1 GENERAL

1.1 RESPONSIBILITIES

Objective
Design requirement: Provide design, drawings and specification for the construction of a reticulated water supply system (either drinking or dual drinking/non-drinking) conforming to the requirements of WSA 03 and the Water Agency, as documented.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- 0010 Quality requirements for design.
- 0072 Water supply – pump stations (Design).
- 0319 Minor concrete works.
- 1341 Water supply – reticulation (Construction).

1.3 REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

Standards
AS 1214-1983 Hot-dipped galvanised coatings on threaded fasteners (ISO metric coarse thread series)
AS 1432-2004 Copper tubes for plumbing, gasfitting and drainage applications
AS/NZS 1477:2006 PVC pipes and fittings for pressure applications
AS/NZS 1554 Structural steel welding
AS/NZS 1554.1:2011 Welding of steel structures
AS/NZS 1554.6:2012 Welding stainless steels for structural purposes
AS 1579-2001 Arc-welded steel pipes and fittings for water and waste-water
AS 1646-2007 Elastomeric seals for waterworks purposes
AS 2129-2000 Flanges for pipes, valves and fittings
AS 2200-2006 Design charts for water supply and sewerage
AS/NZS 2280:2004 Ductile iron pipe and fittings
AS 2419 Fire hydrant installations
AS 2419.2-2009 Fire hydrant valves
AS/NZS 2566 Buried flexible pipelines
AS/NZS 2566.1:1998 Structural design
AS/NZS 2566.2:2002 Installation
AS/NZS 2638 Gate valves for waterworks purposes
AS/NZS 2638.1:2011 Metal seated
AS/NZS 2638.2:2011 Resilient seated
AS 2832 Cathodic protection of metals
AS 2832.1-2004 Pipes and cables
AS 2832.2-2003 Compact buried structures
AS/NZS 2845 Water supply - Backflow prevention devices
AS/NZS 2845.1:2010 Materials, design and performance requirements
AS/NZS 3500 Plumbing and drainage
AS/NZS 3500.1:2003 Water services
AS/NZS 3518:2004 Acrylonitrile Butadienne Styrene (ABS) pipes and fittings for pressure applications
AS 3571 Plastics piping systems - Glass-reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin
AS 3571.2-2009 Pressure and non-pressure water supply (ISO 10639:2004, MOD)
AS 3681-2008 Application of polyethylene sleeving for ductile iron piping
AS 3688-2005 Water supply—Metallic fittings and end connectors
AS/NZS 3862:2002 External fusion-bonded epoxy coating for steel pipes
AS/NZS 3879:2011 Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings
AS 3952-2002 Water supply - spring hydrant valve for waterworks purposes
AS/NZS 4020:2005 Testing of products for use in contact with drinking water
AS 4041-2006 Pressure piping
AS/NZS 4087:2011 Metallic flanges for Waterworks purposes
AS/NZS 4129:2008 Fittings for polyethylene (PE) pipes for pressure applications
AS/NZS 4130:2009 Polyethylene (PE) pipes for pressure applications
AS/NZS 4158:2003 Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
AS/NZS 4331 Metallic flanges
AS/NZS 4331.1:1995 Steel flanges
AS/NZS 4441:2008 Oriented PVC (PVC-O) pipes for pressure applications
AS/NZS 4765:2007 Modified PVC (PVC–M) pipes for pressure applications
AS 4795 Butterfly valves for waterworks purposes
AS 4795.1-2011 Wafer and lugged
AS 4795.2-2011 Double flanged
AS 4799-2000 Installation of underground utility services and pipelines within railway boundaries
AS/NZS 4853:2012 Electrical hazards on metallic pipelines
AS/NZS ISO 31000:2009 Risk management - Principles and guidelines
Plastics Industry Pipe Association (PIPA)
POP001-2011 Electrofusion jointing of PE pipe and fittings for pressure applications
POP003-2011 Butt fusion jointing of PE pipes and fittings - recommended parameters
POP007-2006 Metal backing flanges for use with polyethylene (PE) pipe flange adaptors
POP102-2009 Solvent cement jointing of PVC pipe
POP202-2008 Polyethylene (E) pipes and fittings for compressed air
Water Services Association of Australia (WSAA)
WSA 01-2004 Polyethylene Pipeline Code Version 3.1
WSA 03-2011 Water Supply Code of Australia
WSA 109-2011 Industry standard for flange gaskets and O-rings

Other publications
IPWEA
IIMM-2011 International Infrastructure Management Manual

1.4 STANDARDS

General
Standard: To WSA 03 Part 1.

1.5 INTERPRETATIONS

Abbreviations
General: For the purposes of this worksection the following abbreviations apply:
- AHBP: Allowable Horizontal Bearing Pressure.
- AHD: Australian Height Datum.
- AMG: Australian Map Grid.
- CIOD: Cast Iron Outside Diameter.
- DI: Ductile Iron.
- FF: Full Face.
- GDA: Geocentric Datum of Australia.
- IBC: Inside Bolt Circle.
- MAOP: Maximum Allowable Operating Pressure.
- NDH: No Discharge Head.
- PN: Nominal Pressure (megapascals x 10).
- PRV: Pressure Reducing Valve.
- PReLV: Pressure Relief Valve.
- WHS: Work Health and Safety.

**Definitions**

General: For the purposes of this worksection the following definitions apply:

- Booster: In-line pressure booster pumping station used to increase the hydraulic gradient.
- Concept plan: A package of information provided to the designer by the Water Agency to allow the appropriate planning/design of the major water system components to be performed.
- 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.
- Document: Record of information in written or graphical form.
- Dual water supply: A system of water supply consisting of dual mains (two pipelines from separate sources) and designed to concurrently provide two separate water supplies. One main conveys drinking (potable) water, the other conveys appropriately treated non-drinking water.
- Link mains: Laying a main between the court bowl or cul-de-sac and a main in an adjacent street via a pathway or right of way.
- Looped mains: A continuation of the water main in the street at the entrance to the court bowl or cul-de-sac, looped around the court bowl or cul-de-sac and then continued along the street.
- Maximum allowable operating pressure: Maximum hydrostatic pressure, including a nominal allowance for surge, that can be sustained with a factor of safety by the class of pipe for its estimated useful life under anticipated operating conditions with the frequency of surges less than that expected to lead to fatigue failure for that life.
- Service pressure: Internal pressure delivered at the point of connection to a customer’s installation at zero flow in the service pipe. This does not include surge pressure.
- Surge: A rapid fluctuation of pressure caused by flow alteration over a short period of time.
- Transfer main: A water main that interconnects source(s), treatment works, reservoir and/or supply areas, normally without direct customer connections.
- Water age: The time taken for water to travel through the system, from treatment to customer.
- Water Agency: An authority, board, business, corporation, Council or local government body with the responsibility for planning or defining, design, construction and maintenance requirements for a water supply and/or sewerage systems. This includes Local Water Utilities (LWU).

2 PRE DESIGN PLANNING

2.1 SYSTEM PLANNING

**Water supply system**

Assessment: Before designing the new water supply system or an upgrade to an existing system, assess the requirements listed in WSA 03 clause 2.2.2 and perform the following:

- When providing a new water supply, determine possible sources of supply.
- Consider drinking water substitution such as provision of a non-drinking water supply system and the impact on the drinking water supply system and pipe sizing.
- Prepare a concept plan to WSA 03 clause 1.2.3.
- Consider special requirements such as hospitals.
- Consider water quality including disinfection.
- Consider demands, system configuration and system hydraulics.

**Design brief requirements**

Requirement: Determine and document the following:

- Details of acceptable connection points, available flow (Q) and pressure / head (H).
- Minimum and maximum allowable operating (working) pressure.
- Future expansion requirements such as larger through mains.
- Special requirements for critical mains and fire fighting purposes.
- Water supply boundaries.

In-line pressure booster pumping
Planning criteria for boosters: To 0072 Water supply-pump stations (Design).

Valving system
Concept plan: Consider the following valving systems in the concept plan:
- Pressure reducing valve installations to WSA 03 clause 6.3.
- Pressure sustaining valve installations to WSA 03 clause 6.4.

Future system expansion
Future capacity: Plan water mains with sufficient capacity to cater for all existing and predicted development within the area to be served. Consider water demand allowance and future demand estimations in conformance with WSA 03 clause 2.11.

Minimisation of life cycle costs
Life cycle plan: Submit an asset life cycle plan noting renovation or replacement for items. Conform to typical asset design lives in WSA 03 Table 1.2, without rehabilitation, or submit other source documentation for design life.

2.2 SUBSIDISED SCHEMES

Funding
Government grant funds: If the works form part of a contract attracting Government grant funds, identify the following:
- Items which are not of the least cost option, that:
  - Are intended to have a much longer design life than the normal asset service life detailed in the Asset Management Guidelines of the International Infrastructure Management Manual.
  - Do not meet the project objectives and the requirements of the various Agencies for the least Net present value (NPV) but may become the preferred option for construction.
- Particular equipment which is procured without relevant competition through tendering.
- Duplication of equipment or unit processes in a system configuration.

2.3 CRITICAL INFRASTRUCTURE PROTECTION

Asset categorisation
Concept plan: Address the asset categorisation in conformance with WSA 03 Table 1.1 and WSA 03 Appendix A. Provide a risk assessment of the final design for consistency with the asset categorisation and the concept plan.

2.4 CONSULTATION

Council and other Authorities
General: Approval of design proposals is required from Council.

3 DESIGN

3.1 GENERAL

Responsibility
Concept plan: Review the concept plan provided and make sure the data listed by WSA 03 clause 1.2.5.1 is available.

Conflicting requirements: If there is conflict between this specification and the Water Agency requirements, seek clarification.

Requirements of design: Provide for water supply to each property by a connection point to a water main or a pre-laid property service from a water main including the following:
- Conform with WSA 03 clause 1.2.5.2.
System review
Requirement: Progressively review the planning and design in conformance with WSA 03 clause 2.12.

3.2 HYDRAULIC DESIGN

General
Loss of supply: If possible, provide service for the development from two or more transfer mains to avoid the loss of supply due to maintenance or breakage.
Maximum pressure: Analyse water hammer and design to control surge pressure and dynamic stresses to WSA 03, clause 3.6.
Elevated pipelines: Design piers for any above ground water main to resist pipeline forces from unbalanced pressures and allow for temperature changes and settlement.

Demands
Base: Nominate the hydraulic design demand rates based on the ultimate predicted development demand and the division of the required drinking and non-drinking water supply.

Demand assessment
Residential demand: Determine the residential demand in conformance with WSA 03 Table 2.2 by multiplying the peak hour demand per property or unit and the number of properties serviced. Estimate the number of properties by either counting actual properties or using a conservative density factor for future zoning.
Non-residential demand: Determine the non-residential demand in conformance with WSA 03 Table 2.2 by modelling the system over a period considering the developments use.
Average day demand: [complete/delete] 
Average hour demand: [complete/delete] 
Peak day demand: Determine in conformance with WSA 03 clause 2.3.4.2.
Peak hour demand: Determine in conformance with WSA 03 clause 2.3.4.3.

Dual water supply systems
Demand allocation: Determine demands for each system separately in conformance with WSA 03 Table 2.1 and the following:
- Generally, allow an extra 10% of the total average demand for a dual system.
- No allowance is made in design peak demands for rainwater tanks.

Water quality
Prevention of back siphonage: To WSA 03 clause 2.6.2. including the design of steady state pumping pressure, location and operation of hydrants, air valves and scours.
Backflow prevention devices: To AS/NZS 2845.1.
Water age reduction: To WSA 03 clause 2.6.3.
Disinfection: Determine if disinfection plants are required as part of the distribution/reticulation system and locate to conform with WSA 03 clause 2.6.4.

Service reservoirs
Storage capacity: Determine the minimum service reservoir storage capacity and service reservoir location in conformance with WSA 03 clause 2.9.1.
Risk assessment: Assess risk to AS/NZS ISO 31000 as part of sizing reservoirs and associated pumping stations, and determining system configurations. Address the following:
- Available total storage.
- Relative needs for operating.
- Reserve storage capacity in particular locations.
- Pumping requirements.
- Staging requirements.
- Disinfection and maintenance requirements.
- Secondary tank requirements.

Network analysis
Concept plan: Provide a concept plan including servicing options in a network analysis of the reticulation system. Analyse all elements within the system in conformance with WSA 03 clause 2.5.2, including:
- Peak demand conditions for operating/reserve storage.
- Pressure.
- Average demand conditions for water quality.

Design period: Use a design period where the input capacity is less than the total peak day demands.

**System configuration**

Layout: Position mains considering the concept plan and functional design requirements for the project and to WSA 03 clause 2.4.

**Operating pressures**

- Desirable allowable service pressure: To WSA 03 Table 2.3.

Non-drinking water supply system: Provide for an available static head or steady state pumping pressure of 5 to 10 m head lower than the drinking water supply system.

**Pressure variation analysis**

Surge analysis: Analyse surge for zones affected by pressure variations. Determine the magnitude and frequency of surge pressure in the system by analysing for the full range of anticipated rates of change of flow.

Propose design solutions: Submit for approval a design solution for any significant pressure surges or high pressure areas in an existing or proposed supply system. Investigate de-rating of pipes for pumped systems.

Daily pressure variations: Assess and minimise any daily pressure variations under normal operating conditions.

**Determine supply zones**

Zones to deliver desirable range of pressure: Determine supply zones to provide the desirable range of pressure under peak demand conditions. Provide for service reservoirs, boosters and/or PRV zones to create the zones.

**Pipe sizing**

Minimum pipe sizes: To WSA 03 Table 3.1 and WSA 03 Appendix B except for the following:

- Mains in dual water supply systems: To WSA 03 clause 3.1.4.
- Reduced sized mains for maintaining water quality: To WSA 03 clause 5.2.4.

Fire flow capability: Design water mains required for fire-fighting purposes in conformance with the requirements of the Water Agency. Consult with the relevant fire authority where the need for alternative emergency water supply sources are identified.

**Sizing by analysis**

Pipe and network analysis: Analyse the pipe and network to WSA 03 Table 3.2 or hydraulic design based on the forecast demand, acceptable velocity range, allowable head loss and acceptable pressure range.

Head losses: To WSA 03 clause 3.1.6.2 and as follows:

- 5 m head/km for ≤ DN 150 (CIOD) or ≤ DN 180 (ISO).
- 3 m head/km for ≥ DN 200 (CIOD) or ≥ DN 250 (ISO).

Calculating head losses: To AS 2200.

Hydraulic roughness values: To AS 2200 Table 2.

Flow velocities: Conform to WSA 03 clause 3.1.6.4 and the following:

- Optimum velocity: 0.8 m/s to 1.4 m/s.
- < 4 m/s under maximum flow conditions.
- Submit for approval where flow velocities are considered greater than 3 m/s on cement mortar lined pipes.

Travel time: Submit for approval if the proposed system will result in water age of more than 48 hours for an average day demand.

**Design pressures**

System design pressure: To WSA 03 clause 3.2.

Gravity system: Design pressure is the maximum static pressure in the system, equal to the full supply level of the reservoir or tank minus the lowest ground level along the route of the water mains system, with the following exceptions:
- Any pressure boosted subsystems of a gravity system: To WSA 03 clause 3.6 and WSA 03 section 6.
- If a gravity system supplies a downstream reservoir: Assess the surge effects of inlet control valves to WSA 03 clause 3.6.2.

Systemic surge: To WSA 03 clause 3.2.3.

Dynamic pressure systems: Determine dynamic pressure in conformance to one of the following:
- Pressure due to the NDH of the pump plus the maximum suction pressure minus the lowest ground level along the route of the pipeline.
- Pressure due to the operating pressure of the pump plus the maximum suction pressure minus the lowest ground level along the route of the pipeline plus an allowance for surge due to the pump starting.

Pressure class (PN) of system components: Record the required PN of system components on the drawings. Determine PN to WSA 03 clause 3.7 and 3.8 and as follows:
- For gravity systems: PN > design pressure.
- Allowance for random surges: 10 to 20 % of PN to conform with WSA 03 clause 3.3.1.
- Systems subjected to dynamic pressures: Analyse surge and fatigue and provide all calculations, assumptions and referenced documents in conformance with WSA 03 clause 3.6.
- Mixed gravity and dynamic pressure system: Use the highest PN value.

Thrust and anchor blocks: Design to withstand the system test pressure applied to each section of the water mains network.

System test pressure: Calculate the system test pressure to WSA 03 clause 3.5 and record on the drawings.

Test selections: Determine test sections to avoid exceeding MAOP of individual items.

3.3 PRODUCTS AND MATERIALS

General
Products and materials: Conform to Water Agency product catalogues, WSA 03 Product and material information and guidance and WSAA Product specifications, available from WSAA website www.wsaa.asn.au

Pressure piping: To AS 4041.

Differentiation of drinking and non-drinking pipe systems
Identification: Determine the measures to differentiate the drinking and non-drinking water supply to WSA 03 clause 4.2 following a risk assessment in conformance with the Australian guidelines for water recycling at www.scew.gov.au/archive/water/index.html. Document one or more of the following requirements:
- Pipes of different colours to WSA 03 Table 4.1 and AS/NZS 4158.
- Warnings printed on non-drinking water mains and/or sleeving.
- Marking tape.
- Marking of surface fittings.
- Identification markers and marker posts.
- Operating systems with a service pressure differential.
- Different pipe locations.
- Maintaining a minimum pipe separation.
- Use of different pipe materials for the drinking and non-drinking water mains.
- Testing of products for use in contact with drinking water: To AS/NZS 4020.

Ductile iron pipeline systems
Detail: Document the sizes and configuration of pipeline systems including the following:
- Nominal diameter.
- Pipe series (CIOD or ISO).
- Pipe pressure classification (PN).
- Joint type.
- Length of pipes.
- Types of fittings.
- Internal and external corrosion protection.
- Tapping the reticulation sized mains: Pre-tapped connectors or mechanical tapping bands to WSA 03 clause 4.3.2 and WSA 03 clause 5.11.

Seal coating of lining: Cement mortar lined pipes to AS/NZS 2280 where the total alkalinity of the water being conveyed is less than 30 mg/L.

Sleeving: PE sleeving to bituminous coated DI pipes to AS 3681.

Flange class DI pipes: Fully support flange in the installed condition. Include instructions for preventing loading of the flange during installation.

Flanged joints to AS/NZS 4087: Document the type of flange gasket and the tightening sequence.

Pipes and fittings: Manufactured in conformance with AS/NZS 2280. Minimum Class PN 20 for elastomeric seal joints.

Epoxy coating: To AS/NZS 3862 (or thermal-bonded polyethylene to AS/NZS 4158).

Elastomeric seals: To AS 1646.

Flanges: Manufactured in conformance with AS/NZS 4087 and AS 2129.

Bolts and nuts for flanged joints: To AS 2129, galvanized in conformance with AS 1214, or stainless steel in conformance with ASTM A276.

**PVC pipeline systems**

Detail: Document the sizes and configuration of pipeline systems including the following:
- Nominal diameter.
- Pipe series (1 or 2).
- Pipe pressure classification (PN).
- Material classification number (as necessary).
- Length of pipes.
- Type, material and class of fittings.
- Tapping the reticulation sized mains: Pre-tapped connectors or mechanical tapping bands to WSA 03 clause 4.4 and WSA 03 clause 5.11.


PVC pipe: To AS/NZS 1477.

PVC-O pressure pipe: To AS/NZS 4441.

PVC-M pressure pipe: To AS/NZS 4765.

PE pressure pipe: To AS/NZS 4130.

PVC curved alignments: To POP202.

**PE pipeline systems**

Detail: Document the sizes and configuration of pipeline systems including the following:
- Nominal diameter.
- Pipe pressure classification (PN).
- Material class (PE80 or PE100).
- Length and form of pipes (straight lengths or coils).
- Types, materials and classes of fittings.
- Tapping the reticulation sized mains: To WSA 03 clause 4.5 and WSA 03 clause 5.11.

Jointing: Document in conformance with WSA 01.

Mechanical couplings: Self restraining.

Stub flanges and backing rings: To POP007.

Flanges: To AS 2129, AS/NZS 4331.1 and AS/NZS 4087.

Polyethylene (PE) pipe: Manufactured to AS/NZS 4130 and designed to AS/NZS 2566.1.

PE Fittings: To AS/NZS 4129.

PE curved alignments: To POP202.

Butt fusion jointing: To POP003.
Electrofusion jointing: To POP001.

**Steel pipeline systems**

Detail: Document the sizes and configuration of pipeline systems including the following:
- Nominal diameter: To AS 1579 Appendix C.
- Rated pressure.
- Joint type: To AS 1579 Appendix E.
- Length of pipes.
- Types of fittings: To AS 1579 Appendix D.
- Internal and external corrosion protection.
- Flanged joints, class of flange, type of flange gasket and the tightening sequence: To AS/NZS 4087.

Steel water mains: Submit for approval by the Water Agency for use in reticulation systems.

Gaskets: To WSA 109.

Insulated flanged joints: Document where steel pipes, fittings and other steel appurtenances are jointed to flanges and/or flange backing plates of dissimilar metals such as copper, copper alloys, galvanized steel and stainless steel. Insulated flanged joints are not required where joining to wrought iron flanges, grey cast iron flanges or ductile cast iron flanges.

Jointing: Provide the pipe jointing as follows:
- Elastomeric seal jointed with seals conforming to AS 1646, or
- Butt welded, welded spigot and socket, or welded using a welding collar and with the application of a polyethylene heat shrunk sleeve over the weld, or wrapped, or
- Flanges: To AS/NZS 4087.

Bolts and nuts for flanged joints: To AS/NZS 4087 clause 3.2.

**GRP pipeline systems**

Detail: Document the sizes and configuration of pipeline systems including the following:
- Nominal diameter.
- Pipe series (CIUD or ISO)
- Pipe pressure classification (PN).
- Pipe stiffness classification (SN).
- Joint type.
- Length of pipes.
- Types of fittings.
- Type: Centrifugally cast (CC) or filament wound (FW).

GRP water mains: Submit for approval by the Water Agency for use in reticulation systems.

GRP pipes and collars: Manufactured to AS 3571.2 and designed to AS/NZS 2566.1.

Surge cycles: Refer to the manufacturer when the temperatures are likely to exceed 35°C.

GRP fittings: Ductile iron fittings conforming to AS/NZS 2280 with appropriate elastomeric seals conforming to AS 1646 may also be used.

**ABS pipes and fittings**

Acrylonitrile butadiene styrene (ABS) pipes and fittings: Manufactured in conformance with AS/NZS 3518 and joined in conformance with the manufacturer’s instructions using solvent cement to AS/NZS 3879.

Pipe class: Provide for cyclic loading.

**Copper pipe and fittings**

Copper tube: Manufactured in conformance with AS 1432 in the range of DN 6 to DN 200 for Type A or Type B. Take into account the requirements of AS/NZS 3500.1.

Capillary and compression fittings: Conform to AS 3688 and de-zincification resistant. Document silver brazed joints or solder insert capillary joints for capillary fittings.

**Protection against degradation**

Detail: Take measures to protect all pipeline system items (e.g. pipes, fittings, appurtenances, elastomeric seals) including the following:
- No contact between dissimilar metals to prevent galvanic corrosion.
- Protective coatings to metallic components and concrete structures suitably designed for various corrosivity levels of soil and groundwater.
- Fully sealed conduits for plastics pipes and fittings in contaminated ground.
- Fully sealed conduits for all elastomeric seal jointed pipes and fittings in contaminated ground.
- Control trench fill and pipe embedment materials.
- Stray current or other effects on buried steel pipelines mitigated in conformance with WSA 03 clause 4.8.6.
- Cathodic protection for buried steel pipelines to AS 2832.1 and AS 2832.2 and in conformance with WSA 03 clause 4.8.5.

Protection against damage to coatings: Provide for more than one thickness of PE sleeving between coated fittings, valves and other appurtenances and thrust and anchor blocks.

Stainless steel: Grade 316 or 316L, welding requirements to AS/NZS 1554.6 and threaded component details.

Protection against contaminated ground: Fully welded externally coated or wrapped steel pipeline. Submit alternatives for approval by the Water Agency.

Bolted galvanized connections: An encapsulating system using priming paste wrapped with petrolatum tape or PE sleeving in conformance with WSA 03 clause 4.8.8.

Miscellaneous
Concrete: To 0319 Minor concrete works.

3.4 SYSTEM DESIGN CRITERIA

Design Tolerances
Requirement: Determine design location and levels to WSA 03 clause 5.1.1 including the following tolerances:
- Horizontal alignment for mains: Referenced to coordinate system (AMG or GDA) in metres to one decimal place.
- Level: Referenced to AHD and the following:
  - Reticulation mains in conformance with minimum cover requirements.
  - Transfer and distribution mains in metres with 2 decimal places.

Longitudinal elevation: Document the longitudinal elevation and include the following levels:
- Along the length of the proposed main.
- Each side of a road crossing.
- Crossings of proposed drains, sewers, cables and other pipes or services.
- Valves adjacent to a road crossing.
- Changes of grade.
- At intervals on vertical curves so that the depth of the main will be within the minimum and maximum depths below the surface level.
- All appurtenances.

Depth of cover: Where unusual circumstances occur, document the depth of cover for both initial and future works.

Electrical safety and earthing to water services
Precautions: Develop safety precautions for all personnel before and after the works in conformance with the Water Agency requirements and WSA 03 clause 5.1.3. Alternatively, include the following requirements:
- Test for defects in the electrical supply.
- Monitor for elevated voltage on pipework.
- WHS.
- Turn off power.
- Provide a conductive bridge around the work area.
- Notify occupants and electricity distributors of changes.
- A written consent from the electricity distributor, that it is safe to proceed when a metallic water main is to be replaced by plastics pipes.
Environmental considerations
Water main route: Conform to state, territory and local government environmental, native title and heritage laws. Avoid, where practical, water main routes through environmentally significant areas such as those listed in WSA 03 clause 5.1.4.
Minimise environmental impacts: Determine any requirements for specific environmental protection such as:
- Trenchless tunnelling, boring or micro tunnelling alternative excavations.
- Minimisation of the impacts of dewatering.
- Minimisation of the impacts of rock excavation.
- Type and size of construction equipment.
- Protective measures for steep slopes.
- Protective measures for unstable areas.
- Protective measures for significant flora.
- Minimisation of area of disturbance.
- Season of construction.
- Minimisation of transport of soil borne disease.
- Rehabilitation of the construction site post construction.
Urban salinity: If required, develop salinity management strategies for positioning of infrastructure, materials or construction methods.

Reticulation design for water quality
Layout of water mains: Position in conformance with the following:
- Avoid termination points or dead ends.
- Use continuous network, link mains, looped mains and reduced sized reticulation mains.
Looped mains stop valves: Locate near the intersection of the street and cul-de-sac (court bowl).
Linked mains: Use the size of the smaller of the two mains being linked.
Reduced sized mains: Conform to the following:
- Use where other options are not feasible.
- Use where the front boundary of the furthest lot is less than 100 m (or the maximum distance specified by the relevant fire authority) from a hydrant on a main greater than DN 100.
- Use for non-drinking water supply.
- Design to supply the maximum number of properties at ultimate development using the minimum diameter PE pipe in conformance with WSA 03 Table 5.1 and Figure 5.2.
- Design the size and length of reduced sized mains based on the average service pressure at that location.

3.5 LOCATION OF WATER MAINS
General
Location: Position water mains in the road reserve in conformance with WSA 03 clause 5.4.2 and as follows:
- Any space allocation agreements, local agreement with road owner or other utility service provider.
- Align parallel to property boundaries or road features such as kerbs.
- Maintain adequate clearance from structures and other infrastructure.
- Allow unhindered access for repairs and maintenance.
- On the opposite side of the street to the power cables.
- If laying water mains within another utility service allocation, obtain written consent from the appropriate authority.
- If no space is available in the footway, locate in the kerbside lane within the carriageway. Written consent from the road owner required where locating in motorway reserves.
- In a straight line through roundabout intersections and bus bays. Seek approval if deviation is required.
- If access for maintenance is limited, use a reduced maintenance installation, such as concrete encasement in conformance with WSA 03 clause 7.6.
- Without unnecessary disturbance of any living or dead vegetation.
- Mark all trees for approval to remove where trees are located on the water main proposed route.

Surface fittings: Locate in footpaths, clear of roundabout intersections or bus bays.

Location markers: Document locations showing installation adjacent to surface fittings.

**Marking tape**

General: Document the type of marking tape, location, method of installation and joins. Conform to WSA 03 clause 5.4.16.

Detectable marking tape: Document for pipe systems as follows:
- Buried non-metallic mains with no fixed reference point.
- Buried metallic mains installed deeper than specified maximum depths of cover.
- Identify any restrained joint system with tape spacing less than 3 m.
- All trenchless installation of non-steel pipe sleeve: Use a minimum 2 mm diameter grade 316 stainless steel tracer wire wound around or affixed to the pipe and terminated and fixed at an accessible point at each end.
- PE property services to the water main: All new property services ≤ DN 32 use PE pipe and marking tape.

**Water mains in easements**

Easement guidelines: If water mains cannot be located in a dedicated public road reserve or private access way, register an easement that conforms to WSA 03 clause 5.4.4 and Table 5.2 and the following:
- Provide for isolation valves for the section within the easement.
- Easement alignments: Run easement in conformance with the following:
  - Parallel to cadastral boundaries.
  - Across the rear of lots.
  - Down the side of the lots.
  - Along agreed alignment.
- Parks or reserves: Consider the following:
  - Provision of safe water flow paths for burst mains.
  - Suitable vehicle access to the mains.
  - Mains clear of any existing or proposed trees or shrubs.

Position of main in the easement: Conform to the following:
- 1/3 of the width into the easement on the side away from any buildings.
- Position centrally if there are buildings on both sides and if the easement runs through narrow walkways.
- Where there is a crossfall, position the main on the low side.

**Water main access**

Access: Document the locations of person-access facilities on the design drawings.

**Dual water supply systems**

Locations: Document on the drawings the location of dual water supply systems in conformance with WSA 03 clause 5.4.5 and the following:
- Shared trench in the footway allocation: Locate with common obvert depth.
- Shared trench in the road carriageway: Locate with common obvert depth.
- Separate trenches in the same footway allocation: Locate the non-drinking water main closest to the property boundary.
- Separate trenches in the footway allocation: Locate drinking and non-drinking water mains on the opposite sides of the road reserve.
- Separate trenches in the road carriageway: Locate non-drinking water main nearer to the centreline.
Where they cross, lay non-drinking water under the drinking water main.

**Crossings**

Requirement: Design water main crossings of roads, railway lines, water courses etc. using trenchless techniques and with alignments to minimise the following:

- Failure of the main.
- Future third party interference.
- Conflict with underground structures or foundations.
- Number of joints and surface fittings with the crossing.
- Leakage of joints.
- Necessary restoration of improvements e.g. condition assessment, replacement, removal etc.

**Crossing:** Install the water main at 90° to the road.

**Allowable variation:** [complete/delete]

**Protection:** Document any required protection from external factors such as external loading, third party intrusion including:

- Encasement in conformance with WSA 03 clause 5.4.9.2.
- Precast reinforced concrete removable slabs.
- Concrete encasement.
- Service duct.
- Security fencing.
- Protection barriers.
- Sleeking.

Crossing of creeks or drainage reserves: Document the following:

- Alignment: 90°±15° to the creek or drainage reserve.
- Mechanical protection.
- Construction details.

**Overhead power lines and transmission towers**

Investigate: Assess potential safety risks to AS/NZS 4853 if any of the following apply:

- Welded steel pipelines simultaneously run parallel and close to high voltage power lines for more than 1 km parallel and with 500 m of powerlines greater than 50 kV.
- Metal pipelines are located within 5 m of a transmission tower.
- Metal pipeline access is within 50 m of a transmission tower.

Safety risk: If there is a safety risk, document required alignment, electrical protection, corrosion protection measures and construction details.

**Water mains in conjunction with landscaping and/or other development**

Requirement: Document the design in conformance with the following:

- Access: Clear access or reduced maintenance design, such as concrete encasement in conformance with WSA 03 clause 7.6.
- Avoid detrimental loads such as vehicle, structures, trees, poles, street furniture.
- Structural design: Address anticipated loads and requirement for cover, concrete encasement or other protection methods.
- Cover, as documented.
- Traceability: If necessary, document 10 mm diameter pavement weep holes at maximum 1000 mm spacing along the main line to detect the leakage of water from the surface.
- Minimum clearance from trees and structures for mains ≤ DN 300:
  - If cover ≤ 1500 mm: 750 mm on each side of the centreline of the main.
  - If cover > 1500 mm: Consult the Water Agency.
- Access to surface fittings: Required for all hydrant, stop valve, air valve and water service surface.
Water mains on curved alignments
Requirement: Determine the most appropriate pipeline material and/or combination of components. Include the following details:
- Design radius and tangent point locations.
- Jointing system and allowable joint deflection.
- For deflection joints provide a list of acceptable manufacturers and their products to achieve the specified deflections.
- Material lengths of the cut pipe to achieve the curved alignment.
- Pre-tapped connectors.

Special requirements
Submission: Submit for approval where the proposed route of the water mains includes the following:
- Contaminated sites: Include issues noted in WSA 03 clause 5.4.8.
- Railway reserves: Approval by the railway owner is required. Conform to AS 4799.

Suitable service for mains: Detail within the design if duplicate mains are required.
Separate mains for service connections: Detail within the design including the distribution main, alignments and connection details if rider mains are required.

3.6 INSTALLATION CONSIDERATIONS

Trenchless technology
Geotechnical survey: Investigate the following:
- Soil identification to locate rock, rock inclusions, gravely soils, loose deposits, discontinuities and hardpan.
- Soil strength and stability characteristics.
- Groundwater.
- Pullback loads.
- External service loads.

Trenchless design: Make available all references, assumptions and calculations for the design and documentation of the following:
- Pipe class: Standard dimension ratio (SDR).
- Pipe diameter.
- Bore diameter.
- Minimum and maximum pipe anulus.
- Annulus required.
- Access pits.
- Exit points.
- Clearance from services and obstructions.
- Depth for minimum cover.
- Pipe support and ground compaction.
- Alignment tolerances.
- Grouting requirements.

Shared trenching
Agreement: Design in conformance with the Shared trenching agreement.
Shared trenching design: Submit for approval a detailed design including the following:
- Relative location of services, both horizontal and vertical in the trench.
- Clearances from other services.
- Pipe support and trenchfill material specifications.
- Embedment and trenchfill compactions.
- Trench markings.
- Services location with respect to property boundaries.
- Limitations on future maintenance.
- Drawings showing thrust and anchor block details.

Sections: For each section of shared trench define the following:
- Start and finish points.
- Dimensions.
- Service utilities within.

Vertical alignment: Conform to WSA 03 clause 5.6, Figures 5.4, 5.5 and Table 5.3.

**Connection of new mains to existing mains**

Eliminate disruption of service: Connect to existing systems with UPCIC to conform with WSA 03 Figure 5.6 and Appendix C. If this method is not appropriate, submit for approval, with reasons, the proposed alternative method, such as the inserted tee method, to conform with WSA 03 clause 5.9.

Connection design: Document the connection design including the following:
- Pipe material requirements and limitations.
- Relative depth of mains.
- Standard valves and fittings.
- Pipe restraint and anchorage.
- Potential for insufficiently restrained/anchored stop valves near the connection.
- Limitations on shutting down major mains to enable connections.
- Existing cathodic protection systems.
- Ease of maintenance.

**Termination points**

Detail: Document the design for permanent/temporary termination points, chlorination assemblies and flushing points.

Permanent ends of water mains: Conform to the following:
- Do not locate termination points in driveways.
- Do not install hydrants on ends < DN 100.
- Main < 2 m past the property service connection.

Temporary ends of water mains: Locate mains adjacent to the boundary of a subdivision or 2 m beyond finished road works for future subdivision works.

Chlorination assemblies: Provide for a chlorination assembly at all termination points on mains of DN 225 and greater. Include the following within the design:
- Location of the chlorination injection point and swabs.
- Pitot points if required.

Flushing points: Provide for flushing points to conform with WSA 03 clause 5.10.4 and Figure 5.8. Locate as required for maximum intervals and at the end of reduced sized mains. If required, provide a collection structure or make sure space available for a discharge tanker to conform with environmental requirements.

**Maximum intervals for flushing points:** [complete/delete]

**Property services**

Design: Document the following:
- Property service layouts.
- Services arrangements and sizes.
- Connection arrangements.
- Methods and sizes for single and split services located in footways and across road carriageways.
- Service duct details and kerb marking.
- Above ground and below ground meter layouts and arrangements.

Connection to water mains: Conform to the following:
- Corner lot connections: To the water main adjacent to the shorter road frontage of the lot.
- Minimum pipe and connection sizes: To WSA 03 Table 5.4.
- Minimum 500 mm spacing between connections (tapping bands and saddles), pre-tapped connectors and/or pipe joints.
- Do not use dry connections (drillings/tappings) for industrial or commercial developments.

Services, outlets and meters: To WSA 03 clause 5.11.3, Figures 5.9, 5.10, 5.11, Table 5.4 and consideration of the following:
- New residential lots: Colour coded PE or copper pipe.
- Existing lots: PE or copper.
- Locations.
- Requirements for split property services.
- Property services within footways: Positioned 90° ± 5° to the water main or kerb.
- Service ducts: Positioned 90° ± 5° to the road carriageway and extending to behind each kerb.
- Locate drinking and non-drinking water services within the same service duct.
- Kerb markers.
- Separate property service outlets for each lot for drinking and non-drinking water.
- Locate meters for drinking and non-drinking water together, near a common boundary or in the middle of the front property boundary or at the side of an access way for battle-axe lots.

**Obstructions and clearances**

Design: Identify all underground obstructions and services, surface obstructions and structures along the route of the proposed water main. Detail the methods of avoiding obstructions and services including the following:
- Surface obstructions.
- Clearance from transmission towers.
- Clearance from structures and property boundaries. Provide for the following minimum offset from property boundaries:
  - 1 m ≥ DN 100 mains.
  - 0.6 m < DN 100 mains.
- Underground obstructions and services:
  - Contact DIAL BEFORE YOU DIG to identify location of underground utility services, pipes and cables.
  - Hand excavation is recommended to determine exact locations and depth of obstructions.
  - Determine depths of services that the water main will cross.
  - Clearance requirements in conformance with WSA 03 Table 5.5.
- Deviations of water mains:
  - Verify manufacturers nominated deflection joints and maximum allowable angles of deflection.
  - Nominate pipe lengths and angled bends if pipes without deflection joints are specified.
  - Horizontal deviation: To WSA 03 clause 5.12.6.2 and Figures 5.12, 5.13, 5.14.
  - Vertical deviation: To WSA 03 clause 5.12.6.3 and Figures 5.15, 5.16, 5.17, 5.18, 5.19.
- Curving of pipes to avoid obstructions.
  - Local deviations: Select from PE, PVC-M and PVC-O pipes.
  - Document limitations including limiting of radius and curvature in conformance with POP202.
  - Document connectors and joins to conform with WSA 03 clause 5.12.6.4.
  - Document joint deflection, radius, tangent points and defined limits of bending.

Disused or redundant pipelines: To WSA 03 clause 5.13. Document the required action which may include the following:
- Removal or sealing the ends of the water main.
- Removal of surface fittings and restoration of the surface.
- Protection or preservation for heritage restrictions.
- Conditions for removal of asbestos cement pipes.
3.7 STRUCTURAL DESIGN

General
Design: Provide for flexible pipelines to resist structural failure and conform to AS/NZS 2566.1 and WSA 03 Table 7.1.

Structural considerations: Design pipelines and water mains to suit the following criteria:
- Site conditions.
- Internal forces: Including the following:
  - Transient conditions (surge and fatigue).
  - Negative pressures: Design for at transient pressure of at least 80 kPa below atmospheric pressure, with a safety factor of 2.
  - Maximum static head conditions.
  - Operating temperatures.
- External forces: Including the following:
  - Trenchfill loadings (horizontal and vertical due to the earth loading).
  - Surcharge.
  - Groundwater effects.
  - Dead weight of pipe and contained water.
  - Temperature (expansion /contraction).
  - Traffic.
  - Pipes stiffness: ≥ 4,000 N/m/m.

Design pipe cover: Document the minimum and maximum depths of cover for each section of water main to WSA 03 clause 7.4.2 and Table 7.2.

Design embedment zone dimensions: Document the embedment zone dimensions to AS/NZS 2566.1, AS/NZS 2566.2 and WSA 03 clause 7.4.3.

Design pipe embedment: Document embedment material, reinforcing details and any special bedding requirements to WSA 03 clause 7.4.4 and Figures 7.2, 7.3.

Above ground water mains: Document details of pipeline items, supports, restraints, loading protection, maintenance and access requirements, protection from exposure conditions and impact loading from traffic.

Pipework through concrete pits: Provide structural pipe through concrete pit walls. Do not run PVC-U or PE through concrete pit walls.

Geotechnical considerations
Geotechnical assessment: Complete a geotechnical assessment, to WSA 03 clause 7.5.1, of the proposed route of distribution or transfer main where the following occurs:
- Size: ≥ DN 375.
- Historical data or other evidence of potential geotechnical problems.

Water mains in engineered or controlled fill: To WSA 03 clause 7.5.2.

Water mains in non-engineered fill: Engage a geotechnical specialist to investigate, design and supervise the support and foundation remediation.

Construction of an embankment: Engage a geotechnical specialist to investigate, design and supervise the construction of an embankment, trench and bedding. Determine the relevant construction requirements.

Unforeseen ground conditions: Document a requirement for a review and amendment of the structural design if unforeseen ground conditions are encountered.

Settlement: Provide for piling support to control settlement if appropriate.

Concrete encasement
Design: Document encasement and connections. If concrete encasement is proposed, submit for approval in conformance with WSA 03 clause 7.6 and the following:
- Design as a beam to withstand external loadings where encased length of pipelines incorporated joints or the AHBP < 50 kPa.
- Do not encase cast iron, wrought iron, PVC, rubber ring joints, AC pipe, lead joints, flanged joints, riveted pipe, sections of any main containing a service connection, hydrant or valve (including air valves).

**Encased steel pipelines**

Design: Document encased steel pipelines to WSA 03 clause 7.6.3 including protection and connections to existing steel pipelines and the following:

- Welding: To AS/NZS 1554.1 category SP.
- Design each type and profile of steel pipe separately including the method of sealing or replacing seals.
- Procedure for welding while pipe is charged, if required.
- Mains ≥ DN 375 require an internal inspection verification.

**Water mains in unstable ground**

General: Avoid construction of water mains through unstable ground including mine subsidence areas and slip areas.

Detail: Document the design of water mains constructed in unstable ground, including measures to maintain the integrity of the main to WSA 03 clause 7.7 and Appendix F.

Mine subsidence areas: Submit for approval by the Mine Subsidence Regulator any design for mains located in mine subsidence areas. Include the following information:

- The expected strains on the pipeline resulting from potential subsidence.
- Use area specific ground strains available from the Mines Subsidence Regulator.
- Notate and endorse approved design to WSA 03 clause 7.7.2.

Slip areas: Engage a geotechnical specialist to investigate, design and supervise the construction of water mains in slip areas. Minimise all potential for damage to a water main caused by movement of unstable ground.

Pipe jointing system: Provide for a pipe jointing system capable of accepting ground movements, without impairing the water tightness of the joint, for the ground strain advised by the Mine Subsidence Regulator as follows:

- Non-welded pipe systems in areas with high ground strains: Provide for a pipe jointing system using shorter effective length pipes and/or deep socket fittings.
- If the Mines Subsidence Regulator does not cover an area of known, or suspected, subsidence or slippage, the above requirements still apply.

**Pipeline anchorage**

Design: Document the pipeline anchorage required at all changes in direction, tees, valves, tapers and termination points. Exceptions include restrained joints and welded pipelines. Consider all horizontal and vertical forces. Conform to WSA 03 clause 7.9, Appendix G, Table 7.3 and Figures 7.11, 7.12, 7.13, 7.14, 7.15, 7.16.

Thrust blocks: Document the design for the thrust blocks including:

- Calculation of unbalanced thrust and resultant thrust to WSA 03 clause 7.9.2.1.
- Temporary thrust blocks to conform to the permanent thrust blocks requirements.
- Size: To WSA 03 Table 7.3.
- Location: Must not protrude beyond the space allocation for the main.
- If required, use puddle flanges to transfer thrust.
- Timber and recycled plastics: To WSA 03 Table 7.4 and Figure 7.17.

Anchor blocks design: Document anchor blocks to:

- Resist the unbalanced thrust due to the greater of the design pressure or test pressure to be imposed at the anchorage location.
- Prevent movement of pipe bends in a vertical direction by consisting of sufficient mass concrete to prevent pipe movement.

Restrained joint ductile iron water mains: Document the details including locations and any special construction techniques required. Use manufacturers recommendations for restrained jointing systems.
Design for restraint requirements for special situations: Document any special requirements such as above ground mains with unrestrained flexible joints, buried steel mains with welded joints, above ground steel mains with welded joints, ductile iron and steel mains with flanged joints, PE mains.

**Bulkheads and trenchstops**

Design: Document bulkheads and trenchstops in conformance with WSA 03 clause 7.10, Table 7.5 and Figures 7.20 to 7.26.

Drainage: Provide details for trench drainage where required.

### 3.8 APPURTENANCES

**General valves**

Design: Document the requirement for valves including the following:

- Type and class.
- End connections.
- Location and arrangement.
- Installation requirements.
- Design considerations: Address the issues listed in WSA 03 clause 8.1.3.
- Plastics identification covers: To WSA 03 Table 8.1 and Figure 8.1.
- Location marking: Prepare a marking schedule and drawing in conformance with WSA 03 clause 8.11 showing the type, colour and locations of all required identification markings including marker posts and plates, pavement markers and kerb markings.

**Stop valves**

Design: Document the details to WSA 03 clause 8.2 and the following:

- Location and arrangements: To WSA 03 clause 8.2.7.
- Gate valves:
  - Anti-clockwise rotation of the input spindle for closure.
  - Where required document gearing.
  - Where required document a valve chamber.
  - To AS/NZS 2638.1 or AS/NZS 2638.2.
- Butterfly valves: To AS 4795.1 and AS 4795.2 and the following:
  - Do not use in reticulation mains.
  - Geared unless otherwise approved.
  - Do not use where throttle of flow is required.
  - Install with trunnions horizontal and gearing operated from the surface.
  - Provide for valve chamber where the gearbox is not sealed.
- For transfer/distribution mains:
  - Locations and spacing: Consider requirements for special location, size of pipe or WHS requirements.
  - Sizes: Dictated by hydraulic requirements.
  - Use where required, concentric tapered valve connectors or full size valves.
- For reticulation mains:
  - Number of property services connected in a ‘shut-off’ area: To WSA 03 Table 8.2.
  - Single water service for multi-unit developments: Two-directional supply to WSA 03 Figure 8.14.
  - Arrangement similar: To WSA 03 Figure 8.14 Example B. Submit details similar to example A and C for approval.

Bypass of stop valves: Document type and arrangement for bypassing of stop to valves WSA 03 clause 8.2.6. Submit for approval if not standard default setup.

Verification: Verify with manufacturer’s and suppliers if selecting stop valves with integral bypass arrangements.

Rider mains: If it is necessary to provide water services from a distribution main, design and document rider mains to WSA 03 clause 8.2.9 and Figure 8.15.
Crossing mains: Document pipework and valving for crossing mains interconnection to WSA 03 clause 8.2.10 and Figures 8.16 to 8.19.

**Control valves**

Automatic inlet control valves (AICV) design: Document the location, type and size of valve in conformance with the Concept plan, WSA 03 clause 8.3.2 and the following:
- Make sure compatibility with the existing system, e.g. electrically or hydraulic actuated, fully modulating or two-state open/closed control.
- Nominate the most suitable valve for the application.

Pressure reducing valves (PRV): Document the location, type and size of valve in conformance with the concept plan, WSA 03 clause 6.3 and 8.3.3.

Pressure relief valves (PReIV): Document the location, type and size of valve in conformance with the concept plan, WSA 03 clause 8.3.4.

Pump control valves: Document the location, type and size of electrically operated butterfly valve in conformance with the concept plan and WSA 03 clause 8.3.5.

Pressure sustaining valves (PSV): Document the location, type and size of valve in conformance with the concept plan, WSA 03 clause 6.4 and 8.3.6.

Air valves: Design and document the requirement for air valves including the type, size and location to WSA 03 clause 8.4.

Non-return valves: Document the requirements for non-return valves including location, type, supports and size.

**Maintenance facilities**

Scours and pump-out branches: Document the location of scours and pump out branches for maintenance to WSA 03 clause 8.6 and the size to WSA 03 Table 8.4.

Swabbing points: If required, provide for adequate drainage facilities for dewatering and flushing operations.

Disinfection facilities: Document chlorination installation to WSA 03 clause 8.9 and Appendix I and include the following:
- Fittings as permanent fixtures.
- Identification and appropriate location of hydrants if utilised for disinfection purposes.
- Fittings for transfer and distribution mains.
- Discharge points.

**Hydrants**

Requirement: Document hydrants to WSA 03 clause 8.8 and include the following:
- Siting.
- Type.
- Installation requirements.
- Outlet connections: Conform to AS 2419.2.
- Hydrant size.
- Spacing: To WSA 03 Appendix H and as agreed with Local fire authorities. Identify and resolve any conflicting needs.
- Location.
- Spring hydrant valve: To AS 3952.

**Surface fittings**

Requirement: Document the type and locations of surface fittings required for all buried appurtenances, including the following:
- Marking of surface fittings: To WSA 03 clause 8.10.3.
- Installation requirements: To WSA 03 clause 8.10.4.
4 DOCUMENTATION

4.1 GENERAL

Design
Concept plan: Document and review the concept plan for the water supply system.
Design review: Demonstrate conformance with the approved concept plan and WSA 03 clause 9.1.
Project design documentation: Include project-specific information such as the following:
- Location of pipelines, valves, hydrants, pipe materials, size pressure class, jointing methods and corrosion protection measures.
- Detailed drawings including location of all relevant obstructions.
- Specifications for products, materials, site investigation, excavation/trench details and other technical matters.
- Document design assumptions and constraints.
Asset categorisation:
- Risk assessment of final design for consistency with asset categorisation of concept plan.
- Surge analysis and design for surges.
- Water age.
- PN of system components.

Specifications
Construction documentation: Prepare a project specific completed specification 1341 Water supply – reticulation (Construction).

Design certification
Requirement: Provide a signed and dated design certificate.

4.2 DRAWINGS

General
Design drawings: Provide design drawings to WSA 03 clause 9.2 and the following:
- Pipeline acronyms: Use the WSAA acronym’s provided at www.wsaa.asn.au.

4.3 WORK-AS-EXECUTED

General
Work-as-executed drawings: Document the requirements for recording work-as-executed including GPS coordinate points. Provide an additional set of final construction drawings for this purpose.