
- All new water meters shall be installed according to the manufacturers;
- All commercial meters must be certified as conforming to ISO 4064/BS 5728 Class B or C, or any other performance standard approved by Watercare;
- Watercare may install combination meters, at its discretion;
- Meter tests shall be performed on an IANZ certified test facility to meet ISO 17025;
- Strainers may be required, as determined by Watercare on a case-by-case basis;
- Magnetic flow meters shall comply with the Watercare standard (see attached), and be calibrated post-installation & verified by an independent certifier (usually the manufacturer's local agent). Watercare prefers ABB Aquamaster & Water master meters for Retail Networks;
- All meter and backflow components shall be disinfected during assembly by spraying with hypochlorite solution.

Couplings

- Metric Grade 316 stainless steel bolt assemblies shall be used on all couplings
- All buried couplings are to be wrapped with Denso Petrolatum system
- Ductile iron fittings shall be manufactured to NZS/AS 2280 1995 “Ductile iron pipes & fittings” with fusion bonded epoxy coatings to NZS/AS 4158 (as above)
- Connections over 50mm shall use fabricated tees (MDPE or Ductile Iron)
- Victaulic couplings are not suitable for retail networks pipe-work (commonly used by fire contractors)
- EPDM seals shall comply with AS 1646
- Acceptable types of couplings are:
  - Compression couplings – Pushfit, Pushlok, Plasson Series 1
  - Gibaults – Tyton, Viking Johnson, AVK Supa coupler series

Service Connections

- Service connections shall be sized in accordance with NZS/AS 3500.1.2003 “Plumbing & Drainage Part 1 Water Services Clause 3.2.2
- Standard sizes shall be 20mm, 25mm, 32mm, 50mm, 80mm; 100mm & 150mm service connections shall be made from steel or ductile iron pipe & fittings.
- Service connections may be constructed from copper, MDPE, MLSP or ductile iron; LDPE (alkathene) & galvanised iron are not acceptable materials
- Copper service connections shall comply with AS 1432 “Copper tubes for plumbing, gas fitting & drainage applications”.
- MDPE lines shall be DN20 (min 16 bar PE80) to AS/NZS 4130 “Polyethylene pipes for pressure applications”;
- Polyethylene fittings shall comply AS/NZS 4129 - 2000 “Fittings for polyethylene pipes for pressure applications”
- Service connections shall be laid a minimum of 450mm cover, rising to 250mm cover immediately adjacent to the meter box inlet port.
- Where a service connection will pass under a proposed carriageway or driveway, a suitable and durable duct must be provided.

Post installation testing of service connections shall be either:

1. during pressure testing of new watermains
2. under mains operating pressure for in-service watermains

Check for visual leaks and check for flow & pressure (minimum flow is 25 l/min and minimum pressure is 200kPa)

Tapping Bands

- Approved ferrules and tapping bands shall be made of dezincification resistant bronze (LG2) to AS 2345 “Dezincification of copper alloys”
- Stainless clamps may be used for under pressure tapping, if they comply with AS 4181 “Stainless steel clamps for waterworks purposes”; examples are Wang, Kawandah & AVK clamps (AISI 316 certified to NEN-EN-1509001)
- Electrofusion tappings shall comply with the international 39.5V system, manufactured to WIS-4-32-06 1989
- Electrofusion welded tapping bands are not permitted

Gate, Peet & Ball valves

- Sluice and Peet valves shall be resilient seated gate valves which comply with AS 2638.2 2006 “Sluice valves for waterworks purposes” shall be used, and AS 4158 “Thermal-bonded polymeric coatings on valves & fittings” shall be used.
- For connections under 50mm copper alloy gate valves and non return valves complying with AS 1628 shall be used.
- Valves 50mm and under may be BSP screw-fitted, over 50mm shall be flanged with BS.10 Table D bolt pattern.
- Butterfly valves shall not be used.

Non return valves

- All meters on domestic supplies must be fitted with a non testable double non-return valve or dual check valve, as a minimum; Multi-storey or large developments will require a higher standard of backflow prevention.
- Fire connections require a testable double check valve assembly, as a minimum.
- Water connections to sewer pump stations, ejector stations & pressurised sewer systems require a RPZ device.
- Acceptable brands of dual check valves are RMC, Wilkins, Watts, and Ames.

Manifolds for meter banks

Manifolds may be constructed from copper or stainless steel. Copper manifolds shall be braze welded and stainless shall be arc welded. Fabrication shall be by welders certified to AS/NZS 2980:2007 Qualification of welders for fusion welding of steels.

The use of compression, electrofusion or glue jointed PVC couplings assembled to form manifolds is not an acceptable fabrication method.

Private Water Supply Pipes

The internal plumbing system’s design, installation and maintenance (both in its component parts and its entirety) must comply with the *Building Act 2004* and the New Zealand Building Code. Quick-closing valves of any kind or any other equipment, which may cause pressure surges to be transmitted, must not be used or any piping close to the service connection.

Fire Connections

Fire connections will be designed by an appropriately qualified Fire Engineer.

Watercare will approve all fire connections and determine if metering and backflow prevention is required (the default position is backflow devices are required on all connections, subject to a risk assessment, and metering is at Watercare’s discretion).

Metering of fire connections may be by bypass (check) meter, detector check backflow device or Magflow meter as determined by Watercare.

For residential sprinkler systems and fire hose reels a standard class C meter is acceptable. For commercial sprinkler connections a magnetic flowmeter or detector check backflow device is preferred.

Surface Boxes

The location of valves and water meter surface boxes must be located outside private property, unless Watercare advise otherwise.

The top of all surface boxes must be flush with the reinstated surface.

Meter Boxes
Boxes shall be installed that meet the site requirements and type of installation as noted in the table below:

Meter Size (mm – diameter)	**Berm**	**Footpath**	**Driveway**	**Commercial Driveway/Road**
12-25mm	PE box/lid	CI box/lid	CI box/lid	Specific Design (see note)
32-40mm	PE box/lid	Steel box/lid	Steel box/lid	
50-80mm	Steel box/lid	Steel box/lid	Steel box/lid	
100mm +	Steel box/lid	Steel box/lid	Specific design	

Note:

1. Concrete chambers will require a specific design, unless the designer can provide details from a proprietary system (i.e. Humes, Hynds or Telcrete).
2. For boxes located in heavy traffic areas or "shared space" pavements a specific design may be required. Examples of boxes that may be acceptable (subject to specific Watercare approval) are Sika, ACO, Gatic or Wundercover boxes and lids. These must meet a minimum Class B rating (80 KN test load), per AS 3996 "Metal access covers, road grates & frames".

PE Box/Lid

HDPE boxes shall be inverted taper style and be black coloured. The lid shall have the word "WATER METER" or "METER" embossed on it. A metal locator bar is required in the lid which must also have a surface pattern to minimise slip hazards. Refer to drawing MW-30 HDPE meter box.
Examples of acceptable products are Draper Enterprise DRA30/1 and Humes MD5000 and Acuflo Industries Midi/Jumbo boxes.

Timber/Steel Box with Steel Lid

Galvanised steel boxes with hinged chequer plate lids are required in lightly trafficked and some pedestrian areas. These boxes are custom-made in accordance with drawing MW-20 or MW-47. They are suitable for meter banks (multiple meters on a manifold) or larger meters (40mm diameter and over). Site considerations will determine the suitability of these boxes. Special attention to the skid resistance of the lid surface may be a consideration in the selection of these boxes, which may require additional coatings to avoid creation of a slip hazard.

The walls of a steel box will need to have penetrations drilled for the incoming and existing pipework. Where wooden boxes are used, the timber shall be H4 treated T&G timber fixed with galvanised steel fittings.

The addition of a steel mesh floor on the box prevents the migration of silt into the meter box.

Cast Iron Box & Lid

These shall be manufactured with T220 Grey Iron to AS 1830 "Iron castings Grey Cast Iron" and coated with black bituminous paint, or painted as required. The word "METER" will be

embossed on the lid which will be flush mounted in the frame. Refer to drawing WS-45 cast iron meter box.

Backflow Prevention

Refer to Watercare's Backflow Prevention Policy at:
http://www.watercare.co.nz/business/backflow/Pages/backflow.aspx

Backflow prevention devices are used to ensure that contaminants (or gas) cannot be drawn or pumped into the potable water supply system. By legislation, Watercare is required to maintain a register of all boundary backflow prevention devices (including type, size and location, hazard rating, and maintenance) to ensure that annual testing and audits take place on new and existing devices.

Residential Buildings

A double non-testable check valve is required on all domestic residential new connections. Where no backflow device exists in the following situations, backflow prevention devices are required:

- Multiple dwellings, four or more, with one supply;
- Where special fittings/fitments are connected to the potable water supply. The type of valve required depends on the type of hazard on the site. Refer to the 2004 Building Act's List of Hazards and to the Watercare Public Health Risk Management Plan;
- In the cases of some home-based businesses, for example, hair-dressing or bulk-cooking;
- When an auxiliary water supply (water tank) is being used and is connected to the Watercare water supply network;
- All properties with swimming pools and spa pools where potential backflow or back pressure can occur;
- Where the main into a development is more than 5m long.

Commercial and Industrial Buildings

A testable backflow prevention device is required in all commercial and industrial buildings as close as possible to the boundary.

Installation

Application approval for installation of backflow devices is based on the nature of the development. Prior to installation, Watercare's approval is required, and after installation, Watercare will carry out an audit inspection.

Shutdowns of the Water Supply

Watercare is responsible for managing planned works, unplanned repairs and maintenance to the water supply system. Planned shutdowns to the system are often required for installation of new connections.

Requirements

- Watercare's Approved Contractor are responsible for organising all shutdowns and shutdown notifications, upon approval by Watercare;
- When practical and possible, all planned shutdowns will be organised outside peak demand periods;

- Affected customers will be given prior notification (as per Watercare's Customer Charter);
- Applications for temporary shutdowns must be made to Watercare Network Operations

Where possible, an under pressure tapping is preferred over a "shut and cut" tee connection.

Specification for the Installation of tracer wire

Tracer wire is to be installed when installing non-traceable pipe materials.

The “Tracer wire” shall be a continuous four-strand 4.0 mm copper wires (polythene sleeved) for underground application or similar approved.

a) Installation requirements:

- Tracer wire shall be secured to the pipe at three metre intervals.
- When placing tapping band ensure tracer wire is not placed between the pipe and tapping band. The wire shall be protected from excavation works.
- With exception of approved spliced connections the tracer wire shall be continuous from Valve chamber to Valve chamber or hydrant.
- No breaks or cuts shall be permitted.
- Spliced or repaired connections to the tracer wire shall be made using a wire connector and insulated.
- A wire closure shall be attached at the beginning and end of the buried wire.
- 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 shall be bought into the valve box and placed in such a manner as not to interfere with the working of the valve or damage the wire.
- The main line tracer wire shall follow and be secured to the hydrant lateral up to and back from the hydrant and then continue along the watermain. The tracer wire shall be wrapped neatly around the hydrant with at least two metres of slack in the tracer wire.
- The tracer wire shall extend a minimum two metres beyond any watermain end caps. The wire shall be coiled and secured for future connections.

b) Testing of Tracer for continuity between beginning and end points.

- The testing for functionality will only be undertaken after confirmation from the Contractor that the installation has been completed in accordance with the installation process.
- The test will be organised by the Contractor and executed under supervision.
- A test certificate shall be supplied to Watercare on the outcome of the test.

Photographic illustration can be found on the following pages.

Example of 100 mm diameter pipe wire strapped to the outside of the pipe wall by means of HD tape at both ends

Example of connector used for testing: