

The Auckland Code of Practice for Land Development and Subdivision

Water and Wastewater Code of Practice for Land Development and Subdivision

Chapter 6: Water



Based on Section 6 of NZS 4404: 2010 this document is part of the Auckland Code of Practice for Land Development and Subdivision.

Chapter 6 – WATER

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Draft 1.0	Initial document for internal consultation	J Hodges	11/02/2011
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The latest version of this standard takes effect on the date of release on all new work and supersedes all prior versions or formats of this document.

Where design work has been completed or where construction work commenced, immediate adoption may be delayed unless the change is required within a timeframe provided by legislation, or is an immediate health and safety concern. Under these circumstances Watercare will review any work in progress and provide specific notice for adoption.

Summary of changes

Version	Section	Description of revision
2	Entire document	Formatting and font
	Introduction (section 1)	Foreword and introduction reworded. Sections numbered and rearranged. Legislative -, standards – and other document reference have been updated. Referenced standards moved to section 3. Deleted “Document hierarchy” diagram Deleted “Water supply mains” process flowchart
	Chapter 1	Removed. Referred to Auckland Code of Practice for Land development and Subdivision that now includes Chapter 1. Referenced made in section 3.
	Chapter 8	Removed. Referred to Auckland Code of Practice for Land development and Subdivision that now includes Chapter 1. Referenced made in section 3.
	2	New section describing relationship of Watercare standards and how this code of practice fits into the overall set.
	3	Updated referenced standards and documents
	4	Reproduction of deliverables that is removed from the previous version of Chapter 1 – this section identifies Watercare’s specific requirements to allow engineering plan evaluation.
	6.1	Reworded to clarify document exclusions
	6.2.2	Reworded with updated reference
	6.3.3A	Additional data and definition provided for contaminate free classification of works over water supply infrastructure
	6.3.5.3	Previously referred occupancy reference to wastewater chapter now included in text. Lowered compounding peaking factors based on measured data.
	6.3.5.6	Thresholds included design rates for where none was previously provided. Lowered average daily demand per person.
	6.3.6.2	Deleted appendix H. Expanded on backflow prevention requirement in accordance with the Building Act and Water Bylaw
	6.3.8.1	New image for typical services layout cross section
	6.3.8.5	Reworded to provide for security of supply
	6.3.8.6	Pipe may not be installed in tree root zones
	6.3.8.7	Reworded. The design of shared service trench shall consider the pipe structural impact and minimum clearances
	6.3.9.1	Updated service clearances requirements
	6.3.12.2	Included base isolation options for closely located structures
	6.3.12.6	Updated geotechnical references. Section 6.7 deleted
	6.3.12.9	Updated reference to trenchless technologies
	6.3.12.10.1	Amended acceptable pipe depths for pipe in the berm to include front

Version	Section	Description of revision
		berm depth requirements.
	6.3.12.10.2	Reworded to describe design and minimum clearance considerations for trench widths
	6.3.14.1	Updated to clarify general valve connection requirements
	6.3.15.3.1	New section to include requirements under previous appendix G. Appendix G now deleted.
	6.3.16	Updated section with requirements out of previous appendix H. Reworded to clarify Watercare's requirements. Appendix H now deleted
	6.4	Reworded to clarify construction requirements and appropriate construction standard references. Sub-sections have been deleted
	6.6	New schematics for point of supply definitions
	Appendix C	Removed. A duplication of the testing requirements described in the construction standards. The construction standards are referred to in this document.
	Appendix D	Removed. The CoP for disinfection is a separate document. Referred to in text
	Appendix F	Removed. Processes and forms are available on Watercare's website
	Appendix I	Removed. A duplication of the requirements described in the construction standards.
	Drawing set DW02 (previous appendix B)	Appendix B removed and referenced drawing set in section 3. Drawings updated to reflect document changes.
2.1	1.2	Update reference to Health and Safety at Work Act 2015.
	3.1.1	Update with latest references to as-built requirements.
	3.1.2	Added reference to AS/NZS 2865 for safe working in confined spaces
	6.2.1A	Removed reference to stainless steel. Material is specified in the material supply standard. Sentence added to clarify usage of safety grilles.
	6.3.5.1A	Correct wording around fire flow targets to be set at minimum design pressure. Also see 6.3.11
	6.3.5.9	Added design input to check existing system capacity.
	6.3.8.1	Changed wording to show that easements may be required by discretion by parks managers.
	6.3.8.1 layout sketch	Changed "depth" to "cover". Changed "typical" to "possible" Removed scale.
	C6.3.10.4	Corrected grammar.
	6.3.11	Updated wording to remove Watercare specified fire zone and replace with minimum design parameters to be considered in conjunction with firefighting design criteria stated in the fire code.
	6.3.16.2	Sub-headings re-arranged to follow more consecutively.
	6.3.16.2 d)	Reword to show that mixed land use will require two different meters and sizing.

Version	Section	Description of revision
	6.3.16.2.1 e)	Clarification on acceptable connection isolation valves.
2.2	4	Added section 4.1 and 4.2 on climate change and carbon footprint considerations as part of design deliverables
	6.3.5.6	Sentence added to limit validity period of the capacity assessment.
	Table 6.1.c	Clarification on floor area assessment added to notes
	6.3.16.2.4	Correct drawing references
2.3	6.3.6.3	Water age – introducing additional measures for improving water quality during development of subdivisions
	6.3.12.3	Added design considerations for trench design and location
	6.3.16.2	Added additional connection options for larger development lots
	C 6.3.16.2	Updated not to reflect individual meter reading service
2.4		Accepted updates from rev.2.3

Foreword

This code of practice (CoP) has been developed to guide and govern subdivision, development and re-development of water local network areas. It is applicable within the territory of the Auckland Council and parts of Waikato, where these utility services are provided by, or are to be vested in, or connected to assets owned by Watercare Services Limited (Watercare).

The code of practice is based on NZS 4404:2010 Land Development and Subdivision Infrastructure. Various parts have been reproduced pursuant to Licence 000805 granted to Watercare by Standards New Zealand.

The purpose of NZS 4404 is to deliver good urban design and infrastructure of good quality that is consistent with industry best practices.

NZS 4404 is a national standard developed to accommodate local variations to suit different conditions and circumstances. Accordingly, there are numerous inserts by Watercare to deliver local requirements, many of which have been embedded in the local industry for some time.

The clause numbering of the original standard has been retained for section 5 to facilitate cross-referencing. To assist practitioners used to, or wishing to draw comparison to NZS 4404, altered text or additions are presented in *Italic font*. Deleted text or sections are not shown.

Sections highlighted in grey are intended as comments and guidance notes. These clauses are not mandatory.

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Definitions

Annual exceedance probability (AEP)	The probability of exceedance of a given occurrence, generally a storm, in a period of 1 year (1% AEP is equal to 1 in 100 year storm).
Assets	Water and wastewater infrastructure owned and operated by Watercare.
Brownfield	A land area that has existing or legacy infrastructure, or land that has been contaminated.
Developer	An individual or organisation having the financial responsibility for the development project. Developer includes the owner.
Designer	The developer's professional advisor, appointed by the developer to complete the investigation, design, contract administration, construction supervision, and certification of the works on completion.
Dwelling	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.
Dwelling unit equivalent (DUE)	A unit of water demand of 220 kilolitres per year on average, or, where a wastewater meter is installed, a unit of wastewater discharge of 209 kilolitres per year on average. The number of DUE's is based on the additional demand for water and/or wastewater at the property and will be rounded to the nearest whole number.
Greenfield	A land area that has no prior infrastructure development and is not contaminated.
Infill	Development within a previously developed area.
Water local network	The water local network covers the reticulated distribution system from the water transmission systems to each property. Pipelines are generally less than DN250.
Water transmission	The water transmission system covers the bulk conveyance of water to reservoir storage or to bulk supply points across the Auckland region. Customers are not supplied directly from transmission systems.
Peet valve	A gate valve that is installed on a rider main.
Point of supply	The '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 connection	Private connection is the pipe connection from the private property up to the Watercare meter.
Principal main	A watermain that is DN100 or greater. Fire hydrants may be installed on a principal main.
Rider main	A water supply main that is supplied from a principal watermain. A rider main is smaller than the principal main, but not less than DN50.
Service lead	The lateral pipe connection up to the point of supply is installed in public road reserve and is owned by Watercare. The service lead is also commonly referred to as the “service connection” or “lateral connection”.
Structure	A piece of infrastructure (excluding pipework), that may be constructed from various types of materials that includes something built or arranged such as underground chambers or pits, a building or building components such as foundations, piles or retaining walls.
Sluice valve	A gate valve that is installed on a principal main.
System (water/network reticulation)	The interconnected hydrological engineered layout and hydraulic components such as pipes, valves and pumps.
Toby valve	A small gate valve installed on a service lead.

Abbreviations

AEP	Annual exceedance probability
CBD	Central business district
CCO	Council controlled organisation
CoP	Code of practice
CLS	Concrete lined steel (pipe)
DN	Nominal diameter
ESF	Engineering standards framework
ha	hectare
L/d	Litres per day
L/p/d	Litres per person per day
L/m ² /d	Litres per square metre area per day
L/s	Litres per second

HGL	Hydraulic grade level
IQP	Independent qualified person
m	metre
m ²	square metre (area)
mm	millimetres
MPa	megapascal
m/s	metres per second
NB	Nominal bore. The inside diameter of a pipe
PE	Polyethylene
PF	Peaking factor
PN	Pressure nominal. Maximum rated operating pressure

1. Introduction

This code of practice applies to the design of local network systems in greenfields (urban expansion), infill and brownfield (urban renewal) redevelopment projects. These ventures must demonstrate compliance with the requirements of this code of practice for design and Watercare's material supply and construction standards before being able to be connected to the Watercare local network system. This document is not an urban design policy, or method of master planning.

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. Watercare is responsible for the bulk and retail (local network) water and wastewater services throughout the Auckland region. In the former Papakura District Council, Veolia Water is under contract with Watercare to deliver local network services. Veolia Water applies this code of practice.

The applicable legislation, this document and other Watercare standards, plans and by-laws are to ensure that:

- Water is used efficiently and wastage is minimised as best practicable
- Watercare's and other publicly owned assets are not damaged and future access is not compromised by the actions of third parties
- Infrastructure that is created, is of good quality, meets health requirements and minimises ongoing maintenance costs
- Meets future demands on maintainability and access as infrastructure age and the natural environment change

Developing, setting and monitoring subdivision and development standards for greenfield (urban 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 acceptance of the design, construction and commissioning of elements of water and wastewater infrastructure, which will ultimately become part of Watercare's infrastructure. 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.

1.1 Outcome statement

This code of practice provides developers and their engineering professionals with the standard for design of local network systems that is consistent across the Auckland region and encourages innovation whilst maintaining basic requirements and sustainable development. This performance outcome requirement allows Watercare to manage the infrastructure in an economical and safe manner over the life of the assets.

1.2 New Zealand legislation

The requirements of this Code of Practice (CoP) shall be read subject to the provisions of the latest versions and amendments of the Auckland Unitary Plan and to any applicable statutes, regulations, bylaws, 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 Roadway Powers Act 1989
- Health and Safety at Work act 2015
- 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, and related by-laws
- Reserves Act 1977
- Resource Management Act 1991, including all applicable regional and territorial planning documents
- Local Government (Auckland Council) Act 2009
- Local Government (Auckland Transitional Provisions) Act 2010
- Utilities Access Act 2010, National Code of Practice for Utility Operators' Access to Transport Corridors

1.3 Websites

- Auckland Council www.aucklandcouncil.govt.nz
- Auckland Design Manual www.aucklanddesignmanual.co.nz
- Auckland Transport <https://at.govt.nz/>
- Ministry for the Environment <http://www.mfe.govt.nz>
- Heritage New Zealand <http://www.historic.org.nz>
- New Zealand Legislation <http://www.legislation.govt.nz>
- New Zealand Transport Agency <http://www.nzta.govt.nz/>

1.4 'Must' versus 'Shall' versus 'Will'

Where the verbs must, shall and will (or its past tense forms) are used, they describe a requirement for compliance with the statement in which it is used.

'Shall' and 'must' expresses a mandatory condition or action. 'Will' is used to prescribe a performance outcome or intent.

1.5 Review of standards

Section 1.5 is provided for information only.

Watercare updates its standards and codes of practices from time to time. Users of this document should ensure that the latest published version is used. Suggestions for improvement of this standard are welcome. They should be sent to: **Principal Engineer - Standards, Watercare Services Limited, Private Bag 92521, Wellesley Street, Auckland 1141.**

Alternatively place feedback electronically at www.Watercare.co.nz

1.5.1 Watercare's engineering standards framework

The Watercare standards are provided in the online engineering standards framework (ESF). The system provides guidance to the end user to find the applicable standards for the operational area in which design, construction or maintenance is performed. The system ensures that the latest versions of standards are available. The standards are uncontrolled when copied or printed.

1.5.2 Governance of standards

Changes to standards are made under a governance structure to evaluate any change or improvements against factors such as Health and Safety, legislative compliance, standards, best practice and asset reliability.

2. Standard documents overview

2.1 Relationship of Watercare standards

Watercare standards comprise of codes of practices, design standards, standard design drawings, construction standards, and asset and material standards.

The Watercare standards are requirements additional to nominated national standards, international standards and industry best practice to meet, and in some cases exceed legislative requirements, to accomplish long term operability and good asset management practices to benefit our customers. The interface of these standards with each other and the project specifications are as follows:

2.1.1 Design standards

Design standards set a level of design for particular types of infrastructure based on operational area and associated risk. The design standards provide the minimum criteria for establishing baseline standard design drawings, interface design between standardised components, establishing the correct sizing of components to complement the baseline parameters of standard drawings and the basis for developing bespoke designs. This document falls within the design standards category and must be read with the relevant drawings and standards for asset capture, materials supply and construction.

2.1.2 Design drawings

The standard design drawings support the requirements of the design standard. Minimum and maximum criteria are set, and specific standard details are shown.

2.1.3 Asset and material standards

The asset standards describe the requirements for asset creation, asset numbering, asset capture, production of manuals and operational documentation. Material standards describe the minimum compliance requirements of materials supplied for asset acceptance. Often selected materials will have limitations of use and requirements specific to the operating environment and infrastructure classification.

2.1.4 Construction standards

Construction standards prescribe the methods and requirements for workmanship to be employed when constructing works in accordance with the design requirements, standard drawings and bespoke designs. To achieve the best outcome the construction requirements focusses on proven methods and best practice to ensure quality is maintained to achieve the design life of infrastructure, maintainability, health and safety and environmental requirements are met. Where construction standards are used or referred to in contracts they form part of the specification of the contract.

2.1.5 Project specific specification

These specifications identify site/project specific requirements that are not covered by the normative construction standards or standard design drawings identified during specific design.

2.2 Design build projects

Design build projects shall follow the minimum requirements set out in the standard documents for design and construction.

3. Referenced standards

3.1 Standards list

This code of practice must be read in conjunction with the Watercare, national and international standards listed below and the relevant chapters of the Auckland Code of Practice for Land Development. Where conflict or ambiguity exists, this standard shall take precedence. Where there is conflict between referenced standards, the higher level of standard shall take precedence.

3.1.1 Watercare standards

CG – General civil construction standard

ME – General mechanical construction standard

MS – Material supply standard

7363 – Watercare CAD manual

AI – Data and asset information standard

DP-15 – Local network water pump stations

DW06 - Access structure drawings for water infrastructure

DW07 - Access structures general drawings for public and non-public areas

DW02 - Code of Practice for Land Development and Subdivision –Water drawing set

DW04 - Water pump station drawings for networks

DP-09 Electrical design standard

EC - General electrical construction standards

COP-03 Code of Practice for commissioning

COP-04 Code of Practice for disinfection of water systems

3.1.2 National and international standards

NZS 4404 Land development and subdivision infrastructure

SNZ HB 44 Subdivision for people and the environment

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

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

AS/NZS 2041 Buried corrugated metal structures

Part 1 Design Methods

Part 6 Bolted plate structures

AS/NZS 2566 Buried flexible pipelines

Part 1 Structural design

Part 1 Supp 1 Structural design – Commentary

AS/NZS 3725 Design for installation of buried concrete pipes

AS/NZS 2865 Safe working in confined space

AS/NZS 3500 Plumbing and drainage

Part2 Sanitary plumbing and drainage

AS 2200 Design charts for water supply and sewerage

3.1.3 Other publications

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

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.

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

Seismic Guidelines for Water Pipelines, American Lifelines Alliance, 2005

Guidelines for Seismic Design of Buried Pipelines, NICEE, 2007

Underground Utilities – Seismic assessment and design guidelines, Water New Zealand

NZTA M/07 Specification for roadmarking paints

Health and Safety in Design Minimum standard, Watercare, 2017

4. Design deliverables

The design shall be delivered by a person with evaluated competency, refer to the Watercare compliance statement policy for acceptable levels of qualification and competency registration. The following comprehensive documents shall be provided to Watercare for evaluation of the design:

- a) Geotechnical report on the suitability of the land for subdivision
- b) Basis of design report describing options and selection of design
- c) Final design report that includes:
 - Site information such as location, layout, contours and soil contamination test results.
 - Impact assessment on adjacent properties and services
 - Value engineering that includes material selection, constructability analysis, simplification, innovation and life-cycle costing
 - Assumptions and non-compliance - identifying alternative options to meet performance requirements
 - Detailed calculations
 - Drawings showing location, detailed long sections, pipe grades and sectional details
 - Site specific specification for construction
 - Nominated minimum levels of construction supervision
- d) Risk analysis
- e) Functional descriptions (process and pump stations)
- f) O&M manual
- g) New assets register
- h) Project execution plan that includes the engineering construction plan/approach and Watercare's connection requirements
- i) Design compliance statement – See Watercare compliance statement policy

4.1 Climate change

To address the impact of climate change on new infrastructure, the design shall demonstrate the measures taken to address the impact by:

- The considerations of various scenarios to determine the key financial, operational and environmental performance indicators
- Compare adaptation measures and allow prioritisation
- The location of infrastructure and the impact of flooding on infiltration and overflows,
- Addressing water level rise and possible need for asset relocation, floatation of assets, saltwater intrusion and submerged outfalls
- Mitigating energy costs for increased pumping

4.2 Carbon footprint reduction

The infrastructure owned and operated by Watercare has a large influence on new projects, renewals and ongoing maintenance. Watercare policy is to aim for net zero emissions by 2050 and reducing emissions by 40% by the year 2025. To support this policy new infrastructure should demonstrate opportunities for:

- System selection and layout
- Low carbon infrastructure delivery in construction
- Product selection
- Energy efficiencies
- Carbon removals

5. [Intentionally blank]

Section 5 is intentionally left blank so that the numbering will follow the original format of NZS4404. The wastewater chapter is a separate document, document number COP-02.

6. WATER

6.1 Scope

This section sets out requirements for the design and construction of drinking water supply systems. It covers the design of the *local network system*.

The scope of water networks under this Code of Practice (CoP) is limited to pipe sizes of up to DN250.

If the intended water system exceeds the above limitations, notice shall be provided to Watercare to identify appropriate standard details from the Watercare transmission standard to be adopted. These can be viewed on Watercare's ESF. This code of practice excludes design requirements for treatment facilities, reservoirs or pump stations.

Proposals involving third pipe systems for non-potable supply must be discussed with Watercare as early as possible as it could impact on both water and wastewater networks.

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* 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 and design standards;*
- (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 site specific requirements for service delivery and maintenance;*
- (n) *Compatibility with Watercare's long term management strategy and plan (confirmation to be sought from Watercare) for the overall supply zone*
- (o) *Compliance with Health and Safety requirements in design, construction and disinfection stages of a project; and*
- (p) *Consideration to any environmental changes through the life of the asset in terms of sustainability, asset renewal, future access and levels of service.*

6.2.1A Safety of people

Chamber entries shall be fitted with an accepted 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. Chambers exclude valve boxes and the like where a person cannot fall into the chamber.

6.2.2 Referenced documents and relevant guidelines

Water designs shall incorporate all the special requirements of *Watercare* and shall be in accordance with the appropriate Standards, codes, *technical policies* and guidelines including those set out in Referenced Documents. *Refer to section 3.*

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. *Watercare lists a number of accepted and standardised materials. The use of components not listed on the material supply standards requires specific approval from Watercare prior to their use.*

6.3.2 Structure plan

Auckland Council may live zone land or facilitate 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, 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 *Auckland Unitary Plan*, the water supply infrastructure *must be designed* to cater for future development.

6.3.3A Contaminated sites

Contaminated sites should be avoided. Where a contaminated site has been confirmed, written approval to proceed shall be obtained from the Auckland Council and Watercare. 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.

Any contaminants in the soil, including topsoil on the site, shall be at the lesser levels of the health-based or environmental related protection values as described below:

- **Health based protection values:**
NES Soil contaminant standards (SCS) for residential land use (no produce, if applicable) as derived in accordance with Ministry for the Environment Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health (Chapter 7). In the absence of a derived NES Soil SCS, then a standard following the hierarchy outlined in the Ministry for the Environment, Contaminated Land Management Guidelines No 2 shall be adopted.
- **Environmental related protection values:**
Auckland Council Air Land and Water (ALW) Plan criteria for discharges as described in Rules 5.5.41.
- **No asbestos containing material or volatile organic compounds in site soils.**

No free (or separate) phase liquid contaminants and groundwater contaminant concentrations, with the exception of volatile organic compounds, which must be below the Australian and New Zealand Guidelines for Fresh and Marine Water Quality at the level of protection for 80% of freshwater species. Concentrations of volatile organic compounds shall be below typical laboratory screening detection limits (0.5 mg/L or lower).

The following table sets out the acceptance criteria for contaminant free sites:

Contaminant	Acceptance level (mg/kg)
Arsenic	<24
Cadmium	<7.5
Chromium	<400
Copper	<325
Lead	<250
Mercury	<0.75
Nickel	<105 ¹
Zinc	<200 ¹
Benzo(a)pyrene equivalent	<2.15
Pyrene	<1
ΣDDT	<0.7
VOCs	Below laboratory detection limit

¹ Can use upper limit background concentration in Auckland region (i.e. 320 for Nickel and 1160 for Zinc) if the soil is volcanic source

A site investigation including soil sampling and testing must be undertaken and a report submitted to Watercare in accordance with the requirements of the Ministry for the Environment, 2011, Contaminated Land Management Guidelines No. 1 - Reporting on Contaminated Sites in New Zealand. Testing shall be conducted by a NATA/IANZ accredited laboratory.

Soil testing data is required at the position for the proposed water infrastructure. Watercare reserves the right to request additional soil testing at the cost of the developer where the data supplied is considered inadequate or not representative of the site.

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) or internal diameter 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 residential developments over 10 dwelling unit equivalents, or as deemed required by Watercare, 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 fire-flow targets. Refer to section 6.3.11.

All hydrant flow tests require Watercare approval 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 time during a hydrant flow test the observed pressure drops to or below 100kPa, the hydrant flow test shall be ended. 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.

C6.3.5.1A

Note that only hydrants painted yellow can be used for hydrant flow tests. Some areas have zone isolations that are painted red and cannot 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 the design report detailing any assumptions.

6.3.5.3 Peak flows

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*, the peaking factor shall be 2.5

Peak flow calculation example:

For a new land-subdivision of 50 new dwellings with three bedrooms per dwelling use:

Design Population = 50 dwellings x 3 people = 150 people

Average daily demand = 150 x 220 = 33000 L/d (see section 6.3.5.6 for minimum demand)

Peak day demand = 33000 x 2 = 66000 L/d

Peak hourly demand = (66000 / 24) x 2.5 = 6875 L/h

= 6875 / 3600 = 1.9 L/s

6.3.5.4 Head losses

The head loss through *the local network* pipes and fittings at the design flow rate *for peak day - peak hour*, shall be less than:

- (a) 5 m/km for DN ≤150;
- (b) 3 m/km for DN >150.

Head loss shall be calculated using the *Hazen-Williams formula for pipe internal diameter of ≥50mm NB and a flow velocity of less than 3 m/s. See section 6.3.5.4.1.*

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.

The Hazen-Williams formula and coefficients given in Table 6.1 shall be used. Other acceptable formulae outside the parameters provided in 6.3.5.4 are the Colebrook-White and Manning formulas.

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 <i>concrete lined</i>	0.01 – 0.06	0.006 – 0.011	110-140
Mild steel <i>concrete lined</i>	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. <i>These</i> represents the expected value <i>ranges for</i> clean, new pipes laid straight to typical maximum expected for <i>aged pipes</i> . 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, refer to section 6.3.11.*

6.3.5.6 Minimum water demand

The designer shall complete the Watercare capacity assessment form, obtainable from Watercare, as part of the engineering approval application. The network capacity assessment shall be valid for one year from the date of assessment. Applications received with an expired capacity assessment shall be re-assessed.

Demand estimation shall be based on:

- (a) Daily consumption of 220 L/p/day;
- (b) *High rise buildings 4 storeys and over for residential apartment purposes (excluding student accommodation, see table 6.1.b) shall use 200 litres per person per day;*
- (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.
- (e) *Occupancy of schools, hospitals and commercial buildings must be confirmed on a case-by-case basis. See (f) to (h) below. The design occupancy rates for residential properties and apartments shall be as per table 6.1.a below:*

Table 6.1.a - Design residential occupancy allowances

Number of bedrooms (Notes 1 and 2)	Occupancy for design purposes (i.e. people)
1	2
2-4	3

Number of bedrooms (Notes 1 and 2)	Occupancy for design purposes (i.e. people)
More than 5	Specific agreement with Watercare
Unknown	For high rise apartments (four floors or more) and other residential assume a design occupancy rate of 3 per dwelling unit.

Table notes:

1. Where large dwellings are proposed, which have additional rooms beyond those allocated as dining, lounge and bedroom e.g. family, office, study or sleepouts which have the potential to be used as bedrooms, an additional occupancy allowance should be made on the basis of 1 extra person times the ratio of the total floor area of the additional room(s) to that of the smallest designated bedroom.
2. For residential retirement villages without a hospital facility and that have single bedroom units then a design occupancy rate of 1.5 may be considered.

(f) Other facility type design flows shall be as per table 6.1.b below unless specific data is available:

Table 6.1.b - Other facility design occupancy allowances

Other facility types		Design water flow allowance
Hospitals	Day facility (treatment facilities, wards)	320 Litres per bed per day
	Night and day facility (24-hour operation)	630 Litres per bed per day
	Staff	50 litres per employee per day
Child day-care	Children	45 Litres per child per day
	Staff	50 Litres per employee per day
School (day students)	Primary school	20 Litres per student per day
	Secondary school	25 Litres per student per day
	Staff	50 Litres per employee per day
School (boarding)	Secondary school	160 Litres per student per day
Student accommodation		160 Litres per person per day
Hotels and motels	Guests	200 Litres per room per day
	Staff	50 Litres per employee per day
Community halls and churches and/or facilities with intermittent use		12 Litres per seat per day

Note:

For activities where a large number of people can be expected to use multiple water fixtures simultaneously e.g. community halls and conference halls, the Peaking Factor shall be based on the number of water fixtures / appliances, as per NZS 3500.2 Plumbing and Drainage: Part 2: Sanitary plumbing and drainage.

Water consumption allowances in this table include general irrigation (but not specific irrigation systems) and grounds upkeep.

- (g) Commercial demand must be established on the particular commercial development as the basis of design. Where there is no specific industry design data the criteria as per table 6.1.c below shall be followed:

Table 6.1.c – Wet and dry commercial assumed design allowances

Commercial activity type	Design water flow allowance
Dry retail (Note 1) (where kitchen/toilets are <u>not</u> normally made available to customers)	1 person per 50m ² net floor area at 65 litres per person per day.
Office buildings and dry retail where toilet facilities, etc. are provided to customers.	1 person per 15m ² net floor area at 65 litres per person per day.
Wet retail (Note 2): Food and or beverage retail/preparation e.g. coffee shop, restaurant, bar, butcher, fresh fruit and vegetable retail.	15 litres per day per net m ² of floor area (including kitchen and dining areas).
<p>Table notes:</p> <ol style="list-style-type: none"> 1. Dry retail is where water is normally only used by staff for their own personal food preparation / toileting needs. Examples include: clothes shop, hardware retail. 2. Wet retail is where water is used to prepare food product for customers. Examples include: café, lunch bar, restaurant, butchery, fresh fruit and vegetable, food court-bar and supermarkets. 3. Assuming no significant irrigation. <p>Important: Net floor area is the total floor area of the building (exclude any open land areas), less non-productive areas, such as: lobbies; lifts; machine rooms; electrical services; stairwells; fire escapes; corridors and other passages used in common with other occupiers; car parking areas; etc. If net area is unknown, and the type of buildings are unknown, it can be assumed that the Net floor area is = 80% of the gross floor area of the building.</p> <p>As a guide to how activities will be assessed, commercial washing activities such as car / boat washing activities, etc. would be regarded as a “wet-industry” and not as a commercial - wet retail, as the water is being used as a part of a process (washing). Large-scale food-processing (i.e. for supply to commercial customers, as opposed to on-site retail customers) would be regarded as an industrial type activity. Preparation / manufacture of non-food based products, is also regarded as an industrial activity. Industry design flows are detailed in the section below.</p>	

- (h) Industrial demand must be established on the particular industrial development as the basis of design. Where there is no specific industry design data the criteria as per table 6.1.d below shall be followed:

Table 6.1.d – Wet and dry Industrial assumed design allowances

Dry industry activity type	Routine Peak Daily Usage Litres per square metre per day (L/m ² /d)
Light water users, or up to 2 storeys (Note 1)	4.5
Medium water users, or 2 to 5 storeys (Note 2)	6

Heavy water users, or 5 to 10 storeys (Note 3)	11.0
Very heavy water users (Note 4)	> 11.0 Specific design required

Table notes:

1. A light water usage industry is a relatively dry and clean trade where industrial practices do not include process water usage. Showers provided for personnel's ad-hoc use would still fall into the 'light water usage' category.
2. A medium water usage industry in a dirty trade where good industrial practice requires regular water usage and showers are in daily use because of commercial activities that require staff to have washing facilities, but there is no process water usage.
3. A heavy water usage industry in a trade that use water as a part of commercial activities in moderate quantities, but is not a Wet Industry, as defined in note 4 below. Wherever possible, the design flow for a heavy water usage industry should be checked against known water consumption rates. The Design Engineer shall submit evidence of these checks as a part of the application.
4. A very heavy water usage industry in a trade use in excess of 12 L/m²/d on a routine basis.
5. Assuming no significant irrigation.

(i) As approved by Watercare based on supporting evidence.

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 Internal diameter	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) Existing system hydraulic capacity;
- (c) Water demand (low, average, peak) in l/s, and diurnal profile;
- (d) Proposed land use and water use activities;
- (e) Hydraulic loss functions;
- (f) Fire flow targets for the proposed site;
- (g) An understanding of the general operating philosophy and design constraints of the water district zone the proposed development is connecting to; and
- (h) Elevation assumptions at proposed water meter locations.

The outputs of water main hydraulic design shall include:

- (i) Size of watermains (nominal diameter);
- (j) Maximum, average and minimum design pressure at each of the water meter locations;
- (k) The pressure class/rating of pipeline system components;
- (l) Surge analysis results;
- (m) Pipe headloss (m/km) and velocity (m/s) compliance with low, average, peak demand and firefighting demand scenarios;
- (n) Specification of the maximum and minimum allowable operating pressure;
- (o) Flow and pressure compliance with low, average, peak demand and firefighting demand scenarios; and
- (p) 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).

C6.3.5.10

A design pressure of 250kPa to 800kPa is set at the water meter. Specific consideration should be given for multi-storeyed buildings or areas of significant contours. The design pressure differs from *Watercare's* customer contract.

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 shall be used for all pipe material and PN16 for all components. Refer to Watercare material supply standards.

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.

Backflow preventers must be tested by a registered independent qualified person (IQP) under the building Act 2004 and the Health (Drinking Water) Amendment Act 2007. Backflow prevention shall be installed on all water supplies at the boundary area between public and private pipe ownership. Refer to the Auckland Council Water Supply and Wastewater Network Bylaw, July 2015, for requirements to protect water quality.

6.3.6.2.1 Location of backflow devices

The preferred location of backflow devices is within 500mm of the property boundary in the public road reserve to allow access for ongoing maintenance and inspection. Where this is not practicable the backflow prevention device may be installed in private property within 1m of the property boundary. There may be no other connection upstream of the backflow preventer. Source backflow prevention requires special certification and must consider suitable accessibility for maintenance and certification.

6.3.6.2.2 Ownership of backflow devices

Backflow devices installed in public property are owned by Watercare whilst devices installed on private property may be considered for private ownership under special arrangement with Watercare. The special arrangement shall include arrangements that will allow Watercare access to test the device at any time. Where access is prevented, Watercare may act in accordance with section 6.3.6.2.7. Under both ownership locations, the cost of installation, maintenance and annual certification is borne by the private property owner.

6.3.6.2.3 Service leads

Any service lead shall be installed with minimum a dual check valve. Depending on the property risk profile the backflow prevention device may need to be upgraded accordingly at time of connection/meter installation, or at any time when the supply risk level changes. See section 6.3.6.2.5.

6.3.6.2.4 Fire supplies

All private fire supply systems shall be fitted with a suitable backflow prevention device. The minimum risk level for fire systems shall be medium, but high risk level for fire supplies with chemical additives. See section 6.3.6.2.5.

6.3.6.2.5 Levels of risk

Hazards and classifications shall be to G12/AS1, section 3.0 of the Building Code. The complete site must be surveyed to determine the backflow hazard rating level.

The types of devices shall be considered based on the table below:

Hazard level	Boundary device	Source device (special certification with Watercare)
<i>Low hazard</i>	<i>Dual check valve</i>	<i>Dual check valve Vacuum breaker</i>
<i>Medium hazard</i>	<i>Double check valve Double check detector</i>	<i>Double check valve Spill proof vacuum breaker</i>
<i>High hazard</i>	<i>Reduced pressure zone Reduced pressure zone detector</i>	<i>Reduced pressure zone Registered air gap</i>

6.3.6.2.6 Backflow device approval

Backflow preventer devices shall comply with the requirements of Watercare's material supply standard. When a connection is made to the Watercare local water supply network an approved IQP shall test and certify the backflow preventer.

6.3.6.2.7 Disconnection of water supply

The water supply shall be disconnected in accordance with the Local Government Act 2002 and the Auckland Council Water Supply and Wastewater Network Bylaw 2015 under the following circumstance, but not limited to:

- *Unprotected supply with direct or indirect connection to possible contaminants*
- *Where the level of risk increases (change of use) and the device is not upgraded accordingly*
- *Where the device is not suitable or suitably installed for the level of hazard protection*
- *Expired backflow prevention device certification*

Disconnection may be effected immediately where there is serious risk to the public water supply.

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:

- Mains with dead ends (or termination points – see 6.3.17) shall be avoided by the provision of looped water mains. 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;*
- Mains for short runs shall be reduced in size or looped, for example no-exit roads (see figure 6.6);*
- Watercare may at its discretion require the developer to implement a system to improve the water quality where development uptake versus overall size affects the water grade of the area. This may be in the form of temporary dosing systems and flushing. A development staging strategy shall be provided to Watercare with commitment to provide for any associated costs before connecting to the Watercare system.*

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.

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

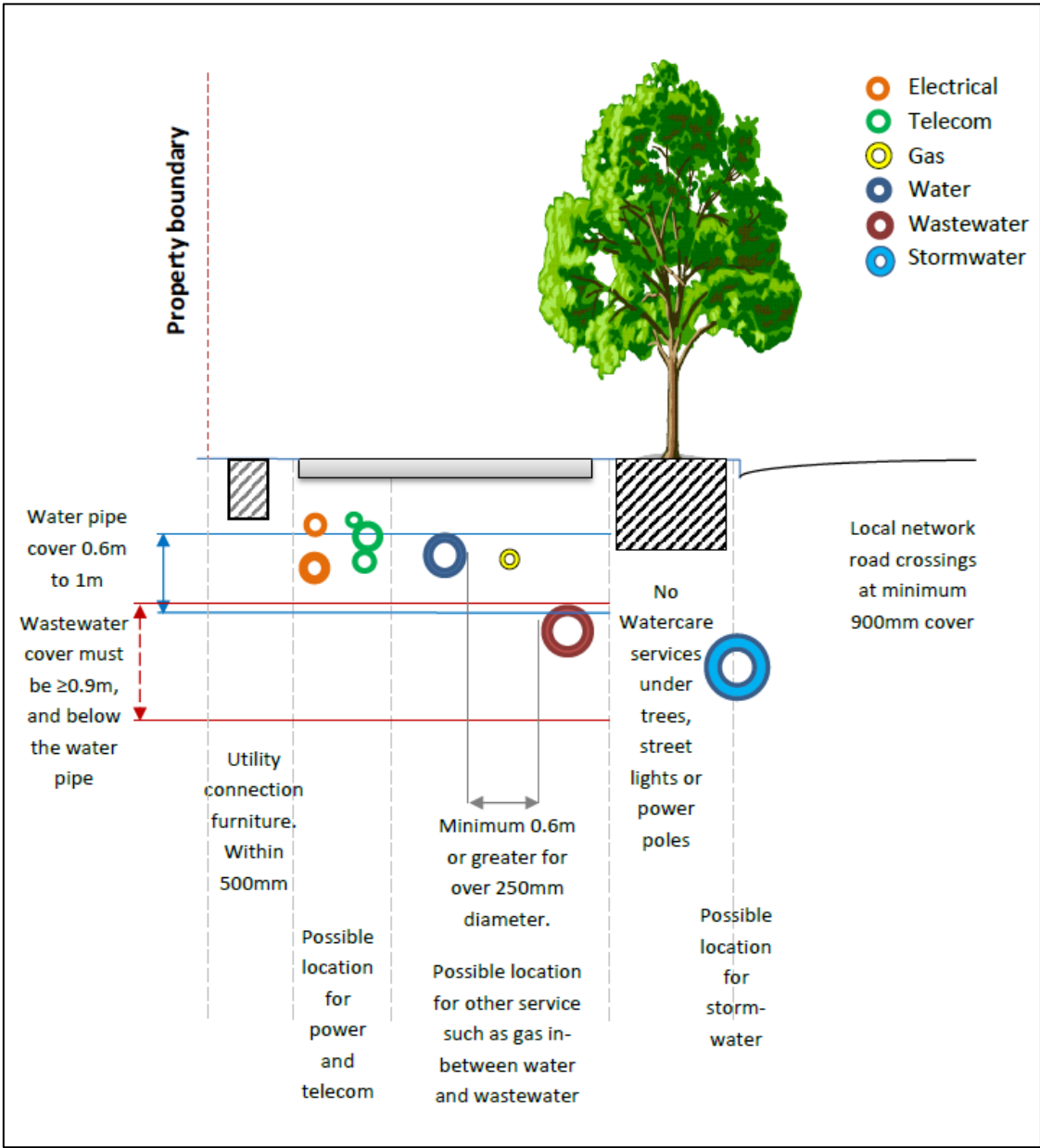
6.3.8.1 General

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 or park. *In some instances an easement may be required depending on the discretion of the parks manger.*

Watermains *shall*:

- (a) Be aligned parallel to property boundaries, *and typically located in the berm*;
- (b) Not traverse steep gradients; and
- (c) Be located to maintain adequate clearance from structures and other infrastructure. *Refer section 6.3.9.*

A typical cross section layout for public roads is provided below:



6.3.8.2 Principal and rider mains layout

For residential areas, a principal water main of *minimum 100mm internal diameter (NB)*, fitted with fire hydrants, shall be laid on one side of all public roads in every residential development. A rider main of *minimum 50mm internal diameter (NB)* shall be laid along the road frontage of all lots not fronted by the principal main. A *minimum 50 NB* rider main shall also be provided for service connections where the principal main is *300 NB* or larger. The principal mains serving commercial and industrial areas shall be *minimum 150 NB* laid on both sides of the road. *To facilitate future development, watermains shall be laid across the full road frontage of the site at the developer's cost.*

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 Watercare'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. Public watermains in private property, right of ways (ROW) and private roads is not permitted.

6.3.8.5 Types of system configuration

Network layouts shall be established in accordance with *Watercare's practice to provide security of supply and zone management, and interconnected ring systems.*

6.3.8.6 Watermains near trees

Locating watermains within the root zone of trees *is not allowed.*

6.3.8.7 Shared trenching

Where shared trenching is approved *the pipe structural calculations shall consider the pipe structural impact and minimum clearances from other services. See section 6.3.9.*

6.3.8.8 Rider mains and duplicate *principal* mains

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

Duplicate *principal* 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 be at right angles. *Ducting and additional protection of the crossing service is subject to the affected authority's requirements. In any event the water main crossing shall be sized at minimum 100 NB.* 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 100 NB and*, as far as practicable, be at right angles to the waterway or reserve. Watercare prefers below waterway invert crossings. *Refer to 6.3.8.12 where it can be demonstrated that such a crossing is not practicable.* 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 *as shown on the standard drawings for Watercare's Code of Practice for Land Development and Subdivision – Water drawing set, document number DW02.*

6.3.8.12 Location of watermains on bridges

The pipe bridge must not be integrated with the bridge support structure. The design must provide for safe and unrestricted access for maintenance, upgrade or replacement. The pipe shall be positioned clear of the 1% AEP flood levels. The pipe and supports shall be structurally designed to meet the following conditions (refer section 6.3.12):

- (a) Empty and full static loads*
- (b) Any dynamic loads and vibration*
- (c) Expansion and contraction*
- (d) Seismic action.*

Timber supports are unacceptable. Provision shall be made for access and clearances to maintain the pipe, connecting structures, drainage, articulation joints, valves and associated fittings as necessary.

Unauthorised bridge access (i.e. onto the pipe) shall be prevented with an adequate barrier structures and if necessary on-bridge railing for fall protection.

The following pipe material options can be considered:

- (a) Polyethylene pipe, however this material must be butt welded and supported inside a full length carrier pipe of suitable rigidity and durability. Cradles are not acceptable. The carrier pipe must be of suitable internal diameter to allow both future pipe size upgrades and thermal expansion and contraction.*
- (b) Steel (lined mild steel or stainless steel). Welded or flange joints. Pipe hangers or supports should be fully welded solution to reduce corrosion and simplify maintenance*
- (c) Ductile iron with flanged joints with hangers or supports that prevent galvanic corrosion and encourage water run-off.*

A formal agreement with the bridge owner must provide Watercare with the ability to access, operate and maintain the pipe on the bridge.

6.3.9 Clearances

6.3.9.1 Clearance from underground services

Watermains that are public and installed in the proximity of other services shall comply with Watercare's minimum clearance requirements. The specific design may require a greater clearance.

The minimum vertical and horizontal clearances are shown in Table 6.4.

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 ≥ 600	See Watercare's transmission design standard. Watercare may consider specific clearances for larger mains due to operational reasons.		
Transmission watermains 600 > DN ≥375	600		500
Watermains DN <375	300 ⁽²⁾		150
Gas mains	300 ⁽²⁾		150
Telecommunications conduits and cables	300 ⁽²⁾		150
Electricity conduits and cables	500		225
Wastewater and Storm water pipes	1000/600 ⁽⁴⁾		500 ⁽³⁾
Kerbs	150		600
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 <i>lengths</i> up to 2 m when passing installations such as poles, pits, and small structures, providing the structure is not destabilised in the process <i>or that the structural integrity of the trench is compromised</i> .			
(3) Watermains <i>shall</i> 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.			
(6) Where a main crosses other services, it shall cross at an angle as near as possible to 90°.			

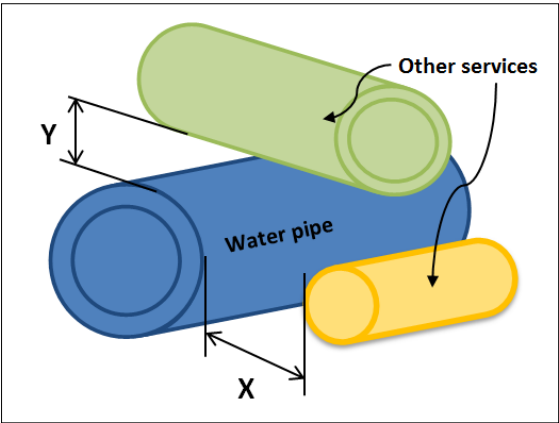


Figure 6.1 Service clearance measurements

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 to the pipeline;
- (c) Protection of the existing structure or building;
- (d) *Consideration to building overhangs and clearances; and*
- (e) *Building over watermains is not permitted.*

The protection shall be specified by the designer for evaluation and acceptance by Watercare. Table 6.5 may be used as a guide for minimum clearances for *access to watermains*.

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 construct close to Watercare’s networks please refer to the ‘Works Over’ page on Watercare’s 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. *Curved watermains require Watercare approval and may not be allowed due to pipe joint stresses or operational constraints.*

6.3.10 Pipe selection

The selection of the appropriate pipe material, sizes, and *pressure* classes shall be based on system demands. See section 6.3.10 for Watercare's minimum pipe pressure ratings.

6.3.10.1 Standard pipe sizes

The principal main sizes shall be standardised as DN 100, 150, 200, 250 nominal diameters only.

Watercare follows standard nominal pipe sizes to ISO standards. When larger pipes are required, contact Watercare.

6.3.10.2 Minimum pipe sizes

Minimum pipe diameters shall be as follows, where DN is the nominal pipe diameter (*for CLS or PE use nominal bore size instead of DN*):

- (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) *DN 100 minimum for stream, 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.*

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 and for fittings PN16 on water reticulation mains. For some pipe materials Watercare require greater minimum pressure class. Designers shall verify Watercare's minimum requirement before specifying the required pipe PN. Refer to Watercare's material supply standard.

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 designated pipe PN.

6.3.10.3.4 Pumped mains

When booster pump stations are considered, the requirements shall be reviewed with Watercare in the first instance. Telemetry requirements are area specific and will be clarified during the process of assessing the design. For general guidance refer to Watercare's Water pump station standard and drawings for networks (document number DP-15 and DW04).

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 Watercare's material supply standards.

C6.3.10.4

When steel watermains are considered, early discussions with Watercare should include the installation of a cathodic protection system. Cathodic protection systems require ongoing monitoring; suitable arrangements for test points need to be considered.

6.3.11 Fire flow

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

Any shortfall between the fire flow required by the proposed development outside the Watercare minimum design supply pressure and flow 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 and the minimum design as stated in section 6.3.5.5 and 6.3.5.10. 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 of special fire protection services 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*, 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. Also see section 6.3.8.12.

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, *ductile iron 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) *where pipe flexibility alone is not adequate to accommodate movement. Where structures are closely spaced such as at pump stations, base isolation of the area may be considered where minor actions are expected. Connecting to the base isolation area requires a flexible connection.*

C6.3.12.2

Guidance for pipe seismic design method and philosophy can found in "Seismic Guidelines for Water Pipelines", American Lifelines Alliance, 2005, or "Guidelines for Seismic Design of Buried Pipelines", NICEE, 2007, or Underground Utilities – Seismic assessment and design guidelines, Water NZ.

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. *Consideration must be given to the future state or possible interactions with the trench that could affect the bedding material's ability to continue functioning as designed, for example very fine self-compacting material may affect the cost of retaining the trench during replacement or other construction work near the trench.*

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 New Zealand Geotechnical Database; <https://www.nzgd.org.nz>. 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. For indicative information refer to <http://data.gns.cri.nz/geology>. Geo-professionals are to satisfy themselves of the correctness of the information and apply current knowledge when meeting any such special requirements.

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*), see section 6.3.3A;
- (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 *effects on materials*.

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

Refer to section 6.3.8.12 for general requirements.

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.

Refer to Watercare's General Civil Construction standard for acceptable trenchless installation methods and its specific requirements.

The designer's project execution plan shall detail the pipe structural limitations for the intended construction method, the location of access pits and exit points and include a risk assessment to other services, abutting surface and underground structures.

C6.3.12.9

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

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 and up to a maximum of 1000mm;*
- (b) *Where located in the front 1m width of the berm (next to the road surface) the minimum depth is 900mm;*
- (c) *In carriageways a minimum 900mm up to a maximum of 1200mm; or*
- (d) *As otherwise agreed or required by Watercare and the Corridor Manager.*

6.3.12.10.2 Minimum trench width

Pipe trench width design shall be based on pipe structural calculations and shall maintain minimum clearances from other services. See section 6.3.9.

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. *Refer to the Code of practice drawing set, document number DW02.*

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 *the Code of practice drawing set, document number DW02*.

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

C6.3.12.11.1

The designer should consider the suitable location mechanical joints for maintenance, access and inspection. Under some scenarios mechanical fittings are often not appropriate and may be declined by Watercare.

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.

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. *The use of certain mechanical joint for ordinary pipe joints are prohibited, see advice note C6.3.12.11.1. Refer to Watercare's material supply standards for acceptable products.*

6.3.13 Reservoirs and pumping stations

Where reservoirs are required, refer to *Watercare* for its specific requirements. *For guidance on pump stations see DP-15 and drawing set DW04.*

6.3.14 Valves

6.3.14.1 General

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

Valves shall be provided:

- (a) *Both sides 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.*

Valves shall be typically flanged jointed and fully supported. No loads shall be passed onto the pipe.

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 (normally shut) – red*

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.

6.3.14.3 Gate valves and sluice valves

- (a) *Sluice valves shall be anti-clockwise closing with a false dolly attached and shall be installed on principal mains;*
- (b) *Peet valves shall be clockwise closing and shall be installed on rider mains;*
- (c) *Toby valves shall be clockwise closing and shall be 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.		

For larger pipe diameters than those listed in table 6.6 consult with Watercare to identify any specific operational requirements.

6.3.14.3.2 Branch mains

Stop valves shall be located on branch mains adjacent to the through water main. *See figure 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.

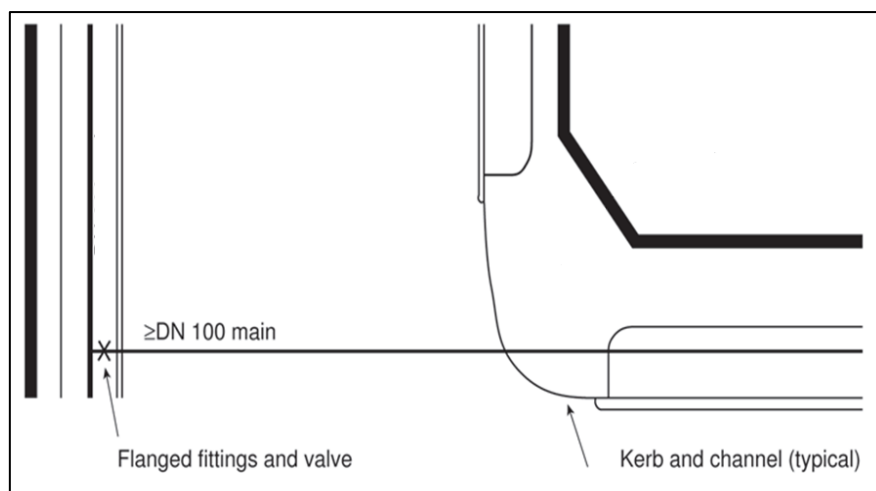


Figure 6.2 – Branch valve adjacent to main

6.3.14.3.3 District zone valves

District zone boundary valves and hydrants shall be in a paired configuration with a standard fire hydrant located between them. See figure 6.3. 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 boundary valves on rider mains shall be subject to specific design in consultation with Watercare to identify operational requirements.

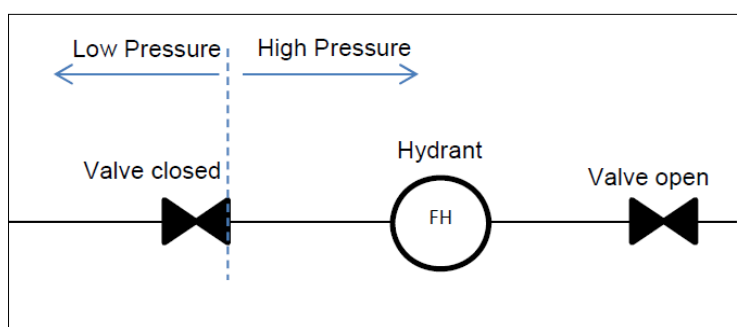


Figure 6.3 – Valve and hydrant combination for district zone dividing valves

A complete detail is available in the code of practice standard drawing set (document number WD02).

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.

6.3.14.3.4 Secure service connections

Additional stop valves may be *required* at a service connection to a customer *needing* 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.

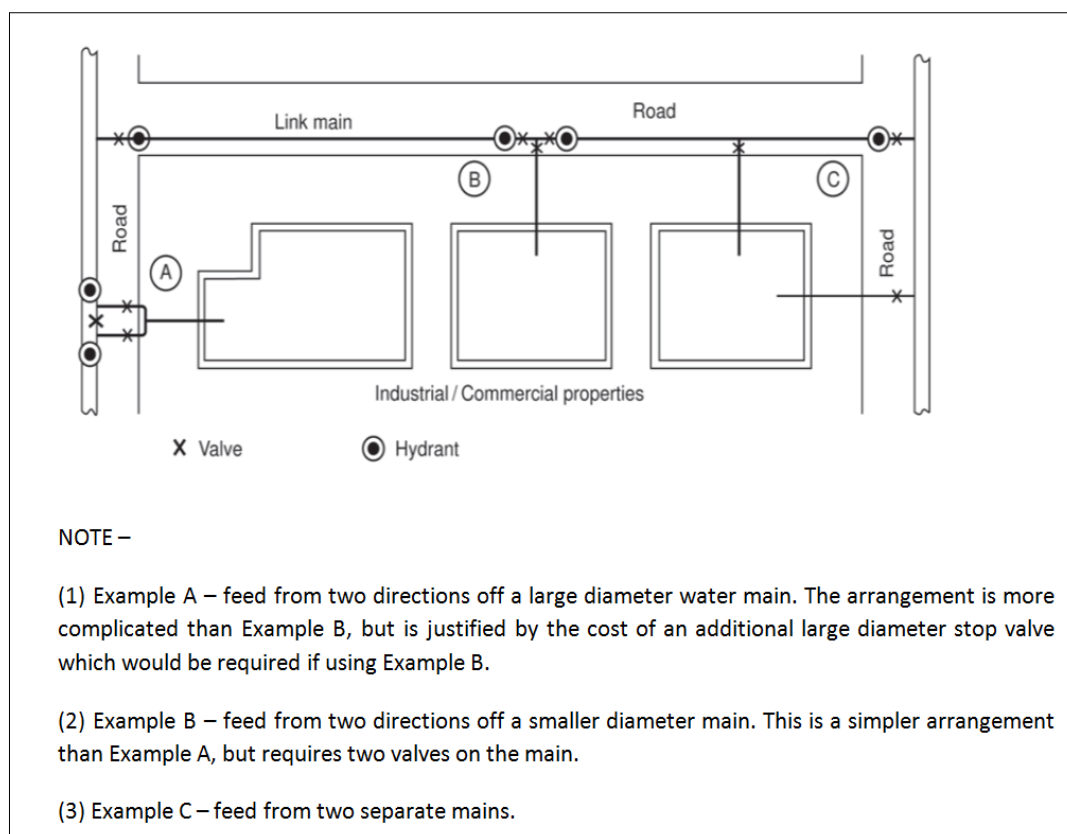


Figure 6.4 – Secure connection

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 *code of practice*. 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. *Watercare may require the PRV site to be monitored or controlled through its telemetry system.*

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.

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.

Scours and pump-out branches shall incorporate appropriate measures to prevent *back-siphon* 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;
- (c) Not be subject to inundation; *and*
- (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.

Refer to section 6.3.6.2.4 for backflow prevention requirements and section 6.3.16 for metering requirements of private fire supplies.

6.3.15.2 Hydrants for firefighting

The spacing of hydrants for firefighting 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 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.

6.3.15.3.1 *Marking of fire hydrants*

All hydrant boxes and markings shall be painted with yellow road marking paint.

For hydrants on or adjacent to sealed roads additional marking shall include:

- (a) An isosceles triangle of solid colour with sides 600mm and base 450mm. The triangle shall be located on or near the centre of the carriageway, with the apex pointing towards the hydrant.*
- (b) 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 road marking paint.*
- (c) A circle 1.2m outside diameter and line width of 100mm around the hydrant box. The circle shall be provided 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).*

Marking shall be either b) or c), not both.

For hydrant on or adjacent to unsealed roads additional marking shall include:

- (d) An NZTA Type C marker post, replacing the two yellow reflectors with blue and repeated on the reverse side. The post shall be located as for the standard edge marking posts in relation to the trafficable portion of the carriageway and in line with the fire hydrant.*

In areas with poor visibility at night, blue raised reflective pavement markers shall be installed where deemed suitable. The reflective marker shall be bi-directional and placed close to, and on the fire hydrant side of the center of the roadway, near the base of the yellow triangle marked on the road.

6.3.15.4 Hydrants for reticulation system operational requirements

Additional to firefighting 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 *air valves* (AVs) are not installed;
- (b) Localised low points on water mains 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

Air valves 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 *and high points* to facilitate maintenance activities such as cleaning of water mains.

6.3.15.5 Hydrants at ends of mains

If a scour is not provided, a hydrant shall be installed *at* the end of every main DN ≥100.

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 water mains shall not be completed without Watercare's approval.

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

Connection of water mains to the public system may only be made with demonstration of compliance with Watercare's Code of Practice for Disinfection of Water Systems, document number COP-04 and all the testing requirements of Watercare's construction standards have been fulfilled.

6.3.16.2 Property service connections

The general requirements for service connections are as follows:

- (a) *Property service connections shall have suitable backflow prevention installed. See section 6.3.6.2.*
- (b) *The point of supply is as defined under section 6.6.*
- (c) *Only one service connection from the public watermain is allowed per property; and*
- (d) *Superlots with over 50 dwelling units where pipework will remain private should be fitted with a second service connection if practical, but should ensure sufficient fire-flows are met, the supplies are fitted with backflow prevention and accurate metering over a wide range of flows is installed. The internal layout design should make provision for flexible system isolation.*

C (d)

The 50 dwelling unit threshold is to support Watercare customer service in the event of water outages. A second connection for larger lots is at Watercare's discretion and should demonstrate:

- a. *Zone classification is not affected*
- b. *Pressure zones are not interconnected*
- c. *Isolation for maintenance and emergencies is not adversely affected*

- (e) *Mixed land use type will require that the service connection be separately sized and metered between commercial and domestic use.*
- (f) *Multiple private connections to dwellings on a single property, or where a subdivision does not provide a dwelling with direct public road frontage, shall be supplied through a bulk site meter under a body corporate (or similar legal instrument) arrangement or with a manifold meter bank arrangement associated with the property. Private connections are made from the bulk supply meter or manifold.*
- (g) *A meter bank shall not house more than six individual water meters. Where more than six individual meters are required for dwellings located along a right-of-way or private road, a bulk site meter installation shall be used in conjunction with private check meters, and a body corporate (or similar legal instrument) arrangement.*
- (h) *Right-of-ways or private roads greater than 135m from the public watermain to the furthest dwelling must have a bulk site meter arrangement in conjunction with private check meters, and a body corporate (or similar legal instrument) arrangement.*

C6.3.16.2

A property may have multiple dwellings, or separate living units constructed within dwellings. Metering is required to the individual separable unit. The bulk site meter arrangement has a reduced maintenance obligation on individual housing units and should be managed through a body corporate (or similar legal instrument), or in the case of a multi-storey apartment building a building management arrangement. Watercare will provide service for separate meter readings and individual billing to customers.

6.3.16.2.1 *Service line connections*

The service connection onto the watermain is made with a tapping saddle.

- (a) Connection saddles, pipe and pipe fittings shall be as required by Watercare's material supply standards. Acceptable service connection pipe materials are:
 - i. Polyethylene in PE80 or PE100
 - ii. Ductile iron
 - iii. Copper*
- (b) The property service lead shall be minimum 20NB. The standard sizes shall be 20mm, 25mm, 32mm, 50mm, 80mm, 100mm and 150mm;*
- (c) The service connection shall be tapped from the top of the watermain, rising directly vertical to a minimum cover of 450mm. A 90° elbow shall be installed at the top of the vertical tapping and the lead graded to a cover of maximum 250mm at the meter box adjacent to the property boundary.*
- (d) Where a service connection passes under a driveway, it shall be installed through a duct of suitable strength to support the driveway loading;*
- (e) The isolation valves must be of an acceptable type. Quarter turn valves are generally not accepted for isolation;*
- (f) Manifolds must be to Watercare standard design or approved equivalent. See the Code of practice's water drawing set document number DW02.*

C6.3.16.2.1

When the tapping is made onto a PE pipe the use of an electrofusion fitting is preferred.

6.3.16.2.2 *Fire suppression connections*

All private fire supplies shall be metered. Fire suppression supplies must be sized by a qualified Fire Engineer.

C6.3.16.2.2

Whilst Watercare does not bill the customer on fire supplies, the purpose of a watermeter is to identify leakage or unauthorised use of the fire supply water within the private property.

6.3.16.2.3 *Metering*

Applications for new water meters must be made to Watercare.

Watercare retains sole ownership of water meters and bulk site meters at the point of supply and is responsible for the ongoing maintenance of associated fixtures and fittings.

Watercare is not responsible for any private check meters.

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 premises. Where the property is managed by a legal entity such as a body corporate a bulk site meter at the boundary is required.

Meters must be located in the road reserve next to the property boundary and be readily accessible at all times. Meters shall not be installed in confined spaces. Properties, such as in the CBD, where meters cannot be located within the road reserve must be approved by Watercare. The design shall take into consideration the following:

- (a) The shortest possible pipe length inside the property and must be readily accessible for maintenance*
- (b) Each meter must be readily accessible for reading, maintenance or replacement (boxes need to be sized appropriately)*
- (c) Meters must not be located inside actual units/apartments or within ceiling cavities;*
- (d) 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. The remote reading device must be compatible with Watercare devices.*

Meters, excluding private check meters shall only be installed by Watercare's approved contractors in accordance with Watercare's standard details.

6.3.16.2.4 Water meters

- (a) Water meters shall comply with the requirements of Watercare's material supply standard.*
- (b) The meter size for the development will be determined by Watercare. In-line meter on fire supplies must be endorsed by the fire design engineer. Demand flow requirements must be provided when the water connection is applied for.*
- (c) For separate fire suppression up to 50mm, a full bore in-line meter shall be installed (refer drawing WS21).*
- (d) For combined fire suppression and water meter supplies a full bore in-line meter shall be installed. Depending on the watermain size a bypass meter may be required for low flow accuracy. (Refer drawing WS24).*
- (e) For separate fire suppression with pipe supply diameters larger than 50mm Watercare will advise whether a bypass meter or full bore meter is required (Refer to drawings WS25 and WS26).*
- (f) Domestic and commercial use within a property shall be separately metered. Metering shall be combined for fire suppression and commercial with a separately metered domestic supply (Refer to drawing WS26).*
- (g) Appropriate backflow prevention shall be installed for (c), (d), (e) and (f) above.*
- (h) 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 data is unavailable for any period of time.*
- (i) Watercare reserves the right to manage connections to its assets and may require that privately owned equipment connected onto the meter be removed at any time.*

6.3.16.2.5 Coupling to meters

- (a) Fittings, couplings and pipe componentry shall comply with the requirements of Watercare's material supply standards and the arrangements as shown in the DW02 drawing set.*
- (b) The minimum upstream and downstream connection clearances of the meter manufacturer shall be allowed for.*

6.3.16.2.6 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, and AS/NZS3500. Quick-closing valves of any kind or any other equipment that may cause pressure surges being transmitted must not be used on any piping downstream of the service connection without a design to prevent the surge being transferred.

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 DN100, particularly in no-exit roads, should be considered (see figures 6.6 and 6.7).

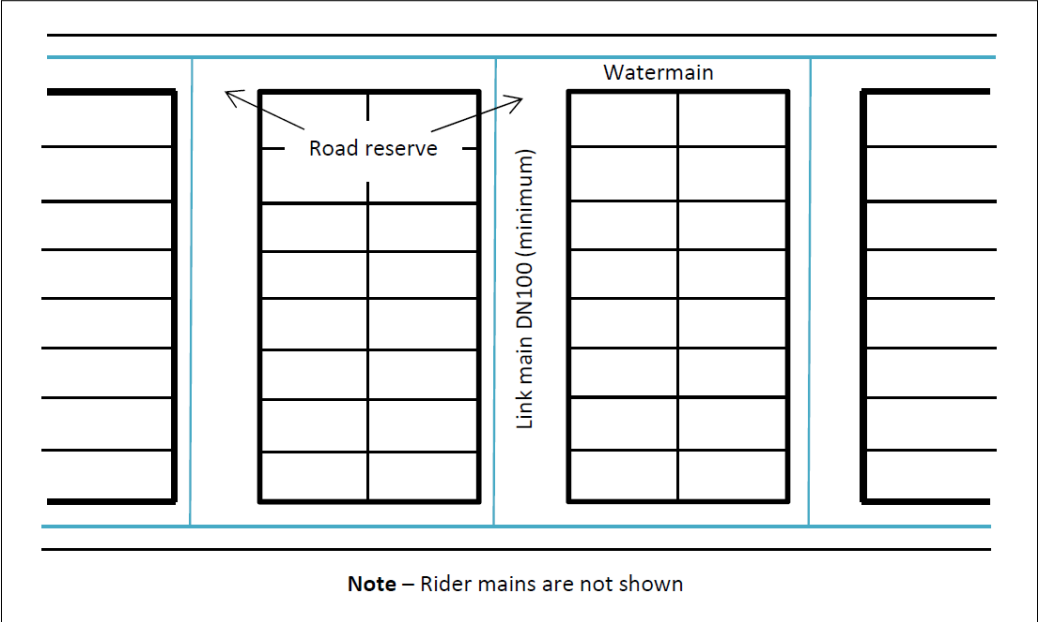


Figure 6.6 – Elimination of termination points

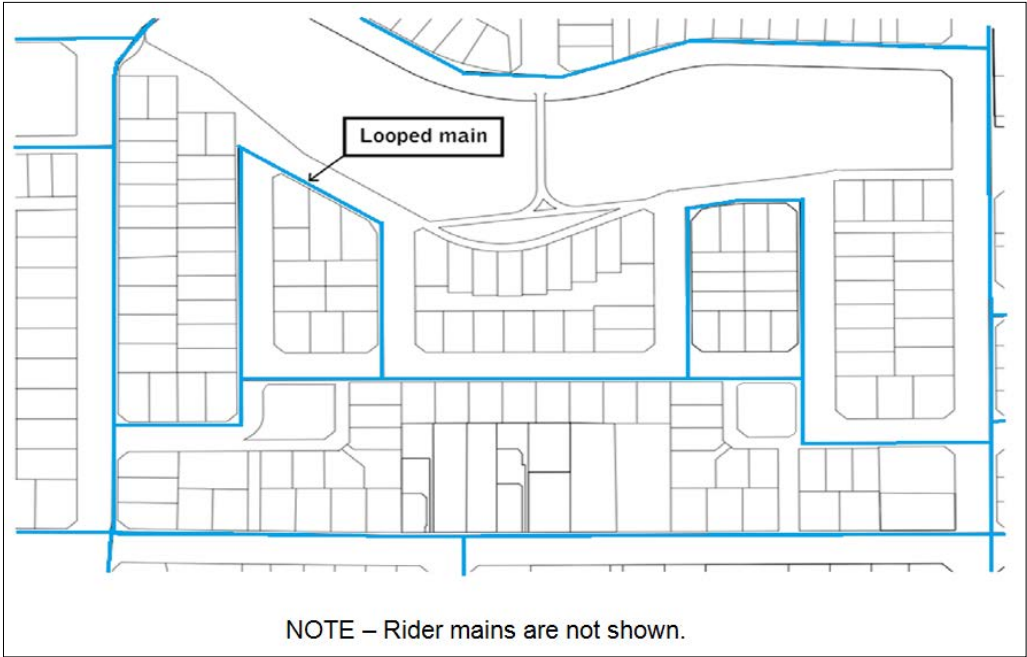
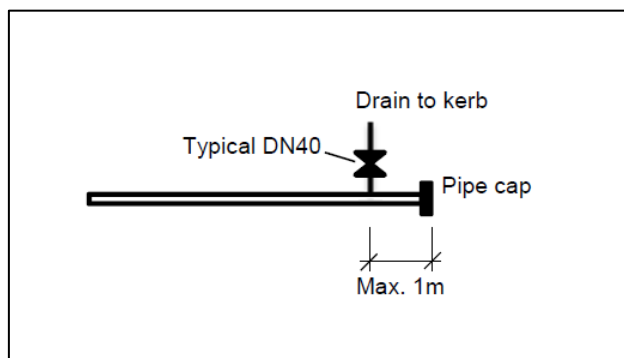


Figure 6.7 – Looped principal mains

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 valve 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 infrastructure, including all private connections, require approval from Watercare, the Auckland Council and where any of the work falls within state highway road reserve, also requires prior approval of NZTA.

6.4.2 Information to be provided

Applications for design approval shall include the information outlined in section 4 of this CoP and the information as required by Chapter 1 of the Auckland Code of Practice for Land Development and Subdivision.

6.5 Construction

A pre-construction meeting shall be arranged with Watercare prior to construction starting. Watercare may at its discretion waive the requirement for a meeting. Construction work shall comply with Watercare's construction standards, refer to section 3.

The designer shall recommend the minimum level of professional supervision required for the various aspects of construction for review with Watercare. Watercare reserves the right to review the recommendation and to propose a higher level of supervision based on a risk assessment that includes contractor competence, asset risk and specific methodology. For more information refer to Watercare's compliance statement guidelines.

The construction deliverables shall include but are not limited to:

- a) *Construction and environmental management plan that includes a schedule of activities and a quality management plan - to be provided prior to construction starting*
- b) *Current type test certification of material, maintenance information and transfer of warranties*
- c) *Completed quality control records*
- d) *Completed test certificates*
- e) *As-built information and drawings*
- f) *Operation and maintenance manuals*
- g) *Construction compliance statement*
- h) *Commissioning records and completion report.*

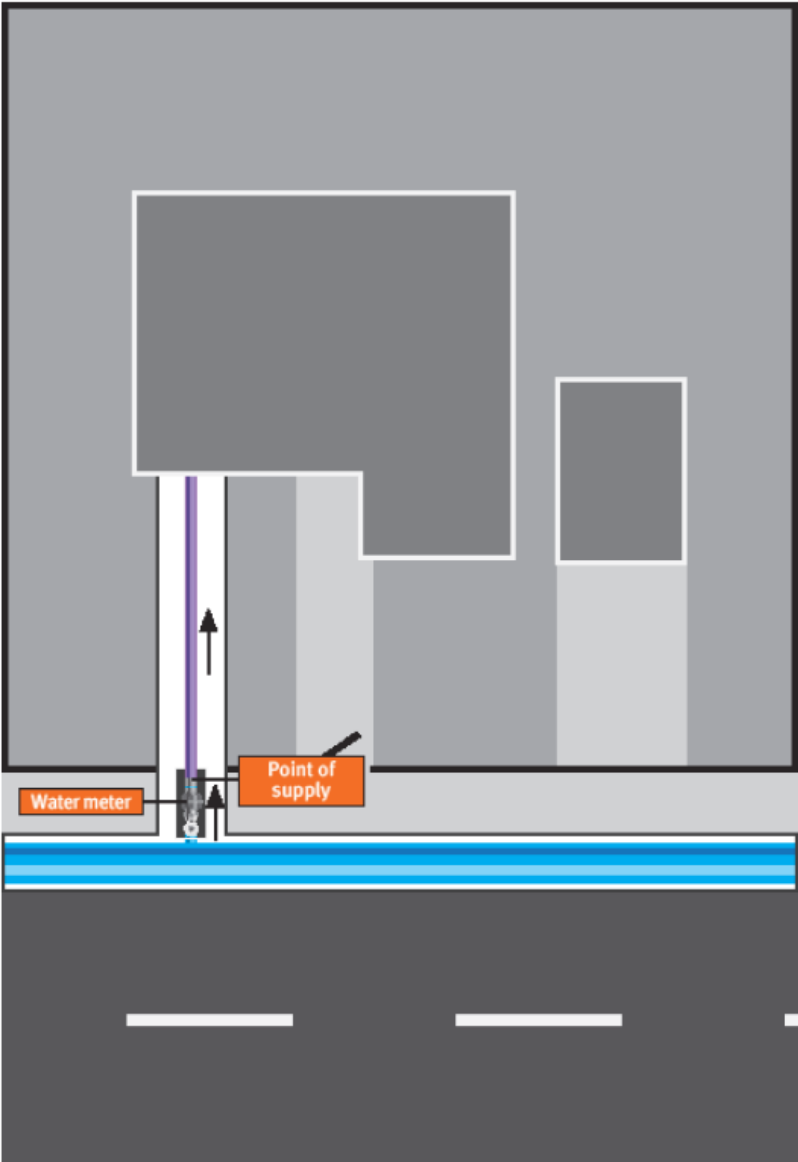
Connecting a network extension or property to the existing water system requires Watercare authorisation following demonstration of compliance and to be completed by Watercare. Refer to Watercare's Code of Practice for Disinfection of Water Systems, document number COP-04.

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

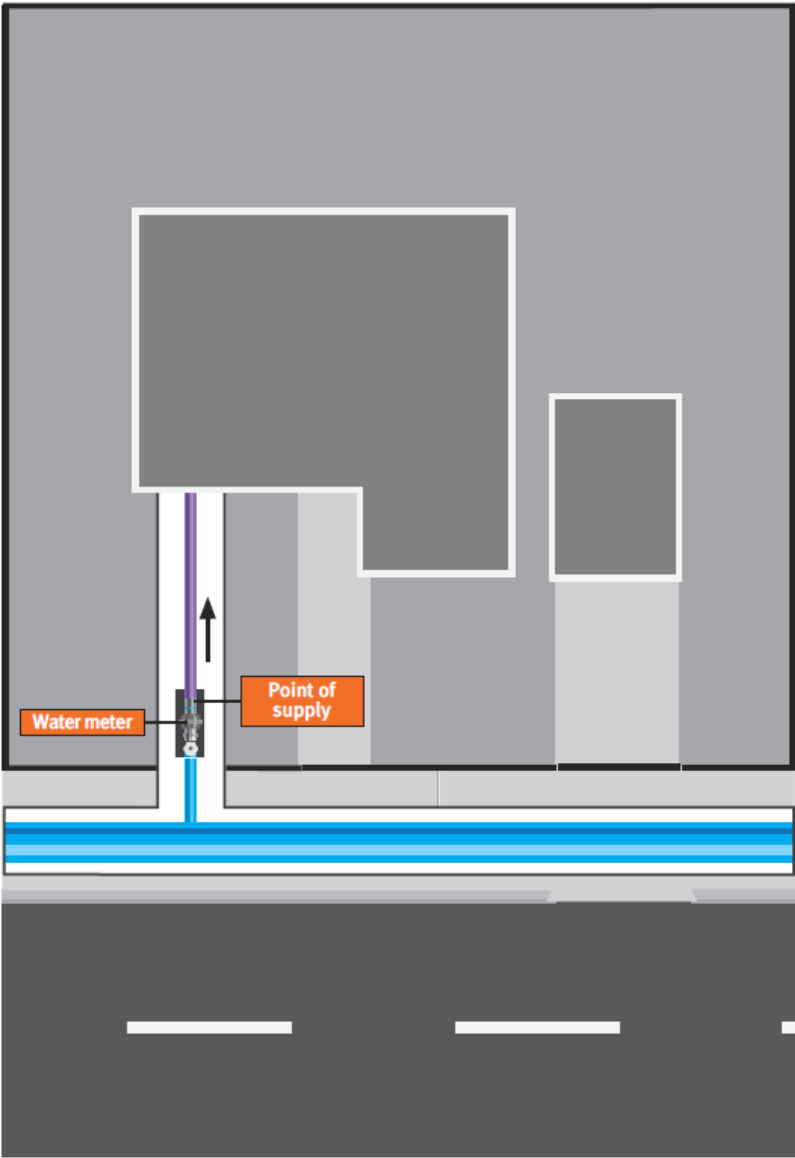
- a) Meter at the property boundary in the road reserve. The point of supply is at the end of the last fitting of the meter.



KEY

-  Your pipe
-  Our pipe
-  Water flow

- b) *The meter is situated inside the property boundary. This option is not available to new dwelling units but considered by application for commercial applications in areas such as central business districts.*



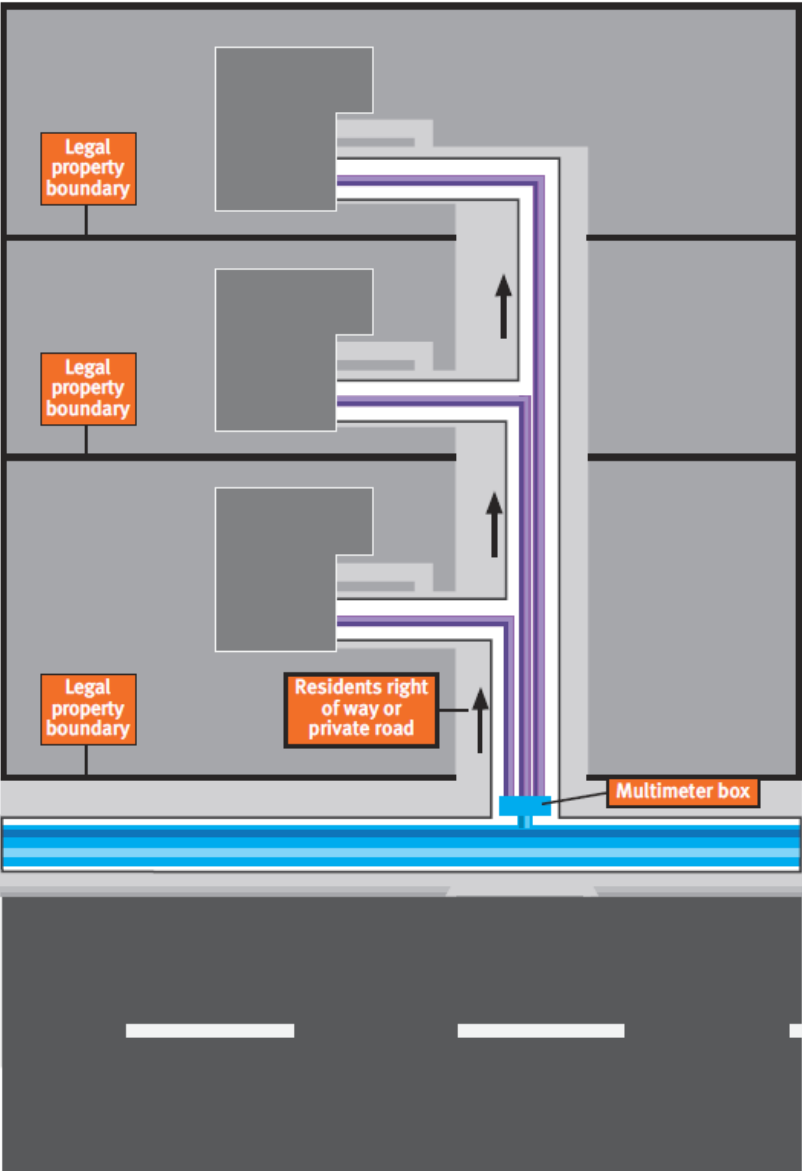
KEY




Your pipe

Our pipe

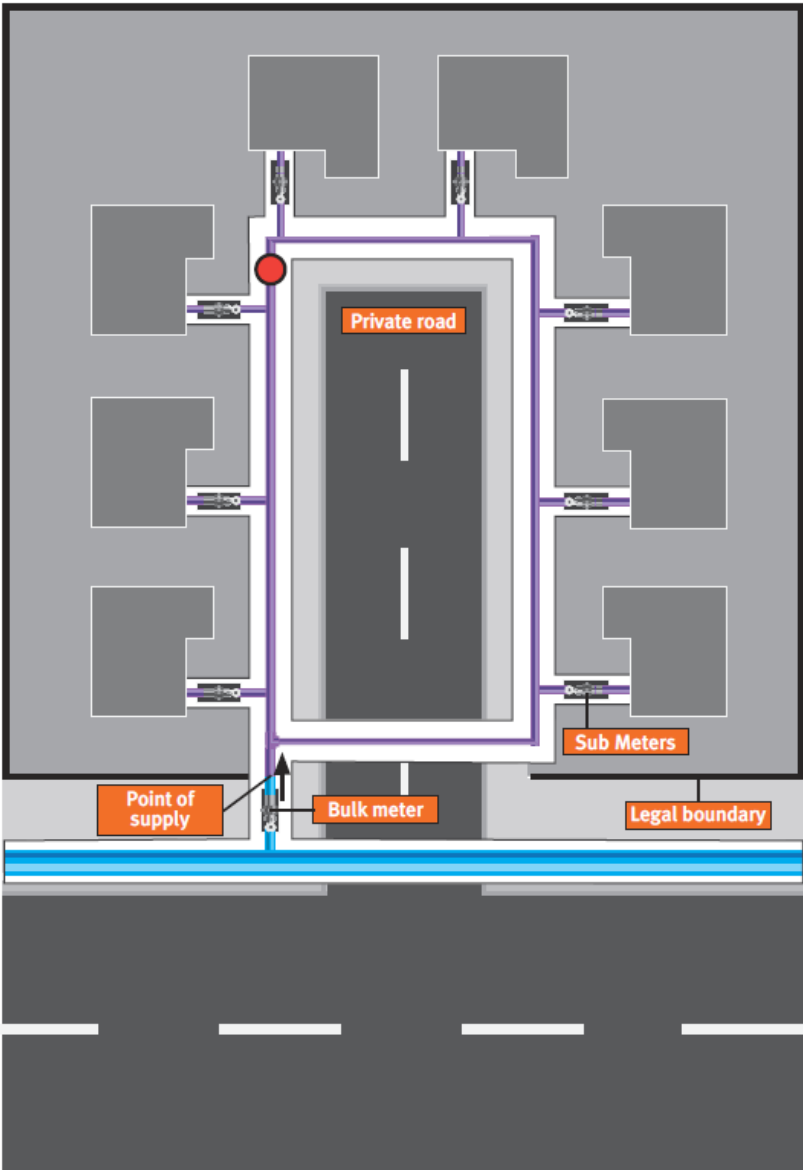
Water flow





- c) *Multi-meter connection from the public main. Up to six properties connected into a single larger meter box. The point of supply is at the end of the last fitting of each of the individual meters.*



KEY
 **Your pipe**
 **Our pipe**
 **Water flow**

- d) *Connections to properties that does not front a public road, but instead a private right-of-way or private road is supplied at the entry of the drive with a bulk meter. The point of supply is at the last fitting of the bulk meter. The private pipework is owned and operated under a legal instrument such as a body corporate or cross lease.*



- KEY
-  Your pipe
 -  Our pipe
 -  Water flow
 -  Fire hydrant