SINGLETON COUNCIL

TECHNICAL SPECIFICATIONS – Water Infrastructure

2023

DOCUMENT CONTROL

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1.0	06/2018	Initial Draft	D. Tynan	K. Hardy	Elected Council
2.0	11/2020	First Review	P. McKoy	K. Hardy	Elected Council
3.0	09/2023	Second Review	P. McKoy	K. Hardy	Elected Council

CONTENTS

1 INTRODUCTION

This document outlines Singleton Council's required practice for design and construction of water reticulation.

It is in no way a comprehensive "Design Manual" and it is intended to be read in conjunction with and as a supplement to:

- Water Services Association Australia WSA 01 - 2004 Polyethylene Pipeline Code
- Water Services Association Australia WSA 03 – 2011 Water Supply Code of Australia
- AS2200 Design Charts for water supply and sewerage
- AS/NZ 3500 Plumbing and Drainage Code
- Plastics Industry Pipe Association (PIPA) POP Guidelines
- NSW Streets Opening Conference Guide to Code and Practices for Streets Opening

Council's required practice for design and construction of sewer reticulation is contained within Technical Specifications – Sewer Infrastructure.

Engineering Guidelines for all other aspects of Subdivisions and Developments are included in Council's Engineering Specifications document.

1.1 Definitions

The Engineer Refers to the Director Infrastructure and Planning, or their appointed representative.

Council Refers to Water and Sewer Group within Council.

The Developer Refers to the owner or their agent who has applied for the development consent. The Developer shall be represented by a nominated person with authority to make decisions, usually the Project Manager. For capital works projects the Developer refers to the Contractor.

The Contractor Refers to the party engaged by the Developer to carry out works for the Developer, to Council's requirements.

Approval Refers to acceptance of materials or treatments determined by the Engineer or in accordance with the relevant standards.

Asset Owner Refers to Council when referring to water assets.

2 GENERAL REQUIREMENTS

2.1 Discussion of Requirements

It is recommended that the Developer consult with the Engineer prior to commencement of design and construction to discuss the following requirements:

- conditions of consent
- local conditions

- intended design
- existing system capacity
- capacity requirements for future development
- construction methods and materials to clarify any points regarding this specification

Design and construction is to be carried out in accordance with this specification current at the time of approval of the engineering plans. Should the approved engineering plans be more than 2 years old, the design is to be resubmitted to Council for approval to ensure that the construction works are in accordance with Council's Specification current at that time.

Water systems shall be designed to meet the requirements of Australian Drinking Water Guidelines.

2.2 General Design

This specification is for the design, supply and delivery of water pipes water pump stations, service reservoirs and the construction of water reticulation, property connections and network infrastructure.

All works are to be carried out in accordance with this specification, the regulations of the relevant statutory authorities and manufacturers recommended procedures where appropriate.

2.2.1 Design Philosophy

The overall objective of system planning, and design is to provide a water supply service that meets Council's obligations under its operating license and customer contract for water quality, continuity of supply and pressure at the connection point.

Council requires that all allotments, within designated water supply area, including areas set aside for recreation, be provided with a reticulated water supply sufficient for both domestic and firefighting purposes consistent with the service provision capacity of the particular water supply scheme. Note: The Jerrys Plains Water Supply System does not provide firefighting capacity.

The design shall ensure that the water transfer, distribution, and reticulation systems are functional and comply with this specification.

The design shall provide a water supply to each property by way of a:

- connection point to a water main; or
- pre-laid property service from a water main.

The design shall address:

- Council policies, customer charters and contracts;
- the hydraulic adequacy of the system;
- the ability of the water system to maintain acceptable water quality;
- the structural adequacy of system components for the design life;
- the operational adequacy of system components;
- WHS requirements;

- environmental requirements;
- the environmental and community impact of the works;
- the “fit-for-purpose” service life for the system by consideration of maintenance needs of system components;
- minimising the life cycle costs;
- each component’s suitability for contact with drinking water, disinfectant demand and biofilm formation rate;
- each component’s resistance to internal and external corrosion or degradation;
- capacity requirements for future development; and
- automatic and reliable operation with minimal operator interaction.

In certain cases where Developers are instructed by Council to construct infrastructure that caters for future loading over and above their own development, Council shall reimburse the difference in costs between constructing the larger components and the size required to service the development. For further details please refer to Council’s Water Supply Services Policy.

The Checklist – Water Reticulation Design in **APPENDIX A** shall be completed and submitted with the Drawings. Should any of the items included in the checklist be outstanding or not to a standard acceptable to Council, the Drawings shall be returned to the developer for amendment. Council shall only commence review of the design drawings once it is satisfied that all the requirements of the checklist have been met.

Design drawings and calculations shall be submitted to Council for approval. Information to be included in the design drawings is detailed in **APPENDIX B** – Information to be shown on Water Reticulation Drawings. The completed checklist shall be submitted with the Drawings.

2.2.2 Servicing Philosophy

All design elements submitted must comply with the Servicing Strategy approved by Council as part of the conditions of development consent issued for the subject development, as appropriate.

Changes to the approved Servicing Strategy must be approved by the Engineer prior to the submission of plans and associated documentation.

2.2.3 Design Life

All water supply distribution systems shall be designed for a nominal asset life of 100 years minimum without rehabilitation. Some components such as pumps, valves, metering and control equipment may require earlier rehabilitation or replacement. The design shall include consideration for future maintenance and replacement of these components. Required design life for water supply distribution components are as listed in the following table:

Item	Minimum design life years
Water Main	100
Reservoirs	50
Pumps	20
Valves	30
SCADA	15

2.2.4 Mine Subsidence

Where the water main is to be laid in areas identified as likely to be influenced by mine subsidence, detail measures are to be taken to ensure the integrity of the main are to be detailed on the Design Drawings.

Pipeline construction in declared mine subsidence areas requires consent of the Mine Subsidence Board. The design shall be submitted to the Mine Subsidence Board for approval.

The expected strains on a pipeline resulting from potential subsidence shall be addressed in the design using area-specific anticipated ground strains available from the Department of Mines (refer www.minesub.nsw.gov.au).

Upon receipt of the Mine Subsidence Board's approval of a design, the Design Drawings shall be notated with conditions specified by the Board and the plans endorsed as follows: "Designed in accordance with the Mine Subsidence Board's approval dated ……, File No ……."

NOTE: In many cases, standard pipe lengths may accommodate subsidence- induced strain. Adoption of special design features, such as short pipes and/or deep entry sockets, provides additional strain capacity.

2.2.5 Other Service Providers

Where proposed water main crosses other services, the depth of those services shall be determined as part of the design. Details of underground services shall be obtained from the Asset Owner.

During the design phase a services location survey of the proposed pipeline route is to be undertaken to determine the proximity of other services to the water main. Where other services are parallel to the water mains and these intrude into the water main allocation, the designer shall consult both the Engineer and the other service provider. Actions to be taken shall be decided on a case by case basis.

Pipelines and services shall cross at 90° if practicable, but not less than 45°.

Location of Services

Verify the exact location of all services which may be affected by construction activities. The Asset Owner must be notified if services are affected in any way.

Road, Rail and Creek Crossings

Pipeline crossings of roads, railway lines, creeks and underground services shall, as far as practicable, be at right angles. Pipelines shall be located and designed to minimise crossing restoration and maintenance of the main in the crossing. Specific approval may be required when crossing main roads and rail infrastructure. The design should consider extending conduits beyond the boundaries of rail corridors to facilitate maintenance works without interruption of train services.

Before You Dig Australia

Before You Dig Australia, BYDA is a free service which facilitates the provision of asset plans and information to anyone working in and around infrastructure assets directly from owners of utility services. Enquiries may be made online via their website at Before You Dig (1100.com.au) or by phone at 1100. Nevertheless, hand excavation (pot-holing) or non-destructive digging is recommended to determine the exact location and depth of underground obstructions during design and again immediately prior to excavation.

Underground services and other obstructions such as power conduits / cables, gas mains, drains, telecommunication conduits / cables, oil / petrochemical pipelines and the underground portions of surface obstructions (tree roots, pits, etc.) may affect the proposed alignment of water main components both in plan and in level.

Note: Council's stormwater assets are not provided on BYDA plans. Location plans of these assets should be requested through Council's Customer Service Centre.

Shared Trenching

Shared trenching is not permitted unless approved by the Engineer.

Protection and Maintenance of Services

Protect and maintain existing services to the satisfaction of the Asset Owner including, if necessary, relocation, temporary diversion, or support of the service.

Clearance Requirements

Pipeline clearances from other service utility assets shall be in accordance with Asset owners requirements. Guidance on clearances is provided in Water Supply Code of Australia - WSA03-2011-3.2.

Repairs of Services

Any damage to a Council owned asset must be reported immediately to Council. Council reserves the right to recover compensation for loss or damage and repair costs to any of its assets irrespective of provisions of plans or undertaking location on site. Repairs made to Council assets are to be carried out by **Council employees or Council approved contractors only**. A minimum charge shall be applied to any repairs carried out, refer to Council's Annual Fees and Charges available at Fees and Charges | Singleton Council (nsw.gov.au).

If a service is damaged during execution of the work, subject to Asset Owner approval, arrange or perform repair to the satisfaction of the Asset Owner. Obtain from the Asset Owner a certificate stating that the repair has been carried out to their satisfaction.

If the service is not under the control of an authority and the Owner cannot be located within a reasonable time, report the damage, and arrange or perform repair to an approved standard. Do not backfill, cover up or make the repair inaccessible prior to obtaining approval.

Disused Water Mains

Unless noted otherwise on the Design Drawings, cap all disused pipelines at each end to prevent ingress of seepage water. Remove and dispose of all redundant surface and other fittings and marker plates as advised.

Do not commence any excavation until all equipment and materials necessary to make the excavation safe are on site and available for use. This includes any necessary fencing and barriers, as well as trench support systems and signage.

Conduct a site hazard and safety assessment prior to commencement of any excavation to identify all potential hazards and safety measures required.

Building in the Vicinity of Trunk Water Mains

Council's Building in the Vicinity of Sewer and Trunk Water Mains Policy and associated guidelines provide details of circumstances when building, filling or excavating adjacent to or over existing trunk water mains will or will not be approved and the minimum requirements if work is approved. The Building in the Vicinity of Sewers and Trunk Water Mains Policy is available on Council's website.

2.2.6 Trenchless Technologies

Trenchless technology may be adopted for alignments passing through:

- Environmentally sensitive areas;
- Built-up or congested areas to minimise disruption and reinstatement; and
- Other areas not suitable for trenching eg railway and freeway crossings.

Excavation by methods such as directional-boring, thrust-boring, micro-tunnelling and pipe-jacking may be used in order to lessen the impact of the works on existing pavements and trees. For further information refer to the Australasian Society for Trenchless Technology (www.astt.com.au) and relevant Australian Standards and/or Authority requirements. All process details including location of access pits and exit points shall be documented and shall address:

- Achievement of clearances from services and obstructions.
- Depth at which the water main is to be laid to ensure minimum cover is maintained.
- Pipe support and ground compaction.
- Required alignment tolerances.

2.2.7 Associated Structures

Detailed engineering drawings shall be provided for all structures such as reservoirs, pumping stations and PRV pits proposed for construction in conjunction with water supply works. These drawings shall be submitted to the Engineer for approval.

Structures shall be designed in accordance with all relevant Australian Standards.

2.3 System Planning

2.3.1 Demands

Water supply components are to be sized to cater for proposed future development in accordance with Council's Integrated Water Cycle Management Plan or further developed strategic planning document. Council's current reticulation analyses shall be used as a guide in assessing size requirements.

Where practical, estimates of demands shall be based on:

- Available long-term consumption records for similar consumer groups in the region
- Relevant historical records of system demand.

The planner shall also consider:

- Seasonal demand type variation
- Typical distribution over a 24 hour period (diurnal pattern)

Assessment of future demands shall be based on historical records or where not available, the typical demands listed below.

An allowance of 15% ADD shall be made for unaccounted water. Peaking factors shall not be applied to unaccounted water.

Category	ADD Kl/d	Peak Day Factor	Extreme Day Factor
Residential House	0.7	2.25	1.15
Rural House	0.96	2.25	1.15
Flats / Units	0.4	2.25	1.15
Industrial - Light	11.5/ha	1.2	1.15
Industrial - Medium	26.5/ha	1.2	1.15
Industrial - Heavy	68.5/ha	1.2	1.15
Commercial	11.5/ha	1.2	1.15

PDD = ADD x PDF

EDD = PDD x EDFTypical diurnal demand patterns are provided below.

Time	Domestic Average Day	Domestic Peak	Industrial	Commercial	Parks and Gardens	Institutions	Clubs, Hotels and Motels	Schools and Colleges	Un-accounted
0:00	0.24	0.48	0.81	0.18	0.18	0.45	0.25	0.20	1.00
0:30	0.19	0.45	0.79	0.14	0.14	0.44	0.25	0.20	1.00
1:00	0.18	0.42	0.78	0.11	0.11	0.43	0.25	0.20	1.00
1:30	0.16	0.40	0.76	0.10	0.10	0.42	0.25	0.20	1.00
2:00	0.16	0.37	0.75	0.11	0.11	0.41	0.25	0.20	1.00
2:30	0.16	0.38	0.75	0.14	0.14	0.41	0.25	0.20	1.00
3:00	0.16	0.38	0.75	0.15	0.22	0.42	0.25	0.20	1.00
3:30	0.17	0.32	0.75	0.17	0.35	0.43	0.25	0.20	1.00
4:00	0.17	0.27	0.75	0.19	0.64	0.45	0.25	0.20	1.00
4:30	0.18	0.28	0.75	0.21	0.82	0.48	0.25	0.20	1.00
5:00	0.22	0.29	0.75	0.23	0.98	0.53	0.25	0.20	1.00
5:30	0.24	0.35	0.77	0.28	1.15	0.62	0.50	0.20	1.00
6:00	0.30	0.40	0.82	0.51	1.25	0.74	0.80	0.20	1.00

Time	Domestic Average Day	Domestic Peak	Industrial	Commercial	Parks and Gardens	Institutions	Clubs, Hotels and Motels	Schools and Colleges	Un-accounted
6:30	0.44	0.61	0.87	1.70	1.32	0.92	1.00	0.20	1.00
7:00	0.60	0.81	0.97	1.80	1.37	1.06	1.15	0.30	1.00
7:30	0.73	1.00	1.02	1.80	1.42	1.18	1.30	1.50	1.00
8:00	1.18	1.19	1.20	1.82	1.45	1.26	1.40	1.90	1.00
8:30	1.47	1.26	1.20	1.85	1.47	1.31	1.45	2.20	1.00
9:00	1.79	1.33	1.20	1.85	1.50	1.30	1.50	2.20	1.00
9:30	1.86	1.31	1.20	1.85	1.50	1.28	1.45	2.20	1.00
10:00	1.95	1.28	1.20	1.85	1.50	1.25	1.40	2.20	1.00
10:30	1.88	1.22	1.22	1.85	1.50	1.23	1.40	2.20	1.00
11:00	1.82	1.16	1.25	1.85	1.50	1.20	1.35	2.20	1.00
11:30	1.68	1.12	1.25	1.85	1.50	1.18	1.35	2.20	1.00
12:00	1.56	1.07	1.26	1.87	1.50	1.17	1.30	2.20	1.00
12:30	1.34	1.03	1.27	1.90	1.50	1.16	1.30	2.20	1.00
13:00	1.20	0.98	1.28	1.90	1.50	1.16	1.25	2.20	1.00
13:30	1.14	0.96	1.30	1.90	1.50	1.17	1.20	2.20	1.00
14:00	1.14	0.93	1.26	1.88	1.50	1.18	1.20	2.50	1.00
14:30	1.13	0.95	1.24	1.85	1.50	1.19	1.20	2.50	1.00
15:00	1.14	0.97	1.22	1.85	1.48	1.21	1.20	2.50	1.00
15:30	1.18	0.98	1.20	1.80	1.47	1.24	1.25	2.50	1.00
16:00	1.20	0.99	1.20	1.75	1.44	1.30	1.25	2.40	1.00
16:30	1.36	1.12	1.10	1.63	1.41	1.38	1.25	2.00	1.00
17:00	1.48	1.24	1.05	1.50	1.35	1.48	1.25	0.30	1.00
17:30	1.62	1.40	1.03	1.10	1.30	1.56	1.25	0.20	1.00
18:00	1.73	1.55	1.00	0.75	1.22	1.61	1.25	0.20	1.00
18:30	1.86	1.70	1.00	0.60	1.13	1.64	1.30	0.20	1.00
19:00	1.86	1.84	1.00	0.48	1.04	1.66	1.35	0.20	1.00
19:30	1.76	1.93	1.00	0.40	0.95	1.62	1.40	0.20	1.00
20:00	1.54	2.02	1.00	0.39	0.86	1.46	1.45	0.20	1.00
20:30	1.37	1.94	0.95	0.32	0.75	1.25	1.45	0.20	1.00
21:00	1.21	1.86	0.90	0.30	0.64	1.04	1.40	0.20	1.00
21:30	0.99	1.57	0.87	0.29	0.53	0.85	1.35	0.20	1.00
22:00	0.77	1.29	0.85	0.26	0.43	0.70	1.30	0.20	1.00
22:30	0.63	1.06	0.83	0.25	0.34	0.58	1.00	0.20	1.00
23:00	0.48	0.83	0.82	0.23	0.23	0.52	0.70	0.20	1.00
23:30	0.38	0.66	0.81	0.21	0.21	0.47	0.35	0.20	1.00

2.3.2 Operating Pressures

The system shall be designed to achieve the operating pressures at the meter location for each lot as outlined in the table below.

Criteria	Desirable Performance
Minimum Pressure	25m during PDD
Maximum Pressure	60m during ADD
	80m absolute maximum if pressure reducing valve installed at each individual lot

2.3.3 Fire Fighting Demand

Council required **design** standard for firefighting flow from hydrants is:

- 10L/s at 15m pressure - residential
- 20L/s at 15m pressure – commercial and industrial

A firefighting flow with a minimum of 15m pressure is required at the nearest fire hydrant during the 95th percentile demand period. This is equivalent to the minimum pressure required under AS 2419.1 where additional boosting will be provided by a fire brigade pumping appliance or a building fire pump unit. A minimum residual pressure of 3m is required at locations other than the subject fire hydrant.

2.3.4 Water Age

Drinking water supply systems shall be designed to minimise water age in the system, to prevent unacceptable deterioration of water quality. The following arrangements to reduce water age in the system shall be incorporated, as appropriate, into the Design Drawings:

- Mains with dead ends to be avoided. Particular care shall be taken at the boundaries between supply zones, where the dead end length shall be minimised. The maximum length of 100mm dead end main shall be 150m.
- Where the cul-de-sac incorporates a pathway to an adjacent street or ends in a park, the water main is to extend through the pathway or park so that a dead-end is not created in the main.
- Where a pathway or park is not provided, the main is to be returned at the end of the cul-de-sac to form a loop main which should conform to the following criteria:
  a. The loop is to be totally on the footway, apart from the one road crossing required to reconnect with the main;
  b. The loop is to incorporate a minimum of 3 separate service tapping's, each separated by at least one block frontage;
  c. A hydrant is to be provided within the loop approximately equidistant from loop back point;
  d. The loop is to cross the road perpendicular and at the start of the neck at the cul-de-sac;
  e. Mains for short runs (in cul-de-sacs) are to be reduced in size, refer to WSA03-2011-3.2 5.2.4 Reduced Size Mains for details;
  f. As bends are required to install pipe in cul-de-sac, poly pipe shall not be used. Pipes shall

not be bent beyond manufacturers recommendations;

g. Flushing points shall be fitted in such a way as to prevent movement or rotation of the valve body;

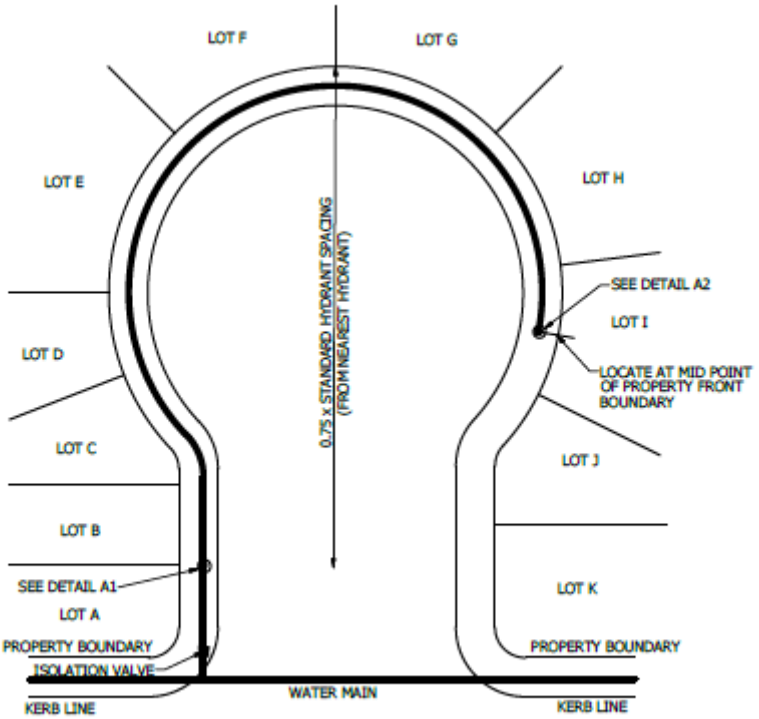
h. Covers and surrounds shall be in accordance with section 3.9.9 Hydrant Flushing Points and Stop Valve Chambers;

i. Thrust blocks shall be in accordance with section 4.7.6 – Thrust and Anchor Blocks;

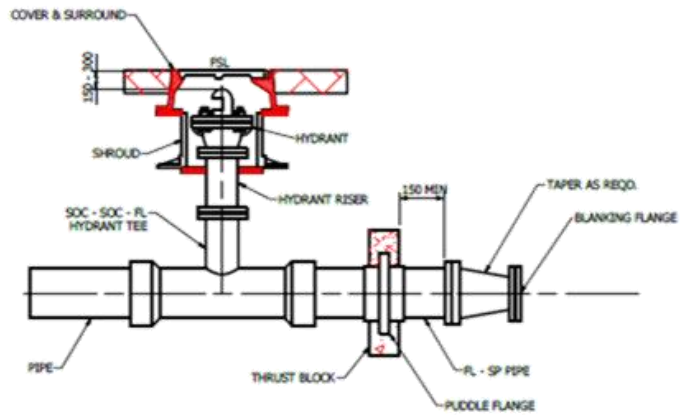
- Provision of large diameter main capacity to be staged by the initial provision of a smaller diameter main, followed by additional mains as the demand increases;
- Staging of the provision of reservoir storage;
- Council reserves the right to insist on dual water mains to avoid future water management and maintenance issues.

Where a dead end has been approved by the Engineer, the main shall be laid no more than 2m past the required location for the last property serviced. Where possible all future driveways shall be established and shown on design plans so main termination/end points shall not be located in a driveway.

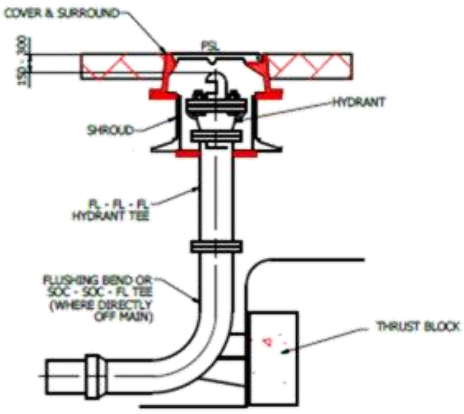
Terminal end of cul-de-sac arrangements are detailed in the drawings below; all dimensions are in millimetres.



TERMINAL END OF CUL DE SAC



DETAIL 'A1'
END OF LINE
FOR FUTURE EXTENSION



DETAIL 'A2'
END OF LINE FLUSHING/WASHOUT
BEND WITH HYDRANT

2.4 General Construction

2.4.1 re Construction

No work shall commence on the site until the development has the following;

- Development and Construction approval;
- Notification of Requirements under Section 306 of *Water Management Act 2000,* (NSW);
- Engineering plans and specifications authorised and stamped by Council;
- Conditions of Consent and Notification of Requirements under Section 306 of *Water Management Act 2000* (NSW) required prior to commencement of works have been satisfied;
- Bonds paid; and
- The Engineer notified.

Two working days' notice is required prior to the commencement of site works. This notice is to be given by the Developer.

2.4.2 Project Manager

On all Projects the Owner or Developer must nominate a person to act as Project Manager for the entire project. This person must be readily available and have sufficient authority and ability to discuss and resolve any operational problems that occur during the development.

2.4.3 Contractors and Contract Work

All work shall be carried out by appropriately trained and qualified contractors in a competent manner in accordance with the approved engineering plans and this specification. No variation from the plan is to be made unless authorised in writing by the Engineer. This may require submission of a redesign for approval.

2.4.4 Quality Control, Inspections and Testing

It shall be the ultimate responsibility of the Developer to construct and present to Council completed works complying with the approved engineering plans, specification requirements herein (including testing) and any additional works advised in writing by the Engineer.

Any testing required shall be at the full cost to the Developer.

During progress of the work uninterrupted access shall be given to the Engineer. Where necessary the Contractor's equipment or personnel are to be made available for the use by the Engineer for examination or testing purposes. The Engineer may instruct the removal or amendment of any such work or material considered to be unacceptable, whether fixed or not.

In the event of a dispute regarding material quality of uncompleted or completed work, the material concerned shall be submitted for testing to an independent authority.

The Engineer shall generally assume the role of quality control inspector, not a construction supervisor.

2.4.5 Materials

All materials used shall be in as new condition and of an approved standard, free of structural damage or defects. If required, the Contractor shall provide full information as to source of supply and mode and place of manufacture. Test results of the particular material proposed shall be submitted to the Engineer for approval.

All material which will come into contact with potable water are required to have WaterMark product certification or a certificate of compliance with AS/NZ4020 must be obtained from the manufacturer and supplier to the Engineer for approval.

Some suppliers have materials that are regularly tested and have been accepted by the Engineer and upon application these materials may be accepted without further testing. Specific requirements are detailed in the relevant sections of this specification.

2.4.6 Setting Out

The Developer shall be responsible for all pegging and setting out. The Engineer shall not carry out any such work or accept responsibility for its accuracy.

2.4.7 Final Site Cleaning

Upon completion of the works, all buildings, plant, spoil, debris, excess and discarded material assembled or used for the development shall be removed and the site left in a clean and tidy state.

2.4.8 State Survey Marks

Adequate precaution is to be taken to protect and preserve any state survey marks relative to or affected by the development. The Developer shall be responsible for the subsequent replacement of marks by a Registered Surveyor. An appropriate plan of survey showing the relocated marks shall be provided by the surveyor and lodged with the Surveyor

General's Office in accordance with the *Surveying and Spatial Information Regulations 2017* (NSW).

2.4.9 Safety

The Developer shall be responsible for adequate safety precautions during progress of the works, in accordance with the relevant legislation and related standard codes of practice. This includes the provision and erection of any signs, lights and barricades necessary for pedestrian and traffic safety in public roads or places. Council shall not be held responsible for any consequence arising from the Developer's failure to take such precaution, whether specifically instructed or not.

2.4.10 Working Hours

No work shall be performed outside the hours that apply under the Department of Environment and Climate Change NSW Interim Construction Noise Guideline. No construction works shall be carried out on Sundays or public holidays, by or on behalf of the Developer without the express approval of the Engineer. Inspections outside normal working hours can be arranged, refer to section 2.4.24 Inspection and Testing for details.

2.4.11 Practical Completion

Practical Completion shall be deemed to be that stage in the execution of the work when it is complete except for minor omissions and minor defects:

- Which do not prevent the works from being reasonably capable of being used for its intended purpose; and
- In relation to which there are reasonable grounds for not promptly rectifying or constructing them; and
- Rectification or construction of which shall not prejudice the convenient use of the works or users of the amenity.

It is essential that the Developer gives Council at least 24 hours notice of the departure of a Contractor from a section of work that is proposed for practical completion.

2.4.12 Remedial Work

If it becomes necessary for remedial work to be performed, the maintenance period for such remedial work shall commence on the day on which the remedial work is approved by the Engineer. The maintenance period on any remedial work shall be 12 months, unless otherwise approved by the Engineer.

2.4.13 Maintenance Period and Maintenance Bond

Prior to final written acceptance of satisfactory completion of works and release of linen plan, Bank Guarantees or cash shall be lodged with Council for the maintenance period to provide for maintenance and/or rectification of any work found to be faulty or suffering deterioration within a period of 12 months from the date of such acceptance (Certificate of Practical Completion). The rate for this maintenance bond is listed in Council's Annual Fees and Charges.

To recover the bond it shall be the responsibility of the Developer/Contractor to arrange a final inspection with the Engineer approximately one week before the end of the maintenance period. No monies shall be refunded unless such an inspection has been carried out in the presence of the Developer and all defects subsequently repaired.

2.4.14 Rectification of Defects

Rectification of defects shall be completed within one month of written notification or work shall be carried out by Council and the cost thereof deducted from bond monies.

2.4.15 Storage of Materials

Storage of pipes, gravel and other materials in public roads or reserves shall not be permitted, unless the express approval of the Engineer is obtained. All materials shall be stored in a safe and tidy manner and shall not cause a nuisance. It may be necessary to erect signposting, safety barriers and silt fences.

2.4.16 Road Opening Permits

Council shall reserve the right to decline permission to open roads and request either tunnelling or boring methods.

Road opening permits may be obtained from Council's Infrastructure Services Group. The cost of the road opening permit shall be in accordance with Council's current schedule of fees and shall apply to both crossing methods.

2.4.17 Bond to Secure Incomplete Works

Generally, bonds shall not be accepted to enable early release of the linen plan, but due consideration shall be given in cases where major works are substantially complete and minor items are delayed by circumstances beyond the reasonable control of the Developer/Contractor. All services to each allotment however should be completed and tested before any bonding shall be considered. The rate for this bond is listed in Council's Annual Fees and Charges.

2.4.18 Sub-Contractors

The identity of sub-contractors and their proposed works are to be supplied to the Engineer prior to engagement. Council reserves the right to preclude any such sub- contractor.

Council must be notified at least 24 hours prior to the arrival and departure of any sub-contractor from the site.

2.4.19 Extra Work

Ancillary requirements such as batter stabilisation, sediment control etc. shall be indicated on the engineering plan. However, variations in the extent of work may be identified during construction. These works are to be completed as directed by the Engineer. Further details and plans may be required. It is in the Developer's interest to provide for the possibility of such extra works when preparing cost estimates for the work.

2.4.20 Erosion Control

For developments where there is a probability of dust or water erosion problems, the advice of the EPA should be sought and in such cases these requirements shall be endorsed by the Engineer, as the minimum requirements.

All other erosion control shall be as details in Council's Engineering Design Guidelines.

2.4.21 Insurance

Public Liability Insurance Policy

Contractors engaged are to obtain Public Liability Insurance to the value of $20 million before commencing work. The policy is to indemnify Singleton Council.

Workers Compensation

Contractors engaged on Development or Subdivision works are to carry a current Workers Compensation Insurance Policy for all employees as required by Statute.

2.4.22 Other Authorities

All work shall be carried out in accordance with the provisions of relevant authorities and related legislation eg Office of Environment and Heritage, EPA, SafeWork NSW etc. The Developer is responsible for obtaining all necessary approvals.

2.4.23 Environmental Protection

Environmental protection measures are to apply to all works and to all persons, Contractor and Sub contractors where the works involve any disturbance to vegetation, which include grasses, shrubs and trees.

2.4.24 Inspection and Testing

Inspections shall be required by the Engineer for the following items:

- Visual inspection of water service road crossings before backfill;
- Visual inspection of all water pressure pipes before backfill;
- Thrust blocks before backfill;
- Final placement of surface boxes and markers;
- Pressure test of water services;
- Pressure test of water pressure pipes; and
- Disinfection of water mains water quality compliance testing.

It is the responsibility of the contracted plumber to ensure all plumbing work, including works by any sub-contractor, meets all applicable standards and this specification. While Council may give direction directly to a sub-contractor, Council is not the supervisor of a sub-contractor. Any shortcoming with works carried out is the responsibility of the contracted plumber and is to be corrected.

Notice of Inspection

24 hours' notice shall be given for any of the above inspections. Failure to notify the need for inspection may lead to the portion of the work not being approved by the Engineer.

It shall be necessary for the Developer to meet the Engineer on site at each inspection to receive written approval to proceed to the next stage of works or be instructed to amend any work.

Inspections outside Normal Council Hours

It may be possible to arrange inspections of work outside of Council's normal working hours. The cost of the inspection shall be borne by the Developer or their Contractor. This cost shall be determined by Council and must be paid to Council's cashier prior to receipt of approval from the Engineer.

Written Approval for Works

In order to receive a final Certificate of Compliance under section 307(1) of the *Water Management Act 2000* (NSW) for the development works, the Developer must have obtained approval under section 305 of the *Water Management Act 2000* (NSW) of the various components of the development work and complied with the Notification of Requirements under Section 306 of the Water Management Act 2000 (NSW). Only the Engineer can issue advice and approvals under the above sections of the *Water Management Act 2000* (NSW).

Approval to proceed from one component of works to the next, in no way absolves the Developer from the responsibility of defects or failure.

It is the Developer's responsibility to obtain approval from the Engineer.

Limitation of Approval

During construction, approval of any component of work shall be given in regard to structural standard only at the time of inspection. This does not absolve the Developer of the responsibility for any damage or deterioration occurring before the final inspection or during the maintenance period.

3 DESIGN OF WATER RETICULATION

3.1 General

All design works are to be carried out in accordance with the current regulations of the relevant statutory authorities, the requirements of this specification and in accordance with the Manufacturers recommended procedures where these procedures do not override the provisions of this specification.

3.2 Design Drawings

All water main design drawings are to be submitted to the Engineer for approval by the Engineer.

Plans to be drawn to a scale at 1:500 or 1:1000 if previously approved, showing locations of hydrants, stop valves, tees, tapers, dead ends, and air and scour valves and services and all lot boundaries and kerb lines.

3.3 Reticulation Mains

Design of water supply mains is to be based on the Water Supply Code of Australia WSA03-2011-3.2 design criteria and further as specified in this Technical Specification.

3.4 Internal Service Works

All internal service works are to be designed in accordance with the Australian Standard AS3500:2021 Plumbing and Drainage or the *Local Government Act 1993* (NSW) with adequate provision of firefighting services to the proposed development.

3.5 Location of Mains

Water mains are to be located in accordance with NSW Street Opening Conference Guide to Code and Practices for Street Openings. Centre of water main should be 1.5m behind the face of kerb and gutter.

The pipeline shall be located with the following requirements:

- Aligned parallel to property boundaries or road features eg kerb;
- With adequate clearance from structures and other infrastructure; and
- With easy access for repairs and maintenance.

Cover to pipelines shall be in accordance with the manufacturer's instructions and relevant Australian Standards. Council's requirements for cover to water reticulation mains are as follows:

Location	Preferred Minimum Cover (mm)	Absolute Minimum Cover (mm) *
Minor Local Trafficable Areas	750	600
Major Council Trafficable Areas	900	750
Non-trafficable Areas	600	600

** Absolute minimum cover only acceptable for consideration, if preferred minimum cover is not possible and at the discretion and approval of the Engineer.*

Variations to these specifications may be required in some circumstances and shall be agreed with Council. Excludes RMS Roads and rail corridors where special treatment is required.

The depths may need to be increased on larger diameter mains to accommodate larger fittings.

The Engineer may give approval for infrastructure to be located in areas other than road reserves provided an easement is created. The Developer shall transfer to Council any water easements provided in the subdivision and execute a transfer and grant of easement in favour of Council pursuant to Section 88B of the *Conveyancing Act 1919* (NSW), as amended. The minimum width of water easement is to be 2.5m.

Council may require water mains to be located on both sides of the road in commercial/ industrial areas, in areas likely to have high or medium density housing, at the boundaries

between pressure zones and on highly trafficked roads or residential areas. Where possible, water mains shall be located on the opposite side of the street to the location of power cables.

Water mains are to be provided for the full extent of the development to facilitate the systematic and orderly expansion of Council's infrastructure.

The approved alignment shall be applicable for all water mains in developments including water mains to be constructed in cul-de-sac roadways. Pipes laid in cul-de-sacs shall not be permitted to be curved or bent along the axis of the pipeline between two consecutive flexible joints. Changes of direction are to be obtained using suitable bends or joint deflections in accordance with Section 4.7.4 – Laying and Jointing – Pipe Grading.

3.6 Pipe Material

Design drawings and specifications shall state water main pipelines may be constructed of any of the following materials manufactured in accordance with the relevant Standards subject to the Engineer's approval:

- Ductile iron cement lined pipe PN35 or PN20 (Rubber ring joints) to AS2280 Ductile Iron Pipes and Fittings;
- PE pipe (Welded joints) to AS4130 Polyethylene pipes for pressure applications shall be designed and constructed in accordance with WSA 01-2004 Polyethylene Pipeline Code (Engineer approval required);
- PVC-m to AS4765 Modified PVC (PVC-M) pipes for pressure applications - Minimum Class 16 Series 2; and
- GRP to AS3571.1 Plastic piping systems SN10000 – Glass reinforced thermo setting plastics (GRP) systems based on unsaturated polyester (UP) resin – Pressure and non-pressure drainage and sewerage. (Engineer approval required);

Materials and equipment must be supplied in accordance with the appropriate Australian Standards, including but not limited to those listed in the Referenced Documents - Australian Standards section of this document.

PVC pipelines shall be compatible with, and shall incorporate ductile iron fittings for all bends, tees, tapers and valves.

Ductile iron fittings shall be cement or epoxy lined and conform to AS2544 and AS2280 respectively.

The Engineer may direct that any main shall be constructed from PN35 Ductile Iron Cement Lined, spigot and socket pipe.

All material which will come into contact with potable water are required to have WaterMark product certification or a certificate of compliance with AS/NZ4020 must be obtained from the manufacturer and supplier to the Engineer for approval.

3.7 Pipe Size

Minimum acceptable pipe size is 100mm diameter for residential areas and 150mm diameter for commercial and industrial areas. 100mm pipes may be considered in some isolated industrial areas.

100mm dead end mains are to be limited to 150m in length.

3.7.1 Head Losses

To facilitate economic designs, the design shall be conducted to achieve less than the following head losses, unless alternate head loss rate limits are provided by Council:

- 5m/km for ≤DN 150.
- 3m/km for ≥DN 200.

Head loss shall be calculated using computer models or hydraulic formulas (Refer to AS 2200).

3.7.2 Flow Velocities

The design shall ensure that acceptable flow velocities are achieved within the supply network.

All mains shall be sized based on a sound compromise between capital and operating costs with flow velocities not exceeding 3m/s under maximum flow conditions.

To achieve economical head losses, flow velocities in the reticulation network shall not exceed 2m/s for an hour period in any day.

In special circumstances, such as with flows required for firefighting, velocities up to 4.1m/s may be acceptable.

The design shall also ensure adequate minimum velocities for maintaining water quality to Water Agency requirements, typically assessed at average day demands.

For pumping mains, a financial appraisal shall be undertaken to determine the most economical diameter of pumping main to minimise the combined capital cost and pumping cost. The resulting velocity shall normally lie in the range 0.8m/s to 1.4 m/s.

The following factors shall be considered in determining flow velocity:

- Water age (travel time through the system);
- Turbidity;
- Pressure;
- Surge;
- Pumping facilities;
- Pressure reducing devices; and
- Pipe materials and pipe lining materials.

3.8 Design Pressures

The maximum design pressure shall be recorded on the Design Drawings. The maximum design pressure shall include the pressure arising from the static head, pumping pressures and an allowance for surge.

The maximum design pressure shall be used for fatigue assessment and selection of:

- Pipe material and classes.
- Pipe fittings and classes.
- Appropriate surge control devices.

The pressure class of pipeline components shall be selected such that the maximum allowable operating pressure (MAOP) for each component within a pipeline system is greater than the maximum design pressure.

For thermoplastic pipes and fittings, the MAOP is the de-rated pressure rating for the pipe class or fitting and shall be determined from:

MAOP = Nominal pressure rating x f

Where f = fatigue de-rating factor (Refer to Fatigue below)

For ductile iron pipes and fittings, the MAOP is the allowable operating pressure (AOP) plus an allowance and shall be determined from:

MAOP = AOP + 20%.

The derivation of AOP for ductile iron pipes is specified in AS/NZS 2280.

The minimum class of all plastic pipe and fittings (ie GRP, PE, or PVC-M) used shall be PN 16 unless specific approval to the contrary is given by the Engineer for a nominated project.

The minimum class of ductile iron shall be PN 20 for pipes and PN 35 for fittings.

The design pressure shall be a minimum of 1200kPa.

3.8.1 Fatigue

For thermoplastic pipes, fatigue is relevant where a large number of stress cycles are anticipated. The important factors to consider are the range of the stress fluctuation and the number of cycles likely to be experienced in the design life of the system. The fatigue response of thermoplastic pipe materials has been extensively investigated to derive de-rating factors that can be applied to the operating pressures to enable selection of an appropriate class of pipe. Changes in pressure as a result of diurnal variations do not need to be considered in fatigue design.

For fatigue loading situations, the maximum cyclic pressure range (MCPR) of a pipe class shall be equal to or greater than the maximum design pressure range (P) of the system. The MCPR for a pipe class is dependent on the number of cycles likely to be experienced in the pressure main design life.

For example, a pump may be designed to start up to 10 times per hour in daily peaks and once per 2 hours in off peak times resulting in typically 50 starts per day. Allowing for secondary cycles and a 100 year design life, the estimated number of cycles can be estimated as:

$$50 \times 2 \times 365 \times 100 = 3.6 \times 10^6$$

To select the appropriate pipe class for fatigue loading, the following procedure shall be adopted:

- Estimate the maximum design pressure range ΔP ie the maximum minus the minimum pressure.
- Estimate the frequency of number of pressure cycles per day.
- Determine the required service life and calculate the total number of pressure cycles which shall occur in the pipeline (see above).
- Using PIPA Guidelines determine the fatigue de-rating factor F to be applied.
- Calculate MCPR
- Compare MCPR with the pressure amplitude ΔP. If MCPR is less than the maximum design pressure range ΔP, try a higher pressure class.

More information on the effects of fatigue loading into pipe class selection is detailed in Plastics Industry Pipe Association Industry Guidelines POP101, POP010A and POP010B available at *www.pipa.com.au*.

3.8.2 Design for Surge

Rapid pressure fluctuations and surges in mains result from events such as pump start-up and shutdown or valves opening and closing. The approach adopted for pipe design and class selection when considering these events depends on the anticipated frequency of the pressure fluctuation as follows:

- For all surge events, the design shall ensure that the maximum and minimum pressures experienced throughout the system are within acceptable limits; and
- For surges comprising frequent, repetitive pressure variations, the design shall also address the potential for fatigue so that pipe classes can be selected accordingly.

A surge analysis of the system shall be undertaken for mains in zones affected by pressure variations eg pumped mains, high surge areas, or in locations in the vicinity of control valves (particularly reservoir inlet control valves and in locations downstream of PRVs) and where required by the Engineer. The system shall be analysed for the range of anticipated rates of change of flow in order to determine the magnitude of the surge pressure in the system.

Allowance for surge and negative pressure shall be included in the structural design of transfer and distribution water mains.

3.9 Pipe Fittings – General

All spring hydrants and stop valves are to be coated internally and externally with a thermoplastic polyamide (Rilsan Nylon 11), thermosetting epoxy powder (NAP-GARD 7 – 2501) or superior product (at the approval of the Engineer) applied using the fluidised bed process in accordance with Australian Standard Interim Specification No 101 Revision 2 dated September 1991 complete with stainless steel bolts, nuts and washers.

Where fittings cannot be supplied that meet the coating requirement because of size or some other limitation, full details of such alternative coating system is to be submitted prior to their use for the Engineers approval.

3.9.1 Other Pipe Materials and Fittings

Where the approved engineering plans indicate pipeline or fittings constructed of other materials, these items are to have performance ratings equivalent to or better than the uPVC alternative and are to comply with all other aspects of this specification. Where other pipe materials and fittings are offered full technical details are to be submitted for approval.

Notwithstanding the above, alternative pipeline and fittings materials are not to be used without the prior written approval of the Engineer.

3.9.2 Pipe Fittings – Design

A hydrant or air valve shall be provided at all high points and a hydrant or scour valve at all low points.

All main cocks, hydrants, stop valves, scour valves and air valves shall be located on the footway, unless approved otherwise.

Hydrants and valve access covers shall open in the direction of the main, except when located in a carriageway, in which case covers shall open in the direction of traffic (so that traffic passing over tends to close them).

Valve surface boxes are to be white and have round surrounds, hydrant tops to be yellow and have square surrounds. Surface boxes and hydrant tops located in trafficable areas to have concrete surrounds, surface boxes and hydrant tops non- trafficable areas may be constructed on UV stabilised plastic.

3.9.3 Hydrants

All hydrants are to be of the spring hydrant type complying with AS3952 - 1991 and shall be coated in accordance with section 3.9 - Pipe Fittings - General.

Maximum hydrant spacing is to be 60m and at all intersections in residential area. Spacing of up to 120m in rural areas shall be permitted as long as all dwellings are adequately serviced. Notwithstanding the above hydrants are required to be installed on the end of all dead end lines, whether temporary or permanent and at the high and low points of the main. If hydrants on existing lines are of inadequate spacing, additional hydrants shall be required to be installed by the Developer to satisfy the above requirements.

Hydrants are not to be located in table drains.

Additionally, general principles to be considered shall include:

- Site hydrants to facilitate flushing/swabbing of each section of water main. This may require a hydrant on each side of a stop valve in some locations.
- A single hydrant adjacent to a stop valve shall be on the upstream, wherever practicable. This facilitates flushing and air release when charging.
- Provide hydrants at regular spacing to facilitate easy location by fire brigade personnel.
- Provide hydrants opposite access ways to bush reserves and fire trails.
- Where a link main is laid in an access way or right of way between two streets, provide hydrants as necessary to satisfy spacing requirements.
- Hydrants are not to be located in a driveway. If a hydrant is located within the proposed

driveway design either the driveway must be moved to give minimum 1m spacing from the edge of the driveway, or the hydrant must be moved to give minimum 1m spacing from the driveway at the expense of the owner.

- Where a main is located in the roadway within 2m of the kerb face, hydrants are to be placed within the footpath.

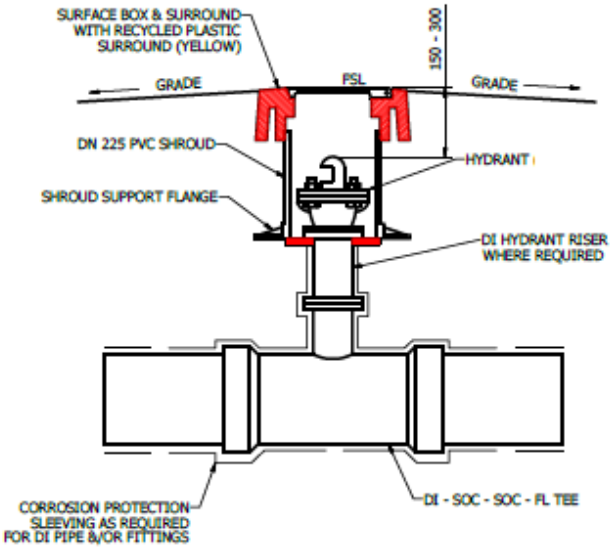
Hydrants shall be DN80, unless otherwise specified on the design drawings and approved by the Engineer.

Isolating valves shall be installed for hydrants on mains greater or equal to DN375. Isolating stop valves shall of a type authorised by the Engineer (butterfly, gate, ball hydrant control valve) and shall be installed such that the hydrant can be removed with the valve in place.

To prevent corrosion valves and fittings shall be fusion bonded coated and joined using 316 stainless steel fasteners. Corrosive protective sleeving or wrap is not required where this system is used.

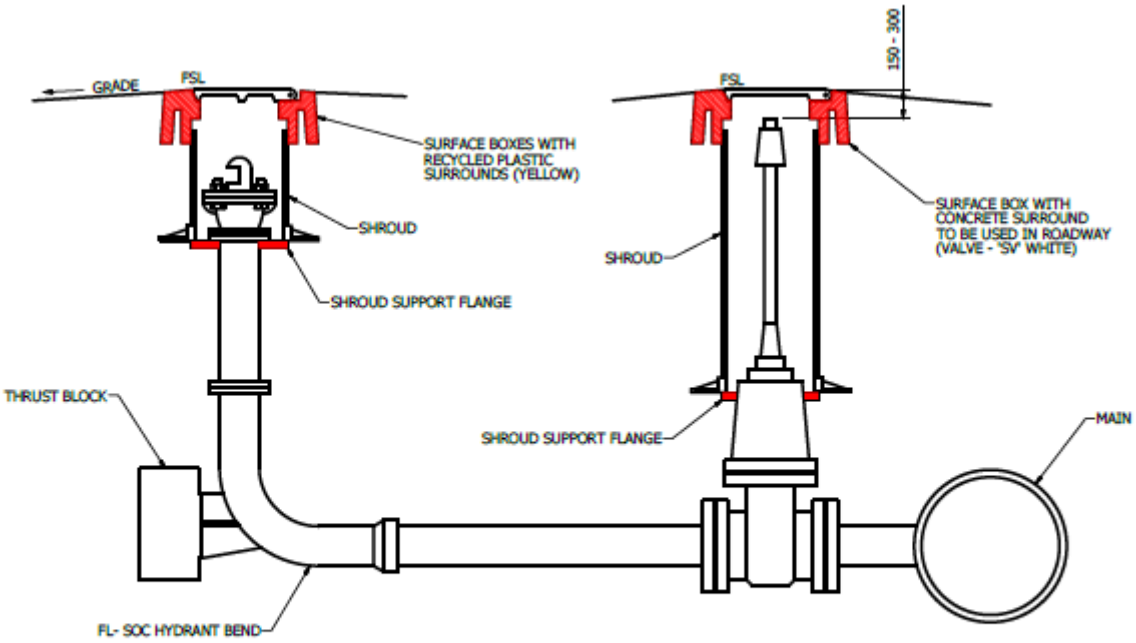
Design drawings shall include the direction and grade of drainage pipe to suitable discharge point and flange branch diameters.

Typical hydrant arrangements and installation are detailed in the drawings below; all dimensions are in millimetres.



TYP HYDRANT ARRANGEMENT UP TO DN375

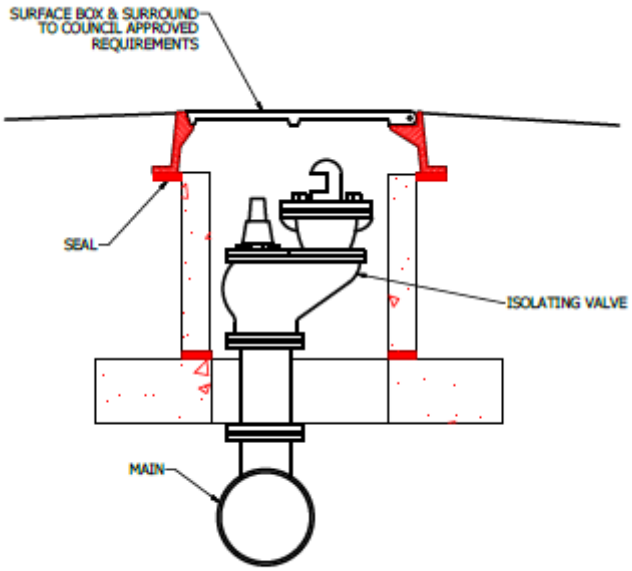
NON TRAFFICABLE INSTALLATION SHOWN



OFFSET ASSEMBLY INSTALLATION
(TO CLEAR ROAD PAVEMENT)

ALTERNATIVE HYDRANT ARRANGEMENTS

(WHERE SPECIFIED IN DESIGN DRAWINGS)



HYDRANT WITH ISOLATING VALVE
(DN375 MAINS & ABOVE)

Hydrants shall be marked in accordance with section 3.9.8 Kerb Impressions and Markers.

A valve chamber shall be provided for all geared valves, where directed and in accordance with section 3.9.9 Hydrant Flushing Points and Stop Valve Chambers.

3.9.4 Stop Valves

All stop valves are to be the same class of the pipe at a minimum and clockwise closing and are to conform to AS2638 as amended.

All stop valves are to be resilient seated in accordance with AS2638 and are to be coated internally and externally with a fluidised bed coating system as specified in section 3.9 - Pipe Fittings - General. Stop valves 600mm and above are to incorporate a minimum 150mm bypass valve.

Stop valves are to be provided at all pipeline intersections and branches so that each section of line can be isolated separately, closing a maximum of three (3) valves. Stop valves are to be suitable for the type and class of pipe used.

The Developer shall establish that all valves and service connections are fully open, following construction as appropriate.

Gearing shall be provided for Class 16 valves of size ≥DN 400. A valve chamber shall be provided for all geared valves in accordance with section 3.9.9 Hydrant Flushing Points and Stop Valve Chambers.

Buried ungeared gate 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 minimum 150mm and 350mm maximum below the FSL.

Valves shall be marked in accordance with section 3.9.8 Kerb Impressions and Markers.

3.9.5 Air Valves

Air valves shall be installed with an isolation valve to allow maintenance of the air valve without shutting down the main, refer to section 3.9.9 Hydrant Flushing Points and Stop Valve Chambers.

Valves shall be marked in accordance with section 3.9.8 Kerb Impressions and Markers.

3.9.6 Scour Valves

Scour valves shall discharge to a stormwater drainage pit or stormwater facility when drainage pits are not available, refer to section 3.9.9 Hydrant Flushing Points and Stop Valve Chambers.

Valves shall be marked in accordance with section 3.9.8 Kerb Impressions and Markers.

3.9.7 Gibault Joints

All Gibault joints used are to be of the long sleeve stainless steel type and are to be suitable for the type and class of pipes being used.

All Gibault joints are to be coated internally and externally with a fluidised bed coating system as specified in section 3.9 - Pipe Fittings - General.

Gibault joints are only to be used as directed by the Engineer. A 6mm spacing is to be maintained between the two lengths of pipe joined and if directed, a spacer shall be used to reduce this gap. The Gibault joint is to be completed to the Manufacturers specification. Stainless steel “all thread” bolts and nuts conforming to section 4.3.5 – Supply of Pipes and Fittings - Fasteners are to be used on all Gibault joints buried in the ground.

3.9.8 Kerb Impressions and Markers

Where kerb and gutter is constructed adjacent to the main the locations of stop valves and hydrants shall be clearly identified by formed kerb impressions in accordance with figure below and by stainless steel location disc.

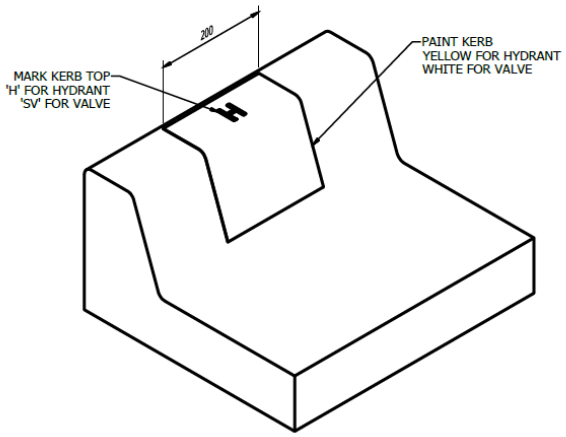


Figure 3.9.8 (1) Kerb Marking

'H', 'SV' and 'W' to marked on the kerb adjacent to the water main or fitting. Kerb paint shall be approved high UV resistant Line Marking Paint and applied using a stencil. Valve markers shall be marked in white, hydrant markers shall be yellow. Markers shall be size 200mm long on face and on top of kerb. Marker letters shall be 80mm high x 80mm wide x 15mm stroke width and placed on top of the kerb adjacent to the hydrant or valve.

In addition, or where no kerb and gutter is available the locations of stop valves (SV) and hydrants (H) shall be delineated by stencilled markers as above on the adjacent road pavement with an arrow indicating the direction of the valve or hydrant. Stencils are to be 400mm high x 400mm wide x 50mm stroked width in size.

Where valves or hydrants are obscured by vegetation or topography, such as trees and gullies. The location shall be marked on a plan and Council shall install a poly post with hydrant markers in keeping with the street amenity.

Water service tappings are to be marked with kerb impression 'W' or as a stainless steel location disc in line with the service connection.

3.9.9 Hydrant, Flushing Point and Stop Valve Chambers

All surface box covers and frames are to be in accordance with AS3996 – Access covers and gates; class D loading (trafficable). Install cover, frame, shroud and shroud support so that no loading is transmitted to the valve or pipe.

An extension spindle shall be installed where the distance from the surface to the valve spindle exceeds 350mm and must be supported such that it always remains central to the shroud by use of a base plate below the shroud through which the spindle penetrates, or similar.

A seal shall be placed between the valve and the shroud. The shroud shall extend 50mm nominal below the hydrant flange. Refer to typical detail in drawing below; all dimensions are in millimetres.

TYPICAL DETAIL 1

For all trafficable applications, concrete supports designed to span the trench shall extend a minimum of 300mm onto supportive earth.

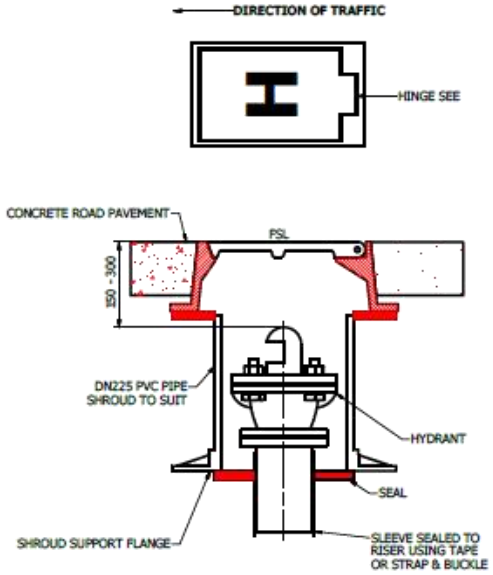
Each valve and hydrant shall be marked in accordance with section 3.9.8 Kerb Impressions and Markers.

Each valve, hydrant and flushing point shall have a surround installed as specified below:

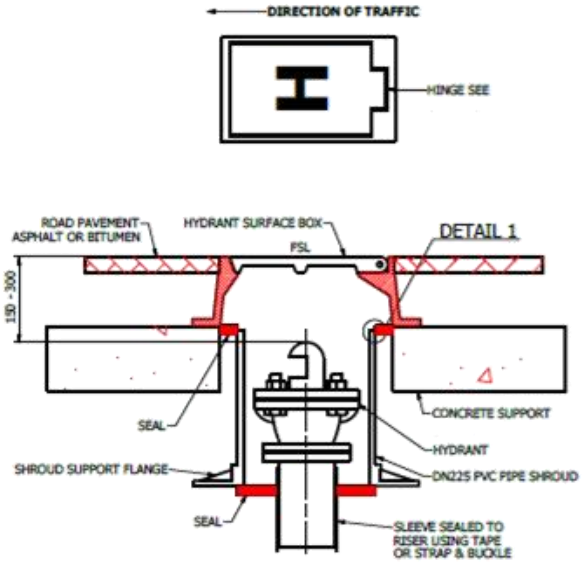
Hydrants

Hydrant covers shall be hinged concrete stop valve surrounds with heavy duty cast iron hinged covers in wet cast concrete surrounds when installed in concrete (eg footways and driveways). Concrete shall be painted yellow. The covers in trafficable areas shall be fixed plumb and square to the centreline of the main. In trafficable areas, hinged openings shall open in the direction of traffic and shall finish flush with ground level, otherwise hinged openings shall open in direction of the watermain. Only concrete surrounds shall be used in trafficable areas..

Hydrant arrangements in trafficable locations are detail in the drawings below; all dimensions are in millimetres.



CONCRETE PAVEMENT

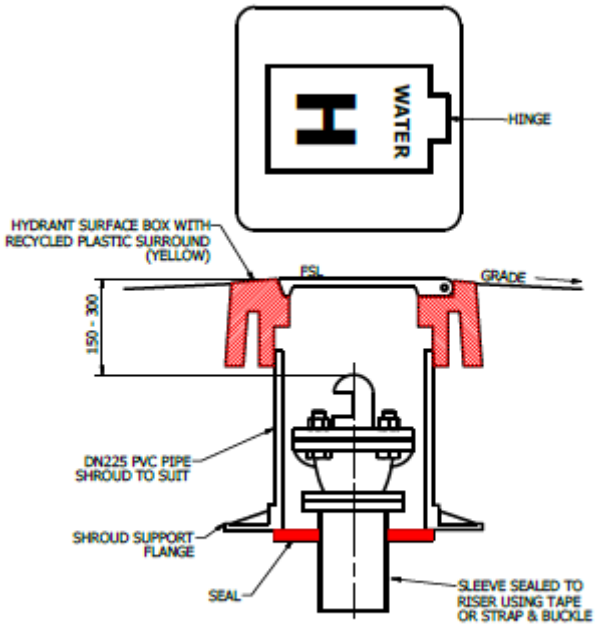


ASPHALT/BITUMEN PAVEMENT

Plastic square hydrant surrounds shall be permitted in non-trafficable areas only eg footways, parks and reserves and shall be yellow, hard quality, durable plastic surrounds with heavy duty cast iron lids. The hinged covers in non-trafficable areas shall close in the directional fall of

the land and shall have elevated cover up to 50mm above finished surface level and soil shall be graded away to prevent water entry.

Hydrant arrangements in non-trafficable locations are detailed in the drawings below; all dimensions are in millimetres.



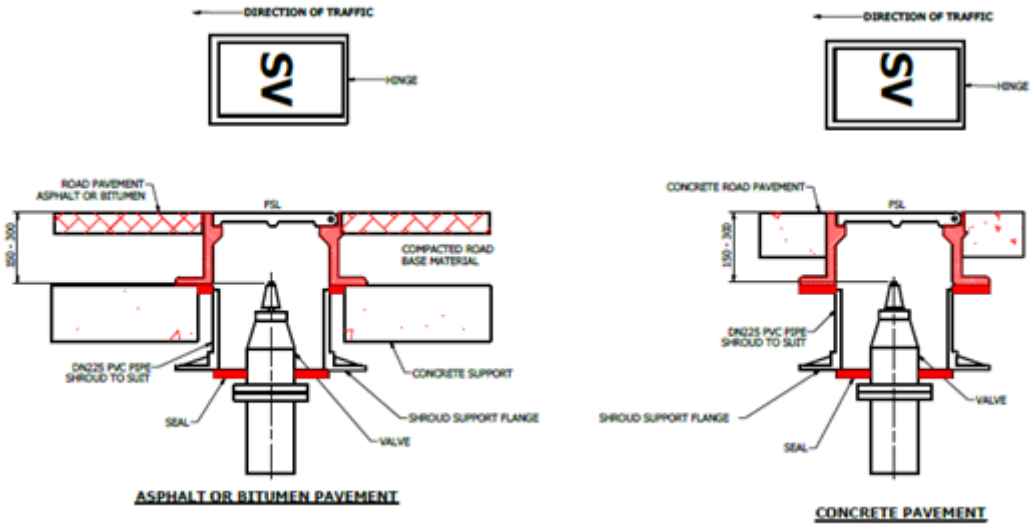
NATURE STRIP

Hydrant installation in driveways is not Council's preferred location and shall be at the Engineers approval where no alternative is viable.

Stop Valves

Stop valve covers shall be hinged cast iron insert covers with hinged lids when installed in concrete (eg footways and driveways). Concrete shall be painted white. The covers shall be fixed plumb and square to the centreline of the main, hinged openings shall open in the direction of the water main and shall finish flush with ground level. Only concrete surrounds shall be used in trafficable areas.

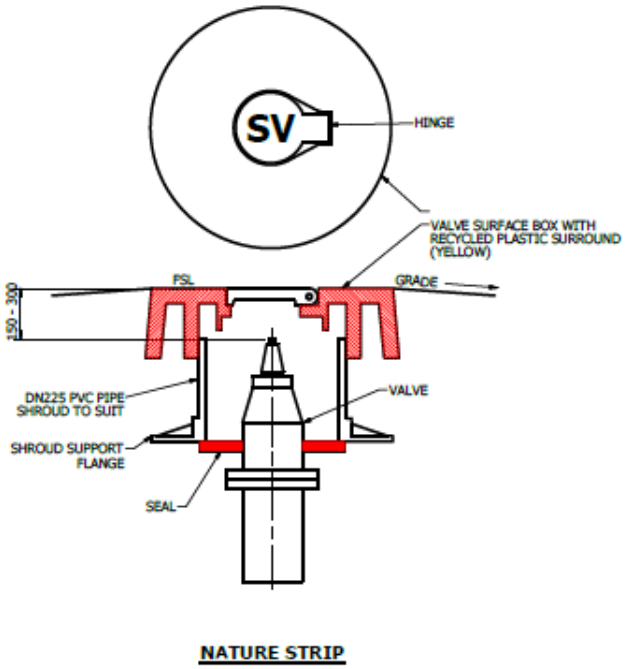
Stop Valve arrangements in trafficable locations are detail in the drawings below; all dimensions are in millimetres.



Plastic round stop valve surrounds shall be permitted in non-trafficable areas only eg footways, parks and reserves and shall be white, hard quality, durable plastic surrounds with heavy duty cast iron lids.

Lid and surround for normally closed stop valves such as zone valves shall be painted red.

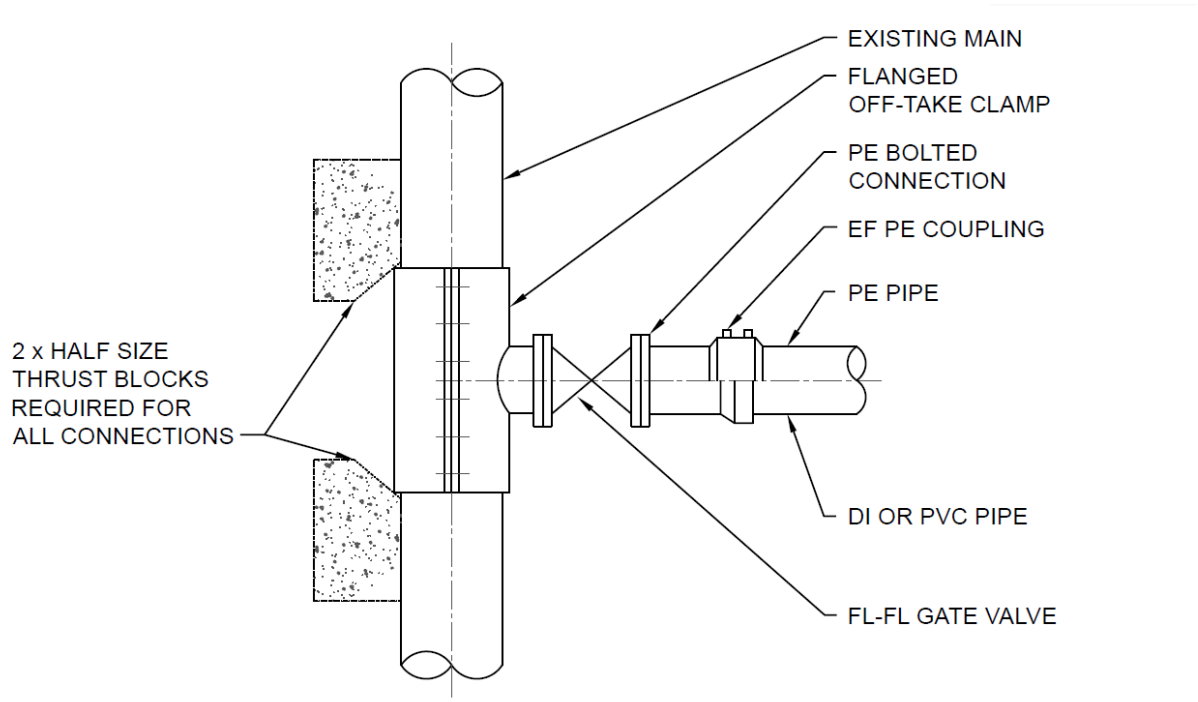
Stop Valve arrangements in non-trafficable locations are detailed in the drawings below; all dimensions are in millimetres.



Stop Valve installation in driveways is not Council's preferred location and shall be at the Engineers approval where no alternative is viable.

3.9.10 Connection to Existing Mains

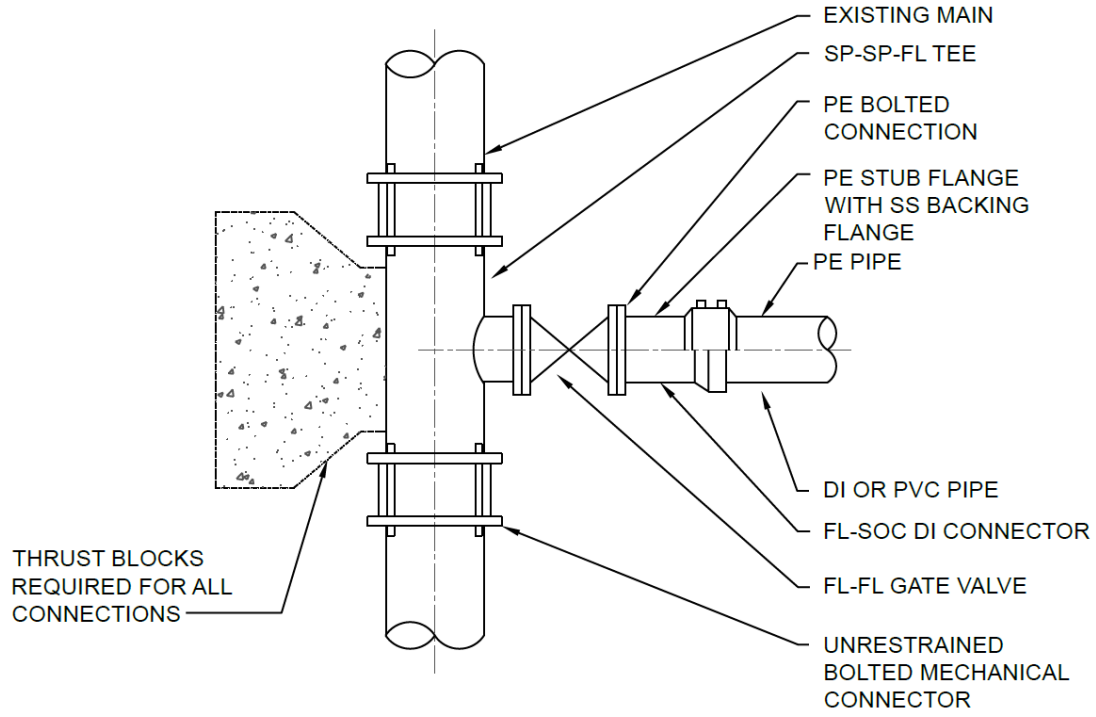
The preferred method of connection of newly constructed mains to the existing water main is under pressure cut in connection to remove disruption of water supply services to customers. A typical under pressure cut in connection is detailed in the drawing below;



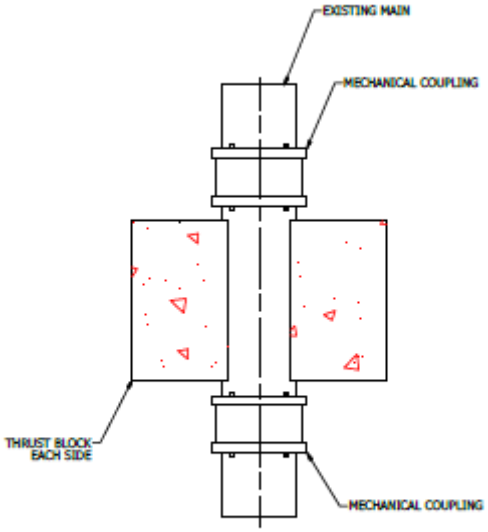
Note: All fittings used to clamp pipes must have compressible membranes

Under pressure cut in connections shall be in accordance with the Water Supply Code of Australia – WSA03-2011-3.2 *Appendix C – Under Pressure Cut-In Connection to Pressure Pipes.*

If under pressure cut in connection is not practical due to limitations by other services or mains materials in place (eg GRP mains), the Engineer shall be consulted for approved us of inserted tee method using mechanical couplings. A typical insertion/cut in connection using mechanical coupling is detailed in the drawing below;

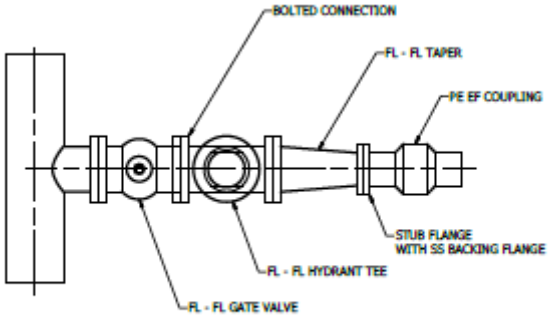


Typical end to end connections are detailed in the drawings below;



END TO END CONNECTION

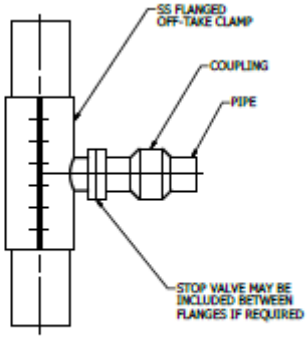
Where a valve and hydrant is required, the hydrant shall not be installed on the permanent end of mains smaller than DN100. Typical valve and hydrant connection method is detailed in the drawing below; Cut in methods are outlined above.



WHERE VALVE & HYDRANT REQUIRED

Where the development utilises existing water mains, the level of hydrant and stop valve surface boxes shall be adjusted to suit new surface levels. Hydrant and valve spindles heights to be adjusted as required.

Where no valve and hydrant is required, the typical connection method is detailed in the drawings below; all dimensions are in millimetres. Cut in methods are outlined above.



WHERE NO VALVE & HYDRANT REQUIRED

Stainless steel off-take clamps shall be graded 316 SS and of full wrap configuration. Backing flanges for PE stub flanges to be manufactured from 316 SS. Bolts, nuts and washers to be stainless steel graded 316 SS.

Gaskets shall be used in accordance with Water Supply Code of Australia WSA 109 Flanges Gaskets and O-Rings.

3.9.11 Tapping Bands

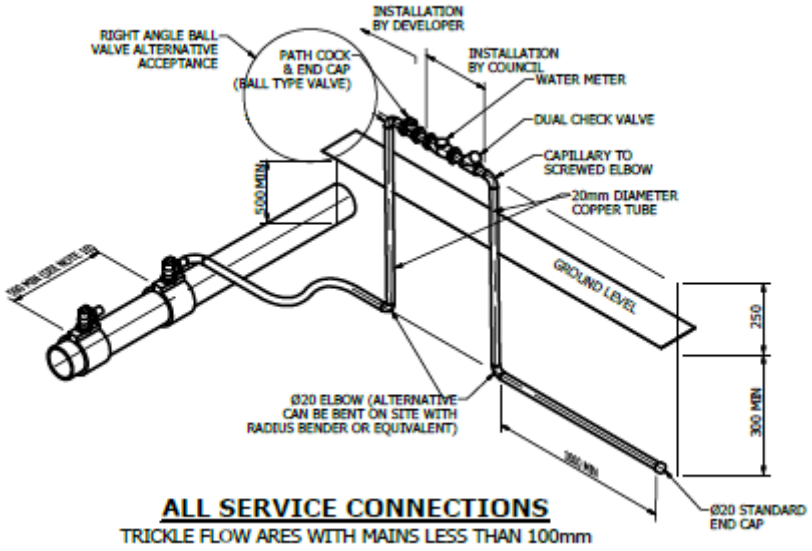
Approved tapping bands are to be used for all service connections. Tapping bands including hard stop design are required when using non DICL pipe material. Thin brass type without rubber backing, plastic or aluminium tapping bands are not permitted. Gun metal (brass) tapping band and stainless steel wrap around-type are acceptable manufactured in accordance with AS4793. All tapping bands are to be installed with stainless steel bolts.

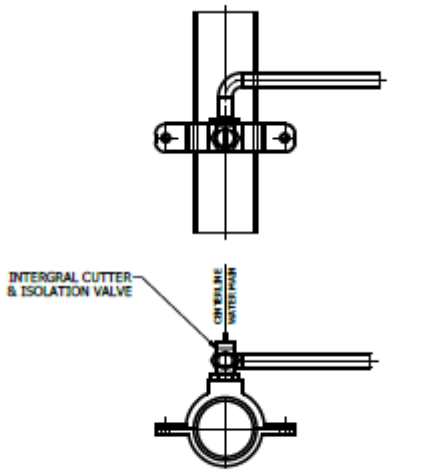
A minimum of 500mm spacing shall be maintained between tapping bands, saddles, pretapped connectors and or pipe joints where practical. Alternate spacing shall be at the Engineers authorisation and dependent on pipe diameter.

All main cocks are to be located in the footpath and have a capped riser pipe, minimum 100mm, vertically over the main cock to within 150mm of the ground level.

Typical tapping band connections are detailed in the drawings below; all dimensions are in millimetres.

Alternative connection arrangements such as horizontal tap for shallow watermains may be considered by the Engineer on a case by case basis.





3.9.12 Water Meter Installation

Council requires that all lots, including areas set aside for recreation, be provided with a water service as detailed in section 4.9 - Water Services

Council shall supply and install a water meter after an application has been received from the property owner, the applicable fees and charges have been paid and upon registration of the subdivision by the property owner.

3.9.13 Backflow Prevention

Drinking water supply systems shall be designed and equipped to prevent back siphonage. The location and operation of hydrants, air valves and scours shall be such as to minimise the likelihood of water entering the system. Backflow prevention devices shall meet the requirements of AS/NZS 2845.

Where meters above 25mm are to be installed a testable dual check valve must also be installed as the minimum provision for back flow prevention. An initial test report in accordance with AS/NZS 3500.1:2018 Appendix F Table F3 is to be provided.

3.9.14 Polyethylene Fittings

Polyethylene pipes and fittings shall be joined by electro fusion techniques in accordance with the manufacturer's requirements. Those carrying out the pipe joins shall be appropriately qualified, capable of demonstrating their experience with this technique and have the right equipment to correctly make the welds.

Service connections shall be copper, however PE service connections may also be approved by the Engineer prior to installation. Refer WSA03-2011 Drawings WAT-1105V (Typical Mains Construction Connection to Existing Mains) and WAT-1108V (Property Services – Connection to Main).

3.9.15 Pressure Reducing Valves

Where Pressure Reducing Valves (PRV's) are required they shall be of a type and design approved by the Engineer.

Installed within a building is the preferred option for PRV's.

Pits to house PRV's shall be constructed from concrete, or other suitable material, and be of a size that allows a clear work area of at least 600mm in all directions around the PRV. A drain shall be located in the bottom of the pit which drains to adjacent water course or drainage structure. At least one dismantling joint shall be required on the upstream and downstream side of the valve and the pit shall have lockable removable covers. Stop valves shall be installed on either side of the PRV.

4 CONSTRUCTION OF WATER RETICULATION

4.1 General

No work shall commence on the site until the development has development approval, the engineering plans and specifications have been approved in writing, conditions of consent required prior to commencement of works have been satisfied, bonds paid, and the Subdivision and Development Engineer notified. Two workings days' notice is required prior to the commencement of site works. This notice is to be given by the Developer.

4.2 Works Carried out by Council

Connection to Council's existing water reticulation system is to be carried out by Council personnel or a Council nominated Contractor. At the Developer's request, Council shall provide estimated costs to carry out the works. The estimates shall be based on the use of Council labour, plant and materials and shall include an allowance for overheads and on costs. As the payment is based upon an estimate only, actual costs shall be charged to the Developer on completion of the works. This may require payment of an additional amount or may result in a refund depending upon final costs. Pre-payment of the estimated amount shall be required prior to Council commencing any works.

The work shall be commenced within 20 working days of the date of receipt of payment, or delivery of material or upon written notification by the contractor to commence work, whichever is later.

The Developer is advised that several weeks lead time after payment may be required for the supply of non-stock materials. Council shall not be held responsible for any delays incurred by the Developer or their agents through a failure to obtain a timely quotation, make payment or make written notification for the required works.

A maximum duration of the shutdown shall be specified for each project. If no project specific maximum is specified, the duration shall be no more than 4 hours.

Before giving notice of the date that shutdown is required.

- Plan all work to minimise the duration of the shutdown.
- Obtain approval of the proposed connection procedures including methods to confirm the water main has been shut down effectively.
- Make all components required for the cut-in available for inspection.

Give notice of the shutdown at least 7 working days prior to the date on which the shutdown is required.

To minimise the duration of the shutdown, Council shall not commence the shutdown unless:

- All pipes and fittings required for the connection are available at the connection point and, where possible, have been assembled above ground ready to lift into place.
- The excavation required for the connection is complete and made safe prior to Council's shutdown personnel arriving on site.

Shutdown of the existing mains may not completely prevent the inflow of water into the sections isolated. Measures are to be implemented to manage the situation.

4.3 Supply of Pipes and Fittings

The Developer is to supply and deliver all pipes, fittings and other materials (with the exception of material supplied by Council under section 4.2 – Works Carried out by Council) required to construct the work as detailed on the approved engineering plans and in accordance with the following sections.

4.3.1 Quality Assurance

In regard to the manufacture of products detailed in section 4.3 – Supply of Pipes and Fittings, the Manufacturer shall have implemented a Quality Control/Assurance System to ensure that all testing and manufacturing equipment, manufacturing processes, hardware, materials and workmanship meet the requirements of the specification or relevant Australian Standard.

Except where otherwise specified, the Quality Control/Assurance system is to meet the minimum requirements of AS3902 (Quality Systems for Production and Installation).

Prior to the use of any product on site, the Developer is to provide the Engineer with a Certificate of Compliance in accordance with Section 4.3.2 – Supply of Pipes and Fittings – Certificate of Compliance for Materials from the Manufacturer stating that all products supplied and which are listed in Section 4.3 – Supply of Pipes and Fittings have been manufactured in accordance with AS3902 (or the applicable Quality Standard) and comply with all requirements.

Where the Manufacturer of any of the products listed involves a number of Manufacturers, a certificate from the Head Manufacturer or supplier shall be accepted subject to the Head Manufacturer establishing Quality Procedures for the product supplied from other Manufacturers and verifying such quality in accordance with the required standard.

4.3.2 Certificate of Compliance for Materials

As a prerequisite to acceptance of any pipe, fitting or valve delivered to site, the Developer is to obtain from the Manufacturer and provide to the Engineer, upon delivery, a certificate indicating that all items listed on the certificate comply with the appropriate Australian standards, sections of the standard Specification and any other relevant conditions of the Specification.

Furthermore, the certificate is to bear the following:

- the Developers name or reference number;
- the name of the Manufacturer;
- the plant where the items were fabricated;
- the signature of the Manufacturers Quality Assurance Officer at the plant and the signature of the Developer's representative on site, confirming compliance of items with the contract conditions.

Any items which are delivered without a certificate are liable to rejection.

The acceptance of the items by the Engineer based on the above certificate do not relieve the Developer of any obligations under this Specification to supply the items as specified and shall not negate the Engineer's right to later reject items which are not as specified.

4.3.3 Marker / Dectector Tape

A plastic mesh style detectable fair warning tape complying with Australian Standard AS2648 shall be laid with water mains in accordance with the manufacturer's specifications. The tape shall be green in colour and contain a minimum of 0.7mm grade stainless steel tracer wire.

At a minimum such tape shall be continuous and electrically bonded to metallic components including services and standpipes. Tape shall loop around valves, hydrants, service line tappings and all other fittings.

Tape is to be long enough to extend beyond the extremities of the pipe and laid a minimum of 300mm directly above the water main.

Where pipes are installed via trenchless or pipe bursting techniques a tracer wire shall be installed. Tracer wire specific to the installation method shall be used. Selection of the tracer wire should consider the installation method and should be robust to prevent breakage.

4.3.4 Witness Marks

A full circle witness mark is to be provided on each spigot of all pipes supplied by the pipe manufacturer. The Developer is to install the pipes such that the centreline of the witness mark or groove or at least one point thereof, is in the plane of the face of the socket and such that no portion of the centreline is inside the socket. The permissible deflection as recommended by the Manufacturer is not to be exceeded, provided that the requirements of the specification shall take precedence. Any pipes cut to length are to have their witness mark reinstated at the position recommended by the Manufacturer prior to joining.

4.3.5 Fasteners

Unless otherwise approved in writing by the Engineer, all bolts and washers for flanged coated fittings that are to be buried in the ground are to be stainless steel Grade 316 to AS1444. All nuts are to be stainless steel Grade 304. All other bolts, washers and nuts that are not buried in the ground may be hot dipped galvanised in accordance with AS1650.

Before and during assembly all stainless steel components are to be thoroughly coated with a copper impregnated anti-seize paste/grease or an approved equivalent.

All exposed bolt heads and nuts are to be hexagonal, and the length of all bolts is to be such that when fitted with a nut and tightened down, the threaded portion shall fill the nut and not protrude from the face thereof by more than half a diameter.

4.4 Handling and Storage

The method of loading and storage of pipes and fittings is to be in accordance with the Manufacturers recommendations and further as follows.

- PVC pipes and fittings are to be stored, transported and handled generally in accordance with the relevant provisions of AS2032 and with equipment such as to preserve their dimensional and physical properties and to avoid damage to the pipes and fittings.

  Pipes and fittings are to be handled with care at all times and in particular with regard to the following:

  a. The impact resistance of PVC is considerably reduced at low temperatures; it is also greatly and permanently reduced by surface notches and scratches and by prolonged exposure to direct sunlight.

  b. High temperatures tend to soften PVC and may result in permanent distortion of PVC pipes

and fittings.

- When handling PVC pipes and fittings, the Developer shall comply with the following particular requirements:

  a. Pipes and fittings are not to be dropped. Impact with other objects shall be avoided, especially in cold weather.

  b. When pipes are stacked the height of the stack shall be limited to seven layers of pipe, unless otherwise allowed or directed by the Engineer. Side supports used in rectangular stacking is to be spaced not further than 1.5m apart. Pipes shall be positioned alternatively in the stack, spigot end against socket end, with sockets protruding sufficiently to ensure contact along the full length of the barrel. When storing different classes of pipe in the same stack, the heaviest class is to be placed at the bottom.

  c. If pipes are nested (ie pipes stored inside pipes of larger diameter) the number of layers of pipes in a stack shall be reduced so that the total weight of the pipes is a normal stack (ie where the pipes are not nested and where the specified maximum height of the stack is not exceeded).

  d. Any pipes which are to be stored for more than 5 weeks shall be protected from sunlight, if necessary, by covering with building paper or other approved material).

  e. The date of manufacture of pipe should not be more than 12 months prior to start of the contract works.

  f. When pipes and fittings are to be jointed, the spigot is to be pushed into the sockets by hand or the joint may be effected using approved implements such as pullers having jaws lined with rubber or similar material in order to avoid scoring the pipe. The use of lever bars shall only be permitted if adequate and suitable protection from damage is applied to the end of the pipe being levered.

4.5 Earth Works

4.5.1 General

All excavations shall be to the lines, grades and forms shown on the approved drawings or as directed by the Engineer in accordance with the requirements of this section.

4.5.2 Existing Services

All existing services in the vicinity of works are to be located and marked prior to excavation. Services in close proximity to works are to be carefully exposed (by non-mechanical/non-destructive excavation or potholing) to ensure the risk of damage when excavating is minimised (eliminated) and appropriate clearances maintained during construction.

Location of Services

Verify the exact location of all services which may be affected by construction activities. The Asset Owner must be notified if services are affected in any way.

Protection and Maintenance of Services

Protect and maintain existing services to the satisfaction of the Asset Owner including, if necessary, relocation, temporary diversion or support of the service.

Asset Owner permission may be required in some circumstances, eg power, telecommunications, gas, etc.

Before You Dig Australia

Before You Dig Australia, BYDA is a free service which facilitates the provision of asset plans and information to anyone working in and around infrastructure assets directly from owners of utility services. Enquiries may be made online via their website at Before You Dig (1100.com.au) or by phone at 1100. Nevertheless, hand excavation (pot-holing) or non-destructive digging is recommended to determine the exact location and depth of underground obstructions during design and again immediately prior to excavation.

Underground services and other obstructions such as power conduits / cables, gas mains, drains, telecommunication conduits / cables, oil / petrochemical pipelines and the underground portions of surface obstructions (tree roots, pits, etc.) may affect the proposed alignment of water main components both in plan and in level.

Note: Council's stormwater assets are not provided on BYDA plans. Location plans of these assets should be requested through Council's customer service centre.

Repairs of Services

Any damage to a Council owned asset must be reported immediately to Council. Council reserves the right to recover compensation for loss or damage and repair costs to any of its assets irrespective of provisions of plans or undertaking location on site. Repairs made to Council assets are to be carried out by **Council employees or Council approved contractors only**. A minimum charge shall be applied to any repairs carried out, refer to Council's Annual Fees and Charges.

If a service is damaged during execution of the work, subject to Asset Owner approval, arrange or perform repair to the satisfaction of the Asset Owner. Obtain from the Asset Owner a certificate stating that the repair has been carried out to their satisfaction.

If the service is not under the control of an authority and the Owner cannot be located within a reasonable time, report the damage, and arrange or perform repair to an approved standard. Do not backfill, cover up or make the repair inaccessible prior to obtaining approval.

Disused Water Mains

Unless noted otherwise on the Design Drawings, cap all disused pipelines at each end to prevent ingress of seepage water. Ends of mains are to be plugged with minimum N10 Concrete with minimum 100mm length of concrete plug column within the pipe.

Remove and dispose of all redundant surface and other fittings and marker plates and/or stencils as advised.

Do not commence any excavation until all equipment and materials necessary to make the excavation safe are on site and available for use. This includes any necessary fencing and barriers, as well as trench support systems and signage

Assess site for prior excavations and consider their impact on the new excavation.

Conduct a site hazard and safety assessment prior to commencement of any excavation to identify all potential hazards and safety measures required.

4.5.3 Limits of Excavation

The extent of clearing and excavation is to be kept to the minimum practicable to allow efficient construction of the Works. Obtain the approval of Council or the Asset Owner for the removal of any trees and prevent damage to trees that shall remain.

Stockpile topsoil separate from other excavated material and use the topsoil to make good the surface after backfilling.

Unless specified otherwise, keep the sides of excavations vertical to at least 150mm above the main.

Ensure that the minimum cover requirements shall be satisfied following any earthworks that may occur in the area of the water main. This is particularly relevant in new subdivisions or developments where earthworks are expected to form roads, driveways, footways and for general shaping of the surfaces. If minimum cover cannot be achieved, propose an alternative for approval by the Engineer.

4.5.4 Excavation Across Improved Surfaces

Obtain written permission of the Asset Owner prior to commencing any excavation across improved surfaces**.** If pipework is to cross improved surfaces such as pavements, driveways, kerbs and gutters, use tunnelling or boring if practicable.

If open excavations across improved surfaces are necessary, keep the trench width to the minimum allowed. Saw cut neat straight lines at least 150mm beyond the outer limits of the excavation through bitumen, asphalt and concrete. Remove pavers, blocks or brick pavements by hand, clean them and set them aside for later replacement.

Road reinstatement is to be carried out in accordance with the Asset Owner's requirements.

4.5.5 Excavation in Root Zones

Ensure that no undue damage is caused to a tree root system. Cleanly cut all roots ≤60mm diameter encountered during excavation.

Tunnel or bore to avoid tree roots larger than 60mm diameter.

4.5.6 Drainage and Dewatering

Keep all excavations free of water. Provide, maintain and operate intercepting Works to prevent surface water from entering the excavations. Provide all equipment necessary for dewatering the excavations and keeping the Works free from water.

Only lower the water table by well points or other external dewatering methods if no damage is likely to be caused to adjacent structures and services or the environment.

Ensure that all downstream Works that are under construction, completed or in use are protected at all times against the effects of any drainage that is discharged or likely to be discharged from the Works.

Do not discharge dewatering to sewers, storm water drains or watercourses without appropriate authorisation and without complying with the Owner's or Regulator's requirements.

4.5.7 Horizontal and Vertical Deflection of Pipes

Do not cold bend any pipe other than PE. Bending of PVC pipe is not permitted. Do not use temporary pegs or stakes to bend the pipe.

Do not exceed the pipe manufacturer's specified limitations to the applicable bend radius and advice.

4.5.8 Excavation Depth

For all pressure pipelines excavation is to be carried out to a depth of not less than 75mm below the underside of the pipe barrel and socket or coupling in the case of earth foundations and 100mm below the underside of the pipe barrel and socket or coupling in the case of rock foundations.

4.5.9 Trench Width

Minimum Width:

For all PVC pressure pipelines the minimum clear width of trench (inside internal faces of timbering or travelling box, if used) to a height of 150mm above the top of the pipe is to be the nominal size of the pipe plus 250mm.

Maximum Width:

For PVC piping, the maximum width of trench from the trench base to a height of 150mm above the top of the pipe is to be the nominal size of the pipe plus 400mm.

However, in timbered or travelling box excavated trenches, the width of trench when measured to the outside of the support used, may be increased to a maximum of 580mm plus the nominal size of the pipe.

Extra Width Excavation:

Where the width of trench below a level of 150mm above the top of the pipe is greater than the maximum specified above, either as a result of over excavation or due to collapse of one or both walls of the trench from any cause whatsoever before or after laying of the pipe, the Developer is to remove all disturbed material from the trench. The Engineer may then direct one or more of the following:

- Bedding and laying, as specified further in Sections 4.6.2 – Pipe Bedding – Bedding Specification and Section 4.7 – Laying and Jointing of this Specification for the same pipe;
- Installation of a heavier class of pipe;
- Filling the space between the pipe and the undisturbed ground on both sides of the pipe and to a height of 300mm above the top of the pipe with sand or granular material of the type approved for pipe bedding as specified in Sections 4.6.2 – Pipe Bedding – Bedding Specification. Such sand or granular material is to be compacted in layers not greater than 150mm thick by approved means.
- Bedding of the pipe on a concrete cradle extending a minimum of 100mm on each side of the outside diameter of the pipe, a minimum of 100mm under the barrel and to

a level above the bottom of the pipe of one quarter of the external diameter of the pipe.

- Backfilling and compaction for the remainder of the trench is to be as directed by the Engineer

4.5.10 Extra Excavation Depth

Where, in the case of poor ground conditions, the Engineer directs extra depth to be excavated in order to obtain a firm trench bottom, the portion so excavated will be refilled to the level required for bedding of the pipe with an approved free draining non cohesive material such as sand, fine crushed rock or granular material (blue metal) free from fly ash, as directed by the Engineer, placed in layers 150mm thick and compacted by approved means.

4.5.11 Backfilling and Compaction

- When laying and jointing of a pipeline has been completed and before backfilling has commenced, the Developer is to request the Engineer for an inspection and approval to proceed with works. No backfill shall be placed until these checks have been made. At this stage, the Developer is encouraged to satisfy himself that the pipeline is correctly laid in relation to line and level.
- Backfill to within 150mm of the pipe surround material (refer Sections 4.6.2 – Pipe Bedding – Bedding Specification) is to be selected backfill free of large stones, rocks or hard nodules, fly ash and may, as far as is practicable be taken from the excavated material. The backfill material is to be compacted to a height of 150mm over the top of the pipe surround.
- For all trenches that are to be subject to vehicular traffic, or as directed by the Engineer, all backfill material is to be fully compacted in layers not more than 150mm thick to 70% density index determined in accordance with AS1289 for non-cohesive material to the subgrade level of the road or the finished surface level as directed. The use of cohesive material for backfill is not permitted. Backfill to the road surface level is to be an approved road base material to a minimum depth of 300mm.. Prior to backfilling and compaction of vehicular trafficable trenches, bulkheads consisting of polyethylene bags are to be provided across the full width of the excavated trench directly behind the kerb to contain the compacted material. The bulkheads are to be recessed into the sides of the trench excavation a minimum of 100mm and are to extend from the top of the pipe surround material (refer Sections 4.6.2 – Pipe Bedding – Bedding Specification to the underside of the kerb.
- When the excavated material is considered by the Engineer to be unsuitable for use as backfill, then the Engineer may order that backfill material of a non- cohesive nature, such as sand or river gravel be used and compacted in accordance with Section 4.5.11(3) – Earthworks – Backfilling and Compaction. Alternatively, the Developer may elect to import selected backfill material borrowed from sources arranged by the Developer and approved by the Engineer and compact this by mechanical means. Notwithstanding the above, all surplus excavated material is to be removed and disposed of into areas approved by the Engineer. The Developer is to pay all costs involved in such removal and disposal.
- Where compaction is ordered and the trench has been externally dewatered, the

dewatering equipment is to be kept operating until the compaction of the trench has been completed. Water discharge from external dewatering equipment may be used for compaction by flooding.

- Where compaction is ordered in areas other than under roadways, the backfill is to be compacted to the approval of the Engineer, by manual or mechanical tampers in layers of not more than 150mm thick to 95% of the standard maximum dry density in accordance with AS1289, or when approved by the Engineer, by flooding with water as backfilling proceeds. Tamping is only to be carried out with backfill damp but not sodden. Flooding of cohesive material is not permitted as a means of compacting backfill.
- Water for compaction by flooding is to be introduced onto each 300mm layer of material placed so as to permeate downwards. To achieve the specified level of compaction, mechanical assistance such as tamping or vibration may be necessary.
- Backfilling and compaction is to be carried out without damaging the pipe or its external coating or producing any movement of the pipe.

4.5.12 Erosion and Sediment Control

In the event of any trenching being left open for an extended period of time is longer than one week, the Developer shall provide erosion control measures to ensure minimal soil disturbance and material loss off the site. These measures are to be provided as outlined in Control of Erosion and Sedimentation.

Additional control measures may be necessary as detailed below:

- Provision of trench stops every 30m along a trench with provision for overtopping to be directed to the kerb.
- Placement of blue metal bags along kerb and gutter at maximum 30m spacing.
- Placement of blue metal bags around downstream drainage pits.
- Construction of diversion banks to divert the uphill catchment water from entering the trench.

4.5.13 Restoration

Backfill shall be placed sufficiently high to compensate for expected settlement and further backfilling is to be carried out or the original backfill trimmed in order that the surface of the completed trench may then conform to the adjacent surface level.

Where, within public or private property, the reasonable convenience of persons shall require such, the Engineer may order trenches to be levelled off at the time of backfilling. The area disturbed during construction shall then be topsoiled and seeded or turfed if required. Any subsequent settlement is to be made good by the Developer.

The Engineer may require the Developer to tunnel under paving, kerb and gutter or other improved surfaces in lieu of trenching. Backfilling is to be carried out so as to restore full support to those surfaces. The Developer shall remain responsible for the maintenance and repair of the improved surfaces, if subsequent damage occurs due to subsidence or erosion of the backfill, until the end of the Maintenance Period.

Immediately the backfilling of a trench excavated through a pavement has been completed, the pavement is to be temporarily restored. Where the trench crosses bitumen or concrete pavement, a pre mixed asphaltic material shall be used for such temporary restoration. Temporary restoration is to be maintained by the Contractor until final restoration is carried out. Final restoration of the pavement shall be carried out to restore the pavement and its sub base to no less than the original condition. Final restoration may include, if required by the Engineer, the removal of temporary restoration.

Where an existing access crossing is cut, broken or disturbed to provide services in trenches, the whole access is to be removed and replaced to its original condition.

4.5.14 Maintenance

All restored surfaces are to be maintained by the Developer until the expiry of the Maintenance Period applicable to those surfaces.

4.5.15 Thrust Boring Under Roads

Where the provision of water mains requires the crossing of existing Council roads and where the Engineer directs such crossing are required to be constructed by thrust boring the method is to be as detailed hereunder:

- Construction shall be by means of thrust boring or pipe jacking or another approved method.
- The Contractor is to supply all materials for the work including but not limited to carrier pipe, exterior encasing sleeve, grout and cradles.
- The encasing pipe is to be steel or reinforced concrete complying with the respective requirements of a) and b) below:
  a. Steel encasing pipe is to be fabricated from steel having specified minimum yield strength of 230MPa and shall have a minimum wall thickness of 8mm for inside diameter less than 450mm or 12mm for encasing pipes of larger inside diameter up to 800mm;
  b. Reinforced concrete encasing pipes are to comply with AS4058 with reinforced concrete rebated joints – the minimum class of pipe shall be Class 4.
- The inside diameter of the encasing pipe is to be at least 100mm greater than the largest outside diameter of the carrier pipe as measured at the joint or coupling to allow installation of the line to its design grade and line within the specified tolerances.
- Subject to compliance with tolerance for line, grade and level, the carrier pipe may be located anywhere within the encasing pipe. These requirements may be varied to allow the tolerance for line and level to be ±100mm.
- The Contractor is to supply and install suitable pipe support cradles to the satisfaction of the Engineer which shall allow installation of the carrier pipes in accordance with the foregoing requirements. The first and last cradle is to be within 1m from each end of the encasing pipe.
- After construction, installation and pressure testing of the carrier pipes the Contractor shall fill the annular space between the carrier and encasing pipe completely with a grout mix complying with item 8 of this section (below). All precautions are to be taken to ensure that there is no movement of the carrier pipe from its line and grade during grouting. The carrier pipeline shall be filled with water

prior to grouting.

- Grout to be used for the sealing of the annular space is to be a mixture of cement and water, plus an admixture if specified or approved.
- These materials are to be mixed to a consistency which satisfies the Engineer, who shall require that such consistency be the stiffest at which, in his opinion, the grout can reasonably be forced through the air space at the specified or approved pressure, so as to completely fill all voids in the ducts. The water cement ration (by mass) shall not be greater than 0.60.
- Testing of the line is to be in accordance with Section 4.10 – Testing and Inspection.

Where the provision of water mains requires thrust bored crossings of RMS or ARTC property the requirements of the relevant authorities is to be sought and complied with.

4.6 Pipe Embedment

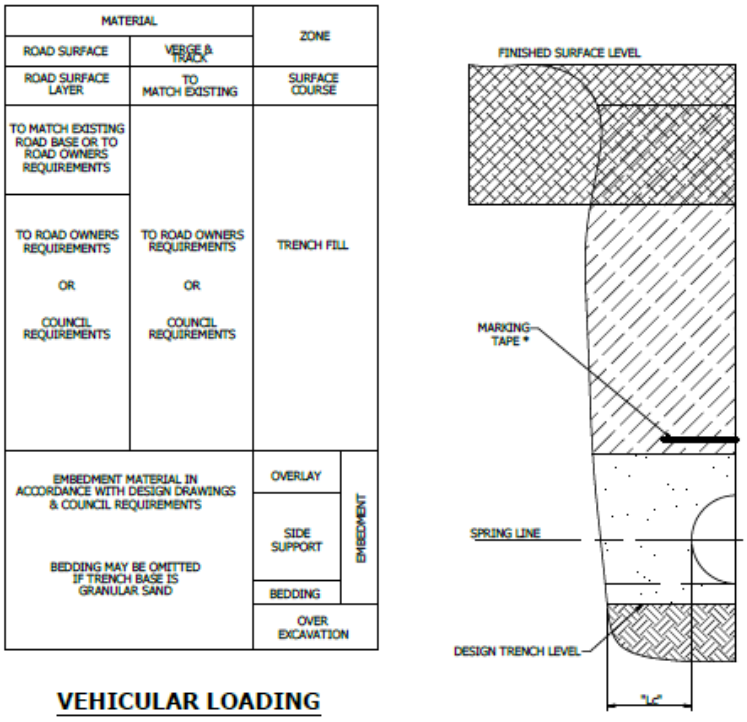
4.6.1 General

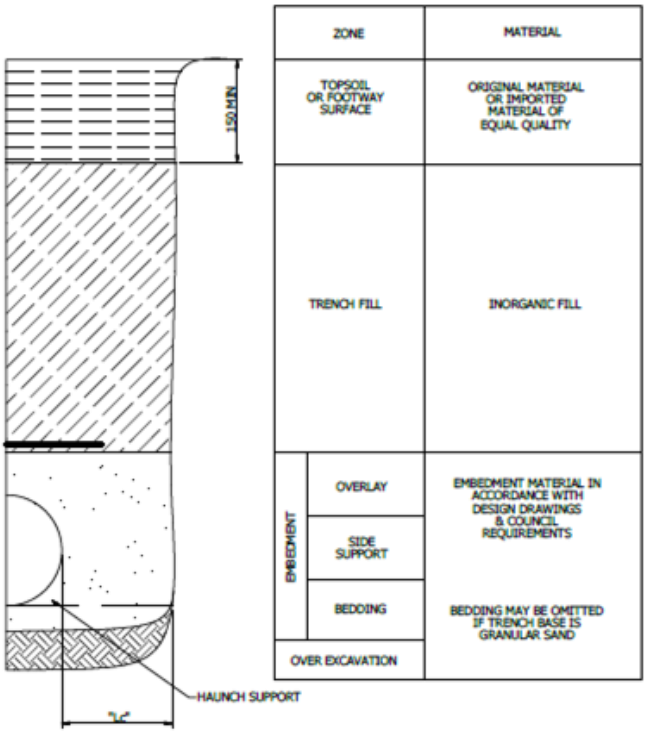
When excavation of a trench has been completed and approved by the Engineer, the Developer is to provide for bedding of the pipe in accordance with the following requirements.

Pipe embedment types and specifications shall be shown on the design drawings and shall include the embedment materials and reinforcement details, where required.

Standard embedment types shall be designed and constructed in accordance with Water Supply Code of Australia WSA03-2011-3.2 *Figures 7.2 Type A Embedment Support (In-situ Sand and Gravel)* and *7.3 Type B Embedment Support (Other then Sand)*.

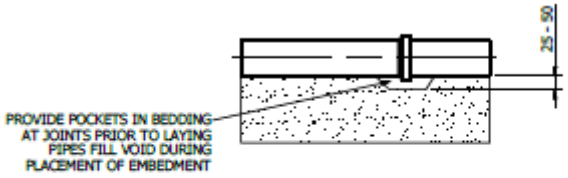
A typical arrangement of a buried pipe in a trench showing embedment and trenchfill zones for trafficable and non-trafficable loadings are shown below.





NO VEHICULAR LOADING

(INCLUDES LOCATIONS WHERE OCCASIONAL VEHICLE LOADINGS OCCUR EG. PARKLANDS, FOOTWAYS)



PIPE JOINT BEDDING POCKETS

FOR JOINT PROJECTIONS (SOCKETS, FLANGES ETC)

Minimum cover depths shall be in accordance with the tables below.

MINIMUM PIPE COVER

LOCATION	ABSOLUTE MINIMUM COVER SEE NOTE 5	COUNCIL PREFERRED MINIMUM COVER SEE NOTE 5
NON ROADWAYS		
- GENERAL	450	600
- INDUSTRIAL	600	750
- FOOTWAYS IN MAJOR ROADWAYS (RMS CONTROLLED ROADS)	750	900
COUNCIL ROADS		
- MINOR LOCAL ROADS	600	750
- OTHER COUNCIL ROADS	750	900
MAJOR ROADWAYS/EMBANKMENTS (RMS CONTROLLED ROADS)	750	1500
FREEWAYS	1200	1500

SPRING LINE TRENCH CLEARANCE

NOMINAL DIAMETER (DN)	MINIMUM CLEARANCE "Lt" TO AS/NZS 2566.1
≤150	100
>150 - <300	150
>300 - <450	200
>450 - <900	300
>900 - <1500	350

TRENCH WIDTH TO BE SUFFICIANT TO SAFELY LAY THE PIPE & COMPACT THE SIDE ZONE

Minimum cover under a sealed carriageway (road pavement) shall be taken from below the finished road level as required by the RMS and the Engineer. Cover shall be increased to accommodate valves and hydrants. Minimum pipe cover requirements shall only be reduced with the approval of the Engineer.

4.6.2 Bedding Specification

For all pipe materials the material to be used for pipe bedding (underlay a minimum of 75mm below the pipe barrel and socket for earth foundations and 100mm for rock foundations), side support and overlay to a minimum depth of 150mm above the top of the pipe (as specified in Figure 5.1 in AS2032) is to be sand or other approved non cohesive granular material, either crushed natural or blended and its grading shall fall within the following limits:

Sieve Size Aperture Width (AS1152)	Equivalent BS Size (BS410)	Percentage Passing
9.55mm	3/8 inch	100
6.7mm	1/4 inch	90 – 100
425µm	No 36	40 – 90
150µm	No 100	0 – 10

The material is to be compacted under, around and to a minimum of 150mm above the top of the pipe and is to extend for the full width of the excavated trench.

4.6.3 Special Embedment

A geotechnical assessment shall be made for all pipes where historical data or evidence indicated geotechnical problems (eg steep slopes, land fill site, mine subsidence and road conditions etc). The design drawings shall incorporate all geotechnical requirements.

Considerations for concrete encasement, cement stabilised fill systems and geotextile surround systems shall be designed and constructed in accordance with Water Supply Code of Australia WSA03-2011-3.2 *Figures 7.4 Type C and D Embedment Support, 7.5 Type E Embedment Support, 7.6 Type F Embedment Support, 7.7 Type G Embedment Support, 7.8 Type H Embedment Support* and *7.9Type J and K Concrete Encasement Embedment Support.*

Special embedment designs shall be approved by the Engineer.

4.6.4 Damage

Particular care is to be taken to avoid scratching or otherwise damaging the PVC pipes and fittings whenever the backfill is compacted by tamping. Tampers and method(s) of compaction are subject to approval by the Engineer.

4.6.5 Steep Pipelines

All pipes laid on grades of 15% to 50% shall be bedded on Grade 20 concrete. Such concrete bedding is to have a thickness of at least 75mm below the underside of the barrel and socket of the pipe and are to extend to a level above the bottom of the pipe of one quarter

of the external diameter of the pipe or 150mm minimum thickness, whichever is greater and a width across the trench not less than the minimum width specified.

- Trench stops and concrete bulkheads are to be designed and installed be in accordance with Sections 4.7.8 – Laying and Jointing – Trench Stops and Section 4.7.9 – Laying and Jointing – Concrete Bulkheads respectively.
- All pipelines laid on grades steeper than 50% are to be encased in concrete in accordance with section 4.6.3 – Special Embedment.

4.7 Laying and Jointing

4.7.1 General

When the bedding for pipes has been prepared as specified herein and approved by the Engineer pipes are to be laid and jointed in accordance with the Manufacturer's instructions and the provisions of this specification.

All pipes, fittings, valves etc. are to be of the class or wall thickness and size specified unless otherwise directed by the Engineer. Before being laid all pipes, fittings, valves etc. are to be cleaned and examined by the Developer and, if required by the Engineer, the Developer is to oil valves and repack valve glands.

Where the use of ductile iron pipes has been approved by the Engineer, all ductile iron pipe installed in the ground is to be wrapped in poly sleeving in accordance with the Manufacturer's specifications.

The Developer is to ensure that the interior of the pipeline is clean and free from obstructions. Approved plugs are to be used to prevent foreign matter entering sections of the pipeline which are left incomplete overnight or during the day.

The Developer is to take all necessary precautions to prevent flotation of pipes during laying, backfilling and initial testing. Any temporary supports are to be removed prior to completion of backfilling.

PVC pipes and fittings are not to be installed above ground, unless adequate support and special protection against direct sunlight is provided to the satisfaction of the Engineer.

4.7.2 Cutting of Pipes

Pipes may be cut as needed or directed to suit closing lengths, to remove damaged parts or to remove sockets if necessary, when jointing a socketed fitting.

For field cuts, only an approved mechanical pipe cutter is to be used, except that PVC pipes may be cut using a power saw or a fine toothed hand saw and mitre box.

Any pipes cut in the field are to have their ends prepared in accordance with the Manufacturer's instructions, or as directed by the Engineer.

4.7.3 Reinstatement of Witness Marks

For PVC pipes, only the antibacterial lubricant specified by the Manufacturer is to be applied in making the joint. When the joint is made, the witness mark is at no point to be more than 1mm from the end of the socket.

Where pipes are to be cut in the field, a witness mark is to be made on the pipe at the length from the end of the pipe specified by the Manufacturer. Scoring of PVC pipes is not permitted. Pencil or similar is to be used to make the witness mark. Where spigots and sockets are not made by the same Manufacturer, reference is to be made to the socket manufacturer for the correct marking depth (refer to section 4.3 – Supply of Pipes and Fittings).

4.7.4 Pipe Grading

All pipelines shall be laid on the grade and alignment as shown on the approved engineering plans or as directed by the Engineer.

Pipeline with gradual changes in alignment or grade, such as in cul-de-sac roadways, are to be laid with the joint being deflected after it has been made. The Manufacturers recommendation in respect of allowable maximum deflections for each joint is to be complied with, provided that no joint is deflected to such an extent as to impair its effectiveness.

4.7.5 Marker Posts and Plates

Marker posts shall only be installed at the request of the Engineer. Marker posts shall be constructed of high tensile powder coated steel with UV resistance and superior weathering; have depth markers for ease of installation and be 1500mm long and 75mm wide. The following colours shall be used;

- Blue indicates Water Mains
- Yellow indicated Hydrants
- White indicated Valves

Marker posts shall be fitted with vertical marker plates or stickers featuring distinct reflective letters for clear visibility at night. All marker plates shall be of heavy gauge galvanised steel and marker stickers shall use high bond adhesive for outdoor surfaces.

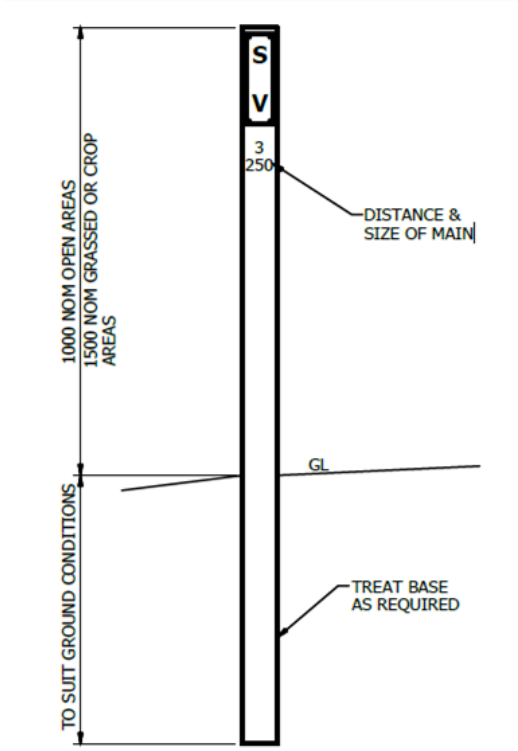


Figure 4.7.5 (1) Marker Post

Marker plates are to be 250mm high x 75mm wide in accordance with details below.

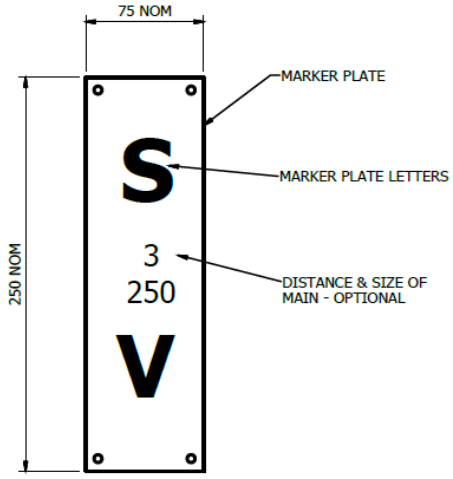


Figure 4.7.5 (2) Marker Plate Arrangement

All marker letters are to be 80mm high x 40mm wide x 15mm stoke width. Marker letters are to be Homebush Red (R22) or other colours to AS 2700 as appropriate to usage and at the discretion of the Engineer. Marker letters shall be lettered vertically, and the following are to be used;

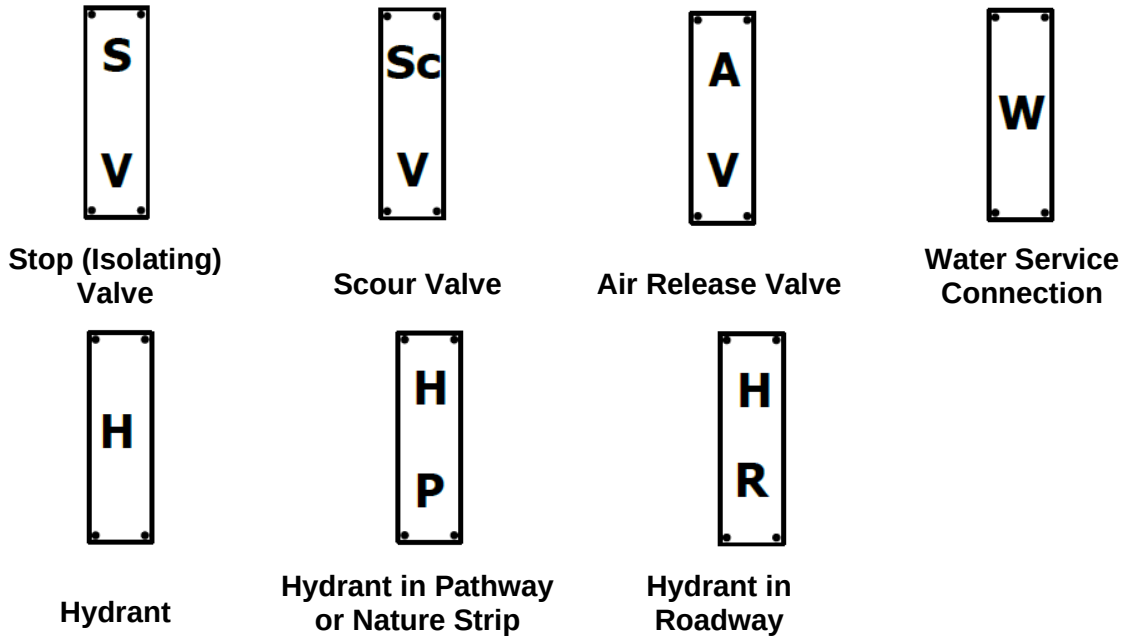


Figure 4.7.5 (3) Marker Plates

Distance to and size of the main/fitting shown on the marker post or plate is optional. If detailing distance to and size of main/ fitting on the marker post or plate, numbers shall be a minimum of 12mm high and either painted or punched to create a permanent identification. The top number shall be the distance to the main/fitting in metres and the bottom number shall be the DN of the main/fitting.

Marker plates may be attached to walls, fence posts or power poles. Where no such structure is available, marker posts shall be placed on the property boundary.

Marker posts and plates shall only be considered when the specifications of section 3.9.8 Kerb Impressions and Markers are deemed unfit by the Engineer.

Raise pavement retroreflective markets are not to be used.

4.7.6 Thrust and Anchor Blocks

Thrust and anchor blocks are to be constructed at valves, tees, dead ends, enlargers and reducers or any other point where unbalanced forces resulting from internal pressures shall occur. Thrust block construction is to be consistent with Manufacturer's specifications.

The Developer is to provide permanent thrust blocks of minimum Grade 20MPa concrete such that the thrust blocks bear against undisturbed material normal to the direction of thrust resulting from internal pressures over the calculated bearing area or as directed by the Engineer.

The Developer is to provide permanent anchor blocks complete with all necessary straps or reinforcement to a minimum Grade 20MPa concrete of a volume not less than that specified on the approved engineering plans or as directed by the Engineer.

Thrust and anchor blocks shall be designed and constructed in accordance with Water Supply Code of Australia WSA03-2011-3.2 typical thrust block details for non-restrained joint pipework in *Figures 7.11 Thrust Block for Tees (Horizontal Thrust), 7.12 Thrust Block for bends (Horizontal Thrust), 7.13 Taper Thrust Block (Horizontal) and 7.14 Thrust Block (Horizontal*

Thrust – Minimum Required Area as per Dead End) and typical concrete thrust blocks for valves in *Figures 7.15 Typical Concrete Thrust Block for Flanged Valves* and *7.16 Typical Concrete Thrust Block for Socketed Valves.*

Sizing of concrete thrust and anchor blocks shall be designed in accordance with the Water Supply Code of Australia WSA03-2011-3.2 *Table 7.3 – Minimum Thrust Area for Concrete Blocks at 1000kPa System Test Pressure.*

All thrust and anchor blocks are to be designed by the Developers Consultant and approved by the Engineer.

4.7.7 Pipeline Fittings Installation

Stop valves and hydrants and other fittings are to be installed where shown on the approved engineering plans or as directed by the Engineer. Stop valves and hydrants are to be fixed plumb and square to the centre line and at a depth to provide clearance of between 150mm (minimum) to 300mm (maximum) from the top of the valve spindle or hydrant to the top of the surface box lid in accordance with drawing details in section 3.9.9 Hydrants and section 3.9.9 Hydrant Flushing Points and Stop Valve Chambers.

All valve and hydrant boxes are to be placed a minimum of 70mm (for 3.5m footpath) above the adjacent top of kerb level, this allows for the standard footpath crossfall plus 30mm for footpath restoration. In all instances, design footpath crossfall is to be checked for non-standard treatment.

In all situations the boxes should be “proud” of the general footpath finished level by 25mm. A minimum 300mm width strip of turf is to surround the finished box construction.

The Developers attention is directed to the pipeline cover requirements detailed in section 4.9.2 – Water Services – Location.

- All stop valves and hydrants must be provided with a cast iron cover box and a concrete surface box (or plastic surface box if in a non-trafficable area) all conforming to the requirements of this section, section 3.9.9 – Hydrant, Flushing Points and Stop Valve Chambers and in accordance with drawing details in section 3.9.9 Hydrants, section and section 3.9.9 Hydrant Flushing Points and Stop Valve Chambers.
- Concrete surface blocks are to be constructed of reinforced Grade 20MPa concrete with 20mm coarse aggregate and is to be a maximum of 570mm in diameter or 570mm square as detailed in section 3.9.9 Hydrants and section 3.9.9 Hydrant Flushing Points and Stop Valve Chambers.
- Hydrant box and concrete surrounds are to be supplied as a two part non bonded assembly and must be compatible with each other to ensure flush finish. Hydrant boxes cast into concrete surrounds shall not be acceptable. Refer to section 3.9.9 – Hydrant, Flushing Points and Stop Valve Chambers.
- The surface finish of the concrete blocks is to be smooth and dense. Locks are to be properly cured and approved by the Engineer prior to placement.
- Protective boxes for stop valves and hydrants are to be constructed around the fitting stems and are to consist of interlocking concrete blocks conforming to section 3.9.9 – Hydrant, Flushing Points and Stop Valve Chambers and drawing details in section 3.9.9

Hydrants. The walls are to provide firm and even support for the concrete surface block as detailed in section 4.7.7 (1) – Laying and Jointing – Pipeline Fittings Installation.

- Marker posts and plates shall be in accordance with section 4.7.5 Marker Posts and Plates.

4.7.8 Trench Stops

Trench stops are required for grades of 5% or steeper. Spacing requirements are detailed in Water Supply Code of Australia WSA03-2011-3.2 *Table 7.5 Requirements For Bulkheads and Trenchstops*:

Table 7.5 REQUIREMENTS FOR BULKHEADS AND TRENCHSTOPS

Grade %	Requirement	Spacing *S* m
5-14	Trenchstop	*S*=100/Grade%
15-29	Concrete bulkhead	*S*=*L*/Grade%, where *L* = 80xPipe length*, m (450 m max) Where *L*>100 m – use intermediate trenchstops at spacing <100/Grade
30-50	Concrete encasement (continuous) and concrete bulkheads	S = 100/Grade(%)
> 50	Special design	
* Pipe length is the standard pipe length installed.		

Adequate trench drainage shall be installed to prevent trench scouring and subsidence due to high permeability of the bedding and trench fill. Typical trench drainage systems shall be in accordance with Water Supply Code of Australia WSA03-2011-3.2 *Figures 7.23 Typical Trench drainage Detail at Bulkhead, 7.24 Typical Trench Drainage Detail at Low Point in Trench, 7.25 Typical Trench Drainage Detail at Concrete Encased Sections and 7.26 Typical Trench Drainage Discharge.*

Trench stops shall be installed in accordance with Water Supply Code of Australia WSA03-2011-3.2 *Figures 7.22 Typical Trenchstop Details*. The bags are to be placed to give close contact with the pipe and to fill the entire space between the excavated recess and the pipe. Bags shall not be placed onto sand bedding.

Pipe material in steep grades shall be approved by Council on a case by case basis.

4.7.9 Concrete Bulkheads

Where a pipeline is installed at a grade of 10% or steeper concrete bulkheads of Grade 20 concrete 150mm minimum thickness shall be constructed in accordance with Water Supply Code of Australia WSA03-2011-3.2 *Figures 7.20 Typical Concrete Bulkhead and 7.21 Typical Road Crossing Bulkhead.*

- Where concrete bedding or encasement to pipe is required as specified in section 4.6.4 - Pipe

Embedment - Steep Pipelines, the 150mm thick bulkhead shall be cast integral with the concrete bedding or encasement across the width of trench and be keyed into both sidewalls a minimum of 150mm in OTR and 75mm in rock. The bulkhead is to extend to surface level or lower as directed by the Engineer.

- Where other bedding, or no bedding, is applicable the bulkhead shall also be keyed into the bottom of the trench 150mm in OTR and 75mm in for the full width of trench.
- A 75mm nominal diameter drain hole is to be provided in the concrete bulkhead immediately above the top of the encasement bedding or foundation and crushed rock or gravel shall be placed in and at the upstream end of the drain hole to act as a filter. The gravel shall be 10 to 20mm in size within 150mm in all directions upstream and above the invert of the drain hole beyond which another 150mm thick surround of gravel 2 to 10mm in size shall be placed. An approved filter fabric may be used in lieu of the 150mm thick gravel surround.

The location and details of all bulkheads and trench stops shall be indicated on the design drawings.

4.7.10 Water Main Connections

Connections to Council's existing water supply network shall be carried out by Council. At the Developer's request, Council shall provide estimated costs to carry out the works.

Where the development requires a fire service or water main extension, Council's scope of works will include provision of a connection point on the water main (tee and stop valve only). The Developer will be required to extend the service main from the connection point to the property. Where this requires works within the road easement the Developer shall obtain a road opening approval under section 138 of *The Roads Act 1993*.

The estimates shall be based on the use of Council or contracted labour, plant and materials and shall include an allowance for overheads and on costs. Additional costs for latent conditions will be passed on to the Developer on completion of the works. Payment of the estimated amount shall be required prior to Council commencing any works. The work shall be commenced within 20 working days of the date of receipt of payment, or delivery of material or upon written notification by the contractor to commence work, whichever is later.

4.8 Restoration

4.8.1 General

As early as practicable, restore the site as near as practicable to its condition prior to construction of the Works.

4.8.2 Pavements

Immediately after filling a trench excavation through a pavement, restore the pavement to a trafficable condition. Where the initial restoration is of a temporary nature, use a pre-mixed asphaltic material.

Maintain temporary restoration until final restoration is carried out. Carriageway pavements and footways shall be reinstated in a continuous manner to a condition equivalent to that existing at the commencement of works.

Complete the final restoration of bitumen and concrete pavements within one (1) month of temporary restoration.

4.8.3 Lawns

Reinstate lawns with turf sods cut and set aside from the original surface or with similar turf imported for the purpose. To make up any deficiencies between the stripped quantity and the quantity required for reinstatement, use imported topsoil consisting of a sandy loam of light to medium texture, containing 5% to 10% by weight of humus, and free of weeds.

For areas to be turfed, ensure topsoil is graded to achieve a smooth surface, is free from lumps, stones and other debris, and conforms to finished levels, blends gradually into the adjoining undisturbed ground and finishes flush with kerbs, footpaths and other paved surfaces.

Incorporate into the topsoil at the rate of 40 g/m² a fertiliser mix with a nominal Nitrogen : Phosphorus : Potassium ratio of 10:4:6.

4.8.4 Grassed Areas

For grassed areas that are not lawns, restore by replacing the pre-existing topsoil and maintaining the disturbed area in a condition that shall promote re-growth of pre-existing grasses.

Alternatively, replace pre-existing topsoil with clean topsoil and seed the affected area with grass seeds or re-plant with runners of the varieties prevalent in the immediate area.

Should re-growth of grass fail to occur, repeat the process until re-growth is established.

4.8.5 Bushland

Carry out all works in accordance with the requirements of the Environmental Regulator.

Restore the works area as near as practicable to the pre-existing condition and leave the site in such condition as shall promote the rapid re-growth of native bush plant species prevalent in the immediate vicinity.

Return stockpiled topsoil to its pre-construction location and place it in such a way that erosion shall be minimised, eg by the use of small contour banks.

Use pre-existing vegetation as a seed source where possible. Upon backfilling of the line and spreading of topsoil, replace the pre-existing vegetation over the line, placing branches and logs across slope to intercept runoff.

Only local native species are to be used in revegetation of disturbed sites. On steep slopes, use jute mesh and plantings to stabilise the soil. Do not use imported topsoil in native bushland areas.

Where the development is in an environmentally sensitive area, employ a qualified bush regenerator to control weeds for a period of two (2) years following restoration.

4.8.6 Maintenance of Restored Surfaces

Maintain all restored surfaces and improvements in a satisfactory condition until the end of the Maintenance Period.

4.9 Water Services

4.9.1 General

Every lot is to have an individual service tapped from the main and serving only one property. The installation of dual services shall not be permitted.

The size of water services serving multiple units shall vary as detailed in Part 4 Table C below as given in the NSW Code of Practice for Plumbing and Drainage 3rd. Edition 2006.

However, firefighting requirements and other considerations may warrant a larger service size. The Developer is responsible for nominating the correct size water service.

A minimum 25mm service is to be provided for rural / residential lots larger than 2000m^2.

Where multiple dwelling developments /commercial units are serviced, Council will require the provision of a larger service line and a manifold for installation of individual meters for each dwelling/consumer on the lot.

Class of Building	Number of Dwellings	PE Water Service Pipe Size (mm)	Copper Water Service Pipe Size (mm)	Total Allowable Length (m)
Class 1 Single Dwelling House	1	DN25	20	30
	1	DN32	25	130
Class 1 and 2 Excludes Single Dwelling House	1	DN25	20	100
	2	DN32	25	100
	3-5	DN32	32	100
	6-10	DN50	40	100
	11-16	DN63	50	100

Part 4 Table C Extracted from NSW Code of Practice for Plumbing and Drainage 3rd. Edition 2006

Notes:

- Classes are defined in Part A3 of the Building Code of Australia 2008 Volume One
- The total length as measured from the water main to the last branch offtake is not to exceed the total length as stated above.

Where the designed installation does not meet these minimum requirements, the Engineers approval is required.

Services are to be turned up and left approximately 300mm above ground level.

For commercial or industrial developments, services of appropriate size are to be provided. In many cases, sizes cannot be determined until individual developments are proposed. Industrial developments shall be provided with a minimum 25mm service to each lot. Separate

mains on each side of the road or suitable under road conduits may be required. Refer to section 3.4 - Service Mains for requirements of the Building Code of Australia for firefighting services.

4.9.2 Location

Each lot is to have an individual water service connection from the main. Water services shall be laid at right angles to the road centreline and parallel to the radius on curves and in cul-de-sac ends.

Council's requirements for cover to water service pipelines are as follows:

Location	Preferred Minimum Cover (mm)	Absolute Minimum Cover (mm) *
Minor Local Trafficable Areas	750	600
Major Council Trafficable Areas	900	750
Non-trafficable Areas	600	600

** Absolute minimum cover only acceptable for consideration, if preferred minimum cover is not possible and at the discretion and approval of the Engineer.*

Water services for all lots are to extend at right angles from the main to the boundary of the property serviced and are to be located 1m in from the front boundary, and 0.5m away from the side boundary of the property serviced. Variations to the previous requirement shall be permitted where conflict between access ways, main cocks and other obstructions may occur. All main cocks are to be located in the footpath and have a capped riser pipe, minimum 100mm, vertically over the main cock to within 150mm of the ground level.

Water service location to battle-axe and multiple lots serviced via right of carriageway are to be approved by the Engineer.

Services under roads shall be laid in individual conduits constructed from approved materials. Dual services may be laid in a shared conduit with approval from the Engineer. The minimum conduit pipe shall be DN90. The minimum conduit pipe shall be PN 16 PVC pipe.

Conduits may be laid for future proposed services, however the service shall not be connected to the water main. Conduits laid for future services are to extend 300mm past the back edge of the kerb and shall be marked on plans.

A minimum spacing of 500mm shall be provided between pre-tapped connectors, tapping bands, saddles and or pipe joints.

Where an existing water meter is to be relocated within 500mm of its current location Council may undertake this adjustment without requiring a new main tap. Marks are to be placed on kerb when relocated.

Fire services appurtenances shall be contained within the lot served.

4.9.3 License Requirements

A water service is deemed to be the pipes and fittings used or intended to be used in connection with the supply of water from the main to the property.

Water services may only be constructed by persons currently licensed under the P*lumbing and Drainage Act 2011* (NSW*)* as follows:

- Be the holder of a plumbers or water plumbers licence;
- Be the holder of a journeyman plumbers or journeyman water plumbers certificate of registration under the general control of a licensee referred to in (1); and
- Be a person under the immediate supervision of a licensee referred to in (1).

4.9.4 Construction Depths

Services are to be located a minimum depth of 150mm below the subgrade level or have a minimum 600mm cover below the crown of road and a minimum of 300mm cover in footpaths. A maximum depth of up to 1m shall generally apply.

The main is to have an 18mm minimum drilling for 20mm tapping bands and 22mm minimum drilling for 25mm tapping bands.

Direct tapping of the water mains without the use of a tapping band is not permitted.

4.9.5 Materials

A water service is to consist of the following components:

- Tapping Bands and Bolts

  Tapping bands are to be approved Gun metal or stainless steel in accordance with section 3.9 - Design of Water Reticulation - Pipe Fittings General incorporating an integral insulating bush which is assembled on the water main in accordance with section 3.9.11 – Tapping Bands. Gunmetal tapping bands shall require an additional insulating bush between the main cock and the No 64 fitting.

- Main Cocks

  All main cocks are to be an approved right angled brass or gun metal type with brass jumper valves.

- Copper Pipe

  Copper pipe is to be a Type B and must comply with AS1432.

- Fittings

  All copper fittings must be silver soldered. Non-soldered, press-type fittings are permissible in above ground applications only.

4.9.6 Service Marks

Service marks are to be shown on the top face of the kerb and gutter to accurately indicate location of copper water service crossings, using a 75mm high “W” impression in the green concrete kerb and in accordance with section 3.9.8 – Kerb Impressions and Markers.

4.9.7 Main Cocks

Main cock covers shall be hinged cast iron toby boxes for installation in footways and driveways. Main cock covers shall be marked with a W and be 113mm long x 112mm wide.

The covers shall be fixed plumb and square to the centreline of the main and 100mm NS PVC minimum Class 9 pressure pipe is to be used as a protective sleeve between the cover and main cock. Main cock cover hinged openings shall open in the direction of the water main. Main cock cover to finish flush with ground level.

Main cock installation in driveways is not Council's preferred location and shall be at the Engineers approval.

4.10 Testing and Inspection

4.10.1 General

Pressure pipelines and associated services where applicable are to be pressure tested in accordance with this sub section prior to connection onto Councils mains, in order to detect excessive leakage and defects in the pipeline including joints, thrust and anchor blocks, if any.

Pressure testing and disinfection shall be done by an independent NATA certified company.

4.10.2 Procedure

Pipelines are to be tested in sections approved by the Engineer as soon as practicable and in accordance with Cl. 6.3, AS/NZS 2566.2. After each section has been laid, jointed and backfilled and water services connected, provided that:

- If so specified, or if the Developer so desires, some or all of the pipe joints may be left uncovered until the whole of the section has been successfully pressure tested to the satisfaction of the Engineer; and
- The pressure testing is not to commence earlier than 7 days after the last concrete thrust or anchor block in the section has been cast.

For the purpose of this sub section a section is defined as a length of pipeline which can be effectively isolated for testing (ie by means of main stop valves or other approved means).

Unless otherwise approved by the Engineer, pressure testing is not to be carried out during wet weather.

During the pressure testing of a pipeline each stop valve is to sustain at least once, the full test pressure on one side of the valve in closed position with no pressure on the other side for at least 15 minutes.

Before testing a pipeline section it is to be cleaned to the satisfaction of the Engineer and filled slowly with water, taking care that all air is expelled. Purging of air from pipelines is to be promoted by opening air valves or hydrants as applicable. In order to achieve conditions as stable as possible for testing by allowing for absorption, movement of the pipeline and escaping of entrapped air, the section is to be kept full of water for a period of not less than 24 hours prior to the commencement of the pressure testing.

The hydrostatic test pressure which is to be applied to each section of the pipeline is to be a 1200kPa, as measured at the lowest point in the main or such pressure as advised by the Engineer, whichever is greater.

The specified test pressure is to be maintained as long as required by the Engineer, while he examines the whole of the section and in any case not less than 5 hours. For the purpose of determining the actual leakage losses, the quantity of water added in order to maintain the pressure during the period of testing is to be carefully measured and recorded.

4.10.3 Water Service Testing

The Developer is to arrange hydrostatic testing of water services in conjunction with charging and testing of the reticulation mains (refer section 4.10 – Testing and Inspection). Air is to be purged and fittings are to be capped with a BSP brass cap or folded and soldered, the main cocks are to be left open during the test, then isolated after the test period.

Water usage from any water service is not authorised until Council has received a water service application and a meter installed.

4.10.4 Allowable Leakage Tolerances

Pipelines are to be tested in sections approved by the Engineer as soon as practicable. After each section has been laid, jointed and backfilled and water services connected, provided that:

- If so specified, or if the Contractor so desires, some or all of the pipe joints may be left uncovered until the whole of the section has been successfully pressure tested to the satisfaction of the Principal; and
- The pressure testing is not to commence earlier than seven (7) days after the last concrete thrust or anchor block in the section has been cast.

For the purpose of this subclause, a section is defined as a length of pipeline which can be effectively isolated for testing i.e. by means of main stop valves or other approved means.

Unless otherwise approved by the Engineer, pressure testing is not to be carried out during wet weather.

During the pressure testing of a pipeline, each stop valve is to sustain at least once, the full test pressure on one side of the valve in closed position with no pressure on the other side for at least 15 minutes.

Before testing a pipeline section, it is to be cleaned to the satisfaction of the Principal and filled slowly with water, taking care that all air is expelled. Purging of air from pipelines is to be promoted by opening air valves, or hydrants, as applicable. In order to achieve conditions as stable as possible for testing by allowing for absorption, movement of the pipeline and escaping of entrapped air, the section is to be kept full of water for a period of not less than 24 hours prior to the commencement of the pressure testing.

Test the pipeline as follows:

- Raise pressure to specified test pressure (STP), close off pipeline and allow to settle for at least

12 hours. During this period, pressure will fall as a result of pipe expansion.

- Using water of the same temperature as that in the pipeline (± 3°C) restore and maintain STP;
- Measure and record water volume added at 2h, 3h, 4h, and 5h from start.
- Conclude test five (5) hours after commencement.
- Calculate the water volume added between the second and third hour, ΔV(3h-2h) and the volume added between the fourth and fifth hour, ΔV(5h-4h).
- Calculate Vall = 0.14.L.D.H (ref. AS/NZS 2566.2, Section 6.3) where:

  Vall = Volume makeup allowance in litres/hour

  L = Test length in km

  D = Pipe nominal diameter in metres

- H = Average test head over pipeline length in metres
- Test passes if Vall < 0.14.L.D.H for PVC, DI, GRP and Steel pipes
- Test passes if ΔV(5h-4h) ≤ 0.55 ΔV(3h-2h) + Vall for PE and PP pipes
- Record the location of the test section, the water temperature, test pressure and duration, the date and the test results and AS/NZ testing standard.

The following tolerances are applicable:

- Water volume: ± 10D litres, where D = pipe nominal diameter in metres
- Time: ±1 min
- Pressure: ± 1 kPa

Specified Test Pressure (STP)

The specified test pressure (STP) is 1200kPa, unless otherwise advised by the Engineer.

Before testing, check the STP does not exceed the manufacture's design safety factor for the material being tested.

Satisfactory Testing

The pressure testing of a section of pipe is satisfactory if:

- There is no failure on any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component;
- There is no visible leakage; and
- The average measured leakage rate during the last four (4) hours of pressure testing does not exceed the maximum loss rate as determined in accordance with the above.

4.10.5 Repair of Leaks

Any failure, defect, visible leakage and/or excessive leakage rate, which is detected during the pressure testing of the pipeline is to be made good by the Developer at their expense.

4.10.6 Disinfection of Mains

Following a satisfactory hydrostatic pressure test and where required by the Engineer, disinfect the following dinking and non-drinking water mains:

- New water mains (unless the Engineer has granted an exemption) before they are placed in service even if the new main will not be providing water to properties immediately after being placed in service;
- Existing water mains that are taken out of service during construction; and
- Renewed, including relined, water mains (unless the Engineer has granted an exemption).

Disinfection shall be in accordance with the Water Supply Code of Australia – WSA03-2011-3.1 *Appendix 1 – Disinfection of Water Mains and Water Quality Compliance Specification.*

Where it is not practical to disinfect pipes and fittings used to connect a new main to an existing main, clean each item and spray with a 1% solution of sodium or calcium hypochlorite immediately prior to installation subject to the approval of the Engineer

During disinfection all valves, hydrants, water meter ball valves (when fitted) and other fittings shall be operated to guarantee a complete disinfection process. The Contractor shall take all appropriate measures to protect the environment.

The Engineer shall accept a disinfected water main that complies with section 4.10.5 Water Quality Testing.

Mains and service pipelines shall be flushed in accordance with the Water Supply Code of Australia – WSA03-2011-3.1 Appendix 1 – Disinfection of Water Mains and Water Quality Compliance Specification. All necessary steps are to be taken to ensure disinfected water used in the disinfection process does not enter any parts of the distribution system already in service.

Scour and flush mains at the earliest opportunity following the minimum contact period.

Disinfected water shall be disposed of in accordance with the Water Supply Code of Australia – WSA03-2011-3.1 Appendix 1 – Disinfection of Water Mains and Water Quality Compliance Specification.

4.10.7 Water Quality Testing

It is compulsory for all new mains to pass a bacteriological test.

The Developer shall conduct a bacteriological test on all new mains following satisfactory completion of flushing and pressure testing of water mains as follows:

- Scour past the sampling point;
- Engage a recognised testing laboratory accredited for the test to collect water samples from the test section of the main; and
- Dispose of testing water in accordance with the environmental Regulator's requirements and/or this specification.

The water quality test shall be accepted if:

- the water quality test results for a section of main falls within the water quality parameters specified in the Water Supply Code of Australia – WSA03-2011-3.1 Appendix 1 – Disinfection

of Water Mains and Water Quality Compliance Specification; or

- the water quality test results for a section of main are no worse than the water quality parameter test results measured by an influent sample of existing mains water, provided that influent sample was collected by recognised testing laboratory at the same time as the test section of water main was collected.

Section off water mains that fail the water quality test, swab, flush and/or disinfect the main and retest, reworking until all test results are satisfactory.

Acceptance of water quality test results is at the discretion of the Engineer.

4.10.8 Inspections

24 hours' notice shall be given for any of the above inspections. Failure to notify the need for inspection may lead to the portion of the work not being approved by the Engineer.

It shall be necessary for the Developer to meet the Engineer on site at each inspection to receive written approval to proceed to the next stage of works or be instructed to amend any work.

It may be possible to arrange inspections of work outside of Council's normal working hours. The cost of the inspection shall be borne by the Developer. This cost shall be determined by Council and must be paid to Council's cashier prior to receipt of approval from the Engineer.

In order to receive written approval of the development works (Certificate of Practical Completion) the Developer must have obtained from the Engineer written approval of the various components of the development work.

It is the Developer's responsibility to obtain approval from the Engineer.

4.10.9 Council Acceptance

Following successful completion of all testing and repair work of the main and services and the acceptance of the work by the Engineer, the works may be connected to Council's main. Following this connection, the work is to remain charged at all times. The Developer or the Contractor is not to operate, adjust, interfere or take water from the main without the prior approval of the Engineer. Non- compliance of this requirement shall be deemed to be an offence under the *Local Government Act 1993 (NSW)* as amended and accordingly penalties as prescribed under the Act may be applied.

5 ACCEPTANCE OF WORKS

5.1 Written Approval for Works

In order to receive a final Certificate of Compliance under section 307(1) of the *Water Management Act 2000* (NSW) for the development works, the Developer must have obtained approval under section 305 of the *Water Management Act 2000* (NSW) of the various components of the development work and complied with the Notification of Requirements under Section 306 of the Water Management Act 2000 (NSW). Only the Engineer can issue advice and approvals under the above sections of the *Water Management Act 2000* (NSW).

Approval to proceed from one component of works to the next, in no way absolves the Developer from the responsibility of defects or failure.

It is the Developer's responsibility to obtain approval from the Engineer.

5.1.1 Limitation of Approval

During construction, approval of any component of work shall be given in regard to structural standard only at the time of inspection. This does not absolve the Developer of the responsibility for any damage or deterioration occurring before the final inspection or during the maintenance period.

5.1.2 Linen Release and Work as Executed Plans

Prior to linen release the following is required:

- Final inspection and certificate of Practical Completion of the development to enter the maintenance period.
- A Surveyor's Statement and "Works as Executed Plans" verifying all work is constructed and located in accordance with the approved engineering plans and construction tolerances detailing all requirements of this policy. Requirements for Works as Executed Plans are provided at 5.3 Works as Executed Drawings.
- Such "Works as Executed Plans" are to be certified as correct by a Registered Surveyor and submitted on copies of the approved engineering originals.
- Where departures from approved plans are made during the course of construction without approval the Works as Executed Plans must be accompanied by a report prepared by the Design Consultant or, if appropriate, a Registered Surveyor, providing an explanation as to how the departures comply with Council's Engineering Requirements for Development.
- The receipt by Council of Works as Executed Plans shall form part of compliance requirements for issue of a Certificate of Compliance under Section 307(1) of the *Water Management Act 2000* (NSW).

5.2 Tolerances on As-Constructed Work

5.2.1 Horizontal Tolerances

Water mains and in-line structures

Do not exceed the following positional tolerances:

- Water mains – ±100mm lateral displacement from the design water main alignment.
- Appurtenances and structures – lateral displacement as for the water main, and ±200mm displacement (from the design position) along the water main axis.

Property services

Do not exceed the following positional tolerances:

- Property services – ±100mm displacement along water main axis from the position as specified.

5.2.2 Vertical Tolerances

Water mains, property connections and structures

Do not deviate the inverts of new water mains, property connections and structures from the specified design level (or interpolated design level) by more than 50mm higher or lower, providing the depth from final ground surface level to the top of the pipe exceeds the minimum cover stated in the Backfilling and Compaction section of this document.

Link up to existing water mains or structures at the design levels equal to or greater than the minimum acceptable covers.

Verticality ("plumb")

For hydrant risers, access chambers, shrouds and aqueduct piers, apply a tolerance at any point on the pipe or structure as follows:

- 30mm deviation (from vertical) per metre rise in any direction; and
- Limited to a maximum 50mm cumulative deviation (from vertical) in any one particular direction for structures higher than 5m.

5.2.3 Tolerances on Finished Surface Structures and Fittings

For structures and fittings designed flush with the ground / pavement surface or proud of the surface, apply a vertical tolerance on the finished surface levels as follows:

- ±5mm in road reserves, including sealed pavements, road verges, driveways, footways, and pedestrian thoroughfares.
- ±5mm in sealed and trafficable areas within private properties (pedestrian and/or vehicular traffic).
- +5mm,−20mm in private property including garden areas, unsealed areas, non-trafficable areas and areas of occasional traffic (pedestrian and/or vehicular traffic)

5.2.4 Cast In-Situ Concrete Structures and Slabs

In addition to the tolerances of Section 5.2, apply a construction tolerance of +5%−2% on the specified internal dimensions (eg diameter, length, width, depth etc.) for cast in-situ concrete structures and the external dimensions of slabs.

Apply a construction tolerance on all thicknesses specified of +50mm, –0.

5.3 Works as Executed (WAE) Drawings

Prepare Work as Executed (WaE) Information and provide Council with electronic copies in Auto CAD and pdf format. Drawings shall be provided at least four (4) weeks prior to release of a Certificate of Practical Completion .

Work as Executed (WaE) plans are required to show the location and alignment of mains and all fittings. Details are to include the size, type and class of pipe used, the location of all main cocks, valves, hydrants, tapers, pipe length between fittings, straight line distance between hydrants etc. "Work as Executed" plans are to be certified as correct by a registered surveyor and submitted on copies of the original for Council to retain prior to the linen release.

All Work as Executed drawings are to be in accordance with Singleton Council - Work as Executed - WaE – Specification August 2014 or its replacement.

5.4 Transfer of Assets

Assets shall transfer to Council upon registration of plans at the NSW Land Registry Service for subdivisions, and release of the s307 Certificate for all other developments. The Maintenance Period shall end 12 months after hand over of works.

6 PUMPING STATIONS

Pumping stations are used within the reticulation, distribution and transfer main systems to increase the hydraulic gradient to supply areas that are remote from the principal network area, or to boost inadequate pressure levels. This may result from a requirement to supply water from a different supply zone or because of system head loss (pipe and fitting roughness) that prevents a section(s) of the network from sustaining the required minimum operating pressure. Localised pressure boosting is not permitted unless specific approval is granted by Council.

A concept or detail pumping station design shall document the design basis and technical inputs to the design.

The Developer shall address the following factors / requirements in pumping station design:

- The combined reservoir, operating storage and pumping capacity to be designed for peak hour demand.
- Where significant operating storage can be provided, pumping station capacity can be reduced provided that the operating storage in the service reservoir can be replenished within the specified design period.
- Capital and system operating and maintenance costs to be balanced ie weigh up the option of providing additional operating storage against pumping station capacity, which is especially critical for long transfer mains / systems.
- A standby pump unit of equivalent duty to be provided in addition to the one or more duty units, with automatic controls to alternate all pumps between duty and stand-by functions.
- Surge conditions arising from normal pump starts and stops and power failure during pumping to be assessed and any necessary surge reduction measures taken. The impact of surge on connected pipe systems to be also assessed.
- Variable speed drives are preferred to avoid peak electrical load.
- Access to the WPS, and consideration of hardstand areas for maintenance activities, including removal of equipment safely from sheds.
- Need for emergency back up generators.
- Chlorine dosing systems including topping up.
- Compliance with relevant environmental approval and considerations, including but not limited to vegetation clearing, noise and drainage.

7 SERVICE RESERVOIRS

Reservoirs serve multiple roles in the water supply network, including pressure control, security of supply and fire fighting water, additional storage for maintenance in other areas of the network, buffering of supply for high demands as well as impacting water quality. In view of this contact Council to determine specific requirements for new reservoirs when required.

As a guide, typical requirements may include:

- Minimum reserve capacity below normal bottom water level is one day's supply (24 hours) at future peak day demand.
- At least 10 hours storage shall be provided under extreme week demands with the reservoir at its lowest normal operating level.
- The lowest normal operating level shall not be less than 20% in order to minimise customer and operational problems. The amount of storage may be reduced subject to agreement from the Engineer based on an assessment of the appropriate level of security to cater for firefighting and potential supply failures in the system.

Supplementary emergency supply arrangements can be proposed subject to review and approval by the Engineer.

Supplementary emergency supply arrangements shall include:

- Connections to an adjacent supply zone that would supply water at a pressure of at least 12 m head, under peak day demand. However, it is necessary to consider the effect of the emergency supply arrangement on the adjacent system.
- Additional pipelines (staged if necessary).
- Duplicate power supply to pumping stations.

All reservoir designs shall include the following equipment:

- Either separate or combined inlet and outlet pipes designed to minimise dead zones. Council may require modelling for large reservoirs to confirm satisfactory mixing
- An overflow able to discharge the maximum design inlet capacity with associated environmental protection requirements (with a minimum of one pipe size larger than the inlet);
- A scour outlet to be set at the lowest practical level to enable sludge collection from sloped floors or channel provisions;
- A non-return (reflux) valve located on the outlet connection of the reservoir for dual connections (ie separate inlet and outlet);
- An automatic inlet valve (where required);
- A depth indicating gauge in a location to provide easy viewing if required by Council;
- An external access stairway to meet relevant standards and security requirements of Council;
- Appropriate telemetry equipment required by Council;
- Reservoirs shall be roofed and made vermin and bird proof. Drainage from the roof shall not enter the tank; Roof access shall be suitable for diver entrance and include grates.
- Access area, eg driveway, vehicle turning area, platforms and hardstands as required by

Council;

- Cathodic protection (if steel);
- Site security including man proof fencing to relevant standards and secondary enclosures to access;
- Water take-off point to be installed as per applicable standard.
- Power supply including consideration for solar power and battery back up.

8 ACCESS

All weather access from sealed public road shall be provided to reservoirs, water pump station and other key fittings.

The access shall allow safe entry and exit from the site, and be trafficable by a 5 tonne maintenance vehicle (unless larger vehicle nominated). The following shall be provided:

- Minimum width 3m, and wider where turning circles require this.
- Maximum grade less than 12%, unless approved by Council Representative. Concrete pavement may be required.
- Cross fall in the range of 3% to 5%.
- A turning area to enable maintenance vehicles to a safe turning area, where required at reservoir, pump station or control valve sites.
- Drainage lines and waterways to have culverts or similar to allow.
- Adequate hardstand area for parking of maintenance vehicles, and to enable access for franners, cranes or other maintenance equipment as required.

8.1 Bush Fire Protection Measures

Adequate bush fire protection is to be provided for all buildings / structures associated with the water supply network including reservoirs, control valves, water pump stations in accordance with NSW Rural Fire Services Planning For Bush Fire Protection, November 2019. The protection measures shall include an asset protection zone of 15m minimum at maximum grade of 15 degrees, capable of being cleared by ride on lawn mower.

Structures constructed for the water supply network must include the following ember protection components:

- Enclosing all openings or covering openings openable (windows, doors, vents, weepholes, and eaves) with a with steel, bronze, or aluminium to maximum allowable aperture of 2mm,
- For doors (both pedestrian and vehicle) establish weather strip with a flammability index not greater than 5 (AS1530.2) and door seal to inhibit embers entering the internal building compartments

External plastic conduit, pipes and fittings will be exposed to high radiant heat levels, which will deform and potentially increase the likelihood of the facility failing during a bush fire. All external conduits or plastic pipes above ground shall be metal or shielded with a metal cover. The shield must extend from the ground to the associated cabinet or masonry shield.

Alternatively, steel conduit or electrical metal tubing (EMT) may be used for external cable protection.

9 GLOSSARY OF TERMS AND ABBREVIATIONS

9.1 Glossary

The purpose of this glossary is to assist with interpretation of terminology used in this document:

Term	Definition
Access Chamber	A below-ground structure with a cover constructed in the line of a water main to facilitate operation, testing and/or maintenance of the system. It shall generally contain appurtenances such as valves
Access Cover	A removable cover that is installed at or above finished surface level to allow access to a maintenance hole
Allowable Operating Pressure (AOP)	Pressure rating marked on a pipe, fitting or appurtenance indicating the maximum pressure at which it can operate throughout its design life at a specified reference temperature, generally 20°C. The rated pressure incorporates a safety factor. The rated pressure for plastic materials must be adjusted for temperature, cyclic loading and other conditions specified by the engineer. This is generally nominated as a PN rating.
Allowable Site Test Pressure	Maximum hydrostatic pressure that a newly installed component is capable of withstanding for short durations (generally<24 h), in order to demonstrate the integrity and tightness of the water main
Australian Height Datum, AHD	A level datum, uniform throughout Australia, derived from mean sea level observations at 30 tide gauge locations located along the Australian coastline and used as a base reference for “derived” datum levels throughout Australia; replaces “Australian Levelling Survey” and other datum
Average Day Demand	The total water demand per year for a given area or category of development divided by 365
Backfill	Material (including embedment and trench fill) and procedure used to fill an excavation. See also engineered fill
Bedding	Zone between the foundation and the bottom of a pipeline. See also embedment
Boring	A method of machine excavation working from a shaft or pit and creating a cylindrical tunnel
Boundary	Survey line separating adjoining properties for the purposes of defining ownership/title
Bulkhead	A structural partition across a pipeline trench, built to minimise longitudinal and lateral movement of the pipeline, to minimise ground movement in the trench, and to restrict movement of fines within and

Term	Definition
	along the trench caused by infiltration and ground water flow through the embedment and trench fill materials
Cathodic Protection	Partial or complete protection of a metal from corrosion by making it the cathode, using either galvanic or impressed current. It is usually applied to mitigate external corrosion of electrically continuous welded steel buried pipelines and internal corrosion of welded steel service reservoirs
Carriageway	Portion of a road or bridge assigned to the movement of vehicles, inclusive of any shoulders and auxiliary lanes. It is designated as that part of a public road (way) between kerbs. See also local road, major road, road, road reserve
Coating	Additional organic or inorganic material applied to the internal and/or external surface of a pipeline component or reservoir at a specified film thickness, which is intended to provide long- term protection from corrosion, mechanical damage and/or chemical attack. Such coatings require special surface preparation and application techniques. See also lining
Constructor	An individual, corporation or legal entity including any contractors and sub-contractors that is accountable at law for delivery of Works under a specific contract or development agreement
Contaminated Soil	Soil that has been affected by previous land use or by direct or indirect infiltration of chemicals or other substances such that it requires special consideration. See also aggressive soil
Corrosion	A valve designed to alter flow and pressure in the pipework on either side of the control valve to achieve the required operational outcomes
Dead Water	Deterioration of a material and alteration of its properties due to chemical or electrochemical reaction between the material and its environment
Demand	Water that is not useable. For example, water below the outlet level of a reservoir or tank
Demand Forecasting	Volume of water used by customers during a certain time interval from a water supply system
Design Drawings	Plans, elevations and drawings required for the construction of the water systems and showing the locality including roads and water main details, the site plan including lots, boundaries, roads, proposed and existing water mains, proposed property connections, pumping stations, sewer mains, drains, watercourses, site contours, proposed aqueducts, proposed boreholes, and construction details. Supplementary information may include proposed buildings, existing services, landscaping, groundwater and watercourse levels as well as other services
Design Period	Period of time a design analysis should cover in order to size system facilities (such as service reservoirs, pumping stations and water

Term	Definition
	filtration plants). It is the number of consecutive days that the daily demand factor exceeds the ratio of supply (or input) capacity to maximum day demand
Design Pressures (DP)	Limiting pressures, both maximum and minimum, that the designer allows for in the design of a pipeline system. These pressures are used to determine: • the extent of the proposed development that may be serviced, in terms of elevation (acceptable range of residual pressures) and distance (acceptable minimum residual pressure after head losses); • a suitable pipe material to meet expected operating pressures for the duration of the system life; and • structural requirements associated with the pipeline pressure
Designer	Person(s) or firm responsible for a design output. Such person or firm may be accountable to a Project Manager or other person having responsibility under a contract or otherwise
Developer	A person, organisation, local government authority or government authority (other than the Water Agency) responsible for provision of a water supply scheme or water reticulation system
Diurnal Pressure Variation	A daily variation in system pressure, at any location, between periods of high and low water usage (normally between day and night)
Distribution Main	A water main serving as the principal distributor within the supply area, normally without direct consumer connections
Distribution Network	A combination (network) of larger diameter water mains necessary to ensure an adequate supply of water to, and within, reticulation networks (systems)
Drinking Water (Potable Water)	Water that is suitable for human consumption, food preparation, utensil washing and oral hygiene. For the purposes of this code, drinking water is cold water at a temperature ≤40°C (adapted from AS/NZS 4020)
Dual Service	A service pipe that bifurcates to provide two property connections from a single tapping of the water main
Duplicate Main	An additional main, laid parallel to the original main (usually on the other side of the road), to service allotments that cannot be easily serviced from the original main. See also rider main
Dynamic Pressure Head	When a pump is operating, vertical distance from a reference point (such as a pump centre line) to the hydraulic grade line
Easement	A right held by one party to make use of the land of another for certain purposes
Embedment	Zones around a pipe between the foundation, the trench or embankment fill and the trench walls.

Term	Definition
Engineered Fill	Fill that has been selected, placed and compacted to meet specified performance criteria
Equivalent Tenements (ET)	The equivalent hypothetical number of residential tenements or residential units that would produce the same peak dry weather flow as that contributed by the area under consideration ie all zonings including residential, commercial and industrial
Equivalent Population (EP)	The equivalent hypothetical residential population that would produce the same peak dry weather flow as that contributed by the area under consideration ie all zonings including residential, commercial and industrial
Existing Surface Level	Undisturbed ground surface
Extreme Day Demand	The demand expected to occur about every 10 to 15 years on average. The extreme day demand is calculated by multiplying the peak day demand by 1.15.
Extreme Week Demand	Exceptional demand which occurs when several days of very high demand occur.
Fatigue De-rating	An allowance made, during the design process, for the reduced performance of products (particularly plastics) as a result of anticipated cyclic loadings within the system
Finished Surface	Paved or unpaved surface of a filled trench or an embankment
Fire Flow Demand	Quantity of water required for firefighting purposes often expressed as a flow rate for a particular time period
Fitting	A component of a pipeline, other than a pipe, which allows pipeline deviation, change of direction or bore. In addition, valves, flanged-socketed pieces, flanged-spigot pieces, junctions, inspection openings, collars and couplings are also defined as fittings
Flexible Joint	A joint that permits angular deflection, both during and after installation, and which can accept a slight offset to the centreline
Flexible Pipe	A pipe that relies primarily upon side support to resist vertical loads without excessive deformation. Flexible pipe materials include PVC, GRP, PE.
Gravity System	A system wherein flow and/or pressure are caused by the force of gravity.
Head, H	Pressure expressed in terms of the height of a column of water (in m). The head is a factor of 9.81 (nominally 10) lower than the equivalent value in kPa, eg 800 kPa ≅ 80 m
Hold Point	A point beyond which an activity may not proceed without the approval of a designated organisation or authority
Hydraulic Grade Line (HGL)	A line (hydraulic profile) indicating the piezometric level of flow at all points along a conduit, open channel or stream. In pipes under pressure, each point on the hydraulic profile is an elevation expressed

Term	Definition
	as the sum of the height associated with the pipe elevation and the pipe pressure (head)
Joint	A connection between the ends of two pipeline components including the means of sealing
k-Value	Colebrook-White roughness coefficient; a measure of the interior roughness of a pipe
Lining	Additional organic or inorganic material applied to the internal surface of a pipeline component or pipe at a specified thickness, which is intended to provide long-term protection from corrosion, mechanical damage and/or chemical attack. Such linings require special surface preparation and application techniques. See also coating
Local Road	A road, under the control of the local government or council, with load restriction, or one that carries less than 200 commercial vehicles per day in each direction. See road, major road
Lot	A property for which a separate title may be held or issued to be serviced by the water reticulation system
Maintenance Period	The maintenance period is the period following completion of a construction project during which the contractor is responsible for certain maintenance issues under the many building or engineering contracts.
Major Road	A state or regional road as defined by the RMS and as advised by the relevant road authority. See road, local road
Maximum Allowable Operating Pressure (MAOP)	Maximum hydrostatic pressure that can be sustained, with a factor of safety, by the type or class of pipe for its estimated useful life under anticipated operating conditions
Maximum Design Pressure	Maximum operating pressure of the system or of the pressure zone as fixed by the Designer, considering future developments and all other foreseeable operating conditions and including an allowance for surge
Maximum Hour Demand	Maximum demand which a system or part of a system is required to supply in any one hour of the year (also called peak hour demand). It is often expressed as a daily rate
Maximum Working Pressure	See maximum allowable operating pressure
Minimum Design Pressure	Lower limiting pressure that the Designer allows for in the design of a pipeline system. This pressure is selected to ensure: Acceptable minimum residual pressure for the types of development; and Acceptable range of residual pressures (between operating pressure limits) In the selection of pipe material, transient pressures below the minimum design pressure should be taken into account

Term	Definition
Minor Road	See local road
Network Analysis	A process of analysing a water supply system by using a computer software network modelling package. Also known as dynamic system analysis
Nominal Size, DN	An alphanumeric designation of size for components of a pipeline system, which is used for reference purposes; it comprises the letters DN followed by a dimensionless whole number which is indirectly related to the physical size, in millimetre, of the bore or outside diameter of the end connections
Non Standard Conditions	Impermeable material such as rock and clay, or where trench conditions are set.
Non-trafficable Area	Any area where vehicular traffic is unlikely or occurs no more than three monthly, eg most areas of private lots, many footways, parks, reserves, recreational areas and easements.
Operating Pressure (OP)	Internal pressure that occurs at a particular time and at a particular point in a water supply system For gravity systems, maximum operating pressure is the full supply level of the reservoir, less the lowest ground level applicable to the pipeline, plus surge. For pumped systems, maximum operating pressure is the greater of: surge HGL less the ground level, or The maximum pump suction HGL plus the no discharge head of the pump, less the lowest ground level. Minimum operating pressure is due to maximum head loss conditions ie minimum supply pressure to the zone combined with peak demand in the zone (maximum water velocity through the pipelines)
Operating Pressure Limit	Maximum pressure to which the Water Agency shall permit a pipeline of particular material and class to be subjected in service. It typically results in a de-rating of the pipe pressure class eg 1.2 MPa for a Class 16 pipe
Operating Storage	Amount of storage provided to accommodate diurnal fluctuations in demand and to cater for demands exceeding the maximum available inflow rate (also called balancing storage or equalising storage)
Owner	Agency, Authority, Board, Company, Controlling Authority, Corporation, Council, Department, Individual, Regulator, Utility or other legal entity who is the owner of the asset and/or who has responsibility for the asset
Peak Day Demand	Maximum demand in any one day of the year. A day is typically taken as any 24 hour period ending at 07:00 (also called maximum day demand)
Peak Week Demand	Demand experienced over a week of exceptionally high demand which includes peak day demand.

Term	Definition
Pipe	A pipeline component of uniform bore, normally straight in axis, having socket, spigot or flanged ends
Per Capita Consumption	An estimate of the water usage in a community, including residential, industrial and commercial, determined by dividing the total water used by the number of persons using it. It is the average amount of water used by a person within a given period of time and is most commonly expressed in units of litres per capita per day
Pipe Barrel	Cylindrical part of the pipe with a uniform cross section excluding socket and spigot or flanges where relevant
Potable Water	See drinking water
Pressure Rating	See allowable operating pressure
Pressure Surge	See surge
Pressure Zone	A reticulated supply area connected to a controlled water pressure source (typically a service reservoir or tank), covering a limited area and range of elevations to enable supply within a range of minimum and maximum operating pressures
Property Service	Portion of a property water service from main to meter location. Also see service pipe
Pumped and Gravity System	A system where gravity and pumping are used, either separately or in combination, to provide flow and/or pressure
Pumped System	A system where flow and/or pressure are provided by means of one or more pumps and where the pipe(s) operate full
Rated Pressure	See allowable operating pressure
Reduced Level (RL)	Elevation of a point or mark related to a nominated datum (metric or imperial).
Regulator	Entity that has the power to enforce Regulations related to the activities and responsibilities of a Commonwealth, State, Territory or Local government. It applies to environmental management and protection, occupational health and safety and the like
Remote Terminal Unit (RTU)	An electronic hardware device used to collect, process and transmit SCADA data and signals at a site
Reserve Storage	Amount of storage provided to cater for some continuing supply in the event of a system component failure and depletion of the operating storage
Reserve Storage Level (RSL)	Top level of the reserve storage
Reservoir	Bulk water storage supplying to transfer and/or distribution mains
Reticulation Main	A water main that connects a distribution main with service pipes. Reticulation mains are generally sized DN 100 to DN 375

Term	Definition
Service Pipe	A water pipe that supplies water from the reticulation main to the consumer. The portion of the service pipe under the control of a Water Agency generally terminates at the water meter, or in the case of fire services, the isolating valve of the fire protection system
Service Pressure (SP)	Internal pressure delivered at the point of connection to a consumer's installation at zero flow in the service pipe. Service pressure does not include surge pressure
Shared Trenching	Simultaneous installation of two or more services in one (common) trench
Static Head	When water is not moving, vertical distance from a specific point in the water/pipeline to the free water surface. See dynamic pressure head and static pressure
Static Pressure	Static head multiplied by the specific weight of water. See dynamic pressure head and static head
Side Support	Embedment zone between the bottom and top of a pipe
Specifications	Precise standards of performance for construction work, materials and manufactured products. Specifications make it possible to express expected values when work or items are purchased or contracted for, and they provide a means of determining conformance with expectations after purchase or construction
Standards	Documents that specify the minimum acceptable characteristics of a product or material, a test procedure, an installation method etc., issued by an organisation that develops such documents eg Standards Australia. Such standards may or may not be used as (or called) specifications A set numerical limit eg a contaminant limit set by a regulatory agency
Surge	A rapid change in water movement caused by flow alteration over a short period of time
Surge Pressure	A short-duration pressure change caused by a sudden movement of water from such causes as a directional change in flow, the starting or stopping of a pump, and opening or closing of a valve or hydrant
Superintendent	The individual appointed by the contract principal as an independent arbiter of contract directions, issues, claims and variations
System	A combination of elements that together makes up a functioning water supply
System Planning	A process of examining the present, recognising trends, making projections and developing plans to ensure water supply systems have the capability to achieve agreed customer, stakeholder and regulator outcomes
Temperature De-rating	An allowance made, during the design process, for the reduced performance of products (particularly plastics) as a result of anticipated operating temperatures above 20°C within the system

Term	Definition
Test Pressure	Hydrostatic pressure applied to a newly laid pipeline in order to demonstrate its integrity and tightness. This pressure may be greater than the operating pressure limit of a pipeline for a relatively short duration
Tester	An individual, corporation or legal entity registered by the National Association of Testing Authorities for the relevant classes of tests and that is accountable at law for delivery of testing services under a specific contract with the Constructor
Trafficable Area	Any area where vehicular traffic is likely, eg road pavement and driveways
Transfer Main	A water main that interconnects source(s), treatment works, reservoir(s) and/or supply areas, normally without direct consumer connections
Trench Fill	Fill material placed over the overlay for the purpose of refilling a trench
Trench Stop	A non-structural partition across a pipeline trench built to restrict movement of fines within and along the trench caused by infiltration and ground water flow through the embedment and trench fill materials
Usable Capacity	Operating storage plus reserve storage (of a service reservoir)
Valve	A mechanical device used for stopping or regulating flow and controlling pressure eg gate valve, isolating valve, control valve, pressure reducing valve, air valve and hydrant
Verge	Areas between the boundaries of a road reserve and the carriageway. This term is usually applied where there are no formed footways
Water Distribution System	Part of the water supply system comprising pipelines, service reservoirs, pumping stations and other assets by which water is distributed to the consumers. It generally begins at the outlet of a water treatment works (or source, if there is no treatment) and includes the reticulation system
Water Supply System	See water distribution system
Water Hammer	Any sudden pressure head change in a pipe caused whenever the velocity in the pipe is changed from one steady state condition to another (commonly caused by stopping flow too rapidly). It is often characterised by pipe movement or noise. See also surge pressure
Working Pressure	See operating pressure
Work as Constructed (WaE)	Documentation showing details of work as actually constructed (in contrast to Design Drawings). Also called Work As Executed (WaE)
Works	All those Works being water mains, valves, hydrants and accessories including valve chambers and storage facilities as shown on the Design Drawings and including any part or parts of the Works
Witness Point	A point in the work process at which an activity may be observed

9.2 Abbreviations

The purpose of this glossary is to assist with interpretation of abbreviations used in this document:

Abbreviation	Interpretation
AHBP	Allowable Horizontal Bearing Pressure
AHD	Australian Height Datum
AICV	Automatic Inlet Control Valves
AMG	Australian Map Grid
AOP	Allowable Operating Pressure
AS	Australian Standard
AS/NZS	Australian/New Zealand Standard
AV	Air (Release) Valve
DF	Diversity Factor
DI	Ductile Iron
DICL	Ductile Iron Cement (Mortar) Lined
DN	Nominal Size
DP	Design Pressure
EIA	Environmental Impact Assessment
EPDM	Ethylene Propylene Diene Monomer
ET	Equivalent Tenement
FSL	Finished Surface Level
GDA	Geocentric Datum Australia
GIS	Geographical Information System
GRP	Glass Reinforced Polyester
h	Hour
H	Head (In M)
ha	Hectare
HGL	Hydraulic Grade Line
HP	Hydrant Path
HR	Hydrant Road
ID	Density Index
ISG	Integrated Survey Grid
ISO	International Standards Organisation
ITP	Inspection And Test Plan
ks	Equivalent Sand Roughness Size
kL	Kilolitre
km	Kilometre
kPa	Kilopascal
kV	Kilovolt
L	Litre

Abbreviation	Interpretation
LP	Pipe Length
LEP	Local Environmental Plan
L/s	Litres/Second
m	Metre
m/s	M Per Second
MAOP	Maximum Allowable Operating Pressure
MCPR	Maximum Cyclic Pressure Range
MGA	Map Grid Of Australia
mg/L	Milligrams/Litre
mL	Millilitre
ML	Megalitre
mm	Millimetre
MPa	Mega Pascal
NATA	National Association Of Testing Authorities
NPV	Net Present Value
o	Degree
°C	Degree Celsius
OD	Outside Diameter
OP	Operating Pressure
PDF	Peak Day Factor
PE	Polyethylene
PHF	Peak Hour Factor
PL	Property Line
PIPA	Plastics Industry Pipe Association Of Australia Limited
PN	Nominal Pressure, In Mega Pascals X 10
PrelV	Pressure Relief Valve
PRV	Pressure Reducing Valve
PSV	Pressure Sustaining Valve
PVC	Polyvinylchloride
PVC-M	Polyvinylchloride Modified
PVC-O	Polyvinylchloride Oriented
PVC-U	Polyvinylchloride Unplasticised
Q	Flow (In Cubic M/Second)
RD	Density Ration
REF	Review Of Environmental Factors
RL	Reduced Level
RRJ	Rubber Ring (Seal) Joint
RSL	Reserve Storage Level
RMS	Roads And Maritime Services

Abbreviation	Interpretation
RTU	Remote Terminal Unit
RV	Reflux Valve
s	Second
S	Spacing
Sc	Scour
SCADA	Supervisory Control And Data Acquisition
SCL	Steel Cement (Mortar) Lined
SP	Service Pressure
SS	Stainless Steel
STP	System Test Pressure
SV	Stop Valve
UPCIC	Under Pressure Cut-In Connection
UV	Ultraviolet
v	Velocity (M/Second)
VC	Vitrified Clay
WaE	Work As Executed
WHS	Work Health and Safety
WSAA	Water Services Association of Australia Limited

10 REFERENCED DOCUMENTS

The documents related to or referenced in these specifications include but are not limited to those listed below.

10.1 Australian Standards

The latest version of the Australian Standard including published amendments applies, except where the year of publication is stated in the text.

Standard	Title
AS1210	Pressure Vessels – cold-stretched austenitic stainless steel vessels
AS1289.1	Methods for testing soils for engineering purposes
AS1554.1	Structural steel welding of steel structures
AS1579	Arc-welded steel pipes and fittings for water and wastewater
AS1906	Retroreflective materials and devices for road traffic control purposes
AS2124	General conditions of contract
AS2129	Flanges for pipes, valves and fittings
AS2200	Design Charts for water supply and sewerage
AS2280	Ductile iron pressure pipes and fittings
AS2419	Fire hydrant installations
AS2566	Buried flexible pipelines

Standard	Title
AS2638	Gate valves for waterworks purposes – metal seated
AS2648	Underground marking tape
AS2832	Cathodic Protection of metals
AS2845	Water supply – backflow prevention devices
AS3000	Electrical Installations (also known as The Australian / New Zealand Wiring Rules)
AS3500	Plumbing and Drainage Set
AS3592	Water supply – Spring hydrant valve for waterworks purposes
AS3600	Concrete structures
AS3681	Application of polyethylene sleeving for ductile iron piping
AS3996	Access covers and grates
AS4020	Testing of products for use in contact with drinking water
AS4041	Pressure piping
AS4087	Metallic flanges for waterworks purposes
AS4158	Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
AS4331	Metallic flanges – Steel Flanges
AS4793	Mechanical tapping bands for waterworks purposes
AS4799	Installation of underground utility services and pipelines within railway boundaries
AS4853	Electrical hazards on metallic pipelines
ISO31000	Risk Management – Principles and Guidelines

10.2 Relevant Legislation

The relevant Acts and Regulations associated with this Developer Specification including but are not limited too:

- Local Government Act 1993 and Local Government (General) Regulation 2021 (NSW);
- Water Management Act 2000 and Water Management (General) Regulation 2018 (NSW);
- Plumbing and Drainage Act 2011 and Plumbing and Drainage Regulation 2017 (NSW);
- Protection of the Environment Operations Act 1997, Protection of the Environment Operations (General) Regulation 2022 and Protection of the Environment Operations (Noise Control) Regulations 2017 (NSW);
- Environmental Planning and Assessment Act 1973 and Environmental Planning and Assessment Regulations 2021 (NSW); and
- Surveying and Spatial Information Act 2002 and Surveying and Spatial Information Regulations 2017 (NSW).

10.3 Related Documents

The relevant external documents listed below are related to or referenced in this Developer Specification:

- NCC 2022 Volume Three - Plumbing Code of Australia

- Australian Drinking Water Guidelines 6 (2011);
- NSW Health and Department of Primary Industries Guidelines for Drinking Water Management Systems (2013);
- Department of Environment and Climate Change Interim Construction Noise Guideline; and
- NSW Streets Opening Conference: Guide to Code and Practices for Streets Opening.

Water Services Association of Australia (WSAA)

May be purchased from www.wsaa.asn.au.

Reference	Title
WSA01	Polyethylene pipeline code
WSA03	Water Supply Code of Australia
WSA109	Flange gaskets and O-rings
WSA132	Access covers for water supply and sewerage

Plastics Industry Pipe Association of Australia (PIPA)

Specifications are downloadable from www.pipa.com.au.

Reference	Title
POP001	Electrofusion jointing of PE pipe and fittings for pressure applications
POP003	Butt fusion jointing of PE pipes and fittings – Recommended parameters
POP007	Metal backing flanges for use with polyethylene (PE) pipe flange adaptors
POP010 A and B	Part 1 Polyethylene pressure pipes – Design for dynamic stresses; and Part 2 Fusion fittings for use with polyethylene pressure pipes – Design for dynamic stresses
POP101	PVC pressure pipes – Design for dynamic stresses
POP202	PVC and PE pressure pipe installation on curved alignments

Singleton Council

Related documents listed in the table below are Council (internal) documents related to or referenced in this Developer Specification and are available for download from www.singleton.nsw.gov.au:

Reference	Title
20/38793	Singleton Council Fees and Charges Schedule (updated annually)
POL/26030	Water Supply Services Policy
14/16271	Singleton Council - Work as Executed - WaE – Specification – August 2014
POL/26013	Building in the Vicinity of Sewer and Trunk Water Mains Policy
POL/23003	Development Engineering Specifications – Design Specifications
POL/23002	Development Engineering Specifications – Construction Specifications
	Developer Specification Checklists – Refer to Annexure

11 APPENDICES

Appendices are provided in separate document;

- Developer Specification – Checklist – Water Reticulation Design
- Developer Specification – Checklist – Water Reticulation Drawings; and
- Developer Specification – Checklist – Water Reticulation – Completion of Construction.

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